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Calculating the Cost of the Universal Service Obligation: The Need for a Global Approach*

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1. INTRODUCTION

In Switzerland as well as in the European Union postal market liberalization is a current issue. The reserved area has been the traditional means to finance the provision of the Universal Services. Absent a reserved area other means of funding are needed. If the universal service obligations (USO) are delegated to one or more postal operators, compensating them is an important issue. There are two problems to solve: First, the cost of universal service obligation needs to be estimated; second, the universal service provider(s) (USP) has to be reimbursed. Our paper mainly deals with the former of these issues.

The paper proceeds as follows. Section 2 provides the background and motivation for calculating the cost of the USO and analyses the new regulations of the European Community (EC) in this regard (2008/6/EC). The EC follows a disaggregated approach by instructing Member States to calculate the total net cost of the USO by summing the net costs arising from the specific components. Section 3 discusses the limits of this approach and advocates a global view which takes into account the dependencies between individual components of the USO. These considerations are complemented in Section 4 by an econometric assessment of the net cost resulting from obligations concerning the postal outlet network in Switzerland. A cross-section dataset of the postal outlet network is analyzed and the difference between a disaggregated and a global approach is illustrated. Section 5 concludes.

2. CALCULATING THE COST OF THE USO – THEORETICAL CONCEPTS AND IMPLEMENTATION IN THE EC-DIRECTIVE

Universal service is a major concern in the postal market and faces great attention throughout the liberalization processes in Europe and elsewhere. Thereby, the USO requiring affordable and uniform prices directly conflict

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* The views expressed are those of the authors and do not necessarily reflect the opinion of the institutions with which they are affiliated.

with the notion of competition. Similar considerations apply in the case of the scope and quality of universal services

Hence, one basic challenge for policy makers is to ensure the fulfillment of USO while providing an environment that offers a prosperous base for effective and welfare improving competition with consumers' choice over a great variety of fairly priced products based on an efficient service provision by postal operators. If the USO constraints are economically binding, the market would not provide the universal services as requested and thus market interventions (regulation) become necessary. Thereby, at least one operator has to be obliged to provide the universal service or parts of it[1] and it is crucial to correctly compensate the designated universal service provider (USP) to avoid distorting competition. Hence, it is important to know the associated burden of those operators providing the USO.

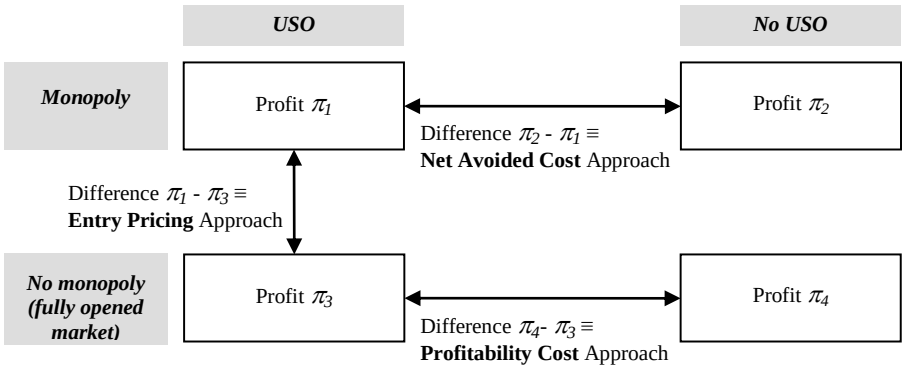
2.1 How to calculate the cost of the USO

In recent years, many contributions have been published on the issue of how to calculate the "cost" or "burden" of the universal service obligation. So far, three basic approaches have been developed and applied to the postal sector. All of them address different questions. Figure 1 provides an overview. See also Oxera (2007) and Dietl et al. (2007) for a more detailed treatment of the three approaches.

A first approach referred to as Net Avoided Cost (NAC) compares the profit levels of a provider with and without universal service obligations whereas revenue effects are neglected. Hence, NAC approaches do not take into account the effects of competition. Instead they aim to identify unprofitable service parts of a given operation. NAC makes sense in a world of monopolies where policy makers like to know the incremental costs of the imposed obligations. The study of Nera (1998) undertaken for the European Commission is one such example. Hence, NAC is of little value in a fully opened postal market, as the USO affects the market equilibrium in various ways. For example an USO requiring price uniformity or increasing the costs will affect the pricing of both the USP and the other market players. This will result in different market equilibria with different markets shares and profits.

A second approach called Entry Pricing was presented by Rodriguez et al. (1999). It compares the USP's profit in a regulated monopoly scenario with its profit with the same obligations under competition. The difference is referred to the "cost of liberalization" as it predicts the change in the USP's profit caused by opening the market.[2] However, in a liberalized market, this is again not the relevant measure as it does not compute the burden that the USO imposes on the USP *in* the market.

Figure 1: Potential approaches to calculate the cost of the USO



Source: On the basis of Curien (2001)

A third approach referred to as Profitability Cost, compares the USP's profit level in a liberalized market with and without the USO. Panzar (2000, 2001) and Cremer et al. (2000) provide a theoretical foundation and/or apply it to the postal sector. If policy makers compensate the USP by this difference, the USP achieves the same profit as it would in the postal market without any obligations. Hence, the profitability cost approach provides the compensation that makes the designated USP indifferent whether to provide the USO or not. In other words, the approach aims to measure exactly the USP's "burden of the USO" or "the cost of the USO" in a liberalized market. Note that the approach requires the simulation of non-observed market equilibrium (USO-scenario in an unregulated market and vice versa, both scenarios starting from a monopoly situation). Such simulations include changes in cost structures (due to obligations) as well as demand effects (customer loyalty, competitive effects of pricing restrictions)

We summarize as follows. Estimates of the cost of the USO aim to provide policy makers with a measure of the extent to which the USP is worse off in competitive markets due to the USO. The profitability cost approach is one approach to estimating the necessary compensation to equilibrate profits before and after entry for the Universal Service Provider. It calculates the cost of the USO as the difference of the USP's profit between a scenario with and without obligations. By contrast, measures like the "cost of the universal service", the profit or financial situation of the USP, the "Net Avoided Costs", or the "costs of liberalization" do not provide guidance to derive the financing need to ensure the USO in competitive markets.

