Topics in Regulatory Economics and Policy

Michael A. Crew
Timothy J. Brennan
Editors

Postal and Delivery Innovation in the Digital Economy

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Preface and Acknowledgements

This book is a result of the Center for Research in Regulated Industries' (CRRI) 22nd Conference on Postal and Delivery Economics, which was held on June 4–7, 2014, at the Villa Tuscolana, Frascati, Italy. The first Conference was held in 1990 in the UK. Over the twenty plus years after the first Conference, the industry has seen considerable change. These include the opening of postal markets to competition for most countries in the European Union on January 1, 2011. Even more important is the increasing impact of multi-modal competition. As a result of e-mail, social networks, and Internet advertising, important questions are being raised about the future of mail. The conference and this book attempt to address some of the resulting challenges. They follow earlier conferences and workshops. This in the 22nd edited volume in CRRI's program on Postal and Delivery Economics.

The Conference was made possible by the support of its generous sponsors. We would like to thank sponsors not only for financial support and for supporting service on the organizing committee but also for, along with others, their intellectual contributions, advice and encouragement: Christo Apostolou, the late John Baldwin, Jody Berenblatt, Geoff Bickerton, Stephen Brogan, Jim Bruce, João Confraria, Margaret Cigno, Bernard Damiens, Constantinos Delicostopoulos, Richard Eccles, Colm Farrelly, Charles Fattore, Stephen Ferguson, Damien Geradin, Ruth Goldway, Stefano Gori, Lina Gousiou, Robert Hammond, John Hearn, Paul Hodgson, Adam Houck, Stuart Holder, Jim Holland, George Houpis, Christian Jaag, Keith Kellison, George Kuehnbaum, Denis Joram, David M. Levy, François Lions, Martin Maegli, Leonardo Mautino, Meloria Meschi, Anna Möller, Heikki Nikali, Chris Paterson, Ted Pearsall, Wolfgang Pickavé, Alberto Pimenta, Michael Ravnitzky, Jim Sauber, Michael Scanlon, Gennaro Scarfiglieri, Rob Sheldon, Jan Smedts, Soterios Soteri, Nancy Sparks, Gregory Swinand, Urs Trinkner, Mark van der Horst, Tim Walsh, David Williams, and Ralf Wojtek.

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We would like to thank our distinguished dinner speakers: Bianca Maria Martinelli, Director for Regulatory and Public Affairs, Poste Italiane, and Alberto Pimenta, Director of Strategic Development, CTT Correios de Portugal S.A. These speeches addressed strategy in addressing current issues of regulation and postal reform against the background of increasing competition in the postal sector.

In addition, we thank all the authors and participants of the Conference. Absent their contributions, the Conference and this book would not have been possible. The usual disclaimers are applicable. In particular, the views expressed reflect the views of the authors and are not necessarily those of the sponsors.

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Business Models: Some Implications for USPS

Michael A. Crew and Timothy J. Brennan

1 Background and Introduction

Business models are of interest currently in the postal sector, particularly in the United States, where postal reform is once more on the agenda of the US Congress. Only in 2006 was USPS the subject of a major reform with the Postal Accountability and Enhancement Act (PAEA). While there was other legislation in the interim, the 2006 Act was the first major reform since the Postal Reorganization Act of 1970, which enacted the governance structure for USPS. PAEA did not enhance USPS' position, and it did little to make it more accountable, except for subjecting USPS to more traditional and more effective regulation with the replacement of the Postal Rate Commission by the Postal Regulatory Commission. The new PRC had greater authority than its predecessor but some of its opinions remained advisory. This contrasts with the powers of state regulatory commissions, which have considerable power to enforce terms of service through their control of rates.

The authors thank participants at the Center for Research in Regulated Industries 2014 Advanced Workshop in Regulation and Competition on New Business Models and Conservation Programs, the 33rd Eastern Conference, the 22nd Conference on Postal and Delivery Economics, and The First Henan Symposium of Development and Institutional Economics, School of Economics, Henan University. We particularly thank Preston Finley and James I. Campbell, Jr, for their discussant comments.

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The critics did not realize how seriously flawed was the Act (e.g. Crew et al. 2008). There was little recognition of the fact that PAEA failed to provide USPS with a viable business model. It paid lip service to the notion that USPS was to be run as a business in that it made it subject to the requirements of Sarbanes-Oxley. However, this alone just raised its costs of operation. It did not provide incentives efficiency and innovation. Indeed, PAEA left USPS with a governance structure that failed to allow it to address effectively the major decline in its mail volumes that followed within months of the Act.

Given the importance of governance to the success of an organization, the current reform initiative needs to take into account the properties of potential business models in determining a future business model for USPS. This chapter is concerned with the properties of different business models, drawing on lessons from a much broader spectrum than the postal sector. Business models of regulated firms and government entities differ considerably from those of unregulated firms. Business models are driven by ownership, market structure, regulation and corporate governance. The nature of business models may be significantly different, depending on the presence and extent of these factors. The incentives inherent in different business models result in various efficiency properties. Comparative institutional assessment is employed to analyze a range of business models, from the investor owned unregulated firm to the government agency.

It may be important to note that "business model" does not refer to specific strategic, tactical, or marketing decisions within a particular context, e.g., how much to invest in research, how to design and differentiate products, targeting particular sets of potential buyers, and the like. The topic here is larger. It is essentially how the particular institutional structure and context of a business—private and unregulated, private and regulated, state-owned, and variations within those—determine whether an enterprise can be expected to act efficiently, i.e. provide the portfolio of goods and services consumers prefer and minimize the cost of doing so.

Arguably, the government agency should not be considered to be a business model. However, as it provides private goods and services in a market context, for purposes of the comparative institutional assessment it is considered a business model. Section 2 of this paper reviews the business models to be examined and introduces the concept of comparative institutional assessment. Section 3 sets out the criteria used in the assessment. Section 4 employs the comparative institutional assessment with special emphasis on USPS including possible implications for reform.

2 Outline of Business Models

This section begins with a broad discussion of the properties of business models, which are summarized in Table 1. It lists a spectrum ordered according to market structure and organization. The unregulated firm operates under competition and oligopoly. Moving down the spectrum in the direction of monopoly results in a

Table 1 Comparative Institutional Assessment

Institution	Residual claimants	Power of incentives	Cross subsidy	Allocative efficiency	Internal efficiency	Externality	Innovation	Market structure
Firm [I]	Yes	High	Minimal	Market structure driven	Strong	Ignores	Strong	Competition, oligopoly
PCR firm [II]	Yes	High	Minimal	Strong but regulation dependent	Strong	Ignores	Fairly strong	Monopoly, oligopoly
ROR firm [III]	Attenuated	Low	Potential	Not achieved	Less strong	Regulatory intervention	Weak	Monopoly
GRR firm [IV]	Attenuated	Low	Potential	Not achieved	Less strong	Extensive regulatory intervention	Weak	Monopoly
Cooperatives, non-profit, labor-managed [V]	Minimal	Low	Likely	Not achieved	Weak	Some attention	Weak	Various
Public enterprise corporate [VI]	No	Low	Very likely	Not achieved	Weak	Some attention	Very weak	Monopoly
Government agency [VII]	No	Very low	Very likely	Not achieved	Very weak	Very important	Almost zero	Monopoly

change in the organization form from unregulated firm to regulated firm to government agency. The starting point for assessing business models is the unregulated firm. This model derives from the theory of the firm in microeconomic theory, where the firm maximizes profit in each period. Real-world firms have some similarity to the firm in economic theory. They are considered to maximize the value of the firm to its owners, and are driven to maximize profits. In other words, they are entitled to the residual whether it be profit or loss. The firm in a competitive situation faces the highest powered incentives.[1] The regulated firm may have the same ownership and corporate structure to that of an firm, unregulated but its residual claims are attenuated by regulation. Regulation changes incentives and, as a consequence, the business model of the regulated firm differs from that of the unregulated firm.

It has long been recognized that in microeconomic theory there is no theory of public enterprise that has the general acceptance of the theory of the firm. Indeed, with some forms of public enterprise the absence of any residual claimants or clear accountability may imply that the actions of the organization are so divorced from responding to buyer preferences, competitive threats, and input costs that their actions may be essentially unpredictable, as if there were no business model at all; USPS may be in that dire shape. The extent to which the business models of the firm differ from those of the regulated firm may have not received significant recognition.

The rows in Table 1 correspond to the different business models and the columns to the criteria employed in the analysis. Moving down the rows in Table 1, the business models increasingly depart from the profit-maximizing firm [I]. The departures from the profit-maximization objective become greater with movement down the table. The properties of each institutional structure are listed in the rows. The presence of residual claimants drives the power of the incentives. The profit-maximizing firm [I] has the highest powered incentives, which are driven by profits and the threat of bankruptcy. The residual claimants get the benefit of the profits and bear the consequences of failure – bankruptcy.

At the other extreme the government agency [VII] faces very low powered incentives as there are no residual claimants. It cannot go bankrupt. Indeed, it is not clear that a government agency can be viewed as maximizing anything at all. The power of the incentives in these circumstances is extremely low. The potential for cross-subsidy is considerable; incentives for efficiency are weak. This contrasts with [I]. A government agency [VII] may take into account externalities. However, it is not clear whether political influences on its day-to-day operations allow for an efficient balancing of the benefits of reducing negative externalities and the costs. Despite this limitation, externalities or market failures can be strong drivers of regulation and government production.

The government agency [VII] with its weak incentives might be the most efficient governance structure where externalities are a major element in production. A pure public good, such as national defense, is a polar case of externality. Positive

[1] The formal definition of high-powered, residual claimants and other terms will be found in Sect. 3.

externalities imply that the high-powered incentives under residual claimants result in under production by the firm as it cannot appropriate all of the benefits of production. Under a pure public good, for which exclusion is not possible and for which one individual's consumption does not reduce the amount available to others to consume, the optimal price would be zero. Such a price produces no revenues, so a profit-maximizing public firm would not produce it absent some other means of capturing value. It could not appropriate any of the benefits but it would incur the costs. With a public good, underproduction can be extreme. It is therefore not surprising that government departments are responsible for the supply of public goods, as any attempt to use the market would result in complete market failure.

Provision of public goods differs from the type of market failure that was traditionally addressed by public utility regulation, namely the market failure arising from natural monopoly. The market failure arose from the overwhelming scale economies of utilities resulting in ever decreasing average costs, making monopoly the "natural" result. Initially, rate of return (ROR) or cost of service was the mechanism adopted and is still employed today. It is employed in the case of the ROR firm [III]. As public utility regulatory commissions expanded their remit to include externalities, especially environmental, the regulation changed to Guaranteed Return Regulation (GRR) [IV], which brought about a further change in the business model of regulated firms.

Public utility regulation was not the only approach to market failure. In some countries, notably in Europe, natural monopolies were regulated by means of public ownership with consequent lower-powered incentives. Large utilities, telephone companies and postal operators (POs) existed often as government departments or agencies. European countries departed from the public enterprise model, particularly the United Kingdom, which privatized its public enterprise utilities beginning in the 80s and adopted a system of public utility regulation.

3 Comparative Institutional Assessment

The columns represent the criteria employed for analyzing the business models in the rows. Put simply, the *residual claimant* is the party, who receives the residual, whether positive or negative, after all expenses have been paid. "Residual" refers to the net benefits of a decision, for example, whether to expand output or change price, offer a new product or cease producing an old one, or invest in research. The decisions made under any organization form create benefits for some and impose costs on others. A competitive profit-maximizing generates revenues, and expenses that determine the firm's profits. Regulation or state ownership means that the organization does not retain all of these benefits. They may be dispersed onto ratepayers, taxpayers, workers and others.

This leads to the most important notion in "residual claimant"—that the decision makers are able to claim the full residual. Textbook consumers and competitive firms are archetypes. The consumer reaps the benefits of the goods and services she chooses

to purchase, and the profit-maximizing owners of the firms capture the revenues and bear the costs from their output, pricing, and marketing decisions.

Both ability and authority to make the decisions are critically important. For a publicly traded corporations, the residual claimants, the stockholders often cannot make the firm's decisions because of the well-known separation of ownership from control. Public enterprises do not have residual claimants. The gap between the owners, the public, and enterprise management is multiplied, as the public's representatives in government sit between the public and the enterprise managers. Public decision making leads to inefficient outcomes. Because some groups are better able to organize and lobby than others, the distance between residual claimants and efficient operation is likely to be all the greater (Olson 1965).

The Power of Incentives reflects the share of the residual received arising from the actions taken by the claimants. The greater the actions are reflected in the residual, the higher powered the incentive. Even under ideal circumstances, the extent to which a business model or organizational structure has incentives to act efficiently depends on whether the residual available to the managers reflects the net benefits the manager's actions would generate. In the ideal competitive market, consumers maximize their net benefits. This is because they are residual claimants and because the residual reflects the difference between the benefits they obtain and the price of those purchases, which under competition equals marginal cost. Similarly, the residual, captured by the competitive firm is the difference between revenues and cost. The nature of the residual is critical to the achievement of an efficient outcome.

The existence of residual claims and high powered incentives does not in itself induce efficient outcomes. Market failures present well-known difficulties. When firms have market power, the residual—profit—creates an incentive to reduce output in order to raise price, leading to inefficient outcomes. When actions have effects that are not reflected in market prices, externalities, then private incentives will not necessarily lead to efficient outcomes, for example, excessive pollution.

The design of institutions can also attenuate incentives. Regulations that fix the firm's level of profit may distort or eliminate incentives to be efficient. If the allowed rate of return just matches the regulated firm's cost of capital, the firm just covers its costs regardless of what it does, eliminating any incentive to be efficient beyond the ability of regulators to evaluate its costs of production (Brennan 1989). Managers of state-owned enterprises may face equally attenuated incentives, and perhaps perverse ones, if they are rewarded on the basis of the size of their budgets or bureaucracy (Niskanen 1974).

Cross-subsidy refers involves taking revenues associated with the sale of one product and use it to subsidize another product. For an unregulated firm, even a monopolist, taking revenues away from one product reduces its profits, leaving unchanged the fundamental problem of having to sacrifice profits now with the hope of recouping them later. Other aspects of the organization's context can make cross-subsidization profitable. If a regulator ties prices to reported costs, a diversified partially regulated firm has an incentive to charge costs of providing competitive services to the accounts of the regulated monopoly service (Brennan 1990). Unlike

an unregulated firm, this regulated firm would consequentially get to raise the rates for its regulated services to fund the cross-subsidy. This may not only result in predatory pricing but also result in a price closer to the monopoly price. Cross-subsidy may be government mandated as well, notably, the universal service obligation (USO) requiring ubiquitous service at a uniform price, where service to low-cost areas subsidizes that to high cost areas. A state-owned enterprise may have similar incentives to cross-subsidize.[2]

One complication of cross-subsidization is the treatment of common costs. In some settings, an enterprise incurs costs to produce, say, two services, and it would have had to incur those same costs to produce just one of them. To cover common costs, a firm has to raise revenues from any individual service exceeding the incremental costs of that service. Ramsey pricing—setting service-specific price–cost margins inversely proportional to the elasticity of demand facing the firm—is consistent with a regulated monopoly service contributing more than competitive services. Whether a particular pricing scheme for covering fixed costs constitutes a cross-subsidy from regulated to competitive services can be a matter of considerable dispute.

Allocative Efficiency is a measure of performance. In general, net benefits from provision of a good or service are maximized when the incremental or marginal benefit (MB) to consumers of the amount of service provided just equals the incremental or marginal cost (MC) to producers of supplying it. This "MB = MC" criterion is the test of allocative efficiency. If MB > MC, the benefits of additional output exceed its cost, and too little is supplied, namely, under monopoly.

Internal Efficiency is a subset of Allocative Efficiency. To achieve allocative efficiency there must be internal or productive efficiency. Internal Efficiency is achieved if the cost of supplying a given level of output is minimized. Whether an organization achieves internal efficiency depends on the power of incentives for minimizing cost. The strongest incentive to cut cost arises when the residual claimant gets one dollar for each dollar it saves in cost cutting. One notable example of the reverse case, where incentives are *not* to cut costs, is "use or lose" public budgeting, when a state agency is penalized by failing to spend money by losing the opportunity to spend it later or having subsequent budgets cut.

Even if the organization keeps what it saves from reducing costs, the incentives for internal efficiency will mean little if the residual claimants to those savings do not make the decisions that determine costs. For example, stockholders of a firm are the nominal residual claimants, but may lack the effective ability to monitor and enforce cost controls by the firm's managers, who then may give themselves excessive compensation and perquisites. For publicly-owned enterprises, both budgeting issues and the absence of residual claimants make internal efficiency unlikely.

Externalities and Other Policy Objectives are those not captured by the decisions of an organization in the incentives that its residual claimants face. The rewards the claimants get may not reflect all of the benefits that their activities generate, and the

[2] Sappington and Sidak (2003) argue that under sales revenue maximization this will be case.

costs they bear need not incorporate all of the costs. This happens when some benefits and costs are not reflected by market price. These missing benefits and costs are referred to as "externalities". The standard example is that a firm will typically not take the costs of pollution in making its production decisions, since those who bear the damage from pollution are frequently unable to charge the firm for polluting, or a way to pay the firm to reduce emissions. Public policies can sometimes restore those incentives, e.g. by taxes on the pollution or by instituting a market in pollution permits so those who can eliminate pollution at least cost can do so. In the absence of policies to "internalize the externalities," some organizations may try to manage them directly as part of their mission.

Some organizations face mandates to promote less readily quantifiable objectives. One example is that schools are expected to do more than maximize test scores or aggregate earning potential; they are charged with instilling a sense of personal and civic responsibility. Postal operators may provide community sustaining function with post offices and the USO. In some settings, postal operators are the first-line enforcers of laws, notably against mail fraud. Providing universal service is more than an indirect means of redistributing wealth from low-cost to high-cost areas, thereby "binding the nation together."

When these "merit goods" are part of an organization's responsibility, they may be difficult to observe and thus reward through high-powered incentives. Taking effective steps toward achieving them could involve delegating authority to an organization that lacks the ability to rely on incentives to induce decisions that benefit those claimants. Employees may be hired on the basis of judgments on how much they personally care about these merit goods, and give them the flexibility to promote them. This may result in their exploiting the opportunity to shirk or otherwise promote their own benefit.

Innovation is a dynamic process, which include developing new products and services or discovering new manufacturing processes. The benefits of innovation are important, as they are often dramatic and long-lasting (until the next innovation comes along). One issue is what sorts of organizations and markets foster innovation. Competition is thought to promote innovation because of the pressure to keep pace with the market and that the greater output produced under competition gives a larger potential gain from cutting costs (Arrow 1962). On the other hand, a monopoly may be better able to appropriate the returns from innovation, with the engine of growth being displacement of one monopoly with another (Schumpeter 2013, originally 1942).

Market Structure is an important determinant of the incentives faced by different organizational forms. A market structure with large number of firms offering similar products may lead to a competitive-type outcome with price close to marginal cost, promoting allocative efficiency. Pressure to keep up with competitors will promote internal efficiency and likely innovation as well. On the other hand, in some markets multiple competitors cannot be sustained; in the limit, only one may survive. The most familiar reason is natural monopoly, when economies of scale result in prices lower than prices that would be sustainable under competition. Another cause is a network externality, where each person values a product or service more

as additional users are added. This leads to dominance if not exclusivity by one provider that all use, for example, computer software.

Market structure is particularly important in assessing business models and organizational forms. When competition cannot be relied upon to limit the exercise of market power, various organization forms may be employed to attenuate it. In assessing regulation or government ownership in addressing market power, it is important to keep in mind how those organizational forms may face shortcomings in terms of the criteria of this section.

The comparative institutional assessment now proceeds with details on each institution. For the privately owned entity, the firm [I], the power of the incentives is strongest. However, depending on the nature of the firm and it environment, the power of the incentives varies. The more competitive the product market, the more powerful are the incentives for profit maximization and internal efficiency. The larger the corporation and the more market power it possesses, the power of the incentives falls. Williamson (1967) analyzed the potential of management to exercise other objectives apart from value maximization. The considerable literature on principal-agent theory examined this issue further including the extent to which management and shareholder objectives could be aligned. Market power potentially weakens the power of the profit incentive for efficiency. Supernormal profits imply that the firm does not have to achieve internal efficiency or cost minimization to survive. Market power also provides the potential for the exercise of managerial discretion along the lines of Williamson (1967). Firms with market power are mostly large complex firms where ownership is separated from control. Such firms are very different from the firm in economic theory, where ownership and control are synonymous. The stockholders are residual claimants but management allocates resources. However, institutions exist aimed at aligning incentives for stockholders and management. Capital market discipline is the major device for bringing about alignment. Failure of the corporation to make the returns expected by the capital market results in a decline in the share price and the potential for hostile takeover. Incentives are further aligned by issuing options to management and other mechanisms to align management compensation with maximization of the value of the firm.

Utility regulation takes two main forms, [III] cost-of-service or rate-of-return regulation (ROR) or [II] price cap regulation (PCR). ROR was employed from the early days. It involved setting prices based upon the costs of the firm as determined by the regulatory commission. The very process of determining price based on cost involves low powered incentives. Price is an increasing function of cost. So, there firm's ability to "prove" costs is critical to its ability to increase prices. If price is based upon a cost-plus formula e.g. $(1+m)$ C, where m is the markup over cost, C, the regulated firm clearly has the incentive to make m and particularly C as large as possible. ROR's negative effects on internal efficiency was a major reason for the interest in PCR. Littlechild (1983) had a major impact on the design and operation of the regulation the UK's privatized utilities, was highly critical of ROR and proposed PCR as an alternative.

Despite its potential for increased efficiency, PCR still ran into the problem that regulation attenuates incentives. At first glance PCR seems to offer the same profit-maximizing incentives as the unregulated firm. It faces a kink in its demand curve which is now flat at the level of the price cap and downward sloping after that. The kink in the demand curve results in a discontinuity in the marginal revenue curve. In neoclassical economics the equilibrium would be where marginal cost pass through the discontinuity in the marginal revenue curve. Regrettably, it is not as simple as that. The determination of the level of the price cap is critical. If it is set too high, and if the firm operates with a high degree of internal efficiency as a profit-maximizing firm would do, it receives substantial rents. This would attract the attention of the regulator, who may then reduce the level of the cap. This in effect reproduces ROR regulation, with a time lag, attenuating the incentives for efficiency. The firm is fully aware of this potential regulatory intervention and may press less hard for internal efficiency and take its rents in other ways. Likewise, if the cap is set too low, the firm will adopt the same kind of cost-driven arguments as the ROR firm would make to justify an increase in the cap.

Whatever the form of regulation, the inability to implement a perfect method implies that it attenuates incentives for efficiency. Regulation is an extremely poor substitute for a competitive market. The notions of Bonbright (1961) and Kahn (1991) that regulation should perform the role of the competitive market are aspirations that can never be fulfilled. Regulation creates very different incentives from those of the market. Attempts to introduce market-style incentives like price caps are of limited value. If overwhelming scale economies or network externalities result in monopoly, the choice of whether or not to regulate amounts to whether costs of the exercise of market power exceed the costs of the inefficiencies inevitably created by regulation.

Guaranteed Return Regulation (GRR) attenuates incentives for efficiency beyond ROR (Crew and Kahlon 2014). It is a regulatory innovation that addresses externality explicitly. It does so at the price of reduced incentives for efficiency. It evolved because of the public policy objective of conservation as a way to reduce pollution. It does so by reducing usage and therefore the pollution that is produced jointly with the energy. However, a firm subject to regulation, particularly PCR, would find its profits reduced if it encouraged conservation. Conservation shifts the demand curve downward with the effect of lowering profits. GRR came into the picture as a means of enabling energy utilities to promote conservation. Effectively, it guaranteed their revenues when demand was reduced by conservation. In principle, its incentives are similar to those of ROR firms. The revenue guarantee may result in less efficiency than ROR but the impact may not be major. The additional conservation may be inefficient from a strict internal efficiency standard but taking into account the perceived public policy benefits the net result for society may be positive.

Category [V] contains a variety of organizational forms under the general umbrella of non-profit, including cooperatives, utility-owned operations especially independent system operators (ISOs), and labor-managed firms. All of these have weak residual claimants. Cooperatives exist mostly in telecommunications and electricity. A member of an electricity or telephone cooperative has a weak residual claim.

The biggest problem is that a member of the community cannot sell or transfer her claim on the revenues. Moreover, it would be worth very little. Berry (1994) found that the efficiency of rural electric coops was very low, which he attributed largely to the absence residual claimants.

Labor-managed firms have residual claimants but the value may be rather small and the transferability/liquidity may be limited. Crew and Kleindorfer (2008) discussed Ward (1958)'s result that a labor-managed firm will not maximize profit but will charge a price in excess of the profit maximizing price to maximize labor's share. So, handing over a public enterprise to the workers may require serious price regulation, with the potential of reducing further the power of the incentives for efficiency.[3] A related problem is that if labor owns the firm, the risks from its "portfolio" of labor income and capital income are now correlated, increasing the worker's vulnerability to downturns in the firm's fortunes.

In the U.S., electricity transmission operates under either the regulated private firm model or the non-profit model. In both forms of ownership externality is a problem. ISOs have a policing and a security role. They may monitor market manipulation internally or retain an independently owned entity to do so. They are also charged with the protection of the transmission system not just from sabotage but from instabilities that can arise in system operations when demand and supply conditions create threats to the system. With such duties, the softer incentives of non-profit might be appropriate for addressing the numerous externalities. The regulated profit model also operates. NGC, the operator of the grid in England and Wales, is a notable example.

Public Enterprise Corporate [VI] is an enterprise with stockholders but the only stockholder is the government. The objectives of such enterprises depend ultimately on the owner. For example, New Zealand Post was established as limited liability company, which "…operates in all respects as a private company…" and "…is required by statute to operate as a successful business, that is as profitable as private companies."[4] With monopoly a public enterprise with this structure could be profitable subject to the regulation under which it operates. However, it would lack the discipline of both the product market and the capital market and would be immune from bankruptcy as the government could not go bankrupt. Such a structure has softer incentives than those faced by a regulated private firm. Under competition such a structure could be criticized on the grounds that it had the potential for subsidized or unfair competition. Where competition is significant there would seem to be little benefit of government ownership of such enterprises.

[3] Labor managed firms are not necessarily inefficient. Law firms and accounting firms are labor-managed firms. Another exception is UPS. Its big difference was that it was owned mostly by management. In addition, it had a highly developed policy of providing opportunities for progression to management by its drivers. So, the power of the incentives was strong. However, problems of coming up with the equivalent of a market valuation for the firm proved to be a difficult problem. As a result in 1999 UPS floated an IPO, so that a value of its stock was established in the stock market.

[4] Toime (1991, p. 275). Elmar Toime was Chief Executive of NZ Post.

Government Agency [VII] covers a variety of activities of government from the production of public goods, regulatory agencies to agencies engaged in production in the market. Regulatory agencies are excluded from the discussion as this chapter is concerned with the organization of production financed through market prices. Confining attention to these "productive" agencies still leaves a large number, making it infeasible to discuss more than a few examples. In the U.S. the Department of Defense is the agency responsible for producing the pure public good of national defense. As such it has very soft incentives. A pure public good is the extreme case of externality – what is produced is shared by everyone equally and one individual's consumption does not affect the amount available to all other consumers. The firm would seem to be singularly incapable of solving this problem, as it could not get revenue for the output. So, the incentives and the internal structure of the DOD and the firm are going to differ considerably. Both are hierarchies but with very different incentives and command and control structure. The armed forces operate under a completely transparent rank structure for enlisted men, non-commissioned officers, warrant officers and commissioned officers. They have rigid pay structures, promotion driven mostly by seniority. The DOD's bottom line does not involve maximization or minimization of some value but is to win the war. Given the nature of the output, national defense, much effort is involved in being prepared. Hence, a structure that emphasizes rigid discipline, seniority, job security, provision for dependents, etc. is more suitable than one that where the incentives are driven by residual claims.

An agency that produces goods that are provided elsewhere by the private sector is the New York New Jersey Port Authority, which operates bridges, tunnels, mass transit, airports, etc. Like other government agencies it operates under soft incentives. It is not clear what if anything it is maximizing.

The DOD stands out in contrast to the situation of the Port Authority and USPS, which sell their products to consumers and businesses at posted prices. Indeed, the government agency form of organization, is likely to be inefficient as demonstrated in Sect. 3 using the comparative institutional assessment developed here.

4 The Government Agency Model for USPS

USPS is like a business in that it has to cover its costs by its sales in the marketplace, but it has a government agency model. Its structure has the appearance of corporate in the sense that its officers have corporate style titles and it is subject to Sarbanes-Oxley. Beyond this it has little resemblance to a corporate structure. It was traditionally used by the Executive Branch as a vehicle of patronage until it faced a crisis in the late 60s. In 1970 a major reform was introduced, changing the Post Office from a Government Department into an independent agency subject to Congressional oversight. This had one major benefit – hires were made on the basis of merit rather than patronage. This benefit of Congressional oversight of USPS has not usefully solved the fundamental failures of the business model that remain. Members of

Congress are in the business of brokering taxes and subsidies with the intent of maximizing their probability of re-election. Congress sees USPS as another vehicle to support this objective rather than as a corporate entity. The prefunding of retiree healthcare in PAEA provides a striking example of this behavior.[5]

PAEA provides a recent and striking example of the impact of Congressional oversight on USPS. It was many years in the making, yet the ultimate result was damaging to USPS. It changed regulation by giving more powers to the PRC, but those proved inadequate. It set up price cap regulation, but without residual claimants, the high-powered incentive to increase efficiency was absent. Insufficient attention was paid to the setting of the initial level of the price cap.[6] Similarly, the automatic price increases using the CPI were not well conceived. PAEA reflected an implicit assumption that the world would continue. It never took into account the possibility of a decline in mail volume to the extent that occurred with the recession and with electronic substitution. The same scale economies, with their continually declining costs as volume increased, that had propelled USPS for many years now worked against it. Volume declined, unit costs increased, and the marginal operating profits from offering more service were not longer available to cover present costs, let alone new ones.

The root of PAEA's problems was Congress's view of USPS as a vehicle for subsidy/taxation whose purpose was improving the probability of re-election. Instead of reforming USPS to make it a more effective postal and delivery system it continued to treat it in the same manner as it had previously. USPS was not provided with a business model that would promote efficient operation. USPS, as a government agency, faces very low powered incentives. There were no residual claimants, no attempt to achieve allocative efficiency and few incentives for internal efficiency and innovation. The compensation structure of postal management was changed slightly but mostly resembled that of the civil service. The organization structure provided little upside for innovation and potential downside for innovation. This structure left it highly vulnerable to the shock of volume decline that hit around 2008.

Moreover, PAEA created a number of problems by the manner in which it distinguished between market-dominant (effectively monopoly) products and competitive products. In practice, this is basically the distinction between letters and parcels. The structure that it provided left plenty of room for cross-subsidy of parcel delivery from revenues from letter delivery. Price cap regulation has the property as shown by Braeutigam and Panzar (1989) and Brennan (1990) of making cross-subsidy unprofitable because shifting costs of competitive services to the regulated sector has no effect on regulated rates, when those rates are not tied to costs. More positively, the PRC was given greater powers, subpoena, to investigate cross subsidy.

Absent residual claimants, price caps will not prevent cross-subsidy. So, cross-subsidy could be a legitimate concern in the situation resulting from PAEA. One way

[5] Prior to PAEA USPS provided a hotchpotch of subsidies to other agencies, e.g. covering the military pensions accrued by its employees, as outlined in Congressional Budget Office 2006. PAEA replaced this with the requirement to prefund healthcare of all retirees.

[6] PAEA allowed for a reset but USPS declined to do so.

of guarding against cross-subsidy would be to establish fully separate subsidiaries around each business, although the failure of this method led to the divestiture of AT&T's operating companies in 1984 (Brennan 1987). PAEA did not consider this approach, much less putting competitive operations in one enterprise, potentially privatized and unregulated, and monopoly operations in another along the lines of one of the regulated business models with residual claimants discussed above. The current situation is sufficiently opaque that cross-subsidies could easily occur and likely do occur. This may create further problems beyond the obvious one of potentially unfair competition. Cross-subsidies of this kind that raise rates for letter delivery will further exacerbate the reduction in volume that the USPS faces.

PAEA and the serious drop in mail volume resulted in an agency model of USPS that is broken. It is not broken beyond repair but the current proposals before Congress will not fix it and are likely to make matters worse. The US is out of step with what is going on elsewhere. The rest of the world favors increased competition in the postal sector, but some proposals before Congress would have the effect of increasing monopoly power – for example, one idea is to place rate making authority back in hands of the Board of Governors instead of the PRC. This open up the potential for further abuse of market power. The Board would be much less likely to consider price increases in an objective manner than would an independent regulatory commission. The decline in volume does not necessarily mean that USPS has significantly reduced market power, as argued by Brennan and Crew (2014). However, abuse of market power would have the effect of reducing scale economies and therefore increasing unit costs. This is a tradeoff that is likely to be more effectively made by an independent regulatory commission than the Governors, who have an obvious conflict of interest.

Effective reform can only take place if Congress recognizes that it can no longer continue with the kind of oversight that it has traditionally exercised and enacts legislation that enables business models similar to other major countries that have corporate structures, which allow more independence and are becoming privatized in increasing numbers.

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E-commerce and the Return of Unwanted Goods: A Case for Cooperation Among Providers of Postal and Non-postal Parcel Services

Ralf Wojtek

1 Introduction

With the rapid development of e-commerce, new forms of distance sales have developed. Although consumers still prefer to order goods from domestic suppliers,[1] the market for consumer goods has grown global. As a consequence, the European Commission in its Green Paper on Parcels (European Commission 2012, p. 4) expresses its intention to improve the conditions for the cross-border transportation of goods in order to facilitate e-commerce. In Chap. B of the Roadmap issued subsequently to its Green Paper (European Commission 2013), the Commission defined as its objective to help boost e-commerce in the EU by providing e-traders and consumers with parcel delivery services that meet their needs in terms of quality, accessibility and affordability. The Roadmap defined two areas of concern: from the consumers' perspective, the lack of transparency and information about available redress mechanisms; and from the e-traders' perspective, a lack of transparency on delivery services and choice of availability of delivery solutions. In addition, the Roadmap focuses on the lack of interoperability between delivery companies when faced with diverging operational solutions.

[1] Hearn (2014, p. 146), with the significant exception of consumers living in small countries that share a common language with a larger neighboring country.

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Issues of consumer protection relating to distance and off-premises contracts are addressed in the Consumer Rights Directive (European Union 2011), which must be implemented by Member States until 13 June 2014. Under the Directive consumers must be informed about the total price, including transportation costs (Art. 6), they must receive the goods without undue delay (Art. 18), and are entitled to withdraw from the contract within 14 days from the date on which they acquire physical possession of the goods, or within 12 months if the trader has not provided the necessary information on the right of withdrawal. In order to be able to comply with these obligations, e-traders must rely on parcel services offering residential delivery (B2C) and consumer-friendly solutions for the return of unwanted goods.

While the Directive allows for transportation delays of up to 30 days, consumers expect instant fulfillment of their orders even if delivery involves cross-border transportation. In addition, consumers expect to be able to return unwanted goods from anywhere within the EU at reasonable or no cost at all. Research conducted at the University of Regensburg shows that part of any e-commerce transaction is the right of consumers to return unwanted goods not only if they are defective but also if they do not fit customers' expectations (University of Regensburg 2012, pp. 6–21). As Borsenberger (2015) argues, e-commerce consumers are price-sensitive and expect bargains. In order to meet customers' expectations e-traders must, therefore, not only provide for prompt delivery but also for a convenient and cost-efficient system of collecting and returning unwanted goods throughout the internal EU market.

Rapid transportation of e-commerce parcels requires dense delivery networks covering the entire area of service, particularly residential areas. Although there are only a few delivery companies capable of servicing every residential area in the EU, a parcel company without such capability will usually find a local provider. More difficult is the handling of return parcels. According to ibi Research (University of Regensburg 2013, pp. 33–39) for the German market, participating e-commerce traders active in the clothing sector indicated that between 25 % and 50 % of all purchased goods are returned by the customers.[2] This finding is supported by the EU Study on the State of Play (Copenhagen Economics 2013, p. 58) emphasizing the importance of fashion in e-commerce. Many customers are known to order several pieces in order to select only one and return the others. In some cases traders even reported return rates up to 2/3. Therefore, the development of e-commerce requires a dense and well-coordinated returns network.[3]

An additional problem results from the need to calculate the cost of the returns in advance. E-traders must know the costs in order to be able to make a proper price indication as required by Art. 6 of the Consumer Rights Directive (European Union 2011). The availability of a network of return stations in residential areas throughout the EU, as well as the ability to calculate the costs of receiving and remitting

[2] OLG Düsseldorf, Decision of 13.08.2003, VI-Kart 52/01 (V) quoting Fraunhofer Institute Study of February 2001.

[3] OLG Düsseldorf, 13.08.2003, Kart 5201 (V), recital 57.

such return parcels to the e-trader's warehouse, constitute major challenges to any e-trader otherwise willing to offer his goods throughout the EU. A well-organized network of return stations able to handle returns from consumers throughout the EU is an essential element in the provision of pan-European e-commerce.

Traders looking for parcel delivery companies that can perform the delivery as well as returns logistics have few choices, particularly over the entire EU market. Commercial parcel delivery companies have historically focused on B2B transportation, which does not require deliveries in residential areas or infrastructure for return parcels. B2B-focused parcel delivery companies will have to offer additional services such as return logistics in order to be part of e-commerce trade. On the other hand, traditional Postal Operators (POs) have the advantage of a dense infrastructure of post offices and similar return facilities. They are used to deliver in residential areas. However, they are not particularly equipped to perform EU-wide deliveries. When comparing the strengths and weaknesses of POs and commercial parcel companies, it appears that the two together might make a good match to solve the new problems resulting from the special demands of e-commerce.

This paper explores the legal framework within which such cooperation may take place. It will explore, in particular, the requirements imposed by EU competition law, the Guidelines on the applicability of Art. 101 to horizontal co-operation agreements (European Commission 2010c) as well as Commission Regulation (EU) No. 1218/2010 on the application of Art. 101 (3) to certain categories of specialization agreements (Commission Regulation 2010). It will also deal with the consequences to be derived from the Commission's decision of 23 October 2003 (European Commission 2003, REIMS II). Section 2 describes the return solution created by the International Post Corporation, Sect. 3 analyses the competition law aspects of the Easy Return Solution and Sect. 4 concludes the analysis.

2 The IPC Easy Return Solution

In response to the demands of the e-commerce market, the International Post Corporation (IPC), an organization of national POs, has developed a solution that provides for a simple returns process for cross-border e-commerce. The IPC Easy Return Solution (ERS) was launched in 2010 and is currently being implemented by 22 POs.[4] The ERS is designed to enable POs to offer distance sellers a priority postage-paid international return service for their customers. According to the FaQ section on the IPC homepage, this leads to increased parcel volume, attracts e-business and avoids over-labeling costs for POs without any operational changes.

[4] The description of the ERS is available at http://www.ipc.be/en/Operational-services/Capability-visibility/ERS_FAQ

According to IPC, ERS provides a returns service enabling POs to collaborate on returning cross-border parcels to e-traders. It allows e-customers in country A to return goods to e-sellers in country B free of charge. Together with his parcel, the e-customer receives a return label. All he needs to do is drop the return parcel together with the return label at a local post office. ERS uses a double barcode label, one for the accepting or dispatching post and the other for the authorizing post receiving the returned parcel. The labels are generated by IPC in a direct interface with authorizing posts using the ERS system. ERS is based on the IPC-managed E-Parcel Group network of POs ("EPG") and uses the same agreed barcode, monitoring and billing systems. IPC's aim is to have the ERS rolled out to the current EPG operators in Europe and the United States. While ERS does not provide which prices are to be charged between the POs it does provide that the return is free.

The advantages of ERS for participating POs are described in the IPC Annual Review (2011) as giving POs the opportunity to offer a return product, "enabling posts to raise their parcel volume, attract e-business and avoid over-labeling costs." Or, as the Royal Mail official quoted in the same publication states: "The fact that the ERS service taps into existing operational, technological and financial processes managed through IPC is a considerable benefit."

3 Application of EU Competition Rules

The ERS system could provide a model for larger-scale cooperation among POs and possibly commercial parcel delivery companies if it meets the conditions of the legal framework set by Arts. 101, 102 TFEU and the regulations and guidelines issued thereunder. Art. 101 prohibits all agreements among undertakings which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the internal market. This includes agreements directly or indirectly fixing prices or any other trading condition. Art. 102 prohibits any abuse by one or more undertakings of a dominant position within the internal market, such as imposing unfair prices or trading conditions, limiting production markets or technical development to the prejudice of consumers, or applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage.

3.1 Agreement Among Undertakings (Art. 101)

Under the EU Commission's Guidelines on horizontal agreements (EU Commission 2010c, Chap. 1.2) a legal review under Art. 101 requires, firstly, a finding of a horizontal or vertical co-operation agreement between undertakings, secondly, a determination whether it affects trade between Member States and, thirdly, an assessment of whether it has an anti-competitive objective or actual or potential restrictive

effects on competition. If the answer to these first three questions is positive, the agreement may be justified under Art. 101 para. 3 if it leads to efficiency gains, the restrictions are indispensable to the attainment of such efficiency gains, consumers receive a fair share of the resulting benefits, and the agreement does not afford the parties the possibility of eliminating competition in a substantial part of the market. According to Bunte (Langen and Bunte 2011, p. 180), the requirement that competition must not be eliminated (Art. 101 para 3 lit. b) acknowledges that the agreement in question may restrict competition under the condition that it is not eliminated. Following Art. 1 (1 lit. e) of the Guidelines (EU Commission 2010c) the term "agreement" is interpreted broadly and means any agreement or decision by two undertakings or an association of undertakings or even a concerted practice.

In its Annual Review 2011 the IPC (2011) stated that the ERS system was developed, in conjunction with a working group consisting of Deutsche Post/DHL, La Poste, TNT Post and Royal Mail. The decision of the working group to establish the ERS within the IPC constitutes an agreement among the members of the working group and the IPC itself. To participate in the ERS, POs must join the system by agreement with IPC. Each agreement by which a post office joins the ERS system as well as all such agreements together constitute an agreement within the meaning of Art. 101.

The ERS agreement certainly affects trade between Member States. As its main objective it was formed in order to facilitate e-commerce throughout the EU by providing a simple returns process. The ERS agreement, therefore, affects the way its members continue doing business within the EU as well as, indirectly, the development of e-commerce in the EU. The impact on intra-EU trade is significant if the POs which are members to the ERS hold market shares exceeding the thresholds defined in Sec. II (7) lit. a, b of the Commission's Notice on agreements of minor importance wihich do not appreciably restrict competition under Art. 81 (1) of the Treaty establishing the European Community ("de minimis") (2001/C 368/07) O.J. 22.12.2001) of 10 % for agreements among competitors or 15 % for non-competitors.

3.1.1 Horizontal or Vertical Agreement

The agreement governing the cooperation between post offices is considered "horizontal" if the undertakings are – actually or potentially – active in the same market. If the market is defined narrowly as the local market for returns parcels it may be questionable if two different national post offices are at least potentially active in the same market. However, considering that many POs have expanded beyond their national boundaries and also offer delivery services in other countries,[5] one could conclude that post offices are potentially active in the same market. A PO of country A which offers B2C deliveries to country B must also provide a returns solution. Without the ERS system, such PO would have to establish their own returns solution in countries where they perform deliveries. But for the ERS, the POs offering

[5] E. g. DHL, which offers express parcels throughout Europe and worldwide.

B2C deliveries in neighboring countries arguably might have entered the markets for cross-border B2C parcel delivery and return logistics.[6]

If, contrary to the above, the agreement is not considered "horizontal" but "vertical" because the POs are not active in the same market for return parcels, the Block Exemption on vertical agreements (European Commission 2010b) might give participating undertakings more room to shape their agreements. In the introductory notes to the Block Exemption, the Commission acknowledges that vertical agreements may improve economic efficiency within a chain of production or distribution by facilitating better coordination between undertakings. However, according to Art. 2 (4), the Block Exemption does not apply to vertical agreements between competing undertakings if they are doing business at the same level of trade where the purchase of contract services occurs.

One might argue that by purchasing returns services from a PO in country A, the PO in country B does not compete on the market for returns services. However, they are at least potential competitors and compete horizontally with one another on the market for transportation of B2C parcels. If two or more POs are active in the market for B2C deliveries or, to put it more broadly, in the market for e-commerce parcels, they are competing with each other for the same business. From the point of view of an e-trader, any B2C delivery company which is able to offer delivery services (including returns parcels) is a potential supplier. Large e-traders like Amazon choose their supplier of delivery services on a European or even global scale and do not follow national boundaries in their choice of suppliers. According to Sec. II (7) of the Commission's Notice on the definition of relevant market for the purposes of Community competition law ((97/C 372/03) O.J. C 372, 09.12.1997) the market is defined from the consumer's perspective. E-traders following their customers' demand, look for a complete solution of their requirements for logistics services, including delivery and returns.

Therefore, one might conclude that the relevant market comprises both sides of the logistics services. Considering the market for e-commerce parcels all post offices offering B2C deliveries are competing with one another. Viewed that way, the Block Exemption does not apply here. But even if the market is defined more narrowly and limited to the handling of returns the application of the Block Exemption would still be excluded. Art. 101 would apply if a national post office performing deliveries or handling returns has a market share in excess of 30 %.[7] In their territories POs often hold a strong position in the market for B2C parcels. As part of their universal service obligation POs visit regularly every address within their country. They are, therefore, able to deliver parcels to every private address and to handle returns through their dense network of post offices. If one or more PO which is a member to the ERS agreement holds a market share in excess of 30 % the Block Exemption exempting vertical agreements from Art. 101 would not apply.

[6] Commission Decision of 21.03.2009, COMP M.5152 Posten AB/Post Danmark AS, recital 63.

[7] Block Exemption for vertical co-operation, European Commission 2010c, Art. 3; see also Guidelines On Vertical Restraints, European Commission, 2010a, 411. If one or more of the participating POs have a dominant position in their home markets the agreement would also be subject to Art. 102 (cf. sub 3.2 below).

3.1.2 Block Exemption for Specialization Agreements

The ERS agreement may be considered as an agreement between two or more parties which are active on the same product market by virtue of which two or more parties on a reciprocal basis agree to fully or partly cease or refrain from producing certain products and to purchase these products from the other parties who agree to produce and supply them. Such reciprocal specialization agreement might fall under the exemption of Art. 2 which declares that Art. 101 (1) shall not apply. However, the exemption provided for in Art. 2 does not apply to geographic market sharing agreements (Art. 4 (c)). In any event, this Exemption does not apply to an agreement where the combined market share of the parties exceeds 20 % on any relevant market. According to recital (4) of the Exemption, it can be presumed, that the positive effects of specialization agreements will outweigh any negative effects on competition below a certain level of market power. If the (combined) market share exceeds this level, this presumption does not apply and the agreement must be reviewed in accordance with each of the requirements of Art. 101 (3). If one or more POs which are party to the ERS-agreement hold market shares in excess of 20 % in their home markets for B2C parcels, the exemption does not apply to the ERS agreement.

3.1.3 Restraint of Competition

The next question is whether the ERS agreement leads to a limitation of competition between the parties (European Commission 2010c, Sect. 4.3.1). The participating POs may take the position that the agreement does not include an agreement on prices other than to offer the returns free of charge to the consumer. However, this argument overlooks the problem of lack of transparency and restraint of competition between POs. While there are no charges to the individual consumer, there still is a cost involved with handling the returns and, accordingly, a price for it. Consumers who are not interested in returning their parcels pay the price for those who make excessive use of returns. By providing free-of-charge returns, the ERS system may hinder the creation of other cost-oriented pricing models. Instead of having to buy delivery and returns services in one "package" from the PO e-traders may prefer to negotiate the price for delivery services separately from the price for returns or to buy delivery services from one company and returns from another. The ERS agreement promotes the business of POs offering the "package" of delivery and returns and does not provide for alternatives to the customer.

Apart from the pricing problem, the ERS agreement may lead to geographic market allocation, at least for returns services. A PO active in country A is unlikely to develop its own network of branch offices in country B. Considering the availability of local deliveries through the PO in country B, a PO of country A may even decide to let the PO in country B handle all of its B2C deliveries as well as the returns in country B. Even though the ERS agreement does not contain express language forcing PO in Country A to use the services of PO in country B, there is hardly any incentive on the side of PO in country A to establish a full-size local

delivery and returns service in country B, as long as the performance of the local operator in country B is satisfactory. If the ERS agreement leads to a situation where POs have no economic incentive to expand beyond their traditional national boundaries, the agreement may be considered as a geographic market allocation.

3.1.4 Foreclosure Effect

Apart from a geographical separation of markets between POs, the ERS agreement must be reviewed in accordance with the Guidelines (European Commission 2010c, Sect. 4.3.1) with respect to possible foreclosure effects on third parties. The possible foreclosure resulting from a potential abuse of dominant position will be discussed in Sect. 3.2. It is of particular relevance if competitors that cannot become members to the ERS system are put at a disadvantage to such a degree that they may be effectively kept out of the market of cross-border e-commerce delivery.

Membership to the ERS agreement is limited to members of the IPC. The Articles of the IPC restrict membership to postal organizations (Art. 9 (3) – with certain exceptions regulated in the general terms and conditions (Art. 3 (2)). By limiting membership to the ERS to members of the IPC, private operators are effectively kept out of the ERS system. Other operators that are not party to the ERS system must establish their own returns network. Alternatively, the end-customer must use the local postal service at the normal rate to return his parcel to the e-trader. This is not an attractive alternative for any customer. Without a similar returns system any competitor is, therefore, excluded from the market of cross-border e-commerce deliveries.

In order to establish a returns network parallel to the existing ERS system, private competitors must establish networks of branch offices not only within one country but within the entire EU. The dimension of this task is demonstrated by the number of post offices which presently serve as collection points within the ERS system. For example La Poste operates more than 17,000 postal outlets or 2.61 postal outlets per 10,000 inhabitants (ITA/WIK, pp. 40, 124). Deutsche Post provides a network of more than 26,000 postal outlets or 3.3 postal outlets per 10,000 inhabitants (Annual Report DP/DHL (2013), p. 16). Doubling these outlets and expanding the network throughout the EU would create substantial costs for any competitor. Even if it is not financially impossible for competitors to establish their own returns network it would take time to establish a reasonably dense network of branch offices throughout the EU, time which competitors might not have given the rapid development of e-commerce. The foreclosure effect on competition is, therefore, of serious concern in evaluating the ERS agreement.

It is questionable whether this concern can be eliminated if individual POs agree to accept returns on behalf of private competitors. In theory, this would put private competitors in a position to offer e-traders their own delivery service with the additional returns service provided by the PO in the country of destination, provided that the PO in the country of destination is willing to enter into such agreement. However, even if such bilateral agreements are concluded between POs on the one hand and private operators on the other, private operators would still be at a disadvantage relative to the ERS system, which provides a simple and uniform returns process including common

labeling features administered by IPC. ERS gives operators and e-traders full tracking and tracing capability, and the system is supported by a full customer service solution. Private operators entering into bilateral agreements with POs would also be excluded from participating in the steering committee, for which only IPC member POs are eligible. The IPC information as published on its homepage emphasizes the benefits of central management by referring to a management team dealing with operational questions, customer service, IT and marketing. Bilateral agreements are, therefore, no equivalent to a centrally administered system such as ERS.

In conclusion, the ERS agreement constitutes an agreement within the meaning of Art. 101 having as its object or effect the prevention, restriction or distortion of competition within the common market.

3.1.5 Benefits to Consumers

Without an exemption under the Block Exemptions for vertical (European Commission 2010b) or specialization (Commission Regulation 2010) agreements, the ERS agreement may still be exempt under Art. 101 (3) if the benefits to consumers outweigh the disadvantages, provided that it does not impose restrictions which are not necessary for the attainment of the objectives, and provided further that it does not afford the participating undertakings the possibility to eliminate competition in a substantial part of the market.[8] The ERS system establishes an effective system of making e-commerce products available to customers throughout the EU. Therefore, the benefits to the consumer may justify certain restraints of competition. On the other hand, the restraint must be limited to the absolute minimum necessary for the attainment of the objectives of the agreement. The economic disadvantages created by the restraint of competition must be weighed against possible efficiency gains, provided they are passed on to the consumer.

The fact that consumers in the EU are able to return parcels free of charge at their local post office, even if the vendor is located outside of their home country, constitutes a benefit which is likely to make EU-wide e-commerce more attractive to consumers. Nearly everywhere within the EU there are post offices in every neighborhood. The use of post offices for the return of unwanted e-commerce goods is, therefore, attractive to consumers. It is not so clear, however, if the full benefit of the system is passed on to consumer although the returns service is free of charge. There is, of course, a cost involved in returning parcels to the vendor and these costs are likely to be included in the price of goods or in the transportation charge. If national POs are the only beneficiaries of the advantages of the ERS system, and if competitors are effectively foreclosed, there is no incentive for POs to pass on the efficiency gains to their customers and, eventually, to consumers. In view of the exclusionary character of the ERS agreement, there are at least doubts as to whether the benefits resulting from lower costs are actually passed on to consumers.

[8] Guidelines on the application of Article 81 (3), European Commission 2004, Chap. 3.3.

3.1.6 Market allocation

The exemption of Art. 101 (3) does not apply if an agreement that has as its object or effect the allocation of geographic markets. As shown before, the ERS agreement eliminates the need for its members to establish their own network of returns stations in countries other than their own. The problem of geographic market allocation would be even worse if the ERS agreement – possibly in conjunction with the functionalities of the E-Parcels Group (EPG) – eliminates the incentive for participating members to expand their deliveries as well as their returns beyond their own national borders. The geographic market allocation would run counter to the objective of creating a single market for postal services. Chances that a geographic market allocation may be the effect of the ERS agreement are particularly high, since the ERS system is available only to POs that are members of the IPC. These POs have a common history of geographically defined separate markets and, with the help of the ERS agreement, POs are able to continue to run their business as separate legal and geographic entities, with the IPC coordinating the international transactions.

3.1.7 Exclusion of Private Competitors

The exclusion of private competitors from membership to the ERS agreement adds to the concerns. The exclusion of private competitors cannot be based on the universal service obligation to which the POs have subscribed in their national jurisdictions. The universal service obligation does not include an obligation to provide for an international returns service free of charge to the consumer. On the contrary, the Consumer Rights Directive specifically permits charging the consumer for the returns service.[9] The ERS agreement is based on the expectation of its members to increase business for its members. Participating POs are not acting in their capacities as providers of universal services but as normal business undertakings.

By excluding private competitors from ERS, the benefits to consumers are decreased rather than increased. Rather than being able to operate a simple and generally available returns service for all parcel companies the ERS agreement limits the choice for e-traders and, consequently, the variety of services offered to the end customer. In its *REIMS II* decision (European Commission 2003), the Commission objected to a similar exclusion of private operators in an agreement on terminal dues among POs. Although the *REIMS II* decision deals with the cross-border delivery of letters, it is comparable with respect to the exclusion of private operators. The Commission found that by excluding private operators, the agreement negated the pro-competitive impact of the market opening for outgoing cross-border mail.[10]

[9] Art. 18 of the Consumer Rights Directive (European Union 2011).

[10] REIMS II, text no. 149.

3.2 *Abuse of Dominant Position (Art. 102)*

It is questionable whether an obligation to grant access to the ERS system would also result from the application of Art. 102, which prohibits the abuse of a dominant position. Although many POs hold high market shares in their national postal markets, they are not necessarily dominant providers on the relevant market for B2C parcels. A dominant position will generally be assumed if an undertaking holds a market share in excess of 50 %.[11] The Commission in its Guidance on Enforcement (European Commission, 2009) describes a more flexible threshold and mentions 40 % as an indicative number. To the extent that the POs involved in the ERS system hold market shares in excess of 40 % or even 50 % in the market for B2C-parcels, they are bound by the restrictions of Art. 102 and, in particular, by the prohibition of applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage.[12]

Apart from market share, other elements contributing to a position of dominance must be evaluated. If other elements contribute to a position of dominance, the level of market share is not the only decisive factor. One consideration is whether the network of post offices controlled by a PO constitutes an "essential facility" access to which is necessary in order to compete in the B2C market. If so, control over an essential facility may contribute to a position of dominance obligating the respective POs to make the essential facility available to other interested parties.

In its *Bronner* decision, the ECJ denied the access claim of a newspaper to the nation-wide delivery service of its competitor.[13] The competitor argued that the defendant held a dominant position in the market of newspaper distribution and should therefore be obliged to grant access to its distribution system. The ECJ denied the competitor's access claim arguing that it was not impossible for the competitor to sell and distribute its newspapers by other means even though they may be more costly than the defendant's distribution network.

In light of its *Bronner* decision, it is not clear if the ECJ would consider the availability of an international returns service operated by European POs as an essential facility. The cost of establishing a private network of returns stations is, by itself, probably not a sufficient argument. In some countries private parcel companies have established or are about to establish their own system of branch offices. Furthermore, individual POs have declared their willingness to enter into bilateral agreements with private operators.

However, the ERS agreement differs from *Bronner* in two important aspects. The *Bronner* case did not involve an agreement among several undertakings but the alleged abuse of a dominant position. The *Bronner* case can, therefore, not be compared to the case of the ERS agreement which, as shown before, conflicts with the rules on horizontal agreements. In addition, the objective of developing

[11] ECJ decision of 06.12.2012 – case 457/10 P "AstraZeneca".

[12] Art. 102 lit. c.

[13] ECJ Decision of 26 November 1998, C-7/97.

competition as stated in the Postal Directive (European Union 2008) must be considered when applying Art. 101 and 102. The provision of access for the return of postal shipments is specifically mentioned in Art. 11 a as a matter of concern to be addressed by the Member States. Therefore, a system which runs contrary to these objectives must be viewed extremely critically

4 Conclusions

The returns solution for e-commerce parcels developed by the International Post Corporation is a feasible model for cooperation among parcel operators in order to provide cost-effective returns services. Although the Agreement constitutes a restraint of competition within the meaning of Art. 101 (1) TFEU the benefits resulting from the agreement may outweigh its disadvantages, provided that the Agreement does not lead to geographic market allocation and, further, that private operators are allowed to participate in the ERS system on a non-discriminatory basis.

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The Concentration Phenomenon in E-commerce

Claire Borsenberger

1 Introduction

The universality of the Internet led experts to expect markets to expand and the range of products and services to proliferate, making Internet-related markets more transparent and competitive. Electronic commerce, in particular, has been seen as an opportunity for retailers to expand their market over a geographically limited customer catchment area. For example, Poon and Jevons (1997) were amongst the first to recognize the potential benefits that the Internet offered to retailers, suggesting that it "creates an unprecedented opportunity for businesses to engage in national and international marketing campaigns that previously would have been unaffordable" (p. 29). This would tend to reduce their (local) market power and increase the intensity of competition. But in many Internet-related markets, only few businesses have emerged, and often one actor is in a dominant position. This phenomenon is observed in the B2C e-commerce market all around the world. In countries where online commerce is relatively well developed, such as France, Germany, the United Kingdom, the USA and even China, despite a large number of merchant sites, the online selling business is highly concentrated around a few major actors and appears to be more concentrated than offline commerce.

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Even if the current level of concentration on e-commerce sector does not raise competition policy issues and could put downstream pressure on prices paid by end-consumers (and increase their surplus), concentration on e-commerce sector is a crucial issue from the point of view of postal operators who offer delivery services to these e-tailers. The structure of the downstream market (formed by the e-tailers) affects the vertical relationships in the value chain and the equilibrium in the upstream market (formed by the input providers like delivery operators). The strategic choices of parcel delivery operators in terms of pricing policy in particular, their revenues, and their profitability all depend on the characteristics of their e-commerce customers. With greater concentration in the e-commerce market, parcel delivery operators would face buyers with an increasing bargaining power. Some large e-tailers, like Amazon, are currently trying to develop their own delivery network in mature e-commerce countries. This raises the possibility that vertical integration could be a credible threat to force delivery operators to offer better terms.

Section 2 describes concentration in e-commerce sector observed in Asia, the United States of America and Europe. Section 3 discusses economic rationales for this phenomenon, emphasizing differences with offline retail activity. Domination by a few players can be explained by the existence of major network externalities and economies of scale, the role of search engines and price comparison websites, the importance of advertising spending, the strong price competition between online and offline retailers, and the strategy of dominant actors which weigh on e-tailers' margins and reinforces the concentration trend. Section 4 concludes.

2 Some Facts and Figures

Concentration in Internet-related markets seems to be a common phenomenon. As noticed by Haucap and Heimeshoff (2013, p. 2), "many very successful Internet-based companies are nearly monopolists". Although the Web has grown to several billion pages over the past few years (Google claimed having indexed over 30 trillion documents in 2012), just a few sites get most of the visits whatever the category of websites or topics considered. As noticed by Dewan et al. (2004, p. 182), "with this number of pages online and the ease with which an individual user can visit any one, it is surprising that just a handful of sites garner a majority of visits from users".

For example, Google clearly dominates the Internet search engine market in many countries and leaves only limited space for a relatively small competitive fringe. In the U.S., Google had a share of 67.5 %, Bing (Microsoft's search engine) 18.4 %, Yahoo 10.3 %, Ask 2.4 % and AOL 1.3 % in February 2014 (comScore 2014). In the UK, just as in many other European countries, Google had a share of 88.6 %, Bing of 6.38 % and Yahoo of 3.44 % in February 2014 (The Eword 2014).

Similar concentration is observed in the e-commerce sector. In countries where online commerce is relatively well developed, such as France, Germany and the United Kingdom, the online selling business is still highly concentrated around a

few major merchant sites and appears to be more concentrated than offline commerce. This holds despite there being a large number of merchant sites, either operators that make the bulk or all of their sales over the Internet ("pure plays") or traditional operators that have developed their online business ("click-and-mortar"). Note that all numbers stated in the following do not reveal any current issue related to antitrust or dominance problem – even in markets considered as unconcentrated, leaders could capture such a market share. The point here is just to show that some actors are growing whereas at the beginning of Internet expansion, experts would expect the emergence of a competitive market. The question is: when this trend would stop? Will the e-commerce market become oligopolistic?

In France, between 2005 and 2013, the number of online retail sites has increased by a factor of 10, but the activity remains concentrated in the hand of some leaders. In January 2013, according to the iCE index (Fevad 2013), 1,330 websites (1 % of the total number of French online sites) recorded over 5,000 transactions per month, while over 47,880 e-tailers (36 %) recorded fewer than 10 transactions per month. Around 80 % of the 133,000 retail websites recorded fewer than 100 transactions per month.

According to the last Xerfi study (Xerfi 2014), "concentration" is growing despite the growth in the number of e-tailers and the rising size of the market. Leaders are capturing an increasing market share: the 30 first e-tailers generated a global turnover higher than €13 billion in 2012 (excluding marketplaces), 30 % of total yearly online sales, against less than 23 % in 2010 (on a cumulated turnover of €7.3 billion). This study also reveals that click-and-mortar retailers are wining market shares over traditional distance sellers and over pure-plays. Three pure-plays, however, lead of the French e-commerce market: Cdiscount, Amazon and Vente-privee.com.

Concentration occurs outside France. In the USA, as in France, Amazon has outperformed the e-commerce industry over the past 5 years, increasing its (value) market share from 6.8 % in 2008 to 16.1 % in 2013 (Siemer & Associates figures). In China, increasing concentration is even more obvious. The first B2C player, Tmall (established in April 2008, belonging to Alibaba Group) dominates the sector with a share equal to 49.7 % of the Chinese B2C market revenues in the last quarter of 2013 (ChinaInternetWatch 2014).

Business is even more concentrated in e-commerce than in offline commerce. According to the ranking established by Xerfi in 2010 in France, around 30 e-tailers generated a turnover higher than €30 million, representing a global activity of €7.5 billion (25 % of e-commerce activity). Amongst this sample of leaders, 70 % of the activity is realized by 10 operators whereas in offline retail sector, this share reaches only 33 % (Xerfi 2012).

Note that the point here is not on antitrust issues, but on the consequences of this concentration at the downstream level on the e-commerce value chain and on the input providers (in particular, the parcel delivery operators). The trend to concentration of e-commerce activity in the hands of few e-tailers is (at the moment) not competitively troublesome. The strong competition between e-tailers benefits consumers since it puts pressure on margins and lowers prices, as we will see in the next section.

3 Explaining Concentration

One might have expected that e-tailers would have less market power than traditional retailers, and that Internet-related markets will be close to pure and perfect competitive markets, for at least two reasons. Firstly, there is no spatial product differentiation and goods sold in B2C e-commerce are assumed essentially homogenous. Secondly, the cost of search on the Internet is lower than on the street. Prices can be compared virtually at no cost.

However, these expectations clearly have not been realized. In fact, goods sold online are not as homogeneous as expected. Indeed, a distance transaction involves non-price attributes (delivery, payment security, reliability) that are relevant for most customers. By reducing the degree of homogeneity of composite goods purchased in B2C e-commerce, the heterogeneity of complementary goods increases search and information costs. Moreover, markets are not as transparent as expected, and as described below, some characteristics of e-commerce tend to raise barriers to entry and lead to market concentration.[1]

3.1 Small Margins

Conventional theories suggested that the Internet would drive down prices and lead to perfectly competitive prices since search engines or price comparison websites (or shopbots, the contraction of 'shopping robots') would lead sellers to compete on prices and make consumers becoming more and more price sensitive.

This price competition was effectively observed for some products. What consumers find most appealing about e-commerce remains the prospect of finding bargains and saving money. Fevad/CSA (2013) reports that the prospect of more attractive prices remains one of the main reasons for shopping online, mentioned by 71 % of online users. A number of studies have found that the prices of many products are lower online than in off-line stores. McKinsey (2011) compared the prices of 150 products sold online and offline, and concluded that the prices found on the Web are nearly 10 % lower than those charged in traditional retails in France. This price differential is thought to generate annual savings of around €2.5 billion for consumers.

[1] Concentration is also an issue regarding sales. In particular, two opposite views exist about the effect of digitalization on the concentration of sales, in particular of cultural goods. Some authors predict a shift in demand from the most popular products (the hits) to niche products, and thus a decrease in concentration. This is the 'long tail' effect, coined by Anderson (2004, 2006). Others believe that Internet reinforces the popularity of bestsellers and thus increases concentration. This is the 'superstar' effect (Rosen 1981; Adler 1985; MacDonald 1988) or the 'winner-takes-all' phenomenon (Frank and Cook 1995). The existence of this long tail effect vs. the superstar one is heavily debated. Empirical studies provide conflicting results both in the book industry, in the video industry and in the music (CD) industry. The long tail theory is sometimes confirmed and sometimes contradicted by facts.

According to the Autorité de la Concurrence (2012), "for most items, the average online price is 5–15 percent lower than the average off-line price."

This price competitiveness of online commerce reduces e-tailers' margins. According to Bourdin (2012), most of the companies engaged in e-commerce activity have not generated positive profits. Among the biggest French e-tailers, the net margin varies between −6 % and +5 %. According to a survey conducted during the first quarter 2013 (CCM Benchmark-Webloyalty 2013), in France 36 % of interviewed e-tailers admitted that their activity was unprofitable in 2012. This proportion reached 55 % for small sites. Low margins reinforce the trend towards concentration in the e-commerce sector: only the largest online retailers or those offering niche products survive.

3.2 The Existence of Increasing Returns to Scale and the Issues of Trust and Visibility over the Internet

E-commerce is characterized by economies of scale in the supply side: the technological infrastructure (website, fulfillment technology, order tracking, reliable payment system) requires non-negligible investments. These investments are fixed costs and a source of increasing returns to scale. The delivery of physical goods is also characterized by important scale economies, allowing large e-tailers to benefit from volume discounts and more competitive tariffs than small and medium e-commerce companies. So it is crucial for e-tailers to reach the critical mass of customers in order to be able to develop their activity. Under these conditions, the strong get stronger, the weak get weaker.

The need to attract a critical mass of customers is reinforced by the fact that demand fuels demand in e-retailing. A purchase on the Internet from a not already known retailer could be considered as an experience good, i.e. a product or service where characteristics are difficult to observe in advance but can be ascertained upon consumption. In this context, a larger customers' base could signal e-retailer trustworthiness. This effect is reinforced by the indirect network externality that consumers' utility increases in the number of users of a website since the range and the quality of services provided by an e-retailer would increase with the number of customers.

Trust and reputation take an extraordinary importance in electronic markets because of the typical spatial separation between buyers and sellers on the Internet. A positive shopping experience will reduce the inclination of an individual to risk the investment of a first purchase at another store, unless the expected price/quality differential compensates at least for the additional uncertainty. This can impede entry and lead to market concentration.

As noticed by Kung et al. (2002), many studies have found that the majority of consumers are not as price sensitive as expected, and they do not actively search competing sites before making a purchase decision. Brynjolfsson and Smith (2000) found that e-tailer reputation is an important determinant of consumer choice. The authors' survey on reputation on the Internet, conducted among 20,000 online

consumers who compared prices at 33 online bookstores, revealed that a majority of them did not opt for the best price but their choice was strongly influenced by the name of the store or brand. In particular, Brynjolfsson and Smith (2000, p. 580) observed that "the retailers with the lowest prices do not make the most sales". Bounie et al. (2012) findings from a price dataset for new books, CDs and DVDs entering the daily top 100 list in the American, British and French Amazon marketplaces from March 2006 to November 2006, confirm these results. The authors show that there is a significant reputation premium: a well-established seller can charge a price 10–20 % higher than the average seller.

The amount of information available on the web is so huge (compared to limited consumers' resources to handle it) that consumers tend to restrict their attention to a very limited fraction of online shops, generally the largest. In consequence, consumers are generally not aware of the existence of all online retailers. As demonstrated by Grossman and Shapiro (1984) in the case of traditional retail markets, but applicable to e-commerce, this incomplete information allows putting prices above marginal cost, resulting in price dispersion. As argued by Cambini et al. (2011), "consumers use brand as a proxy for retailer credibility in non-contractible aspects of the product and service bundle, such as shipping reliability. (…) In this case, most consumers greatly prefer well-known brand even if the total price is higher" (p. 13). Note that this is not specific to the Internet but contributes to create heterogeneity in apparently homogeneous products.

3.3 The Cost of Reputation

As mentioned before, the issues of trust and visibility of the brand on the web are crucial for e-tailers. But establishing a reputation is costly. It involves huge sunk marketing and advertising expenditures to acquire consumers. Sutton (1991, 1998) suggests that such sunk costs could explain the concentration of e-commerce observed in many countries. Internet retailers need to advertise more than traditional retailers, which can rely on their local physical presence to remind consumers of their existence. To increase their audience, e-tailers must 'buy traffic': they must invest in website development to enhance the attractiveness of the browsing experience and advertise to inform consumers about company's existence, web address, prices, and so on. They must buy databases in order to send e-mails, buy advertising banners, keywords or sponsored links on search engines. Moreover, investments in visibility must be permanently renewed.

Advertising and marketing spending represent on average 24 % of the total costs of French e-commerce sites (up to 41 % for pure plays) according to Bourdin (2012). Latcovich and Smith (2001) indicated that Amazon.com spent 20–30 % of its revenues in advertising, Barnesandnoble.com over 40 %, while the advertising/sales ratio of Fatbrain.com had increased by more than 70 % over the period 1995–2000.

One way to create traffic is to be listed first on search engines and price comparison sites. From an econometric analysis of organic clicks—listings on search engine

results pages that appear because of their relevance to the search terms—arising from searches for products on search engines for 759 American retail sites, Baye et al. (2014) found that a retailer's rank on a results page is an important driver of its organic clicks. Exclusion from the first five pages of results for a search led to a 90 % reduction in organic clicks. For retailers that are listed on the first five pages of results, a one percent improvement in rank leads to 1.3 % more organic clicks for that search. The authors found also that the brand equity of an online retailer is an important driver of organic clicks and concluded that the direct benefit of investments in brand equity is an increase in the number of consumers clicking one retailer's link instead of a competing link on results pages. These investments in brand have an additional indirect effect: search engines tend to place retailers with stronger brands in better positions which results in additional increases in organic clicks.

Although search engines and shopbots sites should in theory reduce information asymmetry and consumer search costs, recent economic literature shows that they have adverse effects. Eliaz and Spiegler (2011) showed that vertical search engines—websites that provide products (information and services) tailored to address specific subject matters—do not necessarily maximize consumer search quality. They do not always conveniently assist consumers in finding lower prices and do not allow consumers to be aware of the existence of the plurality of e-tailers. A first reason is related to the fact that search engines often rank merchant sites based on their popularity. This tends to reinforce the attractiveness of already big sites. According to a BVA-Mappy-Novedia study (2013), the first places in a Google search are occupied by the giants of online sales. However, the visibility drops dramatically when a merchant does not appear on the first Google page. The first three results monopolize over 60 % of clicks on a page and have a visibility rate of 100 %, the first page of results represents approximately 85–90 % of clicks, the second one 4–6 % and the third only 2–3 % of clicks.

A second reason that consumers do not rely on shopbots is that they do not always give all information necessary to make a relevant choice. As emphasized by Kung et al. (2002), to make accurate price comparisons, online consumers must know not only the price of the product but also the shipping fees, sales taxes and so on. However according to Civic Consulting (2011, p. 69), "one can find loopholes, shortcomings and ambiguities" in the price listing made by price comparison websites (PCW) in Europe. In more than half of the trials, the PCWs were not informative on delivery costs and taxes. Furthermore, authors found that the prices quoted by PCWs are inaccurate in over 20 % of the cases.

Shopbots are often unclear about their default rankings of offers and do not always rank offers by price, as default ranking presented the cheapest offer among the top five about two-third of the time. The information given by PCW could also be biased by their business models. Only 16 % of PCWs gave clear information about why some retailers were listed but others not. Indeed, consumers could not be sure to see the best prices available or just the 'best prices' PCW are paid to show. As a result, information is not always reliable and could even be detrimental for customers and the e-commerce market is not as transparent as expected. Incautious PCW could be induced to promote offers which generate the highest revenues for

them even if they are not the best deal for consumers. As demonstrated by the recent growing literature on search engines, it could be on their interest to implement strategies of diversion, i.e. introduce noise in the search process through which consumers find the products they were initially looking for. The objective is to divert consumers' attention away from this product toward another unsolicited one which generates higher profit for the intermediary (Hagiu and Jullien 2011).

Finally, increasing the transparency of pricing could contribute to the stability of tacit collusion among B2C e-commerce companies. Improved transparency on the producer side is typically thought to be anti-competitive (Kühn and Vives 1995; Ivaldi et al. 2003). As stressed by Stigler (1964) and formally analyzed by Green and Porter (1984) and Abreu et al. (1985), the lack of transparency on prices and sales makes collusion more difficult to sustain and more limited in scope as price undercutting is harder to detect.

3.4 The Development of Marketplaces

An e-tailer may not just be the seller of products, it may also provide a marketplace for other e-tailers to sell, Amazon and eBay being examples. The activity of marketplaces is growing in all countries where e-commerce is well-developed. In 2013, 2 million sellers were affiliated to Amazon's marketplace around the world, selling more than 1 billion items. In France, according to Oxatis (2014), 32 % of e-tailers sold their goods through marketplaces in 2013. According to the FEVAD (2014), the volume of sales realized in marketplaces increased by 42 % in the last quarter 2013 and represented 16 % of the global activity of these e-tailers.

In theory, this intermediate platforms model could be a win-win arrangement. The marketplace stands to gain by broadening its service line range and building customer loyalty. It optimizes the use of its technical infrastructure, and benefits from larger economies of scale by pooling the marketing, commercial and technical costs with the affiliated sellers. Individual sellers stand to gain by acquiring a new sales channel at a lower cost. They benefit from the reputation and the visibility of the marketplace without incurring marketing and technical costs. Consumers stand to gain by benefiting from the reputation of the marketplace as well and the long tail of products offered on the same site.

Affiliation with a marketplace can, however, ends up making a small shopping site dependent on the platform and, in the long run, hinders its own development, leading to the concentration of actors in the e-commerce sector. This dependency could be mitigated by a multi-homing strategy i.e., affiliation with several marketplaces at the same time. But it is not an attractive strategy according to Haucap and Heimeshoff (2013). First of all, multi-homing is difficult for small sellers because they often sell unique items and heavily benefit from a large group of customers to find buyers for their products. Additionally, it is difficult to build up reputation on several platforms, as reputation depends on the number of transactions a seller has already completed on a given network (Melnik and Alm 2002; Bajari and

Hortaçsu 2004; Dellarocas 2006; Resnick et al. 2006). Transferring reputation from one platform to another is rather difficult.

Hence, investment into one's reputation is typically platform specific. In addition, the design of online trading platforms, their market rules, the handling of the platforms, etc. usually differ from across platforms. As a result, sellers could face significant transaction costs and buyers some switching costs if they decide to use another platform. This adverse effect is reinforced by the fact that some platforms try to create endogenous switching costs in order to lock-in customers (e.g. the so-called eBay university offering courses to learn how to use eBay more efficiently, or the loyalty program Amazon Prime).

4 Conclusion

At the beginning of Internet expansion, it was widely expected that it would be a perfectly competitive market. E-commerce is considered as "one of the main drivers of a more prosperous and competitive Europe, with a significant potential for contributing to economic growth and employment" (European Commission 2013). Many benefits were expected from the development of e-commerce: lower prices and more choice for consumers; more opportunities, access to new markets and higher productivity for businesses; a greener and more sustainable way to consume with optimized delivery solutions for the benefit of the whole society (European Commission 2012). The Commission aims to support the development of e-commerce through a set of actions. In particular, the Commission is focusing its attention on the physical delivery of goods ordered online as one of the key elements for e-commerce growth, placing particular emphasis on the cross-border delivery of parcels and the needs of SMEs, arguing that e-commerce must be accessible to all citizens and to all businesses, regardless of their size and location.

Nevertheless, concentration has been observed in e-commerce. It can be explained by one or a number of several factors, some of which are consistent with competition while others are not. This raises a number of general public policy issues[2] and specific concerns for parcel delivery operators.

This would put pressure on their margins and affect their profitability as the bargaining power of their customers will increase and as the e-commerce market structure would tend toward an oligopsony or monopsony.

Although necessary to create a relationship based on trust between e-retailers and e-consumers, delivery issues appear marginal compared to the obstacles of reputation and visibility over the web faced by new/small e-retailers. As input providers, delivery operators could suffer from the concentration of e-retailers.

[2] Is this concentration good or bad? Would concentration limit the expected benefits of e-commerce (access to a large offer at better price)? Should public authorities intervene to safeguard some (artificial?) competition between actors? If yes, how regulate actors in order to promote competition?

The e-retailers could have substantial power to negotiate attractive commercial terms. The pressure put on prices by big customers like Amazon is already strong and reduces the margin of parcel activity of postal operators. The true challenge for SMEs is first of all to find ways to be visible on the Internet in order to be able to compete with companies such as Amazon.

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Implications of 3D Printing for the United States Postal Service

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1 Introduction

3D printing refers to a set of technologies that builds physical objects from virtual representations. While approaches vary, these technologies process a digital model of an object into horizontal slices, like a loaf of bread standing on end. A 3D printer then iteratively prints each (nearly) two-dimensional slice, layer-by-layer, from the bottom up. By allowing physical objects to be created from virtual representations on demand, 3D printing could disrupt supply chains, warehousing, manufacturing, and the myriad industries that rely on them. These prognostications, however, assume technological advances and consumer acceptance not yet realized. It is not clear which businesses will have the problems and which will have the opportunities.

The United States Postal Service® (USPS) stands to benefit from a major 3D disruption. The outcome for USPS depends upon the advancement of the technology, its adoption by consumers, and the strategies it takes to position itself to capture benefit or avoid injury. For instance, parts could be "digitally shipped" to local post offices or allied nearby businesses, 3D printed, and physically delivered on the same or next day. On the other hand, if 3D printers become ubiquitous, many would-be mail-order shipments could become digital deliveries, bypassing USPS entirely.

This paper provides a framework for considering potential outcomes for USPS should a 3D printing "revolution" occur. It hypothesizes three supply-chain

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scenarios in which 3D printing helps to move the production of goods closer to the point of consumption. For each scenario, we quantify the effects on USPS package flows under varied 3D printing uptake rates. USPS's comprehensive delivery network coupled with its strength in handling lightweight goods gives it a natural advantage to be the best-choice delivery option for new package shipments spawned by the revolution.

This paper is organized into six sections. In addition to this introductory section, Sect. 2 offers a brief overview of 3D printing and summarizes recent forecasts. Section 3 describes the commercial-packages supply chain and builds a framework for scenario analysis. Section 4 determines baseline values for the framework, while Sect. 5 explores three particular disruptions to the framework. Section 6 provides concluding remarks.

2 An Overview of 3D Printing

3D printing, also referred to as "additive manufacturing," is a generic name given to a set of technologies that creates physical objects from virtual representations. The most common 3D printing technique uses materials extruded through a heated nozzle to build objects layer by layer. The approach is analogous to—and first inspired by—a hot glue gun. Other techniques use lasers to create solid objects out of resin that is selectively melted. Still other approaches use glue to fuse together sheets of plastic or paper that are cut to specific shapes.

