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Abstract

The financing of universal service provision in the postal sector has traditionally relied on granting the universal service provider a reserved area. Together with growing electronic substitution, current liberalization policies promoting competitive entry may put the traditional universal service at risk. Hence, there is an increased interest in knowing the cost of universal service provision. The third EC postal directive proposes a calculation approach to separately determine the net cost of a universal service obligation and to compensate the universal service provider (USP). This paper discusses the interaction between universal service costing and financing and shows that the EC approach may result in distorted results. It also quantifies the effects based on a model calibration with Swiss data. The results show that separate costing and financing leads to a considerable under-compensation of the USP if there is a compensation fund to which every operator contributes. The USP is over-compensated if it is exempt from contributing to the fund (pay or play mechanism). The problem of under- or overcompensation can be resolved by an integrated computation of the net cost that includes the competitive effects of the financing mechanism. Such an integrated approach results in a fair compensation of the USP.

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1. Introduction

The financing of universal service provision in the postal sector has traditionally relied on granting the provider a reserved area. Together with increased electronic substitution, current liberalization policies promoting competitive entry may put the traditional universal service at risk.[2] The need for alternative funding sources has increased the interest of regulators and the public in knowing the cost of universal service provision: The universal service provider (USP) should be correctly compensated for its burden. This implies knowing its private cost, as measured by the profitability cost approach pioneered by Panzar (2000) and Cremer et al. (2000). It defines the net cost of universal service obligations (USO) as the difference in the USP's profit with and without the obligation.

A number of contributions have already discussed various possibilities to implement the profitability cost approach.[3] They all have treated universal service costing and financing separately (or have focused on the costing side). Only recently it has been argued that the market structure and the actual cost/burden of USO are directly related to regulation and the funding mechanism in place. Boldron et al. (2009) argue that the challenge of establishing a funding mechanism is that the market structure and the effective cost/burden of USO are endogenous to regulation and funding mechanisms.

We start from the profitability cost approach. The approach has basically been adopted by the 3rd Postal Directive 2008/6/EC (cf. Jaag et al. 2009). Annex I provides guidance on how to calculate the net cost of USO. Article 7 of the same directive determines the possible financing mechanisms to cover these net costs:

> "Where a Member State determines that the universal service obligations […] entail a net cost […] it may introduce:
> (a) a mechanism to compensate the undertaking(s) concerned from public funds; or
> (b) a mechanism for the sharing of the net cost of the universal service obligations between providers of services and/or users."

Hence, EU proposes a two-step approach:

1. **Calculate net cost** according to certain principles;
2. **Compensate the USP** by use of public funds or a sharing mechanism.

Thereby, various sharing mechanisms are possible. Oxera (2007) provides an overview of financing instruments. Article 7 and 9 of the third Postal Directive limit the member states when implementing mechanisms to share the net costs of USO. Especially, the provisions aim at preventing member states from raising new barriers to entry. The main sharing mechanisms compliant with the third Postal Directive are compensation funds to which postal operators are obliged to contribute based on their turn-over or an

[2] Cf. Dietl et al. (2005) or Jaag (2007) for the Swiss case.

[3] Cf. e.g. Copenhagen Economics (2008), Bergum (2009), Frontier Economics (2008), and Cohen et al. (2010).

a per-item basis. These contributions might be waived if an operator provides universal services ("pay or play").

In our paper, we first illustrate how such compensation mechanisms affect the market equilibrium. **We show that the choice of the compensation mechanism has an impact on the size of the net costs.** To do so, we provide a model of a competitive postal sector with a stylized USO. In the model, the net cost of this obligation can be financed by the following three main compensation means compliant with the EC Directive:[4]

External Funds – The USP's net costs of providing universal services are reimbursed with funds provided by the general government budget. In this scheme, no operator in the postal market contributes specifically to the USO funding.

Everyone Pays – All operators contribute into a compensation fund with a uniform output tax. The USP's net costs are reimbursed by the collected funds. In such a system, the USP has to partly compensate his net costs himself.

"Pay or Play" – Operators that provide universal services ("play") are exempt from contributing to the compensation fund ("pay").

In the two latter cases, in which the net costs are financed by a fund, the operators' contributions are based on their turnover (ad valorem tax) or a per-unit tax. Both mechanisms are compliant with the Third European Postal Directive. As demonstrated by Borsenberger et al. (2010), under uniform taxation schemes, the two taxation bases are not equivalent (this is confirmed by our analysis) and a per-unit tax could lead to a higher surplus.