2.2 The European Directive: "Net Costs"

In 2008, the European Parliament issued a third postal directive (2008/6/EC). Annex I gives the Member States guidance as for how to calculate the "net cost of universal service obligations" (in short "*net costs*"):

> "The net cost of universal service obligations is **any cost** related to and necessary for the operation **of the universal service provision**. The net cost of universal service obligations is to 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 obligations**.
>
> The calculation shall take into account **all other relevant elements**, including any intangible and market benefits which accrue to a postal service provider designated to provide universal service, the entitlement to a reasonable profit and incentives for cost efficiency."

The first paragraph seems to consider mainly cost related aspects. However, the net costs are defined twice and differently:

Net Costs = Cost of US provision

Net Costs = Net Costs (USO) – Net Costs (No USO)

The second paragraph introduces "all other elements" – in particular the demand side – into the calculation of the net costs. The paragraph appears to imply that both benefits as well as opportunity costs (e.g. foregone revenues) should be included into the calculation. Moreover, the definition includes elements of rate of return regulation ("appropriate profit") as well as incentive regulation ("incentives for cost regulation").

Net Costs = NC (USO) – NC (No USO) + "all other elements"

Hence, Annex I in principle ,may allow calculations according to the profitability cost approach, i.e. a calculation of the cost of the USO that takes into account the competitive effects of introducing asymmetric obligations to selected market participants in a comprehensive and consistent way.

However, Annex I further states that the "net costs" should be computed *individually* for the various USO elements. The various components of the USO shall be calculated separately and "summed up" avoiding double counting":

> "The calculation of the net cost of specific aspects of universal service obligations is to be made **separately** and so as to **avoid the double counting** of any direct or indirect benefits and costs. The overall net cost of universal service obligations to any designated universal service provider is to be calculated as the **sum of the net costs** arising from the specific components of universal service obligations, taking account of any intangible benefits."

In the next section, we illustrate the problems involved with such a separation and conclude that a global approach like the profitability cost approach should be applied to estimate the cost of the USO.

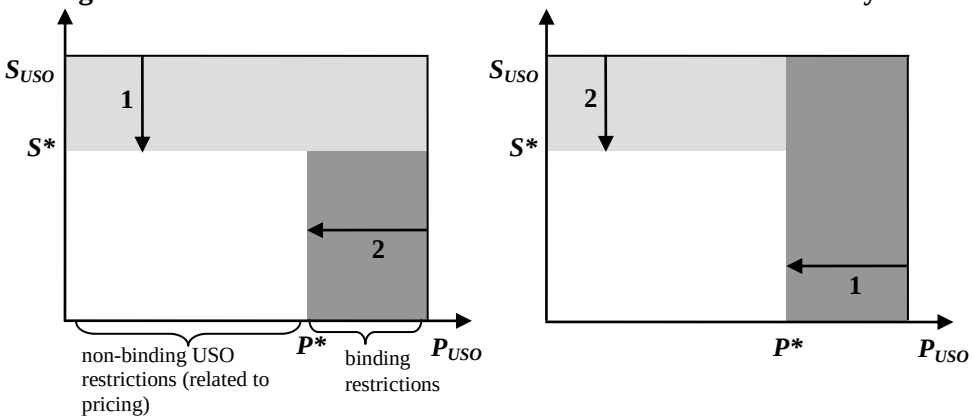
3. NEED FOR A GLOBAL APPROACH – A STYLIZED EXAMPLE

We show by means of a stylized example that the disaggregated EC-approach to calculate the net cost of the USO may not be appropriate if not complemented by a global approach. Instead, all parts of the USO should be considered jointly to capture the various direct and indirect effects involved. Starting from such a global approach, the share of each individual dimension of the USO can be calculated backwards. This is an inherently difficult task, as will be illustrated in the figures below.

We assume that the USO consists of two dimensions only[3] and has no revenue effects.[4] In Figure 2 (left side) the vertical axis represents restrictions on the product/service (*S*) and restrictions in pricing on the horizontal axis (*P*). Then, the square with the black border depicts the total "cost" of the universal service provision in its current scope defined as S_{USO} and P_{USO}. The white area is the total "cost" of a reduced, non-binding universal service provision defined in a way the USO-operator can just realize it's optimal business strategy in both dimensions like there had been no obligation (S^* and P^*). The grey area (the difference between the bordered and the white area) would then be the net cost of tightening the USO in both dimensions.

In Figure 2 (left side) a slackening of the USO with respect to the services range (vertical dimension, arrow 1) results in a decrease in total cost by the lightly shaded area. A subsequent slackening with respect to pricing (horizontal dimension, arrow 2) results in an additional decrease of net costs by the dark shaded area.

