Compensating the Net Cost of Universal Postal Services

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Abstract

This paper analyzes the net cost of universal service obligations in the postal sector after full liberalization and the potential burden they represent for the universal service provider. It considers various interpretations of what an "unfair burden" – as mentioned in the Third Postal Directive – might be and discusses the competitive impact of corresponding compensation scenarios by means of a stylized theoretical model with endogenous entry and coverage decisions.

1.   Introduction

The financing of universal service provision in the postal sector has traditionally relied on granting the provider a reserved area. The need for alternative funding sources after full liberalization has increased the interest of regulators and the public in knowing the cost of universal service provision as the universal service provider (USP) should be correctly compensated for its burden. This implies knowing its cost, as measured by the profitability cost approach pioneered by Panzar (2000) and Cremer et al. (2000). The net cost of universal service obligations (USO) according to profitability cost is the difference in the USP's profit with and without these obligations.[2] This approach has been practically implemented in a number of countries, e.g. in Denmark (cf. Copenhagen Economics, 2008), Norway (cf. Bergum, 2008), in the UK (cf. Frontier Economics, 2008), in the US (cf. Cohen et al., 2010). In all of these examples, the costing of universal services has been treated separately from its financing.

Only recently it has been argued that the market structure and the actual cost or the burden of USO are directly related to regulation and the funding mechanism in place. Jaag et al. (2008) provide an outline of how changes of the USP's cost structure affect pricing, market equilibria and hence indirectly the net cost. They also show that individual elements or dimensions of the USO cannot be priced separately as this would either result in inconsistent or biased cost estimates. Boldron et al. (2009) argue that the challenge of establishing a funding mechanism is that the market structure and the

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[2] Annex I of the Third Postal Directive defines the net cost calculation as follows: "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."

effective cost/burden of USO are endogenous to regulation and funding mechanisms. Similar points are raised in Jaag and Trinkner (2009) and Borsenberger et al. (2010). While the former discusses the competitive impact of various cost sharing and compensation mechanisms on the competitive equilibrium, the latter focuses on the appropriate tax base for a sharing mechanism. Jaag (2008) discusses the importance of a thorough definition of the counterfactual scenario – whether there is no USO at all or universal services are provided by an alternative operator – and its impact on the net cost of the USO.

Based on these considerations, it is apparent that merely calculating the net cost of universal service obligation may not be adequate when devising the fair compensation for a universal service provider. Consequently, the Third Postal Directive 2008/6/EC in Article 7 states that:

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

Hence, a compensation for the USP may only be introduced if the USO entails a net cost and represents an unfair burden. While there is quite a comprehensive literature on the costing of the USO, there has been little discussion so far as to how exactly define an unfair burden. That is the focus of this paper.

We consider three main compensation means for the USP which are compliant with the EC Directive:[3]

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

Compensation fund – All operators contribute to a compensation fund with a uniform 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").

We discuss the implication of these funding mechanisms on the fairness of a USO burden. The remainder of the paper is structured as follows: Section 2 discusses a simple stylized model of the postal sector which allows to discuss the USO, its net cost and its financing. In section 3, various criteria for assessing the (un)fairness of a burden and their effect on the operators' profits are presented. Section 4 concludes.

2.   A Model of Competition in the Postal Sector

Our model approach is similar to the one in Valletti et al. (2002): There are two firms $p = i, e,$ each one offering postal services which are imperfect substitutes. There is a continuum $[0, \bar{r}] \subset R_+$ of different markets, where $\bar{r}$ is the size of the total market. We use a geographical interpretation of a market, such that market r stands for a local delivery route. Hence, the market can be divided into segments by region of delivery. If firm p

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[3] Cf. OXERA (2007) for a comprehensive discussion of various funding mechanisms.

decides to enter a certain market r it has to pay the fixed cost[4] associated to that market $f(r)$, where we assume that $f'(r) > 0$.

For the sake of simplicity, we make the following further assumptions:

Assumption 1: Markets are independent of each other. This implies that the competitive situation in one market does not affect the cost structure or demand in another market.

Assumption 2: There are two symmetric operators. They possess the same technology (cost function) and compete in horizontally differentiated products.

Assumption 3: The sequence of decisions is as follows: First, a profit-maximizing incumbent chooses its optimum market coverage (geographical area coverage). Second, an entrant (competitor) sets its optimum coverage. Third, both operators set their price(s) for each of the delivery markets.

Marginal cost is constant and by assumption 2 the same for both operators. In every market r each operator makes a gross profit (or surplus) amounting to $s(r)$.[5] Because all markets share the same demand characteristics and variable costs, the equilibrium prices in each market and therefore also s depend only on the number of competitors.[6] Typically, in the postal sector, $s(0) - f(0) > 0$, while $s(\bar{r}) - f(\bar{r}) < 0$. This implies that some regions are attractive to serve while others are not and market entry will generally occur, albeit not with full coverage. This is e.g. the case in Sweden where the incumbent's biggest rival Bring CityMail delivers only in the most densely populated areas.

From the perspective of operators, local delivery markets are ranked by increasing order of cost. Without USO, operators begin to cover the most densely populated areas and continue to cover less densely areas as long as it is profitable. Hence, each operator starts offering services from the market with the highest profit and leaves no gaps between served markets. If operator p serves all markets $[0, r_p]$, its total profit will be

$$\pi_p = \int_0^{r_p} s(r) - f(r)dr.$$

Solving the model backwards yields for the optimum market coverages of the entrant and the incumbent, respectively:

$$r^\# = \operatorname*{argmax}_{r_e} \int_0^{r_e} s(r) - f(r)dr,$$

$$r^* = \operatorname*{argmax}_{r_i} \int_0^{r_i} s(r) - f(r)dr.$$

Due to the assumptions made, total cost is convex. This implies that only one type of asymmetric equilibrium can arise in which one operator is bigger than the other. Here, due to sequence in assumption 3, the entrant's coverage, $r^\#$, is lower than the incumbent's,

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[4] In the following, we will refer to the fixed cost associated with serving a market as "marginal fixed cost" in the sense that it is the cost incurred when an operator extends its regional presence marginally.