3D printing confers some significant advantages over traditional manufacturing. Its automated nature allows individuals with no machine-shop experience to produce objects. Many 3D printing approaches reduce materials waste (and therefore cost) as there are no extraneous portions that need to be drilled out or snapped off. 3D printing also allows for designs that would not be possible or practical with traditional techniques. A hollow sphere can be 3D printed, but no such object could be produced from a wooden block without somehow cutting or chiseling through the sphere itself.

3D printing currently has significant limitations. Materials suitable for 3D printing are severely limited, compared to traditional production, meaning that part characteristics such as rigidity or chemical and temperature tolerance may be outside acceptable bounds. The 3D printing process itself can lead to endemic weak spots in finished products, given the layer-by-layer construction and potential flaws in some 3D designs. In addition, all 3D printers have limited materials with which they can print, and many printers are limited to a single material. Importantly, it can take a long time to 3D print larger objects as modest increases in size require exponentially longer times to print.

Rapid prototyping is the dominant industrial application of 3D printing. It allows for relatively quick and cost-effective production of first-of-its-kind goods and gives engineers a greater ability to make swift changes in prototype design. As a manufacturing technique, 3D printing is beginning to establish itself within niche sectors, particularly in the medical, aerospace, and automotive industries.

According to Wohlers Associates (2014), the 2013 total market for 3D printing products and services was $3.1 billion. Forecasts of 3D printing technology's future vary between excellent and incredible. On the conservative side, Freedonia Group (2013) forecasts 20 % annual growth of the industry, leading to $5 billion in world demand by 2017. Wohlers Associates (2014) forecasts markets of $6 billion and $11 billion for 2017 and 2021, respectively. Canalys (2014), a market research firm, forecasts revenue of $16.2 billion by 2018, representing a compounded annual growth rate of almost 50 %. Manyika et al. (2013) forecasts impacts of up to $550 billion by 2025, though this number includes consumer surplus values.

In Sect. 5, we present the results for three non-exclusive scenarios of 3D development—warehouse, local hub, and in-home. These all involve ways in which 3D printing technology becomes incorporated into manufacturing processes of consumer goods.

3 The Commercial-Packages Supply Chain

An analysis of the Fiscal Year (FY) 2013 (Oct. 2012–Sept. 2013) commercial-packages supply chain yields a reference point from which to consider possible impacts of a robust and omnipresent 3D printing landscape. The U.S. commercial-packages supply chain is composed of shipments of small quantities of products from businesses to consumers (B2C) and from businesses to businesses (B2B). This supply chain is a key feature of the "e-commerce" retail segment of the economy, a segment that has been growing considerably over the last decade. Figure 1 depicts the supply chain from manufacture to final delivery. Starting from the left, manufactured products are shipped to regional fulfillment centers or small, decentralized retailers where they are warehoused for future consumption. When consumers place an order, the products are configured into shipment packages and are entered into USPS's processing network or tendered to private delivery firms that provide drop shipment service to a destination postal facility near the final delivery point or make

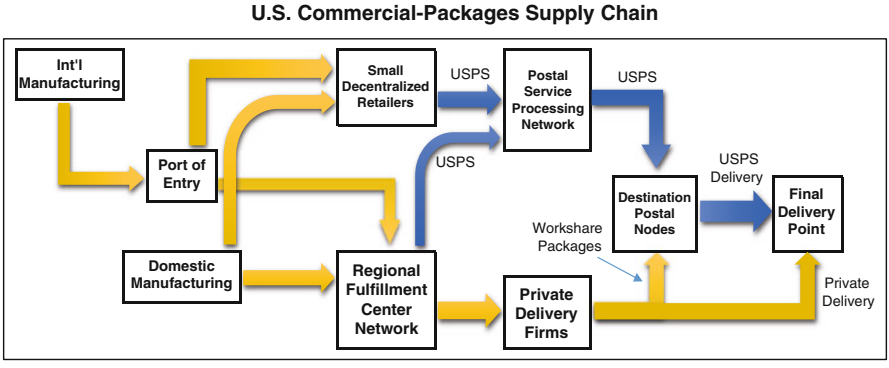

Fig. 1 U.S. commercial-packages supply chain

final delivery themselves. The packages that private delivery firms drop ship to postal facilities are called "workshare" packages because part of the work to process them is performed by private delivery firms and part is performed by USPS. While the supply chain for some finished products is not depicted in this simplified diagram, Fig. 1 nonetheless provides a sufficient structure from which to analyze the disruptive effects of 3D printing on USPS.

The mailing manifest database of USPS's Electronic Verification System (eVS) provides the greater part of the data for this analysis. The eVS volumes represent 39 % of all parcel-shaped pieces delivered by USPS in FY 2013. The eVS volumes also represent almost 70 % of all permit-imprint packages delivered by USPS. The eVS manifest database is a census of each individual package traveling along USPS's portions of the commercial-packages supply chain. Individual package characteristics such as origin entry location, destination location, and piece weight are included in this database.

Package weight and value are the overriding factors that private delivery companies consider when evaluating which of their packages will take advantage of USPS's last-mile delivery network. The mailers with the largest annual volumes in eVS are FedEx, DHL Express (DHL), and United Parcel Service (UPS). This drop shipping activity represents over 75 % of all eVS volumes in FY 2013.

It is often assumed that private delivery firms are handing off these packages to USPS because the final delivery address is in a remote location that is outside the primary distribution nodes of these private delivery firms. Were this true, then we would expect to see within the eVS database commercial packages flowing to these locations at a higher rate than predicted by the demographic profile of these locations. However, the eVS data clearly indicate that this is not the case. Under three different definitions of destination location—urban versus rural, surcharge zone versus non-surcharge zone, and USPS field budget area—the distribution of eVS packages across destination location mirrors the number of delivery points and population at those locations.

If the delivery location is not the primary driver for the decision, then it must be the characteristics of the packages themselves. Executives at private delivery firms have publicly noted that weight and value are the key drivers for packages that are handed off to USPS for final delivery. [1] In FY 2013 almost half of USPS's "Parcel Select Lightweight" package category—parcels weighing no more than one pound—was attributed to drop ship activity from private delivery firms.

Current 3D printing typically involves the manipulation of low-density raw materials. Parts produced by 3D printing are disproportionally small and light. Most 3D printing machines operate within a compact build volume that is comparable to a large shoebox, and the time necessary to make an object, for instance, increases exponentially with that object's size. Also, raw materials are expensive, which motivates designers to employ designs that limit their use. In short, products that can be competitively 3D printed are more likely than not to be small.

[1] See comment from FedEx CEO Fred Smith. cepobserver.com/2010/09/fedex-earnings-implications-for-the-usps.

Furthermore, 3D printing may be motivated by requirements that make lighter parts beneficial. According to Vasagar (2013), designers are contemplating how 3D printing can include "holes" within certain parts to make them lighter, which saves fuel. As private delivery firms seek to harness the density of USPS's last-mile delivery network, a significant portion of the packages flowing through this supply chain are lightweight and low value. The combination of these factors suggests that USPS would be well-positioned to respond to an increased quantity of such packages if 3D printing were to enhance the traditional commercial-package network.

4 Establishing a Baseline

The foundation of our analysis is a dissection of the eVS database by weight interval and mailer category. We focus on packages weighing 1.5 lb or less and originating from mailers whose products are most likely to be impacted by a 3D printing revolution. Over 95 % of eVS packages originate from private delivery firms and national retailers for which no product information is available. We use the U.S. Census Bureau's Annual Survey of Retail Sales (2011) to approximate the product mix for these particular mailers. This survey collects information about e-commerce retail trade sales, and it provides detailed e-commerce data by merchandise lines. By incorporating this survey information, we find that, as of FY 2013, 42.4 % of the eVS package mailstream is likely to be impacted by a 3D printing revolution.[2]

To establish a baseline, it is important to view the commercial-packages supply chain in terms of those firms that make final deliveries. The common perception is that the supply chain is dominated by national carriers such as UPS and FedEx, because these private firms collect revenue directly from package mailers. However, when the "credit" for workshare packages is transferred to USPS, its commercial-packages market share rises to 29.0 %, while the market share for all other firms falls to 71.0 %.

We use these market shares to extrapolate eVS package volumes for two purposes: (1) to approximate USPS commercial packages for non-eVS mailers (about 17 % of USPS commercial packages); and (2) to approximate non-workshare volumes for all other delivery firms. Using eVS volumes in this manner is appropriate since non-eVS mailers and private delivery firms are likely to have similar proportional amounts of packages across industry categories. To approximate the proportions of packages for all other delivery firms, we assign more packages to the "heavy" category since private delivery firms often hand off lightweight packages to USPS.

The results of this extrapolation process are presented in Table 1. As noted at the bottom of this table, the proportion of USPS lightweight packages likely to be impacted by 3D printing scenarios is 42.4 %. By contrast, the proportion of lightweight packages delivered by all other firms that is likely to be impacted by 3D printing scenarios is only 10.6 %. The results of Table 1 provide a baseline snapshot of the entire U.S. commercial-packages supply chain in FY 2013.

[2] Tables containing these calculations are available from the authors upon request.

Table 1 U.S. commercial-packages supply chain, shares (%) of pieces, USPS and all other firms, FY 2013

NAICS code	Description	3D print Impact?	USPS			All other firms		
			Light	Heavy	Total	Light	Heavy	Total
441	Motor vehicles and parts dealers	Yes	1.31	0.90	2.21	0.33	1.88	2.21
		No	0.00	0.00	0.00	0.00	0.00	0.00
442	Furniture and home furnishings	Yes	0.00	0.00	0.00	0.00	0.00	0.00
		No	4.64	3.09	7.73	1.16	6.57	7.73
443	Electronics and appliance stores	Yes	15.06	9.85	24.91	3.77	21.14	24.91
		No	0.00	0.00	0.00	0.00	0.00	0.00
444	Building materials & garden stores	Yes	0.00	0.00	0.00	0.00	0.00	0.00
		No	0.00	0.00	0.00	0.00	0.00	0.00
445	Food and beverage stores	Yes	0.00	0.00	0.00	0.00	0.00	0.00
		No	1.35	0.90	2.24	0.34	1.91	2.24
446	Health and personal care stores	Yes	0.00	0.00	0.00	0.00	0.00	0.00
		No	7.01	2.65	9.67	1.75	7.91	9.67
447	Gasoline stations	Yes	0.00	0.00	0.00	0.00	0.00	0.00
		No	0.00	0.00	0.00	0.00	0.00	0.00
448	Clothing and clothing accessories	Yes	10.78	7.14	17.92	2.70	15.23	17.92
		No	0.01	0.00	0.01	0.00	0.01	0.01
451	Sport's goods, hobby, book, & music	Yes	3.92	2.60	6.52	0.98	5.54	6.52
		No	5.64	3.81	9.45	1.41	8.04	9.45
452	General merchandise stores	Yes	8.99	5.99	14.98	2.25	12.73	14.98
		No	0.03	0.04	0.07	0.01	0.06	0.07
453	Miscellaneous store retailers	Yes	2.36	1.58	3.94	0.59	3.35	3.94
		No	0.21	0.15	0.35	0.05	0.30	0.35
454	Non-store retailers	Yes	0.00	0.00	0.00	0.00	0.00	0.00
		No	0.00	0.00	0.00	0.00	0.00	0.00
Grand total			61.30	38.70	100.00	15.33	84.67	100.00
Total with 3D potential			**42.4 %**			**10.6 %**		

Sources: USPS eVS Manifest Database 2013, U.S. Census Bureau E-Stats Survey 2011, and Market Share Data

5 Scenario Analysis

3D printing technology can cause disruptions at distinct points along the commercial-packages supply chain. Over the last several years, e-commerce retail has been growing by almost 18 % annually, and the retail trade industry overall has been growing by almost 4 % annually. This analysis will be particularly sensitive to the nature of the technology's advancement. Supply chain impacts will be very different between worlds in which most 3D printing is centralized versus decentralized.

Three separate scenarios are considered. In the scenarios analyzed, we seek to measure the incremental commercial-packages volumes that would arise over and

above the impacts already occurring from robust retail sales growth. To the extent possible, these scenarios ignore the reasons for a 3D printing revolution, be it technological advancement, societal trends, legal and regulatory changes, or some combination of all of these. Also ignored is the speed of adoption. The future-year analysis is a snapshot of a robust and omnipresent 3D printing landscape which, for the sake of specificity, we place about 10 years hence in 2023.

5.1 The "Warehouse Scenario"

For the first scenario, which we have dubbed the "Warehouse Scenario," we consider a disruption in the middle of the commercial-packages supply chain. The simplicity of the business model of this scenario will allow a company with a national brand, a diversified footprint, and an established logistics pipeline to capture a significant market share. To the extent that consumers accept 3D printing as a means of producing objects they want to buy, these types of companies will likely incorporate this technology into their just-in-time networks. For these reasons, we have qualified this scenario as being highly likely to occur in the future.

Under this scenario, national retailers incorporate 3D printing technologies into inventory replenishment systems within their logistics warehousing networks. Coupled with our assumption about lightweight packages, this disruption has a positive effect on a substantial portion of the commercial-packages supply chain. As production costs, inventory costs, and fulfillment response times all fall, such products become more valuable for national retailers to sell and for consumers to buy, provided these 3D-printed products are near perfect substitutes for similar products produced by traditional means. This leads to a substantial increase in the demand for such 3D-printable products which, in turn, leads to increased packages in this portion of the supply chain.

To quantify the impact, we increase lightweight packages of 3D-printable products from national retailers by 100 %, which, over the 10-year forecast period, represents 10 % annualized growth. Such growth is conservative compared to the forecasts of 3D printing technology specified in Sect. 2. We choose this somewhat cautious approach on the grounds that growth of 3D printing as a manufacturing technology may not seamlessly translate to growth of demand of retail products produced by such a technology. Table 2 summarizes the results of this scenario. The top section reports volume shares for "light" packages (weighing up to 1.5 lb)—with subtotals for light packages containing 3D printable products and all other lightweight products—and "heavy" packages (weighing more than 1.5 lb). The bottom section reports volume indexes for each package type relative to baseline values.

The enhancement in package demand is spread over all delivery firms. For USPS and all other firms, 3D-printable-product packages grow 42.7 %, which represents a 100 % increase in the volume of such packages from national retailers. Since the disruption is occurring where national retailers are able to replenish their inventories within their fulfillment warehouses, we are assuming that any applicable lightweight

Table 2 The warehouse scenario, commercial-packages volume shares and indexes, FY 2023

Firm	Scenario	Light		Heavy	Total
		3D print	Other		
		Volume shares			
USPS	Baseline	42.4 %	18.9 %	38.7 %	100.0 %
	Warehouse	51.3 %	16.0 %	32.8 %	100.0 %
All other	Baseline	10.6 %	4.7 %	84.7 %	100.0 %
	Warehouse	14.5 %	4.5 %	81.0 %	100.0 %
		Volume indexes			
USPS	Baseline	1.000	1.000	1.000	1.000
	Warehouse	1.427	1.000	1.000	1.181
All other	Baseline	1.000	1.000	1.000	1.000
	Warehouse	1.427	1.000	1.000	1.045

Sources: Table 1 and scenario analysis model

packages coming from these warehouses that private delivery firms choose to deliver themselves also benefit from the increased demand. However, because USPS starts with a higher proportion of 3D-printable-product packages in the baseline, the enhancement in demand leads to a larger increase in USPS's total volume (1.181) compared to the total volume of all other delivery firms (1.045).

5.2 The "Local-Hub Scenario"

For the second scenario, which we have named the "Local-Hub Scenario," we consider a disruption near the end of the supply chain, specifically at the destination postal facilities that serve the last-mile delivery network. Disruption farther down the supply chain will decentralize the impact of 3D printing, spreading the technology among local and regional businesses. Thus, although we consider the probability of occurrence for this scenario to be high, we judge it to be less likely to occur compared to the Warehouse Scenario.

Under this scenario, local/regional businesses find it advantageous to adapt 3D printing manufacturing technology and to locate near postal facilities where finished products are cheaply produced and rapidly incorporated into the last-mile delivery network. A variation of this scenario is that USPS itself embraces 3D printing technology, using its facilities as a manufacturing hub for local/regional businesses to collaborate and generate finished products, which are incorporated into the last-mile delivery network. Because these businesses have a natural advantage to serve local and regional customers, this disruption leads to an increase in lightweight package volumes flowing along this last-mile network.

To quantify how much of an increase would arise, we use the same approach as the Warehouse Scenario and assume a 100 % increase in 3D-printable-product packages for certain businesses. In this manner, the disruption near the end of the supply chain has the same impact on package volumes as the disruption in the

Table 3 The local-hub scenario, commercial-packages volume shares and indexes, FY 2023

Firm	Scenario	Light		Heavy	Total
		3D print	Other		
		Volume shares			
USPS	Baseline	42.4 %	18.9 %	38.7 %	100.0 %
	Local hub	53.7 %	15.2 %	31.1 %	100.0 %
All other	Baseline	10.6 %	4.7 %	84.7 %	100.0 %
	Local hub	10.6 %	4.7 %	84.7 %	100.0 %
		Volume indexes			
USPS	Baseline	1.000	1.000	1.000	1.000
	Local hub	1.573	1.000	1.000	1.243
All other	Baseline	1.000	1.000	1.000	1.000
	Local hub	1.000	1.000	1.000	1.000

Sources: Table 1 and scenario analysis model

middle of the supply chain, except this impact is applied to packages that originate from local/regional businesses rather than national retailers. The results of this scenario are presented in Table 3.

There is one key difference between this scenario and the prior scenario. Since local/regional businesses are partnering exclusively with USPS for last-mile processing and delivery, only USPS experiences increased package volumes. Private delivery firms experience no such gains in their package volumes because—we assume for the sake of analysis—they do not have the extensive last-mile delivery network to entice these businesses to partner with them. Table 3 indicates that for all other firms, baseline and scenario values are exactly the same. However, for USPS, the share of 3D-printable-product packages increases to 53.7 %, which represents a 57.3 % increase in these types of packages and a 24.3 % increase in total commercial packages.

5.3 The "In-Home Scenario"

For the third scenario, which we call the "In-Home Scenario," we consider a disruption that occurs at the homes and businesses that receive products at the end of the commercial-packages supply chain. Under this scenario, consumers themselves obtain the ability to print high-quality finished products in their homes and businesses at a cost that is as least as low as traditional manufacturing techniques.

The growth of in-home 3D printing manufacture will be driven by the price and usability of available hardware, and the practicality of the software ecosystems that serve in-home 3D printers. To make a business case for in-home printing, the technology will have to advance, the convenience gap of in-home production will need to grow wide, and the ability to search for 3D-printed objects will have to become as easy and effective as internet keyword searches are now. For these reasons, we qualify this scenario as unlikely to occur. Nevertheless, if it does occur, it will be hugely

disruptive to the commercial-packages supply chain, leading to the breakdown of the logistics channels among manufacturers, retailers, and consumers. Yet, because these households and businesses will require raw materials for in-home manufacture, there is also the opportunity for a new supply of packages to enter the supply chain.

If consumers become able to print high-quality products in their homes/businesses, then this would also have a huge effect on retail sales at traditional brick-and-mortar businesses. To quantify this impact, we use U.S. Census Bureau data to categorize the entire $4.1 trillion U.S. retail trade industry as of 2011, the most recent year available at the time of our analysis. We determine the total amount of retail sales for 3D-printable products, regardless of whether those products are delivered by the commercial-packages supply chain or by traditional brick-and-mortar in-store pickup. We find that 28 % of the entire retail trade industry could be disrupted by 3D printing technology in this scenario. Using some simplifying assumptions about the average unit price in the retail trade industry, this impact translates to over 45 billion printable units. This is the amount of total products that could potentially be diverted from all retail businesses to in-home manufacture.[3]

It is unlikely that by 2023 all eligible 3D-printable products are diverted to in-home manufacture. It is more likely that consumers print some products at home while continuing to purchase other products at retailers. To gauge how many products consumers print at home, we specify three levels of disruption: 15 %, 25 %, and 35 %. We consider these to be a reasonable range of in-home manufacture adoption rates in 2023. Table 4 reports our calculations of the number of raw materials packages needed on an annual basis in 2023. Each row in the table represents a different level of disruption. Retail sales (expressed in FY 13 dollars) are converted to product counts using the unit price,[4] and then those resulting product counts are converted to raw materials shipments based on the assumption that each raw material shipment can produce 10 printed products. (Note: raw materials shipments typically come in allotments of 2.2 lb.)

To quantify the impact on the commercial-packages supply chain, we select the highest level of disruption, 35 %, in order to measure the effect at the highest end of

Table 4 The in-home scenario—derivation of raw materials shipments in FY 2023

Level of disruption		Retail sales ($ mil FY 13)		FY 13 unit price	Products (millions)	Product/raw Mat'l package	Raw Mat'l packages (millions)
100 %	$	2,236,536	$	25.63	87,265	0.10	8,727
15 %	$	277,657	$	25.63	10,834	0.10	1,083
25 %	$	462,762	$	25.63	18,056	0.10	1,806
35 %	$	647,866	$	25.63	25,279	0.10	2,528

Source: Scenario analysis model

[3] Tables containing these calculations are available from the authors upon request.

[4] This is the average unit price in FY 2013 dollars for all deliverable packages, including shipping costs. We are using this price as a proxy for all retail sales—both brick and mortar and e-shopping—in order to approximate the number of total products represented by those retail sales.

Table 5 The in-home scenario, commercial-packages volume shares and indexes, FY 2023

Firm	Scenario	Light		Heavy	Total
		3D print	Other		
		Volume shares			
USPS	Baseline	42.4 %	18.9 %	38.7 %	100.0 %
	In-home	22.8 %	15.6 %	61.5 %	100.0 %
All other	Baseline	10.6 %	4.7 %	84.7 %	100.0 %
	In-home	6.2 %	4.3 %	89.5 %	100.0 %
		Volume indexes			
USPS	Baseline	1.000	1.000	1.000	1.000
	In-home	0.650	1.000	1.920	1.208
All other	Baseline	1.000	1.000	1.000	1.000
	In-home	0.650	1.000	1.172	1.108

Sources: Tables 1, 4, and scenario analysis model

the reasonable adoption rate range. If this level of disruption occurs across the entire retail trade industry, then a proportional amount of packages will leave the commercial-packages supply chain. However, because of the large use of in-home printing, households and businesses require a steady stream of raw materials. Thus, this scenario has two offsetting effects: some package volumes fall due to the diversion of 3D-printable products to in-home manufacture, but other package volumes increase due to the introduction of new raw materials shipments. In Table 5, we report the overall effects of this scenario.

Referring to the "3D Print" column in the bottom section of this table, due to diversion to in-home manufacture, volumes fall by 35 % (1.00–0.65) for both USPS and all other firms. The increase in raw materials shipments is measured in the "Heavy" column.[5] Because delivery of raw materials can be performed by any type of carrier, we split the 2.528 billion raw materials shipments evenly between USPS and all other delivery firms. For USPS, this influx of new volume increases heavy commercial packages by 92% relative to the 2023 baseline which, after accounting for the drop in 3D-printable-product lightweight packages, increases the total commercial packages delivered by USPS by 20.8 %. Total commercial packages delivered by all other firms increase by 10.8 %.

6 Conclusion

These three scenarios present alternative worlds in which USPS benefits from a robust and omnipresent 3D printing revolution. Its comprehensive delivery network puts it in a strong position to be the best-choice delivery option for new package

[5] Since, on average, raw materials shipments weigh 2.2 lb, they fall in the heavy package category.

shipments spawned by the revolution. In each scenario, USPS commercial-package total volume increased relative to baseline levels—18.1 % in the Warehouse Scenario, 24.3 % in the Local-Hub Scenario, and 20.8 % in the In-Home Scenario. Implicit in this framework is an assumption that these additional packages have a positive per-piece "contribution" (revenue less attributable cost), meaning that they help to cover institutional costs (e.g., delivery infrastructure, retail infrastructure, administrative and field support) and positively impact USPS finances.

However, in the coming years, if the strength of USPS's delivery network diminishes—through cutbacks in service frequency, delivery points, tracking and tracing services, pick-up options, or other similar features—USPS's natural advantage in processing and delivering lightweight, low-value packages may be lost. If this were to occur, USPS could miss out on the benefits of a 3D printing revolution and maybe even lose a portion of its current package business.

With 3D printing currently transforming certain niche markets and making inroads into major industry, we are witnessing a critical point in the evolution of technology and manufacturing. Although forecasts of market size and societal significance vary, it is evident that 3D printing is here to stay. Even the conservative estimates foretell a major impact on USPS and countless other organizations in the United States and across the globe. As these organizations dynamically prepare for this uncertain future, it is likely a poor choice to just cautiously wait to react to a revolution in progress.

As 3D printing democratizes production and design, it could become a fierce engine of economic growth and job development. New businesses are already creating value through the advantages of this technology, and advances may release a groundswell of demand for mass customization. By establishing a role in the 3D printing market in the near future, USPS could put a compelling twenty-first century twist on its historical mission to serve citizens and facilitate commerce.

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Spam or Ham? Assessing the Value of Direct Mail

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1 Introduction

While letter volumes are declining overall (primarily driven by e-substitution), direct mail tells a slightly different story.[1] The provision of direct mail is instead threatened by policy initiatives, notably: opt-out schemes,[2] opt-in schemes,[3] tax on direct mail,[4] and data protection regulation.[5] These initiatives are, to a varying degree, making the provision of direct mail more difficult for advertisers, either by making it more expensive to distribute direct mail or by reducing the acceptance of direct mail among recipients. Generally, new data protection regulation and opt-in schemes requiring the recipients' consent to the distribution of direct mail can be considered more restrictive measures than a tax (which only increases the cost of distributing direct mail).

[1] Data from WIK-Consult (2013) shows that the average number of letters per capita (across AT, DE, FI, FR, IE, NL, UK, CH, CY, ES, IT, MT, PT, BG, CZ, EE, HU, LT, SK, and HR) declined by roughly 3.5 items from 2010 to 2011, while the number of direct mail items per capita declined by 1.25 on average in the same time period.

[2] 'No Thanks' – in place in most countries and sometimes extended to local newspapers, e.g., in Denmark.

[3] 'Yes Thanks' – discussed in some countries, e.g., in Denmark and the UK.

[4] In place in Austria and Sweden and discussed in Belgium, Denmark, and in the US, where an *Ad Tax* has been proposed in Congress, reducing deductibility of businesses' advertising costs. (Osterland 2014)

[5] Hindering companies from developing targeted communication towards consumers.

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Regardless of which policy initiative we consider, its introduction has been primarily motivated by the cost of direct mail to society in terms of a negative environmental impact or unwanted nuisance to consumers. For example, reducing the amount of paper waste by up to 25 % was the main reason behind the 2012 decision of the Danish Ministry of Taxation to impose a tax on unaddressed direct mail (Danish Ministry of Taxation 2012). This tax was approved in July 2014 by the European Commission (2014) for the period August 2014 to August 2020. Similarly, one of the main aims of new EU data protection regulation is to protect consumers from unsolicited marketing and its potential negative effects.[6]

The positive value of direct mail to society has often been neglected in the evaluation of policy initiatives. Policy makers may acknowledge the value of direct mail to postal operators in terms of the production value for their businesses and the importance for the sustainability of the universal service obligation. However, they seldom investigate the content value of direct mail. If the value of the messages delivered by direct mail is substantial for senders or recipients, and if this value is overlooked in the assessment of policy initiatives, then decisions reducing direct mail volumes may reduce total social welfare. In this paper, we make a first attempt to analyze the socioeconomic value that direct mail may bring to consumers and businesses. Our assessment is based on case studies and in-depth analysis of the economic theory of advertising. The results indicate that direct mail is likely to have a positive real value to businesses and consumers that should not be ignored when assessing and evaluating initiatives that will result in lower volumes of direct mail.

The remainder of this paper is structured as follows. Section 2 outlines the marketing channels available to businesses in their communication with potential customers. Section 3 describes how this paper relates to previous literature and research. Section 4 analyses the value of direct mail to businesses and consumers based on economic theory and case studies from Denmark and Austria. Section 5 concludes this paper and suggests topics for further research.

2 Direct Mail and Other Marketing Channels

Before assessing the value of direct mail, one must understand what direct mail is. For the purpose of this paper, we define direct mail as *printed advertisements* that are (i) *addressed* and personalized without altering the nature of the message (addressed direct mail) or (ii) *unaddressed* but targeted to the specific household (unaddressed direct mail).[7] Direct mail is one marketing channel among many. Examples of other

[6] This initiative primarily targets *addressed* direct mail, while *unaddressed* direct mail sent to the *address, 'the resident',* or *'the household',* does not necessarily involve the use of personal data and data protection regulation may not apply to this type of mail.

[7] Targeted direct mail is direct mail distributed according to a segmentation of the recipients. For example, among detached houses and multi-household buildings without gardens, the non-garden owners only those in detached houses with gardens will be targeted with direct mail from a firm selling garden supplies.

channels conveying marketing messages to consumers are newspapers, magazines, internet, TV, radio, billboards, and banners. All channels have different characteristics and are better suited to certain types of marketing messages than to others.

Generally, one can distinguish between marketing channels in two ways. First, one can distinguish between marketing channels with respect to their ability to target a certain audience. Whereas billboards and banners are visible for everyone within a reasonable distance, no matter the identity of the viewer, direct mail (addressed and unaddressed) is more targeted as the items often are only distributed to a certain target group (e.g., parents with small children). The higher target potential of direct mail is also mirrored by key performance indicators such as the return on investment (ROI). Direct mail, as acknowledged by Central Mailing Services Ltd. (2014) and Royal Mail (2013), often has a high ROI compared to other types of marketing.

Second, one can distinguish between marketing channels with respect to the amount and type of information contained. For example, as shown by Abernethy and Franke (1996), printed marketing such as direct mail or newspapers can contain a significant amount of text and rather detailed information about product attributes (e.g., price, color, size, material, special functions, areas of usage, requirements on the user) in contrast with TV or radio spots, which are usually short, with limited space for detailed information about product attributes. For other marketing channels, such as billboards, content may be reduced to a picture, brand, or slogan.

Based on the amount of detailed informational content, marketing messages can be broadly divided into two main categories: *informative marketing* (also referred to as constructive marketing by Marshall (1919), attribute-focused marketing by Tirole (1986), or real marketing by Johnson and Myatt (2006)) and *image marketing* (also referred to as persuasive or manipulative marketing by Bagwell (2007), or combative marketing by Marshall (1919)). Although it often is difficult to draw a sharp line between the two categories in practice (most advertisements contain elements of both), it is often possible to determine if a piece of advertising is of more informative nature or of more image enhancing nature. For the purpose of this study, we define informative advertisements as ads containing objective information ("hard facts") about product attributes where a necessary attribute is the price of the product. Similarly, we define image advertisements as ads containing less information about product attributes (in particular, no price information) and pictures or illustrations aiming to create a subjective, emotional association in order to build or sustain a certain brand. For example, as highlighted by Copenhagen Economics (2011a), advertisements displaying slogans like "Because you're worth it" (L'Oreal) do not hold any information on the product, but provide a good example of image marketing.

Not all marketing channels are equally well-suited for conveying informative or image marketing messages. The Danish Competition Authority (2002) concluded that due to the ability to include much information in the form of plain text and pictures, direct mail is normally well-suited for informative marketing content

(in contrast to TV or radio spots of 15–30 s duration). In the same analysis, the Danish Competition Authority concluded that direct mail is normally inferior to TV and outdoor advertising in its ability to create subjective and emotional associations in response to short messages, images, and slogans. In practice, all marketing channels contain a mix of both types of marketing, and businesses often apply a combination of different channels.

3 Contribution to Previous Research

The value of direct mail is underrepresented in the existing literature. One example of an assessment of the value of direct mail is McNeish's (2006) analysis of consumer attitudes toward direct mail from retail banks in Canada. McNeish shows that the majority of mail from banks received by Canadian consumers is sent from banks without an existing relation to the recipient. McNeish also shows that a majority of recipients welcome and read the mail received. However, McNeish does not estimate the value of direct mail to either banks (senders) or consumers (recipients).

The value of advertising in general in terms of its impact on GDP has been estimated by Deloitte (2013), on behalf of the Advertising Association, and by Union des Annonceurs (2006).[8] Deloitte (2013) estimates that advertising, by increasing the level of economic activity and increasing the productivity of the economy, adds £100 billion to UK GDP per year.[9] Deloitte derives this value from eight effects of advertising: (1) increased price competition, (2) more innovation and differentiation, (3) increased funds to media and creative industries, (4) growth of the digital economy, (5) more market growth, (6) economic value of positive behavioral change created by advertising, (7) increased employment, and (8) increased export. Union des Annonceurs (2006) also find that advertising increases economic growth by stimulating consumption, innovation, and competition. The 2006 Union des Annonceurs report finds advertising to have a positive impact on the economy through its financing of dynamic economic activities such as cultural and sporting activities, TV-channels, and radio stations. By focusing solely on direct mail and its potential contribution to social welfare in terms of increased price competition, this paper adds to the previous contributions described above.

[8] The report written by Union des Annonceurs (2006) is a condensed version of the original doctorate thesis written by Maximilien Nayaradou, University of Paris-Dauphine, which was first completed in 2004.

[9] *'Annual advertising expenditures of £16 billion support the advertising and creative industries and associated employment. (…) We estimate that advertising adds at least £100 billion to UK GDP.'* (Deloitte 2013)

4 Assessing the Value of Direct Mail

In order to conduct a complete cost-benefit assessment of initiatives reducing the volume of direct mail and make an informed decision, at least two sources of value should be taken into account: (1) the *production value* accruing to businesses producing direct mail, and (2) the *content value* to users of direct mail (both senders and recipients).

4.1 Value of Direct Mail to Print Houses and Postal Operators

There is not much publicly available information about the direct value that the production and distribution of direct mail generate for print houses and postal operators. However, Smithers Pira (2007) forecast that the production value to print houses of direct mail in terms of revenues should have reached $150 billion worldwide in 2012. In combination with an average profit margin in the printing industry of 5.1 %, as estimated by Moldvay (2012), we may infer that direct mail creates a net profit to print houses of $7.65 billion worldwide.

By contributing to the coverage of large fixed and common costs in mail delivery, direct mail generates a value to postal operators distributing items from senders to recipients. As direct mail volumes have decreased proportionally less than ordinary letter mail, direct mail has become increasingly important to postal operators with respect to the financing of the universal service obligation. For example, according to Ofcom (2012), 21.8 % of Royal Mail's 2011 mail volume consisted of direct mail. According to ARCEP (2012), 30 % of the total French correspondence market in 2012 consisted of direct mail.

As the value of direct mail to print houses and postal operators in terms of profits or contribution to financial sustainability is relatively straightforward to calculate, we hereafter focus on the value of direct mail that until now has been ignored – namely, its value to recipients who, based on the content of direct mail messages, make decisions about what to purchase and where to purchase it.

4.2 Value of Direct Mail to Consumers

Michael Porter's(1980) work on the competitiveness of the firm argued that there are two ways in which firms can gain a competitive advantage over one other: by charging a lower price or by differentiating their products or services from those of their rivals. Informative marketing, conveyed by direct mail, provides readers with information about the availability, quality, prices, and other attributes of products and services. Obtaining this information reduces consumers' search costs, i.e., the time and money spent on searching the market for a given product or service. Low search costs enable consumers to obtain the preferred product or service at the lowest price or the highest quality. As demonstrated by Popkowski-Leszczyc and Rao

(1989), Bolton (1989), Bemmaor and Mouchoux (1991), Moriarty (1983), and Schroeter et al. (1987), informative marketing increases consumers' price sensitivity and may thus increase the competitive pressure on suppliers, who have to compete fiercely on price in order to attract the informed consumers. Through this mechanism, informative marketing may contribute to lower retail prices and higher consumer welfare.

In its purest form, image marketing might not seem to have the same effect on price competition as informative marketing. By building a brand value and trying to differentiate products from one another, image marketing may aim at reducing the substitutability between products from the point of view of consumers. One example of this is ads for soft drinks such as Coca Cola and Pepsi Cola, where advertising messages often are focused on brand building and contain very little information about product attributes such as price and content. This mechanism attenuates price competition (e.g., between branded and non-branded Cola) and reduces the downward pressure on prices created by informative advertising. Chamberlin (1933) acknowledged this tendency of pure image marketing more than 80 years ago. However, as stated by Deloitte (2013), image marketing may still add value for consumers. By allowing suppliers to reap higher profits and hence invest more in research and development, image marketing may facilitate innovation and product differentiation to the benefit of consumers. Similarly, one of the early economic theories of advertising described by Nelson (1974) suggests that image advertising is valuable to consumers. This is demonstrated by the fact that sellers engaging in image advertising do so because they believe that trying the product once will lead to enough repeat purchases to cover the cost of the image ad. Moreover, the fact that image advertising may boost demand and soften price competition may not necessarily imply that consumer welfare decreases unanimously. This is for example the case if the brand building advertisement increases consumers' willingness to pay for the product in question. This assessment falls outside the scope of this study and may instead be the focus for further research.

To provide an initial assessment of whether direct mail is likely to contribute to lower prices and increase consumer welfare, we turn to two recent case studies from Austria and Denmark.

In **Austria**, *all* marketing since 2000 is subject to a marketing tax.[10] The effect on prices stemming from the implementation of this specific tax has been analyzed by Rauch (2011). This is to our knowledge the only study where the impact on prices from changes in the level of marketing has been investigated. Rauch showed that the tax reduced the overall level of marketing. In product markets where marketing is traditionally informative (such as groceries) this reduction in marketing was found to increase consumer prices. In product markets where marketing is traditionally image enhancing (such as tobacco, perfume, transport, hotels, and restaurants), the reduction in marketing was found to lower consumer prices. The research thus indicated a negative relationship between the level of informative marketing and the level of consumer prices.

[10] The tax harmonised different regional taxation schemes on advertising expenditure, cf. Rauch (2011).

In order to assess the likelihood of direct mail reducing consumer prices, we investigate whether the content of direct mail is of more informative or image enhancing nature. We do this by conducting a case study where we review the content of 20 publications of unaddressed direct mail distributed in **Denmark** during one week in April 2014. Although this review does not provide any conclusive evidence regarding the price effect that can be attributed to direct mail, it nonetheless provides an indication of the likelihood that direct mail increases the price competition among Danish retailers.

In Denmark, door-to-door distributed unaddressed direct mail items are widely used by chain stores, supermarkets, and shopping centers. A review of the content of 20 publications of unaddressed direct mail distributed during one week in April 2014 revealed that unaddressed direct mail items distributed door-to-door in Denmark should be characterized as informative rather than image marketing, due to their significant communication of prices.[11] To measure the extent to which the content of the publications was of informational or image enhancing nature, we counted the number of products and prices displayed together or on their own in the publications. As a proxy for informational content, we used products displayed together with a price (a product-price pair). As a proxy for image content, we used products displayed on a stand-alone basis (without information about the price). The review, which covered 757 pages and 7,902 products in total, revealed a high informational content throughout the entire sample (on average 10 product-price pairs per page). The publications with the highest density of informational content were those distributed by do-it-yourself stores (on average 14 product-price pairs per page). Publications from grocery stores, lifestyle, and household electronic stores displayed on average 10–11 product-price pairs per page.

In general, the publications from shopping centers in our sample displayed fewer product-price pairs per page (on average 6–7) than the other publications. In comparison with the publications from grocery stores, the publications from shopping centers tend to mimic fashion magazines, which contain more image marketing than ordinary unaddressed items. This finding is also supported by the number of products displayed on a stand-alone basis (without price) and the number of pages displaying no product-price pairs at all. Whereas practically all pages in the publications from other senders contain one or several product-price pairs, 10–32 % of the pages in the shopping center publications contained no product-price pairs at all.

Based on our review, we conclude that unaddressed direct mail has a high share of informative content (varying slightly across senders), and hence should be characterised as informative marketing. As indicated by the case from Austria, informative

[11] Conducted in week 15, 2014. The publications reviewed were sent from five different categories of senders: do-it-your-self chain stores, grocery chain stores, lifestyle chain stores (interior décor, book store, hobby store, hardware store, beauty retail), household electronics and shopping centres (regionally distributed). The stores included in the sample were: Bauhaus, Silvan, XL Byg, Harald Nyborg, Bilka, Fakta, Kvickly, Netto, Ilva, Imerco, Bøger og Papir, Matas, Computercity, Elgiganten, Punkt1/Expert, humac, Amager Centret, City 2, City Vest, and Lyngby Storcenter.

marketing may reduce consumers' search costs and place downward pressure on consumer prices. Thus, taxing only this type of marketing may adversely affect the most competition-enhancing kind of marketing, to the detriment of consumers.

4.3 Value of Direct Mail to Businesses

To assess the value of direct mail to businesses, one will have to assess the alternate scenario – that is, which different marketing channels businesses would use if direct mail were to become more expensive or less effective. As shown by Copenhagen Economics (2011b), if policy initiatives make direct mail less attractive, alternative marketing channels (such as TV, internet, and outdoor advertising) will make up a larger share of the businesses marketing communication mix, all else being equal.

Royal Mail (2013), Central Mailing Services Ltd.(2014), Beasley (2013), and MarketingCharts (2012) have shown that direct mail is cost efficient and has a high return on investment and conversion rate in comparison to other media. Because direct mail is cost efficient and has a high return on investment and conversion rate in comparison to other media, a policy initiative that would make direct mail more expensive or less effective to use may have three important implications. First, if direct mail were to become a relatively more expensive or less effective marketing channel, businesses would spend more money on potentially less effective marketing in order to achieve the same effect. The resultant increased cost of advertising for businesses would in turn encourage businesses to increase prices to recover costs. Second, when businesses substitute other marketing channels for direct mail, then less informative forms of marketing will be used more extensively. As shown in the previous section, this may increase search costs, relax competition, and, ultimately, increase the price of goods where informative marketing is predominant. Third, because it is effective at a low cost, direct mail is an important marketing channel for small retailers and new entrants without large advertising budgets. Thus, by making direct mail more expensive or less effective, policies may reduce the competitiveness of small chains and new entrants.

5 Conclusion

We have argued that policy initiatives aiming to reduce the volume of direct mail often fail to take into account the entire value of direct mail. In particular, the socio-economic value of the communication between senders (businesses) and recipients (consumers) often seems to be neglected. We have shown that direct mail is a relatively informative marketing channel. The provision of informative marketing messages via direct mail decreases search costs, something that may increase the intensity of competition between firms and eventually lead to lower consumer prices. We have also shown that direct mail generates value for business senders who benefit from the cost-efficiency of direct mail compared to other media.

Overall, we find that the value of direct mail is likely to be larger than anticipated by policy makers. Thus, when evaluating policy initiatives to reduce direct mail, policy makers should not only take into account externalities in terms of paper waste and nuisance to consumers, but also recognize the socioeconomic loss in terms of less informative advertising and potentially higher consumer prices.

Whether the positive effects described in this paper outweigh the negative effects in terms of a negative environmental impact and unwanted nuisance to consumers must be assessed on a case–by-case basis and may be a topic for future research. By investigating the influence of direct mail on consumers' purchasing decisions, one could attempt to quantify the impact of direct mail on retail prices. One methodology that could be helpful to do this is the calculation of diversion ratios, a methodology that often is used in merger analysis and competition cases to assess and quantify the competitive pressure between different suppliers. Moreover, the recently approved tax on unaddressed direct mail in Denmark (effective from August 2014) may serve as a useful case study to assess the impact on retail prices.

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Targeting Versus Saturation: Derived Demand for Direct Mail

Michael D. Bradley, Jeff Colvin, and Mary K. Perkins

1 Introduction

Over the most recent decade, Postal Operators (POs) have suffered financially from the dramatic reductions in single piece communication mail, which have put Universal Service Obligation (USO) funding in jeopardy. To some extent, however, and especially in the US, weakness in the demand for single piece mail has been partially compensated for by continued strength in bulk mail, though the margin on bulk mail is lower. Electronic substitution has been weaker for presentment mail than for remittance mail. Further, direct mail has held on to its share of the overall advertising market.

If the trend in which bulk mail and, especially, direct mail, contributes significantly to the principal financial base for postal operations continues, it will be important to consider more deeply the demand for direct mail and its role in the financial sustainability of POs. Specifically, it may be of value to expand the consideration of mail demand from a focus on the physical mail piece to the demand for consumer attention.

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In a sense, POs have been in this market for a long time, procuring attention by providing delivery of content (bills, magazines, parcels) and providing (reselling) attention to anyone else who is willing to send mail. The emphasis has been on the content more than on the resale of attention, but this may be changing as POs expand their role as offline attention seekers (along with TV, radio, billboards, etc.).[1]

We seek to deepen the understanding of the demand for advertising mail by casting light on a key characteristic that differentiates advertising messages from other communications. This characteristic, *targeting strength*, a vital characteristic of online advertising, is shared by direct mail and, to one degree or another, other advertising media as well. Targeting refers to efforts to direct messages to potential buyers in such a way as to increase the likelihood of a match of the message (a suggestion to buy a product) and buyers with an interest in that product, and targeting strength is greater where the likelihood of such a match increases. Toward this end, we adapt a recent model of targeting (Bergemann and Bonatti 2011) to a postal market and investigate the implications for the demand for direct mail.

The implications of e-substitution in bulk mail for the postal industry have been examined in De Donder et al. (2011), which presents a model of an incumbent facing competition from "alternative media" (online). They analyze positive "sender" utility for messages, whether delivered by the PO or alternative media, and its impact on equilibrium prices. The focus on price was taken up as well by Crew and Kleindorfer (2012), who discussed nonlinear pricing as a way of retaining customers who would otherwise be lost to e-substitution.

Do other things besides price, and sensitivity to price, differentiate online from offline advertisements? What makes Internet advertising different from any non-postal competition a PO might face? An increasingly popular answer is behavioral targeting, and economists have begun to study this phenomenon and its connection to competition between online and offline media. Targeting is not new. With reference to John Wanamaker's famous remark, "Half my advertising is wasted, I just don't know which half," targeting seems to hold out the promise of finding that wasted half and eliminating it. Recent interest in economic analysis of targeting arises from the expanded capacity for it found in online advertising.

Much of the economic analysis of behavioral targeting has highlighted the impact of targeting on product markets, as in Iyer et al. (2005). However, several recent articles have studied the implications of decisions taken by advertisers for the market for advertising. This literature has focused on online advertising, as it is that media which has featured behavioral advertising most prominently. The general strategy pursued in this work involves specifying the probability that a potential buyer will receive a message that induces him/her to make a purchase of a given item. The profit-maximizing behavior of advertising firms, who must weigh the probability of

[1] Such considerations bear with greatest force upon those POs for whom direct mail is a greater fraction of the business. Standard Mail, under which most direct mail is sent in the US, constitutes over half of USPS volumes (see USPSOIG 2013b). In Europe, direct mail is a substantial fraction of mail volume in Germany, Austria, the Netherlands and Switzerland, but a much smaller fraction in other countries (see Dieke, et al, 2013).

a match (and sale) against the price of the message, establishes the demand for messages from media outlets. For example, Athey and Gans (2009) addressed media competition by comparing general outlets, with targeting, to local news outlets. Their analysis shows that targeting takes on significant value for general outlets where ad space is costly. Athey and Ellison (2008) and Chen and He (2006) offered models that focus on matching products and buyers via Internet advertising.

Bergemann and Bonatti (2011) analyzed targeted advertising in the market for advertisements, including competition among media outlets. In their model, the probability of an advertisement resulting in a sale depends crucially upon the distribution of buyers across the products they buy. Targeting takes advantage of the distribution of buyers across ad markets to improve the odds of a sale. Bergemann and Bonatti (2011) modeled the demand for targeted messages as a means of attracting recipients' attention. They did this by specifying profit maximizing advertising firms that obtain a sale every time one of their messages reaches a consumer interested in buying their product. These firms' goal is to maximize the number of effective matches at the lowest cost. They found that targeting leads to both an increasing effectiveness of advertising and a higher concentration of firms advertising in each market. One drawback of the Bergemann and Bonatti (2011) model is that it assumes that offline media engage in no targeting.

While the recent dramatic growth in targeting has been related to online advertisements, POs have been actively engaged in sending directed ads to customers for a very long time. Mail can be, and is, used as a broadcast media, of course, but even broad mailings are typically "targeted" geographically, and thereby demographically. USPSOIG (2013a) discussed ZIP Code targeting, and suggested that even finer geographic partition might enhance the value of the ZIP Code in a variety of uses, including direct mail. USPSOIG (2013b) focused on technological ways to elicit feedback on ad mailings from recipients. Looking to the future targeting of direct mail, it is clear that POs possess an immense store of data of potential use in this way.

To analyze the potential impacts of this important characteristic of mail, we adapt the Bergemann and Bonatti (2011) model of targeting to a postal application. This means we model the demand for mail as the demand for customers' attention by profit maximizing firms. In the next section, we develop demand conditions for direct mail by appeal to assumptions on the distribution of potential buyers across products. Section 3 discusses the equilibrium in the mail market and presents two methods for investigating that equilibrium. Section 4 provides conclusions and suggestions for future research.

2 Deriving the Demand for Direct Mail

We consider the demand for ad mail to be driven by the desire of advertising firms to match ad messages to potential customers. In specifying that demand, we follow Bergemann and Bonatti (2011) by specifying that if a message to a group of consumers about product 'x' reaches a consumer with an interest in product 'x', then a

sale is made and the advertiser earns revenue of $1.[2] These assumptions allow us to write the revenue of the representative firm as:

$$\$1 * \begin{bmatrix} number\ of\ households \\ interested\ in\ product\ x \end{bmatrix} * \begin{bmatrix} probability\ that\ a\ mail\ piece\ is \\ received\ by\ a\ household \\ with\ an\ interest\ in\ product\ x \end{bmatrix}$$

We further assume, as in Bergemann and Bonatti (2011), that the only cost of the message to the advertising firm is the price it pays to send the message.[3] We model the demand for two types of messages: saturation advertising mail and targeted advertising mail. Saturation mail is defined as sending the same mailing to each household in a geographic area. The households in the area receiving the saturation mailing constitute a subset of all households, and the saturation advertiser decides how many mail pieces to send by expanding or contracting the area. In this type of messaging, advertisers cannot effectively target individual households, though they will try to choose those geographic subareas (such as ZIP Codes) which are more likely to produce matches. Targeted mail, on the other hand, is directed to specific households, on the basis of information about the location of potential buyers of a specific product. Targeted mail depends upon identifying relevant subgroups of households, not necessarily contiguous, that may have a higher affinity for the product being sold. Once this subgroup is identified, they all receive the same mailing. Finally, we assume that firms do not have a fixed budget for advertising. This means a firm will continue to spend on either saturation advertising mail or targeted advertising mail as long as the additional spending increases profit. Thus, the demands for the two types of mail can be derived independently.[4]

[2] Bergemann and Bonattii, on page 421, explain this approach as follows: "A sale of product x occurs if and only if the buyer is interested in the product *and* receives at least one message from firm x. In the terminology of Bagwell (2007), we adopt the complementary view of advertising, in which the message and the suitable recipient are necessary to generate a purchase. Each sale generates a gross revenue of $1, constant across all product markets."

[3] In this framework, the price of the product is given exogenously but the price of advertising (sending a message through the mail) is determined endogenously, measured relative to the $1 net profit from a sale. There are many sellers of homogeneous goods but they are each small relative to the advertising market and are thus price takers for advertising at a constant unit price. Though we do not present a developed analysis of the structure of the ad market, each advertiser sells only one product and is not concerned that an ad for a substitute for x might reduce sales of product x.

[4] In essence, this approach assumes that consumers make a purchase of an item if they receive a targeted message even if they also receive a saturation mail about the same product. In other words, receiving a saturation mailing about a product does not reduce the consumer's receptiveness to a targeted advertisement. It would be of interest to relax this assumption in future work

The profit function for the representative firm sending saturation messages is given by:

$$\pi_A = \left[number\ of\ households\right] * \begin{bmatrix} proportion\ of\ households \\ interested\ in\ product\ x \end{bmatrix} * \begin{bmatrix} probability\ of\ a\ household \\ receiving\ a\ mail\ piece \\ about\ product\ x \end{bmatrix} - \left[cost\ per\ mail\ piece\right] * \left[number\ of\ mail\ pieces\ sent\right]$$

Following Bergemann and Bonatti (2011), we assume that the distribution of buyers of product x follows an exponential distribution, where x is the "size" of the firm providing product x, in terms of an index of historical sales. The index starts at value equal to one and increases thereafter. The larger those sales, the larger the index and the more consumers are interested in the product. Thus, the proportion of households interested in product of type x is given by:

$$S_x = \lambda e^{\frac{-\lambda}{x}}$$

and where λ measures the concentration of households interested in product x. In other words, a high value for λ means that a relatively high proportion of consumers are interested in the product.[5]

We can now consider the profit maximization problem for the representative firm. Using the above expression the profit function takes the following form[6]:

$$\pi_A = HS_x\left(1 - e^{\frac{-M_A}{H}}\right) - P_A M_A,$$

where

H is the number of households,

$\left(1 - e^{\frac{-M_A}{H}}\right)$ is the probability that a household interested in x will receive a mail piece about product x (the probability of such a match rises with the number of pieces sent),

M_A is the number of mail pieces, and

P_A is the price of a mail piece, relative to the revenue from a sale.

We now turn attention to the demand for targeted messages. The general formulation of the representative firm still holds, but it must be modified to account for the fact that additional information on consumers will allow for more effective distribution of messages to a subpopulation of households, i.e., 'targeting.' In the case of saturation mail demand depends partly on the distribution of buyers across products: some simply have more potential buyers among the population than others.

[5] Note that as x gets very large, S_x approaches λ.

[6] The price of the product does not explicitly appear on the profit function because it is exogenously set equal to one.

The PO can do nothing to influence this characteristic of the product market. However, it (or its mailing customers) can use behavioral information to direct product x messages to subsets of H where buyers of x read direct mail and make buying decisions. If the PO has a list of the addresses of potential buyers of product x, it can offer to send mail to just those addresses. Of course, that does not imply that a sale will be made at each household. However, such targeting increases the probability of a match and reduces the frequency of messages sent to buyers with no interest in a product of type x.

As in the case of saturation mail, we use the exponential distribution to define the proportion of targeted households and the proportion of targeted households interested in product x.

The proportion of targeted households ($S_T < 1$) is:

$$S_T = \frac{\gamma\lambda}{\gamma+\lambda} e^{-\lambda}$$

where γ ($0 \leq \gamma \leq 1$) is a measure of the concentration of the consumers in the targeted mail market; $\frac{\partial S_T}{\partial \gamma} > 0$.[7] The share of households in the target group interested in product x is given by:

$$S_{Tx} = \lambda\gamma e^{\frac{-(\lambda+\gamma)}{x}} e^{\gamma}.$$

Using the same formulation as above, we see that the representative firm's profit function for targeted messages is given by:

$$\pi_T = HS_{Tx}\left(1 - e^{-\frac{M_T}{S_T H}}\right) - P_T M_T,$$

where:

$\left(1 - e^{-\frac{M_T}{S_T H}}\right)$ is the probability that a targeted household will receive a message about product x, and M_T is the number of targeted messages. We now derive the demand for targeted mail from the first-order condition for profit maximization.

$$M_T = \left(\frac{\gamma\lambda}{\gamma+\lambda}\right) e^{-\lambda} H \ln\left[\frac{(\gamma+\lambda) e^{\left(-\frac{(\gamma+\lambda)}{x}+(\gamma+\lambda)\right)}}{P_T}\right]$$

[7] Note the difference between λ and γ. The former relates to the concentration of consumers interested in purchasing the product in the product market and the latter relates to the concentration of consumers interested in the product in the targeted subset.

or

$$M_T = \left(\frac{\gamma\lambda}{\gamma+\lambda}\right)e^{-\lambda}H\left[\ln(\gamma+\lambda)-\frac{\gamma+\lambda}{x}+\gamma+\lambda-\ln P_T\right]$$

The demand for targeted messages is increasing in the number of households and the firm size index but it is decreasing in the price of targeted mail. To determine the sign of an increase in targeting on the demand for targeted messages we find the derivative of the demand function with respect to γ:

$$\frac{\partial M_T}{\partial\gamma} = \left(\frac{\gamma\lambda}{\gamma+\lambda}\right)e^{-\lambda}H\left[\frac{1}{\gamma+\lambda}-\frac{1}{x}+1\right]$$
$$+\left(\frac{\lambda}{(\gamma+\lambda)^2}\right)e^{-\lambda}H\left[\ln(\gamma+\lambda)-\frac{\gamma+\lambda}{x}+\gamma+\lambda-\ln P_T\right].$$

While the sign of this derivative is potentially ambiguous, the impact is likely to be positive for large firms, as $\frac{1}{x}$ goes to 0 as x gets large. In the case of saturation mail, the largest firms buy the messages; in the targeted mail market, the largest firms within a targeted subpopulation will buy messages. However, a firm that is small by national standards may be large in a targeted subpopulation of households. Anderson (2006) argues that the advent of behavioral targeting raises the opportunity for niche firms to reach buyers.

3 Investigating Advertising Mail Market Equilibrium

To investigate the nature of mail market equilibrium in a model in which the demand for mail is driven by the demand for attention, we need to specify a model for the postal operator. Because we are focusing on a new approach to specifying postal demand functions, we will specify the simplest model of a postal operator that will capture the flavor of the advertising mail market. For this reason we focus only on saturation advertising mail and targeting advertising mail and ignore single piece and bulk transactions mail. Furthermore, we specify that the postal operator attempts to maximize profit on its two advertising products. This specification can be thought of as a PO attempting to maximize the contribution from its advertising products to support both its USO costs and its transactional mail product. In an environment of declining single piece and transactions mail volume, this is a scenario that deserves investigation. Accordingly, the profit function of the postal operator is:

$$\pi = P_A M_A + P_T M_T - C_A M_A - C_T M_T - F_A - F_T,$$

where the C_A and $F_A$refer to marginal and fixed costs respectively for saturation mail and C_T and F_T, are the same costs for targeted mail.

The complete model is given by the postal operator profit function and the demand functions for saturation and targeted advertising mail, derived above. The postal operator takes the demand functions as constraints and finds the profit maximizing prices for both types of advertising mail. Given those prices, firms that are advertising choose their profit maximizing volumes of the two types of ad mail.

While the approach to solving for equilibrium is straightforward in concept, the nonlinearity of the demand equations makes it difficult to find a closed form solution. As the results from a closed form solution do not provide a definitive answer for the impact of additional targeting on the price of targeted mail, we pursue a calibration approach. In this approach we calibrate the model with numerical values and then solve it numerically using Generalized Reduced Gradient (GRG2) nonlinear optimization algorithm.

The Table 1 provides our initial parameter estimates:

We then vary key parameters to investigate the impact on the endogenous variables. Those variables are the proportions of households interested in the products, the prices for the two advertising mail products, the amounts of the two advertising mail products send, the profits generated for the postal operator and the profits earned by the advertising firm by sending saturation and targeted mail.

Table 2 shows the equilibrium solutions given our initial calibration.

Several points about the equilibrium solution are worth noting. First, given our parameter values, 25 % of households are interested in the product, meaning they will buy it if they receive an advertising mail piece about the product. Due to concentration, just 12 % of households are in the targeted subpopulation. The share of that targeted group interested in the product, as defined above, is 14.9 %.

Table 1 Initial parameter estimates

Parameter	Value
H	1,000
λ	0.25
γ	0.4
X	500
c_T	0.7
c_A	0.2

Table 2 Numerical solutions for equilibrium values

Endogenous solutions	
Sx	25.0 %
S_T	12.0 %
S_{Tx}	14.9 %
M_A	108.2
M_T	31.8
P_A	$0.22
P_T	$0.95
π Postal A	$2.6
π Postal T	$8.1
π Adv. A	$1.4
π Adv T	$4.4

The marginal costs for targeted mail are assumed to be above the marginal costs for saturation mail, so it is not surprising that the equilibrium price for targeted mail is above the equilibrium price for saturation mail. More interesting is the fact that the ratio of price to marginal cost is 12 % for saturation mail and 36 % for targeted mail. This reflects the increased value of targeted mail to advertisers. The higher markup makes targeted mail more profitable for the PO despite the fact that the volume of targeted mail sent is just a third of the amount of saturation mail sent. In addition, because of its higher effectiveness, targeted mail is more profitable for advertising firms despite its much higher price. This result shows the potential importance of targeting.

We now perform sensitivity analyses to see how changes in the parameter values affect equilibrium values. As shown in Table 3 an increase in the concentration of households interested in product x will increase the willingness to pay for saturation mail, and will increase the profits of both senders (advertisers) and the PO. As λ increases, S_x increases so the proportion of households interested in the product rises.[8] This increases the value of sending a piece of saturation mail and the equilibrium price and the equilibrium volume both rise.

Next, we examine the impact of an increase in the marginal cost of sending a piece of saturation mail. As shown in Table 4, this increases the price of saturation mail and reduced the quantity demanded. As a result, both postal profits and advertisers' profits fall.

We turn our attention to targeted mail. The first experiment is to increase the degree of targeting while holding all other parameters constant. This is done by increasing the value of γ. Table 5 shows that an increase in targeting has beneficial effects for both advertisers and the postal operator. The PO is able to increase the price of targeted mail as the volume sent rises. This is because an increase in targeting creates an increase in the demand for targeted mail. Because they are sending more pieces of effective mail, advertiser profits also rise.

Table 3 Effects of changing λ

Effects of changing λ					
Postal profit max		Postal profit max		Postal profit max	
Exogenous		Exogenous		Exogenous	
H	1,000	H	1,000	H	1,000
λ	0.25	λ	0.3	λ	0.4
X	500	X	500	X	500
Ca	0.2	Ca	0.2	Ca	0.2
Endogenous		Endogenous		Endogenous	
Sx	0.250	Sx	0.300	Sx	0.400
Ma	108.167	Ma	191.853	Ma	314.598
Pa	0.224	Pa	0.247	Pa	0.292
π Postal A	2.624	π Postal A	9.109	π Postal A	28.880
π Adv. A	1.361	π Adv. A	4.860	π Adv. A	16.081

[8] In this calibration, x is sufficiently large so that λ and S_x take on the same values to two digits. This is not the case for all calibrations.

Table 4 Effects of changing MC

Effects of changing MC					
Postal profit max		Postal profit max		Postal profit max	
Exogenous		Exogenous		Exogenous	
H	1,000	H	1,000	H	1,000
λ	0.3	λ	0.3	λ	0.3
X	500	X	500	X	500
Ca	0.1	Ca	0.15	Ca	0.2
Endogenous		Endogenous		Endogenous	
Sx	0.300	Sx	0.300	Sx	0.300
Ma	467.618	Ma	314.679	Ma	191.853
Pa	0.188	Pa	0.219	Pa	0.247
π Postal A	41.073	π Postal A	21.674	π Postal A	9.109
π Adv. A	24.150	π Adv. A	12.069	π Adv. A	4.860

Table 5 Effects of changing γ

Effects of changing γ					
Postal profit max		Postal profit max		Postal profit max	
Exogenous		Exogenous		Exogenous	
H	1,000	H	1,000	H	1,000
λ	0.25	λ	0.25	λ	0.25
γ	0.3	γ	0.4	γ	0.5
X	500	X	500	X	500
CT	0.7	CT	0.7	CT	0.7
Endogenous		Endogenous		Endogenous	
ST	0.106	ST	0.120	ST	0.130
STx	0.101	STx	0.149	STx	0.206
MT	15.697	MT	31.838	MT	47.294
PT	0.821	PT	0.953	PT	1.101
π Postal T	1.906	π Postal T	8.065	π Postal T	18.977
π Adv T	1.002	π Adv T	4.415	π Adv T	10.754

The effect of targeting on profit is unambiguously positive, when considered within the framework of the model. Both PO and advertiser profits are increasing in γ. In some rough sense, an increase in targeting can be thought of as increasing welfare.

4 Conclusions and Future Research

This chapter extends the analysis of advertising demand to the demand for postal direct mail products. Such work is of interest in a world where changes in postal markets have threatened the viability of reliance upon single piece and bulk

transaction volumes. Drawing upon complementary literature in studies of Internet advertising, we derive direct mail demand from the behavior of advertising firms and key characteristics of the consumers seeking information to make purchases. We offer preliminary investigation of postal market equilibrium in this framework, showing the impact of mail targeting on postal profits.

A fuller analysis would require inclusion of other postal customers, such as single piece mailers as in De Donder et al. (2011), and an understanding of the impact on surplus maximizing prices subject to some constraint. This is left to future research, as is the question of privacy concerns that looms large in the general issue of behavioral targeting. However, it would seem that increasing the profitability of direct mail would enable a reduction of the single piece mail price at the same level of overall PO profit. In that sense, an optimal targeting level, for any given distribution of consumers across product markets, would maximize the contribution from ad mail to the PO bottom line. Future research in this area might also include analysis of the allocation of fixed ad budgets across channels, including direct mail, as such a single-homing solution may well offer an improved representation of observed firm behavior, as well as a fuller treatment of the welfare implications of using information to target direct mail to consumers.

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Quality and Pricing of Delivery Services in the E-commerce Sector

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1 Introduction

In most European countries, the national universal postal service providers have traditionally been the major operators of parcel home delivery services. For e-retailers, an efficient and reliable delivery system is an essential input. With the development of e-commerce, e-customers are increasingly demanding faster transportation and delivery of goods purchased online, and an ever increasing service quality is expected. In this context, postal operators are facing two major challenges.

The first one arises from the increasing competition in the parcel delivery market, and specifically the development of operators offering alternative modes of delivery. These alternative modes include for instance delivery at a so called "PaketShop" in Germany or delivery in relay points as offered by Kiala in France, Belgium and Luxembourg. We have examined some of these issues in an earlier

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paper (Borsenberger et al. 2014), which concentrates on the pricing problem of the postal operator and the possibility to set up its own relay network.

The second challenge is probably even more fundamental. It concerns the quality of the home delivery service. This mode of delivery is certainly the most convenient for e-customers as long as there is someone at home to receive the parcel. But, in reality the probability of home delivery failure is not negligible and many socio-economic factors lead to prolonged spells of absence of all occupants. This results in a relatively high proportion of first time delivery failure, causing higher operating costs for carriers and lower customer satisfaction. This problem can be mitigated in various ways including pre-arrangement of delivery times (possibly in the evening or on Sunday) or by improving track-and-trace service. Increasing quality is costly and will require both investments and affect marginal costs. Competitors in turn may of course react to this by adjusting the quality of the alternative delivery modes. They may enhance tracking services, increase the number of relay points or invest in new technologies. Examples of the latter include "Packstation" and "PaketKästen" in Germany or Cityssimo in France.

Our formal model, presented in Sect. 2, is based on Borsenberger et al. (2014). There are two delivery technologies and taste differences for these are represented by a simple Hotelling model in which consumers are distributed over an interval, where "location" zero corresponds to home delivery while one corresponds to delivery at a relay point. The major innovation of this paper is that operators now choose the quality of their delivery service. Improving quality is costly and requires an investment which may affect both fixed and marginal cost. We assume that the quality of both delivery technologies can be improved, but since the technologies are different the cost associated with quality improvements will also differ. From a purely methodological perspective, our model innovates in that it combines horizontal product differentiation à la Hotelling,[1] with vertical differentiation à la Mussa and Rosen (1978) and Shaked and Sutton (1982). Unlike most of the industrial economics literature we have continuous (individual) demand functions, rather than just a zero-one decision. A particularly interesting feature of our model is that under the presence of the two types of differentiation, a pure strategy equilibrium typically exists even in a *simultaneous* price and quality game.[2]

We first study the first-best and the monopoly solutions as reference scenarios in Sects. 3 and 4. Then we turn to the duopoly equilibrium which is the most interesting case from a practical perspective in Sect. 5. Both operators choose the quality of their respective delivery service (home or relay point) and the rate and we characterize the Nash equilibrium of this game.

While we adopt the simplest possible model which is consistent with the main stylized features of the underlying problem, the analytical solutions are often quite complex. The interpretation is interesting in itself, but to obtain sharper conclusion we resort to numerical simulations in Sect. 6. These are based on a simulation model

[1] See Gabszewicz and Thisse 1992 for a survey of the extensive literature.

[2] The industrial economics literature has typically concentrated on sequential games, mainly because in the standard differentiation model there the simultaneous game typically has no pure strategy equilibrium.

in which the cost structure and the distribution of tastes are calibrated to achieve market shares which are consistent with a stylized representation of the currently observed market structure. We also integrate reasonable estimates about impact of quality on cost for the two delivery modes. Sect. 7 concludes.

2 Model

The model is based on Borsenberger et al. (2014), enhanced to account for quality both in consumer's preferences and in the operators' cost structure. To keep the paper self-contained we recall the main feature of this model while concentrating on the role of quality. We study the market of an e-commerce product. There are two delivery modes: at home (index h) or in a relay (index r). The marginal cost of this product (excluding shipping costs) is constant and denoted by k; there is no fixed cost. Throughout this paper we assume that the e-commerce sector is perfectly competitive so that prices equal marginal costs (shipping included). Formally we have $q=k+p$:[3] the consumer price (of the e-commerce product) is equal to its marginal cost plus the fixed cost. In other words, there is full pass-through of shipping costs to consumers.[4]

Consumers are distributed over a Hotelling line, $z \in [0,1]$, with $G(z)$ denoting the distribution function and $g(z)$ the density. Consumers' location represents their preferences over home versus relay delivery. Home delivery is the preferred option of consumer 0, while delivery in a relay is the most preferred option of consumer 1.

Let q_h denote the consumer price for the home delivered product set by the e-retailer, while q_r represents the consumer price for the relay delivered product. Utility of consumer z who buys x units of the good is given by

$$\begin{cases} \theta_h u(x) - q_h x - tz^2 & \text{if the good is delivered at home,} \\ \theta_r u(x) - q_r x - t(1-z)^2 & \text{if the good is delivered in a relay,} \end{cases} \tag{1}$$

where θ_h and θ_r are parameters representing "quality of delivery" for home and relay delivery respectively.

[3] Imperfect competition in the e-commerce sector would in most cases result in a different pattern of pass-through. Depending on the type of competition there may be under- or even over-shifting of shipping costs to the final customer.

[4] Chapter 3 shows that contrarily to initial expectations, the development of the internet has not led to perfect competition in the relevant markets. Still, it is shown that even though markets are concentrated and dominated by a few firms competition intensity is so strong that profit margins are small. As far as our problem is concerned this yields for all practical purposes the same result as a perfectly competitive market. In particular, there continues to be full pass-through of shipping costs.

We can now proceed along the same lines as in Borsenberger et al. (2014) to derive aggregate (market) demand for the two products which are given by

$$X_h\left(\theta_h,\theta_r,q_h,q_r\right)=x\left(\theta_h,q_h\right)G\left[z\left(\theta_h,\theta_r,q_h,q_r\right)\right], \tag{2}$$

$$X_r\left(\theta_h,\theta_r,q_h,q_r\right)=x\left(\theta_r,q_r\right)\left(1-G\left[z\left(\theta_h,\theta_r,q_h,q_r\right)\right]\right). \tag{3}$$

Where $\hat{z}\left(\theta_h,\theta_r,q_h,q_r\right)$ is the marginal consumer indifferent between home and relay delivery.

The cost functions of home and relay delivery are expressed by

$$C_h\left(\theta_h,X\right)=c_h\left(\theta_h\right)X_h+F_h\left(\theta_h\right), \tag{4}$$

$$C_r\left(\theta_r,X\right)=c_r\left(\theta_r\right)X_r+F_r\left(\theta_r\right). \tag{5}$$

where the subscripts h and r are used to identify the marginal and fixed costs associated with home and relay delivery respectively. We assume for $i=h,r$

$$c_i^{'}>0, c_i^{''}\geq 0, F_i^{'}>0, F_i^{''}\geq 0.$$

With these assumptions, the SOCs for the choice of θ_h and θ_r are "more likely" to be satisfied. However, these are *not* necessary conditions.

3 First-Best Solution

In the absence of quality choice (exogenous θ's), the first best is trivial; it simply involves marginal cost pricing. This will also be the case here, but the interesting aspect will be the optimal choice of θ's. This part is less trivial and it is useful to study this first best (FB) as a benchmark. Let p_h and p_r denote the respective linear shipping rates for home and relay delivery paid by the e-retailer to the delivery operator. Recall that under perfect competition in the e-commerce sector, we have $q_h=k+p_h$ and $q_r=k+p_r$.

The FB problem can be written as follows

$$\begin{aligned}\max_{p_h,p_r,\theta_h,\theta_r} L_1 &= \int_0^{\hat{z}}\left[v\left(\theta_h,q_h\right)-tz^2\right]g\left(z\right)dz+\int_{\hat{z}}^1\left[v\left(\theta_r,q_r\right)-t\left(1-z\right)^2\right]g\left(z\right)dz \\ &+\left[p_hX_h+p_rX_r-c_h\left(\theta_h\right)X_h-c_r\left(\theta_r\right)X_r-F_h\left(\theta_h\right)-F_r\left(\theta_r\right)\right].\end{aligned} \tag{6}$$

Observe that L_1 represents the total surplus: aggregate consumer surplus plus profits of the two operators. The FOCs with respect to prices yield

$$\begin{aligned}p_h&=c_h,\\ p_r&=c_r.\end{aligned}$$

Not surprisingly, prices are equal to marginal cost. The FOCs with respect to quality, then reduce to

$$\int_0^{\hat{z}} u\left(x_h\right) g\left(z\right) dz - \left[X_h c_h^{'} + F_h^{'} \right] = 0, \tag{7}$$

$$\int_{\hat{z}}^1 u\left(x_r\right) g\left(z\right) dz - \left[X_r c_r^{'} + F_r^{'} \right] = 0. \tag{8}$$

The first term in these expressions measures the marginal social benefit (aggregated over all relevant consumers) of an increase in θ_h and θ_r respectively. The second term reflects the marginal total cost of a quality increase, accounting for the increase in fixed and variable costs. Note that since the benefits are linear in θ, the second-order conditions require that the cost is sufficiently convex in quality (at least beyond some level).[5]

4 Ramsey Solution

When we impose a break-even constraint, with some minimum profit level $\overline{\pi}$, we obtain a Ramsey problem. The Lagrangean expression associated with this problem can be written as follows

$$\begin{aligned} L_2 = &\int_0^{\hat{z}} \left[v\left(\theta_h, q_h\right) - tz^2 \right] g\left(z\right) dz + \int_{\hat{z}}^1 \left[v\left(\theta_r, q_r\right) - t\left(1-z\right)^2 \right] g\left(z\right) dz \\ &+ \left(1+\lambda\right)\left[p_h X_h + p_r X_r - c_h\left(\theta_h\right) X_h - c_r\left(\theta_r\right) X_r - F_h\left(\theta_h\right) - F_r\left(\theta_r\right) \right] - \lambda\overline{\pi}, \end{aligned} \tag{9}$$

Differentiating with respect to prices, rearranging and denoting the elasticity of aggregate demand of good $i = \{h, r\}$ by ε_i yields the following Ramsey type expressions for the optimal prices:

$$\frac{p_h - c_h}{q_h} = \frac{\lambda}{1+\lambda} \frac{1}{\left|\varepsilon_h\right|} - \frac{\left(p_r - c_r\right)}{q_h} \frac{\partial X_r / \partial q_h}{\partial X_h / \partial q_h}, \tag{10}$$

$$\frac{p_r - c_r}{q_r} = \frac{\lambda}{1+\lambda} \frac{1}{\left|\varepsilon_r\right|} - \frac{\left(p_h - c_h\right)}{q_r} \frac{\partial X_h / \partial q_r}{\partial X_r / \partial q_r}. \tag{11}$$

[5] We could have specified utilities as $\theta\alpha u(x)$ with $\alpha < 0$ to make marginal benefits of quality decreasing. However, this is simply a change of variables; the unit in which we measure quality is arbitrary and our formulation is just as general, even though it implies that all the convexity is put in the cost term.

These expressions are not affected by the endogeneity of θ_h and θ_r. To be more precise, pricing *rules* are not affected but actual price levels do change. The optimal level of the θ's is now determined by the following conditions

$$\frac{\partial L_2}{\partial \theta_h} = \int_0^{\hat{z}} u(x_h) g(z) dz + (1+\lambda)\left[(p_h - c_h)\frac{\partial X_h}{\partial \theta_h} + (p_r - c_r)\frac{\partial X_r}{\partial \theta_h} - X_h c_h' - F_h' \right] = 0,$$

$$\frac{\partial L_2}{\partial \theta_r} = \int_{\hat{z}}^{1} u(x_r) g(z) dz + (1+\lambda)\left[(p_h - c_h)\frac{\partial X_h}{\partial \theta_r} + (p_r - c_r)\frac{\partial X_r}{\partial \theta_r} - X_r c_r' - F_r' \right] = 0.$$

Once again we can interpret these conditions in terms of social costs and benefits. We can think about the first term as the variation in consumer surplus and the term in brackets as the variation in producer surplus or profit. The variation in profit is now weighted by $(1+\lambda)$. On the one hand, profits are accounted for in social welfare; this explains the weight of 1. On top of that an increase in profits has the benefit of relaxing the break-even constraint; this explains the extra weight of λ, the Lagrange multiplier associated with this constraint.

Observe that an interior solution requires (with obvious notation) $\partial\pi/\partial\theta_i < 0$, $i = h, r$. In other words quality has to increase up to a level where its impact on profit becomes negative. This "suggests" that profit maximization would yield a level of quality that is *too low*. However, we have to be careful because this argument is valid for given prices and price will change as θ_i increases. Still, the result is interesting because with general demands and preferences, the quality choice of a profit maximizing monopoly may be too high or too low, even for given prices; see, e.g., Varian (1992, Sect. 14.4). Varian's argument also shows why we obtain an unambiguous result in our setting: with preferences as defined by expression (1), the net consumer surplus is an increasing function of θ.[6] In addition, with two quality parameters the argument needs extra regularity conditions.[7] Keeping all these qualifications in mind it remains that this conjecture is confirmed by the numerical simulations below.

5 Duopoly with Single Technology Operators

Let us now assume that there are two operators. One of them, labeled P is the incumbent postal operator who only delivers at home. The competing operator (entrant), E, delivers only to relays. Its cost function has the same structure as (5), with a constant marginal cost of $c_r(\theta_r)$ and a fixed cost $F_r(\theta_r)$.

[6] This is because the inverse demand function which is given by $q = \theta u'(x)$ becomes steeper as theta increases.

[7] Even if we neglect price variations the property that $\partial L_2/\partial\theta_h > 0$ and $\partial L_2/\partial\theta_r > 0$ holds at the profit maximizing, does not necessarily imply that social optimum is achieved for higher levels of θ_h and θ_r.

We characterize the Nash equilibrium of this game, where operator P sets q_h and θ_h while operator E (simultaneously) sets q_r and θ_r. In equilibrium each operator's price must be the best-response to the other operator's strategy. To determine the best-response functions we now study the optimization problem of each of the operators.

The objective function of operator P is now to maximize social welfare subject to a break-even constraint and is represented by the following Lagrangean expression

$$\begin{aligned} L_{D2} = &\int_0^{\hat{z}} \left[v\left(\theta_h, q_h\right) - tz^2 \right] g\left(z\right) dz + \int_{\hat{z}}^1 \left[v\left(\theta_r, q_r\right) - t\left(1-z\right)^2 \right] g\left(z\right) dz \\ &+ \left(1+\lambda\right)\left[p_h X_h - c_h\left(\theta_h\right) X_h - F_h\left(\theta_h\right) \right] - \lambda\overline{\pi} + \pi^E, \end{aligned} \tag{12}$$

where

$$\pi^E = \left[p_r - c_r\left(\theta_r\right) \right] X_r - F_r\left(\theta_r\right) \tag{13}$$

is operator E's profit. This expression differs from its counterpart in the monopoly case, (6), in that profits associated with the relay technology, π^E, are not multiplied by $(1+\lambda)$; this is normal because they now go to the other operator and no longer contribute to the budget balancing of operator P. The FOC with respect to p_h and θ_h implicitly define the best response functions of operator P, yielding p_h and θ_h as functions of the other operator's strategic variables, namely p_r and θ_r. Differentiating π^E yields the FOCs for operator E. These expressions in turn define the best-response functions of operator E. The Nash equilibrium levels of $(p_h, p_r, \theta_h, \theta_r)$ are then determined as the solution to the system of equations consisting of the FOCs.