Figure 2: Cost attribution to individual USO elements is arbitrary

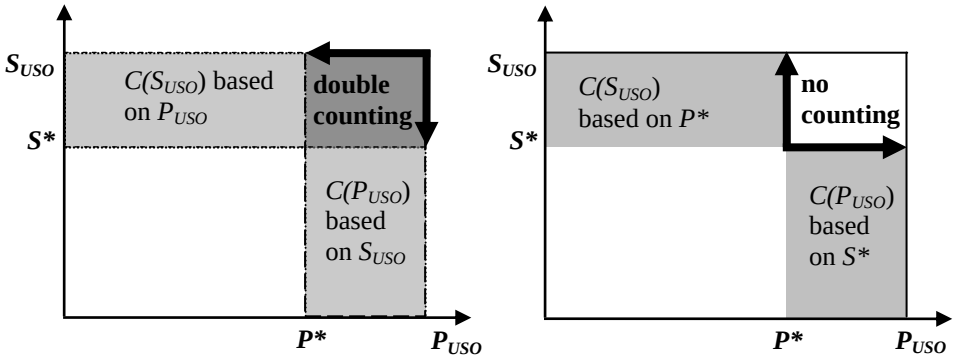


As Figure 2 (right side) illustrates, a change in the sequence of slackening the USO in both dimensions results in a different attribution of net cost, while the difference in total cost remains unaffected. If only the restriction with respect to pricing would be slackened, the total net cost of the USO would decrease by the (now larger) dark shaded area. A subsequent change in the scope of the USO with respect to products results in lower total net costs by the (now smaller) lightly shaded area.

A comparison of Figures 2 and 3 indicates that the total net cost of the USO is equal to the sum of the net costs attributed to different dimensions separately only if done in a consistent and well sequenced way. This is due to the interdependence between these dimensions. Note that a change in the sequence in the slackening of USO dimensions results in a different cost attribution. Hence, if such interdependencies exist, the attribution of net costs of the USO to its single dimensions is arbitrary and hence of little added value.

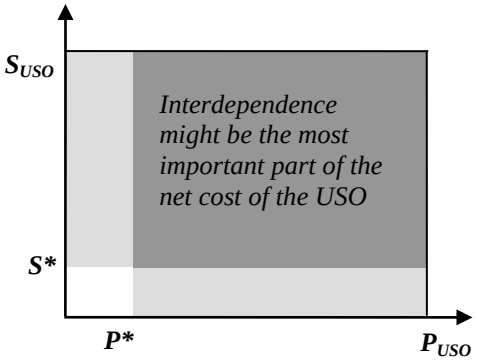
The example further shows that the bottom-up method described in the Annex I of the new EU directive in postal services is problematic. Calculating the various restrictions independently of each other either results in an under- or overestimation of the total cost of the USO. As illustrated in Figure 3 (left side), double counting is a problem if the net costs of the obligations are computed separately based on actual universal service restrictions in the other dimension(s). However, if the net cost of each dimension is calculated based on a scenario with no obligations otherwise, an important part of the net cost is neglected, as depicted in Figure 3.

Figure 3: Separate approach results in over- or underestimation of the cost of the USO



Note that high universal service requirements make the net costs attributed to the interdependency of the various universal service dimensions a substantial part of the cost of the USO. Figure 4 illustrates this argument: Very weak obligations in only one dimension imply that also the cost of strong obligations in the other dimension is low. Strong obligations in both dimensions, however, may result in large overall costs, as illustrated in Figure 4.[5]

Figure 4: Importance of interdependencies in net cost calculations



An economically sensible calculation of the net cost of the USO should be based on a global approach with the status quo as a reference. The problems associated with the EU calculation procedure mentioned above can be dealt with in two different ways:

(1) Sequential approach: A summation of the different cost dimensions is only possible with a well defined sequence of slackening obligations. Then, the additional net cost savings due to the slackening of an additional dimension can be interpreted as this dimension's net cost. However, changing the sequence will result in different net cost attributions (cf.

difference in each dimensions attribution in Figures 2 and 3). Note that a correct application of such a sequenced approach requires both the simulation of a market equilibrium with all USO dimensions together (first sequence) as well a simulation with no USO at all (last sequence). These are exactly the two scenarios needed when applying a global approach.

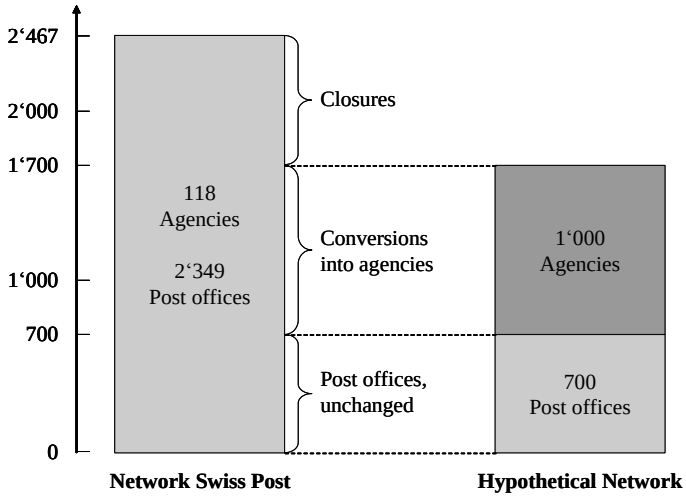
(2) Adjusted separate approach: The net costs associated with single dimensions are calculated by comparing hypothetical scenarios with only one dimension being slackened at a time (cf. Figure 3, left side). This way, the net costs of different dimensions are comparable among each other which might be important in the political process when the USO is defined. As illustrated, summed up they do not yield the true net cost of the USO; double counting has to be eliminated as specified in Annex I of the EC postal directive. Similarly, one can start from a scenario with no USO at all and add one obligation at a time (cf. Figure 3, right side). Doing so yields an underestimation of the cost of the USO as the interdependencies between the various obligations are not considered. The only way to calculation of the various interdependencies in both cases is the application of a global approach requiring the calculation of two scenarios – one without any obligation and one with all obligations at the same time. Hence, computing the net cost of the individual constraints provides no added value for calculating the total net costs and could well be let aside from the beginning.