Secondly, we show that the two-step approach as foreseen by the third Postal Directive results in over- or under-compensation of the USP when applied with sharing mechanisms that affect the equilibrium market outcome. We hence propose an "**integrated procedure"** to calculate the net costs. This allows for a fair USP compensation. Such an integrated calculation is based on the profitability cost approach and includes the compensation schedule in the model to calculate the net costs. Doing so, the compensation raised from the market players exactly leaves the USP indifferent whether to provide its public mission or not.

The Third Directive also mentions an "unfair burden" as a prerequisite for the compensation of net costs. It has been suggested that this is linked to the USP making a loss. E.g. Boldron et al. (2009) argue: "The burden is unfair if the USP's market power is not sufficient to counterbalance the weight of the USO to maintain a reasonable profit" (p. 68).[5] There are other interpretations of how the unfairness of a burden could be

[4] For an analysis of financing mechanisms compliant with Directive 2008/6/EC cf. Trinkner (2009).

[5] Cf. also De Donder et al. (2010).

interpreted.[6] We simplify our argument by assuming that net costs are compensated irrespective of whether or not they constitute an unfair burden.

In the following, we show that the **difference of profits between the situation without USO and a situation with USO *taking into account the funding mechanism implemented* is the cost of the USO that should be compensated**. In this regard, we deviate from and extend the analysis by Panzar (2000) and Cremer (2000) which do not include the impact of the financing instrument itself in their analysis.

Our paper is not about a welfare analysis. Hence, the "best" financing mechanism is not necessarily the one that minimizes the net cost. Similarly, it may not be optimal in any sense to impose USO in the first place. We simply argue that whenever there is a USO in place and its burden should be compensated, the right level of compensation very much depends on the financing mechanism itself.

The remaining part of the paper is organized as follows. Chapter 2 briefly discusses the model and its calibration. Chapter 3 discusses the results. Chapter 4 concludes.

2. The Model

Based on the modeling approach by Valletti et al. (2002), we analyze the interaction of universal service costing and financing after full market opening, i.e. after the abolishment of a reserved area in the market for mail. In the following, we summarize the salient features of our underlying model.[7] To isolate the effects in question we use a stylized model where we keep things as simple and illustrative as possible. In particular, we do not model all USO dimensions.

We model the postal market with one aggregate mail category for addressed mail, unaddressed mail and newspapers. Two postal operators are active in the market: A USP ("incumbent") and a competitor ("entrant"). There are no pricing restrictions and the two operators can decide on their regional coverage in the absence of USO, i.e. the regions they cover with their own delivery organization. There is no downstream access possibility.

To analyze our research question we first define the USO. To avoid an unnecessary complex model we focus on mail delivery and assume that the USO consists of a daily and nationwide mail delivery only; there is neither a uniform pricing constraint nor restrictions on collection infrastructures etc. Hence, the USO operator is able to differentiate its prices across regions.

This USO constraint is binding for the operator being obliged to provide it, as long as the profit with a limited coverage is higher than with nationwide coverage. In such a case, the need for a financing means arises. As outlined above, we include three such

[6] Cf. Jaag (2010).

[7] An outline of the model is available from the authors on request.

financing options in our model: (1) External funds and compensation funds (2) with and (3) without contributions from USP.

There is a continuum of delivery markets, all sharing the same demand and marginal cost characteristics, but differing in fixed costs. First, a profit-maximizing incumbent sets the proportion of markets covered, then a profit-maximizing entrant. Third, the two operators compete in prices over differentiated mail products. From the perspective of operators, regions are ranked by increasing order of cost (or decreasing order of demographic density). Without USO, operators begin to cover the most densely populated areas and continue to cover less densely areas as long as it is profitable. In these decisions, operators take into account the anticipated marginal surplus resulting from price competition in additionally covered markets. The sequence of decisions results in the incumbent always serving at equilibrium a larger proportion of the total market. This sequence reflects that the incumbent operator has traditionally been serving all markets due to the (traditional) USO. Quality other than coverage is treated as exogenous. A time-consistent solution of the model can be found by backward induction. Such a modeling enables us to include all cost and benefits of the USO. Moreover, we can discuss the competitive effects of the main funding mechanisms at hand.

