Estimating the Cost of the Universal Service Obligation in Posts

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Preface

The CRI is pleased to publish Estimating the Cost of the Universal Service Obligation in Posts as CRI Technical Paper 12. Frank Rodriguez, Stephen Smith and David Storer first presented this paper at the sixth conference on Postal and Delivery Economics: Emerging Competition in the Postal and Delivery Sectors on 17th – 20th June 1998, in Montreux, Switzerland, and it has a wider relevance to current policy debate.

The Government plans to give the Post Office greater commercial freedom and to set up an independent regulator which will bring the Post Office closer to the present position of other privatised, regulated utilities and network industries. At the same time, however, the Government is reviewing utilities regulation and expects to bring forward legislation in 1999/2000. The economic regulators will be working with more explicit ministerial advice and the impact of the social agenda, public service and universal service obligations on competitive developments will have to be measured and taken into account.

The CRI would welcome comments on this paper and further analytical work in the area. Comments, enquiries or manuscripts to be considered for publication should be addressed to:-

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1 Introduction

Network industries generally have an obligation to provide customers throughout a country with service to a specified level. The postal sector is no exception. A universal service is offered by public postal operators (PPOs) at a uniform, affordable set of prices in virtually all developed countries and, historically, this has been supported by the existence of a reserved or monopoly area. For member countries of the European Union, the December 1997 Directive raises the prospect of liberalisation of certain postal markets from 2003 (Official Journal of the European Communities, Directive 97/67/EC (1998)). In so doing, it will remove, at least in part, some of the existing support mechanism for providing a universal service in the 15 member countries and highlights some fundamental questions about the cost of the Universal Service Obligation and its funding in an era of liberalisation.

The Directive requires the European Commission to bring forward proposals for liberalisation by the end of 1998. As a major input to this, the Commission has put in place a set of five studies to examine various scenarios for liberalisation as well as an additional study on the cost of the USO. The liberalisation studies cover the liberalisation of direct mail, of cross-border mail, and of clearance, sorting and transport together with a fourth on appropriate weight/price criteria to define the size of the reserved area. The final study is on modelling and quantification of the impact of liberalisation. Work from this is intended to contribute towards an understanding of the impact of liberalisation on the financial viability PPOs and this, in turn, will be an important factor in determining the Commission’s proposals for change from 2003.

Issues related to the cost of the USO and the financial viability of PPOs are central, therefore, to assessing the extent to which postal markets should be liberalised. The starting point for such calculations should be the adoption of an appropriate method to estimate the cost of the USO under the specific liberalisation scenario being proposed. This requires clarity in the definition of the USO itself and the nature of the questions that such a methodology is seeking to answer. In particular, this is not just a matter of identifying and “costing” a particular service specification. It needs to take account also of other key factors including the extent and pattern of the liberalisation proposed, the regulatory framework and constraints in operation after liberalisation and the extent to which the uniform price remains in place.

The purpose of this paper is to identify and develop a methodology which is appropriate to this task. Although the work has been prompted by the Commission’s need to frame its proposals for change on the basis of sound analysis and firmly based results, the methodology we develop has the potential for wider application. In particular, it provides a general framework for estimating USO costs in an environment where markets are

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being liberalised and the key question to be answered is the extent to which this should occur. This contrasts with the more traditional case where estimates of the cost of the USO are produced for an environment which is static and the purpose of the exercise is to decide if, and how much, an incumbent universal service provider should be paid to fulfil the USO requirement.

An extensive literature has been developed on measuring the cost of the USO in other industries, particularly in telecommunications from which parallels are often drawn with the postal sector (Cave(1995)). However, important work has also been undertaken specifically on posts. Some studies have applied the methodology which has been favoured in telecommunications, namely Net Avoided Cost (NAC) (Eisenblast, Pieper and Stumpf (1995)). Others have been critical of NAC on various counts and developed alternative approaches to measuring the cost of the USO from a wider perspective both in Europe (Cremer, de Rycke and Grimaud (1997), Dobbs and Golay (1995), and Gallet and Toledano (1997)) and elsewhere (Castro and Maddock (1997), Crew and Kleindorfer (1997)).

The remainder of the paper is organised as follows. Section 2 presents a definition of the cost of the USO as this is widely understood and operated in nearly all countries. It reviews the types of measure that could be applied in principle to tackle this question and those that are likely to be used in practice which are based on the financial cost of the USO. The section following explores cross-subsidy between routes which is a central issue in various methodologies and presents a framework for interpreting and assessing the relationship between the two principal measures examined in the paper - Net Avoided Cost and Entry Pricing. These are outlined, discussed and evaluated in sections 4 and 5 respectively. There is a review in section 6 of some of the issues involved in applying the Entry Pricing approach.

The final section of the paper sets out our main conclusions. These are that, following Gallet and Toledano (1997), there is no unique cost of the USO but that the cost depends, inter alia, on a number of factors including the extent of liberalisation, the regulatory framework and the degree to which the uniform price remains in place. Consequently, NAC is an incorrect and misleading approach for the application the Commission has in mind - that is, estimating the cost of the USO in the context of assessing the extent to which liberalisation is desirable. The Entry Pricing alternative we develop explicitly incorporates the effects of competition and entry which are central to this task. It is, therefore, a much more appropriate methodology and one that the Commission should adopt. It is a methodology also which has the potential to be applied to other sectors where the costs and benefits of liberalisation are being explored and evaluated.
2 Statement of the problem

2.1 Nature of the obligation

To estimate the cost of imposing a universal service obligation it is crucial as a first step that we define precisely the nature of the obligation. In this paper, we understand the universal service obligation in posts to consist of:

an obligation to provide at least a defined minimum quality of service at a uniform price to all customers.

We will use this definition consistently throughout the rest of this paper but we note that this is not the definition of the universal service obligation used by the European Commission. Council Resolution 94/C 48/02 defines the USO as being a minimum set of quality standards that should be provided at "affordable prices". The Commission allows member states to have a uniform pricing policy but this is not intrinsic to their definition of the USO. In our view, the Commission's definition is both inadequate and unrealistic, since a uniform pricing policy is a reality in most member states and is crucial to determining the magnitude of the USO cost under all possible approaches.

Using the definition of the USO set out above, it is possible to view the universal service obligation as a set of binding constraints on the two strategic choice variables of the incumbent postal operator: price and quality of service. It is important to recognise that the price and quality elements of the obligation are individually necessary but not sufficient conditions to make the obligation binding on the incumbent's actions and impose a financial cost. An obligation to provide a minimum standard of service to all customers could be met at no financial cost if the incumbent were free to differentiate prices according to the cost of meeting that obligation for different classes of consumer. Similarly, an obligation to serve all customers at a uniform price could (potentially) be met at no financial cost by differentiating the quality of service offered to different groups of customers.

A simple observation stemming from the definition of the USO is the need to define the minimum quality of service standard carefully. Since the incumbent's costs will be a function of the quality of service offered, any estimate of the USO cost will be a function

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1 Although this may not be costless from a welfare perspective either to the consumer or the incumbent. If the minimum quality of service is set too high, it might force the incumbent to offer a service at a price at which demand for the service would be zero. If consumers were willing to accept a lower quality of service at a lower price and the incumbent would be willing to offer that quality of service at the lower price, but is constrained not to do so by the USO, the obligation would result in a loss of both producer and consumer surplus.