Note that both approaches require a global approach, whereby a directly applied global approach exhibits the lowest number of scenarios to compute. In the next section, we further illustrate the limits of the EC approach by analyzing the net costs of selected regulations concerning the Swiss postal outlet network.

4. CASE STUDY: SWISS POSTAL OUTLET NETWORK

We illustrate the need for a global USO cost calculation by a case study on Swiss Posts post office network. In 2004, the Swiss postal regulatory body PostReg published new regulations concerning the accounting system of Swiss Post. The primary aim was to define the extent to which the reserved services could be used by Swiss Post to finance the post office network. Among others, the regulations required Swiss Post to define its "optimal" post office network. Up to the year 2007, in-depth discussions between the postal regulatory body PostReg and Swiss Post were held about the optimal size of Swiss Post's postal network which would be in place if there was no USO. PostReg finally defined the optimal post office network to consist of 700 post offices run by Swiss Post and 1000 agencies run by third parties (cf. Figure 5, compared to about 2320 post offices and 150 agencies at the end of 2007).

Figure 5: Actual and hypothetical network



The mix between agencies and post offices reflects that Swiss Post would – without any obligations – provide postal services in about 1700 postal outlets and financial transactions in about 700 outlets. Hence, the parties agreed on the assumption that outlets providing postal services only would be operated more efficiently by agencies compared to post offices (we verify this assumption in section 4.2).

4.1 Disaggregated Approach: Estimating the USO costs separately

For simplicity, suppose that Swiss post’s USO only consists of the provision of (a) 2,467 access points (outlets) for postal services only and (b) a basic set of payment transactions. We now analyze the two obligations separately from each other.

Under these assumptions, obligation (a) alone would result in a burden for Swiss Post amounting to the net cost of 2467-1700=767 access points. Assuming that the closure of 767 access points would have no effects on the demand of postal products (Buser et al., 2008), the associated savings would be the fixed costs of 767 agencies. Depending on the contract details with franchisees and the mix between fixed and variable costs the net cost would be in the range of CHF 0 (contracts with only variable remuneration) and CHF 7.67 million assuming a maximum fixed cost contribution of CHF 10,000.[6]

On the other hand, if Swiss Post only had the obligation to provide financial transactions (and no other obligations), this would imply no USO burden at all, as Swiss Post would offer those services in 700 post offices and adapt the other access points to the needs of postal services.

Summing up, the net costs of the two restrictions as defined in the EC directive results in a net cost close to zero. This would be easy to compensate. However, in the following we argue that the real net cost of the two restrictions is significantly higher.

4.2 Global Approach: Estimating the cost of different USO dimensions jointly

Analyzing the net costs of the two restrictions simultaneously yields a different picture than analyzing them separately. The obligation to provide financial transactions has a significant and considerable impact on the costs of the obligation for providing a nationwide post office network if the same accessibility rules apply as for postal services. That is, a number of post offices can no longer be converted into agencies. To compute such potential "foregone savings", we must know the cost difference between post offices and agencies exactly.

To compute these cost differences we use a cross-section dataset of Swiss Post's outlet network with information about the applied business models (post office or agency) and the associated total costs, about several output characteristics (e.g. collected mail volumes, number of financial transactions) as well as regional characteristics. After a general outline of the idea and the corresponding literature, we specify the model and describe the applied econometric method. The results of our estimation enable us to compute the impact of the constraints on Swiss Post's cost structure.

4.2.1 Background

Total costs of a post office depend highly on the underlying business model. We distinguish between traditional post offices, run by Swiss Post, and agencies. The latter are run by franchisees, typically grocers or other established retailers and take advantage of splitting the fixed costs of their existing infrastructure across various products beyond postal services. Furthermore, they meet changing consumer needs by extended opening hours and the offer of various other products. From a business perspective, agencies are most suitable to meet the obligation of providing a nationwide post office network. However, they have the serious disadvantage are not being capable of providing financial transactions, because these call for expensive security and anti-money-laundering measures. In other words, the agency business model is inappropriate to comply with the corresponding obligation. Hence, the obligation of providing financial transactions affects the obligation for providing a nationwide post office network, such that a combined restriction emerges out of these two single obligations.

We are therefore primarily interested in the differences of the costs emerging from post offices and agencies in order to calculate the impact of

this implicit constraint. To estimate them, we control for variable costs, some other attributes and the underlying business model. The estimators for the business model and the corresponding differences in such product delivery attributes (e.g., in opening hours) then denote exactly the differences in the costs.

To the best of our knowledge, this is a new approach to provide empirical evidence of the existence of combined restrictions of regulatory obligations in postal markets. We do not address efficiency differentials within the two categories of postal outlets, post offices and agencies. The issue that historical post office networks are often operated on an inefficient level has been discussed in several earlier scientific papers. The most recent studies are those by Doble (1995), Cazals et al. (2002), Filippini and Zola (2005), Cohen et al. (2008), and Buser et al. (2008).

Doble (1995) sought to establish technical inefficiency of UK post office counters using data envelopment analysis, applied to data from 1989 covering 1291 counters. It was found that technical efficiency could be significantly improved by making more efficient use of labor inputs and reducing average waiting times. Disparities were found in regional efficiency and it was hypothesized that these differences were due to differing working practices, turnovers of staff and local labor market conditions.