As far as prices are concerned, we obtain the traditional Ramsey expression.

$$\frac{p_h - c_h\left(\theta_h\right)}{q_h} = \frac{\lambda}{1+\lambda}\frac{1}{\left|\varepsilon_h\right|} - \frac{p_r - c_r\left(\theta_r\right)}{\left(1+\lambda\right)q_h}\frac{\partial X_r / \partial q_h}{\partial X_h / \partial q_h}. \tag{14}$$

The optimality condition for θ_h has a similar interpretation as in the previous sections. It is given by

$$\int_0^{\hat{z}} u\left(x_h\right) g\left(z\right) dz + \left(1+\lambda\right)\left[\left(p_h - c_h\right)\frac{\partial X_h}{\partial \theta_h} - X_h c_h^{'} - F_h^{'} \right] + \left(p_r - c_r\right)\frac{\partial X_r}{\partial \theta_h} = 0.$$

Once again it represents the marginal net social benefit of a variation in θ_h. Consumer surplus and E's profit receive a weight of 1, while P's profit has a weight of $(1+\lambda)$. Observe that since $\partial X_r / \partial \theta_h = -x_r G^{'}\left(\hat{z}\right) u\left(x_h\right) / 2t < 0$, we no longer know the sign of $\partial \pi^P / \partial \theta_h$. Put differently, we can no longer say for sure that a profit maximizing operator chooses a quality level that is too low even for a given price. Intuitively, this is not surprising. A profit maximizing operator neglects the impact of quality on net consumer surplus, which here is positive; see Sect. 4. This explains the underprovision of quality in the monopoly case. However, in duopoly, an increase in θ_h also *decreases* operator E's profit. This term is neglected too when operator P is

profit maximizing and this goes in the opposite direction (towards an overprovision of quality). Note that a solution with $\lambda = 0$ is possible, even when $\bar{\pi} > 0$. This is because a profit maximizing operator E will always set its price above marginal cost. To mitigate distortions in the marginal consumer operator P then also has an incentive to set a price above marginal cost and this may imply a markup which proves to be sufficient to cover the fixed costs.

In the simpler case where operator P is maximizing profit, the FOCs become

$$\frac{p_h - c_h(\theta_h)}{q_h} = \frac{1}{|\varepsilon_h|}, \tag{15}$$

$$\left[p_h - c_h(\theta_h)\right]\frac{\partial X_h}{\partial \theta_h} - X_h c_h' - F_h' = 0. \tag{16}$$

The FOCs of operator E can be rearranged in a similar way to yield

$$\frac{p_r - c_r(\theta_r)}{q_r} = \frac{1}{|\varepsilon_r|}, \tag{17}$$

$$\left[p_r - c_r(\theta_r)\right]\frac{\partial X_r}{\partial \theta_r} - X_r c_r' - F_r' = 0. \tag{18}$$

The comparative statics properties of the best-response functions are quite complicated, even for the case where both operators maximize profits, where they are implicitly defined by Eqs. (15), (16), (17), and (18). Pricing behavior is simple only when demand elasticities are constant. In that case, an operator's price is independent of the other operator's price. In other words, there is no strategic interaction in prices and operator's pricing policies are that of two independent monopolies. However, there is strategic interaction via the quality levels. Furthermore, Eqs. (15) and (17) then imply constant markups. Consequently, the increase in *marginal* costs due to an improvement in quality will be more than fully shifted to the consumers, while the increase in fixed costs does not affect prices. This is perfectly in lines with standard monopoly pricing results.

Though worth mentioning, this property is of limited practical relevance in our setting, because the assumption of constant elasticity appears to be very restrictive here. To see this, observe that elasticities in Eqs. (15) and (17) are those of market demand and not of individual demands. Even when individual demands have a constant elasticity, market demand depends also on the distribution G, and on the location of the marginal consumer which in turn depends on both operators' prices. With all these effects at play it would take rather stringent assumptions to obtain a constant elasticity aggregate demand. Since there are no "reasonable" simplifying assumptions that would make the analytical model more tractable, we now turn to a simulation exercise to study the properties of the different solutions we have just defined.

6 Numerical Simulations

Our calibration is based on the one presented in Borsenberger et al. (2014), which is a special case of our current model for $\theta_h = \theta_r = 1$. More precisely, we have used the same value of the transportation cost t associated with the Hotelling model, the same quadratic utility functions $u(x)$, and thus the same linear demand functions $x(1, q)$, the same marginal cost $k = 10$ for the product which is delivered, and the same constant marginal costs of delivery for the two technologies, with home delivery being 50 % more expensive at $c_h = 1.5$ than relay delivery at $c_r = 1$. In other words we have assumed that the *marginal* delivery cost does not depend on quality.

Some of our assumptions, however, differ from Borsenberger et al. (2014). For computational reasons, we assume here a uniform distribution of consumers over the Hotelling line. With this distribution, the market share of home delivery is 31 % when both delivery methods have the same unit quality ($\theta_h = \theta_r = 1$) and when they are each priced at marginal cost ($q_h = k + c_h = 11.5$ and $q_r = k + c_r = 11$), and of 68 % when the relay delivery price is increased to 12 (keeping $\theta_h = \theta_r = 1$ and $q_h = 11.5$).

We assume a fixed cost of delivery that varies with quality for both delivery methods – i.e., $F_h(\theta_h)$ and $F_r(\theta_r)$ and that the two technologies have the following characteristics: *(i)* the fixed cost of home delivery is larger than the fixed cost of relays when both have the same unitary quality (the scenario studied in Borsenberger et al (2014)): $F_h(1) = 100$ while $F_r(1) = 50$, *(ii)* both costs are convex in quality, as it quickly becomes more expensive to increase quality at the margin, and *(iii)* the fixed cost of quality becomes larger for relays than for home delivery when the quality of both is increased by more than 7 % above their starting level of $\theta_h = \theta_r = 1$. This latter assumption reflects the difficulty to scale up significantly the relay technology without incurring significant costs. Figure 1 illustrates the fixed costs of quality for both technologies.

We first study the situation where a monopoly operates both technologies, before moving to the case of a duopoly with each firm operating its own delivery technology.

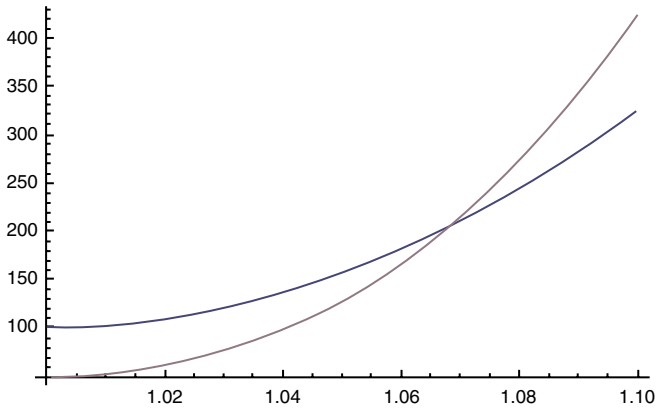

Fig. 1 Fixed cost of quality for relay ($F_r(\theta_r)$, in *red*) and for home delivery ($F_h(\theta_h)$, in *blue*)

6.1 Monopoly Operator with Two Technologies

We start from the first best allocation (first numerical row in Table 1) where prices are of course equal to marginal costs, and thus higher for home delivery than for relays ($p_h = c_h = 1.5 > p_r = c_r = 1$), and where the optimal quality is larger for home delivery than for relays ($\theta_h = 1.1 > \theta_r = 1.04$). Quality is lower for relays than for home delivery for two reasons. First, nearly two thirds of consumers prefer to be delivered at home, so that the aggregate marginal benefit of a larger quality is much higher for h than for r; recall that the cost of quality is a fixed cost. Second, even though $F_r(\theta_r) = 99 < F_h(\theta_h) = 324$ at the first best, the fixed cost of quality increases faster in relays than for home delivery when $\theta_h = \theta_r$.

Observe that the large market share of home delivery is entirely due to the differences in the shape of fixed costs of quality between the two technologies, rather than to any intrinsic preference of consumers for one rather than the other (since we assume a uniform taste distribution). In the first-best allocation, the fixed costs of quality are not covered, so that the monopoly operator makes a loss.

The next rows in Table 1 correspond to the Ramsey equilibria as the minimum profit requirement $\overline{\pi}$ is increased (see last column). As $\overline{\pi}$ increases, the monopoly increases both its prices above marginal costs. It also decreases the relay quality to save on costs.

Interestingly, the optimal value of home delivery quality is not monotone in $\overline{\pi}$; it first increases with $\overline{\pi}$, and then decreases once a threshold is crossed. At the same time, both the market share of home delivery and its contribution to overall profit increase monotonically with $\overline{\pi}$. The contribution of relays to the bottom line is non-monotone, first increasing with $\overline{\pi}$ and then decreasing. Both consumer surplus and aggregate welfare decrease with $\overline{\pi}$. Finally, as $\overline{\pi}$ becomes very large, p_r becomes larger than p_h.

An allocation of particular interest is the one corresponding to $\overline{\pi} = 0$ – i.e., the second best Ramsey allocation. Home delivery quality is slightly larger than its first best level, while relay quality is lower. Prices are significantly larger than at their first best level, with relay cheaper than home delivery. Total welfare is not much (2 %) lower than at its first best level, but its composition is very different, with much lower (25 %) consumer surplus. The positive contribution of relays to profit is compensated by the negative contribution of home delivery.

Table 1 Equilibrium allocation under monopoly

θ_h	θ_r	p_h	p_r	Share h	CS	Welfare	π_h	π_r	$\overline{\pi}$
1.100	1.040	1.500	1.000	63.4 %	1,822	1,399	−324	−99	−423
1.102	1.036	1.746	1.251	66.9 %	1,697	1,397	−253	−47	−300
1.107	1.027	2.202	1.738	74.9 %	1,482	1,382	−115	15	−100
1.111	1.021	2.465	2.041	80.2 %	1,368	1,368	−29	29	0
1.114	1.015	2.751	2.401	86 %	1,246	1,346	72	28	100
1.115	1.010	3.056	2.836	90.7 %	1,116	1,316	183	17	200
1.079	1.004	4.573	5.835	94.8 %	340	894	538	16	554

The last row in Table 1 reports the profit-maximizing equilibrium. The monopoly keeps a very small relay market characterized both by a very large price (larger than home delivery's) and a low quality. The monopoly then extracts a maximum of surplus from the consumers located close to the relay end of the Hotelling line. The home delivery quality is slightly below its first-best level, and the price is much higher. Profit (generated quasi exclusively by home delivery) is larger than consumer surplus, and total welfare is very much lower (36 %) than at its first-best level.

6.2 Duopoly with Distinct Technologies

We now turn to the duopoly equilibrium where each firm operates a distinct technology, and where the entrant sets the relay delivery characteristics in order to maximize its profit. The first row of Table 2 reports the equilibrium where the postal operator sets home delivery price and quality to maximize total welfare without any break-even constraint. Not surprisingly, the profit-maximizing entrant posts a price higher than marginal cost and also degrades relay quality compared to its first best level. The postal operator also increases its price above marginal cost, to mitigate distortions in the marginal consumers (see Borsenberger et al. (2014) where quality level are exogenous) and increases the quality of home delivery above the first-best level. The home delivery market share is then significantly higher than in the first best. Both operators make a loss in this equilibrium. Consequently, with a welfare-maximizing home delivery operator who is not subject to a break-even constraint entry is not sustainable. The home delivery operator's loss is lower than at the first best allocation, but both consumer surplus and welfare are also lower.

As we increase the minimum profit requirement of the postal operator, $\overline{\pi}$ (moving down in Table 2), the postal operator increases its price and decreases its quality, while the relay entrant increases both its price and its quality. The relay's market share increases with $\overline{\pi}$. All this is in stark contrast (except for the increases in prices) with what happens as we increase $\overline{\pi}$ in the monopoly scenario. The entrant even chooses a quality level that is above the first best level for the relay when $\overline{\pi}$ is large enough. The postal operator reacts to this very high quality level for the relay by setting a lower-than-first-best-optimal quality level for home delivery. The relay's market share is then larger than its first-best level. Both the entrant's and the incumbent's profits increase with $\overline{\pi}$. The entrant's profit is always larger than the incumbent's. The relay price remains smaller than the home delivery price whatever the value of $\overline{\pi}$.

Table 2 Equilibrium allocation under duopoly

θ_h	θ_r	p_h	p_r	Share h	CS	Welfare	π^E	π
1.121	1.021	2.084	1.518	81.9 %	1,613	1,396	−17	−200
1.102	1.030	2.209	1.771	71.8 %	1,455	1,379	24	−100
1.075	1.040	2.444	2.120	56 %	1,248	1,359	111	0
1.060	1.046	2.611	2.307	46.5 %	1,145	1,348	172	31
1.056	1.047	2.669	2.363	43.5 %	1,115	1,344	193	37

Table 3 Minimum quality standards in profit-maximizing and mixed duopoly

P max	θ_h	θ_r	p_h	p_r	Sh. h	CS	W	π^E	π
π; $\theta_h \geq 1.1$	1.1	1.041	2.847	2.139	54.8 %	1,238	1,341	116	−13
W; $\pi \geq 0$	1.075	1.040	2.444	2.120	56 %	1,248	1,359	110	0
W; $\pi \geq 0, \theta^h \geq 1.085$	1.085	1.041	2.622	2.135	55 %	1,239	1,355	115	0

Comparing the allocations where the postal operator breaks even ($\pi = 0$) in Tables 1 and 2, we see that the introduction of competition in the relay market decreases both consumer surplus and aggregate welfare. Observe that this is effectively a general result, which does not depend on the calibration, as long as $\pi^E > 0$. This is because with $\pi^E > 0$, the duopoly equilibrium is also an option available to the Ramsey monopolist. Consequently, it is plain that the Ramsey solution can only yield a higher welfare.

The last row of Table 2 reports the equilibrium where both operators simultaneously maximize their own profit. The profit-maximizing scenario is better for consumers but worse for the firms than under a monopoly. Prices are significantly lower, relay quality is larger but home delivery quality is smaller. The relay market share is much larger under a duopoly than a monopoly.

Finally, as an illustration of the possible impact of quality regulation in this setting, we have computed the profit-maximizing equilibrium where the postal operator faces a minimum quality level which is set at the first-best level. In other words, only θ_h is regulated. For the rest, the postal operator sets its profit-maximizing price when θ_h is exogenously set at 1.1, while the relay entrant sets both price and quality to maximize its profit. Results are reported in Table 3.

We obtain that total welfare is lower than without the constraint on θ_h (last row of Table 2), showing that it is better not to regulate the postal operator in this circumstance. In other words, no regulation is better than a partial and asymmetric regulation. The postal quality constraint induces the entrant to decrease both its price and the quality of its relays, and the incumbent reacts by increasing its price for home delivery. Both operators' profit decreases after the introduction of the quality constraint on home delivery. Similarly, introducing a minimum quality standard (even lower than the first-best level) in a mixed oligopoly lowers welfare. Both total welfare and consumer surplus are reduced compared to the case without quality regulation, with only a break-even constraint. This is because of the price increases induced by the higher quality levels. The unique winner of the quality regulation in this case is the entrant who makes higher profits.

7 Conclusion

This paper has studied a stylized delivery market for e-commerce products. There are two delivery technologies, home delivery and delivery to a relay point. Taste differences for these are represented by a simple Hotelling model in which

consumers are distributed over an interval. Operators also choose the quality of their delivery service. Improving quality is costly and requires an investment which may affect both fixed and marginal cost. We have first studied a setting in which a single operator uses both technologies and then considered a duopoly with two single technology operators. The home delivery operator may or may not be regulated while the relay operator is not subject to regulation and maximizes its profit.

Some lessons have emerged. First, if the postal operator is regulated so that it maximizes welfare without break-even constraint, then entry by a profit-maximizing retail operator is not profitable. Second, the introduction of competition on a regulated market (where the incumbent breaks-even) decreases welfare and consumer surplus. Third, if the market is not regulated, entry is socially beneficial (compared to a maximizing profit monopoly situation). Consumer surplus is higher, thanks to lower prices and to a larger relay quality. Fourth, quality regulation (imposing to the home delivery operator to reach the first best quality level) may have an adverse effect on welfare. Total welfare is lower than without the constraint on θ_h (last row of Table 2).

Consequently, no regulation is the superior policy under these circumstances. This adverse effect in the welfare is due to the decrease in the postal operators' profits which is so large that it is not counterbalanced by the consumer surplus increase. Note that the home delivery operator now makes losses. Imposing a first-best quality level for home delivery in a competitive market puts the operator in an unsustainable economic situation. Even under a break-even constraint coupled with a minimum quality-level constraint (lower than the first-best level), both total welfare and consumer surplus are reduced compared to the case without quality regulation (with only a break-even constraint) because of the price increases induced by a higher quality. The unique winner of the quality regulation in this case is the entrant who makes higher profits.

Our numerical results do of course depend on the properties of the cost functions. In particular the discussion of the various scenarios has shown that the degree of convexity of the fixed cost associated with the relay technology with respect to quality plays a crucial role. To keep the presentation concise, we have concentrated on a single specification, namely the one represented in Fig. 1. While this specification reflects the stylized properties of the two technologies, the precise degree of convexity is of course subject to debate and the lack of available data precludes at this point a fully-fledged estimation of these functions. To assess the robustness of our results, we have therefore performed a series of additional simulations both with a larger and with a smaller degree of convexity of the cost function of relay delivery.[8] While this changes of course all the numerical results, it is quite striking that all of our qualitative conclusions remain unaffected.

[8] An Excel file with the detailed results is available from the author upon request.

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A Branching AIDS Model for Estimating U.S. Postal Price Elasticities

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1 Introduction

In this paper we apply an econometric method based upon the Almost Ideal Demand System (AIDS) originally developed by Deaton and Muellbauer (1980) and extended by Hausman et al. (1994) to estimate a series of complete matrices of price elasticities for U.S. Postal Service (USPS) domestic mail. Our model organizes USPS revenues, volumes and prices as a tree with branches corresponding to increasing disaggregations of U.S. domestic mail by class, by rate category and by shape. The matrices of price elasticities apply to the levels of disaggregation as we proceed up the tree. Our results demonstrate that modern econometric methods are capable of producing complete matrices of postal price elasticities at a level of detail and accuracy that is beyond the capabilities of conventional methods.[1]

The matrices exhibit the general properties that we would expect from theory. Own-price elasticities of demand are related to the level of aggregation of mail and tend to become larger in absolute value when mail categories become more refined. An own-price elasticity drawn from a conventional econometric model, omitting cross-price effects, is roughly equivalent to the sum of the true own-price elasticity

[1] The technical reason for this limitation is that the prices of products that are close substitutes are inevitably almost co-linear within a finite sample (Cigno et al. 2013b).

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and all the omitted cross-price elasticities from our matrices. Conventional demand models are adequate for forecasting postal demands when domestic postal rates move in unison. However, it is apparent from our estimates that there are many statistically significant cross-price elasticities of demand among U.S. domestic mail services. Our method provides an adaptable and robust alternative to the computationally demanding random-coefficients discrete-choice normal model developed by Cigno et al. (2013b), and to the non-econometric proportionality calibrated Almost Ideal Demand System (PCAIDS) method proposed by Swinand and Hennessy (2014).

We begin by econometrically fitting a conventional demand equation, the "trunk" equation, to explain aggregate expenditures for domestic mail services. Next, we fit a branching sequence of share equations based on the AIDS model that describes the division of postal revenues among mail classes, then by rate categories, and, finally, by shapes. The AIDS equations at each branching point provide a good fit of revenue shares to expenditures, prices and other explanatory variables. The elasticities derived from the estimated equations conform well to neoclassical demand theory.

Following this introduction, we explain the trunk equation (Sect. 2), and its estimation. The AIDS share equations are described (Sect. 3), as well as the method for fitting them, followed by the results for the share equations that divide total domestic revenue by major class. We also show how to employ the equation fits sequentially to derive the matrices of price elasticities in Appendix 1. Table 3 contains estimates of the matrix of class-level elasticities; Appendix 2 holds the matrix of estimates at the rate-category level; the matrix derived from the shape-level fits is available on request from the authors. We next provide an analysis and summary of the overall properties of the elasticity estimates (Sect. 4) and compare them to estimates derived from conventional demand models. The conclusion (Sect. 5) follows.

In the tree shown in Fig. 1 the trunk is the total of all U.S. domestic mail. The major branches are domestic classes; secondary branches divide the classes into rate categories. The final level divides the majority of the rate categories into shapes: letters, cards, flats and parcels.

Our tree corresponds to a hypothetical budget process for a postal customer. First, the customer determines his aggregate budget for domestic mail services. This amount is regarded as fixed. It is then divided and subdivided as we proceed up the tree. Estimating expenditures by class requires only knowledge of the total expenditure on domestic mail, the price indices for the domestic mail classes and other pre-determined conditions. The division by class does not depend upon the ways that expenditures are divided among the rate categories within each class. Further up the tree, the choice made at each branching point is independent of those made at other branching points on the same level. For example, dividing First-Class letter expenditures among work-sharing categories requires no information regarding similar divisions being made on the same level for the other domestic mail classes.

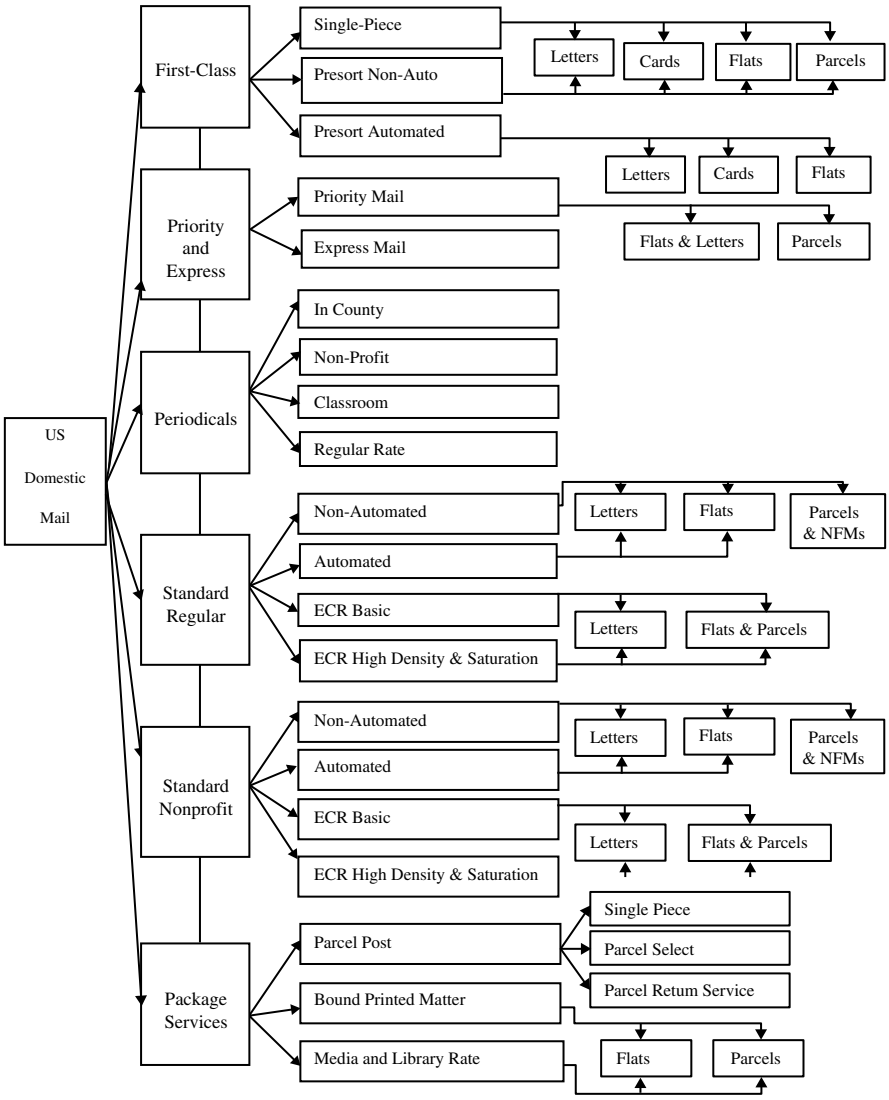

Fig. 1 Tree for U.S. domestic mail

2 The Trunk Equation

The trunk equation follows the general form of the demand equations fit by Cigno et al. (2014) for all major categories of U.S. mail. However, we express demand as an aggregate expenditure rather than as an aggregate postal volume. The equation is a restricted trans-log that is a flexible form with respect to postal prices and Internet

penetration. All nominal values and prices are deflated to 2009 dollars using the implicit deflator for GDP. The trunk equation is:

$$\ln\left(R/H\right) = \beta_0 + \beta_1 I + \beta_2 \ln\left(P/\bar{P}\right) + \beta_3 I^2 + \beta_4 \left[\ln\left(P/\bar{P}\right)\right]^2 + \beta_5 I \ln\left(P/\bar{P}\right) + \beta_6 t + \beta_7 Y_l/H + \beta_8 W/H + \beta_9 \mathrm{D}_{\text{election year}} + \beta_{10-15} \mathrm{D}_{\text{exponential trends}} + u,$$

where: $\beta_0,..,\beta_{15}$ are the parameters to be estimated.

The variables of the trunk equation are:

R/H	the postal revenue from domestic mail per household in a calendar quarter measured in constant-dollar expenditures seasonally adjusted at an annual rate
I	Internet penetration during the calendar quarter measured as a fraction of U.S. households with a broadband connection
$P/\bar{P}$	the deflated quarterly average revenue per piece of all domestic mail divided by its sample mean
t	time measured in calendar years starting from the end of FY 2013.
Y_l/H	long-term real GDP per household defined as a weighted average of the current real quarterly GDP per Household and the previous quarter's Y_l/H.
W/H	real net worth per household.
$D_{election\ year}$	a dummy variable that is set to one for the third and fourth quarters of election years and to zero, otherwise.
$D_{exponential\ trends}$	exponential trends that are included to represent the effects over time of the introduction of new services, the impact of the 9/11 attack and anthrax mailings.[2]
u	the equation error, which is assumed to obey a linear homogenous auto-regressive process with four quarterly lags (AR-4).[3]

The own-price elasticity of the aggregate demand for domestic mail services is:

$$\varepsilon = -1 + \frac{\partial \ln\left(R/H\right)}{\partial \ln\left(P/\bar{P}\right)} = -1 + \beta_2 + 2\beta_4 \ln\left(P/\bar{P}\right) + \beta_5 I.$$

The trunk equation has been fit using techniques described in detail in Pearsall (2005, 2011) and Cigno et al. (2013a). These techniques include the AR-4 process of the equation error, the rate of adaptation for the exponential trends, and a method

[2] The model includes exponential trends to represent the expansion (or contraction) path of demand following a change in market conditions to which postal customers take time to adapt. The trends start on the date of the event that triggered them and are derived using an estimated common annual rate of adaptation. See Pearsall (2005).

[3] The AR-4 process is handled by performing an initial least-squares fit of the trunk equation, deriving an estimate of the parameters of the AR-4 process from the residuals, transforming the data so that the transformed errors are serially uncorrelated, and refitting the trunk equation to the transformed data.

for dealing with the possibility that the estimates may imply positive price elasticity within the normal range of postal prices and Internet penetration.

We face an additional complication by using average revenue per piece as the price for all domestic mail. Average revenue per piece is calculated by dividing seasonally adjusted total domestic revenue by seasonally adjusted number of pieces. This eliminates seasonal fluctuations but introduces an error into the measurement of $P / \bar{P}$. Also, this price is likely to be endogenous because it reflects postal customers' collective responses to a complex postal tariff.

If we fit the trunk equation by using ordinary methods, the resulting estimates of its parameters will be inconsistent due to the presence of the error in $P / \bar{P}$. Cigno et al. (2014) avoid this problem by employing a fixed-weight index (FWI) price, rather than average revenue per piece, to fit their demand equations. However, this solution is problematic when the dependent variable is revenue per household because the formula for calculating the own-price elasticity from a revenue equation presumes that the definition of price is the same on both sides of the equation.

A practical solution to the endogenous nature of $P / \bar{P}$ is to construct an instrumental variable that is correlated with $\ln\left(P / \bar{P}\right)$ but uncorrelated with the error in its measurement. We do this by fitting a reduced form equation using an FWI price. The reduced form equation is the mirror image of the trunk demand equation:

$$\ln\left(P / \bar{P}\right) = \alpha_0 + \alpha_1 I + \alpha_2 \ln\left(F / \bar{F}\right) + \alpha_3 I^2 + \alpha_4 \left[\ln\left(F / \bar{F}\right)\right]^2 + \alpha_5 I \ln\left(F / \bar{F}\right) + \alpha_6 t + \alpha_7 Y_l / H + \alpha_8 W / H + \alpha_9 \mathrm{D}_{\text{election year}} + \alpha_{10-15} \mathrm{D}_{\text{exponential trends}} + u.$$

$F / \bar{F}$ is the average deflated quarterly FWI price of domestic mail divided by its sample average. The fitted reduced form equation may be evaluated to obtain estimates of $\ln\left(P / \bar{P}\right)$ without the error u for each quarter of the sample. These estimates are the observations for an instrumental variable with the requisite properties. The trunk equation is fit by substituting estimates derived from the reduced form equation for $\ln\left(P / \bar{P}\right)$.

Our fits of the reduced form equation and the trunk demand equation are shown in Table 1. The estimates confirm that the long term trend of U.S. postal demand is downwards due to the gradual encroachment of indirect competitors. Also, postal customers adapt to changes quite slowly – at an estimated annual rate of only about 26 %. The effects of the 9–11 attack and anthrax mailings were minor and temporary. Recently, the penetration of the Internet has heavily depressed the demand for domestic mail services. Our estimates also show that changes in the USPS services instituted after the omnibus rate case of 2006 (PRC Docket No. R2006-1) accelerated the decline in household demand for domestic mail services. In our model, changes in economic activity affect postal volumes and revenues through the variables Y_l/H and W/H. The coefficients of these variables are elasticities of total domestic mail volume with respect to long term GDP and net worth per household. Our estimates show that aggregate postal demand is moderately responsive to changing economic conditions and that the responses tend to lag behind movements in GDP per household.

Table 1 Reduced form and trunk equation estimates

		Reduced form		Trunk equation	
		Ln of Rev per Pc		Ln of Rev per H'hold	
Explanatory variable (regressor)	Effective date	Estimate	t-value	Estimate	t-value
Intercept		−3.4177	−3.12	−0.3102	−0.34
Internet penetration (broadband connections per household)		−0.7428	−5.75	−0.4003	−3.50
Mean centered domestic mail FWI price (Ln of deflated fixed-weight index/mean)		0.9116	24.70		
Mean centered price of domestic mail (estimated Ln of deflated rev per Pc/mean)				0.7668	16.30
Internet × Internet		0.8355	3.81	0.4063	2.09
Ln FWI price × Ln FWI price		2.3388	17.90		
Internet × Ln FWI Price		−0.3279	−0.85		
Ln Rev. per Pc. × Ln Rev. per Pc.				−0.5409	−1.17
Internet × Ln Rev. per Pc.				−0.6495	−1.96
Long term annual trend (years from the effective date)	07/01/2013	−0.0075	−1.58	−0.0237	−6.33
Long term GDP per household (Ln of chained 2009 dollars/household)		0.5180	2.35	1.1458	6.01
Real net worth per household (Ln of chained 2009 dollars/household)		−0.0241	−0.64	0.0954	2.67
Election year quarters 3 and 4 (Dummy = 1 for election Year Qtr 3/4, 0 otherwise)		−0.0018	−0.76	0.0061	2.15
R2006 rates installed (exponential trend from the effective date)	05/14/2007	−0.0279	−0.49	−0.3196	−6.70
9-11 attack/anthrax letters (reverse exponential path from 9/11)	09/11/2001	0.0027	0.21	−0.0134	−0.97
MC95-1 automation discounts (exponential trend from the effective date)	07/01/1996	0.0822	2.99	0.0306	1.38
Standard saturation mail introduced (exponential trend from the effective date)	02/03/1991	0.0590	2.17	0.0719	3.44
Standard mail & car-Rte presorting introduced (exponential trend from the effective date)	03/21/1981	−0.0020	−0.08	0.3650	18.37

(continued)

Table 1 (continued)

		Reduced form		Trunk equation	
		Ln of Rev per Pc		Ln of Rev per H'hold	
Explanatory variable (regressor)	Effective date	Estimate	t-value	Estimate	t-value
3/5-digit 1st Cls presorting introduction (exponential trend from the effective date)	07/06/1976	–0.0159	–0.48	0.1414	5.07
Auto-regressive process (AR-4)	Lag quarter 1	0.5827	7.44	0.3454	4.41
	Lag quarter 2	–0.1397	–1.55	–0.0604	–0.73
	Lag quarter 3	0.0176	0.20	–0.0523	–0.63
	Lag quarter 4	0.0706	0.92	0.0284	0.36
Estimated annual rate of adaptation					
Estimated rate (Pct. per year)	26.51%	Adj. R Sqr	0.9778	Adj. R Sqr	0.9996
99 % confidence interval	+/–15.75%	Std. error	0.012	Std. error	0.014
95 % confidence interval	+/–12.57%	d.f.	150	d.f.	150
90 % confidence interval	+/–11.00%				

Total U.S. domestic mail

3 The Aids Share Equations

The AIDS model is well-suited to predicting the proportion of total revenue derived from each branch for reasons that are described in detail by Hausman and Leonard (2005). Each share equation is a second-order flexible form that does not unreasonably constrain the described demand behavior but can be fit by mostly linear methods. The estimates can also be made to conform to several restrictions derived from neoclassical demand theory. The AIDS equations have the unusual and highly-desirable property that they exactly represent the behavior of an average customer, even though the equations are ordinarily fit to aggregate data (Deaton and Muellbauer 1980).[4]

At any branching point postal revenue is divided into $i=1,..,N$ sub-streams according to share equations with the following form:

$$s_i = \alpha_i + \beta_i \ln\left(Y / P\right) + \sum_{j=1}^{N} \gamma_{ij} \ln\left(p_j\right) + \delta_i X_i + u_i,$$

[4]This property also makes the branching AIDS model a generalized Gorman polar form. As Hausman et al. (1994) point out, the AIDS model is compatible with an exact two-stage budget process. In order to have our entire model exactly compatible with a multi-stage budgeting process, each branching point requires a demand model that is a generalized Gorman polar form. We meet this requirement by specifying an AIDS model at each branching point of the tree.

where:

s_i	the share of postal revenue[5] derived from product i
Y	the total revenue divided at the branching point
P	price index (see below) for all $j=1,..,N$ products
p_j	the price of product j
X_i	a set of exogenous variables that includes a long-term trend, dummy variables for sudden classification changes and exponential trends to account for changes in market conditions
α_i, β_i, γ_{ij} and δ_i	the coefficients to be estimated
u_i	is an additive error that is assumed to obey an AR-4 process as with the error in the trunk equation.

The equation for this process is:

$u_{it}=\gamma_1 u_{it-1}+\gamma_2 u_{it-2}+\gamma_3 u_{it-3}+\gamma_4 u_{it-4}+\epsilon_{it}.$, where ϵ_{it} – is a non-auto-correlated disturbance.[6]

One of the greatest practical advantages of the AIDS model is that several basic results of neoclassical consumer demand theory may be imposed easily as constraints on the coefficients:

Slutsky-Schultz symmetry: $\gamma_{ij}=\gamma_{ji}$ for $i=1,..,N$ and $j=1,..,N$.
Homogeneity of degree zero: $\sum_{j=1}^{N}\gamma_{ij}=0$ for $i=1,..,N$.
Adding up: $\sum_{i=1}^{N}\alpha_i=1$, $\sum_{i=1}^{N}\beta_i=0$ and $\sum_{i=1}^{N}\delta_i=0$.

The AIDS model also includes an equation for the log of the price index P:

$$\ln(P)=\alpha_0+\sum_{i=1}^{N}\alpha_i\ln(p_i)+\frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}\gamma_{ij}\ln(p_i)\ln(p_j).$$

If the price index is pre-determined, the share equations of the AIDS model can be fit entirely by linear methods. For this reason the AIDS share equations are often fit using an approximation to the price index that employs fixed weights, w_j, rather than the coefficients from the share equations. Deaton and Muellbauer (1980) recommend Stone's index: $ln(P)=\sum_{j=1}^{N}w_j ln(p_j)$; the FWI price: $P=\sum_{j=1}^{N}w_j p_j$ is another possibility.[7] We have fit our model by using both alternative indices and have found that the results are similar to the estimates we obtain with the AIDS index.

[5] Shares are calculated from seasonally adjusted quarterly revenues and, therefore, are free of purely seasonal effects.

[6] The disturbance ϵ_{it} is serially uncorrelated with a zero mean and stationary variance σ_i^2. However, the disturbances for the N share equations at a given branching point cannot be independent because of the fact that the shares must always sum to one. We have assumed that the disturbances for the equations at each branching point have a stationary N by N variance-covariance matrix Ω.

[7] In order to avoid making the price index endogenous, Hausman and Leonard (2005) recommend using revenue shares that are averages over the sample period as weights.

Fitting the share equations for the branching AIDS model presents many of the same complications as fitting the trunk equation, as well as several new ones. In previous studies (Pearsall 2005, 2011; Cigno et al. 2014) rates of adaptation estimated for postal demand models have been found to vary by major class. The rates of adaptation used for fitting our share equations were taken from those estimated for postal classes in Cigno et al. (2014). We have adjusted these rates proportionately so that their revenue-weighted average matched the annual rate of adaptation of 26.51 % estimated for all domestic mail. Then for each AIDS share equation we applied the different adaptation rates by class. For example, we used the annual rate of adaptation of 15.06 % for First-Class mail to calculate long-run real GDP and the exponential trends (whenever they appeared in a share equation for First-Class mail or any of its rate components or shapes). We have employed the same method for dealing with the AR-4 processes in the share equations as with the trunk equations. This was accomplished within the overall scheme for estimating the branching AIDS model.

We have computed the prices appearing in the AIDS share equations by dividing seasonally adjusted revenue for a component of the domestic mail stream by seasonally adjusted volume of the same component. This calculation results in a price series, p_i, that is non-seasonal but endogenous for all of the same reasons given for the aggregate price index P. For each price appearing in the AIDS equations we have fit a reduced form equation to create an instrument correlated with revenue per piece but not with its measurement error. These equations are all similar log-log forms with explanatory variables that are exogenous with respect to postal demand:

$$\ln\left(p_i\right) = \alpha_{i0} + \alpha_{i1} I + \alpha_{i2} \ln\left(f_i\right) + \alpha_{i3} t + \alpha_{i4} Y_l / H + \alpha_{i5} W / H + \alpha_{i6} X_i + u_i.$$

The reduced form equation for $ln(p_i)$ describes how the revenue per piece for a component of the domestic mail stream is affected as mailers respond to changes in the postal tariff and other exogenous variables. The coefficient, α_{i2}, is the elasticity of revenue per piece, p_i with respect to the FWI price, f_i. The error, u_i, is expected to obey an AR-4 process so each reduced form equation is fit by the same three-step method described earlier. $ln(p_i)$ is calculated from the equation and is used for revenue per piece as required in the fits of the AIDS equations. Alternatively, $ln(p_i)$ can be calculated directly from the initial OLS fits of the reduced form equations with results that are similar to those presented here.

Prices are not the only endogenous explanatory variables in the share equations. The total revenue being divided at each branching point, Y, is also endogenous within the overall context of the postal demand system, although Y is treated as predetermined at each branching point.[8] We exploit the recursive structure of the model to avoid incorporating an error in Y in the share equations at each branching point. This is done by fitting the branching AIDS model in ascending order. First, we fit the trunk equation and evaluate it to obtain an error-free estimate of total

[8] This is the principal operational consequence of using a model that is a generalized Gorman polar form. Total revenue, Y, is predetermined because it is set by a budgeting process that does not depend upon how revenues are sub-divided further up the tree.

revenue from domestic mail. This estimate is used as Y in the share equations for the main branches of the tree. These equations divide total revenue among the major classes of mail leaving us with error-free estimates of mail revenue for each major class. Next, the share equations for each secondary branching point are fit using the estimates Y_k for the class k. The equations at the secondary branching points further divide postal revenue by work-sharing category or by customer qualifications. This progression is repeated again to fit the share equations that divide the secondary branches by shape.

We impose the properties of the coefficients on the estimated parameters by arranging the way we apply linear methods to fit the N share equations for each branch. We directly fit only $N-1$ of the equations. We derive the coefficients for the remaining equation from the others using the homogeneity of degree zero condition and the adding-up condition. The Slutsky-Schultz symmetry condition and the homogeneity of degree zero condition make it necessary to estimate only $N-1$ of the coefficients $\gamma_{ij}\, j=1,..,N$ that appear in a single share equation. From these conditions we also obtain $\gamma_{iN}=\sum_{j=1}^{N}{}^{-1}\gamma_{ij}$. Substituting into the i-th share equation and collecting terms delivers:

$$s_i = \alpha_i + \beta_i \ln\left(Y / P\right) + \sum_{j=1}^{N-1} \gamma_{ij}\left[\ln\left(p_j\right) - \ln\left(p_N\right)\right] + \delta_i X_i + u_i.$$

This is the share equation without γ_{iN}. Slutsky-Schultz symmetry is imposed by arranging the $N-1$ share equations for a branching point as a single combined share equation with $\gamma_{ij}=\gamma_{ji}$ for $i=1,..,N-1$ and $j=1,..,N-1$. This arrangement overlaps the individual share equations so that the coefficients γ_{ij} are all exactly identified.

Given the price index, P, the combined share equation for a single branching point may be fit most efficiently with Generalized Least Squares (GLS) by first applying OLS to the combined equation and estimating the variance covariance matrix, Ω, from the residuals of the OLS fit. This procedure is commonly called "feasible" GLS. The GLS fit using the OLS estimate of Ω matrices is the last step in the procedure.

If the parameters of the AR-4 processes and the elements of the Ω matrices were known *a priori*, the selection of the branch share equation that is omitted from the combined share equation would be immaterial. As it is, the choice has a small effect on our results because both the AR-4 process for each share equation and the matrix Ω are derived from the residuals of preliminary fits. We have chosen the omitted share equation arbitrarily at each branching point, usually by omitting an equation representing a small share. Although different choices will produce slightly different numerical results, the differences would not materially affect our findings.[9]

[9] A minor detail of the estimation process is the estimation of the scale parameter α_0 appearing in the formula for $ln(P)$. Deaton and Muellbauer (1980) describe α_0 as the aggregate expenditure for a subsistence standard of living when all prices are unity. They recommend that α_0 be determined *a priori*. We have estimated subsistence expenditures from our fitted equations and exploited the recursive structure of the branching AIDS model. Subsistence expenditures for all domestic mail

All of the above depends upon having on hand the observations for the price index *P*. *P* is known in advance if we use either Stone's or the FWI price index but is not known in advance if we use the AIDS price index. Then it is calculated from the estimated parameters of the share equations using the formula for $ln(P)$. Our solution to this problem is an iterative process that differs from the scheme proposed by Deaton and Muellbauer (1980) but yields the same coefficient estimates.[10]

The estimates of the coefficients of the class-level AIDS share equations shown in Table 2 are from a single combined share equation fit for the branching point where our tree divides into major branches – six classes of mail (see Fig. 1 in Sect. 2). This branching point is the first of the 22 branching points for which we have fit a combined AIDS equation. We have fit the combined class-level share equation to the quarterly USPS time series for volumes, revenues and prices beginning in 1977 Q1 and ending in 2013 Q4. The combined share equation includes all of the share equations except that for Package Services. The coefficients that apply to Package Services have been calculated using the Homogeneity of Degree Zero and Adding Up conditions. The coefficient estimates are taken from the final GLS fit of the combined share equation to the AR-4 transformed data. The combined equation has 75 explanatory variables and is fit to a combined sample with 720 observations.

The fitted share equations are robust representations of the economic causes affecting postal revenue shares at the class level. Statistically, the AIDS share equations explain the revenue shares by class extremely well as can be seen from the Adjusted R-Squared (.9994) and the Standard Error (0.003) and the estimated coefficients are statistically different from zero. Many of the estimates have absolute t-values that exceed 1.96, the critical value for a two-tail 95 % test for statistical significance. The same is true for most of the AIDS share equations we have fit at the category and shape levels.

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are obtained by evaluating the trunk equation with subsistence estimates of real GDP and net worth per household, with $P / \overline{P} = 1$, and with all other variables set to their sample averages. This yields α_0 for the estimation of the combined share equation for the main branches. The fitted share equations are then evaluated with the subsistence expenditure, with the prices $p_i = 1$ for $i = 1,..,N$, and with the other variables at their sample averages. These shares are used to divide the aggregate subsistence expenditure among the postal classes providing the estimates of α_0 for the estimation of the share equations for the secondary branching points. The calculation of subsistence expenditures is carried on in this fashion all of the way up the tree.

[10] To initiate the iterative process, we calculate Stone's price index using the sample average revenue proportions as fixed weights. Then we fit the combined share equations using Stone's index and use the resultant coefficient estimates to calculate the AIDS price index from the formula for $ln(P)$. Next, we average the AIDS price index and Stone's index to obtain a new index, *P*, which we use to re-estimate the combined share equation. We use the new coefficients to recalculate the AIDS price index. For the next iteration, the new AIDS price index and previously estimated index *P* are averaged again to obtain a new index *P,* which is used to re-estimate the combined share equation. The iterations are repeated until the calculated AIDS price index and the *P* used to fit the combined share equation have converged. In our experience satisfactory convergence typically takes less than ten iterations.

Table 2 Combined AIDS share equations

Explanatory variable (regressor)	Effective date	First-class mail expenditure share		Priority & express expenditure share		Periodicals expenditure share		Standard regular expenditure share		Standard nonprofit expenditure share		Package services expenditure share	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Intercept (Alpha) (Alpha zero = 3.7362)		0.6093	6.09	−0.0249	−0.45	0.0442	2.01	0.2816	3.07	0.0242	1.04	0.0656	n.a.
Price of first-class mail (Gamma) (Ln of Rev per PC)		0.0050	0.13	0.0555	3.07	−0.0473	−6.08	−0.0042	−0.14	−0.0238	−4.07	0.0148	n.a.
Price of priority &, express mail (Gamma) (Ln of Rev per Pc)		0.0555	3.07	−0.0087	−0.69	−0.0049	−1.04	−0.0263	−2.10	−0.0006	−0.17	−0.0150	n.a.
Price of periodicals (Gamma) (Ln of Rev per Pc)		−0.0473	−6.08	−0.0049	−1.04	0.0235	5.96	0.0221	3.87	0.0033	1.90	0.0034	n.a.
Price of standard regular mail (Gamma) (Ln of Rev per Pc)		−0 0042	−0.14	−0.0263	−2.10	0.0221	3.87	−0.0024	−0.08	0.0026	0.50	0.0082	n.a.
Price of standard nonprofit mail (Gamma) (Ln of Rev per Pc)		−0.0238	−4.07	−0.0006	−0.17	0.0033	1.90	0.0026	0.50	0.0165	8.96	0 0020	n.a.
Price of package services (Gamma) (Ln of Rev per Pc)		0.0148	n.a.	−0.0150	n.a.	0.0034	n.a.	0.0082	n.a	0.0020	n.a	−0.0134	n.a.
Expenditures for domestic m ail (Beta) (Ln Re/per household/ price index)		−0.0205	−0.98	0.0267	2.18	−0.0039	−0.75	−0.0057	−0.30	−0.0019	−0.35	0.0053	n.a.

Long term annual trend (years from the effective date)	07/01/2013	0.0027	1.29	0.0001	0.07	−0.0014	−3.19	0.0010	0.46	−0.0007	−1.56	−0.0017	n.a.
Internet penetration (broadband connections per household)		−0.0838	−3.06	−0.0320	−1.97	0.0093	1.56	0.0824	3.29	0.0096	1.68	0.0147	n.a.
R2006 rates installed (exponential trend from the effective date)	05/14/2007	−0.0436	−2.46	0.0597	6.01	0.0057	1.56	−0.0469	−2.90	0.0025	0.62	0.0225	n.a.
9-11 attack/ anthrax letters (reverse exponential path from 9/11)	09/11/2001	0.0095	2.39	−0.0035	−1.64	−0.0010	−1.11	−0.0072	−2.10	−0.0010	−1.08	0.0031	n.a.
MC95-1 automation discounts (exponential trend from the effective date)	07/01/1996	−0.0805	−5.95	0.0246	3.07	0.0040	1.39	0.0293	2.30	0.0052	1.85	0.0173	n.a.
Standard saturation mail introduced (exponential trend from the effective date)	02/03/1991	−0.0345	−2.38	0.0269	3.72	0.0006	0.25	−0.0072	−0 53	0.0009	0.32	0.0133	n.a.
Standard mail & car-Rte presorting introduce (exponential trend from the effective date)	03/21/1981	−0.0068	−0.38	−0.0388	−3.99	−0.0103	−2.76	0.0683	4.46	0.0068	1.73	−0.0191	n.a.
3/5-digit 1st CIs presorting introduction (exponential trend from the effective date)	07/06/1976	−0.0381	−1.10	0.0449	2.10	0.0311	4.30	−0.0374	−1.06	0.0094	1.30	−0.0099	n.a.

(continued)

Table 2 (continued)

Explanatory variable (regressor)	Effective date	First-class mail expenditure share		Priority & express expenditure share		Periodicals expenditure share		Standard regular expenditure share		Standard nonprofit expenditure share		Package services expenditure share	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Election year quarters 3 and 4 (Dummy = 1 for Election Year Qtr 3/4, 0 otherwise		−0.0003	−0.48	−00004	−1.16	0.0003	1.78	0.0000	0.07	0.0004	2.27	0.0000	n.a.
2012 RPW report revisions (Dummy = 1 after Effective Date, 0 before)	01/22/2012	−0.0203	−3.43	0.0064	2.21	0.0005	0.40	−0.0056	−0.97	−0.0027	−2.14	0.0216	n.a.
Auto-regressive process (AR-4)	Lag quarter 1	0.7335	8.77	0.4434	5.24	0.3174	3.76	0.7262	8.74	0.4360	5.22		
	Lag quarter 2	0.0452	0.43	0.1943	2.10	0.1539	1.78	−0.0124	-0.12	0.0592	0.61		
	Lag quarter 3	−0.0528	−0.51	−0.0110	−0.12	−0.1384	−1.60	0.0164	0.16	0.2903	2.75		
	Lag quarter 4	−0.1495	−1.79	−0.0321	−0.38	0.0490	0.60	−0.1901	−2.30	−0.3158	−3.41		
Combined share equation GLS AR-4	Adj. R Square	0.9994		Rate of adaptation									
	Std. error	0.0025		(pct per year)									
	d.f.	645		26.51%									

U.S. domestic mail by major classes

4 Estimated Elasticity Matrices

Elasticities derived from our branching AIDS model are not fixed values. They depend somewhat on the prices for which they are calculated, as well as expenditures and the chosen values for the exogenous variables in the share equations up to the branching level. The estimated elasticities presented in Table 3 and Appendix 2 were all derived using sample averages for the year 2013.

Table 3 provides the estimates for the matrix of the own-price and cross-price elasticities at the class level. The more detailed 20 by 20 category-level elasticity matrix is displayed in Appendix 2.[11] The trunk-level own-price elasticity of all domestic mail with respect to average revenue per piece is estimated as −0.706 and is statistically significant (t-value −3.21). Our estimates comply with the most fundamental requirement of demand theory: the own-price elasticities are negative. All but one of the class-level own price elasticities are statistically significant at the 95 % confidence level; 16 out of 20 of the category-level own-price elasticities are negative and significant.

At the highest level of aggregation, the demand for domestic mail services is price inelastic. However, the own-price elasticities tend to become larger in absolute value as we progress up the tree. The own-price elasticities for First-Class, Priority and Express, Standard Regular and Packages are all greater (in magnitude) than −0.706.

The observed tendency for the own-price elasticities to increase becomes even more pronounced at the category and shape levels where branches define products that are close substitutes for each other. While the own-price elasticity at the class level for Standard Regular mail is −0.925, the estimated own-price elasticities for its categories are −1.160 (for non-automated basic presort), −0.855 (for automated basic presort), −1.764 (for carrier-route basic), and −1.797 (for high-density and saturation carrier-route).

The cross-price elasticities (the off-diagonal elements of the elasticity matrices) may be either positive (for substitutes) or negative (for complements). However, they are more frequently positive than negative. Periodicals and Standard Regular mail, which are broadly competing avenues for advertisers, are substitutes for each other at the class level. On the other hand, First-Class mail and Periodicals appear to be complements.

At the category and shape levels the statistically significant cross-price elasticities tend to concentrate within the diagonal blocks corresponding either to classes or categories (depending on branching level). These are the postal products that are most likely to be substitutes. For example, among the three work-sharing categories of First-Class mail there are four significant cross-price elasticities indicating close relationships. The sign pattern for cross-price elasticities found in the matrices is fairly symmetric. For example, the cross-price elasticity for Standard Regular mail with respect to the price of Periodicals is 0.099. The corresponding cross-price

[11] The shape-level matrix is 43 by 43.

Table 3 Trunk and class-level elasticities of demand

Trunk price elasticity							
All domestic mail	*Rev.per Pc*	*FWI price*	*Elasticity of Rev. per Pc. W/r FWI price*				
	−0.706	−0.578	0.819				
	(−3.21)	(−2.17)	(3.08)				
Class-level matrix of revenue per piece price elasticities							
	First-class	*Priority/exp.*	*Periodicals*	*Std. Reg.*	*Std. N–P*	*Packages*	*Row sum elasticity*
First-class mail	−0.804	0.122	−0.080	0.079	−0.037	0.043	−0.677
	(−5.54)	(3.32)	(−4.53)	(0.97)	(−2.80)	(2.15)	(−3.91)
Priority and express mail	0.524	−1.063	−0.033	−0.170	−0.000	−0.113	−0.856
	(2.42)	(−10.56)	(−0.84)	(−1.36)	(−0.01)	(−2.99)	(−3.09)
Periodicals	−1.477	−0.162	−0.139	0.902	0.131	0.139	−0.606
	(−4.67)	(−0.95)	(−0.97)	(4.12)	(2.10)	(1.89)	(−1.33)
Standard regular mail	0.162	−0.091	0.099	−0.925	0.020	0.045	−0.690
	(0.93)	(−1.82)	(4.07)	(−7.17)	(0.93)	(1.34)	(−3.03)
Standard nonprofit mail	−0.770	−0.010	0.148	0.200	−0.316	0.097	−0.652
	(−2.60)	(−0.08)	(2.05)	(0.89)	(−4.21)	(1.22)	(−1.56)
Package services	0.376	−0.237	0.065	0.197	0.040	−1.208	−0.767
	(1.74)	(−3.18)	(1.84)	(1.30)	(1.25)	(−16.27)	(−2.66)

t-values in brackets (.)

elasticity for Periodicals with respect to the price of Standard Regular mail t is 0.902. Both elasticities are positive indicating that these two categories are substitutes.

An extreme example of a large negative own-price elasticity of demand corresponding to a large positive cross-price elasticity is within First-Class mail at the category level. The own-price elasticity for non-automated presort is −15.843. The demand for non-automated presort First-Class mail is highly own-price-elastic. This occurs because the class includes another, almost identical, work-sharing category – automated First-Class mail. The cross-price elasticity for the non-automated mail with respect to the price of the automated mail is 23.870. Apparently, a small change in the price of either category alone is sufficient to induce a large change in the mail flow between them.

Although the own-price elasticities indicate that many demands at the category and shape levels are price-elastic, this is mainly because of volume shifts among U.S. domestic mail services when the prices of individual products change. U.S. domestic mail actually remains inelastic at the category and shape level with respect to generalized changes in postal prices. This can be seen by comparing the own-price elasticities with the row sums of the elasticity matrices.

A substantial proportion of the cross-price elasticities in all of our matrices are statistically significant. In the class-level matrix there are 11 such elements; at the category level there are 115. These cross-price elasticities are effectively zeroed out by conventional demand models. The row sums of the elasticity matrices are comparable to own-price elasticities derived from demand models that omit cross-price effects. These row sums are the elasticities of demand with respect to simultaneous proportional changes in all postal prices. The row sums in Table 3 and Appendix 2 are roughly within the same ranges as the own-price elasticities shown in Cigno et al. (2014, Table 4.4).

Our estimates are demand elasticities with respect to revenue per piece, however, most previous estimates, such as those in Cigno et al. (2014), are derived from demand equations that have been fit using FWI prices. Revenues per piece and FWI prices are functionally related, and, in principle, one could derive the FWI price elasticities using the formula:

$$\frac{\partial \ln Q}{\partial \ln FWI_i} = \sum_j \frac{\partial \ln Q}{\partial \ln RPP_j} \frac{\partial \ln RPP_j}{\partial \ln FWI_i}$$

where $\frac{\partial \ln Q}{\partial \ln RPP_j}$ is a demand elasticity with respect to the revenue per piece of product j (RPP_j), and $\frac{\partial \ln RPP_j}{\partial \ln FWI_i}$ is the elasticity of RPP_j with respect to the FWI price of product i (FWI_i).

In practice this formula can only be applied to the price elasticity of demand for all domestic mail from the trunk equation. The FWI price elasticity corresponding to our revenue per piece elasticity is obtained by multiplying $\frac{\partial \ln Q}{\partial \ln RPP}$ for all

domestic mail by $\frac{\partial \ln RPP}{\partial \ln FWI}$ (taken from the fit of the reduced form equation per Cigno et al. (2013b)). This calculation is shown at the top of Table 3. The own-price elasticity of domestic mail with respect to the FWI price index of domestic mail is −0.578 and is statistically significant (t = −2.17).

To obtain complete matrices of FWI price elasticities we can refit the entire model with the FWI prices substituted for the revenues per piece in the trunk equation and in the AIDS share equations. In effect, the FWI prices are used directly as proxies for revenues per piece rather than to derive instruments by fitting the reduced form equations. The elasticities that result from this approach are elasticities defined as they are in previous models and tend to be smaller in magnitude than the corresponding revenue per piece elasticities presented in Table 3 and Appendix 2.

5 Conclusion

In this paper we have described a flexible and robust method for estimating complete matrices of postal price elasticities of demand at almost any level of mail product detail for which a suitable sample can be assembled. The method is flexible because, first, it can be applied using a branching scheme tailored to the available data, and, second, the AIDS share equations at each branching point can be individually specified with respect to the selection of exogenous variables. We have demonstrated that the method is robust by making statistically accurate estimates of own-price and cross-price elasticities for matrices of USPS domestic mail services at several levels of aggregation. These matrices characterize the average recent responses of U.S. households and businesses to changes in domestic postal prices. The estimates comply with neoclassical demand theory, generally confirm what is known from previous econometric work, and conform to our expectations regarding the demand behavior of postal customers.

Although conventional demand models allow for forecasting of U.S. postal volumes with fair accuracy, postal rate-setting is more demanding. Setting postal rates requires accurate estimates of cross-price elasticities among postal products, especially among those that are close substitutes or complements. This paper, along with previous papers by Cigno et al. (2013b) and Swinand and Hennessy (2014), shows that modern methods now offer several effective ways to obtain complete and consistent matrices of postal price elasticities.

Appendix 1: Derivation of the Matrices of Price Elasticities

We derive matrices of price elasticities progressively for each branching level. At each level the equation combines a price elasticity derived for the level below with elasticities taken from the estimated coefficients of the AIDS share equations at the branching level to obtain an element of the matrix of price elasticities.

The progression begins with the own-price elasticity, ε, for all domestic mail with respect to its average revenue per piece, P. This elasticity is combined with three demand elasticities drawn from the estimates of the coefficients of the AIDS share equations for the major branches that divide the mail by classes. These are:

The elasticity of demand for product i with respect to total postal expenditures, Y: $\varepsilon_i^Y = (1 + \beta_i / s_i)$,

The elasticity of the AIDS price index, P, with respect to the price, p_j of product j: $\varepsilon_P^j = \alpha_j + \sum_{i=1}^{N} \gamma_{ji} ln(p_i)$, [12] and

The elasticity of demand for product i with respect to the price, p_j of product j: $\varepsilon_{ij}^M = -1(i=j) + (\gamma_{ij} - \beta_i \varepsilon_P^j)/s_i$.

The latter elasticity, ε_{ij}^M, is a Marshallian elasticity because it is derived under the assumption that the expenditure, Y, is fixed.

The Marshallian elasticity does not capture the entire effect of a change in the price of product j on demand for product i. The complete elasticity of demand for product i with respect to the price of product j may be derived under the assumption that revenue per piece in the trunk equation and the AIDS price index that emerges from the estimates of the share equations are the same.[13] Under this assumption we obtain the complete elasticity by adding to the Marshallian elasticity a term to capture the effect on demand for product i, Q_i, of changes in the price p_j transmitted first to the price index, P, and then on through the effect of P on total postal expenditures, Y:

$$\varepsilon_{ij} = -1\left(i = j\right) + \left(\gamma_{ij} - \beta_i \varepsilon_j^P\right) / s_i + \frac{\partial \ln\left(Q_i\right)}{\partial \ln\left(Y\right)} \frac{\partial \ln\left(Y\right)}{\partial \ln\left(P\right)} \frac{\partial \ln\left(P\right)}{\partial \ln\left(p_j\right)},$$

where $\dfrac{\partial \ln\left(Q_i\right)}{\partial \ln\left(Y\right)} = \varepsilon_i^Y$, $\dfrac{\partial \ln\left(Y\right)}{\partial \ln\left(P\right)} = 1 + \varepsilon$, and $\dfrac{\partial \ln\left(P\right)}{\partial \ln\left(p_j\right)} = \varepsilon_P^j$.

We calculate the elements of the matrix of price elasticities for postal volumes disaggregated to the class level by evaluating this formula using the elasticities obtained from fitting the trunk equation and the AIDS share equations for the classes. Substituting elasticities in the formula above we have:

$$\varepsilon_{ij} = \varepsilon_{ij}^M + \varepsilon_i^Y \left(1 + \varepsilon\right) \varepsilon_P^j.$$

This is the general version of an equation found in Hausman and Leonard (2005). Technically, it is the formula for a Marshallian demand elasticity because long-term real GDP per household is fixed when we calculate ϵ. However, postal expenditures

[12] When Stone's index is used: $\epsilon_P^j = w_j$; when a FWI price is used: $\epsilon_P^j = w_j p_j / P$.

[13] In fact, they are the same in Hausman et al.'s (1994) application of a similar branching model to beer. In that application, the AIDS price indices, calculated from the highest level share equation fits, are used as product prices at the next lowest level. This is not a practical option with U.S. postal prices because of the brevity of the time series that are available for fitting the shape-level AIDS share equations.

are a very small part of an average household's total income. So, ε_{ij}, differs little from the Hicksian (compensated) elasticity. Consequently, we can inspect the estimated elasticities, as we normally would, for compatibility with neoclassical demand theory ($\varepsilon_{ii} \leq 0$), and to identify substitutes ($\varepsilon_{ij} > 0$) and complements ($\varepsilon_{ij} < 0$) when $i \neq j$.

The formula above is sufficient to compute all of the elements of the matrix of price elasticities by major class, i.e. for the major branches of the tree in Fig. 1. The information needed to apply the formula is of the same form and origin for every element of the matrix. Specifically, the trunk equation elasticity, ϵ, is the same for every element. Other elasticities in the right-hand side of the formula are all derived from the fit of a single combined share equation.

However, the structure of the matrix of price elasticities becomes more complex as we move up the tree. At the next branch level domestic mail for the major classes is subdivided among work-sharing categories or among customer categories. Each class has its own set of share equations combined and fit to postal data disaggregated into work-sharing and customer categories. The matrix of price elasticities by these categories has rectangular blocks corresponding to the elements of the matrix of elasticities by major class:

$$\begin{bmatrix} [\varepsilon_{11}] & \cdots & [\varepsilon_{1N}] \\ \vdots & \ddots & \vdots \\ [\varepsilon_{N1}] & \cdots & [\varepsilon_{NN}] \end{bmatrix}$$

The diagonal blocks are square matrices with elements that apply to mail categories within the same class. The off-diagonal blocks hold cross elasticities between the categories of two different classes. The formulas above are adapted somewhat differently to calculate the elasticities in the diagonal and off-diagonal blocks.

The block $[\varepsilon_{kk}]$ contains all of the own-price and cross-price elasticities for the work-sharing and customer categories within the major mail class k. The information required to estimate the elements of the block is similar to that used to calculate the elements of the class-level matrix of elasticities. The own-price elasticity for all of the mail in class k is just the k-th diagonal element of the class-level matrix ε_{kk}. This elasticity now assumes the previous role of the aggregate own-price elasticity from the trunk equation, ε. Additionally, we need the three elasticities derived from the coefficients of the AIDS share equations for the major branching point that divide the postal revenues of class k. If Y_k denotes total revenue and P_k is the AIDS price index for class k, the three elasticities that we calculate from the fits of the share equations are:

The elasticity of demand for product i with respect to the postal expenditures, Y_k:

$$\varepsilon_i^{Y_k} = \left(1 + \beta_i / s_i\right),$$

The elasticity of the AIDS price index P_k with respect to the price of product j:

$$\varepsilon_{P_k}^{j} = \alpha_j + \sum_{i=1}^{N} \gamma_{ji} \ln\left(p_i\right), \text{ and,}$$

The Marshallian elasticity of demand for product i with respect to the price of product j:

$$\varepsilon_{ij}^{M_k} = -1(i=j) + \left(\gamma_{ij} - \beta_i \varepsilon_{P_k}^{j}\right) / s_i .$$

Both products i and j are members of class k. The formula for an element, ϵ_{ij}, of the diagonal block $[\epsilon_{kk}]$ is:

$$\varepsilon_{ij} = \varepsilon_{ij}^{M_k} + \varepsilon_i^{Y_k}\left(1+\varepsilon_{kk}\right)\varepsilon_{P_k}^{j} .$$

An off-diagonal block $[\varepsilon_{kl}]$ holds all of the cross-price elasticities between the products in two different major classes, $k \neq l$. The cross-price elasticity of demand for postal services in class k with respect to the class-level price index for class l is the element ε_{kl} in the k-th row and l-th column of the class-level matrix. The division of the total revenue Y_k among the work-sharing and customer categories of class k does not require and makes no direct use of the prices that apply to the categories of another class such as class l. The elasticities taken from the fits of share equations are:

The elasticity of demand for product i with respect to the postal expenditures, Y_k and using the coefficients of the share equations for class k:

$$\varepsilon_i^{Y_k} = \left(1 + \beta_i / s_i\right).$$

The elasticity of the AIDS price index P_l with respect to the price of product j:

$$\varepsilon_{P_l}^{j} = \alpha_j + \sum_{i=1}^{N} \gamma_{ji} \ln\left(p_i\right)$$

The elasticity ε_{ij} consists entirely of the effect on demand for product i, Q_i, of changes in the price p_j transmitted indirectly through the effect on the postal expenditures for class k, Y_k:

$$\varepsilon_{ij} = \frac{\partial \ln\left(Q_i\right)}{\partial \ln\left(Y_k\right)} \frac{\partial \ln\left(Y_k\right)}{\partial \ln\left(P_l\right)} \frac{\partial \ln\left(P_l\right)}{\partial \ln\left(p_j\right)}.$$

After making the substitutions: $\dfrac{\partial \ln\left(Q_i\right)}{\partial \ln\left(Y_k\right)} = \varepsilon_i^{Y_k}$, $\dfrac{\partial \ln\left(Y_k\right)}{\partial \ln\left(P_l\right)} = \varepsilon_{kl}$, and $\dfrac{\partial \ln\left(P_l\right)}{\partial \ln\left(p_j\right)} = \varepsilon_{P_l}^{j}$., we have:

$$\varepsilon_{ij} = \varepsilon_i^{Y_k} \varepsilon_{kl} \varepsilon_{P_l}^{j}.$$

At the highest level of the tree many of the expenditures for work-sharing and customer categories are further subdivided by shape. The mathematics simply repeats with the matrix of price elasticities composed of rectangular blocks that correspond to the elements of the matrix of price elasticities by category.

Appendix 2: Category-Level Matrix of Price Elasticities

Class		First-class mail			Priority & express		Periodicals				Standard regular mail				Standard nonprofit mail				Package services			
	Category	S-P	Non-auto	Auto	Priority	Express	In-County	Non profit	Classroom	Regular	Non-auto	Auto	CR basic	CR HD & Sarcel	Non-auto	Auto	CR basic	CR HD & Sarcel	Po$	BPM	Med & lib	Row sun
First-class mail	Single-piece	−0.153	−0.396**	−0.206	0.092**	0.023**	−0.002**	−0.012**	−0.002**	−0.059**	−0.048	0.082	−0.048	0.089	0.022**	−0.058**	0.023**	−0.022**	0.023*	0.011*	0.007*	−0.636
	Non-automated	−12.243**	−15.843**	23.870**	0.511	0.128	−0.013	−0.067	−0.012	−0.329	−0.268	0.460	−0.270	0.494	0.123	−0.323	0.131	−0.125	0.130	0.060	0.037	−3.550
	Automated	−0.199	0.774**	−1.316**	0.090**	0.023**	−0.002**	−0.012**	−0.002**	−0.058**	−0.047	0.081	−0.047	0.087	0.022**	−0.057**	0.023**	−0.022**	0.023*	0.011*	0.006*	−0.625
Priority & express mail	Priority	0.312**	−0.114**	0.345**	−1.120**	0.019	−0.001	−0.005	−0.001	−0.027	0.113	−0.194	0.114	−0.209	0.000	−0.000	0.000	−0.000	−0.067**	−0.031**	−0.019**	−0.886**
	Express	0.206	−0.075	0.228	0.573*	−1.301**	−0.001	−0.004	−0.001	−0.018	0.075	−0.128	0.075	−0.138	0.000	−0.000	0.000	−0.000	−0.044*	−0.020*	−0.013*	−0.585
Periodicals	Within-County	−0.907**	0.332**	−1.000**	−0.138	−0.035	−0.102	−0.386	−0.163	0.503	−0.620**	1.062**	−0.623**	1.142**	−0.088	0.232	−0.094	0.090	0.085	0.039	0.024	−0.647
	Nonprofit	−0.868**	0.317**	−0.957**	−0.132	−0.033	−0.096	−0.791**	0.029	0.716**	−0.593**	1.017**	−0.596**	1.093**	−0.085*	0.222*	−0.090*	0.086*	0.082	0.038	0.023	−0.619
	Classroom	−0.423	0.155	−0.466	−0.064	−0.016	−0.569	0.212	−1.021**	1.309*	−0.289	0.495	−0.291	0.533	−0.041	0.108	−0.044	0.042	0.040	0.018	0.011	−0.302
	Regular rate	−0.850**	0.311**	−0.938**	−0.130	−0.033	0.019	0.146**	0.034**	−0.338**	−0.581**	0.996**	−0.584**	1.071**	−0.083*	0.217*	−0.088*	0.084*	0.080	0.037	0.023	−0.606
Standard regular mail	Non-automated	0.327	−0.120	0.361	−0.255	−0.064	0.011**	0.055**	0.010**	0.271**	−1.160	−1.486	−0.820	0.224	−0.044	0.115	−0.046	0.045	0.091	0.042	0.026	−2.417
	Automated	0.078	−0.028	0.086	−0.061	−0.015	0.003**	0.013**	0.002**	0.064**	−0.050	−0.855**	−0.043	0.178	−0.010	0.027	−0.011	0.011	0.022	0.010	0.006	−0.575
	Car-Rte basic	0.204	−0.075	0.225	−0.160	−0.040	0.007**	0.034**	0.006**	0.169**	−0.312	−0.671	−1.764**	0.724	−0.027	0.072	−0.029	0.028	0.057	0.026	0.016	−1.509
	Car-Rte HD&Sat	−0.024	0.009	−0.027	0.019	0.005	−0.001	−0.004	−0.001	−0.020	0.215	1.032	0.790**	−1.797**	0.003	−0.009	0.003	−0.003	−0.007	−0.003	−0.002	0.179
Standard nonprofit mail	Non-automated	−1.282**	0.469**	−1.414**	−0.024	−0.006	0.014*	0.068*	0.012*	0.334*	−0.372	0.638	−0.374	0.686	−2.580**	2.337**	−1.334**	0.662*	0.161	0.074	0.045	−1.886
	Automated	−0.321**	0.117**	−0.354**	−0.006	−0.002	0.003*	0.017*	0.003*	0.084*	−0.093	0.160	−0.094	0.172	−0.243**	0.031	−0.399**	0.381**	0.040	0.019	0.011	−0.472
	Car-Rte Basic	−1.203**	0.440**	−1.327**	−0.023	−0.006	0.013	0.064	0.012	0.314	−0.349	0.599	−0.351	0.644	−1.167**	1.138	−1.957**	1.128**	0.151	0.070	0.043	−1.770
	Car-Rte HD&Sat	0.147	−0.054	0.162	0.003	0.001	−0.002	−0.008	−0.001	−0.038	0.043	−0.073	0.043	−0.079	−0.149	0.902	0.374	−1.021**	−0.018	−0.008	−0.005	0.216
Package services	Parcel Post	0.258	−0.094	0.284	−0.225**	−0.057**	0.002	0.012	0.002	0.060	−0.151	0.258	−0.152	0.278	−0.030	0.079	−0.032	0.031	−1.165**	−0.155**	−0.118**	−0.912*
	Bound printed matter	0.052	−0.019	0.057	−0.045	−0.011	0.000	0.002	0.000	0.012	−0.030	0.052	−0.030	0.056	−0.006	0.016	−0.006	0.006	0.168	−0.246	−0.211	−0.183
	Media & library	0.091	−0.033	0.100	−0.079	−0.020	0.001	0.004	0.001	0.021	−0.053	0.091	−0.053	0.098	−0.011	0.028	−0.011	0.011	−0.136	−0.345	−0.026	−0.321

*Flags an estimate that is statistically significant at the 95% level, **Flags an estimate that is significant at the 99% level

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A Demand System Approach to Affordability

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1 Introduction

Postal Universal Service Providers and traditional mail carriers continue to face the dual challenge of falling demand and traditional regulation. Between 2007 and 2011, mail volumes fell by an average of 15 % across Europe, falling by 3.2 % per year in Ireland and 6.4 % per year in the UK. As certain services fall under the Universal Service Obligation (USO), Universal Service Providers (USPs) are obliged to continue to offer these services. In order to finance the USO, USPs often seek to increase prices on certain products. This has been the case in the postal sector; for example, An Post increased the tariff on letters up to 50 g by 5 cent in 2013, while Royal Mail increased the tariff on the same product by 2p to 3p in 2014. As USO products, these price changes must be approved by the regulator.

Postal regulations typically include provisions for flexibility in pricing behaviour but also require that price increases be 'affordable.' For example, in Ireland the 2011 Postal Act requires postal prices to be affordable and orientated to cost (ComReg 2013). Similarly, the European Postal Directive (97/67/CE) requires that postal prices be 'affordable.'

Despite its seemingly intuitive meaning, economists, regulators and postal operators have struggled to define affordability, as there is no universally accepted definition in the postal sector or in economics generally. This paper attempts to address the definition of affordability in a more economically rigorous manner by examining the response of lower income groups to a number of hypothetical postal price increases. We use data from the Survey on Income and Living Conditions

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(SILC) and the Household Budget Survey (HBS) in Ireland. We focus specifically on household consumers' expenditures on postal products and define a lower income group as being in the first decile of disposable income such that savings and net worth are low or near zero.

It is important to distinguish an income group for which affordability is most likely to be an issue, as examining the whole population including individuals in higher income deciles could cloud any conclusions on affordability for the more vulnerable segments of postal users.[1]

To assess whether prices are affordable, we define affordability with respect to price changes, where a price increase will engender affordability issues to the extent that substitution is not possible. Broadly, we propose that an appropriate measure of affordability should recognise that affordability could provoke either a reduction in demand of the own product due to the income elasticity of demand or a reduction in other necessities such as food or heating. We thus assert that a good is unaffordable if an increase in its price leads a consumer to either significantly reduce consumption of the own good in question or to forego a necessity good or a bundle of necessity goods.

We apply the proportionality calibrated almost ideal demand system (PCAIDS) method to estimate a set of demand elasticity parameters for postal products, food and related telecommunications products. The PCAIDS model is based on the same principles as the linear-approximate demand model (LA-AIDS) model, but requires less information and estimates cross-price estimates based on an analytical formula. This formula is derived from and endogenous to observed market shares, the own-price elasticity of one product in the market and an aggregate price elasticity of the industry.

The remainder of the chapter proceeds as follows: Sect. 2 reviews some of the relevant literature on affordability in the postal sector. Section 3 outlines the dataset used and the empirical method. Section 4 presents the results of estimating a PCAIDS model for examining affordability and Sect. 5 concludes with some directions for further research.

2 Background and Literature

2.1 Defining 'Affordability'

Article 12 of the European Directive (97/67/CE) states that 'prices must be affordable and must be such that all users have access to the services provided.' Similarly, the UK the Postal Service Act 2011 requires that services be provided 'at affordable prices determined in accordance with a public tariff which is uniform throughout the United Kingdom.' These requirements are mute on what constitutes an

[1] In general, affordability of postal products is more likely to be an issue for low income groups.

appropriate definition or measure of affordability. Intuitively, one would consider postal prices to be unaffordable where the consumer were to suffer adverse consequences as a result of the cost of sending post, e.g. to forego spending on other items including necessities, or be deprived of the value of communication as a result of not sending post (Ofcom 2013). In sectors such as energy and health, affordability is defined in terms of household budget shares. For example, the UK government considers fuel unaffordable to households who spend more than 10 % of their income on fuel and heating related costs (DECC 2013). Similarly, the World Health Organization (WHO) assesses the affordability of medical treatment by calculating the number of days the lowest paid unskilled government worker must work in order to pay for a course of treatment with a particular drug (WHO 2008).

While basing a service's price on cost promotes some form of economic efficiency, this may not mean that the service is affordable. As costs rise, lower income groups may become excluded from purchasing the good. The European Commission Green Paper on services of general interest (2003, p. 38) makes this point: 'Affordability should not be confused with, and does not necessarily equate to, cost orientation. Indeed, the best the market could offer is a price oriented towards cost. However, if this cost is not judged to be affordable, the State may choose to step in to ensure that everybody has affordable access.'[2]

Postcomm (2011, p. 11) proposed the following definition of affordability for residential consumers:

> A universal postal service product, for example, a First Class stamp, would be 'unaffordable' if a potential residential customer was entirely excluded from purchasing it or faced significant hardship from purchasing it because of the price.

Postcomm considered two questions in testing whether universal postal service prices are affordable for residential customers: (1) Is household expenditure on universal service postal products within household budgets? and (2) Are universal service postal products priced below households' willingness to pay for them? A positive answer to both questions would indicate that prices are affordable; however, Postcomm noted that it is possible for the test not to be passed and for prices to still be affordable. It should be noted also that some negative own-price elasticity of demand indicates that somewhere a price rise is causing someone/some household 'not to be willing to pay' for the product at the higher price. Postal spend was found to account for less than 0.15 % of average household expenditure and less than 0.25 % of low income household expenditure. Postcomm considered prices to be affordable for residential consumers at the time and found no evidence of affordability issues from consumer surveys, in which 'affordability' was understood to mean 'having enough money to make a purchase without getting into too much difficulty.'

[2]While affordability is a legal requirement, its interpretation is typically inclined towards residential consumers rather than business consumers. Although there are potentially affordability concerns for all business consumers, the focus might be on small business customers. It could be argued that regulators should not aim to protect one large firm from another and in any case, promoting prices which are aligned towards cost will ensure some level of welfare maximisation in which business consumers receive the best prices.

2.2 *Measuring 'Affordability'*

Ofcom (2013) surveyed EU regulators on their approach to measuring affordability and found a variety of approaches to assessing affordability across Member States, including the use of comparators such as postal expenditure as a proportion of income or total household expenditure, in which case prices are deemed affordable when they account for a sufficiently low proportion of average income; undertaking consumer research to elicit consumers' views on whether prices are considered affordable; price cap/cost orientation in which case the regulator considers prices orientated toward cost as being de facto affordable since prices below cost would imply a financially unsustainable service; and international benchmarking, in which case prices are considered affordable where they are below or not significantly above prices for similar products in comparable countries. We take issue with some of these approaches: firstly, where expenditure on a good represents a low proportion of average income, it may be unaffordable for some individuals (with below average income) whose spending on that good is zero; and secondly, a survey approach may be too broad in that it may capture the views of all income groups, such that the affordability issues of low income groups are not well represented.

Ofcom (2013) assessed the affordability of prices in the UK ahead of Royal Mail's proposed prices increases in April 2013. Their approach employs data on consumer spending patterns by consumer type and over time, comparative data on expenditure on other items such as utilities and food, and a range of consumer surveys and stakeholder consultations. Budget shares of spend on postal products are computed for five income groups: all households, those in the lowest fifth quintile of income, households with someone aged 65 and over, low income households (lowest fifth quintile) with someone aged 65 or over, and households with no internet connection. Based on data from the Office for National Statistics, average household weekly expenditure on post in 2010 was close to 53p per week (2012 prices), forming a budget share of 0.11 %, as compared with about £13 for all communications services. It was found that average weekly postal expenditure has generally fallen in absolute terms and as a share of budget (0.15–0.11 %) for the five consumer groups over the last 10 years. From the figure below, yearly spend is estimated at about £72 per consumer. The findings suggest that postal prices are affordable for all income groups, including more vulnerable groups (Fig. 1).