2 It can, however, be demonstrated from a general equilibrium perspective that this is suboptimal. Even if the incumbent is able to achieve uniform, marginal cost pricing to all customers with varying quality of service to different groups of consumers, both producer and consumer surplus could be raised by allowing the incumbent the freedom to set differentiated, marginal cost prices for different groups of consumers based on their demand at different levels of service quality. Any distributional inefficiencies would be better eliminated through the use of non-distortionary lump sum taxes and transfers.
of the minimum standard set, as well as the actual service being achieved. This issue is of particular importance in the postal sector because there are a number of different minimum quality standards applied across the European Union. Again the current definition of the USO is inadequate in this respect: the current quality of service standard set by the UK and many other governments is above the minimum level as defined by the Commission and is unlikely to be lowered.

2.2 What is the cost of imposing a USO?

Having clearly defined the obligation to be costed, it is possible to consider the question of the cost of imposing a universal service obligation. This has three important dimensions:

- **the cost to whom**: to the incumbent, the consumer or society at large?
- **in what type of market**: monopoly, partially liberalised or a fully liberalised market?
- **in what type of regulatory framework**: uniform or maximum pricing constraints, managed or free competition?

In considering the first dimension, it is useful to distinguish between the three measures of cost identified by Dobbs and Golay (1995): the profitability, funding and welfare costs.

The profitability or financial cost to the incumbent of imposing a USO on it would focus on:

- calculation of a 'normal' level of profit for the incumbent, consistent with no new entry into the sector at the margin; and
- measurement of the impact of imposing a USO on the incumbent's profitability.

There is inevitably some ambiguity here: the fact that a USO-constrained incumbent is loss-making does not necessarily indicate that there is a financial cost associated with imposition of a USO. To the extent that losses are judged to be caused by productive ('x') inefficiencies, these should be ignored in measuring the cost of the USO. Any measure of the financial cost should be based on a productively efficient provision of postal services. It is also important that the correct uniform price is used in order to reflect financial neutrality through a price level which is consistent with a 'normal' rate of profit on assets. A significant distortion and error is introduced where actual price levels are used if these are either artificially low resulting in postal services which are loss-making or, conversely, prices are set at levels above this resulting in postal services which are earning super normal profits.

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3 This matches in part the criteria set out in Gallet and Toledano (1997) which is based on experience in the telecommunications sector.

4 The regulatory framework may extend beyond price and quality of service restrictions on the incumbent in reserved markets. Even if the market is fully liberalised the regulator may constrain the actions of a dominant incumbent until competition is firmly established.
A wider view of the problem would also consider the 'funding cost' of imposing the USO. This would recognise that imposing a USO also has an impact on consumers. The funding cost measures the effect of imposing a USO through its impact both on the price and the quality of service offered by the incumbent to consumers. The change in price and quality will involve changes in total consumer surplus and will have a distributional impact through transfers of consumer surplus between different classes of consumers. The ‘welfare cost’ of the USO could then be measured as the sum of both the profitability and the funding cost. This would involve measuring both the changes in the producer surplus and consumer surplus as a result of imposing a USO.

The second dimension interacts with the first, but what is clear is that both the financial cost and potentially the welfare cost vary as the assumed market structure varies. Gallet and Toledano (1997) make the point that the financial cost of imposing a USO on an incumbent postal operator with a legal monopoly in all postal markets is by definition zero, if the government allows the monopoly to recover its costs when setting the uniform tariff. The welfare cost may be significant, through the imposition of the dead-weight loss of monopoly and through any static (productive) inefficiencies or dynamic (product innovation) inefficiencies.

### 2.3 How to measure the cost of the USO

The issue of how to measure the cost of the USO becomes important when a regulator or government considers liberalising an industry where it has imposed (and will continue to impose) a USO. Since the USO constrains the incumbent in its two key choice variables, it is important when introducing competition to ensure that there is a 'level playing field' between the incumbent and any potential new entrants. Liberalisation also raises the issue of how to fund the cost of the USO, which we do not explicitly consider in this paper.

The question of how to estimate the cost of imposing a USO was first addressed in the telecommunications industry. The common approach adopted in that sector has been the Net Avoided Cost (NAC) approach (Cave (1995)). This measures the cost of the USO by estimating the impact of imposing a USO on the financial performance of the USO-constrained operator. Application of NAC involves attempting to determine the decisions that a commercial operator would take if it operated in the same market without a USO. The NAC approach identifies those customers, products or areas that are unprofitable at the price and service standard specified in the USO. Under the approach, it is assumed that a commercial operator would be unwilling to serve these unprofitable customers and would withdraw its service. Withdrawing service from such loss-making customers would enable the operator to raise its profitability. The NAC approach determines which

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5 Assuming that the monopoly cannot perfectly price discriminate.
6 Although these could potentially be dealt with through some form of incentive regulation or franchising arrangement for the monopoly rights.
7 There are a number of possible options for ensuring that the USO obligation is met. The obligation to provide USO services may be placed on the incumbent. Alternatively the right to provide USO services in return for a subsidy may be tendered for.
8 Although the government may take the view that there are significant advantages of incumbency which will allow the incumbent to absorb the costs of the USO until competition is firmly established, as was the case in UK telecommunications (Armstrong, Cowan and Vickers (1995)).
customers or routes would be dropped by considering the cost savings that the operator could make by withdrawing service from groups of customers and comparing this to the revenue that those customers or routes generate.

The NAC approach implicitly assumes, however, that there are no other structural changes in the market. Although the approach has been widely used in telecommunications, we are concerned that it is not an appropriate way to measure the cost of the USO in the postal sector particularly in the context of a move towards a more liberalised environment. Indeed, we do not believe there is a single cost of the USO but that this is a function of a number of key factors (Gallet and Toledano (1997)). These include the extent to which postal markets are liberalised, the regulatory framework put in place after liberalisation which will define the constraints on the incumbent in terms of price and product responses and the extent to which the uniform price remains in place. As these variables differ, so will the cost of the USO itself. Later sections of the paper develop and justify an alternative approach to tackling this difficult question.

In formulating that alternative we have developed a different measure based also on financial cost - Entry Pricing. Our reasons for following this route, rather than a measure based either on funding or welfare cost, are essentially pragmatic. The approach pioneered by Dobbs and Golay offers a methodology that allows a wider view of the cost of the USO to be considered. It moves beyond the narrow measure of the financial cost of the USO and considers the welfare cost to society at large of imposing a USO. It measures this by calculating the size of the transfers between consumers inherent in imposing a universal service obligation with a uniform price. Under their approach, the ‘commercial’ prices that the operator would charge are defined as ‘Ramsey prices’. Since Ramsey prices are welfare maximising under a specific set of assumptions, the approach measures the welfare cost of imposing a USO by summing the transfers of consumer surplus between different groups of consumers inherent with a uniform pricing constraint.

Their framework assumes that the incumbent retains a legal monopoly over the whole postal market but given the requirement to evaluate costs in a liberalised market, an extension of their approach would need to allow for at least a competitive fringe in certain activities within the postal sector. Work along these lines has been undertaken by Cremer, de Rycke and Grimaud (1997)) who relax the assumption of a continued postal monopoly and allow for a partially liberated market, with the incumbent operating in both a competitive and a monopoly market. Their paper considers the optimal policy for a regulator with redistributive objectives, developing a methodology to estimate the overall welfare impact of a USO and the optimal financing mechanism for any USO imposed.