[5] Note that the surplus in each market results from selling a range of products in that market. It does not matter how many products are concerned (or e.g. whether or not they are in the product scope of the USO).

[6] There is no reason for price differentiation within markets if same number of operators is the same.

r^*.[7] This is due to the marginal surplus in the monopolistic segment being larger than in the duopolistic segment: There is a mutual business stealing (quantity effect) and competitive pressure on prices in the duopoly region (price effect) such that

$$s \equiv s\left(r < r^{\#}\right) < s' \equiv s\left(r \geq r^{\#}\right).$$

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 regions (cf. Figure 1):[8]

(1) In attractive market segments (e.g. densely populated delivery areas with low wage levels), it is feasible for both companies to operate in parallel ("competitive region", $r < r^{\#}$).

(2) In less attractive local delivery markets (e.g. semi-rural areas), an operator can make a profit only if there is no competitor. Hence, there will be a monopolistic operator in equilibrium ("monopolistic region", $r^{\#} < r < r^*$).

(3) In the least attractive local delivery markets (e.g. rural and / or high wage areas), marginal fixed costs are higher than marginal surplus, such that no operator serves this segment voluntarily ("unserved region", $r > r^*$).
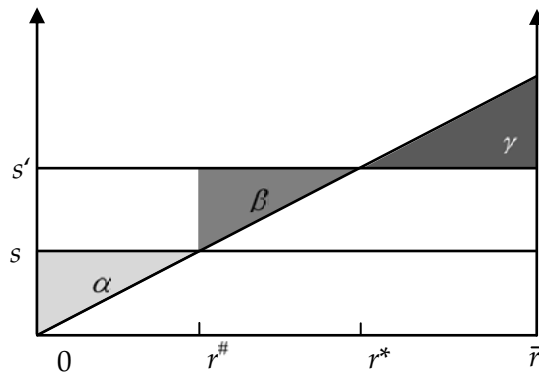

Figure 1: The Segmentation of the Market for Mail.

The horizontal lines at s and s' in Figure 1 represent the marginal gross surplus in each market with two and one operators, respectively. The increasing straight line illustrates the marginal fixed cost associated with serving market r. In our model, we do not assume a concrete functional form of the cost function.

In our model context, we define the USO in line with the Third Postal Directive to consist of the obligation to serve all regions up to $\bar{r}$.[9] However, there is no uniform tariff constraint.[10] Hence the **introduction of a USO** forces the USP to also serve areas $r > r^*$ in which the marginal cost exceeds the marginal surplus from extending market coverage.[11]

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[7] In our model it is the sequence of decisions that results in the incumbent always serving at equilibrium a larger proportion of the market. This sequence reflects that the incumbent operator has traditionally been serving all markets due to the USO.

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

[9] Art. 3 "Member States shall ensure that users enjoy the right to a universal service involving the permanent provision of a postal service of specified quality at all points in their territory at affordable prices for all users."

[10] Cf. Panzar (2008) who discusses the role of postal rates on the costing of the USO.

[11] Other interpretations of the USO are conceivable: If the USO is only concerned with regions which would be unserved without regulation, its scope would be reduced but its burden on the USP may be heavier as it

This replaces the operator's coverage decision in the sequence of decisions and potentially necessitates some kind of compensation. For the ease of analysis, we make a simplifying assumption on the financing of such compensation:

Assumption 4: If operators contribute to compensating the net cost of universal service provision, the necessary funds are collected through profit taxation.

Compared to other taxation schemes (e.g. based on turnover or per unit), this considerably simplifies our analysis as the operators' market coverage decisions are not distorted.[12]

Assumptions 1-4 allow us to define the profits in each of the three market segments separately:

The two operators' profit in the competitive market segment is equal to

$$\alpha \equiv \int_0^{r^{\#}} s(r) - f(r)dr > 0.$$

The profit in the market segment which is served by only one operator in equilibrium is equal to

$$\beta \equiv \int_{r^{\#}}^{r^*} s(r) - f(r)dr > 0.$$

The loss of the universal service provider in the market segment which would not be served in the absence of a USO is

$$\gamma \equiv \int_{r^*}^{\bar{r}} s(r) - f(r)dr < 0.$$

Hence, the entrant's total profit without USO is equal to area α in Figure 1,

$$\pi_e^{nUSO} = \alpha.$$

The incumbent's profit without USO is equal to the areas $\alpha + \beta$ in Figure 1,

$$\pi_i^{nUSO} = \alpha + \beta.$$

Assuming that the incumbent will be the USP, its profit with USO but without compensation is equal to

$$\pi_i = \alpha + \beta + \gamma.$$

As discussed above, we consider three potential financing mechanisms in case there is a net cost which constitutes an unfair burden:

1) External financing ("ext"): The burden is financed by state funding; hence, there are no specific taxes imposed on postal operators, $\tau_e^{ext} = \tau_i^{ext} = 0$.
2) Everyone pays ("fund"): Both operators contribute equally to a universal services fund $\tau_e^{fund} = \tau_i^{fund}$. The total tax base equals the two operators' joint profits, $2\alpha + \beta + \gamma$.
3) Pay or play ("pop"): Only the competitor contributes to the funding of the USO, $\tau_e^{pop} \neq \tau_i^{pop} = 0$, the total tax base is equal to its profit α.

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would not automatically consolidate the USP's position in the monopolistic region. Jaag (2008) discusses this issue in detail.

[12] Cf. Borsenberger et al. (2010) and Jaag and Trinkner (2009) for a discussion of the effect of various taxation schemes on the costing and financing of USO.