Hence, in the **absence of a universal service obligation**, the specific cost structure together with the market penetration decisions result in a natural segmentation of the entire market into three market segments (cf. Figure 1):[8] (1) In cities and dense regions, it is feasible for two (or potentially more) companies to operate in parallel ("competitive market segment", $r < \tilde{r}$). (2) In semi-rural areas, only one operator can make a profit in the long-run. Hence, there will be a monopolistic operator in equilibrium ("monopolistic market segment", $\tilde{r} < r < \bar{r}$). (3) In rural areas, marginal fixed costs are higher than producer surplus, such that no operator serves this region voluntarily ("unserved market segment", $r > \bar{r}$).[9] We then have three kinds of markets: low-fixed cost (with a duopoly), medium fixed cost (with USP monopoly) and high fixed costs (not served unless the USP is required to). Figure 1 depicts these 3 markets. Because all markets share the same demand characteristics and variable costs, the equilibrium price in each market depends only upon the number of competitors. The range of duopoly markets is obtained by comparing marginal profit of the entrant with marginal fixed cost.

The **introduction of a USO** forces the USP to serve areas $r > \bar{r}$ in which the marginal cost exceeds the marginal surplus from extending market coverage.

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[8] There is no obligation to set uniform prices in our model. Note, however, that within the monopoly or competitive segments, there is no reason for price differentiation, as marginal costs are constant and the relevant price elasticities of demand differ only between these two segments, but not within. Therefore marginal surplus is constant within each segment.

[9] Cf. Jaag (2009) for an in-depth discussion of such market segmentation.

Note that the marginal surplus in the monopolistic and duopolistic regions are different. This is due to mutual business stealing (quantity effect) and competitive pressure on prices in the duopoly case (price effect) in the duopolistic regions.

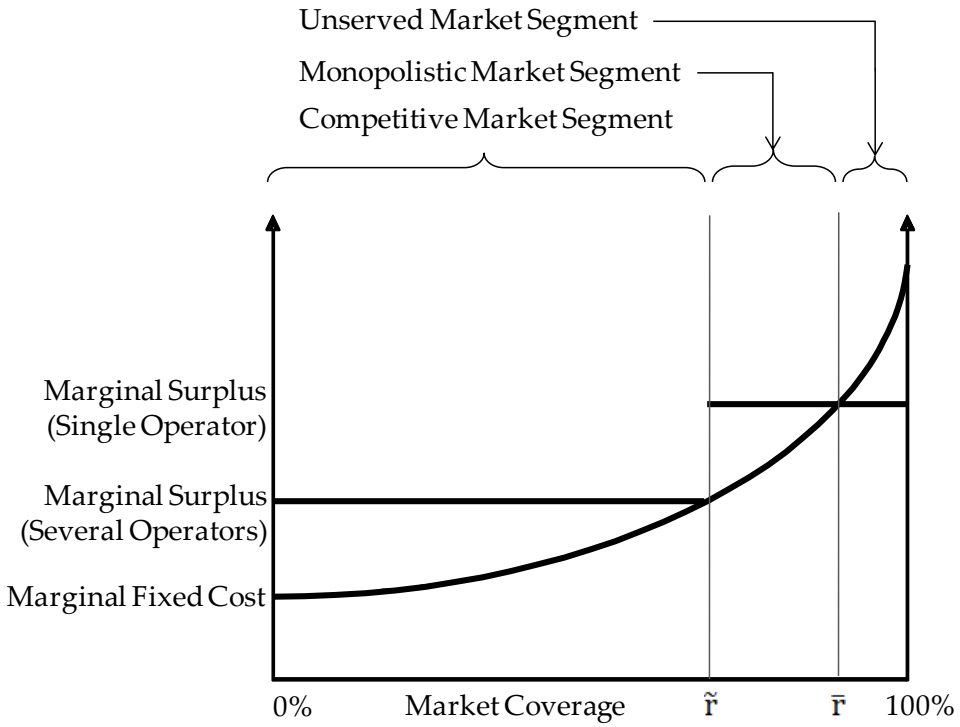

Figure 1: The postal market without USO. Source: Jaag (2009)

Financing Mechanisms

We consider three potential funding mechanisms to compensate the USP.

(1) **External financing**:

With external financing, there is a direct subsidy from government funds. In this mechanism, there is no (or zero) tax and the net costs are reimbursed by the government directly.

(2) **Everyone contributes**:
In this case, there is no distinction between the USP and the entrant who both pay output tax on a per-item or turnover basis.