Borsenberger et al. (2012) argue that the low budget share of postal spending does not rule out affordability issues, as a large part of postal services are used as an input into the production of many other goods consumed by households. In this way prices of postal services have an indirect impact on household budgets through the price of final products that use postal services as an intermediary input. Where the markets in which businesses operate are competitive, they have an incentive to pass on the bulk of the increase in costs attributable to rising postal prices. Borsenberger et al. (2012) note that in 2008, 89 % of global demand for postal services (final and intermediate) in the UK came from UK companies who use postal services as an input to production. Thus, affordability issues for final consumers could arise as a result of increases in firms' operating costs and may fall outside the scope of traditional regulation, although, rates for businesses, especially SMEs, may be regulated too.

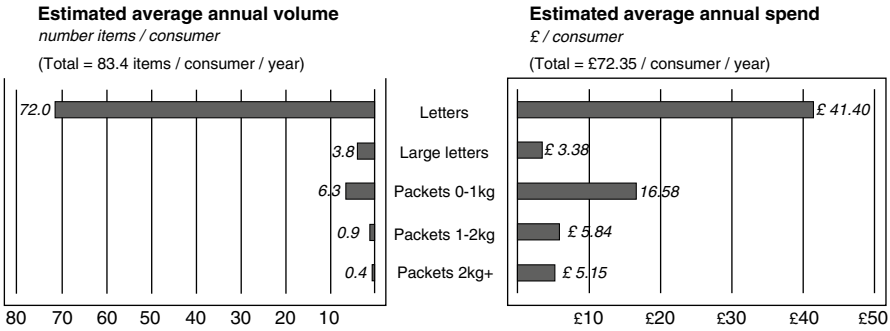

Fig. 1 Estimates of average volume and expenditure on postal products in the UK. (Source: Ofcom 2013)

Borsenberger et al. (2012) also found that previous studies had considered affordability in terms of the equivalent units of work-time required to make up a price rise. Deutsche Post (2014) calculates the number of minutes of work needed to pay the postage on a standard letter. This calculation is based on the hourly wage of an industrial worker as estimated by the Cologne Institute for Economic Research (October 2013). The figure below shows that on average it takes 3 min and 40 s to earn the postage cost of a standard letter in Europe. Bulgaria appears to be considerably above average, where it takes almost 11 min, and Ireland appears to be well below average where it takes less than 2 min to earn the postage cost of a standard letter (Fig. 2).

This method seems to be more akin to a consumer price indexation technique, for comparing prices across jurisdictions than a measure of affordability, and is not a universal method that could be applied across many sectors. In spite of this lack of 'direct' measurement of affordability, there is nonetheless a clear indication of a very wide range of the 'real' price difference across jurisdictions. If all consumers had similar tastes, needs for mail, and ability to use substitute and complementary products, then such a price index would indeed give a 'comparative' measure of affordability across jurisdictions; we would be able to say, for example, that Bulgaria's prices were less affordable than Germany's. We also reemphasize that the issue of lower income groups is not necessarily addressed by indices of work-time per postal price (although in theory this could be done).

2.3 Proposed Minimum Affordability Test Requirements

The definition of affordability according to Postcomm (2011) may be too restrictive in that the outcomes of unaffordable prices are either 'no purchase' or 'significant hardship.' Low budget shares but positive outcomes in terms of actual purchases made could nonetheless indicate some level of affordability. Low budget share could therefore be seen as an indication of affordability but not a necessary condition to conclude that prices are actually affordable. And while the impact of any

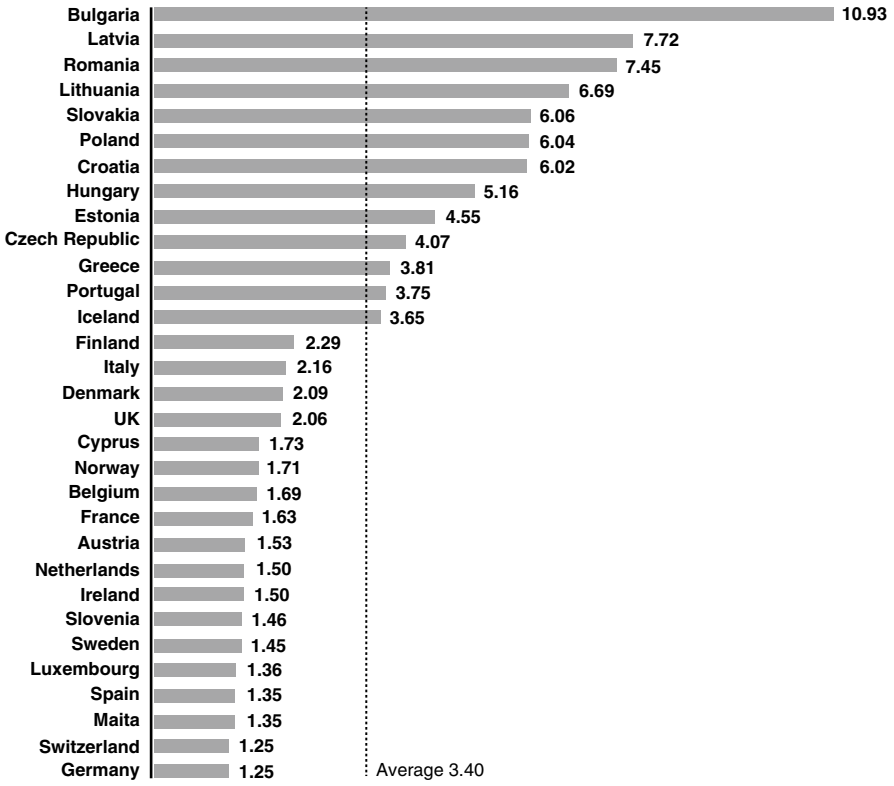

Fig. 2 Work minutes taken to earn the postage cost of a standard letter by country (Source: Deutsche Post 2014)

price rise on the overall household budget is likely to be small, it could be the case that the consumer could already be unable to afford other necessities such as food, heating and clothing, etc.

To examine the own-price elasticity of a product may give little indication of affordability as the consumer could stop purchasing the product because they cannot afford it or they could purchase it and forego other necessity goods. A price increase will engender affordability issues only to the extent that substitution is not possible. We propose that an appropriate measure of affordability should recognise that affordability could provoke either a reduction in demand of the own product due to the income elasticity of demand or a reduction in other necessity goods such as food or heating.[3]

[3]While we do not provide a detailed mathematical description, we would note that the original AIDS model framework is based on the notion of the expenditure function, the indirect utility function, and an assumption of invertibility between the expenditure and indirect utility function. As such, the original formulation of the AIDS model thus assumes optimality of the indirect utility function due to the consumer utility maximising behavioral assumption. Therefore, by the envelop theorem, the change in utility with respect to any change in price, gets multiplied by the change in

To examine affordability in the postal sector, we lay out three requisites for the analysis. We firstly have to define a disposable income/demographic class to focus specifically on as it makes no sense to consider affordability for the whole population or higher income deciles. Income must be defined net of tax and transfers and income and the low income group should have savings and net worth close to or near zero. In this way, price increases cannot be financed out of savings, and even where a low income individual does have savings to finance price increases, prices could still be unaffordable as their increase could lead to a depletion of savings.

Secondly, the availability of substitutes and products for substitutability must be low; if the consumer can merely substitute away from a good, then affordability must not be an issue. The USO somewhat rules out the availability of substitutes through price caps and geographically uniform pricing as similar postal products from commercial providers will likely either not be available or will be priced considerably above the USPs. Similarly, complements must not be high in that the greater the volume of other goods used in tandem with postal products, the greater will be the reliance on postal products and hence the cross-price elasticity will be high and negative. Complementary goods must also not be necessities or hold a large share of the household budget.

Third, a time period must be selected for the analysis. As Christmastime sees significantly higher volumes of mail than any other time of the year, it would be enticing to examine this period but it would not be representative of the annual average.

Our a priori thinking is that a price rise would be affordable if there is a high cross-price elasticity, indicating strong availability of substitutes. Low budget share and significant cross-price elasticity between substitutes and other goods would indicate that prices are affordable, while a high own-price elasticity and a low cross-price elasticity with substitutes would indicates that prices are unaffordable. Similarly, a low own-price elasticity, a low cross-price elasticity with substitutes, and a high price elasticity with other necessities would indicate that prices are unaffordable.

3 Empirical Methodology and Data

The estimation and measurement of affordability should ideally account for income class, and substitutes and complements. Such empirical needs and analysis point towards the desirability of estimating a demand system which includes postal products and potential substitute products.

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utility with respect to the own quantity, which is zero by the first order conditions. The price change thus only impacts through the expenditure impacts, which result in the expenditure share equations, which are the foundations of the AIDS and PC AIDS models. An interesting and potential further line of research might be to relax the maximizing assumption, and assume that not-affordable somehow was then a deviation from an optimal utility-expenditure point in the price-income-utility space of a consumer, but for now, this is beyond the scope of our work.

A conventional method to examine price elasticities and cross-price elasticities is to use a linear approximate almost ideal demand system (LA-AIDS) model. The AIDS model, developed by Deaton and Muellbauer (1980) is a system of equations approach to demand estimation. This approach is useful in the context of estimating a consistent set of own- and cross-price elasticities as it ensures that the full set of parameters will be consistent with certain restrictions implied by the neoclassical model of consumer demand, such as linear homogeneity in prices and income. Problems with econometric estimation of the AIDS or LA-AIDS models can become prohibitive, especially when there is a large number of products and product categories (which might suggest that insignificance or similar estimation problems are due to lack of data). If one were to try to implement or estimate an econometric model of demand that estimated the total number of parameters, data limitations and a lack of degrees of freedom would likely render the estimates insignificant.

An alternative option for estimation when cross-price elasticities and product demand elasticities are required is to use the proportionality calibrated almost ideal demand system (PCAIDS) model developed by Epstein and Rubinfeld (2001). The PCAIDS method was introduced as tool for postal pricing by Swinand and Hennessy (2014). The PCAIDS model uses an aggregate demand elasticity estimate, and then estimates a variety of other parameters needed to characterize the complete demand system of products using restrictions on the system implied by demand theory, and as the name indicates, a proportionality calibration method.

The PCAIDS model is a two-parameter model and thus the number of parameters to be estimated is greatly reduced vis-à-vis a full AIDS model or similar methods. The PCAIDS model requires estimates (as inputs) of the following parameters: own-price industry elasticity, own-price elasticity of one product in the market, nesting matrix (optional), markets shares for all products (or products and brands) in the industry. Epstein and Rubinfeld (2001, p. 11) describe the usefulness of their model:

> It requires information only on market shares, the industry price elasticity, and the price elasticity for one brand in the market. The logic of PCAIDS is simple. The share lost as a result of a price increase is allocated to the other firms in the relevant market in proportion to their respective shares.

By relying solely on data on market share and price elasticity estimates (available pre-merger in the antitrust application, or before a price change—in the case of postal regulatory applications), simulation models (and the PCAIDS model, specifically) are very useful for competition and regulatory authorities wishing to evaluate the possible effects of a proposed merger or a price change (Ivaldi and Verboven 2005). Other models may require the use of *ex post* change regulatory data to evaluate the market effects of a merger or policy change, which can be impractical (Neven and Zenger 2008).

The use of the PCAIDS model has taken hold among competition authorities. This is most likely because mergers and similar competition enforcement analysis might involve two companies with a large number of similar products—breakfast cereals for example. More specifically, the UK's Office of Fair Trading (OFT) uses the PCAIDS model, where appropriate, to evaluate mergers *ex ante* in differentiated

product industries, and a conservative estimate is used for any assumptions made in terms of consumer benefit (see Davies 2010). The OFT uses a set of assumptions and estimates when choosing which simulation model to use. As Jones and Stallibrass (2007, p. 6) stated:

> Given the data we usually have available, the economic models we have used are, in our opinion, the best academically supported method for mechanically deriving estimates of the impact of a merger decision for the purpose of impact estimation after a potential Substantial Lessening of Competition (SLC) has been made by the Office.

However, outside of the application of the PCAIDS model to the most recent pricing application from An Post, the Irish USP to their regulator ComReg, we are not aware of similar regulatory applications (see for example, ComReg 2013).

3.1 Assumptions Underpinning the PCAIDS Model

The PCAIDS model is an extension of the standard AIDS model. The assumptions of the AIDS model are also applied in the PCAIDS framework, with three additional assumptions. These additional constraints are adding-up, homogeneity, and proportionality. The adding-up constraint ensures that the right-hand sides' parameter estimates of the system of demand equations sum to the total market (or unity, in the case of market shares). Homogeneity ensures that demands do not change if all factors change proportionally (linear homogeneity of the demand system in prices is a constraint usually imposed in any demand system). The most important restriction for the PCAIDS model in terms of its potential impact on various elasticity estimates is the assumption of proportionality. Under proportionality, the PCAIDS model imposes the assumption that sales are diverted away from a product according to the relative market share of the suite of products in the defined market. So when a hypothetical *ceteris paribus* price rise occurs for one product in the system, a certain amount of total demand in the system is lost as overall demand shrinks, but another portion of that product's demand is shifted to other products in the system.

As the PCAIDS model is a variant of the standard AIDS model, it can be expressed as a system of equations as in (1). Given that a PCAIDS model does not include any AIDS expenditure terms, the share equations below refer to the share of the product whose elasticity is known and a share for all other products in the market. The market shares in this model can be the average of the revenue shares at the end of the sample period. In this case, there is no need for detailed monthly data, which might be used to obtain more degrees of freedom for econometric estimation. This is the main advantage of PCAIDS as it has much lower data requirements when compared with other demand models such as the standard AIDS model or a very data intensive model such as the random coefficients logit model.

$$\begin{aligned} S_1 &= a_1 + b_{11}\ln(p_1) + b_{12}\ln(p_2) + \ldots + b_{1,N-1}\ln(p_{N-1}) \\ S_{N-1} &= a_{N-1} + b_{N-1,1}\ln(p_1) + b_{N-1,2}\ln(p_2) + \ldots + b_{N-1,N-1}\ln(p_{N-1}) \end{aligned} \tag{1}$$

In (1), ln(p1) refers to the natural log of the price of Product 1. As part of the PCAIDS model, the price elasticity for this one product in the market must be estimated separately. In this equation, the coefficient on b11 must be converted into an elasticity using (2) below. By imposing the adding-up and homogeneity constraints, we are able to derive the various elasticities with reference to the estimated coefficients. These are shown in (2). The coefficient bjj refers to the coefficient on the price variable in the share equation that is estimated in the two-product LA-AIDS model.

$$\begin{aligned} \varepsilon_j &= b_{jj} + s_j\left(1+\varepsilon\right) \\ \varepsilon_{jk} &= \frac{b_{jk}}{s_j} + s_k\left(1+\varepsilon\right) \end{aligned} \tag{2}$$

The value in this approach is that once the own-price elasticity is estimated for any one product within the market, then this estimate can be used to estimate all other own-price elasticities in the market once the revenue shares are known for all products. These can be derived by applying the equations shown in (3) where $\varepsilon 1$ is the price elasticity of one product in the market and ε refers to the price elasticity of the overall market.

$$\begin{aligned} \varepsilon_j &= \frac{\left[\left(1-S_j\right)\varepsilon_1 + \left(S_j - S_1\right)\varepsilon\right]}{\left(1-S_1\right)} \\ \varepsilon_{jk} &= \frac{S_k\left(\varepsilon-\varepsilon_1\right)}{1-s_1} \end{aligned} \tag{3}$$

Our approach in this chapter is to use the PCAIDS model and budget shares for the lowest income decile to estimate elasticities for a two product system with Post and Food and Post and other telecommunications products, e.g., internet, mobile phone, landline phone.

PCAIDS is a two-parameter system calibrated on market shares. Parameters are group and product own-price elasticities. We use a two-product system to allow for differences across cross-price elasticities between food-post, post-other communications. We use an econometric estimate of own-price elasticity from HBS data for the group of products (−0.31 and −0.17, respectively). We use an own-price postal elasticity of −0.22 from previous work.[4] The application of the PCAIDS model also requires expenditure shares for each of these product groupings, and for these we use the expenditure shares from the lowest disposable income decile from the last two Household Budget Surveys (HBS) in Ireland.

[4] Swinand and Hennessy (2014).

3.2 Data

In order to estimate the impact of changes in postal prices on the demand for food and other communications items and necessities, we obtain data relating to Irish consumers from two sources: the Survey on Income and Living Conditions (SILC) and the Household Budget Survey (HBS). The data runs from 2003 to 2011. We use data on other macro variables including Consumer Price Indices for post, telecommunications products and food from the Central Statistics Office. We find that households allocate only a very small proportion of income to postal expenditure and marked changes have been observed in recent years in line with internet usage and email. These findings are similar to those of Borsenberger et al. (2012), Postcomm (2011) and Ofcom (2013). Summary statistics for expenditure shares by the first income decile are presented in the table below. While we do not present data for other income deciles, studying the expenditure on postal products by income decile indicate that postal products on the whole are inferior goods. This is especially true when we compare the bottom two income deciles with the middle income deciles. The highest two income deciles do indeed spend more on postal products and this may reflect their choice of higher quality postal products (Table 1).

We find also that a very small proportion of households do not have a fixed landline or mobile phone (table below). We take this as a preliminary indication of a lack of substitutability. It would perhaps be up to policy makers to define an acceptable level of complete lack of other means of communications outside of post. Interestingly, of those that do have a landline or mobile phone, some (0.38 %) indicated that they have had to forego at least one meal due to affordability issues. Of those that do not have a landline or mobile phone, 7.6 % reported that they skipped at least one meal in the last 2 weeks. This is as expected as the lowest income groups are likely to have affordability issues relating to many products (Table 2).

4 Results

The data covers the period 2003–2012 (December). Aggregate price indices, such as the monthly CPI and the monthly CPI for postal services were taken directly from the Central Statistics Office, Ireland (www.cso.ie) website. The results of a two product model where post and food[5] are the only products in the system are shown in the table below. Based on a calibration of cross-price elasticities from the own-price elasticity for post (−0.22), the PCAIDS model shows very small cross-price effects between

[5] There is of course the possibility that the change in postal prices indicates a change in the mix of an aggregate bundle of necessities, such as food; in other words, consumers could substitute from expensive food to cheaper food. Our methodology, in theory, could cope with this as one of the benefits of the PCAIDs method is that it can be broken down into further categories if the budget shares data are available. We do not have a detailed breakdown of cheap food and expensive food from the HBS, however.

Table 1 Summary statistics for expenditure shares by the first income decile

Variable	Obs	Mean	Std. Dev.	Min	Max
share_post	641	0.0017562	0.0077026	0	0.1114133
share_telecom	641	0.0454351	0.0382987	0	0.2721965
share_internet	641	0.0018046	0.0069037	0	0.0824042
share_food	641	0.2248974	0.1247878	0	0.714889
share_other	641	0.7261067	0.1324234	0.285111	0.9806525

Source: CSO Household Budget Survey, Ireland

Table 2 Share of individuals in the first income decile with communications devices who had food affordability issues in the last 2 weeks

Variable	Obs	Mean	Std Dev	Min	Max
d_mob = 1(have mobile)	51,156	0.018512	0.134795	0	1
d_mob_fix (have fixed)	26,328	0.003191	0.056396	0	1
d_hunger_1	1,103	0.076	0.4885376	0	1
hunger_and_mobile	84	0.00381	0.32998	0	1

Source: CSO EU-SILC, Ireland

Table 3 PCAIDS elasticity estimates for two-product system: post and food

% Δ Price of		
% Δ Quantity of	Post	Food
Post	–0.220[a]	–0.039
Food	–0.039	–0.259

Source: London Economics

[a]There is statistical significance of the original or own price elasticity which is derived from separate econometric estimates (See ComReg 2013). It should be noted that the statistical significance of the other resulting elasticities from the PCAIDS method is generally not given as the method is a calibrated calculation and not completely statistical per se

post and food at the lowest income decile. A 10 % increase in the price of postal products would only reduce food consumption by 0.39 %, all else equal. The own-price effect from a change in the price of food on the demand for food is considerably higher than the cross-price effect of a change in the price of postal products on the demand for food, and this is to be expected (Table 3).

A PCAIDS model where post and communications are the only two products in the system is presented below. As before, we based on the model on the own-price elasticity of post which is derived using an LA-AIDS model. Applying the appropriate market shares to the model indicates that communications products are weak substitutes for post. Thus, if the price of post goes up, then the demand for communication products also goes up, *ceteris paribus*. This is expected as individuals may switch to some other form of communication which is less costly (Table 4).

Table 4 PCAIDS elasticity estimates for two-product system: post and communications

% Δ Price of		
% Δ Quantity of	Post	Communications
Post	–0.220	0.050
Communications	0.050	–0.172

Source: London Economics

Overall, the results indicate that a 10 % price rise would only reduce food consumption by about 0.39 %, all else equal. It is somewhat tenuous to assess the significance and the results do not indicate a large substitution impact from post to other communications products. The impact of considering expenditure shares by income decile indicates a very small expenditure share on post and this suggests that post is unlikely to have a large interaction with food or other communications expenditures. This is also likely to be the case with other necessities such as heating and clothing.

The results imply that post is a very weak substitute with telecoms and internet, and is unlikely to have a large impact on purchases of other products such as food. However, it is important to consider that these impacts are likely to differ significantly by income group. With price increases for postal products expected in the future, it is important that these elasticity estimates are monitored. These elasticities should also be monitored at income decile level. It could be the case, irrespective of affordability issues, that at higher income levels, the cross-price effects are significantly higher.

5 Summary and Conclusions

In this chapter, we have examined the issue of affordability in the postal sector. While there is no consensus on what constitutes a price that is 'affordable,' previous studies have examined the issue by reference to household budget shares. While this is a start, we propose that a small budget share is not necessarily a guarantee of affordability.

We propose that affordability measurement should include a few principal elements. First, it should define and consider a lower income cohort (e.g., the lowest 10 %), and should consider the income and expenditure shares for that group. This can be based on survey evidence of what levels of necessities certain groups are foregoing or by using more formal definitions of 'at risk' for poverty. Second, affordability measurement and investigation should consider the substitutability of other products for postal products, along with interactions with necessity goods such as food. Further, it may be appropriate to examine the cross-price effect with a basket of necessities, including expenditures on heating, clothing and energy in addition to food.

In line with previous studies, we find that households allocate only a very small proportion of their budget to postal products. Based on the PCAIDS models including post, food, and other communications, and data from the HBS in Ireland,

cross-price elasticities with other communications products is found to be very small, suggesting that mobile phones and internet usage have had low substitutability with postal products. We also find that the cross elasticities with necessities such as food are low; a significant (10 %) increase in postal prices would only reduce food demand by about 1 %, all else equal.

Thus our conclusions are somewhat weak in terms of affordability, as the indications from our PCAIDS-based model using Irish HBS data are that the postal products have low budget share, low substitutability, and low impacts on necessity products. Further, the PCAIDS model is somewhat limited in terms of its strong assumptions which allow insights to be made from sparse data.

Additional research is thus warranted that might include better data and more detailed econometric modelling of the interaction effects between postal products and substitute and necessity goods. It would be interesting to apply our framework to other countries and examine the cross price effects between postal products and necessities as well as other communications products. It could be the case that for some countries the effect is more substantial. For example, as discussed above, Deutsche Post (2014) found that in Bulgaria, it took 10.93 work minutes to earn the postage cost of a standard letter, whereas in Ireland, it took only 1.5 min.

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Welfare Impact of Changes in the Scope of the USO

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1 Introduction

Estimating the cost of the Universal Service Obligation (USO) is becoming increasingly important in the regulation of the postal business. At least 13 Member States have calculated or are calculating the net cost of USO (Frontier Economics 2013). Out of the six countries reporting that the net cost of the USO was an unfair burden (CZ, EE, ES, IT, LT, NO), in four of them (ES, IT, PL, NO) public funding was used to finance the net cost (WIK 2013). When funded with revenues from the industry, one can argue that postal users are paying for the costs of the USO. When funded externally, the taxpayer is foregoing the provision of other public services.

Recently, several public studies have provided estimates of users' willingness to pay (WTP) for features of postal services. Whilst these studies are tailored for specific countries, they are helpful to compare customers' valuations of postal services with the scope of the USO. By comparing estimates of WTP with estimates of the net cost of the USO, the policy maker can get a sense of the relevance of the imposition of a USO. For instance, the comparison of the WTP for a given delivery frequency (say 6 instead of 5 day delivery) with its incremental costs provides the policy maker with insights on whether Saturday delivery increases welfare. These comparisons also show how the change in the USO scope can be funded. For instance, if the WTP for the change in delivery frequency is above the incremental

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costs, customers in principle are willing to pay an extra amount which covers the incremental cost of the Saturday delivery. The extent to which the WTP can be used to cover the cost depends on the ability of the postal operator to charge for that USO characteristic. For example, an operator may not be able to set different prices due to an obligation to charge uniform prices. A dedicated price for Saturday delivery may therefore not be possible and charging a higher uniform price may not be consistent with the willingness to pay for weekday deliveries. A WTP above costs therefore does not necessarily imply an ability to recover the costs from customers. If the WTP is below the incremental costs, the change in the USO scope would necessarily require funding outside the postal industry.

We are aware of one paper comparing users' WTP for changes in the scope of the USO with the incremental net cost of such change. This study, undertaken for Norway (Lindhjem and Pedersen 2012), estimates the impact on welfare of three options for the provision of the postal service. The authors find that only if the delivery frequency is reduced to 3 days from 6 and delivery speed is reduced for prioritized mail in some regions, will there be a welfare gain from reduced service.[1]

The aim of our paper is to contribute to this line of analysis. We compare public estimates of the WTP with estimates of the net cost of marginal changes in the USO scope, namely changes in delivery frequency and delivery location, discuss the policy implications and identify the market characteristics where a consideration of the USO scope is more urgent. Section 2 reviews the literature on the rationale for the introduction of the USO in the postal industry and estimates of the WTP. Section 3 presents the results of our comparison of the net USO costs (NUC)[2] against the WTP and the implications from the policy perspective. Finally, Sect. 4 concludes.

2 The Rationale for the USO and Public Estimates on the WTP

Jaag and Trinkner (2011) find that the postal network acts as an "enabler", linking economic parties like buyers and sellers. For instance, after closing a deal, contracts must be signed and sent, invoices from billing statements have to reach their

[1] It may look somehow inconsistent that the authors find that removing Saturday delivery would reduce welfare but reducing delivery to 3 days a week would increase welfare. However if the cost savings of moving to 3 days delivery are much bigger than the cost savings of removing Saturday delivery (the authors find that they are around 3 times larger), this could actually be the case. In addition, one could expect that the benefit from Saturday delivery is different from that of other weekdays for senders (weekend promotions, targeted marketing, etc.) and receivers (physical presence on delivery).

[2] We use two ways to present the net USO costs. When presenting the results of our scenario we're using the common measure of the net USO cost relative to the total cost. When comparing against the WTP, we're converting to a unit cost per mail item.

recipients via post, and parcels that carry ordered goods distributed via the postal network. Second, although the digital age has introduced electronic substitution in the case of a technology failure, traditional post acts as physical back-up. Third, the USO is said to have a positive economic impact on rural regions, including social cohesion. While not explicitly mentioned in the paper, one can add the welfare of the communication itself, which in addition to generating private benefits also provides benefit for the wider economy.

2.1 Estimates of the WTP in Postal

There are several studies estimating the WTP for the USO in the postal sector. These studies are usually based on stated preferences methods. These methods derive customer preferences from surveys. In these surveys, consumers are either directly asked how much they would pay/would be willing to receive for the service improvement/deterioration (contingent valuation methods) or they are presented with mixes of options to always choose the most preferred one (stated choice methodology).

The reports by RAND Europe (2011), Copenhagen Economics (2010) and Accent (2008) use the stated choice methodology. The questionnaire used by Lindhjem and Pedersen (2012) included explicit questions about the amount the respondents would pay either to improve the service or to maintain its current level. The RAND Europe (2011) study covered Sweden, Poland and Italy for business and residential users. They report valuations for many USO dimensions, including time of delivery, delivery location and uniform pricing for letter items and parcels. The results from the RAND Europe surveys are shown in Table 1 below.

For mail delivered at home, a typical SME would need to be compensated with 29 euro cents per letter mail if mail is delivered to post boxes within 100 m of addresses, and with 41 cents if mail is delivered 1 km away. Valuation for households varies among countries. Thus, whilst results for Swedish customers are not significant if the mail is delivered away from their home, Poland and Italy will require a compensation which can be as high as almost 1 euro per mail item (RAND Europe 2011). To obtain the total value of respective WTPs, the figures in the tables need to be multiplied by the total volume of letters.

Copenhagen Economics (2010) undertook a study for households in Austria and for businesses of several European countries, looking at delivery frequency. The results are shown in Table 2 above.

The interpretation of the results is as in the previous examples. Households are willing to pay 17 cents above the price of the mail item to get the mail delivered 5 days a week instead of 3. However, results were not significant for 6 days delivery as opposed to 5. Business users were willing to pay a 29 % price premium for mail delivered 5 days a week instead of 3 (11 % for 6 days instead of 5).

Accent (2008) undertakes a similar analysis for the UK. Questions are framed with respect to a situation in which there is “no minimum USO standard”. Table 3 above shows the results for delivery frequency.

Table 1 Reduction in WTP per letter item for delivery location – with respect to home delivery (figures in € PPS) for letter items

	SME[a]	BB[b]	Sweden (HH)	Poland (HH)	Italy (HH)
Delivered to mail box 100 m from addressee	−0.29	−0.59	0[c]	−0.52	−0.7
Delivered to mail box 1,000 m from addressee	−0.41	−0.61	0[c]	−0.86	−0.96

Source: RAND Europe (2011)
[a]Small and medium enterprises for Sweden, Poland and Italy combined
[b]Large enterprises for Sweden, Poland and Italy combined
[c]0 indicates that the results are not significantly different from zero at the 95 % confidence level

Table 2 WTP per letter for delivery frequency for household and business users

	Households	Business users (% price in crease)[a]
5 delivered days per week instead of 3	€0.17	29
6 delivered days per week instead of 5	Not significant	11

Source: Copenhagen Economics (2010)
[a]Since the WTP for business is performed in several different countries with different price structures all prices are expressed as changes in percent

Table 3 WTP per letter for delivery frequency for household and business users in the UK (figures in £pence)

	Households	Business users
6 days per week	16	12
5 days per week	11	12
3 days per week	−3	−7

Source: Accent (2008)
Note: Figures are approximated by the authors of this paper from the charts provided in the Accent report

The results show a high valuation of either business customers or households for 6 and 5 days per week delivery. Results also indicate that having a 3 day delivery standard is valued more negatively than having no standard (i.e. if the standard specified is low, for example 3 day a week delivery or collection, customers do not value having it in the USO or in other words, it is better to have no standard specified than one which is perceived to be inadequate). We deduce that business users are indifferent between 6 and 5 days delivery standard but households are willing to pay 5 pence per item to get Saturday deliveries.

While the WTP estimates are not always consistent between countries, they provide a useful range for the WTP for different features of the USO that we report in the following table and that we will use as the reference for the comparison with the NUC (Table 4).

Table 4 Summary table of WTP estimates from several studies

	€/ letter mail item	% of price
Post box delivery within 100 m of home	0.29–0.7 (Table 1[a])	
Post box delivery within 1,000 m of home	0.41–0.96 (Table 1[b])	
Delivery frequency from 6 to 5 days	0 (Table 2)/0.06 (Table 3)	11 (see Table 2)
Delivery frequency from 5 to 3 days	0.17 (see Tables 2 and 3)	29 (see Table 2)

Source: Several sources
[a]The result for Sweden is 0 but we used the range in the table as they represent the average for the three countries of the study
[b]idem

3 Estimating the NUC and Comparison with the WTP

Our analysis compares the WTP estimates outlined above with the estimates of the net cost of the USO for changes in the delivery frequency and delivery location, as well as for different "environmental" scenarios such as the share in rural and urban areas; the number of mail items per capita; and population density. The results from this analysis can help determine if a characteristic of the USO enhances welfare. For example, when the reduction in WTP is above the NUC, a USO characteristic (delivery frequency, delivery to the home) would not increase welfare when considering private benefits alone. It may also provide an indication of the sustainability of the service and appropriate methodology for financing the service. However, we note again that the comparison between the WTP and cost of the USO as a basis for considering the sustainability of the USO characteristic using industry revenues has its limits. This is because an average WTP as considered in this analysis implies that some customers with WTP below that average would not be willing to purchase the service at the price required for sustaining the service if the NUC equal the WTP. The analysis is therefore first and foremost a way to consider if a certain characteristic is welfare-enhancing and secondly an indicator of the potential need for public financing of the USO.

3.1 Approach for Estimating the Net Cost of the USO

We use a bottom-up model that simulates the delivery function of a postal operator by estimating the capital and staff costs required to deliver a set amount of mail items to a set number of addresses that are distributed over a given area, assuming different morphologies (e.g. urban and rural based on population densities). This approach is based on the model used in Carslake et al. (2014) and is similar to the operational model in Roy (1999), which simulates how delivery costs vary with volume, delivery point density and grouping index, for example, apartment blocks.

The model estimates the cost of the delivery function in a series of five steps:

1. The daily volumes of mail per household determine the likelihood (call rate) of a delivery taking place at an individual address. The likelihood increases with

daily volumes, e.g. as a result of a lower delivery frequency or increased mail volumes.
2. The volume of mail per address and mix of mail items (packets and letters) determines the time it takes on average to deliver mail to an address.
3. The average call rate and average delivery time determine the total time delivery staff require for delivering the daily amount of mail (taking account of other factors, such as density and delivery modes).
4. The amount of time available for outdoor delivery then determines the number of routes past all delivery points.
5. The model focuses on the delivery function. The net USO cost relative to the total costs was calculated by assuming that the delivery function in the base case represents 30 % of the total cost of the postal operator. The assumption is based on operator cost data and we test the impact of changing it in Sect. 3.3.3.

3.2 Modeled Scenarios

The model estimates the cost of the USP using a set of base assumption and varying a set of parameters (one at a time) to estimate the impact on the NUC. The base case assumes a size of the country at 160,000 km^2 with 22 m inhabitants, of whom 30 % live in rural areas, and receive 200 items per capita per year. These assumptions are broadly based European averages. We consider four USO reduction scenarios:

1. The delivery frequency is reduced from 6 to 5 days in rural and urban areas.
2. The delivery frequency in rural areas is reduced to 3 days per week while the urban delivery frequency remains at 5.
3. The number of delivery points is reduced by delivering to post boxes within 100 m of homes and offices.
4. The number of delivery points is further reduced by delivering to post boxes within 1,000 m of homes and offices.

For each scenario, we estimate the NUC for different assumptions of the share of the population living in rural areas (3–60 %), the number of mail items per capita (50–350) and the population density (40–250 inhabitants/km^2). These sensitivities reflect the variation of these characteristics in European countries.

We find that reducing the delivery frequency from 6 to 5 days results in a NUC of approximately 3.9 %. In other words, the increase in profits as a result of reduced costs from delivering 5 instead of 6 days in all areas of the country represents approximately 3.9 % of the total cost of delivering 6 days a week. This result does not change significantly for changes in the share of the rural population. The NUC decreases from approximately 4.5 to 3.5 % for an increase in the number of mail items per capita per year from 50 to 350. A similar result is obtained for increasing the population density from 40 to 250 inhabitants/km^2.

The relationship between changes in the number of mail items and population density with the NUC, when assuming 3 instead of 5 delivery days in rural areas, are

similar to those in the previous scenario. The key difference is observed for the variation of the share of population in rural areas. The NUC increases from approximately 4 to 13 % for increasing share of rural population.

A delivery to post boxes instead of homes reduces NUC between 23 and 12 % for post boxes within 100 m and between 26 and 28 % for post boxes within 1,000 m of home addresses for an increasing share of the population in rural areas from 3 to 60 %.[3] The change in the number of mail items per capita (50–350) results in a similar impact on the NUC for the 100 and 1,000 m post box scenarios; the net cost decreases from 20 to 19 % and 28 to 26 % respectively. An increase in population density however has a different impact. For 100 m between post box and USO delivery points, the NUC is upward sloping from 12 to 22 % when the population density increases from 40 to 250 inhabitants/km^2. This is the result of greater savings to be made when moving delivery to post boxes as more USO delivery points (and their corresponding mail) fall with a 100 m radius of the post box. This is not outweighed by the fact that the increase of mail at the post box imposes slightly higher costs at the final drop. This does not hold for the 1,000 m radius. The relative increase in the number of delivery points within the postbox radius does not outweigh the increase in costs from the increased volume delivered at the post box. The NUC decreases slightly from 28 to 27 %.

3.3 Comparison with the WTP

3.3.1 Changes in the Delivery Frequency

The following charts compare the NUC from reducing the delivery frequency from 6 to 5 days with the WTP, for the sensitivities discussed earlier. We assume that urban and rural customers have the same WTP.[4] The WTP is significantly above the NUC almost in all scenarios, with the exception of low levels of postal items and very low population densities. With mail items lower than 100 per capita per year or population density below 40 inhabitants/km^2, the NUC would be above the WTP (Fig. 1).

[3] The different directions of the impact are the result of two effects. As the share of the population in rural areas increases, the number of delivery points in the counterfactual required to cover this area increases. For 100 m, the number of delivery points is reduced by 97 % in the case of 3 % rural population while it is only reduced by 82 % when 60 % of the population lives in rural areas. For 1,000 m the difference in the decrease of delivery points when the share of the rural population increases from 3 to 60 % is only 0.15 % points (i.e. 99.97 and 99.82 % respectively). This implies that the 1,000 m counterfactual scenario does not face significant extra costs for covering the increased rural area that would counterbalance the saving from moving to that scenario in more rural countries.

[4] Under uniform pricing, a postal operator may not be able to fully recover the cost of the change in the USO scope due to some customers with WTP below the average not being willing to pay the average WTP. Recoverability therefore depends on the difference between WTP and net USO costs (a large difference suggests that costs can be recovered through charging less than the WTP) or the ability of the postal operator to price discriminate.

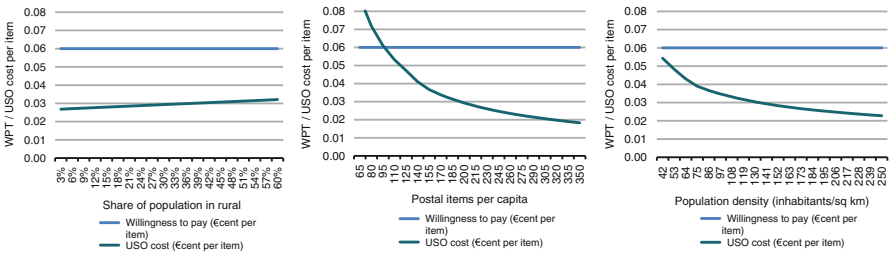

Fig. 1 NUC and WTP delivery frequency reduction from 6 to 5 days

Table 5 Population density and items per capita in countries where the net cost of the USO is financed via public funds (2011)

	Items per capita	Population density (inhab/sq km)
Spain	88	92
Italy	81	202
Poland	34	119
Norway	459	13

Source: Eurostat, UPU and IPC

These results suggest that if the WTP is valued at the levels reported, a greater USO scope increases net welfare. The scope may also be *sustainable* using industry revenues alone when the difference between WTP and NUC is large (e.g. for large number of items per capita), the postal operator is able to price differentiate to reflect the distribution of the WTP, or the PO can separately charge for the incremental increase in service. However, when the number of items per capita is below a certain threshold (in our modeling below roughly 100 items per capita), the external benefits of postal services (e.g. territorial cohesion, physical back up of electronic communications, support for the development of businesses in specific country areas, etc.) would need to be around €2–3 cents per item (c. 50 % of sender WTP) for the sixth day delivery to be welfare-enhancing. In other words, the external benefits would need to be significant in comparison with the WTP for delivery on Saturdays to increase consumer welfare. In any case, Saturday delivery would not be funded internally in countries with very few items per capita (and very low population density). Interestingly, the countries reporting that the net cost of the USO is an unfair burden and where it is financed with public funds (ES, IT, PL, NO) have either few items per capita or low population density, as (Table 5) above reports.

A second delivery frequency scenario provides a small variation in that different delivery frequencies apply in rural and urban areas. The scenario uses the WTP for 6–5 and 5–3 days as outlined earlier relative to the share of postal items delivered to urban and rural areas.[5] As illustrated in Fig. 2, this particularly affects the WTP and

[5] The WTP for an increase from 3 to 6 days is calculated as the sum of the WTP of 3 to 5 days and 5 to 6 days.

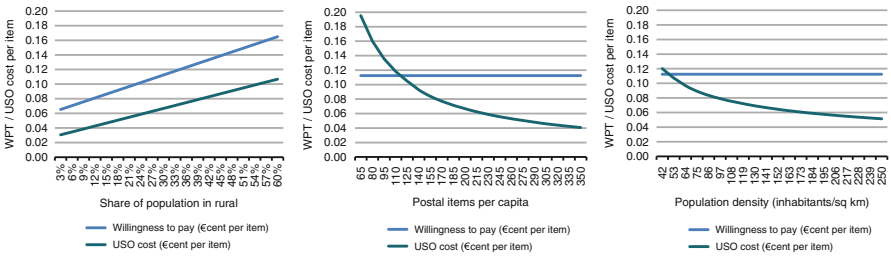

Fig. 2 NUC and WTP for reductions in the delivery frequency from 6 to 5 in urban and 6 to 3 in rural areas

NUC in relation to the share of the population in rural areas. Both increase with the share of population in rural areas increasing but do not reach a point where the net cost per unit exceeds the WTP.

This sensitivity is consistent with the previous scenario, showing that there remains a potential for the cost of the USO exceeding the WTP for countries with very low postal volumes.

3.3.2 Changes in the Delivery Location

The next figure reports the results of the NUC from changing the delivery location to 100 m and 1,000 m away from homes. The WTP valuation (which for delivery location is higher than for delivery frequency[6]) is above the NUC, with the exception of cases when the number of items per capita and population density is low (Fig. 3).

3.3.3 Further Variations to the Estimation of the Cost of the USO

Two variations to the calculation of the net cost of the USO can be considered.

Share of Delivery Costs Our base case assumes that the cost of sorting at the delivery office and outdoor delivery represents 30 % of the total costs. In 2004, NERA reported a range of 33–77 % of the cost of a postal operator referring as delivery costs. As one would expect, assuming that delivery costs constitute a greater share of overall costs results in widening of the gap between the NUC and the WTP when the former is greater, and reduces or eliminates the net benefit when WTP exceeded NUC in the previous examples. The general observations outlined above therefore also remain broadly valid for higher shares of delivery costs.

[6] We note that in the following charts we have selected the lower bound of the WTP for delivery location. WTP estimates for this USO feature can be as high as 0.7€/item for delivery at home with respect to delivery at 100 m and 0.9€/item to avoid delivery at 1,000 m. With these alternative estimates, the WTP would be above the NUC.

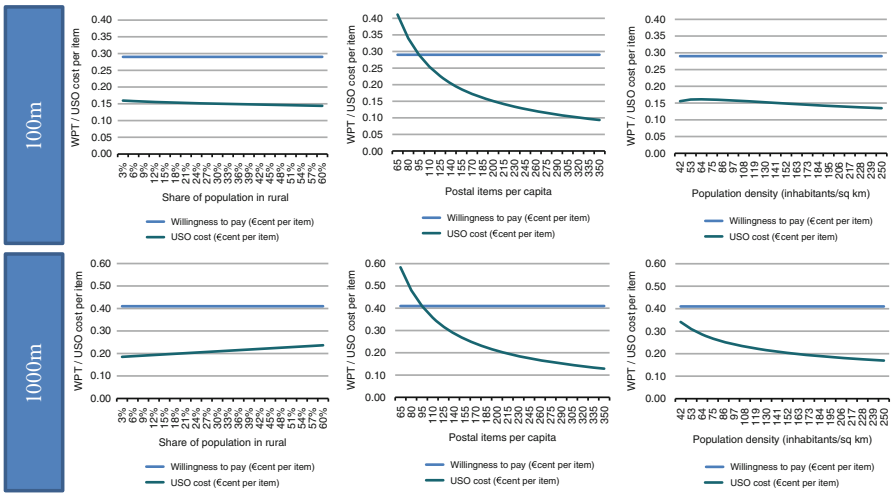

Fig. 3 NUC and WTP estimates for delivery to postboxes within 100 m/1,000 m of homes

Impact of Operational Changes on Demand Some mail may no longer be sent once the scope of the postal service is reduced, resulting in a decrease of postal volumes. On one hand, this decrease results in a reduction of variable costs, on the other hand, revenues are reduced. We assess the impact on the NUC in comparison to the WTP when the postal volume is reduced by 10 % in the counterfactual. As one would expect, the gap between the unit WTP and NUC when the former is greater widens. The existence of a demand response to a change in the scope of the postal service leads to a reduction in the net cost of the USO. This is a result of the existence of fixed costs in delivery, implying that the reduction in revenue outweighs the reduction in costs.

3.4 Further Considerations in Light of the Findings

Our results suggest that there may be two types of countries. In low item per capita/low population density countries, the WTP may be below the net cost of incremental improvements in the USO. The public policy decision is therefore between financing those components of USO with public funds and changing its scope. This policy decision will depend on both the value of externalities in postal and in other sectors, as the public funds used in the postal sector will no longer be attributable to other sectors or uses.

For countries where the WTP is above the NUC and there is a need of USO funding, a question for policy makers and regulators is whether prices should increase further if the net cost of the USO is significant. There may be different reasons why this may not be feasible:

1. **Regulatory constraints**. The Third Postal Directive states that the price of universal postal services must be affordable; cost-oriented and provide incentives for

an efficient universal service provision. They must also be transparent and non-discriminatory. Some of these rules may prevent prices to align with the WTP.
2. **Market competition.** The ability to price discriminate is more difficult with competition as prices will tend towards marginal costs.
3. **Bargaining power of purchasers.** A substantial amount of the revenues of the USP come from few customers, which are also the customers for which competition is fiercest. This gives these customers substantial bargaining power and makes it more difficult for the USP to extract revenues.
4. **Electronic substitution.** Regulators and postal provider may fear that price increases accelerate electronic substitution. In fact, there are studies linking electronic substitution to prices (Veruete-McKay et al. 2011). Thus whilst electronic substitution is to some extent an exogenous trend, these studies show that it increases with prices. However, the WTP is supposed to take into account substitutes (i.e. the WTP estimates should be "net" of the electronic substitution effect).
5. **Lack of information.** Regulators/operators may not have WTP estimates available, or if they have they reckon that the margin of error may be significant. For instance, literature suggests that the ratio of hypothetical-to-real WTP valuation is approximately 1.35 (Murphy et al. 2005) but there are scholars that reported that the ratio could be as high as 3 (List and Gallet 2001).
6. **Loss of external effects.** Regulators may be concerned that if the prices of postal products increase significantly, there will be significant reduction in demand. This may exacerbate the financing problems of the USP and reduce the external beneficial effects of postal services.

If the USP is to be funded internally it is key that the regulator ensures that the price regulation is optimized so that whilst complying with the Postal regulation does not prevent the USP from setting prices which reflect users' WTP. In our view the above analysis suggests that the following areas should be considered by policy makers and regulators:

1. Whether the constraints imposed by e-substitution and competition are sufficient to allow ex-ante regulations to be abolished.
2. The meaning of affordability. If 'cross-funding' between customers is more difficult (high volume customers are more exposed to competition and e-substitution), ensuring the financing of USO may imply higher price increases for less price sensitive customers.
3. The limits of the non-discrimination rule. This implies that the price differences between products and services may not be related to costs and, if marginal costs are low, this could lead to significant price differences.

4 Conclusions

The increased availability of WTP estimates shows that there is a demand side to be considered in the regulation of the USO. The reduction in letter mail volumes and revenues is making the financing of the USO a higher priority. Understanding if the

scope of the USO is increasing welfare is important for considering the scope of the service. Our modeling suggests that this is more urgent in countries with a low level of items per capita and low population density. In addition, the comparison of WTP and NUC indicate that some differentiation of prices may be justified for preserving and efficiently financing the USO scope. Thus, the analysis of the USO cannot be solved without accurately estimating the WTP and the NUC and a careful review of when regulation will be necessary so that the prices of postal services can reflect demand and costs.

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Potential Gains and Losses of (Partial) Lifting of Home Delivery Obligations

Laurian Choain, Frédéric Fustier, and Lionel Janin

1 Introduction

The article investigates the effects on the postal service provider, and its customers, of a (partial) lifting of home delivery obligations included in the universal service, using a bottom-up model of the delivery process. It revisits the calculation of the net cost of home delivery obligations by Trinkner et al. (2013) with a model calibrated for France.

Net cost calculations of the universal service obligations (USO) have remained for the past decade a hypothetical exercise given the limited competition on this market segment and the resulting lack of incentive for universal service providers (USP) to ask for compensation. With of volume declines (−5.5 % for the French universal service provider in France in 2013[1]), USPs are now more motivated to identify means to enable them to preserve sufficient margins and manage costs reduction. Partial lifting of some obligations is increasingly considered by USPs as a way to ensure that postal operations are sustainable.

Delivery is the postal process that represents the largest part of costs, with significant economies of scale and scope and a large geographical heterogeneity.

[1] Annual results – 2013 Le Groupe La Poste, Investor Presentation, 20 February 2014, p. 13.

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The views represented are solely those of the authors and not necessarily those of ARCEP or France Stratégie.

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Delivery is subject to several constraints stemming from the universal service obligations, including: (i) on frequency, requiring that the USP carry out a minimum number of deliveries per week (five in the postal directive, six in the French law), (ii) on coverage, requiring that the USP provide delivery services nationwide to every home.[2] Amendments to those constraints have been considered recently in several countries (plan to change the place of delivery in Canada, reduction of frequency of delivery in New Zealand and in the Netherlands).

To assess the impact of modifications on the frequency and coverage of the delivery, the calculation of the net cost of delivery obligations for the USP (conversely equal to the net savings allowed by the lifting of such obligations) is necessary. Trinkner et al. (2013) have produced an analysis of the net cost of three types of delivery constraints: on the frequency, on the geographical coverage and on the place of delivery.[3] They conclude that "while the effect of reducing delivery days on profits is stronger for low volumes and in rural areas, adapting delivery places is always effective". This article revisits the results on potential cost savings from Trinkner et al. (2013), with a different model (developed by ARCEP and based on initial work with TERA Consultants) providing additional details (mean of transport, types of postal item) and calibrated on France characteristics. It investigates the maximum loss of demand until which changes in delivery obligations remain profitable for the USP with the chosen calibration.

Section 2 describes the bottom-up model and its calibration, Sect. 3 presents the main results of the model, Sect. 4 presents the equation used to assess delivery net costs, and Sect. 5 assesses the impact of home delivery obligations on costs and margins and compares them with those from Trinkner et al. (2013).

2 The Model

The results presented in this article come from a bottom-up model that simulates the delivery process and gives an estimation of the delivery costs. It is based on preliminary work carried out by ARCEP and TERA. The approach and modeling of delivery costs developed by Roy (1999) served as a starting point to the model, which splits the delivery process into five main sub-processes: (i) non-revenue travel, (ii) active route, (iii) stopping, (iv) dropping, and (v) relay boxes.

Only direct costs (labor and transportation) are modeled. Parameters are set as to recover the current general characteristics of delivery in France in the reference

[2] There is also a constraint, not mentioned in the Directive, on the speed of delivery implying in most countries a D+1 service. As the D+1 obligation constrains the frequency of delivery, an amendment of the frequency constraint would necessarily require a change of the D+1 obligation. In the article, speed of delivery is not directly taken into account.

[3] Trinkner et al. note that the "*USP could adapt the place of delivery of households that are particularly costly to serve. In this case, households would continue to be served while the mail would be delivered to delivery points that exhibit lower cost such as road-crossings or PO boxes.*"

scenario (direct costs, number of routes, number of delivery offices). The results remain preliminary and may depend on further calibration of the parameters. Four kinds of data and parameters are used as regards the demand, the geography, the technology, and the unit costs. All those parameters are flexible.

Recipients The model can accommodate different types of mail recipients (individuals, small businesses, and large companies). Volumes can be split into a chosen number of formats. The current version of the model uses four formats based on the observed format mix in France: small letters, large envelopes, packets and registered mails. Each of them is characterized by its specific size (average weight), its specific point of delivery (letter box at a given address) and a demand level specific to each type of recipient. In the reference scenario, the model is calibrated at an average volume of 1.74 items per receiver per day, which corresponds to the current demand level in France.

Geography The model uses a geographical database that divides the French territory into 88,000 zones. These zones are split between housing areas (around 40 % of the zones), industrial areas (around 20 %) and isolated housing (around 40 %). They can be consolidated into larger areas that correspond to geographical units (e.g. city). Each of these zones is characterized by an average distance between addresses, a distribution of the grouping indexes in the area (number of delivery points at each address) and a radius (used to determine the average non-revenue travel distance). For each address, the database also provides information regarding the type of receiver(s) and the specific length to access an address from the main road (for rural areas).

Technology The model relies on a unit time for dropping, depending on the format of the item. Various technologies (transportation modes) can be used for the delivery, each of them having specific speed (that can vary according to the type of area), access duration (shorter when delivery is taking place by foot, longer when parking a vehicle is required) and capacity constraint. The current version of the model uses four transportation modes; two non-motor-driven (foot and bicycle) and two motor-driven (motorcycle and car). Relay boxes are taken into account in the model when the volume to be delivered exceeds capacity and organizational constraints are considered (round maximum duration, maximum non-revenue travel, and the fixed cost of establishing a delivery office).

The model generates the direct costs of the delivery process. It uses an hourly labor cost and an average cost per kilometer for each transportation mode. For each zone, the model determines the optimal delivery mode that minimizes the costs under the constraints of both a maximum non-revenue time and a minimum number of rounds per delivery office. If the traffic in one zone does not prove to be high enough to cover the fixed cost of a delivery office, it is aggregated with those of adjacent zones.

The model allows examining the impact of all these parameters on delivery characteristics. For the purpose of this article, it has been calibrated on France characteristics and concentrates on the impact of delivery coverage and frequency modifications on traffic level and delivery costs, *ceteris paribus*.

3 Outputs of the Model

Direct costs (labor and transportation) of the delivery process depend on the number of item to be delivered (see Sect. 2). In Fig. 1, delivery costs are plotted against traffic. The reference point (100, 100) corresponds to the current average number of postal items delivered in France (1.74) per recipient per day with a specific format mix.[4] Traffic and delivery costs are displayed on a base of 100.

Figure 1 highlights the economies of scale in the delivery process. The model, calibrated on France characteristics, allows identifying that fixed costs in the neighborhood of the reference point amount to roughly 60 % of the total costs. The decrease of the unit cost characterizes the significant economies of scale with traffic variation: a doubling of the traffic from the reference level would lead to a decrease of nearly 40 % of the unit costs. Conversely, a loss in volume increases cost significantly: a decrease of 50 % of the traffic would increase unit delivery cost by 50 %.

Table 1 illustrates the economies of scope in the delivery process. Small letters and large envelopes represent the majority of traffic and cost. They could be delivered on stand-alone basis without many changes to the overall economy of the delivery process. Packets and registered items greatly benefit from shared delivery: delivered on a stand-alone basis, the unit cost of parcels and registered items would be 637 % of the current average unit cost. When delivered with letters and envelopes, the incremental cost of parcels and registered items is only 158 % of the current average cost.

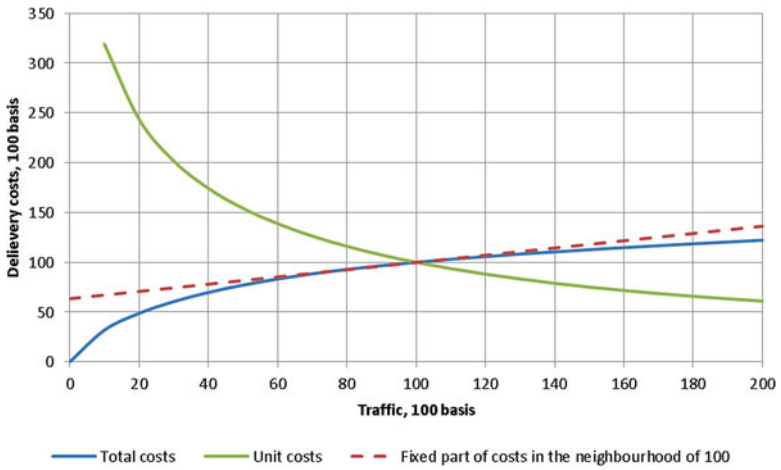

Fig. 1 Total and average delivery costs as a function of traffic

[4] The format mix is kept stable when the traffic varies and does not change over time as the article concentrates on the impact of traffic variation other things being equal (see Sect. 2).

Table 1 Stand-alone and incremental costs

Delivery process	Traffic	Costs	Unit costs
Stand-alone small letter and envelopes	97	96	99
Stand-alone packets and registered items	3	16	637
Incremental packets and registered items	3	4	158

Current situation = 100

4 The Net Cost Equation

A net cost calculation, defined as the difference between avoided costs and lost revenues of the operator resulting from a change in the delivery frequency or coverage, is appropriate to measure the impact of a change in the delivery obligations. For such a change to be profitable, the loss in revenues (proportional to the traffic loss in this model) must be smaller than the costs savings. A wealth of economic literature tackling the issue of the cost of the USO develops theoretical arguments favoring the net cost methodology (Crew and Kleindorfer 1998; NERA 1998; Cremer et al. 2000; Panzar 2000).

In principle, a net cost calculation would require to determine avoided costs and lost revenues. Costs are estimated with the bottom-up model for the delivery process and with a linear calibrated function for other processes. In order to carry out a proper net cost evaluation, information on the demand reaction in France to a change in the frequency or the coverage would also be required. As this information is not available, the article focuses on a second best estimation in line with Trinkner et al. (2013) methodology. In this view, the assessment of the impact of a change in delivery obligations involves determining the break-even point defined by the maximum variation of traffic beyond which a change in the delivery obligations is not profitable anymore. Other things being equal, a large break-even point implies in this context a higher probability for a change in delivery obligations to be profitable.

Assuming that, in the current situation, π is the profit, R the revenues – which are the product of the average price (p) and the traffic (q), and TC the total costs – which are split between the cost of delivery (C), the variable cost of the other processes (VC) and the fixed cost of the other processes than delivery (F), the profit of the operator is given by

$$\pi = R - TC \tag{1}$$

$$\pi = p.q - C - VC.q - F \tag{2}$$

Keeping the average price constant, a change of delivery constraints would induce on the one hand a change in delivery costs and on the other hand a change in traffic resulting from the demand reaction. Let C_0 be the cost of delivery in the initial situation and C_1 be the cost of delivery in the counterfactual scenario, where delivery

conditions have changed. The avoided delivery cost from this change in delivery conditions is given by $\Delta C = C_1 - C_0$. The change in profit is therefore given by

$$\Delta\pi = \left(p - VC\right).\Delta q - \Delta C \tag{3}$$

Dividing this equation by the total cost in the reference scenario (TC_0), that is equal to the average cost (AC_0) multiplied by the traffic (q_0) the change in profit is given by

$$\frac{\Delta\pi}{TC_0} = \frac{\left(p - VC\right)}{AC_0} \cdot \frac{\Delta q}{q_0} - \frac{\Delta C}{TC_0} \tag{4}$$

$$\frac{\Delta\pi}{TC_0} = \frac{\left(p - VC\right)}{AC_0} \cdot \frac{\Delta q}{q_0} - \frac{\Delta C}{C_0}\frac{C_0}{TC_0} \tag{5}$$

M, defined as the margin rate over average cost for processes other than delivery, and $\frac{C_0}{TC_0}$, defined as the weight of delivery costs in total costs, are constant. The values of those parameters have been determined from the current situation of the French USP. Assuming that $\dot{q} = \frac{q_1 - q_0}{q_0}$ is the relative change in total volume (loss of demand), the lifting of home delivery obligations is profitable as long as $\Delta\pi \geq 0$, that is

$$M\left|\dot{q}\right| \leq \left|\dot{C}\right|\frac{C_0}{TC_0} \tag{6}$$

For numerical application, $\dot{C}$ is evaluated through the delivery bottom-up model; *M* and $\frac{C_0}{TC_0}$ are recovered from accounting data of the postal service provider under examination. Define

$$\alpha = \frac{C_0}{M \cdot TC_0}$$

Hence the following formula for the profitability constraint on the relative loss in demand:

$$\left|\dot{q}\right| \leq \alpha \left|\dot{C}\right| \tag{7}$$

From accounting data from the USP, in the case of France, $\alpha \approx 0.4$. Therefore, for a change in delivery obligations to increase profits, the relative change in volumes should not be lower than 40 % of the relative avoided delivery costs: $\left|\dot{q}\right| \leq 0.4\left|\dot{C}\right|$

The change in delivery cost $\dot{C}$ is a function of $\dot{q}$. The variation in delivery cost can be decomposed in two terms: the first one is the avoided cost due to the change

in delivery conditions (change in the place of delivery or in the number of delivery days per week), keeping total volume constant; the second one is the effect of the change in total volume (reaction of demand).

$$\dot{C} = \frac{\Delta C}{C_0} = \frac{C_1(q_1) - C_0}{C_0} = \frac{C_1(q_0) - C_0}{C_0} + \frac{C_1(q_1) - C_1(q_0)}{C_0} \tag{8}$$

In order to find the critical value of $\dot{q}$ in Eq. 7, a first order expansion of $\dot{C}$ can be used. Define γ as the elasticity of delivery cost with respect to volume

$$\gamma = \frac{\partial \log C}{\partial \log q} = \frac{\frac{\Delta C}{C}}{\frac{\Delta q}{q}}$$

and β as ratio of the delivery cost in the counterfactual scenario to the delivery cost in the current situation, keeping total volume constant

$$\beta = \frac{C_1(q_0)}{C_0(q_0)}$$

Equation 8 can then be written as

$$\dot{C} = \beta - 1 + \beta\gamma\dot{q}$$

The critical value $\dot{q}$ in Eq. 7 is a solution of

$$\dot{q} = \alpha\left(\beta - 1 + \beta\gamma\dot{q}\right)$$

which leads to

$$\dot{q} = \frac{\alpha(\beta - 1)}{1 - \alpha\beta\gamma} \tag{9}$$

5 Principal Results

This section investigates the impact of frequency and coverage delivery obligations on the USP. It assesses the maximum loss of volumes for which a change in frequency or coverage remains profitable for the operator. To assess the avoided costs resulting from a change in frequency, it is assumed that only the delivery of small items and envelopes are affected by the reduction of frequency. As the model

Table 2 Delivery avoided costs with reduction of frequency and traffic variation

	Maximum loss from 6 day delivery	Delivery days	
		5	3
Weekly traffic	***100***[a]	–4 %	–15 %
	80	–4 %	–14 %
	50	–4 %	–13 %

[a]100 = current traffic

is calibrated on France characteristics, the reference level is six delivery days per week. Reduction to five and three delivery days is tested in Table 2.

The reduction of the number of delivery days allows for an increase in the volume per delivery point (mail boxes) and, therefore, for more economies of scale. For instance, a reduction from 6 to 3 days of delivery would increase the volume per delivery point by 100 %. From the bottom-up model presented in Sect. 2, a reduction from six to five or three delivery days would lead to substantial avoided costs (respectively up to 10 and 38 %, keeping total volume constant). Based on the Eq. 9 above, reducing the number of delivery days per week from 6 to 5 (respectively to 3) would be profitable for the operator as long as the associated demand loss stands below 4 % (respectively 15 %). The impact of the level of reference traffic has been tested. As shown by Table 2, those results are not significantly altered by the level of traffic in the reference scenario.

These numbers are slightly smaller (in absolute term) than those from Trinkner et al. (2013), who calculated that, in a zone defined by a population density of 500 inhabitants per square kilometer, the break-even volume decline amounts to 7 % (respectively 20 %) when reducing the number of delivery days from 6 to 5 days (respectively 3 days). In a zone defined by a population density of 50 inhabitants per square kilometer, Trinkner et al. also estimates the break-even volume decline at 13 % (respectively 40 %). By way of comparison, the French density raises to 117 inhabitants per square kilometer.

Regarding delivery coverage, potential net gains from alteration of the delivery coverage depend on the costs of the zones affected. The model provides the distribution of unit costs for each zone. Figure 2 shows the distribution of the unit costs per zone weighted by traffic (the area below the unit costs curve therefore is equal to the total cost). The inflection of this distribution curve can be explained by the transportation mode selected as optimal in each zone. For instance, the slope of the unit cost curve rises when the optimal transportation mode gradually switches from pedestrian to bicycle.

This figure suggests that unit costs in dense areas (where the optimal transportation mode is non-motor-driven) can be as far as 70 % lower than the average unit cost (dotted line). The gap between the average unit cost and the unit costs in rural areas (where the optimal transportation mode is motor-driven) can be much more significant (two to three times more costly than the average cost). Extremely high unit costs are restricted to a very limited fraction of zones corresponding to very sparsely populated areas, representing less than 1 % of total population.

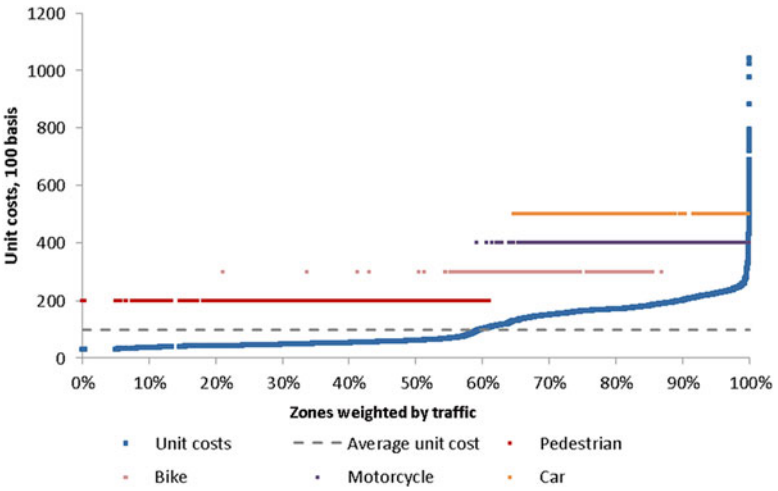

Fig. 2 Distribution of delivery direct unit costs per zone weighted by traffic

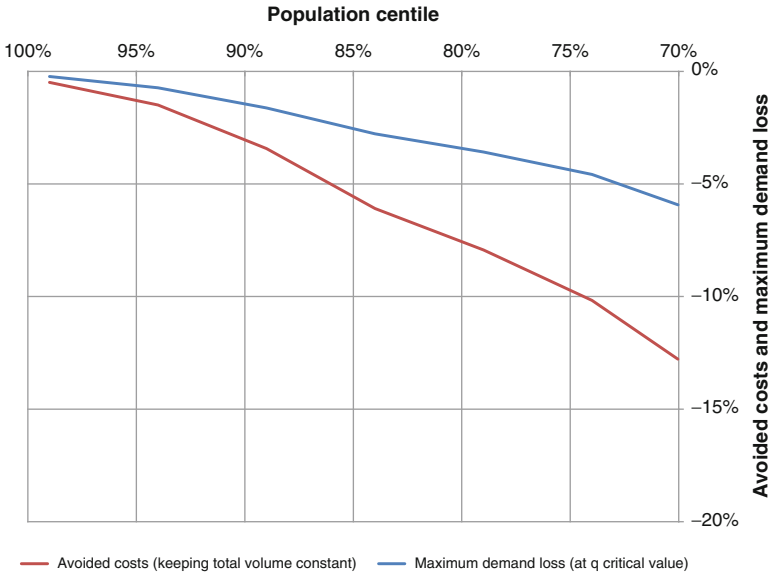

Fig. 3 Avoided costs and maximum demand loss by traffic centile

Figure 3 presents the avoided costs generated by a reduction of the delivery coverage in costliest areas. It is based on a simplified approach to assess the impact of a reduction of the delivery coverage; the reduction of coverage is characterized by a decrease of the delivery cost of the zone under consideration. The cost of delivery is assumed to be equal to the cheapest cost of delivery of the area. Only rural areas are tested (the 30 % last centiles in Fig. 2).

In Fig. 3, avoided costs and net gains generated by the reduction of coverage do not appear significant when compared to the share of the traffic (hence the population) affected. Changing delivery place for 5 % of the consumers would allow saving less than 2 % of costs and would require losing less than 1 % of the demand to be profitable (see Sect. 4). Likewise, changing delivery place for 30 % of the consumers would allow saving less than 13 % of delivery costs and would require losing less than 5 % of the demand to be profitable. The limited amount of avoided costs can be explained by the fact that costs are saved locally (a reduction of the coverage affects only the costs of the zones under consideration). On the contrary, the loss of demand is global (both senders and receivers can be affected by a reduction of the coverage). In this view, a change in the place of delivery can be profitable with only minor demand losses.

These results suggest that, with the chosen calibration, potential net gains provided by the modification of universal service delivery constraints are not always substantial. A reduction of the number of delivery days can have a positive financial impact for the universal service provider but it requires a limited loss of demand. A change of coverage does not appear to be the best option in this model, especially as more qualitative arguments speak rather in favor of a change of frequency; this would indeed affect uniformly all receivers when the reduction of coverage would discriminate only a few of them. A reduction of coverage would also increase the distance between the customers and their mail boxes, which would lead to a time loss that could be valued as an economic loss for these customers.[5]

6 Conclusion

This paper investigates the potential gains and losses of changes in the delivery frequency and coverage for a USP. These gains and losses are assessed based on a net cost equation that results both from a bottom-up model of the delivery process and parameters regarding the margin rate on average cost for other processes than delivery and the weight of delivery costs in total costs. With a calibration on French characteristics, potential gains from changing delivery obligations for the USP appear profitable subject to smaller loss of demand compared with the results from Trinkner et al. (2013). This is especially true for the coverage of delivery which therefore does not appear to be the most relevant option for the USP.

Further work needs to be carried out to test and complete these preliminary results. First, the net cost evaluation, i.e. the potential gains and losses for the operator, could be improved in several ways. Regarding the delivery bottom-up model, different characteristics shall be implemented to test the sensitivity of the results to

[5] "France Stratégie", the former French Policy Planning Commission (CGSP), in its report "L'évaluation socio-économique en période de transition" associates different values with travel time depending on the transportation mode.

the calibration. To improve the assessment of the net cost of the delivery obligations, a full bottom-up model of all postal processes could also be considered as a relevant tool to assess the net cost of delivery obligations, instead of a calibrated equation such as the one used in Sect. 4.

Second, the results obtained on demand could be combined with data from consumer surveys. The purpose of this article involves determining the maximum loss of demand until which a change in delivery obligations is profitable to the USP. It would appear relevant for future work to compare this theoretical maximum loss of demand with stated loss of demand resulting from consumer surveys.

Third, the static assessment of potential gains and losses for the USP does not necessarily result in an exhaustive net cost evaluation which should also include other aspects such as transition costs. In fact, if the net cost appears to be the right tool to compare the characteristics of two situations, it does not allow encompassing specific transition issues. Changes such as a reduction of the frequency or the coverage of delivery would require for the USP to adapt its organization. In this view, it appears highly hypothetical that changes in delivery obligations would instantly materialize into gains, especially since a reduction in frequency or coverage would affect in the first place the lost revenues rather than the avoided costs. Transition costs, and the issue of the time horizon at which changes in frequency or coverage would actually have an impact on the USP accounts, remain crucial issues to investigate.

Finally, if this paper investigates the potential gains and losses of changes in delivery obligations for a USP, it does not address the issue of its impact on global welfare. Further work would require examining the impact of the delivery frequency and coverage on consumer welfare. A reduction of coverage would for instance increase the distance between the customers and their mail boxes; the resulting time loss could be valued as an economic loss. More generally, a welfare assessment of delivery obligations requires looking at the externalities of the delivery frequency and coverage.

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Estimating the Financial Impact of Discontinuing Saturday Delivery of Letters and Flats in the U.S.

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1 Introduction and Overview

In 2013, the U.S. Postal Service (USPS) announced plans to discontinue the delivery of letters and flats on Saturdays, while continuing parcels delivery ("plan 5+"). This would lead to sharply reduced street times on Saturdays, and to a shift of workload from Saturdays to other weekdays, in particular Mondays. Understanding the net effects of modified delivery schedules and reduced delivery frequency concerns an increasing number of postal operators worldwide. This contribution may hence shed some light on the issue of optimizing delivery frequency as a response to declining letter volumes.

To estimate the effect of plan 5+ on delivery cost, USPS' largest component of total cost, the adapted street times and increases of overtime hours are calculated based on the bottom-up delivery model from Trinkner et al. (2012) and Haller et al. (2014) for a subsample of 16,000 USPS routes. To assess the net impact of plan 5+ on profits, we first find the amount of reduced demand that would have to occur in response to the change in service to offset the direct cost savings. Sensitivity of yearly profits is estimated under alternative demand assumptions. The paper ends with a discussion about whether the findings constitute net costs of the USO.

The paper is structured as follows. Section 2 presents the methodology and defines the details of the modified delivery schedules that are analyzed. Section 3

This paper is derived from a study conducted by Swiss Economics for the Postal Regulatory Commission. www.prc.gov. The views expressed in this paper are those of the authors and do not necessarily represent the opinions of the U.S. Postal Regulatory Commission.

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contains the bottom-up delivery model, its calibration to USPS city routes, and the induced net effects on street, office and overtime hours. Section 4 summarizes the analysis of the financial effects of plan 5+ on the USPS and contrasts the findings with USPS' estimates. Section 5 discusses whether the computed savings constitute USO net costs. Section 6 concludes and presents possible further applications.

2 Methodology and Plan 5+ Scenarios

2.1 Analysis of Direct and Indirect Effects

The net effects of a modified delivery schedule on yearly USPS profits π compute as $\Delta\pi = \pi^1 - \pi^2 = (R^1 - C^{fa1}) - (R^0 - C^0)$. Rearranging and extending for processes i and products j yields:

$$\Delta\pi = \underbrace{\sum_{i=1}^{I} C^{i,0}\left(x^{j..J,0}\right) - C^{i,1}\left(x^{j..J,1}\right)}_{\substack{\text{per process i,}\\ \text{avoided cost (C0>C1)}\\ \text{or incremental cost (C0<C1)}}} - \underbrace{\sum_{j=1}^{J} R\left(x^{j,0}\right) - R\left(x^{j,1}\right)}_{\substack{\text{per process j,}\\ \text{forgone revenue (R0>R1) or}\\ \text{additional revenue (R0<R1)}}} \quad (1)$$

Effects on the cost side are computed per process; whereas, net revenue effects are calculated per product category (Jaag et al. 2011). Calculating $\Delta\pi$ requires knowledge on the costs per process $C^{i\ldots I,1}(x^{j..J})$ and the demand effects $x^{j..J,0}$-$x^{j..J,1}$ per product. From (1) it follows that the demand functions are not only relevant to compute the net effect on revenues, but also for assessing the net effects on process costs.

The effect on process costs can be decomposed into a direct and an indirect component. The direct effect is the change of the cost function assuming no demand response (unchanged quantities) and computes as $\sum_{i=1}^{I}(C^{i,0}(x^{j..J,0}) - C^{i,1}(x^{j..J,0}))$. The indirect effect is the effect of the demand response within the new cost function, formally $\sum_{i=1}^{I}(C^{i,1}(x^{j..J,0}) - C^{i,1}(x^{j..J,1}))$.

To compute the indirect effect, cost elasticities or variable costs of all affected products need to be determined. In the analysis, attributable costs as reported by the USPS are used as a proxy for variable costs.

Little is known about the likely magnitude of how plan 5+ would impact demand, so boundaries for induced demand effects under which the delivery schedules are still profitable are calculated, formally, $\min(x^{j..J,0})$ s.t. $\Delta\pi = 0$. If the results suggest volume losses that can be considered as unrealistically high, then plan 5+ very likely increases USPS's profit. In addition, Eq. 1 will be evaluated for selected demand scenarios $x^{j..J,1}$ that are based on quantitative analysis made publicly available by the USPS in its 2010 filing of "plan 5" (Docket No. N2010-1), eliminating Saturday parcel delivery as well.[1] Because plan 5+ preserves service levels for parcels, the demand effect on parcels is excluded.

[1] USPS press release No. 13–019 from February 06, 2013.

2.2 Plan 5+ Scenarios

The operational details of plan 5+ were not made public by USPS. To reflect the impact of potential details about how its implementation, two possible scenarios of plan 5+ are analyzed. "Plan 5+ high" adopts the changes in sortation and transportation that were projected by the USPS for plan 5. (Details are available in Docket No. N2010-1 materials.) In contrast, "plan 5+ low" is much closer to the status quo, implying lower savings.

For collection, plan 5+ low assumes that Saturday retrieval of mail from collection boxes would continue, while plan 5+ high assumes it would not. Both scenarios assume retail post offices would not be affected. Similarly, plan 5+ low assumes the status quo sorting of outgoing mail and transportation of collection mail to sorting facilities on Saturdays continues, whereas for plan 5+ high these processes are eliminated.

The most substantial operational change is in delivery, where both plan 5+ scenarios assume that home delivery of letters and flats is discontinued and the former Saturday volumes are delivered on Mondays and Fridays. This shift of workload (with Monday volumes being about twice the weekly average) may have implications for delivery productivity and may also lead to increased overtime. For plan 5, USPS assumed that volumes moving to Monday delivery will be delivered at the current Monday delivery productivity (which is higher than delivery productivity on Saturdays). Plan 5+ high adopts the plan 5 productivity assumption, and assumes that potential overtime increases can be fully mitigated by management. In contrast, plan 5+ low assumes that the variable costs of delivery are not affected, and that the potential increased overtime cannot be avoided.

As noted above, little is known about the likely impact of these changes on demand, but it is likely that the more substantial operational changes of plan 5+ high may have a greater effect on service and in turn, on demand. The scenarios reflect this reasoning by adopting the demand impact of plan 5 for plan 5+ high, and assuming a smaller demand impact for plan 5+ low.

3 Bottom-Up Delivery Model

3.1 Load, Access and Route Time

Delivery carriers typically spend the first hours of the day in the office to prepare the mail for the route ("office time"). Once finished, the carrier leaves the office and delivers the mail along the route. The time spent leaving the route to access a recipient mailbox is referred to as "access time." "Load time" is the time required to insert the mail into the mailbox. The time on the route itself is referred to as "route time" (Cohen and Chu 1997). Route and access times constitute a significant cost driver for postal services. The sum of the three components is referred to as "street time" by the USPS. For city carriers, street time accounts for more than

75 % of overall delivery time.[2] While load time is essentially variable with respect to the number of mail items delivered, access and route times are quasi-fixed costs. For a given delivery point, access time is variable with the first mail item, after which it is fixed. For a given (independent) route section, route time is variable with the first mail item for that section; thereafter, it is fixed up to the most remote delivery point receiving mail.

In this framework, plan 5+ thus means: (1) on Saturdays, route times are fundamentally different and much more variable, as the probability that a given household gets a (parcel) delivery is reduced sharply (leading to different routes every Saturday); (2) from Monday to Friday, the probability that a household is served is increased slightly. In countries with high volumes per capita such as the U.S., route times can be considered as effectively constant, and access times as mostly constant (Haller et al. 2014), which could be confirmed in Trinkner and Haller (2014).[3] It is therefore assumed that route and access time remain constant from Monday to Friday.

3.2 A Bottom-Up Model

The assessment of the first (Saturday) effect requires a model to predict the changes to route and access times. Such a prediction can be obtained from an application of the model presented by Trinkner et al. (2012) and Haller et al. (2014). The model computes bottom-up route and access times for different delivery schedules, and allows letter and parcel volumes to be taken explicitly into account. In the model, the location of the delivery center is fixed, but the number of delivery days and/or the percentage and location of delivery points to be served can be varied. To determine the route costs as a function of the distribution of the households around the delivery center, the delivery process is treated as a routing problem (minimizing the total route time to deliver all the mail to the served delivery points) and solved by numerical methods (hereafter referred to as "shortest path").

To keep the model tractable, it is assumed that the mail deliverer can move freely in the area, i.e., it is abstracted from spatial obstacles and roads. This approach does not deliver route costs directly. Instead, it computes linear distances that can serve as proxies for the real route costs. The model therefore requires calibration to determine effective route times and/or distances. Calibration can take place either by actual (measured) route times or actual distances, or both. In Haller et al. (2014), the model could on average explain 95.36 % of Swiss Post's route times per delivery region, with high values independent of the specific delivery areas. Once calibrated, the model allows

[2] Own calculations based on the USPS DOIS data provided.

[3] The assumption of fixed routes on regular delivery days was validated for 230 randomly chosen USPS routes.

comparisons of delivery costs across various delivery plans (e.g. plan 5+) or Universal Service Obligations (USO) definitions and letter volumes.