Hence, after compensation, the two operators' profits are respectively equal to

$$\pi_e^m = (1 - \tau_e^m)\alpha, m \in \{ext, fund, pop\};$$
$$\pi_i^m = (1 - \tau_i^m)[\alpha + \beta + \gamma] + \underbrace{\tau_e^m\alpha + \tau_i^m[\alpha + \beta + \gamma]}_{T}.$$

T is the gross transfer the USP receives as compensation. According to the definition in Annex I of the Third Postal Directive, the net cost of USO is therefore equal to

$$\pi_i^{nUSO} - \pi_i = \alpha + \beta - (\alpha + \beta + \gamma) = -\gamma.$$

The Third Postal Directive also imposes rules on accounting separation as a basis for the calculation of the USO net cost (Art. 14, Para. 2):

> "The universal service provider(s) shall keep separate accounts within their internal accounting systems in order to clearly distinguish between each of the services and products which are part of the universal service and those which are not. This accounting separation shall be used as an input when Member States calculate the net cost of the universal service. Such internal accounting systems shall operate on the basis of consistently applied and objectively justifiable cost accounting principles."

In the calculation of the USO net cost, according to Annex I of the Third Postal Directive, the profit level of the entire operator is relevant, not the profit of individual services. Our model shows that in general, there is no need for such a separation in order to calculate the USO net cost. However, in order to be able to calculate the USO net cost, there is another need for separation, namely between α β and γ. It is apparent that there is an inherent difficulty in that calculation due to non-observability: The competitor's profit α is an "existing number" which is observable (at least by itself and its shareholders). The USP's profit $\alpha + \beta + \gamma$ "exists" as well. Therefore, the difference between the two, $\beta + \gamma$, in principle can be calculated. However, β and γ are not observable separately and cannot be computed directly as they exist only in the counterfactual scenario without USO. We will return to this issue in the context of concrete approaches to the definition of an unfair burden.

3.   Approaches to the Notion of Unfair Burden

With respect to the notion of an unfair burden, there are then two fundamental but distinct questions to be answered:

1)   When is there a burden? What is the criterion for implementing a compensation or cost sharing mechanism?
2)   What is the appropriate compensation such that there is no remaining unfair burden?

The net transfer to compensate the USP is

$$C^m = \pi_i^m - \pi_i.$$

If the USO net cost and its financing are calculated sequentially, this net transfer does not take into account its financing mechanism. Hence, the relevant criterion for compensation is met ex ante (but not necessarily ex post) which helps answering the first question. If there is an integrated calculation of the net cost of the USO and its financing, the net transfer meets the relevant criterion ex post (but not necessarily ex ante) which answers the second question.

The paper adopts four different criteria to assess the (un)fairness of a burden and hence on the appropriateness and the level of compensation (cf. Figure 2). Both questions raised above will be considered separately.

The first criterion sets the USP's profit in relation to its profit without universal service provision. The second criterion considers the USP's absolute profit level. The third criterion compares the USP's profit to its competitor's. The fourth criterion compares changes in the USP's and the competitor's profits due to the USO.
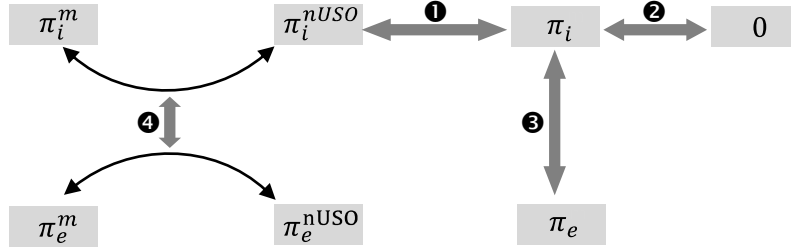

Figure 2: Approaches to the Notion of Unfair Burden.

Criterion 1: Absolute Net Cost Level
According to criterion 1, universal service provision imposes an unfair burden if it reduces the USP's profit compared to a situation without USO.

This criterion matches the view taken by CERP (2008). However, in their view there is an unfair burden only if the net cost exceeds a certain threshold. Hence, if net costs are negligible, their calculation and compensation is to be avoided.[13] This criterion allows for a compensation of net costs irrespective of the competitive situation in the postal sector and irrespective of the impact of the financing mechanism on competition.

Ex ante perspective

Assuming that the USO net cost exceeds a certain threshold, from an ex ante perspective, the USP should receive a transfer such that its resulting profit is equal to its profit without USO. Hence, the necessary gross transfer T^m is to be set such that

$$\pi_i + T^m = \pi_i^{nUSO} \leftrightarrow T^m = -\gamma.$$

Superscript *m* indicates the source of the USO financing and whether the compensation is devised ex ante or ex post.[14] If this transfer is financed by state funds, the USP's loss in the least attractive region is just offset by the transfer; the competitor's profit remains unchanged. If there is a pay or play mechanism, the transfer must be collected from the competitor with its profit as the relevant tax base:

$$\tau^{pop,ea}\alpha = -\gamma.$$

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[13] CERP (2008) states: „If the reference scenario does not vary fundamentally from the scenario with USO the difference can be ignored. Then the cost of administrating a compensation mechanism probably would cost more than it would help the USP" (p.20). It further argues that "If the current universal service provision exceeds the requirements of the USO, the designated USO doesn't carry a burden" (p.20). This is certainly true, but in that case there is no net cost either and the whole point appears to be moot.

[14] In order to keep notation simple, in the following we suppress indices referring to the scenarios we discuss. These differ in two dimensions: The criterion by which the unfairness of a burden is assessed and whether that assessment is ex ante or ex post.

Hence, the tax rate in that scenario is

$$\tau^{pop,ea} = -\frac{\gamma}{\alpha}.$$

If there is a fund to which all operators contribute, the tax base is the sum of both operators' profits. Hence, the tax rate is determined by

$$\tau^{fund,ea}[2\alpha + \beta + \gamma] = -\gamma,$$

which results in

$$\tau^{fund,ea} = -\frac{\gamma}{2\alpha + \beta + \gamma}.$$

Of course, if the USP contributes to financing its own net cost, the criterion by which the unfairness of its burden is assessed may not be met from an ex post perspective.