(3) **Pay or play**:
In this case, only the entrant (non-USP) contributes to the fund on a per-item or turnover basis. The USP is waived from the tax. Note that this is a pay or play mechanism in the sense that each player either provides universal services or contributes to their financing. However, there is no choice for the operators whether to "pay or play". In our model specification and calibration it is optimal for the entrant not to offer universal

services himself but rather to contribute to the fund. In this sense, the results are in line with a true pay or play mechanism.[10]

Model Calibration

The model is calibrated with data from Swiss Post in 2007. In Switzerland, there was a reserved area up to 100 grams at that time. Currently, there are mainly competitors in the market for unaddressed mail and newspapers. Hence, the key parameters are calibrated for a partial monopoly version of the above model.

Volume, revenue and average price data stem from Swiss Post's annual report. From his survey of studies, Robinson (2007) concludes that price elasticity measures for mail products typically range between -0.2 and -0.8 (cf. also Fève et al., 2006, for a recent study on mail price elasticities). In a similar exercise as ours, D'Alcantara and Amerlynck (2006) choose a value of -0.3; Dietl et al. (2005) use values between -0.3 and -0.5 for different mail products. Since we expect price elasticity to further increase over time (cf. Trinkner and Grossmann, 2006) we choose a value for price elasticity of demand in the high range of these estimates. A sensitivity analysis shows that alternative choices of the price elasticity of demand change the qualitative results but leave the ordering of results across scenarios unchanged.

We assume an entrant with a slightly different business model than the incumbent's. Based on evidence from Sweden and Denmark (Citymail), the Netherlands (Sandd, Selektmail) and other (partly) liberalized markets we assume that the entrant chooses to deliver less frequently than the incumbent does and is able to pay the employees lower wages than the incumbent's. Hence, we assume lower fixed and marginal costs. On the other hand, we calibrate demand such that more consumers chose the incumbent when both operators offer at the same price. A critical part of the model calibration is the fitting of the delivery time cost function. Figure 2 shows the actual values in grey and the calibrated model values in black. With full area coverage, the cost of delivery time accounts for about 30% of total fixed cost.

[10] In practice, the difficulty with a "pay or play" system is to define the balance between the provision of universal services and the reduction of the contribution to the fund. Here, we simplify by not differentiating between various degrees of universal service provision. Given the choice between providing full USO (together with the incumbent) and none, it is optimal for him to "pay" and not to "play" in all scenarios discussed below.

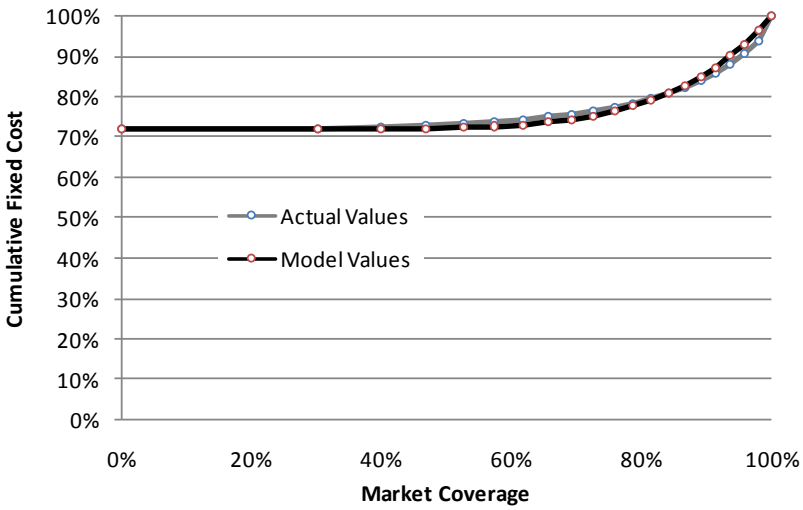

Figure 2: Fitting of the incumbent's cumulative fixed cost function. Source: Swiss Post.

An analogous cost function is assumed for the entrant, taking into account the cost savings resulting from differences in the delivery strategy and wages.

3. Results on USO Costing and the effect of its Financing

In this section we present qualitative results based on our formal analysis and quantitative results based on the calibrated market model.

Qualitative Results

The qualitative results from our formal analysis of the equilibrium properties can best be shown graphically. They do not depend on the chosen calibration.