There is clearly considerable potential in this line of approach but the pragmatic grounds for developing a more narrowly based measure of the financial cost of the USO are twofold. First, the information and modelling requirements for a welfare cost measure are greater because it seeks to capture a broader range of effects and this makes it more challenging to apply successfully, certainly within the limited timeframes set by the Commission. Secondly, regulators, and in this context the European Commission, have

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9 “Ramsey prices” are a set of welfare maximising prices for a monopolist operating in multiple product markets who, because of fixed costs associated with production and falling or constant average variable costs, would make a financial loss if it priced its goods at marginal cost in each of the individual product markets.
tended to rely more on the financial impact of policy changes to evaluate whether liberalisation is both feasible and desirable. They have tended to take the view that if the financial cost to the incumbent is shown to be relatively small\textsuperscript{10}, the introduction of competition and the opening up of markets will improve welfare by reducing prices for at least some types of consumer. While there is a strong argument for regulators, in their role as promoters of overall economic welfare, to attempt to estimate and allow for the wider impacts of changes more directly and adequately than this, the reality is otherwise, perhaps in part because of the complexity of such a task.

In assessing financial cost measures of the USO for posts, the Dobbs and Golay work also provided an important insight in its emphasis on the USO as an obligation involving a uniform price rather than simply the costs of a given service specification. In particular, it is the combination of the uniform price (and the accompanying constraint on the service specification) together with variations in incremental or avoidable cost on different “routes” in the postal network that is a critical component in determining the overall cost of the USO itself. The next section develops these ideas further. It introduces the idea of profitable and loss-making routes before we go on to outline and assess the Net Avoided Cost and Entry Pricing approaches in more detail, for both can be considered and compared within terms of the framework set out there. Whichever approach is followed, there are some issues common to both - particularly around the problems of estimation in practice - and these also are reviewed in the next section.

\textsuperscript{10} Assuming that an explicit funding mechanism is not established.
3 Cross subsidy between routes

3.1 Profitable and loss-making routes

The term “route” can have a purely geographical meaning of being a path between two points, say, two towns. However, for analytical purposes, we define it rather differently as mail products with specific characteristics or “dimensions”. These include the area and type of delivery, distance and type of mail. An example of a route in the way we use the term would be stamped, first class letters travelling from one area of the country to a neighbouring one for delivery by vehicle in an urban area. Defined in this way, the number of end-to-end routes which make up a postal network can run into thousands.

The uniform price is an integral part of the USO and it applies to most of the products or services offered by PPOs. By contrast, avoided costs per item vary across routes and, in some cases, these differences can be very large. While geography is an element of this, the other dimensions outlined above are also important in terms of their impact on costs. The scale and nature of the cost differences between routes is a key element in the cost of the USO and we emphasise the importance of this type of cost variation in postal systems. Where the uniform price is less than the avoided cost per item, that route is loss-making while a route is profitable where the reverse holds.

A base case illustrating profitable and loss-making routes is shown in Figure 1 where the bars record schematically the difference between total revenue and incremental or avoided cost on a particular route and a postal network is divided into a collection of routes. Underlying this we assume that there is a uniform price, avoided costs vary across routes (ranked from the left in order of decreasing cost avoided per item) and that volumes also differ from route to route. We assume additionally: i) there are no fixed or common costs so that all costs are incremental to individual routes; ii) there is an (“x”) efficient postal operator whose level of prices is set to achieve a “normal” rate of profit on assets, all of which are specific to individual routes and iii) there are no economies of scale or scope.

![Figure 1: Profitable and Loss-Making Routes*](image)

* Profitability on each route is measured by total revenue less
Under these conditions we have:

\[ TC = \sum_i IC_i \], where

- \( TC \) is total cost
- \( IC_i \) is incremental cost on route \( i \).

If we assume that the allowance for a ‘normal’ rate of profit is included in total cost then

\[ TC = TR \], where:

- \( TR \) is total revenue, and

\[
\frac{TR}{q} = \frac{TC}{q} = \sum_i IC_i \quad \text{or}
\]

\[
\bar{p}_u = AIC \], where:

- \( q_i \) is the volume of mail on route \( i \)
- \( p_u \) is the uniform price
- \( AIC \) is the average incremental cost per unit across all routes.

While, then, in this base case the uniform price is given by average incremental cost per unit across all routes, cost variability leads to loss-making and profitable routes as shown in Figure 1. Each bar there is measured by:

\[
\left( p_u - \frac{IC_i}{q_i} \right) \times q_i \quad \text{or} \quad \left( TR_i - TC_i \right)
\]

Summing over all \( i \) routes gives:

\[
\sum_i TR_i - \sum_i TC_i = 0
\]

so that, in this particular case, loss-making routes are exactly matched and cross-subsidised by the profitable ones. Note also that volumes on the very highest cost routes can be expected to be comparatively low so that routes with the greatest overall losses are likely to be ones where, per item, losses are smaller but at the same time volumes are high. Similarly, the lowest cost routes are not necessarily those which carry the greatest traffic and so profits may be higher on those where volumes are large.
If we now assume that total costs are the same as under the base case, but that some of these costs are fixed (and there are no common costs), the uniform price will be unchanged and route volumes will be equal under both cases. We have:

\[ TC = FC + \sum_i IC_i' \], where

\( FC \) is the fixed cost of production, \( IC_i' \) are the incremental costs of route \( i \) and \( IC_i' < IC_i \)

In this case, the uniform price is given by:

\[ \bar{p}_u' = \frac{TR}{q} = \frac{TC}{q} = \frac{FC + \sum_i IC_i'}{\sum_i q_i} \]. Hence,

\[ \bar{p}_u' = \bar{p}_u \] but \( \frac{IC_i'}{q_i} < \frac{IC_i}{q_i} \)

Each bar is now measured as:

\[ \left( p_u - \frac{IC_i'}{q_i} \right) \times q_i \]

Each route is more "profitable" (or has lower losses) relative to the base case because incremental costs are lower while the uniform price remains the same.

The two cases are compared in Figure 2. Incremental costs are proportionately less in the fixed costs case and “raise” the profitability (or reduce the losses) of all routes as measured by the height of the bars. Note, in addition, that the bars no longer sum to zero. The sum of all profits must now generate a surplus not only to cross-subsidise the loss-making routes but also to cover the fixed costs of the network. Clearly, if fixed costs are very large relative to route specific costs, the number and significance of these loss-making routes could become extremely small.
This framework also emphasises two other important points. In the base case, if the uniform price is set below average incremental cost, more routes are loss-making and fewer are profitable, subject to the pattern of cost variability across routes. Loss-making routes, in this case, are not supported fully by profitable routes and recourse is necessary to some additional source of funding such as external subsidy. Secondly, in this framework, the benefits of economies of scale and scope would enter through the achievement of lower average incremental costs on routes as volume rises and hence a lower uniform price consistent with a normal rate of profit. If economies of scale and scope did not exist or volumes were lower, this would imply a higher uniform price.

### 3.2 Measurement and estimation issues

As discussed earlier, measuring the size of losses and profits on individual routes and the extent of implicit transfers between them is central to measuring the cost of the USO. Whatever the approach taken to this, however, there are common issues of measurement.