Ex post perspective

In order for the criterion to be met ex post, the USP's profit with and without universal service provision must be equal independently of the financing mechanism in place. Hence,

$$\pi_i^m = \pi_i^{nUSO}.$$

In the case of external financing, the resulting equilibrium matches the result obtained by setting the transfer ex ante. With a pay or play mechanism, the tax rate is now determined as

$$\alpha + \beta + \gamma + \tau^{pop,ep}\alpha = \alpha + \beta \rightarrow \tau^{pop,ep} = -\frac{\gamma}{\beta + \gamma}.$$

Similarly, with a compensation fund in place, the tax rate is calculated by

$$\left(1 - \tau^{fund,ep}\right)[\alpha + \beta + \gamma] + \tau^{fund,ep}[2\alpha + \beta + \gamma] = \alpha + \beta \rightarrow \tau^{fund,ep} = -\frac{\gamma}{\alpha}.$$

Both the USP's and its competitor's resulting profit levels are displayed in Table 1. Note that with external funding, the joint profit of both operators equals $2\alpha + \beta$, which is also the joint profit without USO. If the USO net cost is financed within the sector, the joint profit is $2\alpha + \beta + \gamma$, irrespective of whether a fund or pay or play mechanism is in place. With a fund and from an ex ante perspective, the net cost $-\gamma$ is shared among the operators according to their profit levels: the USP bears a fraction $\frac{\alpha+\beta+\gamma}{2\alpha+\beta+\gamma}$ and the competitor bears a fraction $\frac{\alpha}{2\alpha+\beta+\gamma}$. From an ex post perspective, the "pay or play" and fund-based financing mechanisms are equivalent, as the net compensations received by the USP are the same by definition. Of course, as soon as the competitor's profit turns negative, the financing mechanism breaks down, as the competitor will not remain active in the market.[15]

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[15] Correctly, the profit levels reported in Tables 1 to 4 would have to have a lower bound at zero.

m	USP profit π_i^m	Competitor profit π_e^m
ext	$\alpha + \beta$	α
pop ex ante	$\alpha + \beta$	$\alpha + \gamma$
fund ex ante	$\alpha + \beta + \dfrac{\gamma(\alpha + \beta + \gamma)}{2\alpha + \beta + \gamma}$	$\alpha + \dfrac{\gamma\alpha}{2\alpha + \beta + \gamma}$
pop ex post	$\alpha + \beta$	$\alpha + \gamma$
fund ex post	$\alpha + \beta$	$\alpha + \gamma$

Table 1: Results for criterion 1- absolute net cost level.

Figure 3 displays the distribution of profits between the USP and its competitor resulting from a compensation of the USO net costs according to criterion 1.[16] The horizontal axis shows net costs (-γ) ranging from 0 to 30. α and β are kept constant such that overall profits in the market are decreasing in net costs. Compensation by state funding is not displayed, as it has a trivial effect on the operators' profits. If the compensation is such that the net cost is compensated with a pay or play mechanism and correctly from an ex ante perspective, the resulting burden on the USP is always equal to zero. It is also fair ex post. If the USP is compensated by a fund to which both operators contribute such that the criterion is met ex ante, there are two effects involved. Firstly, The USP contributes according to its profit, which is declining in the USO net costs. Secondly, the competitor's profit and therefore also its contribution increases relative to the USP's. As the total tax base is decreasing in the net cost, this implies that the net transfer the USP receives from the competitor increases if the net costs are high.

The shaded area in Figure 3 shows the range of net cost which represents an unfair burden from an ex ante perspective. Concretely, in the displayed example, the net cost is considered to represent an unfair burden for values of $\gamma < -4$.[17]
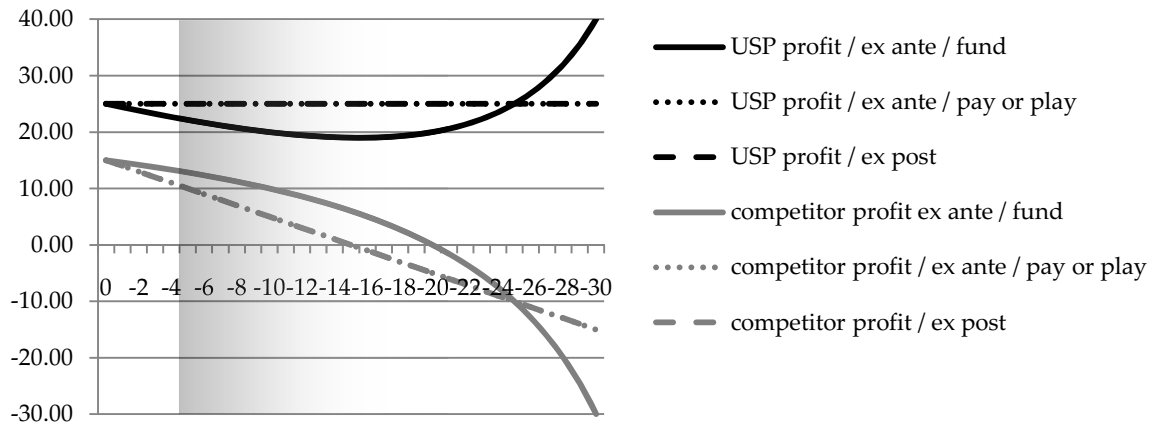

Figure 3: Profits resulting from a net cost compensation according to criterion 1.

Compensation of the USO net cost according to this criterion raises a number of implementation issues:

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[16] Parameter values are: $\alpha = 15$, $\beta = 10$, $\gamma \epsilon [0, -30]$. The profit levels with external funding are not displayed as they are obviously constant in changes of γ (cf. Table 1).
[17] This threshold is set arbitrarily for illustration.

If there is a threshold, as in the CERP interpretation: Who determines that threshold – the USP, the law or the national regulatory authority?

What is the necessary data to determine a fair compensation? Is there a need for accounting separation? In our model, there is no need to separate between universal services and others, but between the unserved market segment and the others.

If compensated according to this criterion, the USP faces no incentives to minimize its net costs, i.e. to maximize efficiency in the provision of services only offered in the USO scenario. If there is a fund with ex ante defined contributions, the USP is even incentivized to increase the net cost, as it is overcompensated by its competitor.[18]

Criterion 2: Absolute Profit Level
According to criterion 2, universal service provision imposes an unfair burden if the USP's profit is negative.[19]

Hence, universal services should not be offered at a loss. The implicit normative reference behind this criterion could be the assumption that competition in fully liberalized postal markets results in zero profits of all operators in the absence of universal service obligations. In this context, 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."[20] This approach also matches the interpretation of an unfair burden by De Donder et al. (2010).