Cazals et al. (2002) have dealt with the estimation of cost elasticities of front-office activities. They distinguished between post offices according to their size, and noticed that returns to scale are relatively high on average in small post offices, while they are constant on average in large post offices. They further pointed out that over-capacity in front-office activities decline when the post offices become larger.

Filippini and Zola (2005) estimated a Cobb-Douglas cost frontier function for a sample of post offices in Switzerland and found empirical evidence for economies of scale. Their results suggested that efficiency gains could have resulted from merging smaller post offices operating in the same service area or in small adjacent service area.

Cohen et al. (2008) illustrated that many (historical) post office networks lacked the alignment to competitive needs. The authors showed that both Italy and the United States had a disproportionate percentage of their post offices located in rural areas as compared with banks (IT) or pharmacies (US) and found it likely that the distribution of post offices had a similar pattern in most postal administrations.

Buser et al. (2008) contribute to a better understanding of post office network optimization programs and identify several key strategic issues. The authors conclude that diversifying into financial services helps to sustain a comparably larger and "classic" post office network based on the counter

concept. If no such option is available, the substitution of traditional post offices by agencies run by third parties seems to be the only long-term solution under competition. In either case, economies of scope play a vital role for sustaining self-financed access points for postal services.

4.2.2 Model Specification and Econometric Methods

In our econometric model we explain total costs as a function of the main outputs such as mail and control for opening hours, costs of physical capital, business model, and regional characteristics.

We incorporate five outputs, namely mail (Q_1), parcel (Q_2), payment transactions (Q_3), account management (Q_4) and sale of optional products (Q_5). The output of mail is calculated as a sum of the number of letters collected. The output of parcel is a term of wider comprehension: Due to similar processes, the number of parcels collected is added to the number of items to be picked up at the post office by the clients. The output of payment transactions can be understood analogously: The volume of incoming payments is added to the volume of disbursements. The fourth output, account management, is the number of account openings (closings) and related consulting services. The last output, sale of optional products, is measured by the sales volume of non-postal products as for instance mobile phones, prepaid cards, tickets or stationary.

The total number of opening hours (OH) is an important cost driver in post offices. In agencies, this variable takes the value of zero, as additional opening hours do not increase the compensation of the franchisee. As the number of opening hours exceeds the time necessary to handle mail, parcels and payments, we interpret it to some extent as a fifth output in terms of a public service. We do not multiply this number by the number of counters for the following reason: post offices with more than one counter avoid running the additional ones unless demanded, and demand is taken into account by the four output variables.

We control further for the price of physical capital (PC) for post offices, measured by rental fee per square meter (ratio of the rental fee and rented surface area). For the same reason as for opening hours, this variable takes the value of zero for agencies. One might think of the labor price as another input factor. We did not consider this, because this price is set by a collective labor agreement and therefore does not vary significantly over units and regions.

The cost structure of a post office depends highly on the underlying business model. As mentioned above, we distinguish between traditional post offices and agencies. Agencies are only 5% of total postal outlets. They vary substantially in processed volumes. We introduce three dummies for agencies (A_1, A_2 and A_3) to represent these differences in type and size: A_1 is

set to 1 for agencies among the 1'000 "biggest" offices, A_2 if ranked between the 1'001 and 2'000 and A_3 for the remaining ones. The reference consists of the traditional post offices.

In addition, three dummies (R_1, R_2 and R_3) are included to control for regional effects among post offices. They represent peri-urban areas, peripheral rural areas, and alpine tourist centre regions. The reference region consists of urban centers and agglomerations.[7] Again, these variables take the value of zero for agencies.

The resulting specification of the cost function can be written as:

$$C = C\,(Q_1, Q_2, Q_3, Q_4, Q_5, OH, PC, A_1, A_2, A_3, R_1, R_2, R_3) \qquad (1),$$

where the dependent variable C represents total annual costs and the independent variables are defined as above.

For the cost function, a quadratic functional form is used. Given our data set, this form is advantageous due to the occurrence of zero outputs for cash payments in the agencies. Other forms like Cobb-Douglas or translog would require extensive additional adjustments for instance through Box-Cox-transformations because logarithms are not defined for non-positive arguments.

The estimated cost function is:

$$\begin{aligned} C_i = {} & \beta_0 + \beta_1 Q_{1i} + 0.5\beta_{11}(Q_{1i})^2 + \beta_2 Q_{2i} + 0.5\beta_{22}(Q_{2i})^2 + \beta_3 Q_{3i} \\ & + 0.5\beta_{33}(Q_{3i})^2 + \beta_4 Q_{4i} + 0.5\beta_{44}(Q_{4i})^2 + \beta_5 Q_{5i} + 0.5\beta_{55}(Q_{5i})^2 \\ & + \beta_{OH} OH_i + \beta_{PC} PC_i + \delta_1 A_{1i} + \delta_2 A_{2i} + \delta_3 A_{3i} \\ & + \gamma_1 R_{1i} + \gamma_2 R_{2i} + \gamma_3 R_{3i} + \varepsilon_i \end{aligned} \qquad (2)$$

with $i = 1, 2, \ldots, N$, where subscript i denotes the post office or agency; N is the total number of post offices and agencies; and ε_i contains unobserved factors. All the independent variables are normalized, namely, they are replaced by their deviations from their respective median values. Estimators of the quadratic values are multiplied by 0.5 in order to directly interpret the corresponding effects of the derivate. The estimation method is Ordinary Least Squares (OLS) in which the error term (ε_i) is assumed to be identically and independently distributed across all outlets.