3.3 Data

The model is computationally intensive. With 224,000 routes in the U.S., it is time-consuming to apply the model to all routes. To get an accurate estimate, a representative sample of 20,000 city routes was chosen as a starting point. The calibration is based on the following data:

(1) Data from the USPS' Address Management System (AMS) for a randomly selected sample of 19,958 city carrier routes, containing for each delivery point coordinates and additional information such as delivery type (e.g., curb line) and USPS sequence number. ArcGIS software was used to identify the coordinates of each address. Prior to the simulations, the data was validated and classified. In total, 16,572 routes could be selected for further use.
(2) Data from the USPS' Delivery Operations Information System (DOIS), containing office and street times as well as volume data for 141,436 city carrier routes for every delivery day of FY 2012. In addition, DOIS information for the type of delivery and base mileage for each route was available. In FY 2012, there were 303 delivery days.

From the selected 16,572 AMS routes, 16,274 could be identified in DOIS data. 77 observations with negative values in either hours or volume variables were excluded. With 303 delivery days in FY2012, a sample with 4.9 million observations was used for the calibration exercise. Calibration per delivery type is only partially possible because from the 16,274 routes from AMS and DOIS data, there are 2,251 routes for which it was not possible to recover information on the delivery type.

3.4 Simulation of Street Time

For the 16,274 sample routes, route and access times are simulated with an algorithm computing the shortest path, resulting in the proxy "shortest path." In 7 % of all routes, the standard algorithm failed to converge in a reasonable time horizon and a greedy algorithm was used instead.[4] To validate these results, a second proxy for the length of the routes was constructed by summing the linear distances between the delivery points along the original USPS sequence provided in the AMS data. This proxy is referred to as the "sequence path."

[4] The "greedy" algorithm moves from one point to the nearest unvisited neighbor.

Table 1 Performance of proxies

Proxy β_0	N	Coefficient β_0	t-Value	Adj. R2 (%)
Benchmark: constant	4.9 M	5.567	3,492.95	6
Linear distance shortest path	4.9 M	**0.00014**	**981.45**	**87**
Linear distance sequence path USPS	4.9 M	0.00000592	265.84	85
Base mileage USPS	3.9 M	0.1288	937.74	87
Linear distance shortest path with dummies	4.9 M	0.00009	682	91.5
Linear distance foot routes	0.2 M	0.00012	161	82
Linear distance park and loop routes	2.1 M	0.00019	806	89
Linear distance dismount routes	0.7 M	0.00013	370	88
Linear distance curb routes	1.1 M	0.00012	629	91
Linear distance other routes	0.02 M	0.00028	81	79

3.5 Calibration of Street Time

The calibration exercises for route and access times are performed with and without distinguishing different delivery types (e.g., curb or foot). In the base calibration, actual street times have been regressed as follows:[5]

$$actual\ street\ hours = \beta_0 distance\ proxy + \beta_1 letters + \beta_2 flats + \beta_3 parcels$$

First, three distance proxies have been tested in the base calibration and compared to a benchmark with a constant as a proxy: (1) Shortest path, (2) sequence path, and (3) "base mileage", measuring actual miles per route as reported by the USPS (from DOIS data set). Table 1 (upper part) provides an overview of the results. In terms of quality of fit, the model with the proxies "base mileage" and "shortest path" perform equally well, and both do better than the "sequence path" proxy. This implies that the simulated distances perform equally well in explaining street hours as actually measuring the effective miles per route. The simulation model is therefore "as good as it can get." Moreover, the shortest path algorithm has two advantages: it is available for all routes (not the case for base mileage), and it is possible to simulate alternative volume and delivery point scenarios, which is of particular value for this study.

Second, the calibration is performed differentiating the delivery methods, i.e., running the regression of actual street times on simulated shortest paths, observed volumes, and the type of delivery. The results are reported in Table 1 (lower half). The delivery type was included as a dummy in the above global regression, followed by a separate regression for every delivery type subsample. The errors made with the global approach without dummies seem not to be excessively large. Comparing the two global regressions with and without dummies, R^2 is reduced to

[5] Regressions were run with log(.) and quadratic specifications. These were not superior to this simple linear model.

a minor extent in the benchmark regression without dummies, but the "shortest path" coefficient is more consistent with the individual coefficients by delivery type. Moreover, the global approach without dummies implies a calibration of load times that is independent of the delivery method. Compared to the individual regressions by delivery type, the global approach allows using the entire sample. For these reasons, the subsequent calculations are based on the global calibration without delivery dummies.

3.6 Calibration of Office Time

To estimate the effect of volumes on office time, it is assumed that only cased items cause office time and that all such costs are variable. Therefore, the following model is estimated:

$$office\,time = \beta_1 casedletters + \beta_2 casedflats + \beta_3 parcels$$

The regression results for the sample of 4.9 M observations are again highly significant and lead to coefficients $\beta_1 = 0.035$, $\beta_2 = 0.025$ and $\beta_3 = 0.084$, all being consistent with expectations—parcels cause more office time than letters and flats. Based on the calibrated model, time and cost differentials on Saturdays, Mondays and Fridays for city carriers[6] can be computed for route and access time, load time, and office time. Taking the three together, the impact on overtime hours can be calculated.

3.7 New Saturday Routes

Saturday parcel-only delivery routes are simulated in the calibrated model for all Saturdays of FY2012.[7] It is assumed that a delivery point is served on a Saturday if it receives at least one parcel. To determine the parcel distribution across delivery points, the actual parcel volumes on a given Saturday are randomly assigned to the addresses of a route.[8] That is, if there were n parcels on a given Saturday, then n addresses of a route are randomly drawn (with delivery points with multiple addresses being more likely to receive a parcel on a given Saturday). The delivery points served are then the points which have at least one address receiving a parcel.[9]

[6] In contrast to city carriers, rural carriers are paid by the item delivered. As a consequence, savings in route and access times translate into USPS savings for city routes only and hence the calculations focus on city routes.

[7] There are 53 Saturdays in FY 2012.

[8] This is as accurate as possible as we do not have any information on address level volumes.

[9] A delivery point can have several addresses.

Table 2 Effects of plan 5+ on street time cost on Saturdays

	Route and access time	Load time
Status quo hours (sample)	1,750,150	3,314,941[a]
Plan 5+ hours (sample)	521,837	194,885
Avoided costs (all city carriers, USD)	**634,466,665**	
Incremental costs compared to plan 5 (all city carriers, USD)	**269,546,784**	

[a]DOIS does not differentiate access and load times. The reported load time here is an estimate from the calibrated model.

This is done for every Saturday in FY2012, assuming no further reorganization of routes, resulting in the new proxy *shortest path_SAT*.

Applying the regression coefficients from the calibration of street and office time, the new street and office hours on Saturdays can be computed as

$$street\ hours = \underbrace{0.00014 * shortest\ path\_SAT}_{route\ and\ access\ time} + \underbrace{0.014 * parcels}_{load\ time}$$

$$office\ hours = 0.0084 * parcels$$

As introduced above, we are primarily interested in changes on route and access times to estimate avoided costs of plan 5+. The net saving is the difference in route and access times multiplied by the average piggy-backed hourly rate of USD 59.42,[10] which accounts for the hourly costs of city carriers including labor and vehicle use.

All other costs shift to other days. Assuming constant productivity along labor days as in plan 5+ low, the shifts are relevant if these cause increased or decreased overtime work. Therefore, total street hours and office hours per route are calculated to estimate the effects on overtime costs. The results are provided in Table 3 further below. The focus on overtime hours implies that the existing full time equivalents (FTE) per route can be reduced proportionally to the new work load.

The resulting avoided cost relative to the status quo (reduced route and access time, reduced overtime) and incremental cost relative to plan 5 from discontinued Saturday delivery of letters and flats is shown in Table 2. The financial effects of route and access time changes on all city carriers are obtained from scaling up the time estimates with the piggy-backed hourly rate and a scale factor of 8.69. The scale factor inflates our sample of 16,274 routes to represent the 141,469 total city routes in the system. Compared to the status quo, route and access times are USD 634 million lower under plan 5+. Compared to plan 5, the corresponding incremental cost is USD 270 million.[11]

[10] See USPS-LR-FY12-44 for productive hourly wage rate and USPS-LR-FY12-24 for piggyback factors.

[11] 521 k additional hours for parcels delivery times 59.42 times 8.69.

Table 3 Financial effect of additional overtime hours

[USD]	Additional overtime hours	Cost effect in plan 5+ high [USD]	Cost effect in plan 5+ low [USD]
Friday (25 % of letters and flats from saturday)	6,870,268	0	95,634,131
Saturday (no letters and flats)	−1,983,070	0	−27,604,328
Monday (75 % of letters and flats from saturday)	22,289,669	0	310,272,196
Total	**27,176,868**	**0**	**378,301,999**

3.8 Overtime

For the effects on overtime, actual USPS working hours for every day and route are known from the DOIS data. The new working hours on Fridays, Saturdays, and Mondays are calculated as the actual working hours in FY2012 plus/minus the additional/reduced working hours from the changes in street time and volume shifts. Overtime is then defined as total working hours minus 8 h.

Assuming Saturday street times of Table 2 and that the routes on Friday and Monday are not redesigned due to the additional volumes, the additional hours on Friday and Monday can be calculated as follows:

$$\Delta streethours_{Friday} = 0.0018*0.25*letters_{Saturday} + 0.0015*0.25*flats_{Saturday}$$

$$\Delta streethours_{Monday} = 0.0018*0.75*letters_{Saturday} + 0.0015*0.75*flats_{Saturday}$$

As DOIS provides data on every delivery day, the volume shifts are done for every Saturday in FY 2012 for each route. Thus, the entire FY 2012 volume shifts are simulated under the new delivery regime.

The same is done for the office hours by using the coefficients of the office hours regression, i.e.,

$$\Delta officehours_{Fr} = 0.003*0.25*casedletters_{Saturday} + 0.0025*0.25*casedflats_{Saturday}$$

$$\Delta officehours_{Mo} = 0.003*0.75*casedletters_{Saturday} + 0.0025*0.75*casedflats_{Saturday}$$

The upper bound of the additional overtime hours is shown in Table 3 by applying constant productivity per piece, independent of the weekday, as it is assumed in plan 5+ low. An assumed hourly surcharge of USD 13.92 results in incremental overtime costs of USD 378 million. In plan 5+ high, it is assumed that overtime can be managed by flexible workforce and hence no overtime costs occur.

4 Financial Impact Analysis

The above findings are now incorporated into an estimation of the annual overall financial effect on USPS. First, the direct effects are summarized. These are then complemented with the indirect effects caused by consumers' response, leading to lower volumes.

4.1 Direct Effects of Plan 5+ in Delivery

Based on the bottom-up model, the following estimates on direct effects on USPS' operational delivery cost for city carriers emerge. As revealed in Table 2 above, the direct savings are USD 634 million before overtime effects, assuming that the cost for load times for letters and flats are shifted from Saturdays to other weekdays with no change in productivity. If the plan 5 assumption of higher productivity on Mondays is applied, the savings are USD 892 million. The figure is the plan 5 savings of 1,162 (which already includes assumed USPS productivity savings of shifted load time) less the incremental cost of route and access time for standalone parcel delivery on Saturdays of 270 million (from Table 2 above). The more conservative estimate of USD 634 million is taken for plan 5+ low, and the higher value of USD 892 million for plan 5+ high incorporates USPS assumption of higher productivity on Mondays.

In terms of overtime, the street time calculations for Friday, Saturday and Monday for FY 2012 translate into an upper bound of incremental overtime costs of USD 378 million. The recent American Postal Workers Union contract allows greater use of workers with more flexible work schedules. This may allow USPS to handle peak loads with fewer overtime hours. If all overtime hours were managed this way, zero additional paid overtime hours could occur. As the scenario plan 5+ high aims at providing an upper bound in terms of saving, it is assumed that additional overtime hours can be fully managed with this flexible work force (resulting in zero additional costs). In contrast, in plan 5+ low, it is assumed that additional overtime hours are required of the carrier in place, i.e., a surcharge on the daily rate is incurred and causes an additional cost of USD 378 million.

For rural carriers, no such savings or incremental costs relative to plan 5 are assumed, as rural carriers are paid by the number of various workload elements (e.g., pieces, miles, and delivery points) each route requires. For incremental express delivery costs, plan 5 estimates are adopted. For administrative "indirect" carrier costs, the approach used by USPS for plan 5 is applied, leading to an estimated additional savings of USD 265 million (plan 5+ high) and USD 238 million (plan 5+ low). In total, the estimated direct savings of plan 5+ in delivery range between USD 0.9 and 1.7 billion. Table 4 provides an overview and compares with plan 5.

Table 4 Financial effects of plan 5+ compared to plan 5

M USD	Plan 5	Plan 5+ high	Plan 5+ low
Direct effects (direct avoided cost)	**2,276**	**1,966**	**912**
Savings collection/sorting/transport	290	290	–
Savings delivery	1,987	1,677	912
City carrier direct street time	1,162	892	634
City carrier direct in-office costs	102	102	–
City carrier adjustment for cost of overtime hours	–	–	(378)
Rural carriers all and city carrier Saturday express	418	418	418
Indirect cost for city and rural carriers	305	265	238
Indirect effects for FY2012 (lost contribution)	**(571)**	**(573)**	**(287)**
Average volume response	–2.22 %	–2.20 %	–1.10 %
Foregone revenue*	(1,234)*	(1,169)	(585)
Avoided cost*	663*	596	298
Total savings	**1,705**	**1,393**	**625**

*Adapted to FY2012 figures

4.2 Direct Effects of Plan 5+ on Other Processes

For processes other than delivery (collection, sorting, and transportation), it is assumed that in the plan 5+ high scenario, the same operational changes are made as in plan 5 (because the plan 5 processing architecture is compatible with plan 5+). The PRC estimated these savings at about USD 290 million.[12] In plan 5+ low, it is assumed that Saturday dispatch continues as in the status quo; therefore, no adaptations take place in these processes compared to the status quo, and there are no savings. However, continuing the dispatch would lead to faster end-to-end delivery times, implying a somewhat reduced secondary effect of consumer response.

In total, the estimated direct effects of plan 5+ range from USD 0.9 billion for plan 5+ low to 2 billion for plan 5+ high.

4.3 Overall Financial Impact

The yearly impact on USPS' profits is computed as the combination of the direct effects of cost reductions, and indirect effects of volume changes as customers respond to the changed level of service. If consumers respond to plan 5+ by sending fewer mail items, the resulting loss of revenue will partially offset savings. To indicate the magnitude of these effects, profitability boundaries are calculated and illustrative demand scenarios are evaluated.

[12] For further information see Trinkner and Haller (2014).

The profitability boundaries are computed by solving for the magnitude of reduced mail demand that would offset savings. For plan 5+ high, this results in a maximum volume loss of 7.5 % on average. For plan 5+ low, an average volume loss of 3.5 % would offset savings.

For the illustrative demand scenarios, demand responses are assumed to be smaller in plan 5+ low compared to plan 5+ high because of less severe effects on quality. The results are shown in Table 4. In plan 5+ high, indirect effects caused by the assumed volume loss of 2.20 % on average would reduce profits by about USD 570 million. In plan 5+ low, consumers respond less sharply, leading to a decrease of USD 287 million. The illustrative demand scenarios hence indicate plan 5+ net savings ranging between USD 0.6 and 1.4 billion. This compares to the expected savings of USD 1.7 billion for plan 5 and estimated USPS savings of USD 2 billion for plan 5+. As no details are known, it remains unclear where the differences are stemming from.

A final assessment would require additional details of the plan and its calculations, and market research on consumers' response to the plan. The estimated impact on USPS finances, which measures the impact on producers' surplus, may be complemented with an assessment of the impact on consumers' surplus to estimate the overall economic effects. If such a comprehensive analysis would point toward the elimination of Saturday delivery, this may then as well imply a similar result for eliminating delivery on other days of the week.

5 Implications for the Net Cost of the USO

According to the profitability cost approach pioneered by Panzar (2000) and Cremer et al. (2000), the "net cost of the USO" N is the difference in profits in a competitive environment without USO π^1 and with USO (status quo) π^0:

$$N^{Profitability\,Cost} \equiv \pi^1 - \pi^0 = \underbrace{\left(R^1 - C^1\right)}_{\text{Profit without USO}} - \underbrace{\left(R^0 - C^0\right)}_{\text{Profit without USO}} = \underbrace{\left(C^0 - C^1\right)}_{\substack{Avoided \\ Cost}} - \underbrace{\left(R^0 - R^1\right)}_{\substack{Foregone \\ Revenue}} \tag{2}$$

If a modified delivery schedule is not feasible due to the US USO, then Eqs. 1 and 2 are equal.[13]

Therefore, if plan 5 or plan 5+ are not feasible because of USO constraints, then the results above may qualify as (a component of) net costs of the USO. For such a classification, an analysis of the legal framework, other USO dimensions, the hypothetical behavior of USPS, and potential benefits of the USO would be necessary.

[13] Technically, this is limited to the special case where no other plans exist where one or several universal service obligations are binding. If there are other service modifications that are profitable but not feasible because of the USO, then the net costs are higher and the net costs of plan 5+ are one element of the net costs.

Moreover, the calculations from plan 5 would require a thorough validation and adaptation to more recent data. A comprehensive discussion is beyond the scope of this paper. However, some indications can be provided.

Currently, the net additional cost of maintaining 6 days of delivery instead of 5 days is considered to be an element of the cost of the USO, because 6-day delivery is required by law and PRC has judged that with fewer than 5 delivery days a week it would be difficult for the mail to remain an attractive channel for bills, remittances, and date-specific advertising.[14] The selection of 5-day delivery as the level of service an operator would provide in the absence of the 6-day mandate predates the proposal by USPS to retain Saturday parcel delivery. It is possible that the demand for parcel delivery would justify the continuation of Saturday delivery of parcels if the 6-day obligation were removed – with USPS' plan 5+ providing a strong indication. If this is the case, it would follow that the estimate of this element of the cost of the USO should be modified to reflect the cost of discontinuing Saturday delivery of letters and flats, as opposed to discontinuing all Saturday delivery service.

6 Conclusions

The USPS perceives increasing pressure to cut costs. Discontinuing the delivery of letters and flats on Saturdays while maintaining parcels delivery, as announced by the USPS in 2013, may be a way to go for the postal service. This "plan 5+" contrasts to "plan 5", a failed attempt of USPS to discontinue the delivery of parcels on Saturdays as well.

In this paper, a methodology is presented to evaluate the financial effects of modifications in the delivery process. In a first step, the shortest path to serve of each carrier route is calculated bottom-up, resulting in a proxy for route and access time per route. In a second step, the proxy is (together with delivered volumes per route and day) regressed against measured USPS street time. Based on the procedure of the first step, different volume and delivery scenarios such as parcel-only delivery on Saturdays of plan 5+ can be evaluated.

The calculations for plan 5+ lead to an estimate of net savings ranging between USD 0.6 and 1.4 billion. USPS' plan 5+ hence appears to make sense from a business point of view. From an economic point of view, plan 5+ should be implemented if the estimated savings are not offset by decreases in consumer surplus. Such a weighing up would require a more thorough demand analysis. The estimated net savings may however qualify as net cost of the USO and should be reflected accordingly in future costing exercises related to net costs.

The model can be modified to evaluate a variety of possible scenarios that would alter the number and location of addresses served by a route on a given day, as well

[14] Postal Regulatory Commission, Report on Universal Postal Service and the Postal Monopoly, December 19, 2008, page 123.

as a more general examination of the behavior of street delivery costs. The study currently used by the USPS and PRC to estimate the volume variability of city carrier street time costs predates many recent operational changes. It is currently being reviewed, and the USPS is collecting data on parcel delivery costs to be used in combination with data on regular delivery and mail collection to develop an updated analysis of total street time costs. The model presented in this paper may prove useful in validating the results of that analysis and providing additional insight.

To respond to recent volume declines and financial difficulties, the USPS may also consider potential changes in delivery operations other than (or in addition to) reduced delivery frequency. Possible changes could include converting routes where deliveries are made to the door into curbline routes, or delivering to centralized neighborhood locations instead of delivering to each address. The model used in this report could be modified to evaluate the likely impacts of these types of operational changes.

In addition to potential changes to USPS operations, the model may allow for a refinement to the estimated value of the letter and mailbox monopolies. The current method is based on the contribution that would be lost due to volume captured by a hypothetical competitor if the monopolies were lifted. It is assumed that if a competitor could profitably deliver the contestable mail on a given delivery route, that USPS would lose that volume to the competitor. This restricts the hypothetical competitor to the route design currently used by the Postal Service. However, a competitor would have a different mix of mail to deliver and would probably deliver less frequently than USPS, suggesting that its optimal route design could potentially be very different. The model could be used to identify the most profitable route design for a competitor, which would allow for the development of an improved estimate of the value of the letter and mailbox monopolies.

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Regulatory Developments in Post and Telecommunications: A Tale of Two Industries

Henrik B. Okholm, Anna Möller, and Bruno Basalisco

1 Introduction: A Tale of Two Industries

In several countries, post and telecommunication are regulated by the same agency tasked to oversee both sectors. Unsurprisingly, postal regulators may draw upon the experience of telecoms regulation when designing postal regulation. Examples of policymakers, who have attempted to change the model of postal regulation inspired by telecoms are the Dutch legislators (2013) and the Italian regulator AGCOM (2013). This enables the regulators to impose access-based competition in the postal sector, which has been a key element in telecom regulation. Moreover, the EC 2012 Green Paper on parcel delivery and e-commerce queried whether price and competition issues in intra-EU cross-border parcel delivery justify the introduction of a price cap or other ex-ante regulation in the postal sector similar to the EU roaming regulation in telecoms.

The purpose of the paper is to investigate similarities and differences between post and telecoms and examine the consequences of applying telecom regulation to the postal sector. The remainder of the paper is structured as follows: Sect. 2 compares the key features of the post and telecoms industries. An applied analysis is then sought. First, Sect. 3 appraises whether regulation devised for the mobile roaming market is relevant for the cross-border delivery of parcels. Then, Sect. 4 considers what would be the effects of applying a ladder of investment access policy (as devised for broadband markets) onto postal markets. Section 5 concludes.

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2 Comparing Key Features of the Post and Telecoms Industries

2.1 Similarities Between Post and Telecoms

Both post and (fixed) telecoms share a history of monopolistic provision in most markets. Even though some competition was present in the early days of telecoms, a single company obtained de facto rights to provide telecommunications. A similar process applied to post and in fact post and telecoms services were often provided by the same publicly-owned organization. A key industry feature explaining the legacy of monopoly is that – absent regulation mandating interconnection (or interoperability) between alternative networks – strong tipping effects will tilt the market in favor of the larger network in each market. In other words the market exhibits some 'winner takes all' features, which in the past have resulted in monopoly outcomes.

In many countries (in particular in Europe), the monopolies providing post or telecoms services (or both) were funded with taxpayer support and subject to public ownership. This could be either directly via ministerial management or via a State-owned, yet separate enterprise. As a result, post and telecoms services have always been industries closer to public scrutiny.

Both also provide Services of General Economic Interest (SGEI), universal service activities that would not be produced by market forces alone or not in the form of an affordable service available to all. SGEI are carried out in the public interest under conditions defined by the State. The latter imposes a Universal Service Obligation (USO) to ensure that these services are provided, where it is believed that they would not be commercially viable. SGEI range from large commercial activities, such as postal services, telecoms (and other network industry key services) to social services, such as care for the elderly and disabled (European Commission 2011).

The public mandate behind SGEI like telecoms and post is thus linked to a desire that all in society can access a minimum set of services at agreed standards. Moreover it is also associated with the network externality feature discussed above. A USO ensures not only the inclusion of some users (otherwise excluded) but also that all other users (even those not served via the USO) can benefit from the ability to reach a universal set of communications counterparts.

Mail delivery (similar to telecoms and other network industries) entails a high share of joint and common costs that are fixed and do not vary with output. Many postal products of varying service levels are delivered together during the same route (sharing the fixed cost). Equally, in telecoms, the wired and wireless infrastructure linking the consumer premises and equipment all the way back into the operator's network (and wider global networks) is used to provide different services. This means that the cost of delivering one extra (marginal) unit is very low.

2.2 *Differences Between Post and Telecoms*

Mail delivery is a highly labor intensive business, and a postal operator's main asset is its labor force of postal workers (European Commission 2012). According to Eurostat, in 2010 the postal industry relied on 1.6 m workers across the whole of Europe, while the telecommunications industry employed 1 m, even though it generated four times as much turnover as the postal industry. The high labor costs constitute a core difference between mail delivery and other network industries such as telecom, where the delivery of services depends closely on company assets of the plant and equipment type, i.e. capital costs (cf. Crew and Kleindorfer 2010, p. 24). High labor intensity means that postal operators can scale up or scale down their networks to adapt to changing market conditions. However, the implementation of cost saving programs requires investments and the presence of extensive collective agreements generally make adjustment processes costly. The presence of a universal service obligation can also to some extent prevent the operator carrying this obligation from scaling down its network.

In the postal industry, the share of business customers is very high. This is in contrast to telecoms (as well as other network industries), where residential consumers constitute a larger share of the market.[1] In many postal markets in Europe, it is not unusual that the lmajority of mail volumes are sent by business customers (De Bijl et al. 2006) and that a single digit share of all registered customers generates more than half of (addressed) mail revenues – for example the large utility and consumer services groups (e.g. retail banking) that send regular transactional mail to their customers. However, these large business customers are able to bypass intermediaries in a way that is not common in telecoms markets – as will be discussed in greater detail in Sect. 4. The customer structure discussed above implies that postal operators often face competitive pressure from substitutes such as electronic substitutes for certain categories of users. (Conseil de la Concurrence 2007).

As mentioned above, both telecoms and post present a Universal Service Obligation (USO) mandated in the law (which in Europe is at both EU and national level). However, the key difference between the two sectors is the extent to which this is a binding constraint that changes the conduct of operators and thus has large commercial implications. While several countries are starting a further wave of reduction in the burden of the postal USO (foreseeably possibly matched by developments at EU level over time), the European Commission is exploring the possibility (cf. European commission 2014) of enhancing the telecoms USO, for instance in terms of the minimum speed of internet provision and as to whether its scope should be not just limited to fixed infrastructure but also provision via mobile networks.

[1] According to Ofcom (2013): "In contrast to the residential sector, the number of fixed voice lines has been falling in the business sector", para 3.36; "Business customers (16 % of the total market)", para 3.109.

3 Mobile Roaming and Cross-Border Parcel Delivery

This section compares the two sectors in two related areas: mobile roaming for telecoms and cross-border parcel delivery for posts. EU institutions, concerned about excessive mobile roaming prices, issued regulation (EC) No 717/2007, which introduced wholesale and retail price caps on mobile roaming calls. The regulation has since been extended to SMS and data roaming, while the caps on calls have been tightened over time. Mobile roaming prices today are much closer to both domestic mobile prices and to their costs.

In a related postal area, the European Commission (2012) queried whether price and competition issues in intra-EU cross-border parcel delivery justify the introduction of a price cap or other ex-ante regulation similar to the EU roaming regulation. In a nutshell, high cross-border prices have been perceived as not reflecting the underlying costs and this (at least on the surface) appears similar to the situation in the European roaming market before the introduction of price regulation on roaming prices. It is therefore interesting to consider whether the drivers of mobile roaming regulation are of relevance to the area of cross-border parcel delivery.

3.1 Initial Screening: Similar Concerns

Until 2007, mobile roaming markets in Europe were characterized by prices considerably higher than domestic mobile prices and underlying costs. The delivery of parcels cross-border was also seen as expensive, with many consumers reporting high prices as an obstacle to cross-border e-commerce (European Commission 2012; Copenhagen Economics 2013). Similarly, consumers may perceive the prices of cross-border parcels not to be aligned with the underlying costs of delivery – when comparing with domestic deliveries (Copenhagen Economics 2013, p. 147).

As recognized in European Commission (2007), mobile users switching does not per se create material pressure on operators to chase their custom by lowering roaming tariffs. Thus, at the wholesale level, the domestic operator has limited incentive or leverage to negotiate a better deal on the wholesale roaming input that it purchases from a foreign operator. At the same time, the foreign operator will also have an incentive to sustain higher wholesale prices when dealing with other operators. The combined effect of weak consumer pressure on retail roaming tariffs and market power at the wholesale level could explain high roaming prices throughout Europe prior to the regulation.

An initial consideration of cross-border parcel delivery suggests that having different operators (from sender to border; then from border to recipient) is also the case. Moreover, end users have limited control over the delivery agreement between their e-retailer and the (sender to border) delivery firm that works with that e-retailer.

3.2 *In-Depth Analysis: Differences Between Roaming and Cross-Border Parcel Delivery*

Crucial differences between the two contexts have important implications for the application of telecoms-like regulation of mobile roaming to the cross-border parcel delivery. The key differences are related to the value chain structure; demand; supply s and regulatory scope and incentives.

In the case of cross-border delivery of e-commerce goods, the e-retailer is the buyer of delivery services. E-shoppers, however, also play a role in selecting amongst e-retailers on the basis of the delivery service and, when buying from some e-retailers, have to make an explicit choice from a menu of delivery options. However, while mobile users see the name of the roaming network on their phones, e-shoppers may only be presented with info on one delivery operator (which in some cases may not be the one responsible for the final mile). Most importantly, parcel delivery markets on both sides of the border have competitive features which are not equivalent in mobile operations, where there are greater barriers to entry. The different value chain structure is shown in Fig. 1.

The assessment of the value chain has a clear implication: cross-border delivery is selected by a professional buyer (e-retailers), while mobile roaming is often bought by a private consumer. This reduces the risk of consumer failure and thus reduces the case for regulation.

E-retailers are business entities and operate in different segments informed by different types of end-user demand. While this can increase heterogeneity amongst businesses, the competition between e-retailers can make them very sensitive to seeking and negotiating a better deal than their competitors (while mobile consumers

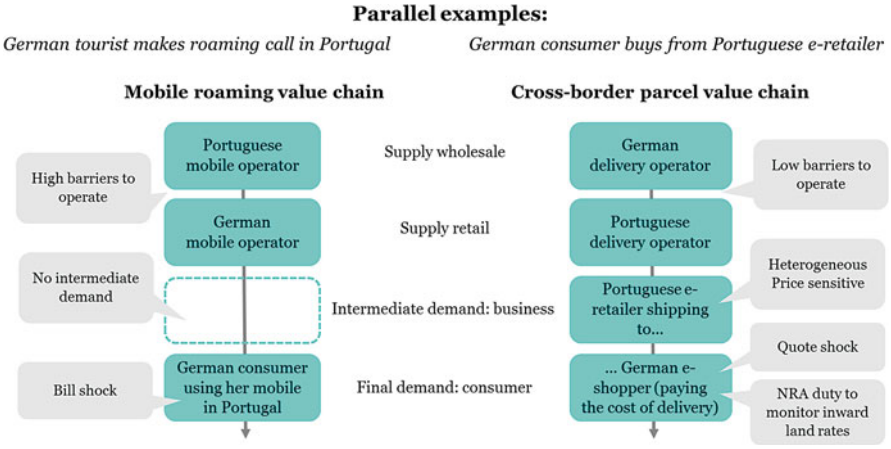

Fig. 1 Value chains: a schematic comparison (Source: Copenhagen Economics 2013)

do not have the same incentive to "beat" other consumers). Large e-retailers are able to procure their own haulage (direct insert) to inject parcels into foreign delivery networks. E-retailers can also negotiate lower, even individual delivery prices, to an extent that large business users of roaming cannot. Moreover, the last link in the transaction chain (e-shoppers) adds price sensitivity. When shipping charges are displayed only at the end of the e-shopping process, this may create not a bill shock but instead a "quote shock", which can lead to abandoned shopping carts (Copenhagen Economics 2013, Chaps. 2 and 4). Mobile consumers, on the other hand, do not see the prices before they receive their bill.

Mobile users, primarily consumers, are more exposed to cumulative margins than postal end users. The same applies when considering the degree of control that end users have on the choice of wholesale provider. In cross-border parcels there are examples of e-retailers that offer consumers multiple delivery options with different firms. In that case, the end users are empowered to choose on a case by case basis what delivery they want. This does not occur to the same extent in mobile telecoms.[2]

The high number of (even local) courier and express operators suggests that there are generally low barriers to operate a parcel delivery business. This is different to the mobile market. Another significant difference is cost structure. In reality, marginal roaming costs are close to zero once the network operators' digital gateways are interconnected. In parcel delivery, marginal costs remain significant even after operators achieve interoperability. Moreover, in post, the interconnection agreements between networks are not as pervasive as in telecoms. Thus the costs of both the inward and outward legs of cross-border delivery will exhibit greater variations across EU countries than roaming input costs do. It is harder for a regulator to intervene and identify with precision a cost benchmark to regulate the prices of cross-border parcels – compared to the task in a telecom market like roaming. This should suggest caution in translating the price cap regulatory approach from one area to the other.

According to article 13 of the postal directive, national regulatory authorities have a duty to monitor parcel inward land rates. The motivation behind this is to avoid excessive prices for last mile delivery resulting from a national postal operator with significant market power on the domestic delivery market. Unlike in roaming, inward parcels termination prices in country Y directly affect consumers in Y, which could make it a higher priority for the regulator in country Y.

Given the differences in the nature of the two markets considered, it would not be wise to perform a straightforward translation of roaming regulatory policies onto the area of cross-border parcels. The comparison exercise signals that value chain structure and the nature of both demand and supply side are key to assess the potential impact of regulation – together with other policy context factors (e.g. the incentives of regulators).

[2] While mobile customers may alter their phone setup to select which network to roam on, they are not presented with a menu before using the service.

4 Access Regulation in Postal Markets: A 'Ladder of Divestment'?

An access obligation is a form of regulatory intervention which forces a firm to supply one or several wholesale products. For instance, this obligation could be imposed on a firm found to have SMP, under the EU telecoms framework. The wholesale products composing the access products must be combined with other inputs (e.g. retail activities in telecoms; mail preparation in post) to allow the provision of a full service. When considering the access obligation, it must be kept in mind that, as a principle, all firms (including dominant firms) are free to choose their trading partners. Therefore, access regulation is one of the most defining and potentially impactful measures that a postal regulator can take. Moreover, the level of access prices set by a regulator has a strong impact on the effect of this remedy on the firms, competitive landscape and end users.

Telecoms policy practitioners often refer to the concept of the 'ladder of investment'. This is a policy approached aimed at promoting entry in telecoms markets (e.g. broadband) by allowing partial entry on the belief that this will eventually lead to full facilities-based provision. It is thus a particular approach to devise access regulation – and a very influential one in telecoms. Examples of policymakers who have applied or considered not long ago this "ladder" concept to postal regulation are the Dutch legislators (States-General of the Netherlands 2013) and the Italian regulator AGCOM (2013). This would lead to a scenario where the locus of competition is upstream, while separate competing upstream firms pay the incumbent postal operator for a downstream service, like local delivery.

This section will consider what would be the implication of fostering a ladder-based access regulation à la telecom in postal markets. It will assess whether access regulation can change the incentives of players in the postal industry and in which way.

4.1 Initial Screening: Similarities Could Make the Ladder of Interest to the Postal Sector

The 'ladder of investment' (also known as stepping stones approach) is the theoretical concept that access regulation should promote gradual competitive investment in a vertically integrated market (Cave 2006). The ladder approach translates into a regulatory policy that aims to reduce the risks faced by entrants, which need to invest large sunk costs in order to compete with an established incumbent. The ladder of investment has been and still is an influential concept in telecoms policy. Its main intended application has been within the telecommunications industry – specifically relative to the provision of broadband based on access to the incumbent's network. It is usually associated to access policies pursuing local loop unbundling, i.e. the regulatory obligation for a telecom operator to lease access to the copper

lines connecting households to local exchanges. Understanding the ladder of investment concept is therefore relevant to understand the general features and drawbacks of access policies, which have been considered in some postal markets too. In a nutshell, the rationale for a ladder of investment is to allow new operators to gradually build a customer base by providing access to the established network.

The ladder splits the necessary investments (sunk costs) into multiple discrete components. It allows an entrant to pick and choose between a menu of each of the disaggregated inputs that the incumbent is now forced to supply on a wholesale basis. Some of these inputs are more replicable than others and thus it is a key task for regulators and entrants a like to rank them according to how easy it is to replicate each input. As its customer base grows larger, an entrant should begin to invest in own infrastructure in order to decrease the amount of wholesale inputs purchased from the incumbent, while increasing the own share of value added.

When implementing ladder based access regulation, the regulator should follow a step by step process (Cave 2006). As a starting point, the regulator should decide which products in the value chain are clearly non-replicable (entrants will never invest to make those). Having ascertained that, it should follow a series of steps: (i) Rank replicable components by ease of replicability; (ii) Identify where on the ladder are all firms located; (iii) Identify the ladder rung which is investment focus and determine investment potential by entrants (e.g. over 2–3 years); (iv) Choose the mode of intervention (e.g. change regulated prices of several components or withdraw mandatory access); (v) Calibrate intervention; and (vi) Make credible commitment to policy. This is a complex plan of action which can be challenging for regulators to implement. Notwithstanding a few departures from the Cave (2006) model, the concept has been of great influence in informing the regulators approach to access policy in telecoms.

4.2 The Conditions Supporting a Ladder-Based Access Policy Are Not Present in Post

Notwithstanding some high-level parallels that can be drawn between network industries such as post and telecoms, fundamental structural differences (cf. Table 1 for bulk mail vs. fixed telecoms) imply that the ladder approach holds a limited applicability to the postal sector.

Thus, introducing a ‘ladder of investment’ framework to the postal sector will not create the intended outcomes. Instead of promoting additional network investments, regulating access to last mile delivery creates a risk of a ‘ladder of divestment’ where favorable access condition proved incentives to network operators to compete based on access instead.

Moreover, there is limited supporting empirical evidence to demonstrate that a ladder approach is effective in postal markets. In fact, in Europe, downstream postal access (which is the closest conceptually to telecoms access regulation) has only been fully tested in one country, the UK, cf. Table 2.

Table 1 Structural differences between telecoms and post

Factor	Fixed telecoms	Bulk mail
Degree of sunk cost	High	Low
Predominant type of input	Capital	Labor
Degree of barriers to entry/exit	High	Medium
Degree of household coverage by alternative fixed network	Absent in countries where no cable network existed; where there is cable, often sub-national coverage. Rarely national coverage	Absent where no E2E firms; national or sub-national coverage where E2E present
Degree of price discrimination	Low	High
Variance in customer types: approx. % of business vs. consumer buyers	50 % vs. 50 %	100 % (bus.) vs. 0 % (res.)
Possibility for end-users to bypass intermediaries and seek access directly	No	Yes

Source: Copenhagen Economics

Table 2 Obligatory and de facto network access regimes in EU

"Model"	Only de facto access		Obligatory access (special tariffs)		Obligatory access and access for competitors
Is access available for certain services?	Yes	No reply	Yes	No reply	Yes
Does your postal services act include a legal obligation to grant access to the postal network?	No	No	Yes	Yes	Yes
Is access provided to competitors for delivery under their own brand?	No	No reply	No	No reply	Yes
No. of countries	7	3	14	3	1
Countries	AT, CH, CZ, FR, HE, LV, RO	PL, SE, SK	BE, BG, DE, ES, HR, HU, IE, LT, LX, MK, MT, NO, PT, SI	EE, NL, SF	UK

Note: In the first two columns, ERGP refers to access to special tariffs, which we understand to include work-sharing. Only the last column refers to access in its customary strict sense, i.e. access for competitors
Source: ERGP (2012), Table 1b

As a result, there is not much experience of downstream access for competitors in post. However, it is insightful to briefly reappraise the experience of the one key country where a fully-fledged access policy has been tested in post: the UK. In the UK, a strong access-oriented policy (i.e. headroom margins) devised by the former regulator Postcomm was premised on relatively low access charges. This led to a large increase in volumes stemming from access customers from 10 % in 2006 to 44 % in 2012 (Ofcom 2013b). However, when a strong access policy was in place, no material alternative network was developed to migrate that traffic onto an end-to-end solution. Only more recently, after the change in regulatory approach (Ofcom 2012), has one operator, Whistl, taken early steps to launch an alternative end-to-end network, with a presently limited geographical and traffic footprint.

Furthermore, in countries where no access regulation has been in place, alternative end-to-end postal networks have been developed – at times reaching nationwide (or quasi-national) coverage, for instance in Italy or the Netherlands, inter alia. In fact, due to a low degree of sunk costs and large share of labor costs in mail delivery, entry barriers for mail delivery are lower than in telecoms (or many other network industries). In fact, entrants did not have to copy the business model of the incumbent. Instead, they can use a different type of workforce, or start with full operation but limited geographical coverage (e.g. Citymail in Sweden) or even full geographical coverage (e.g. Sandd in the Netherlands).

In summary, limited sunk costs allow entrants to experiment with small scale end-to-end business models. This has allowed end-to-end entry and investment in postal networks over time in a way not assisted by ladder or other access policies. Thus, climbing the ladder of investment one step at a time is not a necessary condition for creating a postal network end-to-end competition.

In addition, the cost structure in the postal industry is such that a large share of costs is downstream (i.e. last mile delivery) and would therefore have to be recovered via the incumbent's access charge. Therefore, only a low share of costs would be left exposed to competition. In fact, based on the current design of industrial processes across most European postal operators, only a small share of costs (in general only 20 % of total costs, cf. WIK 2013)[3] will be subject to increased competition. This has also been recognized by UK politicians, which acknowledged that the direct costs of Royal Mail's bulk mail business amount to less than 5 % of Royal mail's total costs and that this left little potential for efficiency improvements (House of Commons Business and Enterprise Committee 2009, p. 50). In practice the share of costs exposed to competition under an access regime will be generally close to the UK figure, because access will primarily be used for large shipments which are easy to process.

A further key difference between telecoms and post is that a much larger share of revenues descends from end users (primarily business customers) in post – compared to telecoms. The composition of demand in the postal industry shows a high degree

[3] Earlier estimates indicate 15.8 % on average, cf. NERA (2004), p. 72.

of concentration. Most importantly, a limited number of organizations (utilities, banks, public sector agencies) are the key source of mail volumes. These large mailers can take steps to procure directly access inputs (from the access-giving firm) and are thus able to bypass the services offered by an access-based competitor. This is very different from the telecoms market, where customarily business customers procure connectivity from a telecoms or IT company.

Evidence from UK and Germany shows that access products have been heavily used by mailers directly. For instance, in Germany more than 2/3 of all access-based volumes in 2010 were entered into the network by large mailers directly. In this way, postal access regulation effectively becomes a regulation of end-user tariffs as large mailers, by bypassing intermediaries, can conduct preparatory activities themselves and enjoy lower delivery prices, i.e. the price of access (WIK 2010, pp. 56, 58, 60).

Furthermore, the change in prices will be relative not only to end-users that choose to buy access directly but also to those that can credibly threaten to do so and use the existence of regulation as a negotiation tool vis à vis any of the postal companies. Moreover, access regulation, by enabling arbitrage, will force convergence in the prices paid by different types of postal end-users. Furthermore, the characteristics of end users in postal markets (notably their ability to arbitrage using access products directly) increase the possibility that the access charges set by the regulator lead to inefficient make-or-buy decisions by end-users or inefficient entry/exit decisions by operators. Finally, the end-users' ability to buy at access prices directly implies that in post regulation cannot balance easily access and end-to-end competition at the same time; while in telecoms mixed outcomes are conceptually easier to achieve (as end-users do not have normally ease to buy access product directly).

As a consequence, a ladder of investment approach, focused on promoting access, is likely to have strong side effects on postal markets – specifically on pricing and allocative efficiency. Thus, if end-user tariffs are the concern for the regulator, these may be more effectively regulated directly rather than through an access remedy.

4.3 Implications

A broad set of factors indicates that applying a ladder of investment approach in post is not conceptually or empirically appropriate. A key implication of embracing this access policy in post is the risk of a 'ladder of divestment'. If a ladder policy is applied in post, specifically in a market where some end-to-end competition already exists, there is a clear risk that the policy can end up inducing divestments. This is because – given certain pricing conditions – existing end-to-end operators will face a clear opportunity to rely on the access-giver's delivery network and move to a different business model. Given that the postal volumes are in decline (in a way markedly different from telecoms), this trend could be a deciding factor for end-to-end networks that could favor the lower risks of adopting a business model where they do not perform the delivery activities themselves (but only pre-sorting or consolidation).

With the benefit of hindsight, a common criticism is that the ladder succeeded in telecoms only as far as entrants investing in equipment to pick up LLU traffic (on a regulated access basis) – but not as far as E2E. In particular, no new E2E infrastructure installed as a result of access-based entrants. It is only existing (pre-ladder policy) infrastructures such as cable networks that have been repurposed to provide high speed broadband alongside the traditional television content. But the much expected new fiber networks have generally failed to materialize in Europe. As a result, Bourreau et al. (2012) conclude that new regulatory models are needed to allow a transition to NGA fiber networks

For the above reasons, the ladder approach has not had the initially expected impact in telecoms and access pricing is now being readjusted. For instance the European Commissioned has issued in September 2013 a Recommendation on copper pricing, aimed at changing the approach in the setting of regulated access charges across all EU countries. Much caution is needed when thinking whether regulated access policy originating in the telecoms sector should be applied in the postal sector. Not only there are conceptual reasons why this could not work – and could lead instead to a 'ladder of divestment' – but also the concept of a ladder policy is being increasingly challenged within the telecoms sphere.

5 Conclusions

The postal and telecommunications industries are characterized by several apparent similarities. Both share a legacy of public-sanctioned national monopolies. Both are associated with universal service obligations to deliver public goods to the whole of society. Both are network industries with large joint and common costs. However, one policy prescription that is designed to work in one industry could be the wrong prescription for the other.

This is because behind the apparent similarities lie fundamental differences. Entry barriers are considerably lower in post, where labor costs are a dominant cost component and sunk assets are lower than in telecoms. Moreover, technological change is driving substitution of services from those conveyed over the postal to those conveyed over the telecoms networks. Demand is also different due to the key role of business customers in post and their ability to make in house mail pre-sorting and – if necessary – buy bulk postal products directly, without intermediary operators.

We have reviewed two cases, each a comparison across both industries, seeking lessons for appropriate regulatory policy in post. We have found that cross-border parcel delivery differs from mobile roaming. Value chains across the two are markedly different, since e-retailers as corporate entities play a role in constraining delivery suppliers – on behalf of the e-shoppers, i.e. end-users of the delivery service. Moreover, the degree of competition in parcel delivery across each of the markets involved is higher than in mobile network operations, where higher barriers to entry are likely in place. As a result, the effect of the EU mobile roaming regulations is unlikely to be met if a similar measure were to be introduced in the parcel delivery context.

Furthermore, a ladder of investment approach – which has been applied to promote entry in the fixed telecoms sector – is likely to have significant side effects in the postal sector. First, since barriers to entry are lower in post than telecoms, the very rationale of the policy is not applicable to post. Second, the ladder policy has not lead to full facilities based competition of new fixed telecoms infrastructures. Finally, there is a risk that a ladder approach can lead in post to a 'ladder of divestment', giving an incentive for existing end-to-end competitors to divest their networks and rely on access-based service competition, which would run counter to the very spirit of the approach.

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Digital Inclusion: A Role for Postal Operators in a Smart World

Caroline Sheedy and Maria Moloney

1 Introduction

Postal Operators (POs) worldwide are launching digital solutions in an attempt to counteract the effects of a decline in mail volume. The cause of this decline in mail volumes is seen to be an increase in use of Information and Communications Technology (ICT), resulting in fewer letters being posted (Rogowsky 2013). Specific sections of society, for numerous reasons, remain static in their use of digital tools. Just 33 % of small to medium-sized companies in the UK have a digital presence and only 14 % sell their products online. Added to this, there are costs of leaving out a section of the public who do not access services digitally. Local authorities, in their need to serve all their constituents, increasingly find themselves with the challenge of engaging these constituents (Goraya et al. 2011).

Research shows that a lack of access to ICT skills development is the true blocker for individuals (Berry 2011; Racherla and Mandviwalla 2013). Computer anxiety is a feeling of discomfort, stress or fear experienced when confronting computers (van Dijk 2006). Similar anxieties surrounding access to libraries and classroom environments are established in the field of pedagogy (Mellon 1986; Jerabek 2001), with findings showing associations with formal settings for learning and accessing information can in fact act as a barrier to access. Consumers and businesses alike could benefit from the neutral and accessible centre that the PO presents. For example, the UK Post Office has 11,500 branches, which are visited by more than 20 million customers each week. 93 % of the UK population lives within 1 mile of a branch

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(Post Office UK 2013). Furthermore, with 40 % of consumers over 55 using the local Post Office weekly and 55 % of branches located in rural areas, POs are well placed to assist in bridging the digital divide.

This paper examines the potential for POs to collaborate with local and national government to provide assistance to the population with regard to both medium-related (e.g. 'button' knowledge, browsing and navigating) and content-related (e.g. information seeking, communication) skills towards improving accessibility of electronic public services like online tax submissions, vehicle registration, payment of parking tickets and even managing government benefits. The next section examines current electronic public services and provides examples of how POs are currently helping governments reach the public. Section 3 describes the methodology used to carry out the research project described in this papers and Sects. 4 and 5 explain and outline the results of a case study, which investigated the feasibility of establishing the postal service as the local digital inclusion arm of the government. Section 5 concludes the paper and gives an outline of future research for this work.

2 Context

In the UK, there are many initiatives aimed at increasing public engagement with the government. Many are aimed at involving those deemed on the 'wrong side' of the digital divide including categories such as labour position, education (Morison 2010). For instance, the UK government committed to delivering all their public services digitally by default in the near future. It argues that by going *digital by default* it can offer better services to consumers. The UK government has committed to ensuring that no citizen is left behind due to their difficulties with technology (Gov.uk 2013). Similarly, the open government initiative of the US federal government uses Internet technologies to achieve their aims of increased collaboration, participation and transparency in government (Haughwout 2009).

Communities are identified as holding power as partners to digitizing governments (Newman and Clarke 2009, p. 15). Communities can be formed by enlisting activists to determine community needs that will in turn become community plans on which partnerships can develop. A community acts not only as a means of mapping and managing difference, but is itself a particular resource that has special authority in terms of the attention and engagement it commands and the resources and capacities it can deploy (Morison 2010). Such collaboration from consumers requires the formulation of partnerships and cooperation not only across all levels of government but also between government and public-private partnerships, non-profit organizations, enterprise, and individuals (Chun et al. 2010). Participation of this type not only provides the government with the collective knowledge, ideas, and expertise of the population but it also enhances the government's effectiveness, improves the quality of its decisions, and promotes accountability (Chun et al. 2010).

However, many government projects are preliminary and remain in a developmental stage. Complex issues such as security, data protection, and digital inclusion

need to be considered for electronic public services. To ensure engagement with electronic public services, governments should understand the reasons why individuals' fail to engage online or disengage at a later point. Trust in any government system is core to adoption.

2.1 EGovernment, Digital Inclusion and Public Access Computers (PACs)

Equal access to information is a critical principle in the global information economy (Gebremichael and Jackson 2006). Tapia and Ortiz (2010) noted that there is a high degree of correlation between social exclusion and digital exclusion. So, those who suffer from social exclusion often also suffer from digital exclusion. Traditionally, broadband proliferation has been identified as precluding digital participation, however, research has identified instances of the failure of municipal wireless broadband initiatives (Kvasny and Keil 2006; Hudson 2008; Tapia and Ortiz 2010; Tapia et al. 2011)

Po-An Hsieh et al. (2008) found that technology access and creating favourable conditions for initial technology use are only the first step in creating an environment for continued intention to use ICT. Eynon (2011) identified four key reasons for use of the internet: costs; interest in using the Internet; skills; and, access. She found that ex-users and non-users have different reasons for not using the Internet. Ex-users are most likely to point to a lack of interest and access. Non-users are most likely to point to a lack of skill and access. Ex or intermittent users are making a choice to disengage with the Internet (i.e. they lack interest), but for non-users, digital exclusion factors are prominent.

The last decade has seen multidisciplinary research into governmental use of ICT (Pleace 2007; Goodwin 2007; Loader et al. 2008), with most recent research identifying issues surrounding the impact of ICT at a local level (Mervyn et al. 2014). Eynon (2011) found that digital inclusion policies designed to support individuals' everyday interests, rather than formal learning, are likely to be more effective in increasing people's engagement with online opportunities.

A visit to the local public library allows many to interact with their community and access the Internet through Public Access Computers (PAC) services. Public access to computers is an important component in ICT programs for development: through public access venues such as public libraries, community centres, and Internet cafes marginalized and underserved sectors of the population have opportunities to learn about and use ICT. Libraries, tele-centres and cybercafés constitute the PAC ecosystem of a community or a country (Baron and Gomez 2012). However, public libraries, the central point of access to PAC services, are on the decline with hundreds of closures across the US and the UK annually and as a result, visits to libraries are also on the decrease (Flood 2011, 2012). This limits the PAC ecosystem of a community and threatens the access to PAC services for the digitally excluded.

2.2 NPO as Services Provider for the Government

Globally, NPOs and governments work together to use the large number of national postal outlets as delivery points for government services. There is no single approach adopted, as there are historical, cultural and socioeconomic factors at play. Consumers worldwide are increasingly seeking ways to conveniently access products and services, prompting NPOs and governments to work on responding to these demands.

The availability of postal outlets in most towns and villages across a country makes them a logical point of contact for governmental services provision (Triangle Management Services Limited 2011). Government agencies across the globe are experiencing budget constraints and resource reductions. Many of these agencies have expensive field office networks that are often inaccessible to many consumers. Because of the extensive national network offered by the national postal service and its extensive first- and last-mile reach, government agencies can cut the cost of their existing field office networks by providing government services through local post offices. For the NPO, allowing other government entities to lease space in post offices could help NPOs to generate revenue, while also increasing motives to visit local post offices (OIG United States Postal Service 2014).

Survey findings by the OIG United States Postal Service on whether government services should be available at local post offices were that the majority of respondents stated that it would be a good thing. However, some felt that having government services available at post offices would lead to time delays in getting served and, due to postal workers not having the needed expertise, the quality of service would suffer (OIG United States Postal Service 2014).

Triangle Management Services Limited (2011) also investigated means for postal operators and governments to work together to use postal outlets as a delivery point for government services and found an important factor for success was ensuring the provision of appropriate knowledge and skills to front-line staff to ensure they delivered accurate, timely products and services. On-going training, responsiveness to change and maintenance of service quality were also vital to customers and the product 'owners', i.e. government.

The UK Post Office recognized the potential for NPOs to fill this position of a trusted, efficient, independent agency that can be the link between consumers and their government. They provide numerous government services both through their website and at post office branches. Examples of these government services offered by the UK Post are passport renewal, driver's license applications and renewals, payment of taxes, social benefit and pension payments and identity verification services (UK Post Office 2014).

The next section outlines the methodology employed by this research. Two methods were used, namely content analysis of a number of existing surveys regarding digital exclusion and a case study. This is followed by a section outlining the results of the case study, which consisted of the roll-out of a community/eGovernment electronic platform to see if there was an appetite among the public for a community platform offering eGovernment services and run by the NPO. Section 5 concludes the paper.

3 Methodology: Content Analysis and Pilot Testing

Content analysis of a number of published surveys which consisted of a fact finding mission to ascertain the viability of POs as the new digital inclusion arm of the government, as a preparation for conducting a pilot study. A pilot project was carried out in the London Borough of Tower Hamlets in collaboration with a number of organizations such as the Tower Hamlets Borough Council, Community Infopoint (a subsidiary of Escher Group Holdings Plc), Your Square Mile and the Big Lottery was the partners involved in the pilot study. The pilot platform was presented to local residents in the borough to understand if consumers of the borough, especially those generally excluded from digital society, would be encouraged to use electronic public services if a local government community platform was set up.

The United States Postal Service Office of the Inspector General (2013) outlined five categories of governmental services that the postal service is currently suited to handle:

1. The Postal Service could combine existing applications such as electronic postmarks with secure electronic messaging and digital-physical hybrid services to authenticate government communications and transactions.
2. Through its vast retail network, the postal service could facilitate the transition of government transactions online by offering digital and in-person identification services.
3. Government agencies that require front office personal contact could utilize the Postal Service's national retail network for applications, status changes, and in-person witness certifications.
4. The postal service retail network could serve as an enrolment and cash redemption or cash top up channel for agencies that issue prepaid cards. The Postal Service could also provide postal money orders and its own prepaid cards on behalf of other agencies, which consumers could use for secure refunds, loan and grant proceeds, and benefit or entitlement payments.
5. National efforts to expand broadband availability could be advanced by the postal service by providing convenient access points via their post offices in underserved communities, as well as aerial access to expand the broadband umbrella (US Postal Service Office of the Inspector General 2013).

As Internet penetration rates are reaching saturation levels in many countries, Europe, the United States and countries in the Asia-Pacific region are establishing USOs for broadband service. Switzerland was first to establish a USO for broadband at a regulated price, followed by Italy and Spain in 2010–2011 (Budde 2010). The emergence of a *broadband USO* could motivate NPOs to revise their entire USO offering in an attempt to retain their status as a major communications provider globally. However, if this revision does occur, to prevent creating barriers for vulnerable groups of consumers, most governments will not substitute the postal infrastructure and traditional services with eGovernment alternatives over the coming decade (Copenhagen Institute for Futures Studies 2011).

3.1 The Tower Hamlets Case Study

The residents of Tower Hamlets found the community platform, which was piloted for 12 weeks in the borough, useful due to the proposed availability of the platform for access within their local community, i.e. their local library, supermarket or local post office. This access was proposed in conjunction with the provision of support for using the system and its electronic public services from these trusted members of their community. Over 3,000 responses were gathered during the 12 weeks. The primary function of the platform was to encourage uptake among residents of the borough.

There were two main motivations for the local council in setting up such a platform in the local community. The first was the knowledge that a face to face visit with the Tower Hamlets Council at one of their *one stop shops*, on average costs the council £9, to service a call from a resident costs them over £4 while interacting over the Internet costs them less than £1. As a result, the council was eager to encourage consumers to engage through a web based platform such as a government community platform to help reduce their costs. The second motivation was to help improve transparency and direct communication between the council and their residents.

Consumers of the borough of Tower Hamlets were asked to test a beta version of a government community platform, entitled *Community Infopoint* that was delivered through four ruggedized iPads located at four strategic locations (three libraries and one mosque) in the borough of Tower Hamlets. These iPads were deliberately not located in local post offices to avoid introducing bias among the respondents when deciding where the access points to the community platform should be located.

These four ruggedized iPads remained in their locations for a total of twelve weeks from September 4th until November 23rd, 2012. In order to gather as much feedback and data as possible to correctly evaluate and analyze the local government community platform, Community Infopoint employed and trained a number of local people to spend on average 4 h a day in each of the four locations where the ruggedized iPads were located. This was to help showcase the community platform and raise awareness of its functionality and uses. These community platform advisors were also responsible for helping and encouraging users to fill out the short user exit survey. The survey provided an opportunity for residents to:

1. Outline where they feel the most likely place within their community would be to locate local access points to the platform.
2. Detail what electronic public services they would find interesting if a wider deployment of the government community platform was to take place in Tower Hamlets.

In conjunction with the pilot study, a group of postgraduate students were enlisted, as part of their postgraduate course, to carry out interviews with local officials and residents to gather ideas and come up with novel suggestions for services for the Community Infopoint Platform. The next section details both the results of the pilot study and of the university project.

4 Results

Every individual that used the ruggedized iPads was asked to complete an exit survey to record their opinions and perceptions of the platform. The survey results were very insightful. It provided both local post offices and Tower Hamlets city council with a snapshot of residents' opinions on the integrated community platform. It also provided suggestions from both local businesses and local residents on what they would like to see in future versions of the platform to ensure it was fully inclusive for the entire community.

4.1 Feedback from Local Businesses

Over the course of the 12 week pilot, Community Infopoint representatives met with a number of local businesses in Tower Hamlets to help raise awareness of the Community Infopoint platform pilot and to understand how such a community platform could add value to their business. Every business owner that was approached gave a positive response to the concept behind the pilot study. All of the business owners indicated that they would be interested in participating in a phase 2 of the project and in the broader roll out of such a Community platform.

The agency for social housing in the borough were very interested in having a presence on the platform as they saw it as a new channel to enable the digitally excluded to bid for social housing through the platform. They also wanted the community platform to offer bill payment services as they believe the agency will need to create additional bill payment channels to facilitate residents when paying their rent. They also agreed that the local post offices would be ideal locations for providing access points to the government platform, even more so than the local libraries as most individuals that they dealt with had empirically more interaction with their local post office than they have with their local library.

The agency for commissioning general medical practices and all major hospitals also gave their feedback on the Community Infopoint platform. The agency agreed that the pilot was a very positive step forward against combating digital exclusion. They would like to locate Community Infopoints in all 36 doctors' surgeries and accident and emergency (A&E) waiting areas. The agency would like to raise awareness of health and wellbeing for the consumers of the borough through the use of the Community Infopoint platform. They agreed with the idea of NPOs coordinating and managing the platform. However, they pointed out that investment was needed from the government to prepare local post offices for this new initiative.

Tower Hamlets Police operate six police stations and they are always striving to improve levels of citizen confidence in local policing. A high ranking representative from the local police department believed that the platform would be a useful channel for raising awareness of good news stories to help improve overall confidence levels in policing from the general public. He also felt that the platform would be an

effective channel for publicizing the four annual open public meetings held by the police department and for raising the profile of community officers. He also felt that the platform would be an ideal medium for publishing crime mapping statistics to enable residents to identify current crime hotspots. When asked who should be in charge of running the platform, the response was a trusted entity within the local community. He agreed that both the NPO or the local library would fit this profile.

Tower Hamlets has 16 % unemployment, among the working age population, this is twice the national UK average of 7.6 %. Twenty-five percent of the borough population has no formal education and only 70 % of all households are in work. This puts a great strain on the local employment centre. The employment centre believes Community Infopoint could be used as a local employment matching service, i.e. matching appropriate candidates with employment opportunities. Additionally, the platform could be used as an information resource that would advise the unemployed on how to find suitable employment. The employment centre would provide content and local employment offers through the platform to the unemployed. Platform access points could be located in the job centre plus reception areas.

An interesting finding from conversations with representatives from the organizations discussed above was that all of them believed the NPO, more so than the local library or the local supermarket, would be a good fit for managing the platform and for ensuring access to the platform for all residents including those with no Internet access at home or at work. This was largely due to the fact that they felt that NPOs had more daily interaction with consumers and was thus more convenient for most members of the community and in particular the marginal members of the community.

4.2 Feedback from Local Residents

Over 1,850 customer surveys were conducted over the course of the 12 week pilot. The results of these surveys were encouraging. Figure 1 shows the ages of the respondents to the survey.

Figure 2 shows the number of people who used the Internet for the first time with the Community Infopoint platform. This is a very interesting result. This shows that a significant percentage of the digitally excluded were interested enough to try the platform and thus engage with technology for the first time. This might imply that the location, access and/or the presence of an individual willing to assist them in getting online encouraged them to try the Internet.

A notable finding of the pilot was that 45 % of all respondents believe that such services as the ones provided by Community Infopoint, i.e. free access to the Internet and to electronic services should be located in their local post office. This was the top location choice by consumers. Another finding was that 11 % of respondents who had never previously been on the Internet would be willing to get training from their local post office workers to learn how to use the system (Fig. 3).

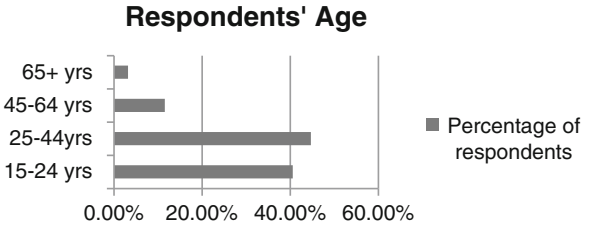

Fig. 1 Breakdown of respondents' ages

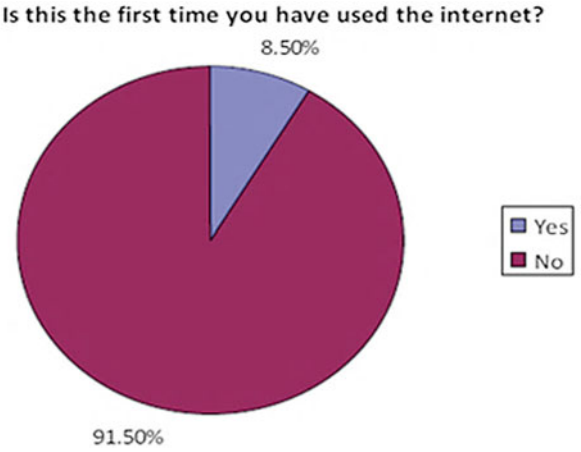

Fig. 2 Number of first time users of the internet

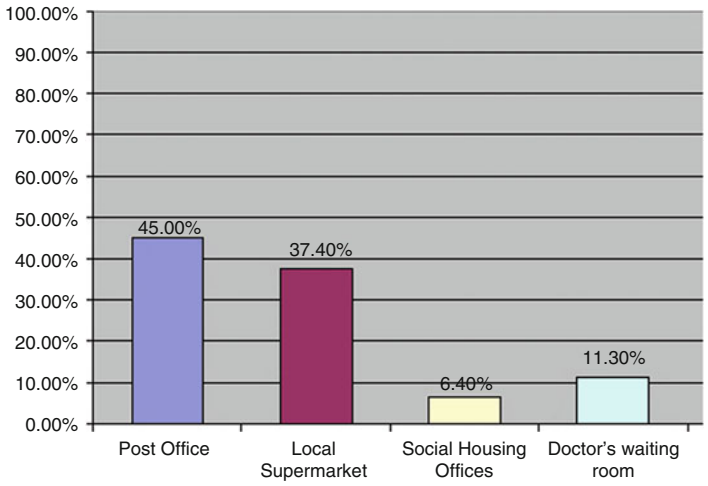

Fig. 3 Preferred community locations for the government platform access points

Providing such a service from the local post office would enable POs to provide the communities they serve with an electronic ecosystem that binds the community together. All members of the community would have support and access to the Internet through their local post office. It would facilitate NPOs to continue their tradition of providing communication services to all members of a state or region, governments, businesses and residents alike.

4.3 Feedback from the Postgraduate Project

An interesting finding was that there is an appetite among residents surveyed by the postgraduates for a form of hybrid mailing service that could be provided via the community platform. The service would link residents' physical mailing address with a registered email service that could be made available on the platform. In this way, residents would have the choice of receiving digital or physical mail from the NPO or a combination of both. This would facilitate the NPO in retaining the communications services needed for the community while also allowing the residents to become more digitally included at their own pace. A lot of the residents and businesses interviewed by the post graduates indicated that they felt that this service of hybrid mail would be a natural progression for the NPO. It would also help the NPO to better establish itself as a partner to both local and national government. Not only would it facilitate the continued communication between local government and residents but it would also link local government agencies together and local businesses with each other. If local government agencies were to invest in separate digital platforms, taxpayer funds would have to be used. The NPO enjoys a high level of trust among the residents of Tower Hamlets, not to mention the local government agencies.

A Postal Service platform strategy such as the Community Infopoint platform would synchronize well with the overall UK eGovernment strategy. Thus, the UK NPO could seek the creation of an interagency task force charged with defining a comprehensive eGovernment approach. The UK NPO could be at the forefront of implementation efforts with respect to reaching the entire UK population. In particular, the UK NPO could assist other borough councils in determining the appropriate mix of digital and physical communication methods to the rest of the UK population, and could be the vehicle for delivering those communications via similar community platforms like the Community Infopoint platform. One such example would be to link online eGovernment efforts with access points located in Post Offices in areas with limited broadband access and large percentages of digitally excluded consumers.

5 Conclusion

The Postal Service needs to address the unavoidable digital disruption and transformation that it is currently undergoing and will continue to undergo for the foreseeable future as a result of the information revolution taking place across the world

and in particular in the west. NPOs continue to have the responsibility of serving the population of a country in terms of formal, national communications. It can continue to do this into the future by providing their customers with access to physical as well as digital communication systems. Given the rapid changes in technology and consumer behavior, NPOs will only succeed if they can identify a competitive advantage for themselves in the digital age. It can start this process by studying the feasibility of some of the prospective applications identified in this paper, particularly providing digital government services at a local level.

The Postal Service has the opportunity to extend its existing national and international platforms into the digital world by facilitating traditional service providers, as well as new entrepreneurial applications developers in generating a wide array of additional physical and digital services to meet the needs of its customer base. By embracing a digital strategy, NPOs can provide many needed solutions to currently digitally excluded customers by providing a suite of digital products and services. By providing such an eGovernment platform like the Community Infopoint platform, NPOs can bring the Postal Service into the digital age and ensure that all customers of the Postal Service have the opportunity to access an innovative eGovernment platform through the postal service.

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Informational Privacy and Registered Certified Mail: What Do the People Want?

Caroline Sheedy and Maria Moloney

1 Introduction

The increasing use of digital channels for communication, both domestic and commercial, has led National Postal Operators (NPOs) to explore other revenue streams. The increase in use of all things digital has been described as 'among the most consequential thing to happen to humanity' (Bostron 2007). There is evidence that it is indeed impacting society in terms of communication, healthcare, governance and education levels.

Public concerns surrounding these changes brought about by technology derive from the impact they are having on society. Such concerns need to be examined, and the positives and negatives of the new technology identified, if possible, ahead of adoption. Traditionally, public confidence has resided in existing public bodies as being *known* and *trusted* entities with actions that are required to be transparent and fair. NPOs may constitute one such body (The Ponemon Institute 2010). In this paper we examine a potential avenue for them to follow to thrive in the current technological revolution (Bostron 2007).

In an attempt to counteract the effects of significant declines in mail volumes and revenue, NPOs have launched a number of digital solutions. An increasingly popular digital solution is certified electronic mail. Certified Mail Systems (CMS) provide users with secure, reliable and evidential exchange of messages similar to the quality that consumers obtain from traditional postal registered mail. Like the traditional postal system, most of these CMS are tailored to meet the requirements of national laws, policies, and the specific needs of the citizenship of a nation. The on-going globalization and opening of the markets, especially in the European

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Union, ask for *global* certified mailing similar in ease-of-use to email but with the security assurances of certified mail (Tauber and Boldrin 2012). Security for digital or electronic mail is still considered the most important thing for consumers when communicating online, as research has shown that individuals continue to experience privacy concerns regarding unauthorised access to the content of their electronic communications (Federal Trade Commission 2012).

In Sect. 2 of this paper, we provide an overview of CMS-specific characteristics, in Sect. 3 we examine the position of NPOs as a digital communications provider, contextualising the position of NPOs in light of current challenges and opportunities. In Sect. 4, we explore informational privacy in more detail emphasising the property of fairness. Section 5 concludes the paper.

2 Certified Mail Systems

CMS represent NPOs' effort to achieve the desirable properties of registered or certified physical mail in an electronic manner. The advantages of electronic communications are manifold, and NPOs are using consumer demand driven by those advantages as a basis to counteract the effects of declining postal volumes and thus revenues. In particular, the use of CMS by governments as a means to provide bilateral communication with consumers has been identified as a future direction for NPOs (Tauber 2010).

Although email is used for a multitude of communications, the lack of evidence for *formal* message receipt precludes it having the evidential support required for use in legal, medical, and professional settings (Oppliger 2004; Oppliger and Stadlin 2004). Most email packages nowadays allow the originator to request notification that their message was received by the recipient, i.e. a delivery receipt option. A delivery receipt informs you that your e-mail message was delivered to the recipient's mailbox, but not that the recipient has seen it or read it. A read receipt informs you that your message has been opened. In Microsoft Outlook for example, a recommendation is made to not rely on the evidential properties of these receipts (Microsoft.com 2014). A recipient has the option to decline to send a read receipt, and not all platforms support read receipts. These receipts are mere flags setting a status associated with a message, and do not have any legal evidential weight. They can be considered more akin to the 'track and trace' provision associated with many forms of postal mail.

Although a number of email schemes addressing secure messaging exist, such as Pretty Good Privacy (PGP), OpenPGP, and Secure Multipurpose Internet Mail Extension, a fundamental issue prevents them from being comparable with registered letter mail. These schemes prevent the originator from pretending not to be the source of a message (traditional non-repudiation), but do not prevent a recipient from denying a message was received. In registered letter mail, a recipient gains access to the message content only upon signing for it. The notion of non-repudiation of receipt replicates this desirable property in CMS.

Registered physical mail requires a signature from the recipient upon receipt. This provides a non-reputable form of evidence that the message has been received. This signature can be presented in case of a dispute, unlike the message received status flag of email. In CMS, this signature is replicated with a digital signature. A digital signature is a cryptographic method for (i) authenticating the origin of a message (authentication and non-repudiation), and (ii) proof that message has not been altered in transit (integrity). A digital signature associates the content of a message to the signature, whereas a physical signature is merely associated with the transaction. The evidential quality of a digital signature cannot be compared with the status flag. A digital signature ties an action to a specific individual and, with the appropriate infrastructure, carries legal weight. Additionally, it prevents the content of a message from being changed, as the signature will not verify if any aspect of the message has been altered.

2.1 Security Properties

Conventional email solutions may have associated security properties of confidentiality and integrity. To achieve them, a message must be visible only to the intended recipient (confidentiality) and that is received as sent (integrity). Regardless of how sensitive the content of the message is deemed to be, the integrity of a message is fundamental – it should not be altered in transit to ensure its original content is received. Cryptographic measures are primarily used to achieve these properties, although measures involving less overhead such as checksums are also used in place. Encryption is the process of encoding a message so that only the intended recipient can read it. Decryption is the process of taking an encoded message and rendering the content readable. The aim of encryption is to prevent an observer from determining anything about the content of a message that is directed only the specific recipient.

Depending on the varying levels of confidentiality required, a message may be encrypted only in transit and decrypted by the email service provider. Alternatively, end-to-end encryption requires the message to be encrypted with the intended recipient's public key, meaning only the intended recipient can decrypt it (assuming appropriate key protection mechanisms are in place).

As detailed above, the integrity of a message constitutes a proof that the message has not been tampered with in transit. It ensures that the originator cannot claim that the content differs from that which is received by the recipient, and also prevents the recipient from claiming the message they received is different from that sent. Physical mail has associated codes of practice for achieving integrity. Regulatory bodies such as Ofcom review the associated operational procedures (Ofcom 2013), and their findings are the basis of changes or advances in achieving postal integrity. However, like all codes of practice, they are subject to be subverted (both intentionally and unintentionally) by those adhering to them. Interference with mail is a criminal offence (e.g., UK Postal Services Act 2000, part V, offences in relation to postal services), which requires detection and proof (Ofcom 2013). Digital

signatures, with the appropriate infrastructure in place, offer the means to both detect and prove any interference with mail in a CMS.

2.2 Fairness

Fair exchange is an academic area of interest in its own right, and is currently receiving much attention. It focuses on the problem of parties agreeing to deliver an item if and only if they receive an item in return. While this bilateral nature of fair exchange goes beyond what is required for CMS, the property of fairness is related. Fairness is core to CMS, and ensures that the recipient and originator must get their expected items (message and receipt respectively), or the transaction fails. That is, the issuance of a receipt is synchronous with the receipt of a message.

The requirement for fairness is only evident should an exchange come into question. An arbitrator uses the evidences to evaluate a claim. Compared to the paper equivalent, digital evidences (non-repudiation of receipt for example) present a significantly harder problem for fraudsters. Using a paper receipt, one is required to forge a handwritten signature. Using the digital equivalent, one is required to forge a digital signature.

2.3 Non-repudiation

Non-repudiation prevents a party in a communication from denying all or part of the communication. A number of ISO/IEC standards, i.e. ISO/IEC 7497-2, ISO/IEC 10181-4 and ISO/IEC 13888-1, specify that a non-repudiation service should collect, maintain, make available, and validate irrefutable evidence about a specific communication's properties (Oppliger 2007). CMS focus on achieving non-repudiation at an end-to-end basis using proof of origin and proof of receipt.

The receipts are used as a signed statement that provides sufficient evidence that an event has occurred. A major advantage in using digital signatures over handwritten is the binding of the digital signature to the message itself. In traditional letter registered mail, the signature is bound to an address on a given date, perhaps at a given time. In the digital equivalent, the signature is bound to the timestamp of a message itself with all the routing information.

2.4 Trusted Third Parties

CMS require a trusted third party (TTP). They can be inline TTPs, acting as an intermediary relaying agent that processes every message. An online TTP does not process the entire message, handling instead only certain information such as

cryptographic keys or receipts. An offline TTP is only required in the case that a message status is in dispute. It is not required for message exchange or receipt. While a CMS without a TTP is realizable, it is not considered feasible on a large scale currently and is considered out of the scope of this work.

Assuming a TTP is not under resourced, from a user perspective there should be no experiential difference. From an efficiency perspective, an offline TTP requires fewer resources as it is only called upon when there is a query. Whilst it would be advantageous to minimize the trust required in a TTP, in practice the associated protocols are difficult to implement.

2.5 Discussion

At the core of a CMS is the notion of non-repudiation, which is central to fair exchange. Should a dispute arise in relation to a communication, the agreed trusted arbitrator facilitates a dispute resolution service. This is of fundamental importance to CMS, and hinges on the non-repudiation feature. Without this, assurances of fair exchange are meaningless.

In the case where a recipient denies receiving a message (non-repudiation of receipt), when the originator claims to have sent the message, the arbitrator must evaluate all the evidence, in this case to be provided by the originator. The arbitrator has to verify that (a) the recipient did receive a message and (b) that the message is the one the originator claims to have sent. The proofs are conducted using cryptographic measures, which prevent any party cheating. Using digital signatures and encryption, a message can be kept confidential while still being associated with a particular communication transaction. Moreover, they come with associated proofs of security that underpin the cryptographic assurances.

The arbitrator is required to act as an independent and trusted entity. The major features of CMS can actually be separated logically from the message delivery service, meaning that the CMS can be provided by a TTP. The role of arbitrator is independent from the message delivery service, providing cryptographic functionality.

The role of the TTP, and the required functionality, is determined by the implementers rather than a standard (Tauber 2011). It is therefore open to NPOs and other CMS providers to determine what in their offering is required.

3 Consumer Concerns Regarding Safety of Information Handled by NPOs

The world has been revolutionized by evolving information and communication technologies and this is having an effect on how NPOs do business. One appropriate solution for digitizing NPOs would be to blend their current provision of universal

services, still valued by customers, with new forms of digitized universal services (Moloney and Church 2012).

Currently, NPOs in many countries remain either state-owned companies or independent agencies of the government. La Poste in France and USPS are both independent governmental agencies. Other NPOs have been privatized, such as Post NL and very recently, Royal Mail. Regardless of whether publicly or privately run, many NPOs are already tackling the challenge of digitization. La Poste in France has introduced electronic services and offers webmail services to their customers, providing @laposte.net email addresses. There has been rapid growth in postal e-services in recent years with 85 electronic postal services of this kind having been introduced globally in 2010 alone, compared to 33 in 2007 (UN News Centre 2013).

Research has shown that given the profit-driven and competitive nature of our digital society and individuals' concerns surrounding issues like the protection of their personal information online, individuals prefer to entrust their personal information to familiar and trusted brands (Shankar, et al. 2002). When individuals 'trust' an online brand, it increases the likelihood of those individuals actually interacting with that brand because trust alleviates concerns regarding possible negative consequences (Kim and Prabhakar 2000). The challenge now facing NPOs is to use their trusted brand to their advantage by extending it to encompass an inclusive, affordable and high-quality electronic service.

3.1 NPOs as Digital Communications Providers

Digital communications provide an interesting paradox for NPOs. While identified as a primary cause of the downturn in volumes of traditional mail, they are also lauded as a basis for future growth in the industry (Office of Inspector General for USPS 2013). Other aspects of digitalizing communications, such as their environmental and economic advantages, must be balanced against the interests, abilities, and willingness of individuals to adopt digital services.

The International Postal Confederation (IPC) report (Copenhagen Institute for Future Studies 2011) identifies communication as a core competency and challenges NPOs to choose between communication and logistics, i.e. physical goods delivery, as their focus. The IPC report includes a body of research using focus groups of communications experts. They differ in their professional opinion of the position of NPOs as digital communications providers to experts within the postal industry. These external communications experts challenge the positioning of NPOs as communications companies, and argue instead that they should be considered as logistics companies. They point out that the traditionally large volume mailers, such as financial institutions and governments, are already looking to avail of existing secure digital communication and that NPOs have essentially 'missed the boat'. They argue that it is more social and institutional factors that are preventing mail volumes from dropping

more dramatically than they are currently and not because the large volume mailers are still using NPOs. Mail volumes are not dropping because NPOs still provide societal benefits. For example, in 2011, the USPS' plan to close 3,600 post offices was met with such an outcry that the plan was revised to reduced opening hours instead.

The Post Office still holds a particular place in any given community. To justify the continued physical presence of post offices in communities, a number of diversifications are being proposed and implemented in an ongoing fashion. Even given that expected and observed declines in postal markets vary from country to country, diversifications are being at least researched by every NPO (Accenture 2009). Whether the nature of this intervention is primarily a logistical or a communication issue remains an interesting question in light of the opinions of the external communications experts contained within the IPC report (Copenhagen Institute for Future Studies 2011).