Ex ante perspective[21]

From an ex ante perspective, the gross transfer T^m, which is necessary for the USP to break even is calculated as:

$$\pi_i + T^m = 0 \leftrightarrow T^m = -(\alpha + \beta + \gamma).$$

If this transfer is financed by state funds, the USP's overall loss or profit is just offset by the transfer (which may well be negative).[22] If there is a pay or play mechanism, the transfer must be collected from the competitor with its profit representing the relevant tax base:

$$\tau^{pop,ea} \alpha = -(\alpha + \beta + \gamma) \rightarrow \tau^{pop,ea} = -\frac{\alpha + \beta + \gamma}{\alpha}.$$

If everyone contributes to the fund, the tax base is enlarged by the USO's profit, such that:

$$\tau^{fund,ea}[2\alpha + \beta + \gamma] = -(\alpha + \beta + \gamma) \rightarrow \tau^{fund,ea} = -\frac{\alpha + \beta + \gamma}{2\alpha + \beta + \gamma}.$$

Ex post perspective

From an ex post perspective, the USP is supposed to just break even,

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[18] If contributions were not on a profit basis but per piece or by turnover, this effect would be even stronger, as it would also degrade the entrant's optimum market coverage.

[19] The zero profit criterion does not represent a loss of generality. The USP's targeted profit could be set to any amount.

[20] P. 68.

[21] In order to simplify notation, we again suppress indices for the relevant criterion and the (ex post or ex ante) perspective.

[22] By symmetry, in our model context, this implies that there may not only be an unfair burden, but alternatively an unfair profit.

$$\pi_i^m = 0.$$

In the case of external financing, the resulting equilibrium matches the result obtained by setting the transfer ex ante. With a pay or play mechanism, the tax rate is determined as

$$\alpha + \beta + \gamma + \tau^{pop,ep}\alpha = 0 \rightarrow \tau^{pop,ep} = -\frac{\alpha + \beta + \gamma}{\alpha}.$$

With a compensation fund, it is

$$\left(1 - \tau^{fund,ep}\right)[\alpha + \beta + \gamma] + \tau^{fund,ep}[2\alpha + \beta + \gamma] = 0 \rightarrow \tau^{fund,ep} = -\frac{\alpha + \beta + \gamma}{\alpha}.$$

Note that as long as $\alpha + \beta + \gamma > 0$, tax rates are negative.

m	USP profit π_i^m	Competitor profit π_e^m
ext	0	α
pop ex ante	0	$2\alpha + \beta + \gamma$
fund ex ante	$\dfrac{(\alpha + \beta + \gamma)^2}{2\alpha + \beta + \gamma}$	$\alpha + \dfrac{\alpha(\alpha + \beta + \gamma)}{2\alpha + \beta + \gamma}$
pop ex post	0	$2\alpha + \beta + \gamma$
fund ex post	0	$2\alpha + \beta + \gamma$

Table 2: Results for criterion 2 – absolute profit level.

Figure 4 shows the distribution of profits between the USP and its competitor resulting from a compensation of the USO net costs according to criterion 2.[23] Because the USP's profit is set to zero from an ex ante perspective, the entire industry profit accrues to the competitor. This is declining in the amount of the USO net cost. If the USP is compensated by a fund to which both operators contribute such that the criterion is met ex ante, the tax rate is negative and ex post the USP retains part of its profit from the competitive and the monopolistic regions. If the net cost exceeds the profit in these two regions, the tax rate becomes positive which implies that the USP is a net receiver of transfers and that it profits from an increase in the net cost.

The shaded area in Figure 4 shows the range of net cost which represents an unfair burden from an ex ante perspective. Concretely, the net cost is considered to represent an unfair burden if $\alpha + \beta + \gamma < 0$.

If the USP's compensation equals the burden calculated according to this approach, there is no need to compute the USO net cost in the first place: Note that in Table 2 it suffices to know α and $(\alpha + \beta + \gamma)$. There is no need to know γ separately. Hence, this approach undermines the elegance of the pure net cost approach which could do without attributing joint and common costs to certain products. If the USP's compensation equals the burden calculated according to this approach, there is no need to compute the USO net cost in the first place.

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[23] Again, parameter values are: $\alpha = 15$, $\beta = 10$, and on the horizontal axis $\gamma\epsilon[0, -30]$. The profit levels with external funding are not displayed as they are obviously constant in changes of γ (cf. Table 2).
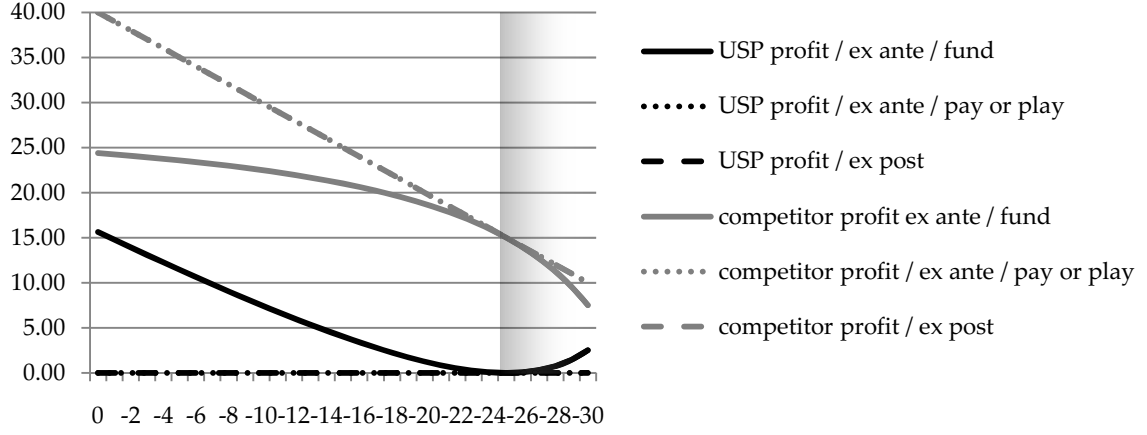
Figure 4: Profits resulting from a net cost compensation according to criterion 2.