**The bias to underestimate the true cost**

Experience in the telecommunications and postal industries has shown the need for highly disaggregated cost and revenue data when estimating the cost of the USO under the NAC approach and other approaches requiring route based information. If the available data are not sufficiently disaggregated, these will underestimate the cost of the USO. This is because aggregate route data will show the route as profitable as a whole but mask the presence of loss making traffic within the route. This in-built bias to underestimate the cost of the USO is a significant disadvantage in posts where the postal operators have not traditionally collected disaggregate cost and revenue data. Since most postal operators have enjoyed a legal monopoly, there has been little need to incur the considerable expense of designing and implementing management accounting systems that provide highly disaggregate cost and revenue data nor develop the modelling systems to fully capture volume variabilities. This suggests that some approaches in posts, particularly NAC, would be likely to underestimate the true cost of the USO.
Interdependence of demand and cost functions

While, for practical purposes, it is usually necessary to assume that demand and cost functions are independent across routes, in practice this is unlikely to hold fully (Oftel (1995)). This implies that determining the cost of the USO is typically a non-linear optimisation problem involving iterative search techniques to solve this optimisation problem. It assumes that there is a (local) maximum of the operator's overall financial performance that can be reached through a series of iterations. Given non-linearities in both the cost and demand functions, however, it is unlikely that there will be a unique solution to this problem. If there are potentially multiple equilibria, the USO cost estimate will depend both on the route disaggregation chosen and the order in which the search process is carried out. The simplifying assumption of independence could be important if dropping mail routes which are loss-making would in reality have large spill-over effects on other flows and reduce their profitability. If both demand and cost functions are not independent across routes then it could make iteration under most approaches difficult. There could potentially be several possible combinations of mail flows that a postal operator would hypothetically drop to achieve break-even if its postal monopoly was relaxed.

Differences between the telecommunications and postal sectors

Although parallels are often drawn with telecommunications, there are differences between the nature of the USO in posts and telecommunications. A major difference is that the pricing constraints imposed on universal service operators in telecommunications are much less severe than those imposed in postal markets. Specifically, the uniform price requirement in telecommunications is weaker than in posts because, unlike postal tariffs, call charges vary both by distance and by time of day. The transactions costs of varying charges to users are lower than in posts and the feasibility of being able to do so much greater. Telecommunications operators also have sophisticated two part non-linear tariff structures with connection and usage charges which enable a substantial proportion of fixed costs to be recovered through connection charges. In postal markets the uniform pricing constraint makes the relative scale of the cross-subsidies inherent in the USO constraint much larger. This suggests that, a priori, we might expect the estimated cost of the USO to be proportionately much higher in posts than in telecommunications.
4 Critique of the Net Avoided Cost approach

4.1 The approach

Initial thinking on USO cost estimation in posts has focused primarily on the Net Avoided Cost (NAC) approach because this is the approach that has typically been adopted in the telecommunications sector. The NAC approach can thus be regarded as in effect 'the incumbent approach' to USO cost estimation. The NAC approach has been used to estimate the cost of the USO in posts in various countries including Germany (Eisenblast, Pieper and Stumpf (1995), Kowalewski and Mueller (1995)).

The essential thrust of the NAC approach is:

- disaggregation of the mail network into a matrix of routes based on dimensions such as content, collection/delivery mode and distance;
- evaluation of the per unit long run avoidable cost (LRAC) associated with the provision of each different service/route combinations;
- comparison of this with the uniform/affordable price at which service is actually provided and identification of service/route combinations where revenue falls short of avoidable costs;
- calculation of the avoided cost of the USO as the sum total of cost savings that would result if the universal service provider were to cease to provide service for these 'loss-making' service/route combinations; and
- calculation of the benefits of being a USO service provider, such as the benefit of ubiquity, and then netting these off from the sum total of cost savings to estimate the Net Avoided Cost of the USO obligation.

A more formal statement of the NAC approach is set out below.

Under NAC, we assume that the incumbent offers service on \( n \) distinct routes and that demand on each route is given by:

\[
q_i = f(p) \quad \text{for } i=1..n, \text{ where }
\]

- \( q_i \) is the quantity demanded on route \( i \); and
- \( p \) is the vector of prices offered by the incumbent on each of the \( i \) routes.

Assume that the incumbent has the following cost function:

\[
c(\overline{q}) = f(q_1...q_n)
\]
This cost function is likely to have a very complicated, non-linear functional form. Broadly speaking we can think of a number of ‘classes’ of cost function including:

\[ c(q) = f(q_1) + f(q_2) + f(q_3) + \ldots + f(q_n) \]

: no fixed costs or common costs

\[ c(q) = a + f(q_1) + f(q_2) + f(q_3) + \ldots + f(q_n) \]

: fixed costs but no common costs

\[ c(q) = a + f(q_1 \ldots q_k) + f(q_{k+1} \ldots q_n) \]

: fixed costs and common costs

The first class of cost function is separable in the output vector. Costs will vary as production on each of the routes varies and there are no fixed costs associated with production. The second class of cost function is separable in the output vector but there are fixed costs associated with the business. The third class of cost function has fixed and common costs: the cost function is no longer separable in \( q \).

The USO places an obligation on the incumbent to serve all \( n \) routes at a uniform price (\( \bar{p}_n \)) subject to the constraint that it achieves a normal level of profit\(^{12} \) (\( \pi_n \)):

\[
\max \pi = \bar{p}_n \bar{q} - c(\bar{q}) \text{; subject to } \\
\pi = \pi_n \\
p_1 = p_2 = \ldots = p_n = \bar{p}_n ; \text{ and } \\
q_i > 0 \text{ for all } i
\]

The uniform price solves the demand function and derives the volumes on each of the \( i \) routes served at the uniform price:

\[
\bar{q}^* = f(\bar{p}_n)
\]

Under the NAC approach, the cost of the USO is measured by the hypothetical improvement in financial performance that the incumbent could realise if it was free to drop loss making routes. This is equivalent to assuming that the incumbent must continue to charge the same uniform price but that it is no longer constrained to serve all \( n \) routes. It is assumed that the incumbent would maximise profits at the current uniform price by withdrawing services from loss making routes:

\[
\max \pi = \bar{p}_n \bar{q} - c(\bar{q}) \text{; subject to } \\
q_i = q_i^* \text{ or } q_i = 0 \text{ }^{13}
\]

\(^{11}\) A simple, linear form of this class of cost function would be:

\[ c(q) = c_1 q_1 + c_2 q_2 + \ldots + c_n q_n \]

\(^{12}\) The objective function is set as the profit function for ease of notation. Given the binding constraints on profits and prices, there is likely to be a unique solution. As a result, the monopolist is not ‘maximising profits in any meaningful sense when subject to a profit constraint.

\(^{13}\) On profitable routes, the incumbent would maintain output at its previous level, on loss making routes the incumbent would withdraw service.
If we define the new output vector as $q'$, the cost of the USO is:

$$USO_{NAC} = \left[ \overline{p}_u q' - c(q') \right] - \left[ \overline{p}_u q^* - c(q^*) \right]$$

The formal model demonstrates that in principle, correct application of the NAC approach would require specification of the demand and cost functions to allow the impact of any spillover effects to be considered. In practice, demand and cost independence is often assumed. This is broadly analogous to assuming that the cost and demand functions are separable in the output vector, $q$. In effect it is assumed that:

$$q_1 = f(p_1), q_2 = f(p_2) \ldots q_n = f(p_n)$$

on the demand side. In addition, it is assumed that the cost function is of the following form which, in terms of the earlier classification, allows for fixed costs both at the network and the route level:

$$c(q) = a + (a_1 + c_q q_1) + (a_2 + c_q q_2) + \ldots + (a_n + c_q q_n)$$

Whilst these assumptions are likely to hold for marginal changes in the total output vector $q$, they are unlikely to hold generally. Any parameters ($a_1, c_q$) in either the cost or demand functions may not be stable for large variations in total output.