4.2.3 Data

The data was observed in the year 2006. It consists of a cross section of a total of 2'467 postal outlets, subdivided into 2'349 post offices operated by Swiss Post and 118 Agencies, run by franchisees.[8] 80% of these agencies

belong to the category A_3, representing agencies with little quantity, 17% to A_2 and only 3% to A_1. About half of the post offices and agencies are located in the regions R_1, R_2, R_3 as defined above and the other half in the reference region, namely, in urban centers and agglomerations.

The various units cover a wide range of outputs and costs. They all collect mail and parcels, whereas financial transactions and account management are not offered by agencies. The outputs are quantified by the number of collected items or executed transactions except opening hours, which are measured by hours per week. The opening hours changes eminently with the underlying business model, whereas the price of capital varies considerably among large cities and rural regions.

Interestingly, the median value of the dependent variable, *C*, lies above the mean value, whereas the reverse is true for the independent variables except *OH*.

4.2.4 Estimation results

We have estimated the model as explained in Equation 2 for the sample. The results are listed in Table 1. Note that the numbers should be treated with caution. Due to the cross-sectional data we are not able to control for individual heterogeneity emerging from variations in the size of post offices. Further, we did not scrutinize possible differences in variable costs between post offices and agencies.

Apart from one regional dummy (R_1), all independent variables are highly significant and exhibit the expected sign. The F-test for overall significance is highly significant. Furthermore, no multicollinearity is existent in the data.

All five output coefficients show the expected sign and are of reasonable size. The coefficients of the squared output variables indicate increasing returns to scale for mail and parcels, decreasing returns to scale for financial products, and constant returns to scale for third party products. The values for P_c an *OH* show that parts of the cost differences among post offices can be explained by higher renting costs and longer opening hours. R_1 exhibits a coefficient with an unexpected sign: Post offices in peri-urban regions seem to exhibit lower costs than those in urban regions.

We are particularly interested in the coefficients for the agencies. The negative signs show that operating agencies generates considerable savings. The values further indicate that the associated savings increase with the size of the agency. In the next section, we demonstrate how we calculate the effect of a combined restriction by means of the coefficients for the agencies.

Table 1: Estimation Results

Variable	Coeff.	se	t	P > t
Mail Output (Q_1)	0.50	0.04	13.65	0.00***
0.5*($Q_1 Q_1$)	-6.21E-08	9.21E-09	-6.75	0.00***
Parcel Output (Q_2)	19.06	0.69	27.43	0.00***
0.5*($Q_2 Q_2$)	-3.05E-05	3.03E-06	-10.08	0.00***
Payments Output (Q_3)	7.83	0.22	35.54	0.00***
0.5*($Q_3 Q_3$)	4.04E-06	4.42E-07	9.15	0.00***
Account Output (Q_4)	390.18	45.51	8.57	0.00***
0.5*($Q_4 Q_4$)	3.92E-01	1.77E-02	22.22	0.00***
Optional Products (Q_5)	0.94	0.12	7.66	0.00***
0.5*($Q_5 Q_5$)	8.77E-08	1.90E-07	0.46	0.64
Price Capital (P_C)	5892.83	772.12	7.63	0.00***
Opening Hours (*OH*)	17667.70	815.41	21.67	0.00***
Agency (A_1)	-782401.29	178924.73	-4.37	0.00***
Agency (A_2)	-290926.84	72671.68	-4.00	0.00***
Agency (A_3)	-179475.47	40802.08	-4.40	0.00***
Region (R_1)	-46082.09	15091.61	-3.05	0.00***
Region (R_2)	35638.48	23880.95	1.49	0.14
Region (R_3)	295190.98	46477.15	6.35	0.00***
Constant	1674553.84	11467.08	146.03	0.00***
	Overall-F Test:	F (18, 2'448) = 13'087; P > F = 0.00***		
	N=2'467	significant at the 10% level *		
values normalized (not CHF)		significant at the 5% level **		
		significant at the 1% level ***		

4.2.5 Computing the cost of the combined obligations

Our estimation results enable us to compute the costs of the implicit combined restriction that emerges for Swiss Post from the two single obligations to provide (a) a nationwide post office network and (b) payment transactions in every office.

If only obligation (a) for itself had to be satisfied, nothing would argue against replacing post offices by agencies to exploit economies of scope between postal products and third-party infrastructures, be it in grocery stores or other retail businesses. However, obligation (b) of providing payment transactions in every access point presupposes extensive investments in security devices and structural adjustments (counter concept). Furthermore, it calls for staff familiar with banking business and anti-money-laundering measures. In other words, obligation (b) affects the cost

of obligation (a) in a significant way as it prevents Swiss Post from replacing post offices by agencies. The issue is how large are those foregone savings?

The coefficients of the agencies (δ_1, δ_2 and δ_3) give a first indication. They give notice to two things: First, replacing common post offices by agencies reduces total costs by a considerable amount (negative sign of δ). Second, the associated savings increase together with the size of converted post offices, indicated by the larger coefficients for "bigger" agencies.

Computing the direct effect of the implicit constraint between (a) and (b) on the cost of the USO requires more precise calculations based on equation (2) using the coefficients from Table 1. Such a calculation presupposes detailed knowledge about the optimal number, location, and nature of postal outlets as well as how the former output $Q_{1\text{-}5}$ of closed or converted post offices disperses into other outlets to consider the scale effects as measured by $\beta_{11\text{-}55}$. This is a fairly complex task and lies beyond the scope of this paper.

Based on the optimal post office network as defined by PostReg (cf. Figure 5) and applying a more simplified approach neglecting scale economies and revenue effects yields foregone savings of over CHF 200 Mio.[9] The amount lies approximately in the region of the amount as announced by PostReg[10] and is significantly higher than the costs derived from the separate approach in Section 4.1.