We have so far assumed that the entire operator's profit is regulated to zero profit. Alternative extents of the USP's operations that are regulated to just break even may be the

- provision of individual products within the scope of universal services;
- provision of universal services as a whole;
- relevant business unit providing universal services;
- entire company.

This choice very much affects the USP' incentives to minimize costs associated with the operations relevant in the zero-profit regulation resulting from this criterion.

Criterion 3: Absolute Difference to Competitors' Profit Levels
According to criterion 3, universal service provision imposes an unfair burden if the USP's profit is lower than its competitor's.

Hence, the USP should not be worse off than its competitor. According compensation results in a leveling of pre-existing differences among operators. In real postal markets, such differences are possibly due to asymmetric competition as a result of differences in reputation or asymmetric cost structures, asymmetric strategic behavior related to the dynamics of their entry decisions or the USO or just asymmetric management capabilities. Hence, it is difficult to assess whether asymmetries are really unfair.

Ex ante perspective

From an ex ante perspective, the gross transfer T^m which is necessary for the USP's profit to equal its competitor's is calculated as:

$$\pi_i + T^m = \pi_e \leftrightarrow T^m = -(\beta + \gamma).$$

If this transfer is financed by state funds, the difference in the operators' profits is just offset by the transfer; again, the competitor's profit remains unchanged. In case there is a pay or play mechanism, the transfer must be collected from the competitor with its profit being the relevant tax base:

$$\tau^{pop,ea}\alpha = -(\beta + \gamma) \rightarrow \tau^{pop,ea} = -\frac{\beta + \gamma}{\alpha}.$$

If everyone contributes to the fund, the tax base is the total of the two operators' profits, such that:

$$\tau^{fund,ea}[2\alpha + \beta + \gamma] = -(\beta + \gamma) \rightarrow \tau^{fund,ea} = -\frac{\beta + \gamma}{2\alpha + \beta + \gamma}.$$

Ex post perspective

From an ex post perspective, the USP's profit is supposed to equal its competitor's,

$$\pi_i^m = \pi_e^m.$$

In the case of external financing, the resulting equilibrium matches the result obtained by setting the transfer ex ante. However, with a pay or play mechanism, the tax rate is determined as

$$\alpha + \beta + \gamma + \tau^{pop,ep}\alpha = \left(1 - \tau^{pop,ep}\right)\alpha \rightarrow \tau^{pop,ep} = -\frac{\beta + \gamma}{2\alpha}.$$

With a compensation fund, it is

$$\left(1 - \tau^{fund,ep}\right)[\alpha + \beta + \gamma] + \tau^{fund,ep}[2\alpha + \beta + \gamma] = \left(1 - \tau^{pop,ep}\right)\alpha \rightarrow \tau^{fund,ep} = -\frac{\beta + \gamma}{2\alpha}.$$

m	USP profit π_i^m	Competitor profit π_e^m
ext	$\alpha + \beta$	α
pop ex ante	α	$\alpha + \beta + \gamma$
fund ex ante	$\alpha + \dfrac{(\beta + \gamma)(\alpha + \beta + \gamma)}{2\alpha + \beta + \gamma}$	$\alpha + \dfrac{\alpha(\beta + \gamma)}{2\alpha + \beta + \gamma}$
pop ex post	$\alpha + 0.5(\beta + \gamma)$	$\alpha + 0.5(\beta + \gamma)$
fund ex post	$\alpha + 0.5(\beta + \gamma)$	$\alpha + 0.5(\beta + \gamma)$

Table 3: Results for criterion 3 – absolute difference in profit levels.

Figure 5 shows the distribution of profits between the USP and its competitor resulting from a compensation of the USO net costs according to criterion 3.[24] From an ex ante perspective with a pay or play mechanism, as the USP's profit is fixed, increases in the net cost are fully borne by the competitor. The effects of a fund are the same as discussed under criterion 1. If the compensation is calculated from an ex post perspective, the burden resulting from the net costs is evenly distributed among the two operators.

The shaded area in Figure 5 shows the range of net cost which represents an unfair burden from an ex ante perspective. Concretely, the net cost is considered an unfair burden if $\alpha + \beta + \gamma < \alpha$.

If the compensation of the USO net cost is implemented according to this criterion, the incentive problem associated with the first two approaches discussed in 0 and 0 is extended to the USP's competitor, as the compensation is contingent on its own profit as well.

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[24] Again, parameter values are: $\alpha = 15$, $\beta = 10$, and on the horizontal axis $\gamma \epsilon [0, -30]$. The profit levels with external funding are not displayed as they are obviously constant in changes of γ (cf. Table 3).
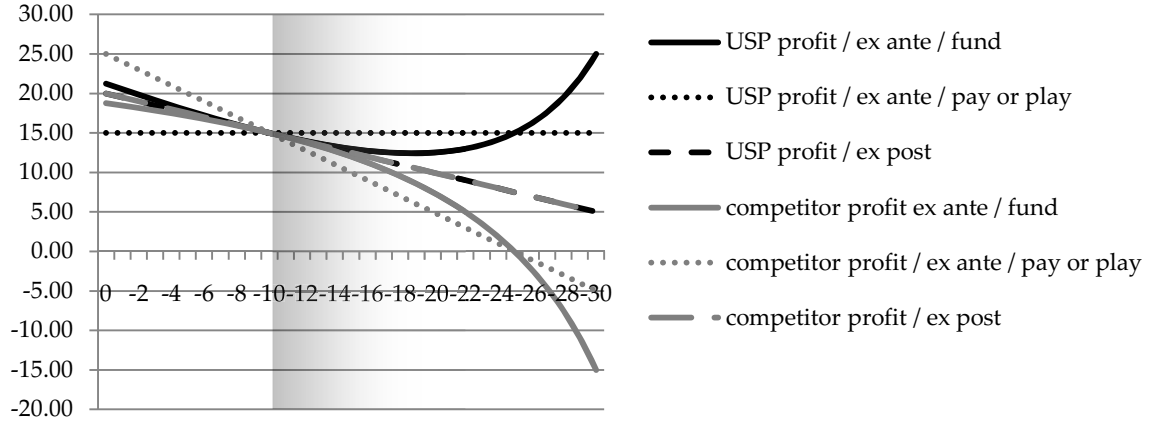
Figure 5: Profits resulting from a net cost compensation according to criterion 3.