External Funds

Starting from an equilibrium as shown in Figure 3, operator i (the incumbent) has the lowest incremental cost for reaching full market coverage r=1. Hence it makes sense to designate (or force) operator i to provide universal delivery services. To ensure that this operator is not worse off due to this obligation, the correct compensation equals exactly its incremental costs minus the incremental revenue (the dark shaded area in Figure 3). A compensation mechanism based on external funds has no effects on the market equilibrium.[11] Hence, the USP is neither under- nor overcompensated. In Figure 3 this is illustrated by the two light and medium shaded areas (surpluses of the operators in the competitive and monopolistic segments, respectively) which remain unchanged by the USO designation and compensation. Note that the figure is simplified for illustration purposes (in the calibrated model we assume asymmetric marginal fixed costs).

[11] Recall that the specification exhibits no cross-side effects between regions on the demand or cost side.

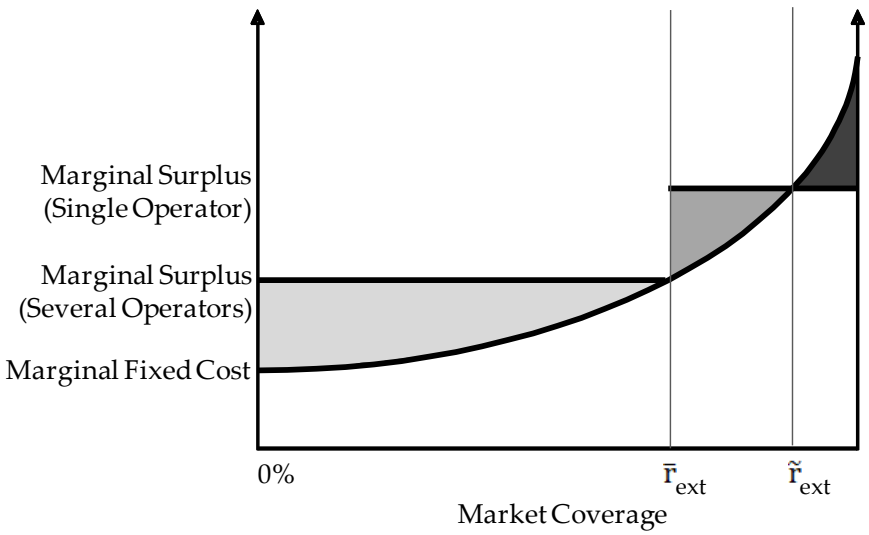

Figure 3: The postal market with external funds.

Everyone pays

With a financing of the USO by means of fund to which every operator contributes to, the incumbent's and the entrant's marginal surplus is reduced in all served market segments due to the output tax (downward shift of the marginal surplus curves in Figure 4). This results in a reduced optimum area coverage (leftward shift of the curves indicating optimum coverage in Figure 4) as formerly profitable regions turn unprofitable.

With respect to the real net cost of the USO, there are three effects to be considered: First, the USP's total surplus in the duopolistic region is reduced due to a lower marginal surplus and the smaller size of that region. Second, the effect on the USP's total surplus in the monopolistic region is ambiguous: The total surplus is reduced due to the decrease in the marginal surplus; it is increased or decreased due to the expansion/reduction of the area. The direction of this latter effect depends on the relative reaction of $\tilde{r}$ and $\bar{r}$. Third, the total net loss in the "unserved region" increases due to its expansion and the lower marginal surplus.

Hence, depending on the size of these effects, the real net cost of the USO as measured by the difference of USP's profit in the two scenarios with and without USO is higher or lower with an internal funding mechanism than with external financing.

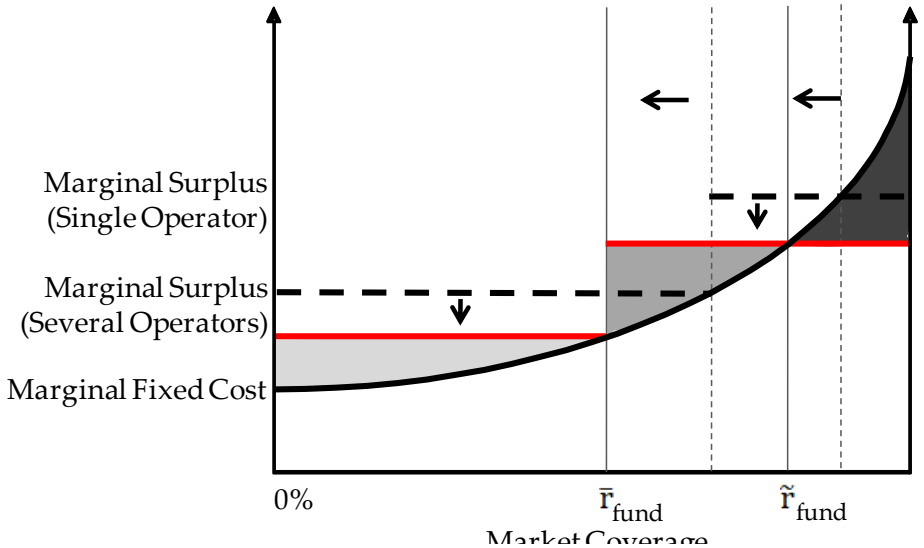

Figure 4: The postal market with a mechanism to which everyone contributes (schematic).