The example demonstrates the existence of interdependencies between various restrictions. Obligations (a) and (b) should not be considered individually but jointly because (a) is affected by (b) and vice versa.

5. Calculation and compensation for effects of competition

In Section 4 we computed the direct effect of two interacting universal service obligations on the burden of the USO. Thereby, we did ignore effects resulting from competition in a liberalized postal market. For example, if the state decided not to compensate the USP for its USO burden at all, the USP would need to finance those costs by a comparably higher price. This would have an immediate impact in the market as the USP would lose market shares. Similarly, if USO obligations change variable costs and are compensated by fixed subsidies, the incumbent will find different prices optimal. Hence, indirect effects, which increase (or decrease) the burden of the USO might arise if (direct) costs of the USO are not properly compensated for. Differences in the USP's perceived net operating costs affect equilibrium prices, market entry strategies chosen by competitors, market shares, profits, and hence again (and indirectly) the cost of the USO.

Related to such indirect effects, the theory – as discussed in Section 2 – states that an estimation of USO costs should be derived by comparing two scenarios, namely one with and one without USO under market conditions.

We now illustrate the extent of such indirect effects by a stylized market entry model as described in the Appendix and show that a proper compensation arising from a "corrected separated approach" is a complex task. We argue that a global approach is – despite the complex calculations needed – easier to implement in practice.

Table 2 provides the results for the model in the Appendix assuming that (i) operator *i* is mandated with USO obligations, (ii) operator *j* behaves as a competitive fringe ($p_j^*=c$), (iii) the USO constraints do not include pricing constraints, and (iv) have no effects on customer loyalty but (v) increase variable costs by 0.1 and fixed costs by 100. This stylized world allows us to isolate the indirect effect on the burden of the USO of a change in the USP's cost structure. Note that the absolute values in Table 2 serve as an illustration only and are unrelated to the postal market.

Table 2 illustrates the effects of various compensation schemes. In column 1, the government pays the USP a two-part subsidy consisting of 0.1 per mail piece and a fixed component of 100. In such a way, the USP behaves as there would be no USO obligations. This exactly restores the market equilibrium without any obligations and the policy hence is competitively neutral.

In column 2, the government pays ex post a lump sum compensation that it derives from a net avoided cost approach. The policy results in higher USP prices (subject to the 0.1 higher variable costs) which reduce its market share and affect profits. Despite the USP's slightly improved profit situation (before compensation) it is worse off as the government does not compensate for the indirect effect of about 30. Bottom line, the USP is worse off by these 30.

Table 2: Indirect effects and optimal compensation schemes

	Two-part USO compensation	**Bottom up lump sum compensation**	**Global lump sum Compensation**
Profit *i* Base Case	364.3	364.3	364.3
Profit *i* with USO	-50.0	-21.4	-21.4
q_i	3142.9	2571.4	2571.4
Total Compensation	414.3	357.1	385.7
Price Level	1.08	1.13	1.13
Direct Effect on USP	414.3	357.1	357.1
Indirect Effect on USP	0	28.6	28.6
State Financing	414.3	357.1	385.7
USP Net Burden	0	28.6	0
Burden to the consumer	0	142.9	142.9
Total Burden	414.3	528.6	528.6

Column 3 exhibits a compensation derived from a global approach. In contrast to the lump sum regime, it correctly compensates the USP but results in a market equilibrium with higher prices and lower welfare properties as compared to the two-party compensation.

How do the results change if the USO exhibits not only higher costs, but also restrictions in pricing and more loyal customers? Similarly, what happens if we relax the assumption of a competitive fringe and allow operator *j* to behave in a strategic way as described in the Annex?

We do not report our results here but summarize the findings. First, a two-part compensation scheme does not anymore ensure a correct compensation or competitive neutrality. The reason is that the effect of the USP policy on customer loyalty cannot be offset by such a compensation scheme and would result in over-compensation. If there is direct price regulation in addition, the indirect effects are even more complex and might result in under-compensation. The same problems arise with an ex post lump sum payment based on net avoided costs. The distortions of both methods can only be offset by applying a correction based on a global approach. Such a global approach is used in the global compensation scheme (column 3) which can still be applied in the more complex setting without any adjustments.

In other words, in a real world environment, compensation schemes 1 and 2 (two-part, lump sum) result in poor measures that have to be corrected by a global approach.

6. SUMMARY AND CONCLUSION

Policy makers are interested in the net cost of the USO for a variety of reasons, including ensuring that the designated USP is not disadvantaged relative to competitors in liberalized postal markets. The profitability cost approach as discussed by Cremer et al. and Panzar yields an estimate of the necessary compensation, if any, to pay for the net cost of the USO. This approach calculates the cost of the USO as the difference of the USP's profit between a scenario with and without obligations. In this regard, the new postal directive (2008/6/EC) allows for a consistent calculation of "net costs" based on the profitability cost approach. However, the directive also states that these net costs should be computed *individually* across the various USO elements so as to avoid double counting.

The inherent problem arising out of such a disaggregated approach to calculating the net USO costs is the presence of various interdependencies among the individual USO elements. These interdependencies even scale up under competition. For example, the obligation to deliver letters nationwide

on a daily basis gives room for selective market entry if the USO further foresees that all letters have to be provided at a uniform tariff. In Section 4 such interdependencies were analyzed by an econometric case study of Swiss Post's outlet network, where the obligations to provide financial transactions, as well as mail collection services, imply an efficient solution with a greater number of post offices relative to agencies than would be the case with only an accessibility constraint. Hence, accessibility obligations designed for postal services are more costly if financial transactions are included in the USO (which is the case in Switzerland). Consequently, the cost of this combined restriction is significantly higher than the costs derived from a separate approach.