Criterion 4: Relative Difference to Competitors' Profit Levels
According to criterion 4, universal service provision imposes an unfair burden if it reduces the USP's profit compared to a situation without USO by more than the competitor's profit is reduced due to its contribution to USO funding.

Hence the USP should not be worse off by more than its competitors due to its universal service provision.

Ex ante perspective

From an ex ante perspective, the competitor's profit is unaffected by the USO. Hence, the gross transfer T^m, which is necessary for the USP's profit difference compared to a situation without USO to be zero, is calculated as:

$$\pi_i + T^m = \pi_i^{nUSO}.$$

Note that this is the same condition as under criterion 1.

Ex post perspective

From an ex post perspective, the USP's profit without and with USO (including compensation) is supposed to equal the difference in its competitor's.

Criterion 4a: The absolute difference in profit levels is supposed to be the same:

$$\pi_i^{nUSO} - \pi_i^m = \pi_e^{nUSO} - \pi_e^m$$

With a pay or play mechanism, the tax rate is determined as:

$$[\alpha + \beta] - [\alpha + \beta + \gamma + \tau^{pop,ep}\alpha] = [\alpha] - [(1 - \tau^{pop,ep})\alpha] \rightarrow \tau^{pop,ep} = -\frac{\gamma}{2\alpha}.$$

With a compensation fund, it is

$$[\alpha + \beta] - [(1 - \tau^{fund,ep})(\alpha + \beta + \gamma) + \tau^{fund,ep}(2\alpha + \beta + \gamma)] = [\alpha] - [(1 - \tau^{fund,ep})\alpha]$$

$$\rightarrow \tau^{fund,ep} = -\frac{\gamma}{2\alpha}.$$

Criterion 4b: The percentage difference in profit levels is supposed to be the same:

$$\frac{\pi_i^{nUSO}}{\pi_i^m} = \frac{\pi_e^{nUSO}}{\pi_e^m}.$$

With a pay or play mechanism, the tax rate is determined as:

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$$\frac{\alpha + \beta}{\alpha + \beta + \gamma + \tau^{pop,ep}\alpha} = \frac{\alpha}{(1 - \tau^{pop,ep})\alpha} \rightarrow \tau^{pop,ep} = -\frac{\gamma}{2\alpha + \beta}.$$

With a compensation fund, it is

$$\frac{\alpha + \beta}{(1 - \tau^{fund,ep})(\alpha + \beta + \gamma) + \tau^{fund,ep}(2\alpha + \beta + \gamma)} = \frac{\alpha}{(1 - \tau^{fund,ep})\alpha} \rightarrow \tau^{fund,ep} = -\frac{\gamma}{2\alpha + \beta}.$$

m	USP profit π_i^m	Competitor profit π_e^m
ext	$\alpha + \beta$	α
pop ex ante	$\alpha + \beta$	$\alpha + \gamma$
fund ex ante	$\alpha + \beta + \dfrac{\gamma(\alpha + \beta + \gamma)}{2\alpha + \beta + \gamma}$	$\alpha + \dfrac{\gamma\alpha}{2\alpha + \beta + \gamma}$
a) pop ex post	$\alpha + \beta + 0.5\gamma$	$\alpha + 0.5\gamma$
a) fund ex post	$\alpha + \beta + 0.5\gamma$	$\alpha + 0.5\gamma$
b) pop ex post	$\alpha + \beta + \gamma - \dfrac{\alpha\gamma}{2\alpha + \beta}$	$\alpha + \dfrac{\alpha\gamma}{2\alpha + \beta}$
b) fund ex post	$\alpha + \beta + \gamma - \dfrac{\alpha\gamma}{2\alpha + \beta}$	$\alpha + \dfrac{\alpha\gamma}{2\alpha + \beta}$

Table 4: Results for criterion 4 – relative difference in profit levels.

Figure 6 shows the distribution of profits between the USP and its competitor resulting from a compensation of the USO net costs according to criterion 4.[25] From an ex ante perspective and with a pay or play mechanism, the USO net costs are fully borne by the competitor. With a compensation fund designed from an ex post perspective, the USP shares the burden and it bears more if the percentage difference in profits is the relevant measure due to its profits being higher than the competitor's in a rage of low net costs. The higher the net costs are, the closer the two profit levels become after compensation.

The shaded area in Figure 6 shows the range of net cost which represents an unfair burden from an ex ante perspective. Concretely, the net cost is considered an unfair burden for all values of $\gamma < 0$. Hence from an ex ante perspective, any positive net cost represents an unfair burden.

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[25] Again, parameter values are: $\alpha = 15$, $\beta = 10$, and on the horizontal axis $\gamma \epsilon [0, -30]$. The profit levels with external funding are not displayed as they are obviously constant in changes of γ (cf. Table 4).
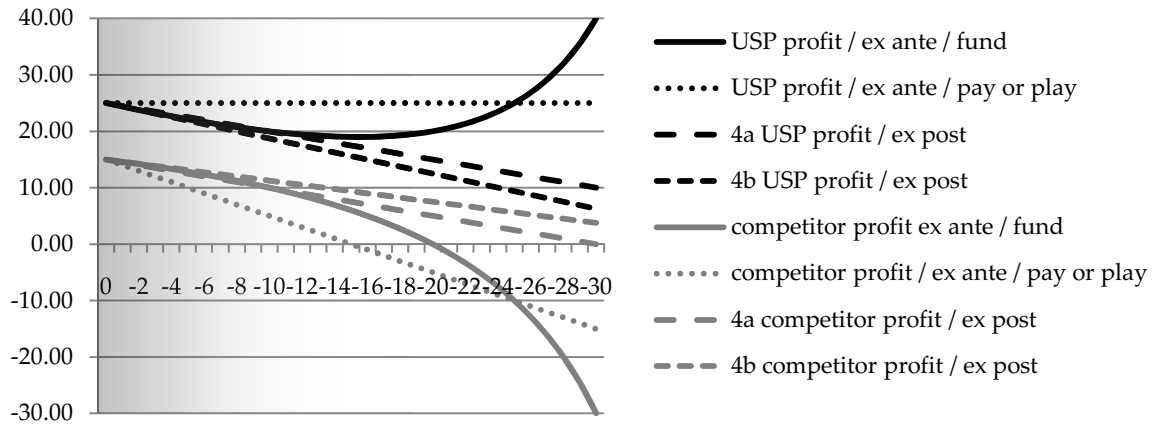
Figure 6: Profits resulting from a net cost compensation according to criterion 4.