Pay or play

With a financing mechanism in which the incumbent's revenue is exempt from the output tax, again the entrant serves a smaller region up to r̃ because the output tax it faces and its reduced marginal surplus (leftward shift of the curves indicating optimum coverage in Figure 5). Due to the asymmetric taxation in the competitive region, the USP's marginal surplus increases in this region. Because the USP is exempt from the output tax, all revenues in the markets $r > \tilde{r}$ are unaffected by the output tax. Hence, in contrast to the all pay mechanism, the surpluses in these regions do not change (no output tax levied on incumbent). In the regions $\tilde{r} < r < \tilde{r}_{External}$, the USP is also exempt from the tax. In these regions, a second effect is to be considered; compared to the external funding scenario, the USP is now the sole operator and earns a higher surplus in that market.

This results in an unambiguous effect; the real net costs are smaller compared to a situation with external financing as there are strictly positive marginal effects on profits in the monopolistic segment of the market. Hence, if the USP receives an amount equaling the dark shaded area in Figure 5, it is clearly over-compensated.

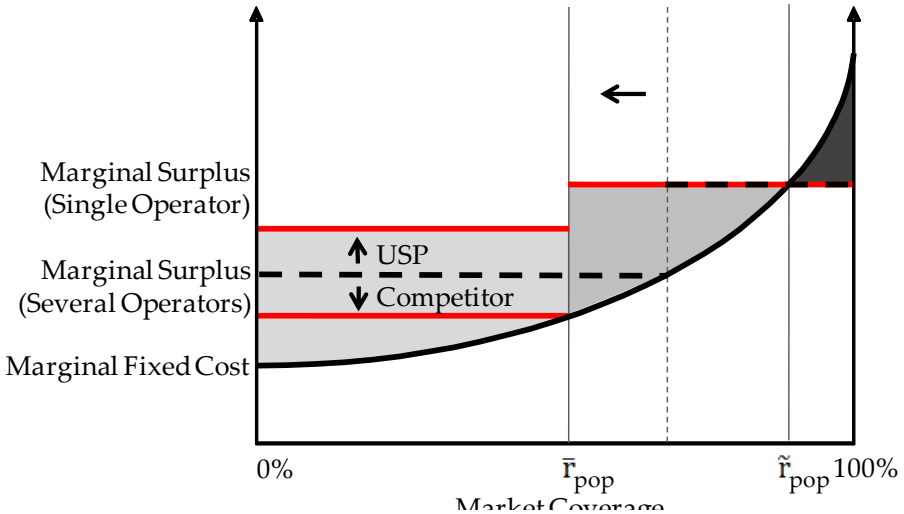

Figure 5: The postal market with a pay or play mechanism (schematic).

Quantitative Results

With the above qualitative results in mind, a quantitative calculation helps to resolve the indeterminacy in the qualitative analysis and gives orders of magnitudes to the under- or over-funding of the incumbent in the Swiss case. We provide results for the two-step approach as well as for the integrated approach in which the necessary compensation is computed in market equilibrium, hence eliminating any over- or under-compensation in all scenarios. We also differentiate between the cases in which the contribution to the compensation fund is based on turnover (Table 1 and Table 3) or based on a unit tax (Table 2 and Table 4).

Two-step approach (sequential calculation)

In the ("classical") two-step approach, the net cost of the USO is in a first step determined by the difference in USP profits serving with optimal coverage $\bar{r}$ compared to USO coverage r = 1 without taking into account the effect of the sharing mechanism (first row in Table 1 and Table 2).

In a second step, the necessary output tax to be collected from the operators is determined by the competent authority. In case of external funds (first column), the output tax is zero and net costs are reimbursed to the USP from general government funds. In this case, 63.7% of the total market is served by the entrant. In the two sharing mechanisms (second and third column), the contribution rates are calculated such that the contributions to the fund raised from the market players equal the previously calculated net costs. The corresponding contribution rates are given in rows 2 and 3. In the "pay or play" scenario, the competitor's contribution rate (9.4%) is the highest by far as it is the sole contributor to the fund.