On the demand side, we can imagine that in response to partial liberalisation, bulk mailers may be able to ‘switch’ their mail onto liberalised routes to take advantage of lower prices. On the cost side, as the incumbent’s total volumes are reduced, the cost of serving routes may increase (in the example given, the parameters $a_i, c_i$ may be constant for marginal changes in $q$ but a function of $q$ for larger changes).

Note that none of the routes is actually to be withdrawn: the approach simply measures the hypothetical improvement in the operator’s financial performance from withdrawing services on those routes. As a result, the approach does not require a new (lower) uniform price to be set at each iteration as routes are withdrawn and costs are hypothetically reduced.

### 4.2 The NAC approach and liberalisation

There are a number of reasons for believing that NAC will not provide an accurate estimate of the cost of the USO in posts. Some of these were reviewed earlier and include the difficulty, which is particularly severe in the postal sector, of obtaining sufficiently disaggregated data to allow an effective calculation and the likely inter-dependence of demand and cost functions across routes but the need, for practical purposes, to assume independence. There is also the issue that NAC is a financial cost measure and so only partially incorporates the overall welfare cost. Nevertheless, while these are important limitations and indicate that estimates of the cost of the USO calculated using NAC need to allow a wide margin for potential error, they are criticisms that apply more widely to other financial cost methodologies which tackle this difficult question.
However, there is a much more fundamental criticism of the approach if it were to be used to attempt to evaluate the cost of the USO under alternative liberalisation scenarios. Experience from the telecommunications industry shows that the NAC approach can meaningfully be applied in a context where:

- the competitive environment is not changing or only changing to a relatively minor extent; and
- the price and cost structure is established and appropriate to the competitive environment.

The NAC approach is not, however, appropriate when trying to establish the size of the reserved area that would be necessary to ensure adequate funding for the provision of the USO by a financially viable universal service provider.

This limitation of the NAC approach has been recognised in the telecommunications sector. Since completing their report on the cost of the USO in UK telecommunications, Oftel's consultants, Analysys, have expressed reservations about whether the methodology is universally appropriate:

"Whilst we conclude that the methodology can easily incorporate the financial changes brought by the introduction of competition - for example, interconnect costs and revenues - other more fundamental issues make application of the methodology in a highly competitive environment more difficult" (Oftel (1995)).

The key point here is that the NAC methodology assumes little competitive response or dynamic innovation in response to liberalisation and the new entry that this will inevitably precipitate. The methodology would focus on loss-making routes based on the USO operator’s current cost structure. It does not allow for any radical restructuring in the way that the operator delivers the service on each of the routes in response to competition. In effect it assumes that the operator's cost function is fixed despite a structural shift in the nature of the market it faces.

The European Commission is currently considering a spectrum of possible scenarios to liberalise the postal sector. These include a phased reduction of the postal monopoly through reductions in the size and weight limits that define the postal monopoly. The Commission is also determining whether the USO cost should be funded through a reserved area or through a USO fund. Many of the scenarios under consideration would result in considerable changes in the structure of the postal sector and would be likely to have a significant impact on the prices and volumes on all postal routes. This reinforces the objection that the NAC approach is inappropriate in the postal sector because it is more appropriate when considering marginal changes to the industry structure, the pattern of service provision and the resulting prices and volumes.

It is important to recognise that the NAC approach was used to answer a different question in UK telecommunications to that being posed by the Commission in relation to the postal sector. Liberalisation of the telecommunications market had already taken place, with the removal of BT's legal monopoly, competition was established and the regulatory framework was already in place (see Armstrong, Cowan and Vickers (1995)). It was also recognised that BT's universal service obligations covered only a small
proportion of their business given their complex, non-uniform tariff structure, unlike in posts. Given this, the NAC approach was able to provide a reasonably robust estimate of the financial cost to BT of its USO given the structure of the telecommunications market after liberalisation, its tariff structure and the regulatory framework it faced. The NAC approach was not used by Oftel to consider whether liberalisation of the telecommunications market would be beneficial to customers nor to determine the extent of liberalisation of the telecommunications market.

We conclude that it would be inadvisable to use the NAC approach to estimate the cost of the USO in posts because it is inappropriate in the context of the question being asked: NAC is only suitable for marginal changes to the competitive and regulatory environment and is not suitable for evaluating the impact of various liberalisation scenarios some of which involve major structural change.

As a result, it is important to develop an alternative approach to estimating the cost of the USO. The alternative approach should aim to overcome the identified weaknesses of the NAC approach and:

- should be robust in principle to calculating the USO in a diverse number of potential/hypothetical market situations and regulatory frameworks, including full liberalisation of the postal market;

- should be capable of measuring the cost of moving to any point on the spectrum between the current industry structure and full liberalisation;

- should attempt, where practicable, explicitly to consider the spill-over effects on both demand and costs on all routes if prices and volumes change on liberalised postal routes; and

- should, if possible, reduce the in-built bias to underestimate the true cost of the USO in the absence of highly disaggregate cost and revenue data.
5 Entry Pricing

5.1 The rationale for the approach

The Entry Pricing approach is based on the assumption of (some degree of) relaxation of the postal monopoly. It is then assumed that competitive entry will occur. We show that, under this approach, the cost of the USO is measured by the sum of the losses of revenue to the incumbent on each of the routes where entry occurs less the impact on the incumbent’s costs. As such, this measure of the cost of the USO emphasises the need to focus on the financial impact on the PPO of effects on routes which are profitable to entrants rather than, as under NAC, those which are loss-making to the incumbent.

The assumption of market entry requires that the following two conditions be met:

- that competition in the provision of postal services is feasible; and
- that regulation of the market will ensure that the (actual or perceived) threat of predatory behaviour by the incumbent postal operator will not deter market entry.

Experience clearly suggests that competition in the postal market is feasible: there is already competition in the deregulated parts of the postal market in the UK. There is also evidence of competitive entry in postal markets where liberalisation has already occurred and the legal monopoly has been relaxed (for example Sweden and New Zealand (Leskinen and Palgrem (1997), Allen (1997)).

Given that some degree of competitive entry is likely to follow any liberalisation, it is important to consider the form of competition that will evolve under different liberalisation scenarios. The form of competition will be a function both of the underlying market structure of the postal sector and of the regulatory arrangements that are put in place. Broadly, we can identify a number of potential forms of competition:

- **competition in narrow niches**: in which new entrants provide end-to-end postal services in specific markets (for example, the contract market) or on specific routes (for example, city to city mail);

- **competition with regulated access to the incumbent’s network**: in which competitors will provide end-to-end services but will have regulated access to say the incumbent’s (monopoly) local delivery services; and

- **national competition**: with other national postal operators emerging offering end-to-end services on the bulk of incumbent's routes.

The first is the form of competition that appears most likely to emerge in the postal sector after liberalisation, at least over the medium term. Competition in narrow niches, while the incumbent continues to have a uniform pricing requirement, is possible as a new entrant could profitably take traffic from the incumbent by undercutting the uniform price. Even without the uniform price, such an outcome would be likely to arise, at least partially, because of the transactions costs in differentiating prices fully. Note that natural
monopoly in postal networks is not inconsistent with inefficient cream skimming entry of this kind if the uniform pricing constraint continues to be imposed on the incumbent. If the market is best served by a single operator, entry of this kind will reduce welfare by raising the total cost of providing postal services.