NPOs have to rethink letters mail (Hearn 2014). One approach for NPOs is to leverage their established reputations to become digital transactional mail service providers. Transactional mail is normally between business or governments and customers. It has already suffered large declines in volume in the last decade, with companies opting to 'go paperless', citing environmental and cost saving reasons. NPOs are particularly well placed to become key players in the field of electronic delivery because they are traditionally trusted entities (The Ponemon Institute 2010). However, a finding of Moloney and Church (2012) was that users have reservations about the technical competencies of public bodies to safeguard private data. A significant number of survey participants surveyed by Moloney and Church believed that private companies like Microsoft, Google and IBM had more technical expertise and financial resources to invest in research and development investigating how to best safeguard personal data stored within their systems.

These findings are similar to the findings of Kim and Prabhakar (2000), who found that trust in the actual technology that provides a service is an important determinant of IT adoption. A view that is echoed by Kelly et al. (2002) who, when analyzing what it is that consumers value in respect to government and public services, identify three categories, (1) positive personal experience of public services, (2) positive perceptions of service outcomes and (3) trust.

3.2 Consumer-Oriented Privacy

The pace of change with which Government to Consumers (G2C) communications is moving is important because, in contrast to the predictions about the decline of other mail types, according to a report by the Copenhagen Institute for Future Studies (2011) a slower decline in volumes of letter mail associated with G2C communications is predicted.[1] Even though governments are keen to avail of the same advantages of cost as businesses, and additionally have environmental impact

[1] These predictions were made by a panel of communications experts not directly associated with NPOs.

targets to reach. Initiatives such as Go On UK focus on increasing digital engagement of the population. Hence, government must continue to engage with all members of society including those reluctant to engage in digital communication.

Within Europe, protection of personal data and the processing thereof was initially addressed with a 1981 Council of Europe Convention, which was followed by the 1995 EU Data Protection Directive (Electronic Privacy Information Centre 2010). Data protection laws are enacted in each EU country individually, covering personal data held on individuals in automated or manual form, ranging from CCTV footage to files and phone call recordings. The Irish Data Protection Commissioner, Billy Hawkes, describes the current state of play for those attempting to provide privacy protection:

> Data protection must adapt to changing social norms and methods of communication. But its basic aim of giving us as much control as possible over our personal information is even more important in the Web-enabled world we live in. (The Irish Data Protection Commissioner 2012)

One detects signs of an erosion of the taste for and expectation of privacy in society (Allen 1998). If privacy is seen as *a control over access to locations and information…necessary for human well-being* (Moore 2007), governments have an obligation to protect consumers. The UN Declaration of Human Rights, the International Covenant on Civil and Political Rights, and many other international and regional treaties, all deal with the minimum provisions of rights of inviolability of the home and secrecy of communications. South Africa, for example, has a recently written Constitution, i.e. 1996, which specifies rights to access and control one's personal information.

4 Informational Privacy and Fair Exchange

The notion of privacy in the context of information technologies is not something that is intuitively understood by individuals. As Introna (2000, p. 3) observes:

> Privacy (or the lack thereof) for most at least is easy to identify when experienced but difficult to define.

Preventing and correcting privacy breaches of personal data is a topic that continues to receive much attention, both in the media and academia (Accenture 2009; Kelly et al. 2002; Smith et al. 2011). Introna's (2000, p. 4) second definition of privacy is pertinent, and is thus stated:

> If a subject cannot control how their information is used, they may refrain from undertaking socially useful information-based activities.

This is often described as informational self-determination. As more and more governments and state bodies in particular move toward placing their services online (Chun et al. 2010), consumers are increasingly required to provide their personal information in order to access these services via the Internet. Without informational

privacy as core to any government services becoming digitized, the risk of disenfranchising consumers is great.

With regard to the fair exchange aspect of CMS, Introna's second definition (1997) of privacy may be understood by way of an example. If individuals cannot reasonably control how their information is used, they may refrain from undertaking socially useful information-based activities. If the individuals have all their digital communications on a large platform recorded by authorities by default, they are less likely to provide meaningful commentary in another context such as online forums. Conversely, should individuals believe that procedural fairness is in place, they are more likely to participate with the system (Culnan and Armstrong 1999). The notion of 'voice and control' over actual outcomes contributes to an individual's perception of procedural fairness.

Individuals may not understand the manifold measures, technological and legal, that are put in place to protect their personal data. Paradoxically, there exists a growing recognition that affording individuals control over their data is an important aspect for maintaining trust. Opinions on how this control is to be afforded differs, with the most common interpretations centering on information only being disclosed, used or disseminated with the express permission of the individual (Malhotra et al. 2004; Stewart and Segars 2002). In order to provide fair information practices for individuals, Culnan and Armstrong (1999, p. 107) provide a foundation for consequent research:

> People also have the right to control how their personal information will subsequently be used by objecting to uses of their personal information when information will be collected for one purpose and used for other purposes.

Digital communications platforms, in particular those aimed at deployment in the e-Government domain, should now be cognizant of the need for informational privacy:

> If we understand that privacy creates the clearing from which autonomy, trust, and accountability can emerge, then privacy will become part of the design agenda. (Introna 1997, p. 16)

This notion of privacy becoming part of the design agenda is core to the concept of by Design, as introduced by Ann Cavoukian (Cavoukian 2014). The concept of Privacy by Design (PbD) builds on the Fair Information Practices (FIPs) outlined by the Organization for Economic Cooperation and Development (OECD) in 1980 (Gellman 2012). Cavoukian argues that the scale of the technological revolution, in addition to its complexity, could not have been foreseen by the OECD when creating FIPs. To bring FIPs into the twenty-first century, she puts forth the edict of Privacy by Design: build privacy in early and thoroughly into your data management systems, and reap the many rewards that will result from enhanced trust (Cavoukian 2010). The seven Privacy by Design principles are as follows: Data Minimization, User participation, Safeguards, Accountability, Proactive not reactive, Privacy embedded design, and Positive-sum not zero-sum. The majority of these principles are met by CMS systems. Given that the informational privacy literature in recent decades repeatedly reinforces the fact that behavioral constructs of risk perception, perceived control and trust have an effect on users' levels of privacy concerns, which in turn affect their engagement (Culnan and Armstrong 1999; Whitley 2009;

Featherman and Pavlou 2003), certified mail systems indeed have a place in the digital world.

CMS allows individuals to associate the recipient of a message with the content of the message. This is not feasible with letter mail, unless the confidentiality of the message is compromised. Evidences are the distinction between CMS and standard communication systems such as email. Evidences afford individuals 'voice and control' over who they disseminate data to by ensuring that those with whom data has been shared cannot refute, at a later stage, that this has occurred. This creates an evidential chain showing the flow of data for which the originator is responsible.

5 Conclusion

A CMS does not require the role of the arbitrator to be involved in digital communications message transfer, i.e. the 'logistics' aspect of digital communications. It requires an independent trusted third party to evaluate the validity of any claims of incorrect behavior by parties to a communication.

As certified mail systems proliferate in the international interoperability marketplace (Tauber and Boldrin 2012), it is pertinent for NPOs to consider their position within this emerging world. The 'logistics' aspect of digital communications has commonplace solutions such as email plugins, webmail, etc., that are pervasive. It is up to individual NPOs to decide whether they find economic value in the provision of a full CMS communications solution, or target their resources towards the role of TTP arbitrator, cryptographic manager, leveraging their trusted position in society in this manner.

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Advanced Semi-parametric and Parametric Methods to Assess Efficiency in the Postal Sector

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1 Introduction

This paper uses Two-stage Data Envelopment Analysis ("TS DEA") and Stochastic Frontier models ("SF models")[1] to compare the efficiency performance of national postal operators. It applies TS DEA and SF methods to the same postal operator dataset, and compares their efficiency rankings and the way they account for the effect of exogenous variables. Section 2 contains a literature review. Section 3 applies two-stage DEA with bootstrapped Tobit regression and SF models to the database used in Pierleoni and Gori (2013). Section 4 concludes. The critical aspect of this paper is limited data availability (77 observations, seven operators for 11 years). This calls for caution in interpreting the results; there is a need for a combination of qualitative and quantitative analysis to fully grasp differences in performance between postal operators.

This paper represents the view of the authors and not necessarily of the affiliated institutions.

[1] We use the following software: DEA Frontier for DEA and Limdep version 10 for the second stage in TS DEA and for SF.

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2 Literature Review

2.1 Two Stage DEA and Exogenous Variables

DEA estimates a production possibility frontier consisting of the convex hull of input–output vectors (Farrell 1957), without requiring the definition of a functional form. Charnes et al. (1978) extended DEA to multiple input/output settings. Their model imposes three restrictions on the frontier technology: (1) constant returns to scale, (2) convexity of the set of feasible input–output combinations, and (3) strong disposability of inputs and outputs. DEA has evolved to treat variables that are beyond the direct control of management. Banker and Morey (1986a)[2] adapted DEA to allow for a partial analysis of efficiency on the basis of exogenously and non-exogenously fixed inputs and outputs (Murillo-Zamorano 2004). New developments have been proposed to overcome the drawbacks of DEA. Grosskopf (1996) provides a survey of statistical inference in non-parametric, deterministic, linear programming DEA models. The asymptotic results described in Grosskopf (1996) and developed in further references such as Kneip et al. (1998) or Park et al. (2000) may be misleading in small samples. In addition, the asymptotic sampling distributions in Grosskopf (1996) are available for univariate DEA frameworks, whereas most DEA applications deal with multivariate ones.

These limitations can be overcome by using bootstrapping techniques to analyze the sensitivity of the efficiency scores to the sampling variations of the calculated frontier, provided a reasonable data-generating process and estimator are used (Simar and Wilson 1998). The procedure for constructing confidence intervals requires bootstrap estimates of bias to correct for the bias of the DEA estimators. The use of these biased estimates introduces a further source of noise into the process (Simar and Wilson 2000a), a weakness corrected by Simar and Wilson (1999c) with an improved procedure. Several issues remain to be solved, namely the high sensitivity of non-parametric approaches to extreme values and outliers, and how to account for random noise in a non-parametric framework (Murillo-Zamorano 2004).

2.2 Stochastic Frontier Model and Exogenous Variables

Aigner et al. (1977), Meeusen and van den Broeck (1977) and Battese and Corra (1977) simultaneously developed a SF model that separates efficiency effects from random noise whilst accounting for the impact of non-controllable factors. SF models have been extensively used to estimate cost and technical efficiency in applied economic research.[3] Generally, they assume that the error term comprises two

[2] Koop had treated this issue in 1981. Fare et al. (1994) also analyze the non-discretionary variables by what they referred to as 'sub-vector optimisations'.

[3] Kumbhakar and Lovell (2000), Coelli et al. (2005), Kumbhakar and Tsionas (2006), Greene (2008) and Kumbhakar et al. (2012) are reviews of such applications.

terms: statistical noise and inefficiency. The term representing statistical noise is assumed to be an independently and identically distributed normal random variable, while the one-sided inefficiency term can be distributed as half-normal, exponential, truncated normal, or gamma. SF models can be applied to cross-sectional and panel data. The efficiency estimates obtained from cross-sectional models, although unbiased, are inconsistent. This is not the case with panel data. Schmidt and Sickles (1984) develop a SF panel model where inefficiency is measured by fixed (or random) effects. Panel data models have been further refined to include efficiency estimates obtained with maximum likelihood techniques (Pitt and Lee 1981) and time-varying efficiency (Battese and Coelli 1995; Cuesta 2000). Further developments include accounting for individual heterogeneity in time-varying SF models (Greene 2005a, b).

3 Applying TS DEA and SF Models to the Postal Sector

3.1 The Database

Our modelling is based on six variables for seven countries (Italy, Austria, France, Germany, the UK, Finland and the US). Four are linked to the postal operator and hence endogenous to the firm: total cost of mail ("TCM"), total mail volumes ("TV"), unit labor cost ("ULC", the ratio of labor cost to mail employees), and volume per dwelling ("VPC", the ratio of TV to number of dwellings); two are exogenous variables: the urbanization rate ("UR", the ratio of urban to total population) and total population ("POP"). The database is limited to annual data for the period 1998–2008 because prior to 1998 some operators were state departments, and data on labor costs is difficult to harmonize. Since 2008, three major changes have occurred: growing competition, e-substitution and the economic and financial crisis; these will have to be accounted for in any future research. The sources of the database are: NERA (2004), Gori et al. (2006) and Comandini et al. (2010), updated using 2008 annual reports, and the Universal Postal Union ("UPU")'s statistics. For demographic and population data, we use the UPU database (2003, 2004, 2005, 2007) and The "Pocket World in Figures" (2003–2007), Pierleoni (2012), Pierleoni and Gori (2013) and Gori (2013, 2014). For Finland and Austria, UR came from the UN Habitat project. For monetary values of non-Euro currencies, we used fixed exchange rates for the pound (1£ = 1.45€) and the dollar (1$ = 0.86€), based on averages over the last decade.[4] The input variable for DEA is ULC, the ratio of total gross labor costs incurred by each postal operator to total full time equivalent workers directly employed in the mail division or in the departments managing postal products, excluding employees of foreign subsidiaries. We consider this variable not to be

[4] A flexible rate would distort the data on costs by negatively impacting the operators of countries which have experienced devaluation and positively impacting those operating in currencies with higher exchange rates.

fully controllable by management because several factors influence either labor costs or employee numbers. For example, salaries may not be set by management because the employees are government employees, or there is an industry wide contract with a minimum salary, or there is collective bargaining since postal operators tend to be unionized. Moreover, employee numbers may be beyond management's control because the universal service obligation and quality targets require postal operators to be ubiquitous, and because of the nature of postal operators in terms of state ownership, regulation, unionization, and legislation protecting employees' rights.

3.2 DEA2s with Bootstrapped Tobit Regression

The objective of this paper is to measure the efficiency performance of the seven postal operators by applying semi-parametric and parametric approaches, taking into account the role of exogenous cost-shifters. Our TS DEA uses input oriented DEA with variable returns to scale ("VRS") in the first stage. The following reasons justify using DEA with VRS. First, the selected operators have very different scales of operations. Second, previous studies show that scale is very important to determine the cost structure of a postal operator (Gori et al. 2006). Lastly, the inefficiency scores obtained from DEA with VRS are equivalent to "pure" inefficiency scores obtained from SF models without considering external factors (Amornkitvikai and Harvie 2010).

In the second stage, we regress the efficiency scores from the first stage on two exogenous variables, using the bootstrapped Tobit regression proposed by Simar and Wilsons (2007) to correct for bias and serial correlation of the dependent variable. We note that the lack of data represents a shortcoming for the robustness of our results, as currently only 11 years of data are publicly available for each country.

Our empirical analysis starts with TS DEA. We first apply simple DEA (input-oriented with VRS) considering as input variables TCM and ULC, as a proxy of the input wage, and TV as output variable.

We then regress the efficiency scores, each ranging from 0 to 1, on UR and POP (the latter expressed in logarithms). We assume that the underlying cost function is Cobb Douglas, expressed in log form as:

$$\ln C = \ln(A) + \alpha \ln(TV) + \sum_{i=1}^{n} \gamma_i \ln(Z_i) + \mu \tag{1}$$

Where: C = TCM, A is a constant, and Z_i are independent variables described above represented by ULC, POP, UR and another exogenous variable, MOU, which is the percentage of the total surface of a country which is mountainous; finally μ is an error term. The coefficients measure elasticities.

After the simple DEA is carried out in the first stage, in the second stage, the estimated equation is:

$$Eff_{it} = \alpha_o + \alpha_i + \beta_1 \ln\left(POP_{it}\right) + \beta_2 URB_{it} + \varepsilon_i \quad (2)$$

where Eff_{it} are the efficiency scores for each postal operator and year, obtained from the first stage non-parametric DEA. These estimated efficiency scores presented problems of serial correlation. To overcome this, we estimated Eq. (2) using bootstrapped Tobit regression (a parametric method) for panel data, with 1,000 replications. The number of replications is based on Poi's (2004, p. 320) argument, "…we have chosen to use 1,000 bootstrap replications, though we have not given any formal justification for using this number. On the one hand, using more replications provides more accurate bootstrapped statistics, yet in practice we must weigh the benefit of more bootstrap replications against the computational cost associated with them." Our results are presented in Table 1.

All coefficients are significant, signaling that the exogenous variables have a significant impact on the efficiency scores obtained in the first stage, and therefore on the levels of efficiency of the postal operators under scrutiny. Table 2 shows the efficiency ranks and the average of efficiency computed for the sample period for the seven postal operators according the simple DEA and the two stage DEA methods. As mentioned before the efficiency scores related to each postal operator for the 1998–2008 period are based on the estimated coefficients of Eq. (2) using a bootstrapped tobit regression[5]

Table 1 Estimates of efficiency with bootstrapped Tobit regression

Dependent variable:	Eff_{it}					
	Observed value	Std-error	T	95 % Conf. interval		
Constant	2.24	0.367	6.13*	1.524521	2.959513	(N)
				1.489608	2.882219	(P)
				1.528499	3.006179	(BC)
Log(POP)	0.15	0.047	3.21**	0.0584715	0.242615	(N)
				0.050519	0.2361429	(P)
				0.0593269	0.2572891	(BC)
UR	−4.037	1.027	3.93*	−6.053592	−2.021031	(N)
				−5.659078	−1.638297	(P)
				−5.673702	−1.661388	(BC)

*=1 % significance level, **=5 % significance level
Note: *N* normal, *P* percentile, *BC* bias-corrected

[5]As suggested by Banker and Natarajan (2004) and Barnum et al. (2008), it would be useful for further research to apply a significance test to the efficiency scores obtained by the simple and two stage DEA presented in Table 2. This would allow analysing another interesting topic, that is, the relevance of the related ranks.

Table 2 Rank and average efficiency of each postal operators

Postal operators	Rank first stage DEA	Average efficiency (1998–2008)	Rank two stage DEA	Average efficiency (1998–2008)
Poste Italiane	6	0.70	1	1.00
Österreichische Post	2	0.92	2	0.97
USPS	1	0.95	3	0.92
Itella	3	0.88	4	0.86
La Poste	4	0.72	5	0.85
Deutsche Post	7	0.57	6	0.40
RM	5	0.72	7	0.28

N.B. "1" represents the most while "7" the least efficient

To analyze these rankings it is important to go one step backward. As explained above, in the first stage we carried out simple DEA without exogenous variables: the second column in Table 2 shows the first stage rankings. The change in rank after the second stage (column 4) is mainly due to the impact of the UR coefficient, with a negative sign (Table 1). Thus, the rank of operators (such as Royal Mail and USPS) with high UR worsens in the second stage compared to the first stage. This strong result reinforces the counterintuitive results of Pierleoni and Gori (2013), where higher urbanization leads to higher costs, due to the fact that urban postal networks are already saturated while rural networks can manage more volumes without impacting the cost structure. The economic implication of this analysis is that it is more difficult for operators facing highly urbanized populations to improve efficiency because they have fewer opportunities to optimize their operations.

3.3 SF Modelling

Our SF modelling is based on three different techniques, P&L, BC, and Cuesta.[6] The P&L model assumes that inefficiency is time invariant, the BC model assumes that it varies over time but identically across countries, and the Cuesta model assumes that the time path of inefficiency differs across countries. We started out by using the same variables in the TS DEA, but the models failed to converge. This was due to singularity problems brought about by the small variation in UR, POP, and costs. As it is important to follow tradition and separate economies of scale from density effects, we express TCM as a function of scale, measured as the number of dwellings in the country (a proxy for the number of delivery points), density, measured as VPC (a proxy for items per delivery point), and factor prices, proxied by ULC. The model is estimated in logarithms, i.e. it assumes a Cobb-Douglas functional form which is applied across all countries. The results are shown in Table 3.

[6] A specification with the mean of the inefficiency term as a function of exogenous determinants did not lead to satisfactory results.

Table 3 SF models: estimated coefficients and t-ratios

	P&L		BC		Cuesta	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Constant	0.86	0.39	2.08*	11.55	1.38*	6.38
Scale	1.05*	15.99	1.08*	113.68	1.10*	58.08
Density	0.52	1.29	0.55*	28.68	0.49*	18.41
ULC	0.23	1.16	0.24*	−4.16	−0.01	−0.16
Poste Italiane					0.3872	1.33
Deutsche Post					0.32*	2.85
La Poste					0.26*	3.24
Royal Mail					0.02	0.57
USPS					0.56**	2.09
Österreichische Post					−0.14481***	−1.77
Itella					0.10*	4.42

* = 1 % significance level, ** = 5 % significance level, *** = 10 % significance level, the number of observations are the same as above

The coefficients of the scale and density variables are highly consistent across the three models, while that of ULC is more unstable. In line with previous findings, there is evidence of constant returns to scale, and of economies of density; a 1 % increase in scale (number of dwellings) increases costs by 1 %; and a 1 % increase in density (mail items per dwelling) increases costs by about 0.5 %. The coefficient on the time path of efficiency for the BC model is highly significant, as are the country-level coefficients for the efficiency trend for most countries, with the sole exception of the UK and Italy. The time path of inefficiency implied by the BC model rises sharply over time, implying that inefficiency increases in every country, and in the same fashion. The country specific time paths for inefficiency implied by the Cuesta model differ for each country but are still increasing. Table 4 shows the inefficiency scores for the three models.

Average inefficiencies, computed over the sample period, and the implied rankings by country are shown in Table 5. Because the coefficients for the time path of inefficiency are significant for the Cuesta model, and the BC model is nested within it, the large differences in estimated inefficiency between the two models may be taken as an indication that it is not correct to assume that different countries have the same temporal efficiency path, and that this assumption leads to misleading results. It is important to note that these models do not account for the impact of non-controllable time invariant factors that are specific to individual countries, which may be confused with that of inefficiency, thereby over-estimating its extent. This is a particularly serious problem when comparing countries with very different geographic makeups. Adding time-invariant factors to the models has proved impossible because the models fail to converge, as we explained above. The results show that looking at cross-country comparisons using inadequate models or datasets, and using the results for policy would lead to erroneous conclusions.

Table 4 SF: implied inefficiency scores

Year	Postal Operator	P&L (%)	BC (%)	Cuesta (%)	Postal Operator	P&L (%)	BC (%)	Cuesta (%)
1998	Poste Italiane	11.7	2.4	0.2	Deutsche Post	8.7	4.1	0.9
1999			2.9	0.4			5.0	1.2
2000			3.5	0.5			6.0	1.7
2001			4.2	0.8			7.3	2.3
2002			5.1	1.1			8.8	3.2
2003			6.2	1.7			10.6	4.3
2004			7.4	2.4			12.7	5.9
2005			8.9	3.5			15.2	8.0
2006			10.8	5.2			18.1	10.8
2007			12.9	7.5			21.6	14.5
2008			15.4	10.9			25.5	19.3
1998	La Poste	6.6	3.5	1.6	Royal Mail	15.6	3.7	12.7
1999			4.2	2.0			4.4	12.9
2000			5.0	2.6			5.4	13.1
2001			6.1	3.4			6.5	13.3
2002			7.4	4.4			7.8	13.5
2003			8.9	5.6			9.4	13.7
2004			10.7	7.2			11.3	13.9
2005			12.8	9.1			13.5	14.2
2006			15.3	11.6			16.2	14.4
2007			18.3	14.8			19.3	14.6
2008			21.7	18.6			22.9	14.9
1998	USPS	3.7	3.3	0.1	Österreichische Post	2.3	0.4	17.4
1999			4.0	0.1			0.4	15.2
2000			4.8	0.2			0.5	13.3
2001			5.8	0.3			0.6	11.6
2002			7.0	0.6			0.8	10.1
2003			8.4	1.0			0.9	8.8
2004			10.2	1.7			1.1	7.7
2005			12.2	3.0			1.4	6.7
2006			14.6	5.2			1.6	5.8
2007			17.5	8.8			2.0	5.1
2008			20.8	14.9			2.4	4.4
1998	Itella	33.4	8.0	24.1				
1999			9.6	26.3				
2000			11.6	28.6				
2001			13.9	31.0				
2002			16.6	33.6				
2003			19.8	36.4				
2004			23.5	39.3				

(continued)

Table 4 (continued)

Year	Postal Operator	P&L (%)	BC (%)	Cuesta (%)	Postal Operator	P&L (%)	BC (%)	Cuesta (%)
2005			27.7	42.3				
2006			32.6	45.5				
2007			38.0	48.9				
2008			44.1	52.3				

Table 5 Average efficiency and ranking

	Average efficiency			Rank		
	P&L (%)	BC (%)	Cuesta (%)	P&L	BC	Cuesta
Poste Italiane	11.7	7.2	3.1	5	2	1
Deutsche Post	8.7	12.3	6.6	4	6	3
La Poste	6.6	10.3	7.4	3	4	4
Royal Mail	15.6	10.9	13.7	6	5	6
USPS	3.7	9.9	3.3	2	3	2
Österreichische Post	2.3	1.1	9.6	1	1	5
Itella	33.4	22.3	37.1	7	7	7

4 Conclusion and Way Forward

The two models have produced very different results. TS DEA with bootstrap shows that exogenous variables have a significant impact on efficiency, changing the ranking dramatically. DEA however is a non-parametric technique and does not distinguish between noise and inefficiency. SF models do, but adding UR and POP to these models results in failure to converge: the effect of these country specific factors may therefore be confused with that of inefficiency, and care has to be taken to interpret the results. Future analyses could expand the database by increasing the number of years, postal operators and number of variables. It would also be helpful to identify the characteristics of the different methods with special attention to those that have difficulty in managing time invariant exogenous factors. For example, the effect of exogenous variables in simple DEA or that of time invariant factors that are specific to individual countries in SF may be confused with that of inefficiency. Finally, it may be possible to mix parametric with non-parametric methods to take advantage of the characteristics of each method: till now the most promising results with our dataset have emerged from two stage semi-parametric methods.

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On the Detection of Market and Intangible Benefits Through Consumer Surveys

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1 Introduction

The 2008/6/CE Directive of the European Parliament and of the Council, of 20 February 2008, states that the net cost of universal service obligations (USO) is to be calculated as the difference between the net cost for a designated Universal Service Provider (USP) operating under USO and that of the same provider operating without USO. The Directive also requires taking into account in the calculation any other relevant elements, including "any intangible and market benefits which accrue to a postal service provider designated to provide universal service". With the transposition of the Directive into national legislations, Member States are required to implement a mechanism for the calculation of the USO net cost which will fulfill the provisions of the Directive, including an evaluation of the intangible benefits enjoyed by the USP.

In order to provide a general definition of what intangible benefits are, the WIK-Consult (2010) operational definition has been used: "a benefit is classified as 'intangible' when a universal service provider's performance and cost accounting, and its calculation of the net cost of the universal service obligation does not (fully) reflect the impact on revenues and cost that result from the existence of this benefit". WIK Consult also pointed out that: "The definition is relevant insofar as the identification of such benefits becomes necessary only if they are not already included in the universal service provider's net cost calculation".

The views expressed in this paper are those of the authors only and do not necessarily reflect those of Poste Italiane.

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According to WIK's definition, intangible benefits could be those that, as a consequence of an error, have not been included in the net cost calculation: in fact, if one has considered all aspects of universal service provision there should be no element left out of net cost calculation. However, to understand the reason why the Third Directive introduced the intangible benefits concept, it is necessary to consider the change of methodology of universal service burden calculation introduced by that Directive versus the Second Directive.

The Second Directive defined the burden as the negative difference, if any, between revenues and cost of universal service provision. The Third Directive introduced a more sophisticated method of universal service burden calculation. In particular, according to the Third Directive, the net cost should be calculated "as the difference between the net cost for a designated universal service provider of operating with the universal service obligations and the same postal service provider operating without the universal service obligation" (Panzar 2000; Bergum 2008; Fustier et al. 2014).

The methodology of the Third Directive aims at measuring the profit lost by the USP (Universal Service Provider),vs a non-universal service obligation status, because of the universal service provision. However, the Third Directive specifies that while the calculation may be widened, in respect to the previous Directive, to take into account not only losses but also lost profit, at the same time that calculation must also take into account all benefits that the USP might enjoy thanks to universal service provision (which were not explicitly considered by the previous Directive).

In the specific case of a company providing only postal universal services, all intangible benefits would be already included in the net cost calculation (Jaag et al. 2011). In the case of a provider offering both universal and non-universal services, by limiting the analysis to universal services, as prescribed by the Second Directive, not all benefits need to be included in the net cost calculation. Benefits that are not included in the calculation and are considered as intangible need to be measured. For example, a USP that offers both postal and financial services could happen to compute the net cost with reference only to postal services (as prescribed by the Second Directive): in this case, the intangible benefits might be those that the company enjoys in the provision of financial services thanks to its USP status. Starting from the WIK definition, it is possible to identify the two main problems related to market and intangible benefits: the first relates to whether these are already included in the USP's net cost calculation; the second – which arises if the answer to the first issue is no – relates to their measurement.

On behalf of the European Commission, in January 2013, Frontier Economics (2013) carried out a 'Study on the principles used to calculate the net costs of the postal USO'. On market and intangible benefits, in the absence of any further guidance by the Directive, and considering the very limited international experience to date, Frontier Economics asserted that "the methods for quantifying the USO intangible and market benefits are sketchy and at a preliminary stage of development in post. There is no established method for dealing with each benefit attributed to the USO and the applicability of the preliminary methods to real data remains to be tested and evaluated. The public evidence on the actual application is also limited". Frontier Economics also stated that it was unaware of studies in the

economic literature which produced an evaluation of intangible benefits, the only exception being one study, carried out by London Economics in 2002, on Royal Mail's intangible benefits.

This paper aims to provide insights on the potential sources of any intangible and market benefits which accrue to a USP due to universal service provision. In particular the focus is on two of the most important of such benefits identified by the economic literature: enhancement of brand value and demand complementarities.

The issue of enhancement of brand value and demand complementarities, as sources of intangible benefit, will be tackled through the results of a series of multi-year customer surveys, highlighting the behavioral drivers in the choice of purchasing USO and non-USO products provided by the USP (with a special focus on financial services). A measure of how many customers are driven primarily by PI's USP status in their financial services purchases could help toward the measurement of intangible benefits enjoyed by the USP. The analysis will be conducted with reference to the Italian USP, Poste Italiane (PI). The case of Italy is particularly interesting, since PI also provides a wide range of financial services whose revenues are higher than those it obtains on USO service. However, it is possible that revenue from financial services is higher as a result of the USO.[1]

The paper is arranged as follows: Sect. 2 illustrates how a set of specifically designed surveys can contribute toward understanding potential sources of intangible benefits enjoyed by the USP, while conclusions are in Sect. 3.

2 Brand Value and Demand Complementarities

Frontier Economics (2013) provides a list of intangible benefits frequently discussed in the postal literature. Among others, this paper will focus on: enhancement of brand value, that is higher sales due to positive impact of brand (customer retention and acquisition), and demand complementarities, that is higher sales of other products (as complement to the sale of USO products). Examples include benefits derived from PO's ability to provide one-stop-shopping. Demand complementarities could also work in the opposite direction. For example, if customers view the USP in a bad light because of poor quality of service, that bad reputation may spill over into demand for the USP's non-USO offerings.

Enhancement of brand value and demand complementarities seem to require the development of new tools. They are rooted in the purchasing behavior of customers. Therefore, they may require analysis, possibly through consumer surveys that capture customers' decision criteria that drive the selection of non-USO services provided by the USP versus those offered by other providers.[2] In this paper, a

[1] Poste Italiane provides also services which are different from postal universal and financial ones, but financial services are by far the most important source of diversified revenues, so the analysis conducted in this paper will concentrate on financial services only.

[2] Also Copenhagen Economics (2011) suggested to use consumer surveys to quantify intangibles.

methodology based of consumer surveys is used to capture customers' decision criteria that drive the selection of PI's non-USO services versus those offered by other non-USO providers.

In what follows it will be presented the consumer surveys that may provide an estimate of the purchasing behavior of financial services customers who choose to buy PI's financial services primarily because of PI's USP status.

2.1 Consumer Surveys

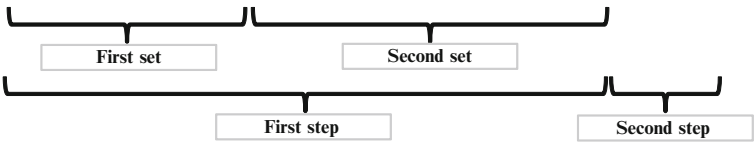
To provide a starting point for estimating PI's profit from financial services as a consequence of being the USP in Italy, two steps were developed. The first step is grounded on two series of customer surveys (the first one repeated three times over the years and the second one repeated twice over the years): (1) consumer surveys developed by IPSOS in 2009, 2011 and 2012, which aim at quantifying the degree of joint purchasing behavior between financial and universal services by consumers in the post office; (2) customer surveys developed by GN Research in 2010 and by Doxa in 2012, which investigate the purchasing behavior of PI's financial services customers. In particular, these surveys are designed to capture customers' decision criteria driving the selection of BancoPosta (i.e. PI's Division in charge of financial services provision) versus other financial services providers. The second step is grounded on a customer survey developed by Customized Research & Analysis (C.R.A.) in 2014 which investigates the reason of choosing Poste Italiane as financial service provider. Table 1 highlights the main methodological characteristics of each survey.

2.2 Results of the Surveys

The benefits on financial services provision deriving from the fact that the provider of financial services is also the USP must be reflected in the willingness of consumers to purchase more financial services from BancoPosta than they would do if BancoPosta were not part of the USP. Financial services provided by PI can be clustered in the following three categories: (1) payment services, which allow consumers to pay, for example, utilities bills, fines, etc.; (2) current account services, meeting cash management needs of customers; (3) investment and saving services, meeting saving allocation needs of customers, through products like, for example, savings accounts, insurance and bonds. It is important to note that payment services (and some investment services) can be purchased by consumers even if they do not hold a BancoPosta current account.

Table 1 Customer surveys

	Customer satisfaction of BancoPosta current account holders (2010)	Customer satisfaction of BancoPosta current account holders (2012)	Services provided at the post offices 2009 Barometer	Services provided at the post offices 2011 Barometer	Services provided at the post offices 2012 Barometer	Reasons for choosing Poste Italiane as financial services provider 2014
Company in charge	GN Research Institute	Doxa Institute	IPSOS Institute	IPSOS Institute	IPSOS Institute	CRA Institute
Survey technique	CATI technique (computer aided telephone interview)	CATI technique (computer aided telephone interview)	Personal face-to-face interviews in a sample of 665 small and large post offices in the	Personal face-to-face interviews in a sample of 500 small and large post offices in the	Personal face-to-face interviews in a sample of 500 small and large post offices in the	On-line questionnaires
Period of survey	Jan/Feb 2010	Nov/Dec 2012	Nov/Dec 2009	Nov/Dec 2011	Nov/Dec 2012	Jan 2014
Sample	2,100 interviews to BancoPosta current account holders, representative of all current account holders	2,100 interviews to BancoPosta current account holders, representative of all current account holders	9,044 interviews in 665 post offices, representative of all post office customers	5,326 interviews in 500 post offices, representative of all post office customers	5,320 interviews in 500 post offices, representative of all post office customers	4,020 interviews representative of the adult Italian population
Sample selection			Random selection "fixed time step" at the post office (post office's customers) Stratified	Random selection "fixed time step" at the post office (post office's customers) Stratified	Random selection "fixed time step" at the post office (post office's customers) Stratified	



2.2.1 First Step

A starting point for the estimate of the positive effect that the US provision generates on BancoPosta can be obtained through the results of customer surveys carried out by IPSOS. In these surveys, customers in post office premises – not(necessarily) BancoPosta current account holders –were asked which of PI services they were about to purchase. The survey's results show that among consumers purchasing payment services, 5.6 % in 2009, 5.1 % in 2010 and 5.2 % in 2012 purchased also USO products at the same time. In addition, these surveys show that among customers purchasing other financial services (i.e. current account services and investment services as previously defined) 3.2 % in 2009 and 3 % in 2010 and 2012 purchased also USO products on the same occasion. These results are summarized in Table 2. However, it is important to notice that the joint purchase of financial and universal services does not necessarily mean that the financial services demand is enhanced by universal service provision. This issue will be addressed in Sect. 2.2.2.

Before discussing in depth the results of the IPSOS surveys just presented, it is worth analyzing the results of the second set of surveys of the first step of analysis, which will help to interpret the insights gained so far. Based on the customer surveys made by GN Research in 2010 and Doxa in 2012, Table 3 shows the percentage of BancoPosta's customers (current account holders),who believe that PI has a positive/neutral/negative influence on BancoPosta.

Table 2 Commercial behavior of consumers at the post office

		2009	2011	2012
(A)	% of consumers who purchased payment services	57.0	57.0	61.0
	of which:			
(B)	% who purchased payment services + USO products	3.2	2.9	3.2
(C = B/A)	**Number purchasing payment services + USO products** --- **Number purchasing total payment services**	**5.6 %**	**5.1 %**	**5.2 %**

		2009	2011	2012
(A)	% of consumers who purchased other financial services	25.0	33.0	27.0
	of which:			
(B)	% who purchased other financial services + USO products	0.8	1.0	0.8
(C = B/A)	**Number purchasing other financial services + USO products** --- **Number purchasing other financial services**	**3.2 %**	**3.0 %**	**3.0 %**

Table 3 PI's influence on BancoPosta

	GN research	Doxa
	Jan 2010 (%)	Dec 2012
Positive influence	55.8	58.9 %
No influence	41.6	36.4
Negative influence	2.6	4.7 %
Net positive impact	**53.2**	**54.2 %**

	GN research	Doxa
Reasons for PI's positive influence	Jan 2010 (%)	Dec 2012 (%)
Higher level of trust	48.6	45.3
Better brand name	3.6	8.1
Service efficiency	3.3	7.6
Long historical presence	3.6	5.7
Quality of professional staff	2.1	5.1
Transparency/clear communication	1.8	3.8
Network coverage/National entity	7.6	3.4
Italian company	2.6	3.2
Synergy between postal and banking services	0.2	3.0
State-owned company	13.8	2.8
Competitiveness/wideness of services offered	8.3	2.2
Greater customer protection/customer orientation	2.4	1.3
Other	0.4	5.0
No answer	1.8	3.5
Total	100.0	100.0

As it can be seen from Table 3, 55.8 % of respondents in 2010 and 58.9 % in 2012 believe that PI has a positive influence on BancoPosta while, at the same time, 2.6 % of the sample in 2010 and 4.7 % in 2012 believe that PI has a negative influence on BancoPosta. If a certain percentage of customers value positively the ownership of PI on BancoPosta and another, lower, percentage, value such ownership in negative terms, a net influence of PI's ownership might be calculated as the difference between the two percentages. The difference between the two values is 53.2 % in 2010 and 54.2 % in 2012. These results do not solve the issue of how big is the positive or the negative influence that PI has on BancoPosta. To solve this issue, the survey that will be presented in the second step has been conducted.

Table 3 also highlights that the most important positive feature of PI for BancoPosta's customers is by far their trust in the provider. 'Higher level of trust', 'Long historical presence', 'Italian company' and 'State-owned company', are all features related to the safety of the provider. By summing their percentages it is possible to obtain a value of 68.5 % in 2010 and 56.9 % in 2012. These values express the safety that customers enjoy from dealing with a trusted, Italian State-owned company, as reflected in its 'better' brand name. Although the brand name effect seems to stem from State ownership and not from the provision of the USO, no final conclusion can be drawn on the basis of these answers only; the uncertainty will be solved through the results of the survey in the second step of analysis. The brand name of PI seems to be inextricably linked with its acting as a State owned services provider (postal and financial) since the foundation of the Country. This conclusion is in line with that outlined by Frontier Economics (2013): brand name effects are to be attributed to State-ownership and not to USO. This conclusion is also reinforced by the survey's results where none of the respondents spontaneously declared "US provision" among the reason of positive influence of PI on BancoPosta.

In relation to demand complementarities, the positive effect that US provision generates on financial services sales, according to BancoPosta current account holders, could be investigated through the results shown in Table 3: in particular, the percentage of answers related to the 'synergy between postal and banking services' is to be considered as a proxy for this positive effect. Although on the basis of the survey results it is not possible to fully understand what "synergy" means for the respondents, the second step will let us shed light on the matter.

It is also important to note that the answer 'Network coverage/National entity' provided by interviewees is, at least partially, linked with US and the geographical coverage associated with it. Although 'National entity' does not univocally mean 'universal service', the concept of 'National entity' might be cautiously associated with 'universal service' (being aware that, as a consequence, the positive impact of PI as USP will be overestimated). This approximation will be addressed in the second step of analysis. Summing values related to 'Network coverage /National entity' and 'Synergy between postal and banking services', leads to value of 7.8 % in 2010 and a value of 6.4 % in 2012, representing the USO characteristics providing a positive influence on BancoPosta sales, according to current account holders. These values must be weighted by the net positive effect of PI on BancoPosta (53.2 % of customers) obtaining 4.2 % in 2010 and 3.5 % in 2012. This represents a measure

Table 4 Net influence of PI's USP status on customers' choice of BancoPosta

		GN research	Doxa
		Jan 2010 (%)	Dec 2012 (%)
(A)	Network capillarity/National entity	7.6	3.4
(B)	Synergy between postal and banking services	0.2	3.0
(C = A + B)	Total (customers choosing BancoPosta because of characteristics linked with US provision by PI)	7.8	6.4
(D)	Net positive effect of PI on BancoPosta	53.2	54.2
(E = D * C)	**Net influence of PI's US provision on the choice of BancoPosta by its customers**	**4.2**	**3.5**

of BancoPosta customers that choose it as their provider because BancoPosta is part of a company (Poste Italiane) which is the national USP. This is summarized in Table 4.

The results of these surveys confirm the results of previous surveys.[3] For 2012, IPSOS survey leads to an estimate of the US provision positive influence on current account services and investment services of 3 %, while the survey carried out by Doxa leads to a result of 3.5 %. Such a higher result in the Doxa survey can be explained considering that the Doxa survey was based on a sample of BancoPosta current account holders, i.e. of more loyal PI's financial services customers.

It is then possible to discuss in depth the results of the IPSOS surveys to elaborate a more precise estimate of the reasons that drive customers to choose BancoPosta, based also on the insights provided by the second set of surveys. In fact, the IPSOS surveys (all surveys of the second set were run by IPSOS) give a more general view of consumers buying PI's financial services, since they are based on the answers of all consumers in the post offices, as opposed to the other two surveys, which concentrated on consumers already holding a BancoPosta current account.

The result by IPSOS in 2012 (see Table 2) highlights that 5.2 % of customers purchasing payment services also purchase USO products.

In relation to current account services and investment services, the results by IPSOS 2012 lead to an estimate of 3 % (Table 2) as a measure of joint purchasing of USO and financial services. However, as shown by the answers provided by BancoPosta current account holders, the most important reason behind the purchase of financial services is, in most cases, the safety of the provider, and, thus, the State ownership of the company, rather than its USP status (see Table 3). Therefore, only the purchase of current account services – as well as the purchase of payment services -is sensitive to the US characteristics of the distribution network (e.g. geographical coverage) and, so, can be assumed to positively benefit from US provision. Conversely,

[3] Results of the surveys on consumers at the post office premises (IPSOS) and those conducted on BancoPosta current account holders (GN Research and Doxa) are not strictly directly comparable, since they refer to two different consumer segments (see Table 1).

the purchase of investment and saving services is sensitive to characteristics of the provider which are independent of US provision, i.e. the issuer's reliability and safety, as well as to the competitiveness and transparency of the services provided. In fact, the perception of PI's financial services reliability and safety stems directly from the State ownership of the Company, rather than from its USP status. Furthermore, it is obvious that going to the post office to purchase a stamp for a postcard will be by no means a sufficient reason to purchase in the same place a 10,000 Euros postal bond, while a customer may find it convenient to pay the electricity bill at the post office together with purchasing a stamp.

As a consequence, the positive influence deriving from US provision can be applied only to those services that are sensitive to characteristics connected with US provision (i.e. payment services and current account services) and not to those services which meet customers financial needs related to the trustworthiness of the provider (i.e. investment services).

2.2.2 Second Step

The 2014 C.R.A. research consisted of three separate questionnaires: a first questionnaire addressed to holders of at least one investment and/or loan product issued by Poste Italiane (as, for example, savings accounts, insurance and bonds); a second questionnaire addressed to holders of BancoPosta current accounts, and a third questionnaire to consumers who, over the last year, had made at least one payment transaction at the post office (for example, payment of bills, money order, etc.). This segmentation aimed at analyzing the reasons why customers choose Poste Italiane in each of the three families of financial products offered by the company (investment, current account and transaction).

The market research is organized along two main questions: in the first set of questions, respondents were asked to indicate the main reason for choosing Poste Italiane, while in the second set of questions, it was scrutinized the specific reason behind each of the given answers to the first set of questions in order to verify its connection to PI status of USP. The answers given by respondents to the first set of questions are shown in the following table (Table 5).

For investment products and current accounts services, the main driver of customer choice relates to the economic characteristics and quality of financial products offered by the company (the answer "Cheaper economic conditions/provides better services" has been chosen respectively in 44.3 % and in 52.9 % of cases); as for payment services, the main driver of customer choice is the service easiness (the answer "Easiness of service" was shown in 20.3 %). Respondents who answered "Cheaper Economic Conditions/provides better services" declared to choose Poste Italiane for the economic characteristics and for the quality of financial products offered by the company, which are independent of Universal Postal Service provider status.

Similar implications followed from responses to "There is more privacy" and "Courtesy/Staff competence", since both the level of privacy offered by the com-

Table 5 Main reason for choosing Poste Italiane

	Investment products (%)	Current account services (%)	Payment services (%)
Cheaper economic conditions/ provides better services	44.3	52.9	20.1
More trust/is more reliable	10.7	7.7	19.4
There is more privacy	0.9	0.3	1.1
Easiness of service	20.0	23.8	20.3
Courtesy/staff competence	0.9	0.5	3.0
Does not indicate	22.9	15.2	33.9
TOTAL	100	100	98

pany and the staff expertise are not linked with the status of Universal Postal Service provider. Responses to "More trust/Is more reliable" and "Easiness of service" are open to different interpretations and require further analysis. In fact, the greater confidence in Poste Italiane could also derive from being a supplier of the universal postal service. The "easiness of service" might be linked to either the widespread presence of post offices throughout the country or to the possibility for customers to simultaneously perform at the post office both financial and Universal Service transactions.

Therefore, to estimate the choice of financial services customers connected with PI's provision of the universal service, it is necessary to analyze in detail specific reasons behind the two categories named "More trust/is more reliable" and "Easiness of service". Such an analysis is illustrated in the Table 6 below.

In relation to the category "More trust/is more reliable", the answer: "it is responsible for delivering mail throughout the national territory" indicates that the greater confidence in Poste Italiane as a financial services provider stems from it being the universal service provider and, therefore, should be considered as an advantage of being the Universal Service provider that Poste Italiane enjoys on a different market. On the contrary, the answers: "it is owned by the State", "it is an Italian company", "it protects all customers in the same way" and "the payment is more secure/ guaranteed" cannot be linked to the notion of Universal Service, since, in this case, the confidence expressed by respondents relates to the nationality and the State ownership of Poste Italiane.

On "Easiness of service", the answers "postal offices are more comfortable", "it is easier to underwrite financial products/services", "I can control the investments through the Internet", "longer/flexible opening hours", "there are no barriers to entry" and "Comfort/opening times" indicate that the easiness of service appreciated by respondents relates to the quality of service offered by PI as financial services provider and it does not arise from the universal service provision. By contrast, the responses: "I have a post office near where I live/work" and "I still have to go to the post office to purchase universal services" might be cautiously linked to the

Table 6 Specific reasons for choosing Poste Italiane

		Investment products (%)	Current account services (%)	Payment services (%)
More trust/ is more reliable	**Specific reason**			
	It is owned by the State	5.8	4.1	3.8
	It is responsible for delivering mail throughout the national territory	0.2	0.7	1.5
	It is an Italian Company	0.8	1.1	1.6
	It protects all customers in the same way	3.7	1.6	0.8
	The payment is more secure/ guaranteed	0.0	0.0	11.8
	Other	0.2	0.1	0.0
	TOT	**10.7**	**7.7**	**19.4**
Easiness of service	**Specific reason**			
	Post offices are more comfortable	1.0	0.0	1.6
	It is easier to underwrite financial products/services	3.6	4.2	3.5
	I can control the investments through the Internet	0.2	3.5	0.0
	I have a post office near where I live/work	7.1	6.8	5.1
	Longer/flexible opening hours	2.4	2.3	2.2
	I still have to go to the post office	1.9	3.8	3.1
	Of which to purchase universal services	0.2	0.3	1.4
	Of which to purchase other services	1.7	3.6	1.8
	There are no barriers to entry	0.0	0.2	0.7
	Comfort/opening times	2.5	1.0	2.8
	Other	1.3	2.0	1.3
	TOT	**20.0**	**23.8**	**20.3**

notion of universal service. In fact, the answer "I have a post office near where I live/work", which refers to the geographical distribution of post offices, does not coincide uniquely with the qualification of the Universal Service Provider.

The results of the answers linking customers choice to universal service provision are summarized in the following table.

Results in Table 7 show that the answers related to the Universal Service provision assume comparable values in each of the three families of products. In particular, the answers related to the notion of universal service were respectively 7.5, 7.9 and 8 % for investment products, current accounts services and payment services.

Table 7 Responses linked to the universal service provision

	Investment products (%)	Current account services (%)	Payment services (%)
I have a post office near where I live/work	7.1	6.8	5.1
I still have to go to the post office to purchase universal services	0.2	0.3	1.4
It is responsible for delivering mail throughout the national territory	0.2	0.7	1.5
TOTAL	**7.5**	**7.9**	**8.0**

3 Conclusions

By market research survey methods, this paper has examined the nature of intangible and market benefits which accrue to a USP from providing non-USO services. By focusing on two of the most important sources of benefit identified in the literature – enhancement of brand value and demand complementarities exploitation– this paper developed a two-step approach for the economic estimate of the benefits. A first step investigated the reasons that drive consumer choice towards BancoPosta, focusing in particular on the reasons connected with PI's USP status. In a second step, the percentage of customers quoting reasons related to PI's role of US provider as their principal driver of choice of BancoPosta was refined. By doing so, the paper has attempted to fill a gap in the literature identified by previous surveys on the topic (Copenhagen Economics 2011; Frontier Economics 2013). It is also shown that the enhancement of brand value is only weakly related to the USP status of PI. Future research can illuminate how such percentages might be translated into monetary benefits that would figure into net cost calculations of the USO.

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Different Models of Postal Financial Services

Silvia Spinazzola, Stefano Gori, Erik Maurice, Simona Romito, and Ignazio Vacca

1 Introduction

Historically, Postal Operators (POs) have benefited from a monopoly of services and from governmental aid. Lately, liberalization in the postal sector together with the decrease in revenues coming from the mail business have forced the re-thinking of the business models of POs. Leveraging the traditional role of interface between government and the public, some POs have opted for the diversification of their business into the more sustainable provision of financial services.

Globally, POs can be described as natural government partners to provide basic financial services to unbanked and underserved segments of the population. This scenario creates benefits to all involved stakeholders-citizens, governments and POs as it creates a favorable sound solution that delivers clear cost benefits.

Many POs are currently attempting to diversify their business activities to counter the increasingly dramatic reduction of mail volumes due to e-substitution, increased competition, and the consequences of the economic crisis.

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A debate about the entry of the national POs in the financial services market is on-going in many countries. One of the main argument put forward is that whilst POs are seeing a decline in their traditional sector while financial institutions are also closing branches in rural areas. Yet, as indicated by Baradaran (2014), poorer segments of the population often spend some 10 % of their salary to access credit.

Such discussion is particularly relevant to USPS who is facing a large mail volume decrease while the US banking sector is also closing many branches in rural areas. In this way, the most isolated and poorest segments of the population are excluded from these services.

The USPS Office of the Inspector General (2014), has put forward the idea that USPS could supplement the offer of the banks covering their gaps in financial services with affordable products.

Figure 1 provides some idea of the dimension of the POs' revenue stream diversification phenomenon between 2007 and 2012, mostly derived from the entry into financial services or innovative businesses areas.

This paper examines the different business models of POs that have entered into financial services. It focuses on the diversification of the business of the POs into the financial services market with a methodology that classifies the different business models. This is then applied to a selection of POs that have developed more significant revenue streams from this business. Section 2 summarizes postal banking in selected countries. Section 3 describes the taxonomy that resulted in four business models of the POs. Section 4 analyses the result of the assessment of the four different models matching them against five major POs. Section 5 shows the results of our attempt and identifies a way forward in our analysis.

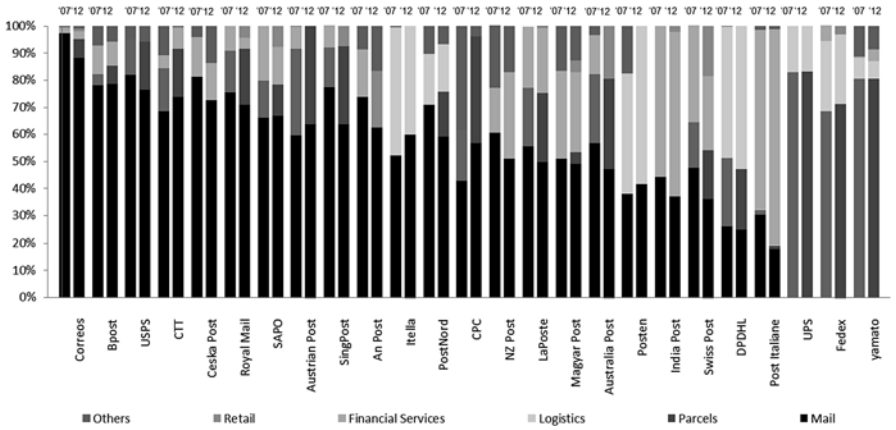

Fig. 1 Revenue diversification by type of service (%). Note: Revenue diversification is based on business unit breakdown and numbers reported in the company's annual reports. Accenture categorizes revenue into the above groups based on its understanding of activities which represent an approximation of diversification (Source: Accenture (2014), reprinted with permission)

2 PO Banking in Selected Countries

Diversification of POs' activity and the development of new sources of revenues through the expansion into financial services has been discussed by many authors over time: Walsh (2001), Steinhoff and Bickerton (2013) and Gonnet (2013). The diversification of POs' services portfolio into financial services may be considered a key element to achieving social inclusion and contributing to economic development.

Walsh (2001) analyzed the importance of postal infrastructure in boosting economic development of poor countries, using a study from the World Bank (1994) that showed that a 1 % increase in the infrastructure expenditure was associated with a 1 % increase in GDP.[1] Walsh noticed that infrastructure investments and reforms were key elements of economic development and human welfare. He emphasized that the postal infrastructure had network and operational attributes similar to other infrastructures industries. Moreover it also had the benefit, from a development perspective, of being highly labor intensive whilst relatively low in capital costs for the physical infrastructure.

The postal infrastructure that Walsh identified, included financial services, because one of the most important constraints for economic development in developing countries was the limited network for the distribution of financial services such as savings, micro financing, money transfer, and payment systems. This concept was supported by the World Bank study (1994) that underlined how experiences showed that economy of countries with a well-developed financial systems not only grew faster and more consistently than the economy with weaker systems but these were also better equipped to adjust to economic shocks. Walsh noted that in many developing countries financial services were an important revenue stream for the PO and, more importantly, that the PO was the primary financial intermediary for the majority of the population. This is because it also provides a wide and simple range of payment instruments and saving account services for the lower segment of the population. Furthermore, Walsh underlined that a PO which acted as a financial services intermediary provided stability and security in period of banking crisis.

Steinhoff and Bickerton (2013) assessed the evolution of financial services in a variety of POs. They described the development of the financial services portfolio among POs in various part of the world. In their paper they focused on the history of financial services of a few main European POs including La Poste (France), Poste Italiane (Italy), Swiss Post (Switzerland), as well as India Post (India) and Correios (Brazil). The authors found that the POs had different supply and distribution models for their respective financial services including whether their financial affiliate was an external partner, a group company, or the same PO. For instance, Correios, Post Office and India Post have external partners for the provision of financial services.

[1] Walsh T. "Delivering Economic Development" (2001), p. 6.

La Poste (La Banque Postale) is a retail bank with its own-branded products, whilst Poste Italiane and Swiss Post with a partial banking license can provide a wide range of financial services, except credit products that are sold on a white labeling basis (i.e. product/service produced by one company rebranded by the selling company under its own brand). Although the authors recognized that the business models of financial services were different they did not analyze this phenomenon further. The authors noted that the financial services were an important source of revenues for the POs as well as a way of supporting economic development and financial inclusion, most notably in rural and low income areas where banks did not compete or provide adequate financial services. They suggested that, independently from the model that would be chosen, financial inclusion of vulnerable social groups and rural areas should be considered as well as the financial self-sufficiency of the PO.

Gonnet (2013) in the Ipemed review focused on the analysis of three POs of the Maghreb region: Al Barid Bank from Morocco, La Poste Tunisienne from Tunisia and Mauripost from Mauritania. These operators entered into the financial market to support the development of their countries. The authors noted that these POs have had a historical role in the collection of savings from citizens on behalf of the local Saving and Loans Governmental Institution (CDP) or as local or international money transfer operator.

In Morocco, the Government created Al Barid Bank, as a spin-off from Poste Maroc. The purpose was to help achieving financial inclusion in the Country by increasing the accessibility to banking services. In 2010, Al Barid began offering financial activities with the green light of the Central Bank Authority. As a financial institution, thanks to an offering of simple and easily accessible products, Al Barid could provide its customers with the right services, such as credit products to increase the loyalty of young and unbanked prospect customers. The new business model of the Company foresees that Al Barid is the owner of the postal network as well as of the courier activities. The biggest effort was on the human resources education and IT innovation. After this transformation, access to banking grew from 34 % in 2007 to 52 % in 2013, making Al Barid market leader with 80 % market share.

La Poste Tunisienne started its financial activity in 1918 by offering checking accounts. Tunisia has a high rate of access to banking and the presence of Banks is widespread, offering a large portfolio of services to customers. Today, the division of postal financial services is a business unit in the Corporate Staff of the PO, providing checking and savings accounts along with its large range of money transfer services. In 1999, the transformation of the Operator started, with service portfolio diversification as core objective. The strategic repositioning focused on innovative services, such as mobile and internet banking, as well as insurance products linked to savings for a targeted customer base. Despite the diversification effort, revenues are still coming from the two main products, checking accounts and savings, with a high rate of inactive customers. The lack of IT and HR investments has been traslated in poor customer experience.

Today La Poste Tunisienne is considering becoming a post bank in order to provide the right credit product to its customers. Gonnet (2013) claims that can also be achieved in a faster way through partnership with other financial institutions.

In 1999 MauriPost was restructured from the previous Bureau of Post and Telecommunication and in addition postal service provides financial products from the National Saving Bank and checking account as well as money transfer. In 2010, thanks to an aggressive commercial strategy, a significant increase in financial services revenues was registered. Although MauriPost and its network could play a greater role in achieving the social and financial inclusion of the country, the lack in infrastructure is still too strong and the regulatory authority is not yet defined. MauriPost is facing competition from international banks that can offer credit or microcredit products.

These cases indicate that the key to success of a PO rests with its ability to respond to the needs of its country with the right products, leveraging its nationwide presence. It is advisable in most cases to partner with third parties to cover the products and services gaps not provided by the other international financial institutions. The concept underlying Gonnet's (2013) opinion is that becoming a Post Bank is an opportunity for both the PO and the Government, but also for the banking institutions. The PO can leverage the institutional role of partner of its government to contribute and speed up the economic development of the country, helping increasing financial and social inclusion. This role can be further reinforced through strong partnership with other financial institutions that will make better use of the network and the presence of the PO. The regulatory authority and the support of the government itself are the key elements that can make this process successful.

3 Taxonomy of Business Models

Given the above examples, this paper seeks to address the additional elements in order to define better the postal financial services scenario for the POs that are diversifying their business model. We have defined a taxonomy of the postal financial services models to analyze the provision of these services through the PO network, in order to identify the various business models that characterize this market participation. The methodology is based on analyzing some factors to identify the best choices for POs when entering the financial services market:

(a) **Strength of the brand**
The POs that have moved into financial services can leverage the strength of the brand of the Universal Service Provider, generally regarded as reliable, convenient, transparent and safe because it is, in the overwhelming majority of cases, owned by the government.

(b) **Widespread presence of postal network**
The POs that have decided to provide financial services can exploit the widespread presence of the POs' retail network built to provide the Universal Service. Banking branches are not generally located in rural and less economically developed areas.

(c) **Control of the post office network**
The control over the post office network allows the PO to manage both the human resources and the commercial strategies.

(d) **Range of Financial Services**
The financial services range varies among the POs as some of them have chosen to sell basic financial services such as payments, money transfer, current accounts, payment slips, payments for/from the public administration to citizens, while others offer a complete range of financial services. In this case the POs sell not only basic financial services but also sophisticated financial services such as insurances, saving plans. The POs that sell a complete range of financial services become a competitive substitute of a retail bank for customers.

(e) **Banking License**
It is possible to provide financial services without having a banking license, through partnership with third parties, within the regulatory framework defined by the Authority. Yet it is advisable to develop the provision of a wider and customized portfolio of own products, especially credit and microcredit, to subsequently become an "independent" financial institution.

(f) **External benchmark: banking market and competition**
When a PO enters the financial sector it is necessary to study the existing banking institutions and their possible reactions. The best option is to address markets gap both in terms of presence and product offering. Another relevant factor is the support from the Government (i.e. lobbying and law policies) and of the Regulatory Authority to the PO.

(g) **Institutional Role**
The PO can further leverage its link between the government and citizens to build strong support in the financial and social inclusion, helping increasing the development of access to banking rate of the Country.

We have analyzed the behavior of five POs that sell financial services, matching the operators with the following taxonomy of four business models, that, according to our experience, we deem to be reliable tools for the analysis. We analyzed the five POs using two tools: the four business models and the above mentioned six main parameters, to identify the characteristics of the five POs.

Specifically, the four models are:

Weak Reseller in the case of the reselling of third party products through the post office network, where the Operator is remunerated on the basis of revenue share, commission or business target.

Generally the PO fitting this model is mainly focused in logistic and postal services.

Strong Reseller is the model where the PO sells white label products on behalf of a financial institution, the remuneration can be based on sales or being revenue share based.

Usually this model represents the transitional phase towards the diversification of the business.

Strong Business Unit is when a PO enters into the financial market with a license (full or partial) without a separate subsidiary.

This model reflects a strategic change in business of the PO and implies a strong market share.

Subsidiary is the case of a PO spin-off of a separate company dedicated to financial services.

Similarly to the previous, this model represents a step further and reflects a strong business strategy to operate in separate subsidiary from the mother company.

4 Applying the Different Business Models

We applied the parameters (strength of the brand, widespread presence of postal network, control of the post office network, financial service range, banking license, external benchmark banking market, institutional role) to five POs: Correios, La Poste, Swiss Post, Poste Italiane, and India Post. We qualitatively measured the parameters (low, medium, medium high, high), to better identify the differences among the POs business models. We have chosen these Operators as they earn significant revenues from their financial activities.

4.1 Correios (Brazil)

First of all we have applied our taxonomy to Correios, the Brazilian PO. This PO is a strong reseller as it sells services on behalf of Banco do Brasil with an improved remuneration policy for the PO. It has no banking license and the services are recognized as that of the Banco do Brasil. Moreover, it is out of the competitive market because it operates as a correspondent bank. Although Correios fits the majority of the features of the weak reseller model it has some characteristics of other models, as it sells a wide range of financial services, such as insurance policies and the revenues coming from the new agreement with Banco do Brazil. Correios benefits from high brand awareness as it is the Universal Service Provider (USP) of the country. It owns the widespread post office network and has managed to improve the access and use of financial services for relatively low income people as summarized in Table 1.

4.2 La Poste (France)

La Poste provides financial products through its company La Banque Postale, is a wholly owned subsidiary. La Banque Postale has a complete banking license and delivers a complete and wide range of financial services. Moreover the PO is a long

Table 1 Correios

Main parameter	Analysis	Degree
Strength of the brand	As the PO is the historical USP of the country the brand is strong	High
Widespread presence of postal network	As the supply of financial services reaches 95 % of Brazil municipalities, the capillarity is high	High
Control of the post office network	The post office network is within the PO	High
Financial service range	Correios sells a wide range of financial services, for example also insurances	Medium high
Banking license	No banking license	Low
External benchmark banking market and competition	Correios begun supplying financial services as a correspondent bank as it's still a correspondent bank. We could think that there is no competition among the PO and the banking system	Low
Institutional role	According to a UPU study, Correios managed to improve the access and use of financial services for relatively low income people	High

standing player with a very strong brand in the retail financial market: in 1881 the National Savings Bank was put under the administration of the Post Office. The PO is a major retail financial institution, which faces full competition from other retail financial institutions. It owns the postal network which also reaches rural areas. La Banque Postale successfully fought against the banking sector lobby that sought its exclusion from the market. Table 2 summarizes the analysis.

4.3 Swiss Post (Switzerland)

Swiss Post fits the strong business unit category despite the fact that it operates through Swiss Post Finance Ltd, a subsidiary. Swiss Post Finance Ltd has a partial banking license and cannot provide its own mortgages and loans (credit products). Swiss Post delivers a wide range of financial services and faces full competition from other retail financial institutions for the services provided by Post Finance. Swiss Post acts as a correspondent bank for mortgages and loans. The PO is the historical USP of the country, consequently its brand is strong. It owns its widespread post office network and it has a legal mandate to provide adequate universal postal and payment services throughout the company. Table 3 summarizes the analysis.

Table 2 La Poste

Main parameter	Analysis	Degree
Strength of the brand	As the PO is the historical USP of the country the brand is strong	High
Widespread presence of postal network	La Poste sells financial services through his postal offices which reach also rural areas	High
Control of the post office network	The post office network is within the PO	High
Financial service range	The range of financial services is wide as it offers, for example, a complete range of insurance and asset management services	High
Banking license	La Banque Postale was created in 2006 and is one of the most important retail bank in France	High
External benchmark banking market and competition	There is a long tradition of the postal network selling financial services as the National Saving Bank was established in 1881 and put under the administration of the post office. The PO has always been a player of the retail banking system	High
Institutional role	La Banque Postale has pursued its mandate to fight banking exclusion	High

Table 3 Swiss Post – Post Finance

Main parameter	Analysis	Degree
Strength of the brand	As the PO is the historical USP of the country the brand is strong	High
Widespread presence of postal network	Swiss Post has had an infrastructure mandate since 1 January 2004. It must operate a nationwide post office network. Moreover, a post office providing the universal service must be available within a reasonable distance, i.e. within 20 min for 90 % of the population	High
Control of the post office network	The post office network is within the PO	High
Financial service range	The range of financial services is wide as it offers, for example, saving and investment services	High
Banking license	It has a banking license but it is not permitted to offer SME loans and mortgages under its own name in Switzerland, only in cooperation with partners	Medium high
External benchmark banking market and competition	It is an important financial retail bank in Switzerland. It is a competitor for its services but works as a correspondent bank for others (such as SME loans and mortgages)	Medium high
Institutional role	It has a legal mandate to provide adequate universal postal and payment services throughout the company, so the commitment is only on the payment services	Medium high

4.4 Poste Italiane (Italy)

Poste Italiane is also a long standing provider of financial products, although it is only in 1999 that the business unit BancoPosta was created to manage financial services. Through a customized presidential decree, BancoPosta was allowed to provide financial products except for credit products. Credit products are thus provided through partnership with third parties such as Financial Institutions and Banks, mostly using a white labeling approach. Poste Italiane, which has a very strong brand, is considered to be the historical interface of the Government for the delivery of services such as pensions, savings but also more "institutional products" such as passport and permit of stay release or social card management for the financial and social inclusion increase. Poste Italiane owns its 13,300 post offices spread across the national territory; the network is fully controlled by the Company, and the post office offers a wide range of products, from the insurance to the postal and logistic, and the commercial politics are set by its own management team. Table 4 summarizes the analysis of the parameters.

Table 4 Poste Italiane

Main parameter	Analysis	Degree
Strength of the brand	Poste Italiane is one the most reliable brand in Italy, historically attracting savings from consumers	High
Widespread presence of postal network	The network of Poste Italiane with 14,000 post offices is widespread all over the national territory, granting the access to postal and financial services to the mass market	High
Control of the post office network	The post office network is owned by the PO	High
Financial service range	BancoPosta offers a wide range of products, from the saving accounts to the prepaid cards. It is especially powerful in the government services	High
Banking license	BancoPosta has a partial and customized banking license but it is not permitted to offer credit products except through third parties cooperation	Medium high
External benchmark banking market and competition	It is an important financial retail bank in Italy with the largest presence. It offers also a wide range of products on behalf of the government	Medium high
Institutional role	Poste Italiane is considered the interface of the government with citizen, as a financial and social inclusion boost, and historically it offers savings products on behalf of Cassa Depositi e Prestiti	High

4.5 India Post (India)

India Post has a long history in providing financial products for the mass market as it has a strong brand and a wide range of financial services, especially savings and money orders in the rural areas of the Country. It has the biggest presence of fully owned post offices with 150,000 points and it can be considered the largest banking institution of India. India Post does not have a banking license, but has been providing financial products since 1880, through partnerships with Banks, especially for microcredit and savings products in remote rural areas. It is an engine for financial inclusion and in this way acts as an agent for the Ministry of Finance. In our analysis, India Post fits the Weak Reseller Model as it sells on behalf of third parties with low level of marketing control. Table 5 presents the assessment of all the parameters for India Post.

The above discussion indicates that some chosen parameters such as strength of the brand, widespread presence of postal network, control over the post office network and institutional role, are the basis on which the different business models are built, as they are common across the models but to different degrees. POs generally have exploited their distributed asset (post office network) as they have based the financial services business upon the widespread of the network, the strength of the

Table 5 India Post

Main parameter	Analysis	Degree
Strength of the brand	Historically India Post is the provider of financial products for all the large customers, especially saving and money orders in the rural areas	High
Widespread presence of postal network	With 150,000 post offices, India Post has a widespread presence over the Indian territory, from the urban to rural area (although with different condition of the offer and infrastructure). POSB Post Office Saving Bank is now the largest banking institution in the country.	High
Control of the post office network	India Post is fully controlling the post office network	High
Financial service range	POSB offers financial products since 1880 also through partnership with third banks, as financial provider of microcredit, saving accounts etc.	High
Banking license	India Post has no banking license	Low
External benchmark banking market and competition	India Post is a partner for major financial institutions that can leverage its network to reach a large amount of customers even in the more rural areas	Low
Institutional role	India Post considers itself as an engine of social and economic development. POSB acts as an agency for the Ministry of Finance, who pays back an annual amount to the Department of Posts	High

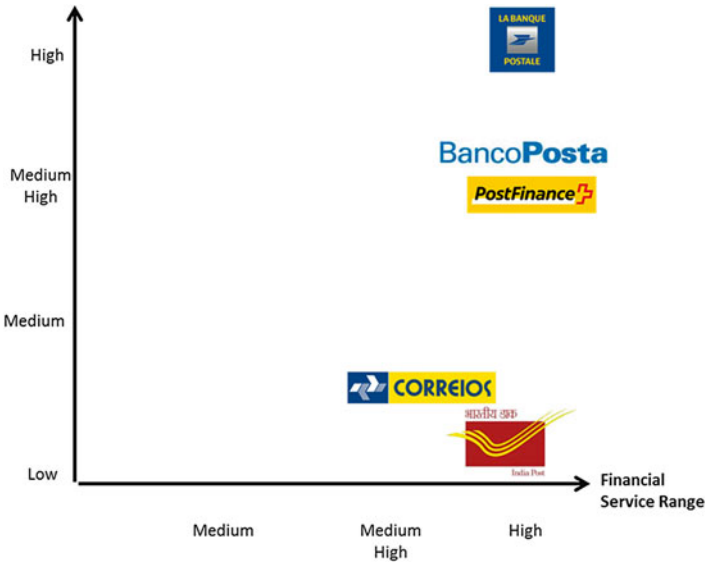

Fig. 2 Banking license/external benchmark banking market and competition

brand, and the control of the network. The second feature that we discussed is how POs have tailored their financial services business based on their branch networks. Figure 2 illustrates the differences among the business models of the POs based on two of the parameters. It shows that the majority of the POs have tried to offer the maximum range of financial services subject to banking license and the degree of market competition.

5 Conclusion and Way Forward

The models as illustrated above are based on the external and internal context of the PO, from the legal and regulatory framework, i.e. whether the operator owns a banking license, competition in banking markets, relationship with the Government, and the presence of banks and postal branches. The POs do not match perfectly the models, with the exception of La Poste which is a major retail financial institution in France and has been a key player of the retail financial market for a long time. Although the features of many POs match the majority of the model's characteristics, there is not a perfect model that matches completely all the parameters of our taxonomy. However, we can conclude that the widespread presence of postal network, the ownership or control of the network, the strength of the brand, are clearly

emerging as the basic features in order to establish a successful business model when providing financial services.

Whilst the chosen parameters appear indeed relevant and play a critical role in the decision to participate/enter the financial services market, the unique characteristics of each PO and their environment (regulatory framework, external market) does not confirm that there are broad standard models that can be followed. This is the first step in order to find a well-defined model, which can fully match with our taxonomy, and we also noted that the POs have chosen a business model which follows the majority of parameters identified but with some specific feature.

Our exercising also enlightened the importance of the institutional role of the PO. The interface between citizen and government is one of the most representative characteristic of the PO. Like other features, such as the strength of the brand and the proximity of the network, we can assume that, when entering into financial services market, a PO can also easily leverage on its main intangible asset, such as the institutional role indeed. Governments too should grab the opportunity to boost the financial and social inclusion of the country through the postal network. Moreover, we can easily confirm that the integration of the selling of financial services does represent a very important revenues stream for the POs that entered into the market, helping to face the present crisis of volumes of the traditional activities.

Further studies should address the different results in terms of economics of the POs, as responses to the market. It would be also interesting to explore the possibility for the POs to exploit their asset, such as technological platform or other related but non-core activities, in different areas of business, opening to new opportunities.

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When Rapidly Decreasing Mail Volumes Call for More Innovative Social and Economic Approaches

Dominique Bailly and Margaux Meidinger

1 Introduction

Postal operators have gone through drastic changes for several years. However, the optimization measures used in the past may no longer be sufficient to deal with rapidly decreasing mail volumes and the impact this is having on employment. In employing innovative responses, postal operators (POs) have to take into consideration several constraints, internal ones with in particular their long-standing structured social framework and external ones in view of their major social role in society. Postal operators can follow two main directions. On the one hand, they have to reduce employment whilst aiming to improve the flexibility and quality of their workforce. On the other hand, they have to find new business opportunities, which are driven by their human resources assets. To what extent, then, do successful future strategies have to be employment-driven?

This paper aims to investigate how POs can increase their social performance and develop new employment-driven business models when faced with not only a highly structured social framework but also the need to adapt. Section 2 explores the current situation within the postal sector following several years of intense modernization and diversification. Section 3 highlights the growing economic pressure on operators. Section 4 explains the internal and external constraints within which postal companies are operating. Section 5 considers how, in view of these constraints, POs need to follow a strategy based on a more flexible employment structure. The final section presents some innovative employment-driven initiatives.

The paper is based on the observations made within the framework of the European Social Dialogue Committee for the postal sector activities; they do not represent the situation or ideas of Le Groupe La Poste.

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2 Profound Transformation in the Postal Sector

Over the last decade, the postal sector has experienced a drastic change in its activities as well as its business and social model. In particular, this change has led to major diversification and modernization, which have been implemented, at different levels and paces, by all European POs. As a result, the sector's main characteristics are totally different today than they were just a few years ago.

2.1 Major Diversification

As explained in Bailly-Meidinger (2013), POs have undertaken an intense diversification process, harnessing a wide range of strategies. They have embraced lateral diversification by focusing on the development of logistics and express activities, as for Deutsche Post DHL, or a more service-oriented diversification, especially into banking and insurance, examples being Poste Italiane and La Poste. They have also embraced vertical diversification with regards to mail activity and value-added services, in particular digital services such as address management, cloud computing, e-signature solutions and marketing advisory services. Lastly, some of them have diversified through geographical expansion. Some operators, such as Deutsche Post DHL, have opted for global economic development, usually in non-mail activities, whilst the majority of them, such as PostNord, Eesti Post, Österreischiche Post, have opted for regional development. As Fig. 1 below shows, POs have quite different profiles in terms of business activities.

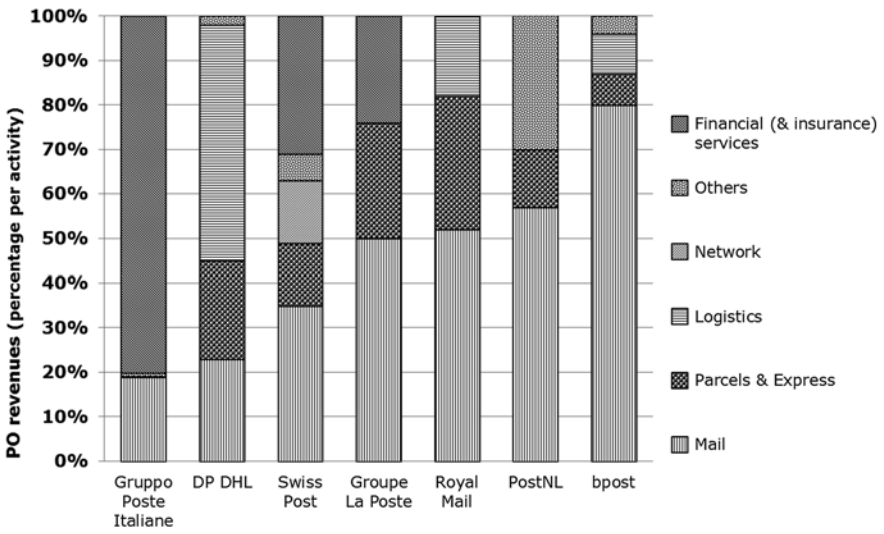

Fig. 1 Revenue by activities within selected national POs

As a result of such diversification, mail is no longer the core activity for some operators. As shown by Fig. 1, for companies such as Poste Italiane, Deutsche Post and Swiss Post, it now represents less than 50 % of their total revenues. This is in stark contrast to some years ago, when mail was still the main driver of their businesses. The postal sector is, therefore, a lot more complex today, with a mix of activities from very different sectors and borders that are becoming increasingly blurred.

2.2 Far-Reaching Modernization

The diversification process has been supported by intense modernization on both economic and social levels. While varying in intensity, this modernization has been conducted in a socially responsible manner in all European national POs.

Modernization of the postal sector has first of all relied on significant optimization of business activities. Sorting centers have become more efficient, at different times and to varying degrees by operators. This process has been implemented through the automation and centralization of sorting centers, resulting in more streamlined facilities. Over the past few years, the degree of automation and, by extension, the productivity of sorting centers have significantly increased. It should be noted that some operators today are sequencing by automation a large percentage of routes for standard letters. In Germany, for instance, 95 % of all delivery routes are currently sequenced.

The increased operational efficiency has been visible in the network of post offices, with national POs following different strategies to optimize and reengineer their network. The first approach involved improving efficiency and flexibility by reducing the number of post offices owned. This has been implemented by stepping up the outsourcing of the network, especially through partnerships. As a result, several major postal companies like Deutsche Post, PostNL and to some extent PostNord, no longer own a network of post offices. Another possible approach is to maintain ownership and defend market leadership in the core business by enhancing the efficiency of the network through increased automation, restructuring spaces and flows, changing opening hours and reducing waiting times, whilst developing new products and services. All POs which have decided to keep a network of post offices have undergone such a modernization process to varying degrees.

2.3 Socially Responsible Optimization

The large majority of European POs have put in place a decrease of their employment, as it is a key lever for significantly reducing operating costs. The study conducted by WIK entitled “Main developments in the postal sector 2010–2013” for DG Market has been used as an important resource, providing up-to-date information on key social trends. The study showed that, on average, employment within

national POs has fallen 2.5 % over 2 years (2010 and 2011), with significant differences between countries (WIK 2013, p. 257). At PostNL, employment has declined 15 % in 2 years. In the last 10 year almost 50,000 employees have left Royal Mail, which now has around 139,000 employees. This trend is very much likely to continue over the coming years as shown by recent announcements made by European operators or USPS outside of the European Union.

The majority of European POs have managed this decrease through natural attrition, a trend which has particularly relied on the high average age of POs' employees. Natural attrition is supported in many operators such as Poste Italiane, Royal Mail and Swiss Post through voluntary departures that usually incorporate financial incentives for employees. The Italian operator initiated such a program supported by financial incentives in 2010, which has already enabled over 11,000 people to leave the company.