Row 4 in Table 1 (turnover tax) and Table 2 (unit tax) is of special interest. It reports for every funding mechanism the "funding factor", i.e. ratio of the actual compensation and the one that would have been needed to leave the USP's profit after universal service

provision and after compensation equal to its profit without universal service provision. Correct compensation occurs only if this funding factor is 100 percent. The results can be summarized as follows:

External Financing: The funding factor is equal to one in the case of government subsidies as the net costs are directly reimbursed and the market equilibrium is unaffected by the financing mechanisms.[12] There is **no unfair compensation** for the USP.

Everyone pays: With this sharing mechanism, the USP contributes the largest share to the compensation fund as it is the biggest operator in the market. Entrant coverage remains about unchanged. However, only about two thirds of the actual net costs – i.e. the difference in profits in market equilibrium – are reimbursed and the remaining part is left to the incumbent. **This results in an underfunding of the USP**.

Pay or play: The entrant turnover tax rate reaches 9.4% and results in a significant reduction in entrant market coverage (from 63.7% with external financing to about 54.4%). The reduced market coverage has a positive effect on the USP's profit and results in **overfunding:** With a turnover tax it receives a compensation amounting to 60.6% of what it would have to pay in order to be indifferent between the two scenarios with and without USO. Hence the negative sign on the funding factor in this case: The USP profit in the USO case with compensation is higher than in the non-USO case. Even without compensation (but taxation of the competitor), the USP is better off due to the USO as his monopolistic market segment is extended by the competitor's taxation which overcompensates the loss in the "unserved" market segment. With a unit tax, this effect is basically the same: The entrant now serves 54.5% of the market, while the funding factor is -50.9%.

We conclude that a two-step approach that first calculates net costs and later applies a sharing mechanism to collect the net costs results in an over- or underfunding of the USP depending on the sharing mechanism in place. This issue can be solved by determining the necessary compensation in market equilibrium, taking into account the output tax' impact on the operators ("integrated approach").

Financing Mechanism	External	Everyone Pays	Pay or Play
Compensated USO Net Cost*	1.4%	1.4%	1.4%
Contribution Rate Incumbent	0.0%	1.2%	0.0%
Contribution Rate Entrant	0.0%	1.2%	9.4%
Funding Factor**	100.0%	63.5%	-60.6%
Entrant Market Coverage	63.7%	63.0%	54.4%

* relative to USP-turnover in the non-USO case
** actual compensation / needed compensation

Table 1: Model results with sequential simulation and a turnover tax

[12] This assumes that the general tax needed to collect the funds needed is insignificant. Given that the postal sector is small compared to the economy overall, this is certainly the case.

Financing Mechanism	External	Everyone Pays	Pay or Play
Compensated USO Net Cost*	1.4%	1.4%	1.4%
Unit Tax Incumbent**	0.0%	1.0%	0.0%
Unit Tax Entrant**	0.0%	1.8%	9.6%
Funding Factor***	100.0%	76.4%	-50.9%
Entrant Market Coverage	63.7%	62.8%	54.5%

* relative to USP-turnover in the non-USO case
** expressed in % of the operator's gross revenue
*** actual compensation / needed compensation

Table 2: Model results with sequential simulation and a unit tax

Note that the tax rates in Table 1 and Table 2 are directly comparable: The contributions to the USO fund collected by a unit tax are expressed as a percentage of the operators' gross revenue. Taxation of the entrant in the "everyone pays a unit tax" scenario (1.8%) lies between the results in the "everyone pays a turnover tax" (1.2%) and a "pay or play" system with a turnover tax (9.4%). The actual unit tax rates in Table 2 with an "everyone pays" mechanism are the same for both operators. Compared to gross turnover, the entrant's contribution is higher than the incumbent's due to his lower prices.

Integrated Approach

In the two-step approach discussed in the previous section, the output tax rates are determined to cover the calculated difference in *USP profits before compensation and taxation*. As shown above in Table 1 and Table 2, this results in an imbalance if the compensation mechanism changes the market equilibrium. The main difference in the integrated approach is that the contribution rate is now determined such that the *USP profit after compensation and taxation* is unchanged compared to a scenario without universal service. Doing so, the net costs are computed in market equilibrium simultaneously with the necessary contributions. In such an integrated approach, a funding gap cannot occur by definition with any sharing mechanism.