The other two forms of competition are less likely in posts but should not be discounted as both have been observed in other liberalised public service industries. The provision of postal services can be divided into a number of distinct activities (clearance, sorting, transport and delivery). Although these activities are not markets in themselves, in the sense that customers' demand is for the provision of end-to-end services, the regulatory framework may seek to unbundle these activities to allow competitors access to them in providing their own end-to-end services. A new entrant may then use say, the incumbent's delivery services at a regulated price and use its own clearance, sorting and transport facilities.

This model has been adopted by the European Commission in other network industries (telecommunications, electricity and gas\footnote{European Commission Directives requiring unbundling of distinct activities and third-party access to network assets at regulated prices have been issued covering the electricity and telecoms sectors. In the natural gas sector, the Directive has not been issued to date but the Council’s Common position places the same requirement on gas companies.}) and has been proposed as a possible model for posts\textsuperscript{15}. In each example it is envisaged that retailers may bundle each of the separate activities and market the final product to customers without owning any physical production assets themselves. The telecommunications industry in the UK provides an example of where national competitors to the incumbent have emerged.\textsuperscript{16}

The Entry Pricing approach is robust to estimating the cost of the USO under any of the three forms of competition but it is important to determine which form of competition is appropriate as the cost of the USO will vary according to the form and scope of competition that emerges.

\section*{5.2 Key features of the approach}

Under the Entry Pricing approach some degree of entry is assumed. This has two important implications:

\begin{itemize}
  \item the prices that are the appropriate point of comparison in costing the USO are Entry Prices - the prices that a new entrant to the postal market would charge on any particular route; and
  \item in deriving these prices, the appropriate costs are the costs of the new entrant, and not necessarily the incumbent's own incremental costs.
\end{itemize}

\textsuperscript{14} European Commission Directives requiring unbundling of distinct activities and third-party access to network assets at regulated prices have been issued covering the electricity and telecoms sectors. In the natural gas sector, the Directive has not been issued to date but the Council’s Common position places the same requirement on gas companies.

\textsuperscript{15} The Postal Notice recognises a number of distinct intermediate product markets (clearance, sorting, transport and delivery) in posts and places a requirement for accounting transparency and non-discriminatory access to the incumbent’s postal network.

\textsuperscript{16} Although in this example, the creation of a duopoly resulted from government policy and the regulatory regime. (Armstrong, Cowan and Vickers [1995]).
Even if the incumbent were judged likely to continue to enjoy a dominant position in the industry, new entrants costs should be used as the basis for determining prices in each of the (potentially) competitive sectors of the market. While it is true that the incumbent would be likely to enjoy significant advantages as a result of its dominant position immediately after liberalisation, it would also be likely to face regulatory constraints in setting its prices. In an unregulated market, the incumbent would be expected to lead in setting commercial prices for each of its products. In reality, this scenario is unlikely. Even if the uniform pricing constraint was relaxed, as the dominant producer, the incumbent would be open to charges of predatory pricing from either a regulator or the competition authorities if it posted a lower price than a new entrant in response to a loss of market share. Experience from other network industries suggests that the incumbent could be constrained to follow and not to lead in price until effective competition had been established. This precedent has been set in both the gas and electricity industries in the UK in their phased transition to full competition.\textsuperscript{17}

Under the approach, it is possible to assume that a uniform pricing constraint imposed on the incumbent remains in place. The regulatory framework will then determine how the incumbent is allowed to respond to competition after liberalisation. As a base case, it is assumed that the incumbent will continue to be required by its regulator to maintain uniform prices.

This base case is likely to produce a large estimate of the cost of the USO. If the incumbent is unable to lower its prices, particularly, to contract customers in response to new entry, it is likely to lose large volumes of mail (and even larger amounts of contribution). The scale of these losses may suggest that an alternative regulatory framework would be one in which the incumbent is allowed to deviate from the uniform prices for contract customers in response to competition. An alternative case could reinterpret the uniform price as a maximum price constraint for all customers. Under this alternative case, the cost of the USO would be measured assuming that the regulatory framework will prevent the incumbent from raising its prices on any routes but will allow it to lower its prices in response to new entry. Under this assumption, the incumbent will only face competition on those routes where the current uniform price is above the new entrant's costs on that route.

5.3 The cost of the USO under the approach

The impact of new entry on the USO operator’s financial position will depend on the relationship between the operator’s cost function and the cost function of a new entrant:

- on routes where the operator’s incremental costs are below new entrant costs, for example, as a result of economies of scale or scope, then the operator would be able to price at the new entrant price and continue to enjoy some contribution on the competed routes;

\textsuperscript{17} Standard Condition 13 of the Gas Suppliers’ Licence permits a dominant supplier in a market to offer to supply to all or a class of customers in an area on terms, including price, which are reasonably necessary to meet established competition (Ofgas [1997]). Offer has proposed a similar licence condition for Electricity supply licences in the UK. (Offer [1996/7]).
• on routes where the operator’s costs are above new entrant costs, for example, as a result of inefficiencies or because the new entrant enjoys economies of scope between its postal business and other businesses, the operator would have to price above the new entrant's price and would lose significant market share on the competed routes;

• on routes where the operator’s costs are equal to new entrant costs, then the operator will match the new entrant's prices but would make only normal profits on its traffic on the competed routes.

In all three cases, the incumbent will bear a financial cost as a result of having a USO imposed on it. New entry will only occur on those routes where the current uniform price is above the new entrants' cost of provision. Under the uniform price, the incumbent is earning contribution on each unit on these routes. However, under the monopoly, these represent a transfer that funds the loss making USO routes, where the uniform price is below the cost of provision.

Assuming no price response is allowed, the incumbent will lose significant volumes from contract customers as it continues to charge a uniform price above the new entrants prices on the competed routes. It will no longer be able to fund the loss-making USO routes and fixed costs of the network in full. Alternatively, the incumbent may be allowed to lower its price to the new entrants’ price on some routes. On these, it will only be able to maintain some contribution from contract customers to cover these losses if it has lower costs than new entrants. This will inflict a financial loss on the incumbent unless the extra volumes generated by the reduction in price for contract customers are sufficiently large to offset the loss of per unit profit from contract customers.

This is unlikely, however, since the volume effects will probably not be large given the low overall price elasticity of demand in postal markets (Nankervis, Carslake and Rodriguez (1997)). It is also unlikely that the incumbent could sustain a significant cost advantage over its competitors except from the effects of significant economies of scale and scope. Apart from these, any difference in operational performance or costs would be expected to close over time. If entry were to be at the national level and the new entrant enjoyed significant economies of scope between its postal and other businesses, the incumbent might in principle gain access to these by expanding its activities outside the postal sector. Conversely, if the incumbent enjoys significant economies of scale and scope then any new entrant would need to expand its activities greatly to obtain access to the same economies of scale and scope.

The Entry Pricing approach assumes that the current USO will remain in place but that the incumbent’s monopoly will be relaxed. After liberalisation, new entrants will offer lower prices on those routes where the unit cost of serving the route is below the current uniform price. The incumbent will continue to offer service on these routes at the uniform price. The price charged on each of these routes by new entrants will be the entry price, which is the unit cost of a new entrant on that route. The price on non-competed routes will continue to be the uniform price and the incumbent will continue to serve all of these routes at that uniform price.