The various examples confirm that the status of employees in the postal sector has been rather a protected one. Indeed, several POs set out an employment guarantee through a collective agreement. At Deutsche Post DHL, for instance, dismissal protection for its employees has been subsequently renewed by the various collective agreements.[1] Royal Mail has combined efficiency measures and socially responsible employment measures. The agreement negotiated with the trade union CWU and approved by the vast majority of staff at the beginning of 2014 includes measures for industrial stability and working condition guarantees.[2] Some weeks after the approval of this agreement, Royal Mail announced that it will launch a formal consultation with the two trade unions Unite and CWU with a view to achieving a net reduction of around 1,300 positions mainly amongst its operational and head office managerial staff. The group has underlined its commitment to conduct "this consultation carefully and sensitively" and underlined its "strong track record of achieving change through natural turnover, redeployment and voluntary redundancy wherever possible" (Royal Mail 2014).

Various studies that we have conducted show that there are for the moment few cases of forced redundancy.[3] There are some exceptions such as PostNL, which saw an agreement signed with unions included a maximum of 2,700 layoffs. Nevertheless, in practice, such redundancies there have been limited to between 450 and 650, thanks to the success of the "PostNL Mobility" program implemented by the Dutch operator as well as the agreement with unions on "limitation of forced redundancies". More recently, in early 2014, the Finnish operator Itella announced that the

[1] Since 1994, every CLA signed at Deutsche Post has renewed this protection. In the latest agreement dated 2011, the protection against economic redundancies was extended until 2015.

[2] This agreement covers all the company's 139,000 employees. One of the main measures is to maintain the objective of delivering change without resorting to compulsory redundancy.

[3] The projects conducted within the framework of the European Social Dialogue Committee for the postal sector (SDC) have made it possible to collect several national testimonies. The Social Observatory of the postal sector launched in 2009 has made it possible to track the main social changes in the sector.

rapidly declining addressed mail volumes will force it to make 800 staff cuts including 495 redundancies.

Following this period of intense diversification and modernization, the postal sector currently displays a completely different structure to what it did some decades ago. Despite its size and the existing constraints, it has already been able to implement a profound transformation, which has, nevertheless, been socially responsible. Against the backdrop of an increasingly difficult environment, it appears that this major effort may not be sufficient in the future.

3 The Postal Sector at a Tipping Point

Today, the postal sector is facing increasing economic pressure from the decline of its traditional core business, whilst the growing parcels market is highly competitive. Mail volumes continue to show a steady decline. In Western countries, were the market is more mature, forecasts indicate that the trend is likely to gather even more momentum. In most Eastern countries, such a decline has come later but it is a reality today.

In addition, the development of e-commerce offers great opportunities for economic development with a direct positive impact on the growing parcels sector. However, as analyzed in Bailly-Meidinger (2014), the parcels market differs from the mail one. Postal operators find it difficult to compete in parcels, where there are many smaller players with a different business model. The use of independent workers is particularly prominent in parcel delivery. The WIK study underlines that there is a strong cost pressure and that "subcontractors are mostly not bound to labor agreements, and their employees are barely organized in unions. This leads to very low wages and difficult working conditions." (WIK 2013, p. 272). The issue of independent workers and low social conditions in the parcels market was also one of the core topics of the debates organized as part of the 3rd Postal Users Forum held in March 2014 by the DG Market. However, the parcels market is a highly fragmented and heterogeneous that involves a variety of players in addition to the national POs. These players often have few employees, providing greater flexibility and competitiveness in comparison to incumbent operators that have numerous employees.

Against this backdrop, the optimization measures put in place so far, especially natural attrition, may no longer be sufficient to compensate the decline in activities. As a result, more radical measures may need to be sought in the future. Bailly-Meidinger (2014) studied the opportunities of redeployment from traditional activities to new diversification ones. The paper highlighted the potential for redeployment and increased synergies, despite the fact that implementation would be intricate and require some significant changes. Digital services are not a labor-intensive activity and therefore require different skills. The parcels market, where competition revolves around costs, relies on the extensive use of sub-contractors. The express activity has mainly developed on a European scale. Lastly, financial services require quite different skills and are also not developed in all NPOs. In short, there are

indeed opportunities for redeployment but, given the projections in terms of the change in mail volumes, they may not be sufficient enough to ensure the sustainability of the current business and social models in the long-run. In view of these limitations, POs should improve the flexibility of their social model.

4 A Socially Constrained Framework

The difficult economic environment is not letting up. However, the postal sector is a sector unlike any other. Postal operators need to take into account several external and internal stakeholders to manage the transformation process.

As a result of their particular culture inherited from public administration and the important social role they play in society, national POs have a tradition of quality social conditions, welfare of employees and social responsibility. The status of postal employees, among whom there is still a number of civil servants, is a historically protected one. Moreover, many POs have a rate of unionization that is generally higher than in most other companies. The trade unions are considered as major stakeholders who have played a key role in the current changes. In most incumbents, they are associated with and support each step of the change process as part of the negotiation of collective agreements that make it possible to set some fundamental principles but also participate in day-to-day social dialogue.

The ongoing changes have highlighted the key role of social dialogue, which is considered to be of strategic importance for the company's sustainable transformation through agreements including measures touching on wages and employment conditions as well as initiatives to support the change process. These agreements are essential for ensuring that the increased need for adaptability is accompanied by appropriate social conditions for all employees. For all these reasons, the structure of postal companies with their large number staff and a social framework shaped by their long history explain their rigidity. Implementing drastic change and ensuring increased flexibility in work organization is more difficult for large companies than it is for smaller and more recent ones, since they are much more responsive and adaptable.

The postal sector has always played a crucial role in the economic and social life of all European countries, and postal companies are considered to be a structural part of the society. As a result, the public has a particular attachment to the postal sector. Due to this role in society, the sector's transformation is under close scrutiny and any major social decision needs thus to take into consideration the potential reaction of the public.

Moreover, today, the issue of corporate social responsibility is of increased concern throughout the European Union for all the main stakeholders in the sector. We observe changing customers' needs with an increased demand for more responsible products but also a growing concern from the market and the shareholders as the image of a company can have significant economic impacts. Public authorities are also very much involved in debates on how the sector is changing in view of its role

in terms of territorial cohesion as POs are expected to ensure nation-wide physical presence. This explains why all changes implemented by stakeholders are under close scrutiny and social issues or unrest can have wide-spread and long-lasting impacts.

In view of these internal and external constraints, POs have limited room to maneuver. Not only do radical measures appear to be an unsuitable option, but it also appears that companies which have chosen to follow this path do not meet with success as a radical optimization can have a direct impact on the quality of their services.

5 The Need for a More Flexible Employment Model

Within such a structured framework where the interests of several stakeholders have to be taken into consideration, POs have to find innovative approaches on both social and economic levels. Mainly quantitative levers have been used so far on the social level, but it is important that workforce optimization is also qualitative so as to ensure long-term effects.

5.1 More Flexible and Qualified Staff

A more flexible workforce requires POs to strike the right balance between several levers including part-time employment, short-term contracts and working time modulation. The development of part-time work has been one of the main levers for increasing flexibility but also decreasing the cost of the workforce. The results of the WIK study show an average rate of 19 % at European level, with extremely different situations between operators. Indeed, in some companies, the use of part-time workers is widespread, such as in Switzerland (49 %), Germany (37 %) and Belgium (30 %). PostNL has made the decision to move to a structure consisting of almost exclusively part-time employees, with 92 % of the delivery workforce working on a part-time basis (WIK 2013, p. 266). The use of this type of work is very much linked to the national context and the characteristics of the internal labor market. In some countries, especially in Northern Europe, part-time work is indeed commonly used as a means of ensuring diversity, by promoting a better work-life balance. In many cases, it is used by parents to take care of their young children.

Moreover, the development of innovative part-time methods specifically targeted at senior workers can be observed in companies like Deutsche Post, PostNord, bpost and Swiss Post. In Deutsche Post, in particular, the “Generations Pact” included in the 2011 company collective agreement aims at enabling employees to continue working until they retire while taking into consideration the physical workload of their job. Senior employees can therefore use the legal option of part-time retirement, which enables them to work less while the proportional decrease of wage is

compensated by a demographic fund created by the company. Our research shows that there are different types of part-time work which have been put in place and that it can consist of some days per week or of some hours per day. Within Poste Italiane, an interesting method of part-time work which is currently under development consists in full-time work but for a limited period of time in terms of weeks per month or months per year.

Short-term contracts are also used. The results from the WIK study once again highlight the diverse range of policies. Some companies, like Correos in Spain, have a significant rate of 20 % of short-term employees which appear to be mainly seasonal workers or newly recruited staff (Grupo Correos 2011, p. 41). At PostNord, there is a large use of temporary workers, which represent 26.4 % of the workforce, especially through partnerships with temping agencies (PostNord 2012, p. 27). Another tool to increase the flexibility of the work organization is working time modulation which enables employees to maintain full-time employment while allowing an adaptation to the variability of activities. They may work more hours during peak periods in exchange for working fewer hours during less busy periods. This system is mainly used in delivery by operators like Austrian Post, bpost, Royal Mail, Swiss Post and Magyar Posta. In Austria, for instance, a new working time model has been in place since 1 January 2013 as part of a collective agreement signed in September 2012 (Austrian Post 2012). This model features a new calculation of worked hours which will enable postmen/postwomen to work more during peak periods like the end of the year celebrations and less hours during slack periods.[4]

5.2 More Competitive Staff

A more flexible workforce should also be combined with a more competitive staff structure. In order to cut costs, a recent trend in several companies involves differentiating wages between old and newly-recruited employees. At Deutsche Post, the 2011 collective agreement provides for recruitment wages to decrease by 4 % in exchange for the delivery route outsourcing to be frozen.[5] The same method has been negotiated within Austrian Post, where the wages have decreased between 10 % and 20 % for employees recruited since May 2009. Freezing wages or limiting wage increases have also occurred. The 2009 agreement in Deutsche Post also sets a wage freeze in 2010 and 2011; the usual wage increase has indeed been replaced by a one-off annual payment. This makes it possible to replace a permanent measure by a one-off one.

In bpost, an agreement in January 2010 put in place a new status in mail delivery with the function of auxiliary workers. This new status was highly criticized by the unions which considered it as a "low cost" one. The main difference between the

[4] If employees work less than 150 out of a maximum of 300 working hours, they will have to get back the hours and if they work more than 150 h, they will be paid for the overtime.

[5] The beginners' wage will total €10.70 per hour in comparison to €11.13 per hour given to employees already in the company.

auxiliary employees and traditional postmen/postwomen is their wage: they have a lower hourly wage of €986 and are covered by a different CLA and system of wage promotion than the traditional postmen/postwomen. In terms of job function, however, their role seems to be the same as the postmen's one.

5.3 More Qualified Staff

In addition to optimization measures, the quality of the workforce is also essential for competing with new entrant. Cost-based optimization measures had to be supported by qualitative improvements. One of the priorities for supporting modernization has been enhancing the quality of customer service. The major changes undertaken by incumbents have largely focused on employees and on developing their role and approach. They are expected to manage multiple tasks and be flexible, but also be more customer-oriented and cater to each customer's individual needs. To prepare employees for this new approach, these changes should be supported by adequate training and relevant career paths. The conclusions of the report of SDC project entitled "Matching skills and jobs in the European postal sector" shows just how important new transversal but also expertise-focused skills are.[6]

As most operators need to look internally for these resources it is crucial to train employees and develop their skills. Skills' development also relies heavily on changing the way people perceive things. It is crucial for the majority of employees to back the new organization and vision so as to achieve a win-win situation with increased customer but also employee satisfaction.

5.4 Striking a Balance Between Various Social Levers

Postal companies have decided to implement a variety of flexibility options, with some proving to be more popular than others. Due to the major role played by trade unions and social dialogue, the different company collective agreements set the framework for change and reflect the trade-offs between the various options which have been negotiated. It seems that the social strategy adopted by some POs is to prioritize the employment security whilst ensuring increased flexibility in the work organization and reducing labor conditions for the newly-recruited employees. The content of various collective agreements negotiated at company level shows how in exchange of the employment security – i.e., the exclusion of any economic dismissals generally coupled with the freeze of mail delivery outsourcing– the decrease in

[6] "The structural changes taking place in the sector […] lead to the need for new and adapted skills and competences. The availability and development of skills which meet market demands is crucial in order to produce an adequately qualified labor force, and ensure the competitiveness of companies." European Social Dialogue Committee for the Postal Sector (2014b) final report of the project "Matching skills and jobs in the European postal sector", p. 65, 2014.

wages for newly recruited workers has been achieved.[7,8] In other companies, however, social partners have preferred to accept forced redundancies rather than reducing labor conditions for employees who remain.[9]

6 Developing Employment-Driven Activities

The need to increase the flexibility of the employment model should also be accompanied by innovative economic approaches. New activities which are driven by the incumbents' human resources assets can also be harnessed. Bailly-Meidinger (2014) provided an initial overview of the potential in terms of creating jobs as a result of diversification. This paper aims at going deeper into the opportunities given by another type of activity: the new services of proximity.

6.1 The Postal Sector's Assets

The choice made by some incumbents to develop services of proximity hinges on several aspects. First of all, POs are the companies which have the most extended network nation-wide both in terms of physical network through their post offices (when they are still owned-ones) and the postmen/postwomen who come into contact with all citizens on a daily basis. Moreover, postal companies are considered to be trustworthy third parties which, over a matter of centuries, have developed a trust-based relationship with all customers in addition to building up significant knowledge of them. Lastly, postal companies boast significant expertise at the crossroads of the physical and digital world. These elements represent competitive advantages which cannot be duplicated easily by any other company.

A number of ideas regarding services to individuals are being tested or implemented by several POs. The aim is to test as many concepts as possible in order to identify actually customer needs and see whether this can create a viable demand over the long term. Some emerging trends like the 'silver economy' (aging of the population), the energy transition as well as the modernization and rationalization of public action appear to be key areas where POs can develop new, added-value services and offers adapted to specific audiences.

[7] In Deutsche Post, the 2011 agreement provided for mail delivery outsourcing to be frozen in exchange for a 4 % decrease in wages for newly-recruited workers. In Austrian Post, the possibility of decreasing wages for newly-recruited employees was incorporated into the 2009 collective agreement in exchange for ceasing mail delivery outsourcing.

[8] European Social Dialogue Committee for the Postal Sector (2014a), Final Report of the project 'Developing a quality postal service in the digital age'.

[9] At PostNL, the 2009 in-principle agreement signed by the unions which aimed at avoiding compulsory redundancies by lowering labor conditions was rejected by their members who refused to reduce their labor conditions, preferring instead to accept forced dismissals.

6.2 Taking Advantage of New Societal Trends

The 'silver economy' is one of the main areas in which experiments are carried out. The Belgian operator, bpost, has launched a pilot project in the city of Ostende. Having concluded that their own social assistants cannot visit each person in the city, the social service agencies have asked for assistance of the postmen/postwomen in conducting a survey of elderly residents to diagnosis any potentially problematic situations.

In France, La Poste is also considering the extent to which it can develop services to visits elderly or isolated people on a large scale and at what price, since in practice, postmen and women already visit informally. Postal operators could also develop services as part of the fight against climate change and, in particular, the energy transition to more sustainable forms of energy. One of the ideas involves meter readings, which can be carried out by postmen instead of utilities' providers in order to identify the needs of individuals and especially the cases where homes are badly isolated. This activity can open up additional activities of La Poste, especially the funding of the necessary insulation or renovation work through loans provided by La Banque Postale.

6.3 Contributing to the Modernization of Public Services

As bpost has shown, postal companies can contribute to the modernization of public services. As trusted third parties, POs could provide services on behalf of the state, local government and public organizations through post offices or via the postmen. At a time when people are looking for greater flexibility and individualization in terms of pick-up options, the delivery of identity papers or driving licenses in multiple places could be a value-added service for citizens.

This service could be of particular interest to POs having opted to maintain their own post offices, since their nation-wide networks could be of real added-value. Eventually, as entrusted third parties, mail carriers can also assist local public authorities in identifying some pressing issues pertaining to the condition of public roads, the electricity network or river flooding. A pilot project for this service has been launched in the Gers region of France, which could be put into general use at national level. Postmen can use their smartphones to send real-time alerts to the public authorities so that issues can be solved quickly. This example shows how physical presence and digital technology can be combined in an optimized way.

Postmen can offer other products and services since they are in direct contact with each customer. With this in mind, POs need to take a pro-active position. Take Poste Italiane, for instance, which has chosen to implement a 1,000 new delivery staff with a view to providing delivery services throughout the day. Whilst traditional postmen only work on weekday mornings and not on Saturdays, these new

agents work 6 days a week, during weekdays from 2 p.m. to 8 p.m. as well as on Saturdays in order to deliver new kinds of added-value services.[10]

7 Conclusions

After a period of drastic change relying on large-scale diversification and modernization, there is now growing pressure on PO employment due to a rapid decline in mail volumes. Within this context, natural attrition may not always provide a sufficient solution to some incumbents seeking to compensate the decline in activities. Due to a highly structured social framework, POs have to find more innovative and qualitative levers to further optimize and adapt their social model. On an economic level, innovative approaches should also be developed, especially with regards to employment-driven strategies to create new activities, making their specific social structure and identity a strength rather than a constraint. Despite these encouraging initiatives, there are still several sources of uncertainty. Given the highly structured social framework, the extent to which POs are able to make the social model more flexible raises certain questions. Not all levers can be fully harnessed at the same time, so trade-offs must be addressed. The economic value of employment-driven services has yet to be made clear. The development of these services of proximity is still in the early stage and their capacity to be a real source of revenues on a large scale and create sufficient employment is not yet guaranteed.

One major element of uncertainty is the sector's future scope and identity in view of its increased modernization and the development of very diverse services at domestic, cross-national and international levels. Indeed, the further economic and social optimization of the sector could see the postal sector become a sector like any other. At the same time, the very different paths of diversification question the sector's scope. Indeed, it seems as though there are two different ways forward. One possibility is that POs evolve towards integrated structures in "One Post" that will consist in an association of diverse activities, which are, nevertheless, in a common social framework and shared networks based on reinforced synergies. Another possibility involves splitting the various business activities – banking, logistics, services to individuals and e-commerce – into specialized sectors. This would see operators focusing on different business activities, with each of them being independent and having a different social framework and specific network. Such a development may call the sector's specific identity into question.

[10] These services include in particular, new express parcel products, urban products (same-day delivery), fastest products and other commercial products and services.

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Proactive Surveys and Calculations for Meeting Declining Mail Volumes

Kari Elkelä, Heikki Nikali, and Päivi Rokkanen

1 Introduction

During this decade, postal organizations have faced with the fastest ever decrease in mail volumes and this is likely to continue. This situation will demand a well-planned adaptation. It will not be possible to continue 5- or 6-day delivery, not at least in all areas. This will also mean that Universal Service Obligations (USOs) should be redefined proactively before operators begin to encounter major problems. This paper will examine the anticipated decline in mail volumes from three perspectives: (1) measuring customer needs with surveys, (2) new calculation methods for necessary cost savings, and (3) pressure for reform of legislation and regulation. The surveys and calculations are tools both for determining possibilities for change and outlining the needs in reforming legislation.

Section 2 explores the pressure from other targeted communication on letter delivery. In Sect. 3, implemented delivery solutions and experiments that have taken place in different parts of the world in recent years are discussed. Section 4 presents findings from surveys of consumers and customer enterprises conducted in Finland. A new way of estimating delivery costs and related factors is considered and solutions outlined for keeping expenses down to a reasonable rate in Sect. 5. Section 6 considers the need for changing the USO and Sect. 7 provides summary and conclusions.

The views expressed in this chapter are those of authors and do not necessarily reflect the views of Itella Corporation.

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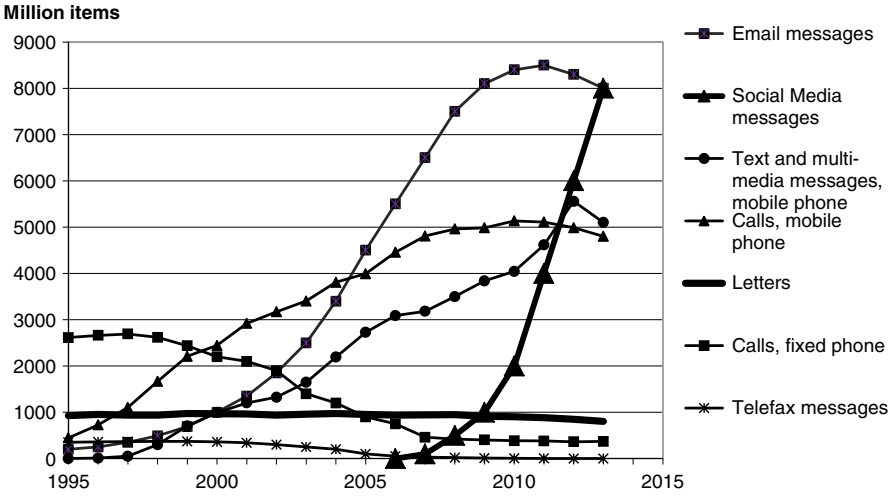

Fig. 1 Total number of messages sent in Finland according to form of communication 1995–2013 (Ficora 2014)

2 The Letter Under Pressure from Other Targeted Communication

It is important to define the development of letter communication and its future in determining which market areas should be examined. The letter is a form of targeted communication, in which recipients who are specified by name receive messages to their own physical address. Other forms of targeted communication are the telephone, e-mail, text message and telefax. The use of targeted communication has been changing rapidly during the 2000s. The development of the amount of targeted communication presented in Fig. 1 illustrates this change. Total volume of communication has grown swiftly, been inspired by e-mail, text messages and mobile telephone calls, which nevertheless all became saturated 2012–2013 and have even begun to decrease. Landline phones are clearly falling in number and fax has all but disappeared. Letter communication has also begun to fall, but particularly on account of the fast growth of other targeted communication, the proportion of letters in all targeted communication is now only 4 %.

The most important change in recent years has been the breakthrough of social media. Social media can be classified as targeted communication, although it does include some features of mass communication. At present about 70 % of 15–64 year olds in Finland use social media (Statistics Finland 2013). If social media messages market for 2013, estimated to be eight billion, is included in targeted communication, the total number of messages reaches 27 billion. The total volume is thus still increasing, as the rapid growth of social media has reversed the downturn in all other digital channels.

Social media have been viewed as a challenge to the postal industry (Elkelä and Nikali 2013) and are now beginning to challenge the telecommunication sector as well. Because the unit prices of electronic messages have dropped and the use of free messaging has increased, revenue from targeted communication has been falling for the past few years, despite the growth in volume. The proportion of letters in this more widely defined sector is 3 %.

3 Novel Delivery Solutions in Different Countries

As volume decreases, the development and implementation of cost-saving solutions must become the central issue. So far very few examples of how this can be accomplished have been published. The Canadian postal services have announced that they will transfer deliveries from letter boxes to communal lockers. New Zealand post has declared that it will change to 3-day delivery in built-up areas. For their part the postal services in Holland have dispensed with Monday delivery, in other words, shifted from a 6-day to a 5-day delivery.

In Finland, Itella Posti will launch a product-specific delivery experiment in six areas in September 2014. During the experiment, products referred to in the Postal Act as universal service products, as well as newspapers and parcels, will be delivered 5 days a week, as is the current practice, whereas letters, advertisements and magazines sent by companies will not be delivered in the experiment areas on Tuesdays (Itella 2014).

Many postal service operators have responded to the fall in paper communication by developing Internet-based services. These have been mainly directed towards the conveyance of official correspondence, alongside traditional forms. Such services have become available in, for example, Canada, South Africa and the Nordic countries Finland, Denmark, Norway and Sweden. Nevertheless, a practical business problem with these services has been that revenue from them has remained much smaller than that from traditional physical delivery.

Itella experimented in 2010 with a hybrid form of physical and digital delivery. The residents of the rural village of Anttila had their correspondence digitized daily with immediate delivery to the recipient in electronic form. The local newspaper was also circulated as a digitized version. Paper letters were sent each day to the local store, where each recipient had a personal locker, from which the letters could be collected daily. If the letters had not been called for in the store, they would be forwarded on twice a week for physical delivery.

The participants were satisfied with the experiment, with physical delivery twice a week considered sufficient. Actually, many felt that electronic delivery was unnecessary. Forty percent never even read the digitized letters, even though they were provided with a tablet for that specific purpose. Further, those in the experiment considered letters and newspapers in paper form a much more agreeable alternative compared to an electronic form. Only delivery of advertisements, notices of arrival and invoices had wide support in digital form (Kuusisto et al. 2010).

A problem revealed in the experiment occurred with the high cost of digitizing, which was decidedly greater than the cost savings from reduction of the coefficients of physical delivery. There were also juridical problems related to physical letter digitization. For example, banks refused to open letters for the purpose of digitization.

4 Measurement of Mail Delivery Needs Using Surveys

In the fall of 2013, Itella defined its new vision up to 2020, according to which Itella would be "Your first choice in postal, logistics and eCommerce services" (Itella's Year 2013, 2014). Starting in the preparation stage for the strategic task a consumer study with a representative sample of 910 Finns was carried out wherein consumers' changing communication needs and the role of the mail under pressure from telecommunications were assessed, while consumers were also asked to evaluate possible new delivery alternatives.

It became clear from the study with representative sample of 910 Finnish consumers (Elkelä 2013) that printed newspapers, free Internet news, and television viewing comprise now the most important media. By 2020, respondents estimated that free Internet news will be more emphasized than ever and paper newspapers will be forced to lose their position. The significance of payable online newspapers and magazines is small now and will continue to be in the future. Viewing of television broadcasts is expected to decrease because more and more programs will be watched online at a self-chosen time.

E-mail is already now considered the most important channel for written messages, and its role is expected to continue to grow at least until 2020. The role of social media seemed difficult to evaluate, but it seems to be most important for the young, especially women. It appears that the role of communication by letter will considerably diminish (Elkelä 2013). The growth of the use and diversification of electronic channels has clearly reduced appreciation of the letter, which is decidedly regarded as more expensive, slower and more awkward than, for example, e-mail and text message. Also, concerns about security and safe arrival are thought to be weaker in the case of the letter compared to that of other channels, even though the letter is believed to be on the same level as Internet services and applications (Elkelä 2014a).

Letter communication is clearly being squeezed out by electronic messaging, since the proportion of letters and postcards comprises about 1 % of messages sent by consumers. The predominant forms of messaging are telephone calls, SMSs, e-mails, and messages using Internet services and applications. Consumers consider themselves to be regular users of telecommunication companies but only occasional users of postal services. For this reason for most consumers either a telecommunications company or an Internet service provider comes to mind as an electronic communication and media provider. A postal services operator receives only a few top-of-mind choices (Elkelä 2014a).

In evaluating the situation for 2020, a majority of consumers think that it would be a bad idea to purchase single copies of printed newspapers and magazines or to pay for digital versions in the Internet. Yet, only every fifth consumer expects to be ready to pay 20 €/month for either early or daily delivery of all of their post. On the other hand, no less than three-fifths are nevertheless prepared to pay 20 €/month for an Internet connection to the whole of the European Union (Elkelä 2013).

Most consumers do not want to restrict themselves to merely electronic newspapers and magazines, but would still want to read these in paper form, even in 2020. However, most consumers will be ready to dispense with paper letter communication. The best electronic alternative for receiving messages is considered to be online bank or e-mail. This finding confirms that the electronic channels are dominating the daily lives of consumers more and more and as a consequence paper letter communication is becoming marginalized (Elkelä 2013).

Questionnaires targeted at a representative sample of 1,000 Finnish consumers and a representative sample of 300 SMEs in March 2014 aimed at gaining an even clearer understanding of the acceptance of various delivery alternatives as paper mail decreases approaching 2020. The key questions in this study were:

1. In the opinion of senders and receivers, what is the optimum delivery speed and number of deliveries for different types of paper mail: invoices and other correspondence, advertising, and newspapers and periodicals?
2. What are the attitudes toward different alternatives for door and box mail delivery?

Consumers and companies were first asked in turn what the volumes and use processes for each type of paper message and its electronic alternative were. After outlining the current state of affairs, the respondents were distanced from feeling bound by the present circumstances by asking them for an evaluation of the situation in 2020. The answers given did not necessarily extend to that year, it being more essential to get them to break loose from the confines of the present situation and think of possible novel alternatives with an open mind.

It is evident from the results of the consumer study (Elkelä 2014b) that even now digital channels dominate private messaging. Most consumers use e-mail every day and many use the social media as well. Paper messages are rarely sent and most of these are Christmas cards, that is, many consumers are activated to become senders of letter messages only once a year. Most consumers see themselves sending fewer letter messages or none at all in 2020. In that case, for most consumers a 2 or 3 day delivery speed would be sufficient for both letters sent and received. For some, even a 4–5-day delivery speed would be satisfactory. Only every sixth consumer feels a need for overnight delivery for letters and cards. Because invoicing is rapidly becoming electronic, more than one forth are not interested in the speed of letter deliveries; rather, they want all of their invoices in electronic form (Fig. 2).

Questions concerning the channel preferences for marketing communication revealed that at present the most popular channels for marketing still use paper messaging: catalog or brochure, and newspaper and magazine. Next come the electronic channels Internet and e-mail. However, by 2020, delivery of advertising mail every third day or less frequently will be sufficient for the majority of consumers.

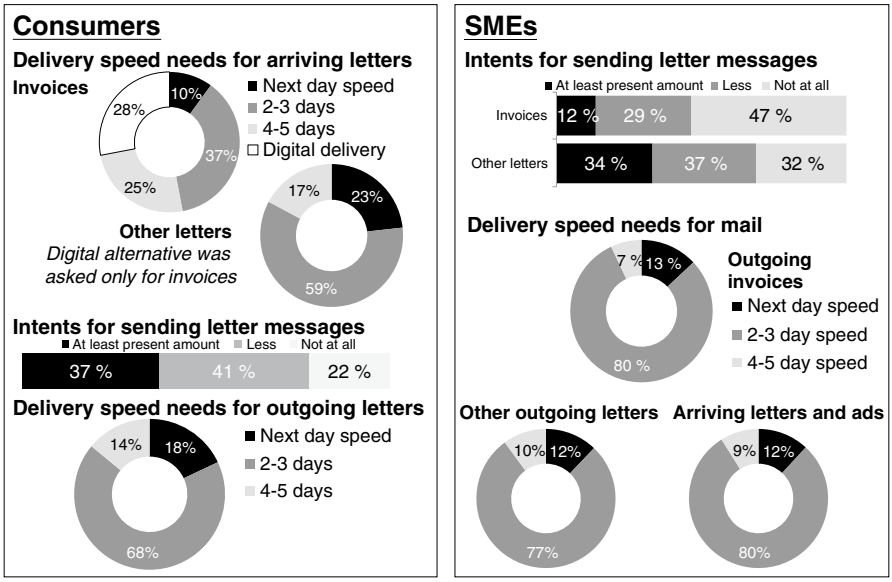

Fig. 2 Consumers' and companies' needs for sending letter messages and their delivery speed requirements 2020 (Elkelä 2014b, c)

Nowadays both newspaper and magazine subscriptions are mainly delivered in paper form. The digital versions may complement the traditional form, but few readers subscribe to the electronic version alone. On the other hand, a free supply of Internet news and entertainment is consumed in abundance. In 2020 three-fourths of all consumers will expect early morning home newspaper delivery to continue to be 7 days a week, even though an electronic version would always be available. There is in Finland a separate network, early morning delivery, for newspaper distribution, enabling subscribers to receive their papers before 7 o'clock in the morning. The results obtained clarify that at present 89 % of subscribers receive their paper in the early morning (before 7) and only 3 % read electronic newspapers alone.

Turning to magazines, most magazines in Finland are subscribed to a home address and only 10 % are sold as single copies. Every second subscriber answered that a magazine delivery once a week would be sufficient. Because a specific delivery day was not specified in the question it is probable that all respondents did not understand what this would mean in practice. If we compare this with answers of other mail delivery questions, it seems reasonable to say that every second day delivery looks like the most acceptable alternative. This in spite of the fact that nowadays magazines are nearly all included in the daytime delivery and only 1 % of consumers read electronic magazines alone.

Previous results dealt mainly with acceptability of delivery day reduction. At the end of questionnaire we asked respondents to take another view point and answer questions about new delivery point alternatives. Consumers were asked to evaluate a possible situation in 2020 in which the daytime mail would not be delivered as it

is now to the letter boxes in apartments or to boxes near row houses and detached houses. This idea sprang from an experiment (Canada Post 2014). In both situations the majority of consumers considered the best alternative to be a locker with a key either in the apartment building basement or one that would serve as a district locker for many row and detached houses. Only a few consumers were ready to pay € 20/month for continuation of delivery to the present boxes and lockers. The most unacceptable alternatives were considered to be a large communal pickup box and an unlocked locker with pigeonholes.

Next, consumers were requested to consider a situation in which mail items would not be delivered to a home address on a regular daily basis at all. In this case the majority of consumers thought the best solution would be electronic delivery of letters and papers. Only every fourth consumer was ready to pick up the mail from a collection point near the local shop. Thus, consumers are prepared to transfer their mail to electronic reception, if it is found necessary for one reason or another to end physical delivery.

The study of SMEs (Elkelä 2014c) comprising companies employing 5–250 persons, that is, micro-companies; large enterprises were not included in the survey. The findings showed that even today the electronic channels dominate company communication. Paper and electronic volumes of letter messages sent are on average of equal size only in the case of invoices. Over three-fourths of companies believe that by 2020 they will reduce the dispatch of paper invoices and other letters or not send these at all. For about four-fifths of firms a delivery speed of 2 or 3 days will suffice for both sending and receiving letters (Fig. 2).

Nowadays the most important marketing communication channels for companies are their Internet pages, e-mail and the newspaper. By 2020 they expect to continue to concentrate vigorously on their own Internet pages and e-mail. Marketing will increase in the social media, search engines and elsewhere in the Internet. On the other hand this means that they intend to reduce newspaper advertising considerably and only a little over half contemplate using any advertising on paper. Less than one-fifth of companies foresee a need for paper advertising deliveries every weekday.[1]

5 A New Way of Estimating the Net Income from Mail Delivery Areas

It is a basic business principle that revenue exceeds expenditure. The problem with mail delivery arises because the costs of maintaining motor vehicle routes in sparsely populated areas per recipient are many times those of delivery trolleys and bicycle routes to apartment building areas.

[1] Statistical detail of presented three surveys are available from the authors.

Population density greatly affects delivery costs. The difference between Finland and Central Europe is quite clear. The average population density in Finland is 16 persons/km^2, whereas in Germany it is 230 persons/km^2. Nevertheless, the total surface area of Germany is approximately the same as that of Finland. In sparsely populated areas the distance covered on the delivery route, that is, the interval between delivery points is an essential factor in considering delivery expenses (Nikali et al. 2012). Delivery costs vary significantly also within one country, especially in Finland, where one-third of the population lives in areas that comprise only 2 % of the total surface area. Correspondingly one-fifth of the population lives in areas that make up 80 % of the country (Nikali et al. 2012).

In our calculations the net income from deliveries is estimated by comparing the average total costs incurred by a 1-h outdoor delivery with the revenue accumulating from the same hour. Use of average costs and average revenue makes it easy to make comparisons between to situations in different area types. Income from outdoor deliveries is realized every time a single mail item is dropped in the door or mail box. The accumulated expenses during the hour of the outdoor delivery and all other costs which have made the outdoor delivery in question possible, such as collection, transportation, processing, sales, management, are then subtracted from the accumulated income to measure the net profitability of deliveries.

The variables affecting costs are recorded as follows:

w_h = Outdoor delivery hourly wage rate together with non-wage labor costs, assumed to be a constant average rate 25 €/h.

v_h = vehicle costs/h vary according to distance covered The cost in Finland of 0.45 €/km is converted in calculation to average hourly costs, which then differ between routes according to hourly length of drive.

t_h = all other expenses which make possible a 1-h outdoor delivery. These are in the main the previous costs of collection, transportation, processing, sales, management, etc., and which are gathered and targeted at this 1 h; assumed in calculation to be a constant 80 €

The variables affecting revenue are recorded as follows:

p = average price of one delivered mail item, assumed first to be a constant 0.45 €. This covers letters, magazines and advertising mail, but not newspapers and parcels, which have a separate delivery network.

d_h = number of delivery points, to which delivery is made in the course of 1 h; varies according to area and vehicle in use; real figures for route groups in Finland used in the calculation.

a = average daily number of mail items delivered per delivery point—per mailbox if there are multiple boxes at a delivery point—assumed first to be a constant 1.5.

c_d = accumulation coefficient of mail before delivery day; if mail delivered daily $c_1 = 1$, if mail is delivered every second day $c_2 = 2$

In this case the net income from a 1-h delivery N_h can be calculated as follows

$$N_h = \left(p \times d_h \times a \times c_d\right) - \left(w_h + v_h + t_h\right)$$

In this simplified formula it is assumed that the mailman has to visit each delivery point on the daily route, taking on average the same time regardless of the amount of mail. Table 1 presents examples of estimations based on this formula, in which the expenses of postal operations and income from different kinds of delivery areas are compared. The classification of route types is founded on the situation in Finland, although many costs, prices and volumes are not factually correct information but rather approximations of the different illustrative values of influencing factors. The normal types of delivery route in Finland are: *a*. under 15 km delivery trolley or bicycle route in apartment-building-type areas (proportion 47 %), *b*. 15–40 km motor vehicle route on private-house-type areas (16 %), *c*. 40–90 km motor vehicle route in sparsely populated areas (17 %), and *d*. over 90 km motor vehicle in extremely sparsely populated areas (19 %). Actual information concerning the circumstances and distribution of the routes has been used in the estimate.

In the examination, the total expenses required to make possible 1 h of outdoor delivery are compared to accumulated income from routes of varying lengths. For the most part costs of collection, transportation, processing, sales, management, etc., make up the expenses targeted at the delivery hour, which has been given a fixed sum of 80 € in the estimation examples. For the delivery hour itself expenses arise for the wage, in the calculation the average hourly rate 25 €, and possible use of a motor vehicle, in which case costs vary in accordance with the distance covered. Average hourly expenses for the use of a motor vehicle have been calculated so that a cost of 0.45 € has been attached to every kilometer driven, which well corresponds to the actual situation in Finland.

At the starting point in Table 1 (1.1) the figures have been so arranged as to produce near zero profit and loss result. In this way it is easier to compare different area groups and to compare a starting point later with a situation of declining volumes. The fastest delivery takes place in private-house areas of towns on motor vehicle routes and in apartment-building areas using delivery trolleys and bicycle routes. Slower to deliver and therefore quite unprofitable are the motor vehicle routes in the extremely sparsely populated areas.

Table 1 (1.2) shows that if total revenue at the starting point only just falls on the plus side, there is no way to prevent losses on these routes even by reducing the deliveries to be accomplished every second day. Yet, this solution would improve net income considerably. However, in this simple calculation it is assumed that there is no price elasticity and also implicitly assumed that other expenses become adapted according to the delivery hours. This means that a zero result will be reached more easily than would be possible in the real world.

In Table 2 (2.1) we look at a probable future situation in which mail volumes have been halved. In such a case, an average of only 0.75 mail items can be delivered to each delivery point and there will be high losses in net income. Table 2 (2.2) shows that in this case revenue will fall so much that only by reducing delivery in all areas so as to be accomplished every second day will it be possible to return to a positive result. Table 2 (2.3) presents another alternative, which is price increases. In the estimate examples prices have been raised 25 %. However, this means that breaking even is only possible when at the same time all delivery to motorized delivery areas is reduced to be performed on every second day.

Table 1 Example of calculations for net income of 1 h of outdoor work

Route group; Length of delivery route, km	All costs for one outdoor hour				Revenue acquired by way of one hour of mail delivery						Net income/h, Revenue Costs/h, €
	Outdoor delivery work costs /h	Vehicle costs/h	Other costs/h (about 77 % of total costs)	Total/h, €	Delivery days	Accumulation coefficient of mail before delivery day	Average daily number of mail items/ delivery point	Number of delivery points delivered/h	Average price of one delivered mail item	Total/h, €	
1.1. Starting point—near zero result											
(a) Less than 15 km	25	0	80	105	Every day	1	1.5	195	0.45	132	27
(b) 15–40 km	25	4	80	109	Every day	1	1.5	210	0.45	142	33
(c) 40–90 km	25	9	80	114	Every day	1	1.5	135	0.45	91	−23
(d) 90+km	25	15	80	120	Every day	1	1.5	75	0.45	51	−69
Average	25	5	80	110	Every day	1	1.5	165	0.45	111	1
1.2. Every 2nd day delivery in one area as solution to increase income											
(a) Less than 15 km	25	0	80	105	Every day	1	1.5	195	0.45	132	27
(b) 15–40 km	25	4	80	109	Every day	1	1.5	210	0.45	142	33
(c) 40–90 km	25	9	80	114	Every day	1	1.5	135	0.45	91	−23
(d) 90+km	25	15	80	120	Every 2nd day	2	1.5	75	0.45	101	−19
Average	25	4	80	109	Every 2nd day+	1.19	1.5	165	0.45	133	24

Table 2 Example of calculations of adjustment alternatives in a situation of decreasing volumes

Route group; length of delivery route, km	All costs for one outdoor hour				Revenue acquired by way of one hour of mail delivery						Net income/ h, Revenue Costs/h, €
	Outdoor delivery work costs /h	Vehicle costs/h	Other costs/h (about 77 % of total costs)	Total/h, €	Delivery days	Accumulation coefficient of mail before delivery day	Average daily number of mail items/ delivery point	Number of delivery points delivered/h	Average price of one delivered mail item	Total/h, €	
2.1. 50 % lower volumes											
(a) Less than 15 km	25	0	80	105	Every day	1	0.75	195	0.45	66	−39
(b) 15–40 km	25	4	80	109	Every day	1	0.75	210	0.45	71	−38
(c) 40–90 km	25	9	80	114	Every day	1	0.75	135	0.45	46	−68
(d) 90+km	25	15	80	120	Every day	1	0.75	75	0.45	25	−95
Average	25	5	80	110	Every day	1	0.75	165	0.45	56	−54
50 % lower volumes + solutions to avoid losses											
2.2. Every 2nd day delivery in all areas											
(a) Less than 15 km	25	0	80	105	Every 2nd day	2	0.75	195	0.45	132	27
(b) 15–40 km	25	4	80	109	Every 2nd day	2	0.75	210	0.45	142	33
(c) 40–90 km	25	9	80	114	Every 2nd day	2	0.75	135	0.45	91	−23
(d) 90+km	25	15	80	120	Every 2nd day	2	0.75	75	0.45	51	−69
Average	25	5	80	108	Every 2nd day	2	0.75	165	0.45	111	3
2.3. 25 % higher prices and every 2nd day delivery in three area groups											

(continued)

Table 2 (continued)

Route group; length of delivery route, km	All costs for one outdoor hour				Revenue acquired by way of one hour of mail delivery						Net income/ h, Revenue Costs/h, €
	Outdoor delivery work costs /h	Vehicle costs/h	Other costs/h (about 77 % of total costs)	Total/h, €	Delivery days	Accumulation coefficient of mail before delivery day	Average daily number of mail items/ delivery point	Number of delivery points delivered/h	Average price of one delivered mail item	Total/h, €	
(a) Less than 15 km	25	0	80	105	Every day	1	0.75	195	0.56	82	−23
(b) 15–40 km	25	4	80	109	Every 2nd day	2	0.75	210	0.56	177	68
(c) 40–90 km	25	9	80	114	Every 2nd day	2	0.75	135	0.56	114	0
(d) 90+ km	25	15	80	120	Every 2nd day	2	0.75	75	0.56	63	−57
Average	25	5	80	108	Every 2nd day+	1.53	0.75	165	0.56	107	−1

The estimates demonstrate that delivery costs are already a problem in sparsely populated areas. Delivery expenditure increases in relation to the distance it is necessary to cover by motor vehicle, and less revenue is realized from long routes, because far less mail items can be left at delivery points in the course of an hour. As the number of mail items decreases, delivery will become unprofitable even in more populated areas.

The example presented is a simplification, in which many parameters have been held constant, even though in reality their values fluctuate. Also, for example, prices and volume distribution could be separated according to product group using real values. Previous results are similar to those of Haller et al. (2014), who modeled delivery costs and came to the conclusion that the greatest benefit from reducing delivery days occurs in the scattered areas. In keeping with our results, they found that decreasing time spent driving is an effective way of saving costs.

6 Pressure for Changes to Universal Service Obligation

Raising prices can only be a temporary solution to the problem. The more effective means for increasing work productivity have, in many cases, already been used. Obviously then, more radical approaches will be needed, such as that shown in the estimate examples; reducing deliveries gradually to be performed every second day.

The Postal Directive aims at achieving an internal market for postal services and at the same time safeguard a common level of universal services for all users in all EU countries. Not all postal services are universal services. However, there is substantial variation in Member States as to the range of services considered to be universal. In eight member countries (e.g. Belgium and Denmark) all non-express postal services are considered to be within the scope of the USO whereas in 11 countries (e.g. Finland and the Netherlands) only one basic single-piece letter service (either priority or non-priority) and one basic parcel service are covered by the USO (Dieke et al. 2013).

In addition to service scope other relevant dimensions of the USO are the requirements for delivery and service quality. Our survey results and estimations support a reappraisal of the USO, as does the test of the market. In Finland according to the Postal Act, the Government shall impose license terms that are essential for ensuring the quality, availability and efficiency of services. In January 2014 the competitor of the universal service provider was granted a license with an obligation to deliver letters at least once a week, with no other quality requirements. Even this obligation was considered to be too severe by the licensee and appeal against the decision was made to the Supreme Administrative Court. This clearly shows that there is no demand for a 5-day delivery service. The gap between the USO and the competitive offering guided by market forces is too wide and there will be no voluntary offering of universal services under the current terms.

Moreover, the USO could be defined outside traditional paper delivery. Many electronic alternatives are available as substitutes for paper communication. Paper mail could be delivered to the most sparsely populated areas only two or three times

per week and on other days it could be retrieved for example from the municipal center, if desired. It is particularly important to define a reasonable 'light USO' for sparsely populated areas. Criteria could include the distance from a population center, the distance between delivery points or the distance of extra branches from the main delivery routes. Before paper mail volumes diminish to a third or half of the present amount, the possibility of a USO which would require only two deliveries per week should be seriously debated, (Nikali et al. 2012).

7 Summary and Conclusions

Digital communication has marginalized the significance of letter messaging in both quantity and attitudes. Because all quick messages are transmitted digitally, the clear majority of consumers and companies do not demand overnight speed for their letters. Our surveys showed that delivery within 2–3 days is sufficient for most, and some will accept even a 4–5 working-day speed. Besides speed, another driver for digitalization, especially in companies, is costs savings.

Letter volume decline appears to accelerate because senders intend to reduce letter messaging even further in the future. In this situation, even reasonably high price increases or an intensification of work efficiency is not enough. We will be faced with a need to cut down weekly delivery days, for example by moving to every-second-day delivery. Our calculations proved that daily delivery is especially challenging in sparsely populated areas because costs per delivery hour are higher and on the other hand income per delivery hour is lower. The USO requirements should be updated to allow slower delivery speeds e.g. every second day delivery—first in sparsely populated areas and gradually also elsewhere.

Our surveys and calculations help to show the need for change, and tools of the kind presented here can be also applied in order to prove how necessary change is. In view of this more flexibility will also be needed in mail business regulation. At least it should not prevent different experiments with different delivery speeds and times. Furthermore, there should be a readiness to evaluate the USO in a new way so that it would, in some circumstances, also allow digital delivery as a substitute for physical delivery.

Besides letters, consumers will accept delivery of advertisements and magazines every second day or less often. Therefore in those countries in which these are included in the USO, there are good grounds for tempering delivery time demands. Even though the USO supplements the operation of the market, there should not be an unreasonably large gap between it and the market. Also for this reason, it is important to reappraise and proportion the regulation to the real market situation.

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E-invoicing as the Principal Driver of Change in B2X Letter Market Definitions

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1 Introduction

The postal service industry is experiencing significant changes in its fundamental features in light of rapid and consistent improvements in technology pushed by the broad availability of the internet. The growth in electronic means of communication has had an impact on traditional mail volumes. In particular, demand for addressed B2X mail is under pressure due to such developments as e-invoicing. This paper discusses whether the arrival of e-substitution might alter previous relevant market definitions. The focus of the analysis is whether the reduction in B2X demand follows from entry by a marginal substitute or a gross substitute, reflecting on Crew and Brennan (2014).

In their paper, the authors stated that it would be erroneous to conclude that a postal operator lacks market power because it has lost business to electronic delivery. According to the authors, the important distinction is between gross substitutes that reduce demand for a postal operator's services, and marginal substitutes, where the effect on demand depends significantly on postal operator's prices: only the latter matters for market definition. If a substitute is marginal, the ability of a postal operator to raise price will be limited by the threat that a price increase alone will lead customers to switch to the substitute. If the new service is a gross substitute, a postal operator will not face a loss of business just because it raises price.

To evaluate whether e-substitution is a marginal substitute, the Hypothetical Monopolist test (HMT) will be implemented by means of a customer survey. The HMT is a widely accepted methodology to define antitrust markets. If the empirical

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analysis proves that marginal substitution takes place traditional B2X letter market definitions in the postal service industry might need to be adjusted including both traditional postal delivery and modern electronic delivery of mail items.

The structure of the paper is as follows. Section 2 elaborates the developments in letter mail volumes in recent years. The claim is made that e-substitution already caused a significant change in the mailing behavior of companies. Section 3 identifies that e-invoicing is the driving change factor in B2X letter mail. The majority of letters mailed B2X is transactional mail (64 %). Within transactional mail, invoices represent the largest share (75 %). This means that about 48 % of letters mailed are invoices. Research is done whether substitution with respect to invoices is indeed crucial in market definition. Section 4 finally investigates whether e-delivery of letters is a gross substitute or a marginal substitute. In case it can be shown that price is the decisive factor for companies to move to e-deliveries and that a hypothetical price increase by a postal operator would be not profitable, the relevant antitrust market needs to be redefined including both, postal and e-delivery of B2X letter items.

2 B2X Letter Mail Developments and E-substitution

Mail operators globally have experienced significant reductions in the level of mail volume. The main drivers in this dramatic change are the potential cost reductions by e-substitution, the broadband penetration rate and the digital acceptance in the population (Copenhagen Institute for Future Studies 2011, p. 5). According to Crew and Kleindorfer, the volume decline from intermodal (electronic) competition is much more serious than anything faced by postal operators in their entire history (Crew and Kleindorfer 2010, p. 14).

Surveys indicate that since 2007, letter volumes have been declining at an average annual rate of 6 %. Cumulatively, this decline in the last decade amounts to 30–50 % of previous volumes (Copenhagen Economics 2012, p. 119). The following table illustrates the decline in mail volume 2006–2011 in different regions worldwide. On global scale, letter volumes dropped by 15.5 % in the period 2006–2011. In Europe, the decline was lower than in other regions (−12.5 %). The Americas are suffering the most (−21 %) (Table 1).

Table 1 Development letter volume 2007–2011 (2006 = 100)

Mail volume	2006	2007	2008	2009	2010	2011
Global	100	99.4	96.6	89.1	86.5	84.5
Americas	100	99.7	95.2	83.3	80.3	79
Asia-Pacific	100	99.4	101.3	99.9	99.4	98
Europe	100	98.6	96.7	94.8	91.4	87.5

Source: International Post Corporation (2012, p. 7)

The economic effects of e-substitution differ from country to country. In the UK, inland letter volumes declined by 3.1 % p.a. from 2005 to 2008, and by 6.3 % p.a. from 2008 to 2013 (PricewaterhouseCoopers 2013, p. 7). Poste Italiane registered a 9.9 % drop in its postal product volume (Accenture 2011, p. 6). TNT mail volumes have declined by 7.2 % in 2011 (An Post 2012, p. 17).

Mailers have various electronic alternatives, which they could use for their communications: (1) E-mail: Companies and other institutions are increasingly making use of e-mail to communicate with their customers. The services that are provided by e-mail range from sending invoices embedded in the e-mail or as an attached PDF file, to more complementary and innovative services, for example, e-mail reminders and alerts where a customer is close to becoming overdrawn on his or her account. (2) Internet C2B: Many companies and other institutions allow individuals to access information through websites. Many banks offer online banking services and allow customers to opt out of receiving hard copy statements. Government departments increasingly allow and often strongly encourage internet transactions. (3) Text messaging: Many companies and other institutions now communicate with their customers through text message. Some banks offer customers text message balance updates and overdraft alerts. (4) Bill payment using mobile devices is another application that is becoming popular.

By now digitalization is defining many of the large-scale mailers' (financial institutions, governments, etc.) communications choices. The digital communications infrastructure already exists for these mailers and (potential) cost savings from digitizing letter mail are large. Notably, customer communication such as invoices and contract information are shifted to electronic channels – strongly supported by the legal situation – since it is less expensive and has no disadvantage for the companies. If cost savings by large mailers or pay-to-play (where customers have to pay to receive physical mailings) quickly become dominant communications models among senders, mail volumes could decline much faster than ever anticipated.

Empirical results from numerous studies show that e-mail, online banking and e-invoices substitute physical letters directly (Okholm et al. 2010, p. 210). The results are quite similar for both residential users and businesses. Cazals et al. assume that it is likely that broadband connections combined with advances in Internet enabled technology are resulting in a continuing substitution of social and commercial letter traffic (Cazals et al. 2010, p. 12). Their econometric models confirm that in the periods 2005/2006–2007/2008, e-substitution was reducing the demand for direct mail by at least 9 % per annum, social letter mail by around 4 % per annum and commercial letter traffic by around 2.5 % per annum (Cazals et al. 2010, p. 14). Nikali (2008) found significant substitution for C2X and B2B mail too (Nikali 2008, p. 104).

When sending and receiving post, e.g. the majority of participants to a research stated that, they are increasingly substituting post with electronic methods of communication such as e-mail, telephone or text, online document sharing and video calling. Residential users in particular send little mail: the volume of items they reported sending by post in 2011 was on average 1.5 items per week per user compared with 3.5 items in 2006 (Ofcom 2012, p. 2). In addition, digital communication

has eroded letters mail's role in government to citizen communication. Government to citizen (G2C) communications are increasingly automated and function through single-point entry systems, leading to declines between 2.5 % and 3 % annually towards 2020 (Copenhagen Institute for Future Studies 2011, p. 18).

The postal regulatory authority in UK – Postcomm – confirmed with respect to business customers that e-substitution increased in 2009, with an 11 % increase in those who had moved mail to other media. Switching was particularly notable amongst the top mailers. The main catalyst for over the half was cost savings. Transactional mail was with 51 % the main type of mail that was moved to other media and this move was most notable amongst the small mailer segment. E-mail was the most common form of media being substituted for post (Postcomm 2010, p. 10).

A survey of industry experts indicated that, on average, an opinion that markets would decline by a combined 2.39 % annually, or 22 % over 10 years (Fève et al. 2011, pp. 17–18). If declines follow the trends established during the financial crisis, letters mails volumes would even decline by 40 % or more (Copenhagen Institute for Future Studies 2011, p. 5).

Using the Internet for communication has already reduced the demand for postal letter delivery. The research question is whether this ongoing loss in business because of e-substitution has an effect on market definition. As identified by Crew and Brennan (2014), the concept of market definition is applicable only to marginal substitutes, but not gross substitutes. This means that the extent of the displacement of postal letters by digital communication should depend on price. The remaining demand for mailing letters may still be sufficiently insensitive to price. This logic is applied below to the business mail segment as identified by the European Commission in its previous case law.

3 E-invoicing as the Driving Change Factor in B2X Letter Mail Market Definition

The European Commission has held in previous decisions that there are separate markets for domestic and international letter mail. Other segmentations in the case law of the European Commission distinguish between (1) standard and express delivery services and (2) business mail and mail for private customers. The Commission found that business customers usually require and receive different services compared to private customers, who have to buy a stamp at a post office and mail their letter through mailboxes or post offices. Business customers negotiate rebates and receive additional services. Thus, in the following the relevant market with respect to business mail B2X is defined. The letter volume in a B2X national market is about 90 % of all letters mailed (10 % in C2X national).

Transactional mail (64 %) is according to different surveys the most important B2X letter mail application followed by advertising (15 %), social (10 %), publishing (7 %) and fulfillment (4 %) (Postcomm 2011, p. vi). Fulfillment mail is the

sending of packets, ordered goods, tickets. Transactional mail is also the leading choice for a switch to electronic means among businesses.

Transactional mail is defined as communication between companies or between companies and individuals relating to the ongoing provision of goods or services. The senders of transactional mail typically fall into one of four types (Postcomm 2011, p. 27): (1) Financial companies sending information to their customers, for example, banks sending monthly statements or credit card bills. Mailings sent to inform customers about changes to the terms and conditions of their credit cards, mortgage and savings accounts or insurance policies would also be considered as examples of transactional mailings; (2) utility companies sending bills or information to their customers; (3) public administration/government departments which communicate with members of the public or businesses; and (4) other companies and institutions communicating with their customers, who may be private individuals or other companies. About 75 % of all transactional mail is invoices or financial statements. That is why e-invoicing is considered to be a crucial element in B2X letter mail market definition.

For decades, enterprises have created paper invoices, putting them into envelopes with stamps, and sending them either through the postal system or by courier to their clients. When clients receive the paper invoices, they must check that the information in the invoice is correct and manually enter the details into their systems before the payment can be approved (Ciciriello and Hayworth 2010, p. 1). On the other hand, e-invoicing is the automated process of issuing, sending, receiving and processing invoice data by electronic means. E-invoicing is the electronic transfer of billing and payment information, via the Internet or other electronic means between the parties – businesses, the public sector, consumers – involved in commercial transactions. The following examples represent a gradual path from manual invoicing to the full end-to-end automation that a company could achieve by expanding its capability over time. These examples are: (1) traditional manual invoicing; (2) semi-automated processes over the Internet using PDF invoices, web portals (sender and receiver based); and (3) end-to-end automated e-invoicing as fully integrated order-to-payment processes. Compared to paper invoices, e-invoices may offer huge advantages for companies. They are said to be easier to process, they reach the customer faster and can be stored centrally at a very low cost.

E-invoicing is also part of the European Commission's flagship initiative *A Digital Agenda for Europe*, which gives prominence to achieving a single digital market and calls for removal of the regulatory and technical barriers that prevent mass adoption of e-invoicing. The European Commission wants to see e-invoicing become the predominant method of invoicing by 2020 in Europe. The mass adoption of e-invoicing within the EU should lead to significant economic benefits and it is estimated that moving from paper to e-invoices will generate savings of around € 240 bn. over a 6-year period. Providing invoice data electronically and in a format could allow businesses to benefit from shorter payment delays, fewer errors, reduced printing and postage costs. Most importantly, structured e-invoices facilitate business process integration from purchase to payment, meaning that invoices could be sent, received and processed without manual intervention (European Commission 2010, pp. 1–2).

Table 2 Development of e-invoicing (2008–2013, in %)

Electronic share	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (E) (%)	2014 (E) (%)
B2C	6	7	10	11	13	14
B2B/B2G/G2B	7	10	13	15	20	24
Weighted average	6	9	11	14	18	**21**

Source: Koch (2014, p. 12)

In this context, 2016 is defined as a milestone: In that year, the majority of procurements by the government and the invoices to the administration shall be made electronically in Europe. Other initiatives from the European Commission push interoperability among operators. There are operator associations with a standardized approach, (e.g. EESPA/European E-Invoicing Service Providers Association, German E-Invoicing Alliance, OpenPEPPOL, the SimplerInvoicing initiative, etc.).

Expectations are that, within the next 2 years, e-invoices will account for the *majority* of invoices. Surveys suggest that the drivers that increase the adoption of e-invoicing are the speeding up of the invoicing process (75 % of the respondents), the reduction of invoicing costs (64 % of the respondents) and environmental considerations (47 % of the respondents). The development in e-invoicing in the EU is documented below. The estimate for 2014 is that 21 % of the volume of all invoices is already distributed by electronic communication (Table **2**).

Due to high volume and low legal barriers in the B2C sector, organizations with high outbound volume were the first offering electronic bills to consumers via their customer portals. This development started in most European countries before the millennium. Around 2001, this "Electronic Bill Presentment" channel was enhanced with e-mail delivery of PDFs, causing a huge jump in the number of users. In the B2B market, the e-invoicing market was initiated by large purchasing organizations, pushing their large suppliers to deliver e-invoices. Due to the fragmented invoice situation, even large organizations did not achieve satisfactory electronic volumes, just with their large trading partners.

Currently we are in the middle of the next evolutionary step: addressing the SMEs. There is a sharply increasing number of SMEs issuing and receiving e-invoices. In most cases, SME projects have been initiated by large trading partners or governments having pushed them to do so. The more SMEs enter into the e-invoicing market, the more the PDF volume increases. Following that step will be e-invoicing on the mass market. The various initiatives by the national public sectors and the European Commission will result in the breakthrough in this sector. The breakthrough of e-invoicing is expected to happen in particular in those Member States where e-invoicing is mandatory for the public sector offering simple tools for users in the B2G domain (Koch 2014, p. 12). There are currently just a few segments receiving a very high invoice volume. These sectors are healthcare, retail, public sector and buyer clubs/trade.

Developments with respect to e-invoicing are indeed remarkable in Europe. In the following it is examined whether this e-substitution is a marginal substitute where the effect on a postal operator depends significantly on prices or a gross substitute which would not change antitrust market definitions.

4 Need to Adjust B2X Letter Mail Market Definitions?

Market definition techniques have become used around the world. With respect to methodology the consensus is that the HMT is used to measure demand and supply substitutability. For the definition of the relevant market, demand substitution constitutes the most immediate and effective disciplinary force on the suppliers of a given product, particularly in relation to their pricing decisions. A firm or group of firms cannot have a significant impact on the prevailing conditions of sales, such as prices, if its customers are in a position to switch easily to other products. The exercise of market definition consists of identifying the effective alternative sources of supply for the customers involved. The essential idea in defining markets is to identify the conditions under which a price increase would be not profitable. In such a case, substitutes, which exercise significant competitive constraints, need to be included in the relevant market. The European Commission's Notice on market definition refers in paragraph 17 to the HMT as a speculative experiment (European Commission 1997). The European Court of Justice confirmed the application of the HMT for market definition purposes in the AstraZeneca-case (AstraZeneca AB and AstraZeneca plc v. European Commission 2012).

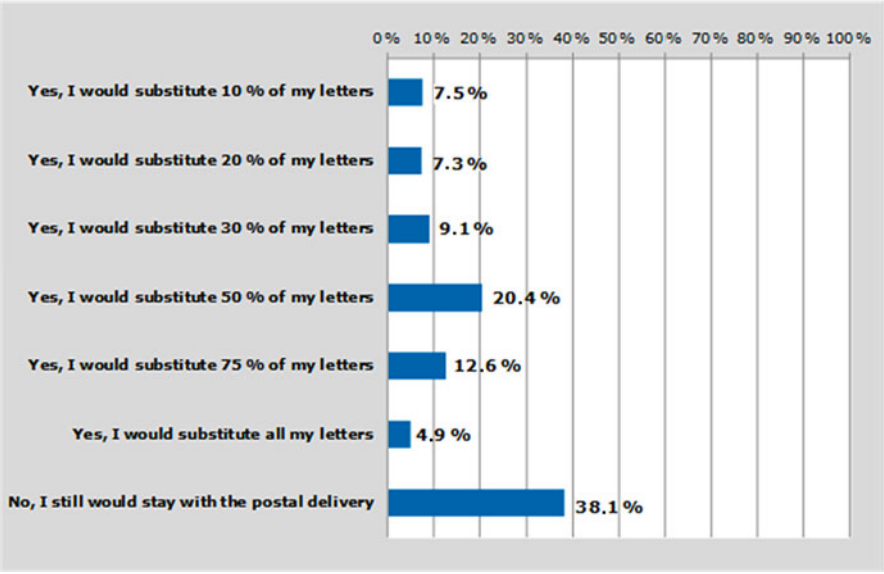
In the following, these market definition techniques are applied to define the relevant antitrust market for national business mail B2X in Austria. The research question is whether e-delivery exercises a significant competitive constraint on traditional postal letter mail delivery or in other words, whether e-delivery is part of the delivery market for letters. If the survey reveals that e-delivery is a marginal substitute for Austrian business customers, the market needs to be enlarged.

The questionnaire for the Austrian customer survey is designed according to competition law requirements as outlined above. The Internet-based survey was conducted in July 2013. The survey includes (1) direct and (2) 20 indirect choice-decision/Conjoint Analysis questions. 451 companies answered the questionnaire.

The answers to the direct questions showed that 28.2 % of the respondents are larger companies with 250 and more employees. The medium sized companies with 50–249 employees are represented with 27.3 %. The lowest respondent rate is coming from very small companies (10.9 %). The mailing volume is in accordance with this segmentation; 12.6 % of the respondents are mailing on average more than 10,000 letters a month, 35.3 % of the respondents mail between 100 and 1,000 letters a month. The distribution of both criteria – size of the companies as well letter volumes – is coherent with the business client distribution of Österreichische Post AG.

The companies surveyed predominantly send invoices (43.5 %) followed by business letters (31.7 %), other (21.9 %) and contracts (2.9 %). The majority of letters go to consumers (B2C) with a share of 41.2 %. Letters mailed mainly to businesses (B2B) count for 26.6 % and to the government (B2G) with 7 %, adding up the B2B/G group altogether to 33.6 %. 24.8 % of the respondents mail roughly the same amount B2B and B2C. 30.6 % of the respondents already think about sending letters in the future in an electronic manner. Currently, 76.1 % of the respondents predominantly send letters on paper by postal services. 20.8 % use for their e-deliveries e-mails with a PDF attachment, 1.6 % a website/portal and 1.6 % EDI.

Table 3 Direct question HMT Austrian business customer survey; Q: "Would you mail your letters by e-delivery, if the price for postal deliveries would increase from 62 Ct. to 65,1 Ct. ?" (2013, in %)



73.2 % of the respondents receive letters by postal mail, 24.2 % by e-mail, 0.9 % by a website/portal and 1.6 % via EDI. Only one company surveyed receives invoices predominantly by fax. All these observations are consistent with general market information available. Thus, the Austrian 2013 survey is representative.

Part of the survey was a *direct* question of whether the customers would switch away to e-deliveries, in case of a hypothetical price increase of 5 % for postal deliveries. This question was answered by 61.9 % of the respondents positively: just 38.1 % of the respondents would stay with the postal service provider at a higher price. This strongly indicates that substitution is based on price, meaning that e-delivery of letters is a marginal substitute. For mailers even a small, insignificant price increase for postal services motivates them to switch away. The survey also indicates that in particular the mailing of invoices is highly price sensitive (Table 3).

Crew and Brennan (2014) pointed out correctly that the market definition inquiry is not suited to address whether a single firm or cartel is dominant or a monopoly. If it could increase profits by a price increase, however, it presumably already has done so. Any profit-maximizing firm acting on its own will raise price up to the point when further price increases would be unprofitable (Crew and Brennan 2014, p. 8). This means that at monopoly prices there will be many substitutes for the monopolists' product (Geroski 2003, p. 7). As a result, excessively broad market definitions can be observed. In the literature, this is known as "cellophane fallacy" (O'Donoghue 2006, pp. 82–84). That is why it has to be checked that the price that is used in the

direct question above, namely 62ct for a postal stamp, is not a monopoly price. At monopoly prices, consumers regard even inferior substitutes as attractive.

Despite these concerns, the cellophane fallacy does not imply that a new theoretical framework to defining relevant markets is required. The challenge in the application of the HMT is to identify what that "competitive" level should be (Card et al. 2013, p. 71). The European Commission specified in a 2002 recommendation that for implementing the HMT in regulated network industries current prevailing prices need to be used. The assumption is that those prices are close to prices that would emerge in a competitive environment (Buigues and Rey 2004, p. 393). Thus, in markets where the provision of the relevant products is subject to a cost-oriented regulation, these cost-oriented, regulated prices are used as a starting point for the application of the HMT (European Commission 2002, p. 42). The consensus is broad that these regulated prices should be used (Rundfunk and Telekom Regulierungs-GmbH 2004, p. 59). The prices for the delivery of letters charged by Österreichische Post AG are regulated, cost-based prices. The HMT at these regulated prevailing prices remains useful in the sense that it is indicative of substitution patterns at such prices.

Another way to check that prices are at a competitive level is the use of comparable markets (OECD 2012b, p. 42). If a competitive market for the same product exists, for example in a different region or in another country, the price in this region can serve as a proxy for the competitive price. The concept of comparative markets consists of two steps. First, similar and more competitive markets are identified. The second step is to compare the prices in those markets with the prices in the market under scrutiny. With respect to the identification of comparable markets, the Postal Freedom Index provides useful information (Consumer Postal Council 2012, p. 5). According to this survey, few letter postal markets in Europe qualify as competitive markets: Sweden, United Kingdom and Germany. A price comparison for standard letters delivered on the next working day reveals that the purchasing power parity adjusted price charged in the United Kingdom is around 29 % higher than the letter price in Austria. The German letter price is almost equal whereas the Swedish letter price is around 5 % lower than the Austrian standard letter price (Deutsche Post AG 2013, p. 17). It can be concluded that the letter price charged by Österreichische Post AG is at the same level as the price observed in some competitive markets in Europe. Therefore, the regulated price for letter mail, 62 Ct, is used in the HMT as the benchmark for a competitive market environment (Hausman and Sidak 2007, p. 389).

With respect to the *indirect* questions in the survey, Conjoint Analysis is used. Since the HMT is intended to reflect actual purchasing decisions, the Conjoint Analysis technique ensures that the decision made by respondents when answering the survey questions is as close as possible to the decision made when actually purchasing a good. An OECD paper describes this technique for market definition as follows (OECD 2012a, p. 184): "*In a conjoint analysis, the relevant product can be decomposed into its constituent attributes which include qualitative attributes (such as brand, functionality, reliability, colour, shape,* etc.*) as well as price. When consumers make a choice between different goods, they are weighing up the relative value of the different levels of the different attributes offered by the rival goods.*

Conjoint analysis seeks to determine how consumers value these different attributes in order to predict how they will make choices in reality. … With a successful conjoint analysis, it is possible to estimate the underlying consumer demand functions, with reasonable accuracy."

9,200 choice decisions (451 respondents * 20 questions) were sampled. Multiple or incomplete answers have been made impossible by technical provisions. Tests within the Sawtooth Software used confirmed that the answers collected are statistically significant. In addition, the indirect conjoint questions were developed and programmed in accordance with the market definition requirements outlined above. In particular, the following three criteria (1) product characteristics, (2) price and (3) intended use are applied. In this respect, preliminary research about the client behavior of Österreichische Post AG revealed that in their buying decisions the following attributes are of importance: price, sender preferences, receiver preferences and the mode of delivery.

To implement the HMT, the levels of these attributes are identified in accordance with market realities and programmed. Whereas the basic layout of the indirect questions is held constant during the survey, the software randomly for each question generates the levels of the attributes. The respondents have to decide which of the presented buying decisions they prefer. The choice decisions obtained from the survey enable a comprehensive analysis of the choice behavior of Austrian business customers regarding the usage of the different delivery products.

The revealed preferences identified by Conjoint Analysis are that the attribute "price" has an importance of 45 % in the buying decision of an Austrian business customer. "Price" importance measured by Conjoint Analysis in other surveys are usually lower (30–35 %). Austrian business customers seem to be very price sensitive. The result from these indirect questions confirm also the answers already obtained from the direct question ("*Would you mail your letters by e-delivery, if the price for postal deliveries would increase from 62 Ct. to 65,1 Ct.").* The importance of the other attributes in the buying decision, adding up to 100 %, are "mode of delivery" (28 %), "receiver preferences" (11 %) and "sender preferences" (16 %).

The Conjoint software computed the demand curve for Austrian business clients. This demand curve was used to simulate the hypothetical price increase of 5 % for postal services as requested by the Market Definition Notice of the European Commission described above. The result of these computations is that in case the relative price for a stamp in Austria would increase by 3.1 Ct – from 62 Ct. to 65.1 Ct – demand would decrease by 9.33 % in the B2X segment.

The calculation of the profit of such a hypothetical price increase is the second step in the application of the HMT after the estimation/calculation of the price elasticity took place. To calculate the profits, turnover data (NOS, Net Outside Sales) as well as variable cost data (TDC, total direct costs) are required. The contribution margin is defined as NOS minus TDC. Thus, the profit or loss of the hypothetical price increase is calculated by comparing the contribution margins before and after the price increase.

If the profit is higher than the profit before the price increase, the price increase is profitable. This means that substitutability is not enough to constrain a hypothetical

Table 4 Results of HMT calculations B2X letter mail Austria (2013, in %)

B2X letter mail			
Elements HMT	Before price increase	After price increase	Change in percent
Price per letter (in Ct.)	**Ct 62** 100 %	**Ct 65.1** 105 %	**5**
Volume letter national (in mio.)	100 %	90.67 %	**–9.33**
Revenues (in mio. €; volume * price)	100 %	95.21 %	**–4.79**
Variable costs (in mio. €)	100 %	90.67 %	**–9.33**
Contribution margin (in mio. €)	100 %	96.42 %	**–3.58**

monopolist. Thus, the relevant product would be defined in a narrow way. On the other side: in case that the hypothetical price increase is not profitable, the market needs to be enlarged by the substitute. Such a substitute is considered to be – to stay with the Crew and Brennan (2014) definitions – a marginal substitute where the effect on a postal operator depends significantly on a postal operator's prices. This would confirm that the extent of the displacement of postal letters by digital communication depends on price.

The table shows that the HMT is not profitable – based on the reduction in demand and lost profits. Thus, other neighboring markets, like in our case e-delivery, needs to be included in the relevant antitrust market (Table 4).

The results of the Austrian customer survey were checked with data on demand elasticities gained by a natural experiment. A natural experiment or shock analysis can be used for antitrust market definition to verify demand elasticities. The natural experiment relates to an actual price increase by Österreichische Post AG in 2011. Demand elasticities for B2X letter mail measured by this natural experiment were similar to the survey data discussed above (about –9 % decrease in demand for a +5 % price increase). This means that the conclusion with respect to an adapted definition of the relevant antitrust market B2X is quite strong for Austria.

5 Conclusion

This paper discussed the extent to which electronic means of communication is impacting the industry and the implicit ramifications on market definition. The paper showed that in particular the market for transactional mail B2X is affected by e-substitution. With affirmation from a survey done in Austria in 2013 as well as from a natural experiment in 2011, the paper supported the claim that B2X letter mail in Austria include e-deliveries as well as postal deliveries. Evidence was presented that large business and Internet competition are marginal substitutes in Austria. In particular, the HMT showed that antitrust market definition for B2X letter mail needs to be adapted. The delivery of letter items is technology neutral. Invoicing was identified as the principal driver for change in this B2X letter market definition.

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The Competitive Fringe: Informing New Customer Experiences and Driving Additional Value for Recipients

Adam C. Houck

1 Introduction

In myriad marketplaces today, customers demand greater flexibility and customization, both in the shopping and purchasing experiences they encounter and in the actual products they buy. Postal services are no different. For postal operators (POs) to capitalize in both traditional letter mail and parcel delivery marketplaces, they must become more data-driven to create additional value in existing product offerings and offer new product offerings. In particular, just as new technologies such as Quick Response (QR) codes have transformed the way consumers browse catalogs and purchase goods, there are opportunities for the data generated in growing parcel markets to further improve direct mail and catalog targeting.

POs must identify and exploit the linkages between parcels and advertising mail or be relegated to serving as last mile delivery companies, a 'deliverer of last resort', competing solely for business against fringe entrants on price. Section 2 explores current and emerging trends in the parcel segment including innovative delivery models. Section 3 examines the need for POs to exploit the data generated in parcel markets to improve advertising mail offerings and conclusions are presented in Sect. 4.

The views expressed are those of the author and do not necessarily represent those of IBM Global Business Services. The author is indebted to Lorraine Galloway for her contributions to this paper.

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2 Parcel Delivery

In an age of rising postal prices, the seminal question remains: how do firms make direct mail more effective? This is of keen concern to even the most technologically savvy generation, Digital Natives. "Although Digital Natives primarily rely on digital communications, physical mail still resonates with them because it provides a strong emotional connection and utility" (USPS OIG 2013a, p. 4). As this customer segment is entering its prime income-earning years its rising purchasing power is immensely attractive to all retailers, and specifically e-tailers, as these younger customer segments show a greater propensity to complete purchases online with the assistance of their mobile device of choice.

Traditional, physical advertising mail is reasserting itself as a compelling medium, as evidenced by the "growing trend for B2C manufacturers of consumer products to prefer direct mail as the primary marketing channel" (IPC 2011, p. 41). However, parcel delivery finds itself at the heart of this trend, with significant market forces driving much of this change. Globally, 3.3 billion people, more than half the world's population, currently live in cities and the urban population is expected to grow to five billion by 2030 (IBM 2014). As more people move back to cities, this re-urbanization brings a large concentration of wealth and purchasing power to smaller geographical areas and paves the way for additional alternative delivery models that respond to this extreme localization. It also creates the volume density to make such alternative delivery scenarios affordable.

It is much easier to define, measure, and improve recipient value in parcel products than in traditional letter mail products. Unlike advertising mail, in parcel products, customers measure all experiences against their best customer experience for these higher value items. This means that POs are competing against not only fringe players in the parcel delivery space that offer customized, unique services such as LaserShip and Uber. It also includes brands in unrelated industries that deliver enhanced, innovative customer experiences such as Apple and Zappos. To compete in this evolving marketplace requires POs and delivery firms to expand parcel delivery models and acquire the data and analytical capabilities to quickly respond to new customer demands.

Recent evidence reveals that parcels are the silver lining that aids POs in their attempts to stem the losses from traditional mail products. In China, 6.18 billion parcels were delivered in the first 9 months of 2013, an increase of 61.2 % (Tong 2014). In Europe, Austria Post is expecting mail volumes to decline at a rate of 3–5 % in 2014 but be offset by parcel growth of 3–6 % (Post and Parcel 2014b). In 2013, Canada Post saw "double-digit annual growth across all provinces in the volume of parcels this year from retailers and e-commerce business, averaging about 16 %" (Toneguzzi 2013).

This growth is not unique to Europe and Asia, for the growth in U.S. parcel shipments also continues on a significant upward trend. A recent collaborative report by OC&C Strategy Consultants and Google predicted that international sales from U.S. online retailers will increase from $11 billion in 2014 to almost $50 billion by

2020; (OC&C Strategy Consultants 2014). Evidence confirms the effect of these market forces. In its first fiscal quarter of 2014 which ended December 31, 2013, USPS saw revenue from Shipping and Package volume grow by 10.3 % versus the same period last year (USPS 2014).

This is both a moment of opportunity and a moment of concern for POs. As "consumers are generally not interested in choosing the delivery partner for their e-commerce purchases, and mostly see delivery as an extension of the e-tailer's brand" (IPC 2011, p. 10), these retailers will search for the delivery provider that best matches the retailer's own value proposition to its customers. If no differentiation exists, they will likely choose solely on price. If indeed consumers view delivery as a simple product extension and care little for which firm is delivering the parcel, the benefits of the two-sided parcel market will abate.

In a world shaped by the forces of extreme localization and more citizens moving back to urban areas, the providers that best meet these needs may not be POs. Rather, fringe players that can offer flexible delivery options at competitive prices that sync with the e-tailer's brand are positioned to capture significant market share of local delivery markets. If POs are not able to differentiate their delivery service offerings against fringe players, these market structures will collapse towards perfectly competitive models where the only differentiator will be price. Given economies of scale, POs likely possess a distinct advantage to compete on price. However, as noted by John Hearn, "competition is not just about price; it is also about quality."[1] Thus, POs must strive to differentiate their service offerings to increase quality and value to recipients to position themselves to capture volume in these markets.

There is no shortage of innovative delivery models being offered in the U.S. and around the world. In the U.S., Amazon and Wal-Mart offer same day delivery in a limited number of markets. In this emerging, highly fragmented market, fringe players in large metropolitan areas such as Zipments in New York City are offering same-day options for local retailers and e-tailers to deliver shipments from local fulfillment centers. However, it is not necessarily easy to adapt and deploy this same-day capability, and it has not emerged as the sole value proposition of a post or delivery service. With the recent acquisition of the UK startup Shutl, eBay launched eBay Now, a same-day delivery service, but acknowledged that this offering was only one component of overall delivery services. According to eBay CEO John Donahoe, "we're trying to build a set of capabilities to give consumers choice. I think same-day delivery will be a piece of the equation…the bulk of consumers have more time than money, so they are willing to search for value, and convenience is one of the criteria but value is a much bigger criteria" (Steiner 2014).

In addition to same-day delivery options, flexibility can also be offered through fulfillment models that move to an 'any day per week' service. Parcel lockers are a viable sending and delivery option that provide additional collection and drop off points for customers when they are not available at their residence or place of work. This model has been tested with success in many locations across the globe including but not limited to Singapore Post's POPStations, Australia's Automated Delivery

[1] While chairing a session at the 2014 CRRI Rutgers conference in Frascati, Italy.

Asset Manager (ADAM) parcel lockers, and Finland's Automated Parcel Terminals. Parcel lockers are an example of a differentiated service model that allows operators to offer more than just a standard delivery service and increase both sender and recipient value in these localities. In the U.S., USPS developed its own parcel locker offering in February 2012 called GoPost®. Based on pilot test results, the USPS Office of Inspector General determined that "the parcel locker concept has significant potential" (USPS OIG 2013b, p. 2).