Any calculation of the cost of the USO should hence tackle the various interdependencies between elements of the USO in a consistent way while avoiding double counting. We showed by means of a stylized example that the profitability cost approach ensures such a correct estimate. It does so by incorporating all relevant aspects of the USO *and* competition in a *global* way. Moreover, we showed that a disaggregated approach as suggested by the EC involves in one or the other way the application of a global approach – be it implicitly in a "sequential approach" or explicitly in an "adjusted separate approach". Otherwise, any disaggregated approach will result in an under- or overcompensation of the USP. In such a case, indirect effects on the market equilibrium would further increase the market distortions and un-level the playing field. Thereby, a two-part compensation schedule that allows for a mix between lump sum and volume dependent compensation will mitigate the distortions to a minor extent only. Again, a global profitability cost approach is the only way to derive a fair compensation correctly accounting for indirect effects.

Concluding, the global approach provides consistent estimates of the net costs of the USO and it does so with a clear recognition of the joint impact of the multiple obligations in any given USO. The interdependencies across obligations, illustrated here for postal and financial services in Switzerland, should not be hidden by separation arguments, but rather these interdependencies should be made as transparent as possible so that policy makers and the USP can understand the joint impacts and net costs of the multiple obligations imposed under a given USO.

APPENDIX

For our simulations discussed in Section 4, we use a Dixit-like approach to model price competition with product differentiation and assume that there are no information asymmetries. See Trinkner (2008) for more details on the specification. A representative sender has quasilinear preferences with

respect to money and faces the choice among two competing and non-collusive operators *i* and *j* charging price p_i and p_j respectively. We use a quadratic utility function which yields linear demand in quantities *q*:

$$q_i(p_i, p_j) = \frac{1}{b(1-e^2)}\left(a_i - ea_j - p_i + ep_j\right).$$

The higher the degree of product differentiation among the two operators, the closer to zero is parameter *e*. Parameters *a* and *b* determine the market size and the slope of the demand curve. Note that the slope of the demand curve in a given market is equal for both operators. Parameters a_i will allow us to include potential benefits of the USO (higher customer loyalty towards USO-operator).

Profit maximization over a cost structure consisting of marginal costs *c* and fixed costs *F* yields the following reaction functions and equilibrium prices for the two operators:

$$p_i(p_j) = \frac{1}{2}\left(a_i - ea_j + c_i + ep_j\right),$$

$$p_i^* = \frac{a_i - ea_j + c_i + \frac{1}{2}e(a_j - e\ a_i + c_j)}{2 - \frac{1}{2}e^2}.$$

We calibrate the model as follows. The operators face symmetric costs consisting of fixed costs of 500 and variable costs of 0.8. *e* is set to 0.75. If served only by operator *i*, consumers would demand 10000 letters at a price of 1 with a price elasticity of -0.5. For this initial situation, the following conditions hold which enable us to calibrate first *b* and then a_i:

$$q(p) = \frac{a_i - p}{b} \quad \text{with price elasticity} \quad \varepsilon = -\frac{1}{b}\frac{p}{q}.$$

Parameter a_i influences the size of the market of the two operator's services. By setting $a_i > a_j$, we can include effects that let customers prefer operator *i* over *j* in case operator *i* is designated as USP with obligations. Formally, we define *x* as the percentage of total demand the USP receives if operator *j* were to offer the same price for its services and yield

$$a_j = \frac{1}{1-e+\frac{e}{x}}\left(a_i(e-1+\tfrac{1}{x}) + p(1-e)(2-\tfrac{1}{x})\right).$$

We allow for universal service obligations that have an effect the profit function of operator *i* in three different ways: Obligations might change the variable costs c_i, the fixed costs F_i, and/or pricing p_i^* by imposing certain restrictions on the incumbents pricing:

$$c_{i,USP} = c_i + c_{USO}; \quad F_{i,USP} = F_i + F_{USO}; \quad p^*_{i,USO} = p^*_i(USO).$$

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1 Ideally, this would be the most efficient operator. For more on the issue on designating procedures with an emphasis on tendering see Jaag and Trinkner (2008).

2 Market entry models that (1) assess the sustainability of the postal USO in a liberalized market and (2) include a monopoly scenario as a benchmark implicitly provide such an estimate. Examples include Crew and Kleindorfer (2005). For Switzerland cf. Dietl et al. (2005), Trinkner (2008) and Jaag (2006).

3 In reality, many more dimensions interact. An intuitive representation in three dimensions is provided by Ambrosini et al. (2006).

4 In the calculations below, potential revenue effects are discussed as well.

5 Depending on the structure of the interaction between USO dimensions, it may also result in a total net cost which is smaller than the sum of the individual net costs.

6 We assume here that variable costs are the same for agencies as for outlets run by Swiss Post.

7 Classification implemented by the Federal Office for Spatial Development.

8 We had to exclude 7 of the post offices and 5 of the agencies due to missing values of total costs.

9 Basically, we calculated the savings from post office closures as the difference between total costs C_i less variable costs as estimated in Table 1 for the five output categories. Thereby, we did not account for economies of scale (no additional savings from the increased quantities in remaining access points) and revenue effects (i.e. consumers chose a neighboring access point). Similarly, we computed the savings from conversions of post offices into agencies as the sum of costs not incurring in agencies (agency dummies, regional post office dummies, opening hours, and capital costs).

10 Press Conference from February 4th, 2008.