Under the Entry Pricing approach, then, the cost of the USO is measured by the loss of the implicit transfer between profitable customers (at the uniform price) and the loss
making customers (who will continue to be served at the uniform price). An estimate of the USO cost is obtained by:

- defining a number of end-to-end mail routes which, together describe the whole postal network;
- determining new entrant costs on each of the routes, possibly using the incumbent’s marginal costs as a proxy for these;
- identifying the competed routes where new entrant cost is below the current uniform price and entry is therefore likely to occur;
- comparing the current pricing and volumes on each competed route with the liberalised scenario where the incumbent's volumes are determined on the competed routes by its volumes when charging the uniform price in the face of competition from new entrants at the lower entry prices; and
- measuring the cost of the USO as the financial loss imposed on the incumbent as a result of the loss of revenue (less cost savings) of the traffic lost to competition from having to offer a uniform price above the competitive entry prices, whilst continuing to serve the non-competed routes at a loss at the uniform price.

In the main, entry can be expected to be on denser routes and, depending on the liberalisation scenario being considered, to only a subset of all potentially competed routes. As a result, Entry Pricing should prove less difficult to apply in practice than NAC where it is necessary to estimate losses on all loss-making routes, at least some of which are likely to have relatively small amounts of traffic.

A simplified illustration of the Entry Pricing approach is provided in Figures 3a-c. The lower panel, Figure 3c, reproduces the fixed cost case from Figure 2 where the total of losses on the loss-making routes is less than profits on the profitable routes by the extent of the fixed cost of the network. The Entry Pricing measure of the cost of the USO is the loss of contribution on routes which are competed following liberalisation of the postal market and is shown schematically. The figure is also consistent with the existence of economies of scale and scope for, as discussed in Section 3, the greater the extent of these, thereby allowing a lower overall level of costs, the lower will be the uniform price prior to liberalisation consistent with a normal rate of profit. This reduces the number of routes where new entrant marginal costs would be below the uniform price. The relationship between these is shown in the top panel Figure 3a.

For those routes where new entrants costs are below the uniform price, these costs determining the entry price, volumes are cream skimmed (Figure 3b) and these losses undermine the ability of the PPO to fund the loss-making USO routes and the fixed costs of the network. Note that because the entry price is driven by the entrants marginal costs, not those of the incumbent, competed routes do not map identically into the set of routes that are profitable to the USO provider. Any lack of congruence, however, is likely to be mainly in routes which are close to break-even, as shown in Figure 3c.
Figure 3a: New Entrant Costs Determine Prices on Competed Routes

Price/Marginal Cost of Entrants

New Entrant Costs

Uniform Price

Entry Price

Routes in decreasing order of costs of incumbent

Figure 3b: The Incumbent will Lose Volumes on the Competed Routes

Mail Volumes

Incumbent volumes at uniform price
Incumbent volumes lost
Extra volumes on route due to

Routes in decreasing order of costs of incumbent

Figure 3c: Loss of Contribution Undermines Funding of Loss-making Routes and Fixed Costs

£

Routes in decreasing order of costs of incumbent
5.4 A formal statement of the Entry Pricing approach

Under the Entry Pricing approach, it is assumed that prior to liberalisation, the incumbent has a legal monopoly in all \( n \) routes. We make the same assumptions about demand and cost functions, profits and uniform prices as under the NAC approach\(^\text{18}\), namely that:

\[
q_{mi} = f(p_m) \quad \text{for } i=1 \text{ to } n,
\]

where

- \( q_{mi} \) is the quantity of the incumbent's product demanded on route \( i \);
- \( p_m \) is the vector of prices offered by the incumbent on each of the \( n \) routes;
- \( c_m(q_m) = f(q_{m1} \ldots q_{mn}) \)

We then assume, as under NAC, that the uniform price \( p_{mu} \) is set to achieve a normal level of profitability, \( \pi_n \)\(^{19} \):

\[
\max \pi = p_m q_m - c_m(q_m) \quad \text{subject to } \quad \pi = \pi_n \quad \text{and } \quad p_{m1} = p_{m2} = p_{m3} \ldots = p_{mn} = p_{mu}
\]

Solving this profit function, we can derive the vector of quantities on each route \( q_m^{*} \) at the uniform price.

We now assume that the market is liberalised and, further, that the market is contestable (specifically, we assume that the incumbent is not able to sink a significant proportion of its costs).

New entrants costs are given by\(^\text{20}\):

\[
c_e(q_e) = f(q_{e1} \ldots q_{en}) \quad \text{where}
\]

- \( q_{e1} \) is the output of a new entrant’s product on route \( i \).

The entry condition determines those routes where new entrants may compete with the incumbent. New entrants will only consider entry on routes that are profitable at the current uniform price. Since in the absence of competition the incumbent will continue to offer services at the uniform price, new entrants will only consider entry on those routes where their marginal costs are below the current uniform price:

---

\(^{18}\) We use a subscript \( m \) to denote the incumbent.

\(^{19}\) As in the formal statement of the NAC approach, the objective function is set as the profit function for ease of notation. Given the binding constraints on profits and prices, there is likely to be a unique solution. As a result, the monopolist is not ‘maximising profits in any meaningful sense when subject to a profit constraint.

\(^{20}\) Since we do not assume homogenous costs, we cannot assume that either the incumbent or the new entrants will necessarily price at marginal cost. Note that entry to individual routes may be by one or more new competitors.
\[
\left. \frac{\partial c_e}{\partial q_{ei}} \right|_{\tau_e} \leq p_{mu} ;
\]

We assume that demand is now a function of both the incumbent's and the new entrants prices, so that:

\[
q_{mi} = f(\overline{p}_m, \overline{p}_e) ;
\]

and

\[
q_{ei} = f(\overline{p}_m, \overline{p}_e) ;
\]

We now distinguish two possible cases. Case 1 assumes that the incumbent must continue to charge the pre-liberalisation uniform price \((\overline{p}_{mu})\) on all routes. Case 2 assumes that the incumbent must continue to charge the pre-liberalisation uniform price on all non-competed routes but that it may lower prices in response to competition on routes where entry occurs.

**Case 1: The incumbent must continue to charge a uniform price after entry**

In this case a new entrant will have a strategic advantage because the incumbent cannot change its prices in response to entry. The new entrant will set its prices to maximise its profits given demand, the incumbent's uniform prices and the new entrant's cost function:

\[
\max \pi_e = \overline{p}_e \times \overline{q}_e (\overline{p}_u, \overline{p}_e) - c_e (\overline{q}_e) ;
\]

Maximising this profit function will yield the new entrant's price vector and the resulting volumes for the new entrant and the incumbent. A new entrant will not enter on those routes where the uniform price is above the cost of providing service. Since we are assuming that the market is competitive, new entrants will maximise profits by setting their prices equal to marginal costs, for a given scale of entry. Solving this function will yield:

\[
\overline{p}_e' ; \text{ the vector of prices for the new entrant};
\]

\[
\overline{q}_e' ; \text{ the vector of volumes for the new entrant};
\]

\[
\overline{q}_m' ; \text{ the vector of volumes for the incumbent}.
\]

Competed routes can be defined as those routes where:

\[
q_e' > 0
\]

We assume that there are no changes to the prices and volumes on the non-competed routes, which the incumbent continues to serve at the pre-liberalisation uniform price.

\[\text{21} \quad \text{We assume that because of the presence of search and transaction costs the incumbent may be able to maintain positive demand on competed routes even if it continues to price above the new entrants price.}\]
The USO cost is then measured as the sum of the losses of revenue from each of the competed routes after new entry at the lower prices less the impact on the incumbent's costs:

\[
USO_{EP1} = \left( \sum \left( (p_u \times q_u^*) - (p_u \times q_u^m) \right) \right) - \left[ c_m(q_u^* m) - c_m(q_u^m) \right] \text{ for all i where: } q_u^m > 0
\]

The movement in costs could be in either direction. The incumbent will be able to shed some costs at the lower volumes on the competed routes but if volume losses are large, this may lead to a loss of economies of scale and scope. This will raise the cost of provision on the non-competed routes.