4. Conclusion

In this paper, we have discussed four different criteria by which the (un)fairness of a burden could be assessed and by which the appropriateness and the level of compensation could be determined. Based on a stylized theoretical model with endogenous market entry and coverage, we have demonstrated the impact of these four criteria to the "unfairness" of the burden represented by the USO net costs on the competitive equilibrium and the resulting distribution of profits among the operators. This provides policy makers with a guide towards the implementation of a compensation or cost sharing mechanism in the postal sector.

A priori, none of the criteria outlined above is superior to the others. In general, each of them results in a different distribution of profits. The choice of one among the others is therefore to be oriented on the goals to be reached by the compensation.

Sequentially calculating the net costs of USO, determining whether there is an unfair burden and then finding a financing mechanism in general (and from an ex post perspective) does not result in the distribution of profits sought after. Specifically, the implementation of a compensation fund to which all operators contribute results in a systematic undercompensation of the USP. Hence, an integrated approach is necessary.

The incentive problems of universal service costing and financing are imminent in the compensation problem. In principle, they can be dealt with the same way as in incentive-compatible price-cap regulation: by determining the amount of compensation ex ante for a number of years and thereby restoring the operators as residual claimants of their efforts to be efficient.

Our analysis is based on a very stylized model. Asymmetries in the operators' technology or specific customer preferences towards one of the operators are not considered. Neither are alternative bases for contributions of postal operators to a USO fund. These would not only yield distributional effects but also affect the equilibrium allocation in the postal sector. The consideration of these issues as well as an implementation of such models when determining the appropriate compensation of unfair burdens in real postal markets is left to future research.

5. References

Bergum, Kristin (2008). "Calculating the Net Cost of the USO: A Practical Example from Norway". In: Handbook of Worldwide Postal Reform, ed. by Michael A. Crew and Paul R. Kleindorfer and James I. Campbell, Edward Elgar.

Boldron, François, Claire Borsenberger, Denis Joram, Sébastien Lecou, and Bernard Roy (2009). "A Dynamic and Endogenous Approach for Financing USO in a Liberalized Environment". In: Progress in the Competitive Agenda in the Postal and Delivery Sector, ed. by Michael A. Crew and Paul R. Kleindorfer, Edward Elgar.

Borsenberger, Claire, Helmuth Cremer, Philippe De Donder, Denis Joram, and Bernard Roy (2010). "Funding the cost of universal service in a liberalized postal sector". In: Heightening Competition in the Postal and Delivery Sector, ed. by Michael A. Crew and Paul R. Kleindorfer, Edward Elgar.

CERP (2008). "Guidelines for Calculating the Net Cost of the Universal Service Obligations".

Cohen, Robert, Charles McBride and John C. Panzar (2010). "The Cost of the USO in the United States". In: Heightening Competition in the Postal and Delivery Sector, ed. by Michael A. Crew and Paul R. Kleindorfer, Edward Elgar.

Copenhagen Economics (2008). "What is the Cost of Post Danmark's Universal Service Obligation?" Study on behalf of the Danish Chamber of Commerce.

Cremer, Helmuth, André Grimaud, and Jean-Jacques Laffont (2000). "The Cost of Universal Service in the Postal Sector". In: Current Directions in Postal Reform, ed. by Michael A. Crew and Paul R. Kleindorfer, Kluwer.

De Donder, Philippe, Helmuth Crémer, Paul Dudley, and Frank Rodriguez (2010). "Welfare and Profit Implications for Changes in Service Specification within the Universal Service". In: Heightening Competition in the Postal and Delivery Sector, ed. by Michael A. Crew and Paul R. Kleindorfer, Edward Elgar.

Frontier Economics (2008). "Net Costs of Elements of the Universal Service". Report prepared for Postcomm.

Jaag, Christian (2008). "Entry Into Liberalized Markets: The Strategic Role of Universal Service Obligations". Mimeo.

Jaag, Christian Martin Koller and Urs Trinkner (2009). "Calculating the Cost of the Universal Service Obligation: The Need for a Global Approach". In: Progress in the competitive agenda in the postal and delivery sector, ed. by Michael A. Crew and Paul R. Kleindorfer, Edward Elgar.

Jaag, Christian and Urs Trinkner (2009). "Would the Real Net Cost of Universal Service Provision Please Stand up? A Calibrated Approach to Universal Service Costing and Financing in the Postal Sector". Paper presented at the 17th Conference on Postal and Delivery Economics, Bordeaux.

OXERA (2007). "Funding universal service obligations in the postal sector". Report prepared for La Poste, De Post-La Poste, Hellenic Post, Poste Italiane, P&T Luxembourg, Correos, Magyar Posta, Cyprus Post, Poczta Polska.

Panzar, John (2000). "A Methodology for Measuring the Costs of Universal Service Obligations". Information Economics and Policy 12:3, 211-220.

Panzar, John (2008). "Funding Universal Service Obligations". In: Handbook of Worldwide Postal Reform, ed. by Michael A. Crew and Paul R. Kleindorfer and James I. Campbell, Edward Elgar.

Valletti, T. M., S. Hoernig, and P. P. Barros (2002). "Universal Service and Entry: The Role of Uniform Pricing and Coverage Constraints". Journal of Regulatory Economics 21(2), 169-190.