The parcel locker model benefits POs, which can save on the labor costs of delivery, but more importantly it benefits customers, who have greater flexibility in picking up and dropping off parcels. In addition to regular mail drop off and delivery activities, it is also critical to consider the volume of returned goods purchased online by consumers who have markedly different buying behaviors compared to the customers of the past. Influenced by these behaviors, "behind the up tick in e-commerce is a little known secret: as much as a third of all Internet sales get returned, according to retailer consultancy Kurt Salmon. And the tide of goods flowing back to retailers is rising" (Banjo, 2013). Responding to these trends, flexible delivery and drop off offerings such as parcel lockers are helping to transform fulfillment networks and offer greater choices to customers.

In addition to flexible delivery options that are visible to consumers through product offerings, many underlying strategies and tactics are invisible yet have significant impacts on fulfillment and delivery models of companies. In the U.S., Amazon is transforming its fulfillment and delivery infrastructure by dividing the country into three market segments based on population. In the top 40 markets which comprise approximately half the U.S. population, Amazon will utilize a privately-owned transportation fleet to deliver goods on the same day and the next day from its forwardly-positioned fulfillment centers including Amazon Fresh, its online grocery business. The second market segment, comprised of the next 60 largest population areas, will be serviced by regionally-based delivery carriers and the last segment will be mainly serviced by USPS. In this model, orders will be processed through Amazon's 55 fulfillment centers and all deliveries will be made within 2 days at most (Solomon 2014). As consumers continue to see delivery as solely an extension of a retailer's brand, Amazon's moves demonstrate a willingness to vertically integrate the business model that might result in significant impacts not only for local courier delivery services, but also for national and international delivery companies such as UPS, FedEx, DHL, and POs.

The implications from this move by Amazon are extensive, especially for USPS. If indeed customers care little for which firm delivers an item, any delivery company that offers commensurate service levels and price can compete for this business. As a result, USPS needs to build a parcel delivery strategy that allows it to win all three Amazon segments or risk being relegated to Amazon's third market segment as a simple tool for delivery. The implications are not unique to the U.S. and apply to other POs across the globe.

The competitive parcel marketplace, where customers have shown a willingness to pay a premium for an enhanced customer experience, is at the precipice of transformation and the diverse delivery and fulfillment models being offered by POs and

private operators alike, are evolving at high speed. Common to new service offerings and fulfillment models is the requirement for operators and private delivery companies to obtain more granular, real-time data on customer behavior and to respond agilely to these changing demands in order to offer services of value to existing and new potential customers. Utilizing these new data also creates an opportunity for POs to apply insights to increase the targeting of physical advertising mail. In essence, delivery firms must become more data-driven enterprises to better serve customers. If the USPS is to compete with nascent fringe entrants that 'cream-skim' these parcel volumes from its last-mile delivery network, it must develop these same flexible delivery capabilities or seek to partner with local courier services to acquire these competencies.

3 Analytics and Implications for Advertising Mail

In today's markets, the race to collect, analyze, and interpret data is pervasive. The trends are clear: more data is being generated and collected, different kinds of data are emerging, there is a race to analyze data quickly, and more uncertainty exists in much of the data being generated. In a world where 80 % of the world's data has been created in the last 2 years, data is emerging as the world's new natural resource according to IBM's CEO Ginni Rometty (Lenzner 2014). Successful firms across numerous industries use analytics to transform data into knowledge and then use that knowledge to create competitive advantages. POs and delivery firms are no different. For POs, there are significant challenges to adopting new analytical practices, as well as significant potential benefits from doing so.

For POs, adopting deeper analytical capabilities means finding additional areas to save on costs, efficiently downsizing operations, codifying next best actions in processing centers, and transforming fixed components and costs into variable costs. Additionally, it means engaging with current customers – both senders and recipients – in new ways, and identifying and attracting new customers in both categories. Perhaps most importantly, it means developing knowledge from existing data to offer new services and products. In the parcel market, this translates into developing and offering differentiated flexible delivery models that meet customer demands and better allow POs to compete with emerging, non-national fringe delivery companies on more than just price. Unlike parcel delivery companies, POs have the ability to capture and utilize the data generated in both market segments and possess the distinct advantage to exploit the linkages between advertising mail and parcels.

Fringe delivery companies are already using data and analytics to offer innovative new fulfillment and delivery models in parcel markets. In addition, national providers like UPS and FedEx use data to enhance customer experiences. According to a 2014 USPS OIG study, "UPS understands that technology and information are only as useful as the applications that help its customers. Customers can schedule their delivery within a 2-h window and effortlessly keep track of each package

because UPS sends notifications of the pickup, en-route status, and delivery to customers' email or mobile devices" (USPS OIG 2014, p. 5). Interacting with customers electronically is nothing new; 78 % of all businesses use SMS messaging to communicate with customers as well as other businesses (SlickText 2013). The implications, however, extend well beyond delivery.

UPS and other fringe players use analytics to drive their business decisions and commit to developing customer-centric applications that enhance a customer's experience. Thus, for POs to collect and use additional valuable data provides the opportunity to transform parcel offerings and offer differentiated services that increase recipient value compared to other fringe players. Those offerings are perhaps the most critical segment of the core business today, and their transformation applies not just to offering flexible delivery models, but also seeking larger opportunities to transform the overall customer experience.

An important trend is that many firms already realize that increasing recipient value, through advertising mail products, is not just an opportunity but a requirement, especially for younger generations. In the traditional paradigm, advertising mail is sent to a targeted segment of the population to elicit a response from those recipients, to take action and purchase a particular good or service. Retailers utilize this model for the additional sales it produces; POs enjoy this model for the additional volume and revenue it can create, preferably as a result of customers purchasing goods that require delivery to the home. Increasing data and technology in advertising mail, such as QR codes, have enabled greater recipient value creation in competitive products. However, by reversing the flow of atoms and information, there is tremendous opportunity to further improve advertising mail targeting and increase recipient value in market dominant products. POs must find ways to exploit the linkages between parcels and advertising mail themselves or assist retailers and e-tailers in this endeavor as a trusted third party information broker.

In an age of declining letter mail volumes, retailers and e-tailers still send large volumes of advertising mail for a simple reason: it is still effective. Retailer Williams Sonoma spends half of its total marketing budget on catalog production and mailing (Holmes 2014). The question therefore is not whether advertising mail works, but how to improve the product. Retailers see advertising mail as an important component of a multi-channel advertising campaign, especially given the fact that over 80 % of Americans ignore the digital ads to which they are exposed (Mobile Marketer 2014). Direct mail helps cut through the digital clutter; while it is a successful media option, further options remain to improve its effectiveness.

The value a parcel recipient receives is the parcel itself, the customer experience surrounding the transportation and delivery of that parcel, and any ancillary value they receive in the process. To conclude that there are opportunities for parcels to improve the effectiveness of advertising mail first requires an assumption that firms such as Amazon are not just in the business of delivering physical goods. The increased value can manifest itself at different times and in two distinct ways. When opening the parcel, the recipient may find inserts for additional offers for other products she might find valuable; this value is quite tangible and obvious to the

receiver. However, at a later time that is less obvious to the receiver, she may receive advertising mail offers that are better targeted to her specific interests.

The first example, inserts, can be delivered a number of ways with options including unaddressed advertising offers included inside the parcel box and offers being placed in a transparent sleeve and adhered to the outside of the package. These offers could include simple product offers in the ZIP Code in which the parcel is to be delivered. While this method is likely underutilized today, it warrants further exploration as the effect can be significant and offer a greater opportunity for local retailers and e-tailers to communicate product information to consumers.

The second example, advertising mail that is better targeted to individuals and demographics, is more compelling and likely offers a much greater opportunity for POs and retailers. Advertising mailers work to compile data elements that aid in segmenting populations into smaller distinct groups that allow them to best target the most receptive customer groups likely to respond positively to a product offer. For years, simple attributes such as marriage status, address, personal hobbies, and income estimation, drove catalogers to send a publication to a household.

Over time, catalogers and other advertising mail senders became quite adept at this practice and recent technological advances such as geo-fencing have allowed these entities to drill down into quite granular customer segments. Aided by the widespread adoption and use of smartphones in the U.S. and globally, more customer purchases are occurring via mobile means, which has further driven the creation of new technologies. One example is QR codes. This unidirectional model, where advertising mail has driven customer responses, leading to a greater number of parcel shipments, has proven to be successful in numerous industries. Just as QR codes have transformed the way mobile consumers browse and purchase products, there are opportunities for the data generated in parcel markets and deliveries to improve direct mail offerings and deliver greater value for the recipients of advertising mail. This concept is best illustrated by Amazon's recent foray into anticipatory shipping as well as its efforts to build a nationwide e-commerce fulfillment network.

Adding more flexible delivery options is just one component of the overall e-commerce fulfillment model. However, Amazon's move to revamp its delivery network illuminates the growing demand for shortened fulfillment times and the opportunity to deliver more than just physical goods. By segmenting its markets and adopting a strategy for flexible, speedy delivery, Amazon will position inventories across the U.S. to both serve local deliveries as well as enable its foray into an even more cutting edge service: preemptive delivery.

Using predictive modeling, Amazon will begin anticipatory shipping to segments of customers with expectations that those customers will purchase the product. If not, based on a cost-of-return algorithm, Amazon may let the individual keep the item at no cost. Of key interest is the fact Amazon is "thinking of physical item delivery in the way a utility might approach supplying water or electricity to homes – by forecasting demand spikes and lulls, and tweaking its pipeline accordingly, but above all by keeping the stuff flowing (ergo having trucks constantly filled with packages in continuous perpetual motion)" (Lomas 2014). This organic inventory will create "data that could be analyzed to determine customer demand

for a particular pre-shipped package to help decide where to route it…including historical buying patterns, preferences expressed explicitly via surveys/questionnaires, demographic data, browsing habits, wish-lists, and so on." (Ibid) As this data is created, POs and retailers are faced with two options: selling the data generated from parcels – as Canada Post is currently examining and is currently prohibited by law in the U.S., or using the data as an enabler for something else, whether to generate added value, to generate new products, or to improve existing business processes.

As stated in the patent notes from Amazon, "speculative shipping of packages may enable more sophisticated and timely management of inventory items, for example by allowing packages to begin flowing towards potential customers in advance of actual orders." (Ibid) The implications for advertising mail are significant. Traditional methods to mine customer data in order to create distribution lists are facing the disruptive forces of more complex, granular, organic data sets from non-traditional means that present the opportunity for advertising mail senders to enhance their capabilities in identifying new customers. The same analytical frameworks that predict where products should be pre-positioned can likely assist direct mailers in a similar fashion. As a result, the discussion is widened when examining with whom advertising mailers should partner in the future to analytically mine this new customer data.

These attributes describe a world where direct mailers are working with POs and delivery companies to extract more than just data from parcel deliveries; this is a world where cutting edge retailers and e-tailers are using advanced analytical techniques to examine myriad data and information flows from inventories across the U.S. and the globe. Amazon's venture into speculative delivery is only the beginning. In 2011, Google was able, for a time, to accurately predict where the next flu outbreak would occur in the U.S. from simply analyzing the search engine queries entered by users across the country. That predictive power weakened over time, but it demonstrates another example of an alternate data source that advertising mailers can utilize in their quest to send the most germane offers to a customer at the most critical time to elicit a response.

In myriad industries, companies are using data and analytics to personalize offers to customers. POs can play a critical role as they own perhaps the most important element of the fulfillment supply chain: the actual movement of parcels, which are dense atoms and bytes of valuable data. POs must strive to identify linkages between parcels and advertising mail to provide unique value for retailers and e-tailers, especially small and medium enterprises that might lack the advanced analytical capabilities of large cataloguers such as Crate and Barrel, Lands End, and Pottery Barn.

Clearly there are privacy concerns; not unlike other marketplaces, the advertising mail industry finds itself faced with the modern, technologically-driven chicken-or-the-egg problem, the trade-off between greater privacy and greater value. However, as the results from both the 2013 study by the USC Annenberg School and the 2013 USPS OIG study on Digital Natives reveal, one solution might lie in citizens volunteering increasing levels of personal information to receive advertising mail that is relevant to them, a behavior to which younger generations have shown greater

proclivity in recent years. This is critical as the share of consumers moving their commerce online is likely to only increase as both smartphone adoption and broadband penetration rates grow, and each future generation will be more 'online' than Digital Natives. As the USPS OIG study revealed, "While Digital Natives state that they don't worry about privacy and protecting their personal information, their actions reveal a different priority. Digital Natives are very interested in fast, personalized buying experiences and expect personalized advertisements" (USPS OIG 2013a, p. 10). If these trends continue in the U.S., at the intersection of ebbing privacy concerns and new, data-rich parcel information streams to better inform direct mail targeting exists a post that endures, thrives, and remains essential to the economic development of the United States.

4 Conclusion

Transformations in parcel delivery have significant impacts on advertising mail. Emerging technologies and data sources from these very parcel markets provide the opportunity to create greater value for recipients. Using advanced techniques to analyze organic inventory flows from e-commerce companies and aggregated customer search engine queries is just the tip of the spear. The results of understanding how these emerging data sources can better inform advertising mail offerings will serve to reverse the traditional, unidirectional information flow from advertising mail to parcels and identify new ways for parcels to create greater value in direct mail targeting. As a result, POs are challenged with developing segmented and customized parcel businesses that compete with fringe players in order to identify and exploit the linkages between parcels and advertising mail products. Failure to exploit the linkages and offer differentiated services risks POs being relegated to last mile 'deliverers of last resort' that compete for business against fringe entrants in a perfectly competitive marketplace solely on price.

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Market Regulations and USO in the Revised Swiss Postal Act: Provisions and Authorities

Christian Jaag and Martin Maegli

1 Introduction

New postal legislation in Switzerland entered into force on October 2012. It encompasses a new Postal Act as well as a new Postal Organization Act. The reform of the Postal Act covers three main areas. The first is market regulation, which applies to all operators symmetrically. It includes the replacement of the former licensing system by compulsory registration and provisions on ex-post regulation of mutual access to PO boxes and address data. Second, it restates the definition of the Universal Service Obligation (USO), with different provisions for services offered to private and business customers and distinguishing between the accessibility of postal and financial services. Third, the new Postal Act defines a new institutional design, i.e. the division of tasks, organization and responsibility of public authorities in the postal sector. The Postal Organization Act governs Swiss Post's range of activity, its corporatization and the spin-off of its financial services branch PostFinance.

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This paper focuses on the analysis of the market regulations and USO as defined in the Postal Act as well as their interaction with competition law. Specifically, the paper covers the following aspects of the regulatory framework for the postal sector in Switzerland:

First, it discusses the *scope of the USO*, consisting of provisions on the range of products to be offered and their prices, on the density and accessibility of the postal outlet network as well as the coverage and frequency of delivery.

Second, it analyzes the *financing of the USO*, consisting of provisions on the calculation of the net cost, a residual monopoly for letters up to 50 g and a regulatory cost allocation mechanism to ensure consistency of price regulation and the financing of the USO. This is discussed in the context of general competition law (Cartel Act and Price Supervision Act).

Third, it presents the relevant *regulatory authorities*, consisting of the allocation of competences and the interfaces between the regulators (PostCom, OFCOM, ComCo, Price Supervisor).

The remainder of this paper is structured as follows: Section 2 presents a short overview of recent legislative changes affecting the Swiss postal sector. Section 3 outlines current regulation with a focus on the scope of the postal USO. Section 4 discusses the financing of the postal USO in the context of Swiss competition law, while Sect. 5 gives an overview on the regulatory institutions involved in the postal sector. Section 6 compares the Swiss regulatory framework with EU provisions. Section 7 concludes.

2 A Short History of Swiss Postal Legislation

At the end of the twentieth century, technical developments in communication, the simultaneous worldwide liberalization fostered by the World Trade Organization (WTO), and the emergence of a single European market called for structural changes within the Swiss postal and telecommunications network. As a result, in 1997, new postal legislation was enacted in Switzerland. Subsequently, the postal business and telecommunication services were separated into two different enterprises (Swiss Post and Swisscom). Swisscom was given the status of a company with limited liability in 1998. In the same year that Swisscom went public, the postal system was newly regulated through both a technical decree (Postal Act) and an organizational decree (Postal Organization Act).

This legislation transformed Swiss Post from an agency within the government to an autonomous public (state-owned) corporation. In 2002, the Federal Council took stock of this postal reform, which it basically saw as a success. As a consequence, the Federal Council planned to open up the market in two steps. First, the parcel market was to be fully opened by 2004, and second, the same was to be done for the letter market in 2006, with the exception of addressed letters of up to 100 g.

The Federal Council reserved the right to commission an evaluation of market opening steps that had been taken up to that point before it further opened the postal market for letters. Such an opening also called for regulatory adjustments. Switzerland had previously known no sector-specific regulatory authority for the postal market. With an ordinance amending the Postal Act, the Federal Council created the postal regulatory authority, PostReg, in 2004 (Swiss Federal Council 2009). Since then, the Postal Act also obligated Swiss Post to operate a countrywide network of post offices (infrastructure mandate), ensuring that universal services are available in all regions to all segments of the population and at affordable prices. A new rule imposed by PostReg called for a network that was accessible by 90 % of the population in 20 min by public transport or walking.

Prior to further opening the market for addressed letters, a study commissioned by the Swiss Government (WIK 2005) concluded that lowering the reserved area for addressed letters to 100 g would not put universal services and their funding at risk. Following this recommendation, the Federal Council opened the market for letters weighing more than 100 g as of 1 April 2006. In 2009, the Federal Council further reduced the postal monopoly for letters from 100 to 50 g by a revision of the Postal Services Ordinance. As an accompanying measure, the Federal Council strengthened the postal regulatory authority. The Federal Council proposed to Parliament to open the market fully as part of the total revision of the postal laws (DETEC 2009). However, the Parliament did not approve full market opening, so there remains a reserved area for letter mail up to 50 g.

Revisions from 2010 to 2013 converted Swiss Post into a limited company under special law (the new Postal Organization Act). At the same time, Swiss Post's division for financial services, PostFinance, was hived off and placed under the control of the Swiss Financial Market Supervisory Authority (Finma) as a limited company under private law. Today, Swiss Post is a public corporation, owned entirely by the Swiss Confederation. Its scope of operations is limited by the institutions laid down by the federal legislation. The government (Federal Council) not only determines the scope of postal products, services and prices of universal services as defined in the Postal Act, but also defines the strategic objectives of Swiss Post every 4 years (IPC 2011, and the Postal Organization Act).

3 The Scope of the Swiss Postal USO

The new Swiss Postal Act aims to guarantee sufficient, inexpensive universal services for the entire Swiss population in every part of the country. In addition, the Act is also intended to form the basis for fair competition in the postal sector. The new postal legislation assigns the task of providing universal services directly to Swiss Post. The legislation deliberately omitted applying a tender mechanism, as this would be too complex in terms of administration and, other than Swiss Post, no operator would be in a position anyway to provide universal services in the current form of the USO (cf. Jaag and Trinkner 2009). Therefore, Swiss Post is obligated to

ensure provision of the universal services and to comply with the relevant requirements of the regulatory authorities. Swiss Post has a USO for postal services and payment transaction services. However, it is not required to provide these services independently; it can cooperate with third parties or outsource parts of the mandate to subsidiaries.

Under the new Postal Ordinance, the Federal Council differentiates between the two USO mandates more clearly than in the past, paving the way for a customer-oriented, financially viable service tailored to meet market requirements. The postal USO sets out guidelines concerning the range of services, prices and quality to be provided, recognizing needs of both senders and receivers. High demands are placed on Swiss Post for home delivery regarding both delivery method and nationwide availability. Swiss Post can and will also offer other products in addition to the services within the scope of the USO. Below we shall briefly describe the requirements and the scope postal and payment transaction USO in Switzerland (for an overview of the services within the scope of the USO, see Table 1).

According to the law, Swiss Post is required to operate a nationwide network of post offices and agencies. As a rule, at least 90 % of the population must be able to reach this network within 20 min by foot or by public transport (30 min if a doorstep collection service exists). There must be at least one post office in every region (there are 130 districts or so-called "ARE Raumplanungsregionen"). Post offices, as well as postal agencies, are explicitly regarded as access points. The core services for the USO in these access points continue to include the mail and parcel services Priority (next day delivery) and Economy (delivery on third day after deposit). For posting letters, at least one letterbox must be available in every locality. For bulk mailings, suitable acceptance outlets must exist for the business customers. These do not necessarily need to be accepted in the retail post office network. Individual consignments of the USO (private customer consignments) are offered in traditional post offices and postal agencies operated by third parties. Financial services included in the USO must be accessible by at least 90 % of the population within 30 min by foot or by public transport. The methodology for measuring accessibility is approved by the relevant regulatory authorities, PostCom for postal services and the Swiss Federal Office of Communications (OFCOM) for transaction services.

The Postal Act sets very high quality requirements of Swiss Post for the delivery times in comparison to international standards; 97 % of letters and 95 % of parcels must be delivered on time. The methods for measuring delivery quality must be approved by the regulatory authority. They must comply with internationally recognized standards and correspond to the state-of-the-art. This quality measurement for the above must also be carried out and certified by independent bodies.

The delivery requirements apply to recipients of both single-piece and bulk mail. The Postal Ordinance requires the USP to deliver mail and parcels at least 5 days per week. Press items, such as newspapers and magazines are delivered 6 days per week. Due to economies of scope, Swiss Post also voluntarily offers the delivery of priority mail 6 days per week. Addressed mail must be delivered to all locations in Switzerland inhabited year round. In addition, Swiss Post must also deliver to houses inhabited throughout the year for which the additional journey time by motor

Table 1 Differentiation of the USO (the cited Articles refer to the Postal Act)

	Collection in post offices and agencies (Art. 30)	Delivery location (Art. 31)	Delivery frequency (Art. 32)	90/20-accessibility of the network, incl. home delivery service	90/30-accessibility of the services	Indirect press subsidies (Art. 47)	Uniform prices (Art. 47)
Domestic postal services (Art. 29 Par. 1)							
Letters/parcels "individual"	X	X	X	X			X
Letters/parcels "bulk"		X					
Newspapers		X	X			X	X
Court documents		X					
Payment transaction services (Art. 43)							
Payment transaction services account, electronic transfer							
Cash credit note, cash deposit, cash withdrawal					X		

vehicle, measured from a location that is inhabited all year round, is not longer than 2 min, corresponding to a distance of approximately 1 km. If there is no obligation for home delivery, Swiss Post must offer an alternative solution. For example, it can reduce the frequency of delivery or specify another delivery location, such as a post office box or a delivery facility on the way to another location that is inhabited all year round.

Table 1 briefly summarizes the relevant requirements for the services within the scope of the USO.

Press subsidies are also regulated within the context of the USO, motivated by the goal to support the diversity of the press (cf. Hugentobler and Jaag 2014). The new Postal Act contains a number of modifications concerning indirect press subsidies. Swiss Post is compensated for the mandate to offer reduced rates to titles eligible for subsidies by payments from the Federal government. Swiss Post redistributes the subsidy payment from the government to the press by means of reduced prices for delivery. With annual subsidies for the delivery of newspapers and magazines totaling CHF 50 million (approx. EUR 40 million), the Federal government continues to contribute to maintaining the diversity of the press and opinions in Switzerland.

Eligibility criteria are in part taken from the previous Postal Act (Article 15) and specified in the Ordinance on the Postal Act. With regard to membership and foundations publications as well as the regional and local press, certain criteria were adapted and/or additional criteria were incorporated. OFCOM rather than Swiss Post determines and grants eligibility. Parties deemed eligible are daily and weekly newspapers on subscription, produced by the regional and local press, which satisfy the criteria in Article 36 of the Ordinance on the new Postal Act. Regional and local press is defined as small newspapers, in particular with a daily print-run of between 1,000 and 40,000 copies on average and which satisfy certain criteria in the Ordinance on the new Postal Act. The regional and/or local nature of the publication is no longer defined by geographic, linguistic or content-related criteria concerning the printed matter.

The USO for payment transactions will continue to include opening an account and making transfers, deposits and withdrawals. As already mentioned above, payment transaction services should be accessible to 90 % of the population within 30 min on foot or by public transport. Unlike the basic postal service, the payment transaction service is formulated without reference to specific technologies, thereby facilitating the introduction of modern, more customer-friendly services. Those access points that also provide payment transaction services will continue to be operated by Swiss Post itself. Those that only offer logistical services will increasingly be outsourced to agency partners.

4 The Financing of Swiss Postal USO

In line with EU requirements, the net cost of the USO must also be calculated in Switzerland. It results from a comparison of the actual profit of Swiss Post (status quo) with the hypothetical profit of Swiss Post without USO. In 2013 the net cost of

Table 2 Net cost rebalancing

	Product 1	Product 2	Product 3	Total
Revenue	200	200	180	580
Cost	220	150	170	540
Profit before net cost rebalancing	**–20**	**50**	**10**	**40**
Net cost rebalancing	30	–40	10	0
Profit after net cost rebalancing	**10**	**10**	**20**	**40**

the USO amounted to CHF 409 million (approx. EUR 340 million). In contrast to the EU, there is no additional examination of whether the burden is to be considered as unfair (cf. Jaag 2011). Also, in contrast with the Postal Directive, there is no financing mechanism in Switzerland that envisages state funds or a contribution by competitors to financing the USO. However, Swiss Post will continue to be permitted a reserved area for letters up to 50 g (contrary to the Federal Council's initial proposal).

The medium-term sustainability of the USO financed by the residual monopoly is jeopardized by the increasingly intensive competition from electronic means of communication. At the same time, there is strong price regulation for Swiss Post services. For the reserved area, Art. 18 of the Postal Act authorizes the Federal Council to define and approve the adaptation of regulated prices for individual services. Outside of the reserved service, another (non-sector-specific) authority, the Price Supervisor is responsible, provided that the prices are not the result of effective competition. This price regulation is cost-based, which prevents services arising that generate a significant surplus to Swiss Post. However, it also prevents these services from covering losses from unprofitable services due to the USO.

Article 51 of the Ordinance on the new Postal Act resolves this conflict by means of a specific financing instrument, *net cost rebalancing*. Swiss Post is allowed to reallocate the net cost of the USO through transfer payments between its units and subsidiaries. It can charge these costs to the services for which it is able to generate high prices in order to relieve unprofitable services (Jaag 2011). By shifting costs to the more profitable services, it increases its costs and can therefore also enforce higher prices under price regulation (which is cost-based). Hence, the legislation made cost-based pricing consistent with USO subsidies by allocating USO net costs to profitable services and including that in the "cost" used to set prices. The net cost rebalancing also makes it possible for Swiss Post to separate operational accounting from regulatory accounting. In a first step, it allocates its costs according to regular accounting principles (business accounting); in a second step, it carries out the net cost rebalancing (regulatory accounting). This interplay between the financing of the USO and price regulation makes it possible for Swiss Post to provide universal services without external financing. For a general assessment of the interaction between price regulation and the financing of the USO see Jaag (2013); for an in-depth discussion of net cost rebalancing see Haller et al. (2014).

Table 2 displays a stylized example for the Swiss net cost rebalancing: Without rebalancing, there is a Product 1 (the "USO-product") with negative profit due to the high cost caused e.g. by daily and ubiquitous delivery. Product 2 is not affected by

the USO. It is highly profitable and thus able to contribute to the financing of the USO. With a very narrow price control mechanism, the price of this second product would be considered excessive and set lower which would question its contribution to the financing of the USO (while overall profit may be deemed appropriate). By means of net cost rebalancing, product 1 is disburdened while product 2 is charged. Since the profit and cost structure after net cost rebalancing is relevant for price regulation, prices are allowed to stay high for product 2 such that it can contribute to the financing of the USO. Product 3 is also disburdened in the example of Table 2.

With net cost rebalancing Swiss Post allocates cost in two steps. In the first step cost is fully allocated based on activity. The resulting allocation is used for management purposes. Then, in the second step, the net cost is rebalanced. The resulting regulatory accounts are the basis for price control and other regulatory intervention.

5 Institutions in the Swiss Postal Sector

The Postal Act creates the new regulatory authority, PostCom, with tasks as specified in the new postal legislation. This was not the case within the old framework, in which the former authority, PostReg, did not have a sound legal basis for its activity. The new legal framework clearly determines what duties Swiss Post and the private providers of postal services have with regard to regulatory authorities. PostCom is allowed to collect information in order to perform its core tasks: (1) monitoring the quality of the USO (including price uniformity) and (2) observing the development of the postal market with the purpose of ensuring the provision of the country with postal services. In addition, PostCom has created an arbitration board for customers and postal enterprises.

Administratively, PostCom is attached to the General Secretariat of the Federal Department of the Environment, Transport, Energy and Communications (DETEC). While PostCom is given new tasks within the new legislation, it no longer has to accomplish its current tasks related to postal policy and international affairs. These tasks are now managed by a specialized unit in OFCOM, which is also responsible for the allocation of subsidies to the press. With OFCOM, a new actor was created, which, in addition to policy tasks (such as the further development of general regulatory conditions), assumes roles associated with the control of basic postal and payment services. OFCOM also coordinates the participation and distribution of roles in international bodies (e.g., UPU).

Under the old legislation, Swiss Post assumed conflicting roles: On the one hand, it was a provider of delivery services in a competitive market; on the other hand, it was responsible for the execution of the legislator's press-political directives. Now, OFCOM also assumes press promotion tasks which in the past were the responsibility of Swiss Post. Organizationally, the specialized unit is attached to OFCOM. This institutional separation ensures that regulatory tasks (PostCom), policy tasks

Table 3 Institutions in the Swiss postal sector

	Swiss Post Ltd.		
	Post CH Ltd	PostFinance Ltd	PostBus Switzerland Ltd
Policy	OFCOM		
USO (postal, paments)	PostCom	OFCOM	
Monopoly price control	Federal Council		
Price control	Price Supervisor		
Press subsidies	OFCOM		
Sector-specific market supervision	OFCOM	Finma	FOT
Owner	General Secretariat DETEC/FAA		

(OFCOM) and owner function (General Secretariat DETEC together with the Federal Finance Administration, FAA) are managed by different organizations (see Swiss Federal Council 2009 and Maegli and Jaag 2012).

Another player, the Swiss Financial Market Supervisory Authority Finma, pursues its mandate to protect creditors, investors and policy holders and ensure the smooth functioning of the financial markets. It is thereby also interested in universal financial services and their funding. The Federal Office of Transport (FOT) implements and to helps design Swiss policy on public transport. Finally, by converting Swiss Post into a limited company, the new legislation subjected Swiss Post to taxation. Consequently, tax authorities will increasingly become stakeholders of Swiss Post (see Swiss Federal Council 2009).

Table 3 gives an overview of the regulatory authorities involved in the Swiss postal sector.

6 Comparison with EU Law

Table 4 compares the scope of the Swiss postal USO (Articles 13–17 of the Postal Act) with the minimum provisions of Articles 3 of the Postal Directive.

The comparison reveals that the Swiss USO is compatible with the provisions of the Postal Directive, while its financing through a reserved area is not. In addition to a postal USO, there is also a USO for payment services in Switzerland. The postal accessibility constraint is economically less severe than the constraint on cash payment transactions even though the number of necessary physical access points is lower for payments than for postal services. However, the former need self-run offices which are rather expensive to operate while the latter can also be offered in agencies run by third parties. Both constraints on Swiss Post's infrastructure together result in one of the densest networks operated by a postal service.

Table 4 Comparison between Swiss and EU postal regulation

	Switzerland (Postal Act)	EU (Postal Directive)
Market opening	Reserved area up to 50 g	Full market opening
NRA	PostCom as independent regulatory authority	Independent NRAs
Scope of USO		
Product range	Bulk and single piece mail and parcels	Not specified
Frequency of delivery	Five days (newspapers six)	Five days per week
Delivery location	Doorstep	Doorstep or appropriate installations
Prices	Economic principles, uniform, uniform principles	Affordable, cost-oriented, transparent, non-discriminatory
Infrastructure	Accessibility (90 % in 20 min)	Not specified
Financing of USO	Net cost rebalancing	If net cost represents an unfair burden: compensation from public funds or sharing mechanism

7 Summary and Conclusion

The new Swiss Postal Act entered into force in 2012 and was fully implemented in June 2013. Swiss Post now operates in a quite complex regulatory environment consisting of various laws and regulatory institutions. Consistency of the entire regulatory framework is not a priori clear and will depend on the coordination between the various institutions and their application of the law.

While maintaining a partial monopoly for letter mail weighing less than 50 g, new legislation brought changes in the definition and the financing of the USO. The USO is now much more differentiated and oriented to the consumers' needs than it used to be. This differentiation becomes apparent in three dimensions: Firstly, the accessibility of postal services and cash payment transactions is defined separately. According to the Postal Act, financial services have to be accessible by "reasonable means", while postal services have to be accessible within "reasonable distance". This differentiation gives rise to different measures of proximity in the Postal Ordinance (see Table 1). Secondly, there is a differentiation between services directed to sending customers (retail network, narrow range of products with regulated quality) and services to receiving customers (home delivery for a broad range of products). Thirdly, the regulatory framework differentiates between private/retail customers and corporate customers. Services targeted to the former group are much stronger regulated and are considered basic services which serve as a safety net.

The net cost of the USO is not directly compensated. However, Swiss Post is allowed to reallocate its cost which enables it to finance the USO through the revenues of all its products. This necessitates specific rules to coordinate general price regulation and postal regulation.

Three years after the entering into force of the new postal legislation (i.e. by the end of 2015) the Federal Council will have to evaluate the market opening to date and the viability of the postal USO. In the new institutional setting, the number of authorities involved and the complexity of the regulatory framework have increased. It is questionable whether this expansion of regulatory oversight is actually necessary in times of increasing competitive pressure and market dynamics.

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Positioning the Postal Service for the Next Generation: An Overview of Market Research

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1 Introduction

Traditionally, postal operators (POs) have considered mail senders, rather than mail recipients, as the primary customers because they pay for the service. In the Digital Age, mail recipients are gaining influence in a two-sided marketplace, as their needs and preferences help drive senders' choice of physical and digital communications. In order to keep the mail channel as a viable communications medium, the U.S. Postal Service (USPS) and POs around the world have to address how best to serve recipients' needs, while still fulfilling their service obligations. One way to do so is through market research. Findings from the USPS Office of Inspector General's (OIG's) growing body of research, in combination with secondary market research, provide valuable insights on the changing preferences of senders and recipients, as well as shed light on the future use and delivery of mail.

To help understand mail recipient expectations, the OIG has conducted four projects to-date. First, the OIG commissioned a survey to understand what Internet-connected Americans want from the USPS now and in the future (OIG Survey 2013b). The OIG followed up with focus groups in urban, suburban, and rural areas throughout the continental United States to determine the kinds of services they rely on USPS to provide (OIG 2014b). A third study consisted of focus groups with Digital Natives, aged 16–25, to understand their existing views of mail and identify ways that mail could be more effective (OIG Digital Natives 2013a). The project

The views presented in this chapter are those of the authors and do not necessarily represent those of the Office of Inspector General, United States Postal Service (USPS) or any other organization

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with Digital Natives spurred an OIG-hosted discussion forum event held on January 21, 2014, with marketing, communications, and mailing industry experts (OIG Recap 2014a). A key takeaway was that hard copy communication is not the relic some claim it to be. Well-designed, digitally-interactive mail elicits a strong connection from its recipients and presents new opportunities to reach and build relationships with them (OIG Recap 2014a, p. ii).

Through this work, the OIG discovered a number of findings that shed light on the expectations of Americans from a wide range of demographic groups. These have broad implications across the postal sector, as operators grapple with the effects of a raging Digital Revolution. Postal operators must stay relevant to young and increasingly digitally savvy consumers, while still serving businesses and customers in communities on the other side of the lingering digital divide.

This paper highlights two major findings based on the related OIG body of work and secondary market research. Section 2 posits that USPS should continue to develop customer-centric products and services while maintaining the organization's long tradition of privacy protection. Section 3 gives reasons why the USPS should continue to develop a network that supports parcel volume growth, which is quickly becoming the centerpiece of every household's mail. Section 4 concludes with suggestions for the future.

2 Meeting Customers' Expectations: Providing Convenience While Addressing Privacy Concerns

Consumers are more empowered than ever. They no longer have to wait for the advertising or product to come to them. Instead, the Internet allows them to access enormous amounts of information about retailers and their offerings through just a few clicks, and increasingly at their fingertips through mobile devices. As a result, businesses are developing customer-centric communication methods to support individualized campaigns that are highly tailored and drive convenience. At the same time, companies must be attuned to consumers' interest in personalized advertising and shopping experiences that also respect privacy—a growing customer concern.

In today's increasingly data-driven market, relationships between customers and brands are evolving, with customers providing an increasing amount of feedback and companies collecting more data than ever. The OIG also recently completed focus groups with Digital Natives aged 16–25 to gauge the relevance of mail to them now and in the future (OIG Digital Natives 2013a). The research revealed that Digital Natives still value mail, with almost all focus group participants checking their mail daily. Digital Natives expect mail to be relevant, useful, and personalized. They had little tolerance for non-relevant mail, which the majority immediately discarded. When they received personalized pieces from companies whose offerings did not align with their needs, Digital Natives felt that their privacy had been invaded (OIG Digital Natives 2013a, p. 9). Yet Digital Natives were very comfortable receiving personalized mail from companies they had transacted with before, creating an individualized advertising experience based on the Digital Native's

preferences. Once the Digital Natives had transacted with a company, they expected advertising from that company to be targeted to them.

Digital Natives valued advertisements and promotions that offered a simple buying experience. The focus group participants were especially interested in mail that flowed from one medium to another. For example, they appreciated scan-to-buy technology, which allows a user to purchase something in a catalog by scanning it with his phone to initiate a one-click buying experience. They expected that mail with a digital component would have clear instructions on how to use the integrated part of a mailpiece. If it was not immediately obvious how the digital integration worked, Digital Natives were unlikely to take the time to try to figure it out. Most of the participants agreed that they liked receiving catalogs, but were unlikely to search for a desired item again in stores or online to make a purchase (OIG Digital Natives 2013a, p. 9). The Digital Natives expressed interest in personalization to make the buying experience simple. For example they wanted their personal information to be pre-populated on forms to expedite the buying process, especially if they had previously made purchases from the company (OIG Digital Natives 2013a, pp. 9–10).

Indeed, personalization is a key customer expectation for other cohorts as well. A recent IBM study supports the notion that every age group of consumers wanted the same thing from advertisers—more personalization (Schaefer and VanTine 2010, p. 8). To create the uniquely tailored experience, marketers must know their customers, and they do this through data collection. Yet, without a previous relationship with a company or brand, when a company shows what the consumer considers to be, too much about him or her, the consumer is turned off.

Today, such personalization is becoming increasingly common and affordable across all advertising channels, whether mail, television, Internet, or email. Findings from a recent OIG-sponsored discussion forum noted that, as print technology evolves, it is increasingly cost effective to fully personalize mailpieces (Bear 2014). If a company is spending money to figure out who its customers are and what they want, it should also spend money to make sure the customer feels understood. In this era of intense competition for consumer attention, it is more important than ever to grab the attention of the consumer and give them easy-to-use, instantaneous purchasing potential (Elo Touch Solutions 2012, p. 2). At the same time, it is important that a company's interaction with a customer balance what the customer expects the company to know with what the company actually knows about the customer.

In addition to being personalized, mailpieces are more effective if they are able to engage the recipient. Some of the mail innovations that sparked the Digital Natives' interest included augmented reality and mail with embedded near field communication tags. These innovations allow a reader with an internet-enabled mobile device, like a tablet or smartphone, to activate a new advertising experience by scanning or placing the device near the printed advertisement. The examples the Digital Natives saw during the OIG-sponsored focus groups enabled many experiences. One of the most discussed examples was a clothing advertisement that, when scanned, led to an online catalog that allowed the user to view the item being worn in different ways as well as add the item to their online cart for purchase.

Other applications of these innovations can take the recipient to a gaming experience, or it could give them an opportunity to test out part of a new product.

In one example, the Digital Natives viewed an example where putting a near field communication enabled smartphone near a printed car advertisement allowed users to experience the electronic dashboard of the car on the phone's touch screen. The dashboard included apps that allowed the user to listen to music, buy movie tickets, or make reservations at a restaurant. The advertisement allowed the recipient to test drive a new capability of a vehicle without leaving his home.

Digital media offers the dynamic capabilities and immediacy of a purchase experience that hard copy lacks. Innovations that connect the mailpiece with the digital realm allow companies to engage with their customers in new ways, like by "trying on" nail polish with an image of their hand or by clicking on an object to put in their virtual shopping cart for immediate purchase. This also creates a feedback loop of information from the consumer to the company. If consumers are drawn to a certain use of the product through a mobile application, the company can gain insights on what aspects of a product consumers most appreciate. These innovations are becoming increasingly less expensive, and many augmented reality companies now offer turn-key programming that allows a company to create an augmented reality application in minutes.

To provide an interactive experience, print innovations are becoming more accessible and affordable. For example, augmented reality applications and near field communication technology are two innovative ways to enhance the value of mail. Both technologies allow the user to engage with a mailpiece using his or her phone, bringing the user dynamic content that may otherwise not be available. Personalized, customizable experiences like this allow customers to decide how they would like to interact with a product or company.

2.1 The Trade Off Between Privacy and Convenience

The Internet has created an enormous information exchange that is much more complex and instantaneous than could have been imagined in previous generations. The ability to process data has, in many ways, made people's lives easier by affording the convenience and personalization they now expect. At the same time, though, it has also made individuals more traceable, as they provide an increasing amount of personal information to websites and companies in order to achieve a more seamless experience.

In its research, the OIG asked Americans throughout the country about their views on personalization in advertising mail and the tradeoff between privacy and convenience. Consumers want a personalized experience, but mostly did not understand how the information they give retailers is collected or used. One way customers provide companies with information that helps produce targeted mail is through their use of the Internet to shop online and create profiles with specific companies. Data collected about preferences and habits, which fuels desired personalization,

can also potentially lead to privacy vulnerabilities (Pingitone et al. 2013, p. 4). Seventy percent of consumers surveyed across the world reported that they were concerned about the erosion of personal privacy (Pingitone et al. 2013, p. 4). Many of these people do not fully understand the nature and extent of the data that is collected or how it is used (Pingitone et al. 2013, p. 4).

The Digital Natives in the OIG-sponsored focus groups acknowledged concern about companies getting their information (OIG Digital Natives 2013a, p. 9). They said that when they received information not targeted to them or personalized advertisements from companies with whom they have never transacted, it worried them. They openly wondered how advertisers who did not know their preferences got their names and addresses. The Digital Natives did not express concerns about personalized advertisements from new companies online. They only worried about hard copy communication from new companies. This could stem from the feeling that they are in control of their online profiles. The Digital Natives mentioned that they controlled what personal information viewers of their social media profiles could see, but they did not express concern for how much personal data they gave to the social media provider itself. The Digital Natives' concern about mail addressed to them without their consent may spring from a sense that they have no control over companies getting that information, while they have a sense of control, however fabricated, in their online identity.

The Digital Natives voiced a clear concern about their personal and financial information that was kept online (OIG Digital Natives 2013a, p. 9). They quickly forgot their privacy apprehension, though, when discussing scan-to-buy technology and one-click purchases. Digital Natives expressed a strong interest in these advances, where companies already have user information on file and can automatically fill in any necessary forms. Once the Digital Natives shared their information with a company once, they expected the company to retain the information to make future transactions with that company simple and convenient.

2.2 Implications

Although privacy remained a perennial concern, convenience remained of paramount importance for consumers. This leads to important implications for the USPS and the mailing community—they must balance convenient, customer-centric communication with privacy. The USPS has access to an incredible amount of consumer data. By leveraging this data, it could help companies effectively target their customers. However, the USPS must balance the need to keep consumer data safe, while still allowing companies enough information to create a personalized marketing experience. The USPS could further help companies create a positive experience for consumers by supporting mailers' use of innovative designs, digitally

interactive mail, and by providing consumers with a way to control the information they make available to advertisers.

2.2.1 Innovative Designs and Digitally Interactive Mail

The USPS should listen to both senders and recipients to maintain the effectiveness and viability of the mail channel. If those opening their mailbox each day find value in what they see, marketers, in response to a strong return-on-investment (ROI), will use the channel more often to communicate their messages. There are a number of steps the USPS could take to support mailers' use of innovative designs, digitally interactive mail, and targeted advertising. First, the USPS could conduct research to better understand recipients' communications needs and wants and to demonstrate the effectiveness of enhanced mailpieces for senders. The USPS's efforts, coupled with data about ROI or market research on customers' increased engagement with mailpieces that include these features, could prompt mailers to use them more. By increasing awareness about these mail innovations and their effectiveness, the USPS's research would likely drive more mail volume, and potentially new business.

Second, the USPS could leverage its unique role in the mail value chain as the communication and commerce platform provider to connect members of the postal industry to those in the innovative technology space. By fostering these relationships, the USPS can reduce mailers' transaction costs of trying to find new design and technology partners to make mail exciting and relevant to recipients. The USPS could also pave the way for digital/physical integration by creating its own partnerships with innovative technology companies. The USPS has already begun to establish relationships with augmented reality companies, such as Blippar and Aurasma, to create campaigns (Kaufman 2014 and OIG Recap 2014a). The USPS is uniquely suited to support or create, with partners, a physical/digital platform that could facilitate use of this technology.

Third, the USPS could continue to shift its focus from volume discounts to greater use of promotions that leverage emerging technologies, such as augmented reality and near field communication to nurture innovative, interactive features. Specifically, USPS could incentivize mailers that utilize innovative features on a mailpiece or parcel that leads to an online purchase experience. These promotions could last for a longer portion of the year in order to allow the advertisers time to design and add the new features over time. The promotions could be extended to mailers of all sizes in order to increase the effectiveness of their omni-channel campaigns.

2.2.2 Privacy and Using Data for a Better Recipient Experience

Regulations and policy decisions in consumer privacy will evolve as more issues arise. The USPS must prepare to make major decisions about whether and how it will use the large amount of data in its possession. This is a complex topic, which includes consideration of (1) how the USPS can effectively but responsibly use the

vast amount of data available, (2) whether mail recipients can decide the type of advertisements they would most like to receive, and (3) the ability, in terms of capability or jurisdiction, to share such data under the current regulatory scheme. The USPS's privacy policy ensures that it does not sell or rent personal consumers' information to outside companies (USPS Privacy Policy 2014).

The USPS, the most trusted government entity, owns an enormous amount of customer information (USPS Annual Report 2014). The USPS has the opportunity to be a pioneer in the industry with regard to consumer privacy management. First, by helping consumers control data about themselves, and second, by serving as an information hub to foster more targeted communications between its customers and empowered consumers. The USPS has the resources and capability to connect a person's digital identity with their physical location through an opt-in system, which could be instrumental in creating the personalization consumers now expect.

The USPS has a policy that supports permission-based marketing (USPS Privacy Policy 2014). Under this policy, the USPS does not provide information to companies about a consumer's past purchases, but instead, requires that the consumer expressly provide consent to share their preferences by opting in. The express consent is provided through the creation of a customer profile on usps.com. The USPS could improve marketing of this service by using open source data, such as stated interests on a person's social networking site, to gather additional information for personalized marketing. However, the only people who are likely to know about this service are those that already have an account on the USPS's website. The USPS does not actually manage the subscriptions; rather, it provides access to third party websites where people can manage their catalog and sample subscriptions.[1]

The USPS could implement a transparent system, allowing consumers to easily control their privacy settings and opt-in to receive advertisements from industries in which they are interested. This would increase recipients' excitement about getting mail, and allow companies to better target their customer communication. The focus group of Digital Natives found that even young consumers enjoy advertising mail but with content that is relevant to their needs and interests (OIG Digital Natives 2013a, p. i). The dichotomy between convenience and privacy is complex, but working with customers by accepting and incorporating feedback can help the USPS successfully navigate the future.

3 The Evolution of the Mail Moment

Understanding customer expectations is important to creating mailpieces that generate excitement and have value to the recipient. By understanding what aspects of mail recipients most highly anticipate and capture their attention, we can better understand how mail can most effectively drive consumer action.

[1] Some third party websites include: https://www.mailmeacatalog.com, http://startsampling.com, and http://www.mysavings.com

A major finding from the OIG's customer research regards parcels and their ongoing displacement of periodicals as the new "anchor" to the physical mail mix (OIG Digital Natives 2013a, p. 15). For years, the USPS has studied the composition of the mail and how households and families anticipate and review their mail (Mazzone and Rehman 2013). Periodicals, composed of magazines and newspapers, were the central component of the so-called "Mail Moment," as consumers anticipated the weekly and daily arrival of their favorite publications. As the circulation of newspapers and major magazines declines, parcel volume, driven by continuing e-commerce growth, is fast becoming the centerpiece of the new mail moment for younger generations (OIG Digital Natives 2013a, p. ii).

Magazines and newspapers have long made up the most important components of the Mail Moment—the daily household ritual of picking up, sorting, and prioritizing the mail ("Mail Moment"). Newspapers have continued to decline since their peak in the 1990s, but remain an important part of the USPS's revenue. In 1987, newspapers composed 35 % of all periodical volume. In 2012, newspaper volume was just 13 %, with magazines constituting the remaining share (Mazzone 2013, p. 49). Social networks, such as Facebook and LinkedIn, as well as news aggregators, like Feedly and Reddit, have added a customized dimension to news that newspapers and magazines cannot match, despite efforts to develop more interactive and personalized on-line content. Community newspapers have fared slightly better in their niche markets, but circulations continue to fall in this category as well (National Newspaper Association 2014). Magazine circulations also continue to decline—approximately 8 % annually the past few years (Pew 2014). The overall number of magazine titles, however, increased in niche markets such as hobbies and specific interests. The Copenhagen Institute for Futures Studies forecasts that this decline will continue, at a rate of between 1.5 % and 1.8 % for magazines and a steeper drop for newspapers of some 2.7 % annually (2011). Such a decline reflects the shift to mobile devices, like tablets and smartphones, which will likely continue to reduce magazine volumes. As previously referenced, the future of magazines is very much tied to its ability to become a hybrid medium of physical and digital content.

OIG research uncovered certain aspects of this trend as well. About 40 % of the 5,000 respondents in the OIG's Internet survey indicated that they preferred to receive their periodicals in physical form (OIG Survey 2013b, p. 11). When broken down by age group, those 65 or older preferred to receive their periodicals in physical form, while those in the 18–34 age group preferred receiving their periodicals digitally (OIG Survey 2013b, p. 12). Rather than periodicals, the parcel is fast becoming the anchor of today's mail, particularly for younger generations.

While the use of hard copy magazines for younger generations is declining, parcel volumes are steadily increasing, likely as a result of the boom in e-commerce. USPS volume of First-Class Packages (excluding CD/DVD rentals) raised 32 % in 2012 over 2010 volumes (Mazzone and Rehman 2013, p. 57). Although the number of USPS-delivered packages remains relatively low per household, there are noticeable increases among households under age 35, with higher incomes, and with people who are well-educated. Market research firm eMarketer forecasted global

business to consumer (B2C) e-commerce growth at a rate of 20.1 % in 2014 and will continue to grow at a robust pace over the next 4 years (2014). eMarketer also projected the U.S. market to grow 11.8 % in 2014 (2014).

The accelerating transformation of the mail mix from periodicals to parcels has a number of implications for the USPS, as well as most other POs impacted by the growth in e-commerce and the decline in periodicals and correspondence. Three major themes emerged. First, periodicals remain an important component of the mail stream for the short term. Second, USPS should support the growing product samples business. Third, younger generations will be drawn to the mail because of the growing volume of parcels, which will also help other mail products retain their value.

First, the USPS should not dismiss the importance of periodicals over the short term. While the Mail Moment is undergoing a major transformation, periodicals remain an important component of the overall mail stream, particularly because of the strong interest by older generations maintain—an important part of the USPS's customer base. Research indicates that newspaper circulation will continue to decline, with readership diverging into freely distributed online versions or those appealing to a niche readership (Copenhagen 2011, p. 47). However, recent growth in the number of specialty magazines remains promising. Magazines, through interactive digital features, can serve as an interactive bridge between the physical and digital worlds that both maintain readership with the growing senior population while attempting to attract younger readers.

A second implication is the promising role of product samples and customization in the mail stream. Now more than ever, prospective consumers, or "prosumers,"[2] are critical to the development of new retail products. Consumer goods companies have the ability to query loyal customers through product trials and feedback. Additionally, samples often convince customers to buy a product. The OIG focus groups with Digital Natives confirmed their interest in receiving additional free items in the mail in the next 5 years (OIG Digital Natives 2013a, p. 8).

Some brand marketers consider samples to be "the single most effective marketing tool there is" (Ben-Achour 2013). The USPS recognized this opportunity and in 2013 offered a 2-month promotion, giving sample mailers a 5 % discount on qualifying Standard Mail and Nonprofit Marketing Parcels (Ben-Achour 2013). Although modest, this was the largest discount, by percentage, the USPS offered that year. Sample subscription companies have also grown around the strong marketer and consumer interest in monthly sample boxes. These businesses send a box of "surprise" samples once monthly, and then offer full sizes of the products for sale on their website. One company, called Birchbox, now has more than 800,000 subscribers, many of whom have made full-size purchases online after receiving the sample (Cutler 2013 and Passikoff 2013).

[2] A "prosumer" is "a prospective consumer who is involved in the design, manufacture, or development of a product or service", http://www.oxforddictionaries.com/us/definition/american_english/prosumer

Samples are also effective in generating interest and sales through word of mouth (Jayakumar 2014). Digital Natives are more likely to rely on the opinions of those around them and online consumer reviews than professional review websites (Barton et al. 2012). Samples enhance this drive to share with others, as users are more likely to share their experience. As an example, one subscription sample company reports that 15 % of all full-size products sales on their website come from people who have not subscribed to receive the monthly sample box (Barton et al. 2012).

Finally, as OIG focus groups with Digital Natives indicate, the increase in per capita parcel volume over the coming years will likely create a new ritual, as younger generations anticipate parcel delivery and ensure they continue to check their mail often. Digital Natives' excitement around parcels generates additional anticipation in checking the mail, upholding the viability of the mail channel as an advertising medium. Other products such as advertising mail and catalogs will retain their relevance as generational interests shift over the coming years.

4 Conclusion

Through a series of surveys and focus groups over the past year, the OIG uncovered a number of findings about the expectations of Americans of different ages and geographic groups. The findings from these studies have broad implications for the postal sector, while it determines how to serve an increasingly digitally oriented youth population and maintaining service to communities on the other side of the digital divide.

Based on the survey and focus group data, three areas appear to be particularly promising for further research. First, as Digital Natives indicated the OIG research, mail continues to retain value. Initial research signifies that today's consumers like to receive advertising across a number of physical and digital marketing channels—finding the right proportion and the degree of customization to connect with the consumer will be critical in the future.

Employing interesting shapes and bright colors, as well as various types of digital technologies used in physical print has already made an impact. But further research to assess the appropriate mix to optimize an omni-channel approach to a campaign would be very helpful to marketers trying to decide how to maximize their advertising spend. Based on the results of this research, USPS could consider providing exciting and digitally integrated customer-centric products and services, while also balancing these efforts with the organization's long tradition of privacy protection.

Finally, as mobile broadband continues to rapidly expand, the role of postal operators remains unknown. A study of how mobile usage will impact postal operators and a closer look at how mobile applications, such as digital mail and mail/parcel notification, will impact rituals such as the Mail Moment would be valuable.

The USPS will need to continue optimizing the network to support the growing volume of parcels associated with e-commerce—the future centerpiece of every household's mail.

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Analyzing the Prospects for Transactional Mail Using a Sender-Recipient Framework

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1 Introduction

Letter volumes in countries with advanced postal networks have been in decline since the early to mid-2000s. The principal cause of this decline has been the substitution of paper communications by electronic methods (e-substitution). However, analyses of letter volumes in the USA and UK (see USPS 2010; PwC 2013) suggest that the impact of e-substitution has varied widely across different content types of mail (e.g., advertising mail and transactional mail) and within transactional mail by different segments of traffic. In particular, the UK study concludes that while some segments of transactional mail have largely moved on line others are just beginning this transition. Understanding the processes at work in the development of e-substitution and assessing how their effects differ across different types of transactional mail is of major importance to postal operators and policy makers.

The aim of this paper is to construct a theoretical model of the decision by senders and recipients of transactional mail to use electronic forms of communications rather than paper mail. The model takes explicit account of the characteristics of different types of transactional mail (e.g. statements, invoices, general correspondence and

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official documents) that are relevant for this decision. More precisely, we build a model with a generic type of transactional mail, where a representative business sender (for example, private sector organizations, such as banks and insurance companies, or not-for-profit organizations, such as government departments and charities) sells a final good to its customers, with each unit necessitating one unit of communication with its customers. This communication can take the form of either paper mail, or of an electronic substitute.

The choice between modes of communication is modeled as a classical horizontal differentiation problem *à la* Hotelling, with two modifications. First, there exists a fraction of individuals who do not have access to the e-substitute technology (e.g. they are not connected to the Internet). Second, the communications strategy of the business affects demand for its final product. Sending letter mail may be preferred for some types of communications on the grounds that it could increase overall demand (e.g. information on services potentially acting as trans-promotional mail or ensuring people turn up for hospital appointments). The key point to note is that transactional mail communications are heterogeneous and different types of senders and recipients differ in their willingness to e-substitute.

Section 2 of the paper briefly outlines our analytical model, which has parallels with that reported in Borsenberger et al. (2015). In Sec. 3 we calibrate the model under two alternative sets of assumptions to provide insights on the extent to which the interactions of sender and recipient preferences can impact on the e-substitution of different types of transactional mail. The calibrations differ in that in one case transactional mail is considered to have no impact on the demand for the final product of the representative firm and in the other it is considered to have a positive impact. Section 4 concludes and summarizes a number of important insights gained from these alternative calibrations.

2 The Model

Businesses send many different types of transactional mail (such as general correspondence, statements, invoices and official documents), corresponding to different markets (such as banking, utilities and government services).[1] To simplify notation, we model a generic market in this section. We then calibrate the model and show how results are impacted as a function of the characteristics of the type of mail studied.

A representative firm is assumed to sell a final good to consumers. Selling this final good requires communication between the seller (the firm) and the buyer (the final consumer). We make three assumptions regarding this communication: *(i)* each unit of final good sold requires one unit of communication, *(ii)* communication

[1] The term business or firm in this paper refers to all types of senders of transactional mail, including private and public sector organizations. We assume for simplicity that each type of transactional mail corresponds to a market and they are not substitutes for each other.

can take place either through paper mail or through an electronic substitute, and *(iii)* the communication channel used is part of the firm's overall business and marketing strategy and can potentially have an impact on the demand for the final product. Final consumers are then assumed to choose individually whether they prefer to purchase the good with the communication to take place via mail or an electronic substitute, depending on their (exogenous) ability to use this e-substitute and on their willingness to do so, which in turn depends on the characteristics (including price) of the two communication channels. In other words, the demand for transactional mail is a derived demand in our model, and the final consumers of the firm are the recipients of mail, while the representative firm is the mail sender.

2.1 Demand Side

An exogenous fraction α of the general population (final consumers) has access to the e-substitute technology (i.e., they own a computer, tablet or mobile phone and have access to Internet). The remaining fraction of final consumers, $1-\alpha$, always uses paper mail rather than e-substitutes.

We model the willingness of the fraction α of final consumers to use the e-substitute rather than receive paper mail by a classical horizontal differentiation model *à la* Hotelling.[2] To represent these taste differences, we assume that consumers are distributed over a Hotelling line, with $z \in [0,1]$, according to distribution function $G(z)$ and density $g(z)$. Point 0 corresponds to paper mail while point 1 corresponds to the electronic substitute. Each customer is characterized by a "location" on this interval, denoting her relative preference for the two modes of communication. The distribution of individuals on this line represents the distribution of the willingness to e-substitute among those who are able to do so.

The unit price of the final good sold by the representative firm may depend on the communication channel used. We denote by q_0 the unit price when the consumer chooses to use paper mail, and by q_1 the unit price when the consumer opts for the electronic substitute in her dealings with the representative firm. A final consumer located at $z \in [0,1]$ and buying the quantity x of the good is assumed to have utility

$$\begin{aligned} &\theta u(x) - q_0 x - t z^2 \quad \text{if she buys paper mail,} \\ &u(x) - q_1 x - t(1-z)^2 \quad \text{if she prefers the e-substitute,} \end{aligned}$$

where t denotes the usual psychological, or convenience, cost borne by a customer who has to use a communication method that differs from the intermediate method (located at z) which she most prefers. This utility cost, t times the distance between used and most-preferred communication methods, is independent of the quantity x of final good bought. This in turn means that all consumers who choose a specific

[2] Borsenberger et al. (2015) develop a similar model applied to another context.

communication channel (either paper mail or the electronic substitute) buy the same amount of final good (and thus use the same quantity of communication) at the prevailing price for the good.

The parameter $\theta \geq 1$ embodies the assumption that the use of paper mail in the communications between the firm and its customers may allow it to engage more effectively with them and thus increase their utility. The provision of information by mail may impact on consumer utility directly; for example, where a firm's good has complex terms and conditions (say an insurance policy) receiving it in paper form rather than electronically may be of positive value to consumers. Paper mail may also provide the firm with a more effective channel to communicate with consumers for the promotion and sale of its set of products (for example, through the use of trans-promotional mail), which may allow consumers to increase their utility through the better matching of their preferences to products. A larger value of the parameter θ increases the amount of good sold using the paper mail communication method (thereby increasing the amount of transactional mail), both because more consumers choose this communication method and because all those who do so buy a larger quantity of the final good, thus requiring more communication with the firm.

We refer the reader to De Donder et al. (2014) for the computation of the aggregate (market) demand for the two final products and the two communication methods, which are given by

$$X_0(\theta, q_0, q_1) = x(\theta, q_0)\left[1-\alpha+\alpha G\left(\hat{z}(\theta, q_0, q_1)\right)\right],$$
$$X_1(\theta, q_0, q_1) = x(\theta, q_1)\left[\alpha\left(1-G\left(\hat{z}(\theta, q_0, q_1)\right)\right)\right],$$

where $x(\theta, q)$ denotes the individual demand functions and where $\hat{z}(\theta, q_0, q_1)$ is the marginal consumer indifferent between using paper mail and the e-substitute. The individual demand functions are obtained as the solution of

$$v(\theta, q) = \max_x \theta u(x) - qx,$$

with the function $v(\theta, q)$ denoting the indirect utility (consumer surplus) of a final consumer buying the quantity x of final good at price q (with $\theta \geq 1$ if paper mail is used to communicate with the firm, and $\theta = 1$ otherwise). The marginal consumer corresponds to

$$\hat{z}(\theta, q_0, q_1) = \frac{1}{2} + \frac{v(\theta, q_0) - v(1, q_1)}{2t}. \tag{1}$$

Observe for future reference that $\hat{z}$ is increasing in θ.

2.2 Supply Side

The cost function of the representative firm selling the quantities X_0 of final goods using paper mail and X_1 of final good using the e-substitute is

$$C\left(X_0, X_1\right) = F + \left(p + c_0\right)X_0 + \left(p + c_1\right)X_1,$$

where F denotes the fixed cost of running the firm, including the fixed cost of using both communication technologies, and where the variable cost when using communication technology $i \in \{0, 1\}$ is divided into the price for the firm of one unit of final good, p, deemed to be independent of the communication method used, and of the variable cost c_i per unit of communication method i.

2.3 Equilibrium Allocation

The representative firm chooses its prices for the final good it sells according to the communication method (q_0 and q_1) in order to maximize a weighted sum of consumer surplus and of profit, with the weight put on profit denoted by λ.[3]

A weight $\lambda = 1$ corresponds to the first-best allocation, while a weight λ tending towards infinity models the profit-maximization scenario. The value of λ can then be taken as a proxy of the competition intensity in the representative firm's market (with a lower value of λ for a more competitive industry, and the polar cases of $\lambda = 1$ for a competitive fringe and $\lambda \to \infty$ for a profit-maximizing monopoly), and/or a depiction of its stated objective (such as profit-maximization for a private firm or welfare maximization for a nonprofit entity). The optimal prices $q_0^*(\lambda)$ and $q_1^*(\lambda)$ are traditional Ramsey formulas (but with the value of λ being exogenous, except for the Ramsey case).[4] They can be simplified into *(i)* marginal cost pricing when $\lambda = 1$ and *(ii)* profit-maximizing prices when $\lambda \to \infty$.

We now turn to the calibration of the model.

3 Calibration

As noted above, different segments of transactional mail are being impacted differently by e-substitution. In our model, this is reflected by: differences in the willingness of senders to e-substitute (as summarized by the density function $g(z)$); by the value added by paper mail as opposed to the e-substitute (the parameter θ); and by

[3] See De Donder et al. (2014) for the analytical formulation.

[4] They are available upon request.

the objective and/or the competition intensity in the representative firm's market (the value of λ). We provide here two different calibrations of the density function, each corresponding to a specific value of θ. For each of these two calibrations, we compute the equilibrium allocation for several values of λ. The two calibrations are based on the same set of assumptions presented in the following subsection. We then turn in the next two subsections to the assumptions specific to a particular calibration and to the results obtained with this calibration.

3.1 Assumptions Common to the Two Calibrations

We set exogenously the cost of the final good sold by the firm (excluding communication), p, at 100 and assume the cost of letter communications is 0.5 % of the output price (so that $c_0 = 0.5$) and the cost of electronic communications is a low fraction (2 %) of letter communication costs, so that $c_1 = 0.01$. Hence, the marginal cost prices are $q_0 = 100.5$ and $q_1 = 100.01$.

We assume the utility function $u(x)$ is quadratic, so that individual demands for final goods $x(\theta, q)$ are linear in q (although not in θ). Utility functions and individual demands are then determined by two parameters, which are calibrated so that (1) the direct demand price elasticity for the final good is −1, and (2) the individual quantity demanded at the marginal cost price with letter communication of 100.5 is 1000 (an arbitrary number). Data provided by the UK Office for National Statistics (ONS) shows that in the latter part of 2013 84 % of adults had "ever used the Internet" and of these users 97 % state they had used it over the past 3 months.[5] We then set $\alpha = 0.85$.

Based on market research commissioned by Royal Mail on consumer preferences for letter versus e-communications if charges were explicitly introduced for paper items, we report in Table 1 four estimations of the letter market shares as a function of the prices of final good according to the communication method used, q_0 and q_1.

Note that the letter market shares in Table 1 are expressed in terms of fractions of consumers, as given by

Table 1 Letter market shares assumptions

q_0	q_1	Letter market share (%)
100.5	100.01	50
101.0	100.01	35
102.5	100.01	24
103.5	100.01	22

[5] Further details can be found in the Internet Access Quarterly Update Q3 2013 available at http://www.ons.gov.uk/ons/dcp171778_336739.pdf

$$1-\alpha+\alpha G\left(\hat{z}\left(\theta, q_0, q_1\right)\right),$$

rather than in terms of volumes, which would correspond to

$$\frac{X_0\left(\theta, q_0, q_1\right)}{X_0\left(\theta, q_0, q_1\right)+X_1\left(\theta, q_0, q_1\right)}.$$

The two market share measures differ from each other because individuals buy different quantities of the final product (and thus use different quantities of communications) depending on the type of communication method used ($x(\theta, q_0) \neq x(1, q_1)$ both because $q_0 \neq q_1$ and in the case where $\theta > 1$).

We assume a density function $g(z)$ as $h(1-z)$ where $h(.)$ is a Pareto function indexed by a single parameter γ. There remain three parameters to calibrate: γ (the skewness of the distribution of consumers on the Hotelling line), t (the disutility incurred by consumers when they do not consume their most-preferred type of communication technology) and θ (the extent to which using letter mail boosts the demand for the final good) and market research could be used to inform such assumptions. We are especially interested in how results are affected by assumptions related to the value of θ. We cover two distinct possibilities in the next two subsections.

3.2 *Calibration with* $\theta = 1$

We first calibrate our model by assuming that the final demand for the representative firm's good is not impacted by its choice of paper versus electronic communication channel, which can be represented by assuming that $\theta = 1$. In Table 2, we report the market shares for the four pairs of prices using $\theta = 1$. Since we have two degrees of freedom (the setting of γ and of t) and four calibration points, we use the points in the first and last rows in Table 1 and report the letter market shares we obtain in Table 2. The shares obtained for the two intermediate rows are larger than, but close to those in Table 1 while shares in volumes are lower than (since $q_0 > q_1$ so that $x(1, q_0) < x(1, q_1)$), but close to, those measured in fractions of consumers.

Table 2 Calibrated market shares with $\theta = 1$

		Letter market share of	
q_0	q_1	Consumers (%)	Volumes (%)
100.50	100.01	**50.0**	49.9
101.00	100.01	45.1	44.8
102.50	100.01	31.0	30.4
103.50	100.01	**22.0**	21.3

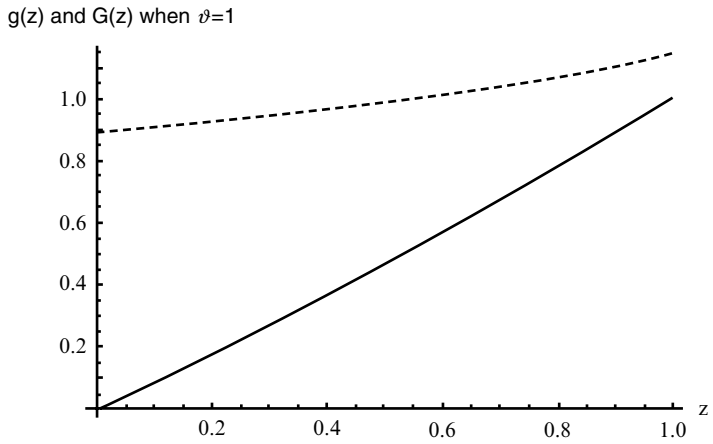

Fig. 1 Calibrated density (*dashed line*) and distribution (*solid line*) functions when $\theta = 1$

The resulting density (dashed line) and distribution (solid line) functions are depicted in Fig. 1 and are close to the uniform distribution but slightly increasing in z, meaning that slightly more customers locate themselves close to the electronic substitute than to letter mail (i.e., $G(0.5) < 0.5$).

Observe first that, for the first row of Table 2, letter mail has only a 41 % market share among consumers who have access to the e-substitution technology (since $0.15 + 0.85*0.41 = 0.50$). At the same time, this row corresponds to $q_0 > q_1$. As q_0 increases, we can see from Table 2 that the letter market share decreases at a roughly constant rate. But, with concave utilities, the location of the marginal consumer $\hat{z}$ (as given by Eq. 1) increases by a slightly smaller amount as q_0 increases. This in turn means that more people are located close to the right-hand extreme of the Hotelling line–i.e., that $g(z)$ is slightly increasing in z. Hence, if $\theta = 1$, the letter mail assumptions imply that, although the distribution of intrinsic tastes for letter mail vs e-substitute is close to uniform, slightly more consumers would actually prefer the electronic substitute to letter mail. We will see in the next section how the distribution function is impacted if we assume that $\theta > 1$.

We are now in a position to report in Table 3 the equilibrium allocation as a function of the value of λ. The first row reports the first-best allocation, attained when the representative firm maximizes unweighted welfare (either because this is the objective of this non-profit organization or because it faces a competitive fringe) and thus sets prices equal to marginal costs. The letter market share corresponds to the first row of Table 2, with 41 %- that is, $G\left(\hat{z}\right)$ of Internet connected consumers preferring letter mail when the price difference with the e-substitute is 0.49, for a total market share of 50 % when adding the fraction $1-\alpha$ of consumers unable to use the e-substitute because of lack of access to the Internet. Profit in this case is zero, absent any fixed cost (i.e., assuming that $F = 0$), and the totality of welfare is made of consumer surplus.

Table 3 Equilibrium allocations as a function of λ when $\theta = 1$

λ	q_0	q_1	$G(\hat{z})$	X_0	X_1	$X_0/(X_0+X_1)$	π	C. surplus	Welfare
1	100.5	100.01	0.4118	500.00	502.44	0.4988	0	50,186	50,186
1.2	114.9	114.36	0.4109	427.55	431.69	0.4976	12,366	36,790	49,156
1.5	125.8	125.09	0.4073	371.31	380.54	0.4939	18,936	28,095	47,031

As λ increases, the representative firm puts more weight on profit, as opposed to consumer surplus (for instance because the degree of competition in its industry decreases, allowing it to set a mark-up over marginal costs). We obtain that the representative firm increases both prices. Note that it is not possible to disentangle the margin made on selling the final good and the one made on selling one or the other communication method, since good and communication method are bundled into a single package. Also, the extent to which the firm increases its prices is in large part driven by our assumption on the direct price elasticity of the demand for the final good (numerical results available upon request show very intuitively a larger increase in prices with a lower demand price elasticity). More interestingly, the firm increases both prices in a similar way although the difference between the two increases slightly. This results in a very slight decrease in the letter market share, both in fraction of consumers and in volumes. Consumer surplus decreases more than the increase in profit, so that total welfare decreases.

Finally, the Ramsey solution (i.e., the allocation maximizing welfare subject to the representative firm breaking even) depends on the value of the fixed cost F. In other terms, the Ramsey allocation corresponds to the second row of Table 3 if $F = 12{,}366$, and to the last row if $F = 18{,}936$. A reasonable value for λ in numerical studies often lies between 1.2 and 1.3 so that the second row seems a good approximation of the Ramsey solution.

3.3 Calibration with $\theta = 1.05$

We now calibrate our model by considering the case where the final demand for the representative firm's good would be positively impacted by sending letter mail (possibly due to paper based trans-promotional communications being more effective than e-communications) by assuming $\theta > 1$. In particular, we set $\theta = 1.05$ and, to ease comparison with the previous calibration, we keep all other assumptions (including the first and last rows of Table 1) unchanged. We calibrate the values of γ and t in order to replicate these first and last rows. Table 4 reports the letter market shares we obtain for the four pairs (q_0, q_1) proposed in Table 1 which for the two intermediate rows are even closer to those reported in Table 1 than with the previous calibration. Letter market shares are now a little higher in volumes than in consumers, because the impact of $\theta > 1$ on volume is larger than the impact of the larger letter price (i.e., $x(\theta, q_0) > x(1, q_1)$ when $\theta = 1.05$, even though $q_0 > q_1$).

Table 4 Calibrated market shares with $\theta = 1.05$

		Letter market share in	
q_0	q_1	Consumers (%)	Volumes (%)
100.50	100.01	**50**	51.2
101.00	100.01	41.2	42.2
102.50	100.01	26.6	27.1
103.50	100.01	**22**	22.3

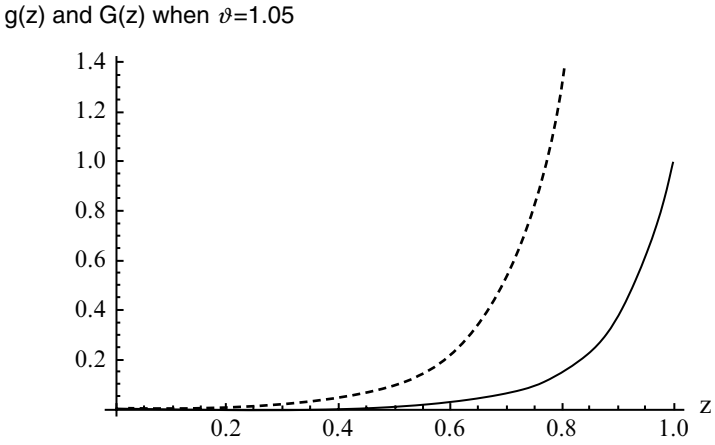

Fig. 2 Calibrated density (*dashed line*) and distribution (*solid line*) functions when $\theta = 1.05$

The resulting density (dashed) and distribution (solid) functions are depicted on Fig. 2. We obtain a density function which is much more increasing and convex than when $\theta = 1$. The intuition for this result runs as follows. Market shares are assumed to be the same, at marginal cost prices, when $\theta = 1$ and when $\theta = 1.05$. At the same time, Eq. 1 shows that the value of $\hat{z}$ increases with θ. From Figs. 1 and 2, and concentrating on the first row of Table 1, we obtain that $\hat{z}$ is slightly lower than one half when $\theta = 1$ while it is close to 0.9 with $\theta = 1.05$. To maintain the market share $G(\hat{z})$ at the same value of 0.41 in both cases, we thus need that the distribution of preferences be more skewed in favor of e-substitutes when $\theta = 1.05$. As q_0 increases from 100.5 to 103.5 (while $q_1 = 100.01$), the value of $\hat{z}$ increases more slowly with $\theta = 1.05$ than with $\theta = 1$, which implies that the density function is increasing and convex–much more so when $\theta = 1.05$.

The comparison between Figs. 1 and 2 is striking, since we have increased θ by only 5 %. This shows the high sensitivity of the density function $g(z)$ to the value of θ, and the importance of the latter for our results.

We now report in Table 5 the equilibrium allocations for various values of λ when $\theta = 1.05$ the first row of which corresponds to the first best allocation. Compared with the first row of Table 3, the letter market share in volumes is now larger than

Table 5 Equilibrium allocations as a function of λ when $\theta = 1.05$

λ	q_0	q_1	$G(\hat{z})$	X_0	X_1	$X_0/(X_0+X_1)$	π	C. surplus	Welfare
1	100.5	100.01	0.4118	500.00	477.56	0.5115	0	45,127	45,127
1.2	113.73	114.20	0.4489	461.59	377.96	0.5498	11,471	32,699	44,169
0.5	124.07	126.54	0.6908	564.32	178.14	0.7601	18,028	23,984	42,012

50 % for the reason explained above and the consumer surplus is lower.[6] As we increase the value of λ, both prices posted by the representative firm increase. The prices q_0 and q_1 remain close to each other, but now q_1 increases more than q_0, so that the use of the e-substitute is priced at a higher level than that of letter mail when the representative firm puts enough weight on its profit, even though the e-substitute is less costly to the firm than business mail. This stands in sharp contrast with Table 3.

Two factors concur in explaining the differential impact of a larger λ on q_0 and q_1. First, raising q_0 would be especially detrimental for volumes because the impact of a larger price is magnified by $\theta > 1$ (both for individual demand $x(\theta, q_0)$ and for the location of the marginal consumer $\hat{z}$). Second, the density function $g(z)$ represented on Fig. 2 shows that in this case a large fraction of consumers would be located close to one –i.e., would have an intrinsic preference for a communication method close to the e-substitute. Raising q_1 then allows more profit to be captured from these consumers. As a consequence, the letter market share increases with λ, in contrast to the results obtained when $\theta = 1$. Finally, profit increases at the expense of both consumer surplus and welfare as λ increases.

4 Conclusions

Transactional mail contains many different types of communication. Postal operators and policy makers should assess prospects for each major segment separately and take into account the significant impact that both sender and recipient preferences can have on demand over the longer term. Further, a substantial minority of individuals do not have regular access to the Internet (mainly the old and vulnerable) which limits the extent to which shifts to e-communications can take place – although in the very long run this effect is likely to disappear.

Our results indicate that where there is a need to send mail in order to complete a business transaction and the form of that communication (paper or electronic)

[6] As we calibrate the model so that the one half of consumers who prefer letter mail buy in total ($X_0 =$) 500 items when the final good is priced at marginal cost with letter mail, the increased market share (in volumes) of letter mail, compared to Table 3, is obtained at the expense of X_1. This also explains why consumer surplus is lower in the first row of Table 5 compared to Table 3.

does not impact the demand for a firm's product ($\theta = 1$), then the share of letter versus e-communications is broadly unaffected by the market structure the firm operates within ($\lambda \geq 1$). Here our analytical model suggests that, while the price of goods and services requiring paper based communications will be higher than those using e-communications under different competitive market structures, their relative price remains broadly unchanged. In such cases the key determinant of letter versus e-communications would be recipient preferences.

However, our analysis suggests that where the demand for products and services can be positively influenced by communication strategies incorporating an element of paper communications (such as trans-promotional mail resulting in $\theta > 1$) then at higher values of λ (that is, where the intensity of competition is lower) profit maximizing firms or cost minimizing public sector bodies may send more letter mail. The key driver of this result is that to some extent firms have an incentive to offset the relative cost advantage of e-communications via pricing decisions in order to stimulate demand. In such cases a more important determinant of letter versus e-communication would be sender preferences.

The analytical model we have constructed provides insights to postal operators to help limit the structural decline in letters. For example, for specific segments of mail where paper based communications are deemed to have very little impact on the final demand for the product being consumed, postal operators should support activities that will influence recipients mail preferences and engage in activities to ensure non-Internet users are not unfairly disadvantaged by business mailer decisions. In other cases where transactional mail is generated by business activities which are, or could be, positively benefiting from sending paper communications, postal operators should be making the case for mail to senders strongly. Our model could be a powerful tool in assessing prospects for different types of transactional letter mail over the longer term when enhanced by market research to better identify sender-recipient preferences in different market segments.

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