Financing Mechanism	External	Everyone Pays	Pay or Play
Compensated USO Net Cost*	1.4%	3.3%	0.4%
Contribution Rate Incumbent	0.0%	2.7%	0.0%
Contribution Rate Entrant	0.0%	2.7%	2.5%
Funding Factor**	100.0%	100.0%	100.0%
Entrant Market Coverage	63.7%	61.9%	61.3%

* relative to USP-turnover in the non-USO case
** actual compensation / needed compensation

Table 3: Model results with integrated simulation and a turnover tax

Financing Mechanism	External	Everyone Pays	Pay or Play
Compensated USO Net Cost*	1.4%	2.1%	0.4%
Unit Tax Incumbent**	0.0%	1.5%	0.0%
Unit Tax Entrant**	0.0%	2.6%	2.3%
Funding Factor***	100.0%	100.0%	100.0%
Entrant Market Coverage	63.7%	62.4%	61.6%

* relative to USP-turnover in the non-USO case
** expressed in % of the operator's gross revenue
*** actual compensation / needed compensation

Table 4: Model results with integrated simulation and a unit tax

Table 3 and Table 4 provide the results. By definition, the funding factor is now 100 percent in all scenarios and hence there is no under- nor overfunding. It is straightforward that external compensation leads to the same figures as reported for the two-step approach (government subsidies do not further change the market equilibrium). Of highest interest are the results for the two sharing mechanisms.

Everyone pays: The compensation rate has two opposing effects. First, it compensates the USP for the net costs. Second, it raises the net cost as the output tax is levied on the USP as well which creates an additional need for compensation. This results in higher tax rates for full compensation in equilibrium compared to external funding.

Pay or play: The output tax is now substantially lower than in the sequential simulations (2.5% instead of nearly 9.4% with turnover tax or 2.3% instead of 9.6% with a unit tax) and it is also lower than in the case that everyone pays. The reason is the following: The asymmetric pay or play mechanism has stronger effects on the market equilibrium. As these effects work in favor of the incumbent, smaller compensation fund contributions are needed from the entrant. As tax rates are kept lower than in the two-step sequential approach (to avoid over-compensation), the entrant's pricing and coverage decisions are now much less distorted.

Note that the financing with a sharing mechanism affects not only unprofitable but also profitable products. Hence, these have to be considered as well in the calculation of the net cost of the USO; it does not suffice to just calculate the deficit of the unprofitable products.

Comparing the turnover tax and the unit tax as basis for contributions to the compensation fund, it is interesting to see that in our integrated approach the latter imposes a lighter burden on the entrant. The incumbent is affected relatively less by a unit tax than by a tax on turnover due to his price which is higher than the entrant's. Hence, there is less need for compensation and lower tax rates for both operators. This allows for a higher entrant market penetration in the scenario with a unit tax than with a turnover tax.

4. Conclusions

In this paper we have shown that the net cost of USO – defined as the difference in the USP's profit with and without USO – very much depends on design of the compensation mechanism. If the USP is compensated from the general government budget, this does not (or only insignificantly) affect the market equilibrium. In this case, USO costing and financing are independent of each other. However, if there is a turnover or unit tax levied from the operators in the market in order to finance the USP's contribution, this distorts the operators' decisions and has to be taken into account. If this is not done, a sequential approach – as envisioned in the third Postal Directive in the EU – the USP may be hugely over- or undercompensated. A compensation fund to which all operators (including the USP) contribute according to their market shares will lead to an under-compensation of the USP. In contrast, if the USP is excluded from contributions, this will result in over-compensation.

We therefore propose an integrated approach to USO costing and financing in case national regulations implement a sharing mechanism. This implies that the regulatory authority sets the contribution rate in a way that the USP's profits remains unchanged comparing a situation without USO and one with USO *after compensation*. In particular, it turns out that it does not suffice to just calculate the deficit of the unprofitable products: As the financing affects also profitable products, these have to be considered as well in the costing of the USO.

We have only considered the private net costs of the USO. This is relevant when having to compensate the USP for its burden. However, there are also social costs (and social benefits) of the USO which include the difference of consumer welfare and the competitor's profit with and without USO. For a cost-benefit-analysis of the USO, these social effects would be the right measures to consider. This is a possible extension of this paper. Further research is also necessary to assess not only the net cost of one single aspect of the USO but all dimensions usually in place, including pricing restrictions and the obligation to operate certain infrastructures.

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