**Case 2: The incumbent must not raise prices on any routes but may lower prices in response to competition**

We assume that both the incumbent and the new entrant set their prices to maximise profits on the competed routes\(^{22}\). The new entrant will be unconstrained in setting its prices, the incumbent will be constrained not to set prices above the current uniform price.

The incumbent, in setting prices, will seek to:

\[
\max \pi_m = p_m \times q_e(p_u, p_e) - c_m(q_m) \text{; subject to } p_m \leq p_u
\]

The new entrant, in setting prices, will seek to:

\[
\max \pi_e = p_e \times q_e(p_u, p_e) - c_e(q_e)
\]

To solve for the optimal price vectors for the incumbent and the new entrant, we use the concept of Nash Equilibrium. We find the set of prices\(^{23}\) for the incumbent \((p_m^*)\) and the new entrant \((p_e^*)\) that satisfy the following conditions. Again, we would expect the form of this solution to be that the new entrant prices at marginal cost, given the assumption of competitive entry:

\[
\pi_m(p_m^*, p_e^*) \geq \pi_m(p_m^*, p_e^*) \text{; for all } p_e \in R \text{; where } R \text{ is the set of real numbers; and}
\]

\[
\pi_e(p_m^*, p_e^*) \geq \pi_e(p_m^*, p_e^*) \text{; for all } p_m \in R \text{ where } R \text{ is the set of real numbers.}
\]

\(^{22}\) From the incumbent's point of view, it is maximising the contribution from these routes towards the losses incurred on the non-competed routes.

\(^{23}\) Since the demand function determines the volumes as a function of price, we can substitute for the quantities in the profit function to define it in terms of price.
We can then determine the volumes \( q_{m}^{'} \) at these prices for the incumbent and for the new entrant \( q_{e}^{'} \). The USO cost is then defined, analogously to the expression USO_{EP1} in Case 1, as:

\[
USO_{EP2} = \sum \left( \left( p_{u} \times q_{m}^{'} - (p_{m}^{'} \times q_{m}^{'}) \right) - \left[ c_{m} - c_{m}^{'} \right] \right) \text{ for all } i \text{ where: } q_{e}^{'} > 0
\]

5.5 The relationship between Entry Pricing and Net Avoided Cost measures

The link between the Net Avoided Cost and the Entry Pricing approaches is illustrated in Figure 4. The Entry Pricing measure is as shown in Figure 3c and records the loss of contribution from profitable routes due to entry following the liberalisation of postal markets. This loss of contribution reduces the ability of these routes to fund those that are loss-making and also the fixed costs of the network. By contrast, the sum of the losses on the loss making routes is equal to the avoided cost component in the NAC measure.\(^{24}\) This records the potential savings that could be realised if these loss-making routes were no longer served at the existing uniform price with no other changes occurring in the market. While the Entry Pricing estimate clearly will vary significantly according to the degree of liberalisation, post-liberalisation pricing constraints and the extent of entry, the NAC estimate as normally calculated is invariant to all these given its focus on loss-making routes at the existing uniform price.

Only under very particular circumstances will these alternative measures yield similar results and, in fact, they exhibit a much stronger tendency to **diverge**. If route specific costs are a comparatively low share of overall costs, the number of loss-making routes also will be very low as will the NAC measure of the cost of the USO. The corollary of a very low number of loss-making routes, however, will be that the number of profitable routes will be very high. Liberalisation would offer the potential for many of these to become competed routes and so the Entry Pricing measure of the cost of the USO would yield a very high estimate, too. Estimates from the NAC and Entry Pricing measures are inversely related to one another and a low estimate of the cost of the USO from NAC is likely to imply a high estimate under Entry Pricing and vice-versa.

\(^{24}\) The full NAC estimate will be smaller than this to the extent that there are financial benefits from being the USO service provider.
Profitability of route*

Loss of contribution due to entry

Cost of USO Under Net Avoided Cost (NAC) = Total Losses on Loss-Making Routes**

Cost of USO under Entry Pricing = Total Loss of Contribution on Competed Routes

Routes in decreasing order of costs

* Profitability on each route is measured by total revenue less avoided cost.

** Less any benefits from being USO service provider.
6 Issues on the application of Entry Pricing methodology

Liberalisation Scenarios

The Entry Pricing approach requires a clear specification of particular liberalisation scenarios for it to be possible to produce an estimate of the cost of USO in that environment. The key elements of this are the specification of the services to be opened up to competition, the regulatory framework and the extent to which prices will be allowed to respond to entry on competed routes. In principle, each scenario, ranging from partial to complete liberalisation, will result in a different environment and, hence, separate estimate of the cost of the USO for each scenario. Under the Entry Pricing approach, intermediate scenarios merely restrict the number of routes that must be considered as a subset of all routes served by the incumbent. If, for example, liberalisation of cross border mail is proposed, then new entrants costs will be calculated only on cross-border mail routes. The cost of the USO, however, will be an increasing function of the degree of liberalisation - the more routes are open to competition the less the incumbent will be able to fund the loss making routes and fixed costs of the postal network.

Economies of scale and scope

If the volume losses after entry cause a loss of scale or scope economies, then not only will the incumbent lose part of the transfer from the profitable routes but the size of the losses on the loss-making routes will also increase. In this situation, the cost of the USO would be measured by the loss of the transfer from profitable routes and the increase in the cost of serving the loss making routes. Note that the formal statement of the model, set out above, clearly still holds but it may become more difficult to estimate costs adequately.

Similarly, although it is assumed that the current uniform price is maintained and, therefore, that there will be no volume effects on the loss making routes, the incremental costs of serving these routes will increase if there is a loss of economy of scope. A possible example could be if as a result of entry, the scale of the incumbent's operation contracted to the point where volume discounts in purchasing vehicles were reduced. This increase in the purchase price of vehicles would spill-over onto the loss-making routes raising the incremental costs of serving the routes. As the volumes and uniform prices remain unchanged, the losses on each loss-making route will have increased.

Although the importance of spill-over effects following partial liberalisation are integral to the analysis: if a particular stream of mail is opened to competition, users may switch their mail to these liberalised routes to take advantage of lower prices. The volume of mail on a particular route may be a function of both the regulatory regime and relative prices. In the example cited, bulk domestic mailers might send their mail from another European country to take advantage of lower prices on the liberalised cross border routes.
**Tariff adjustments and financial neutrality**

The current uniform price may not be the appropriate benchmark price to use in estimating the cost of the USO under the Entry Pricing approach. As noted earlier, financial neutrality is also an important issue in correctly applying the NAC methodology. The current uniform price may have been set administratively and the incumbent may be running at a loss, because prices have been set at a low level, or earning excess returns if prices are too high.

It is important, therefore, to define an appropriate level of profitability and the implied uniform tariff for the incumbent. Under the approach it is desirable to calculate a 'normal level' of profit and the corresponding uniform price consistent with this profit level. When estimating the cost of the USO, the appropriate benchmark price (and volumes) may need to be hypothetical uniform prices and not the actual uniform price. If the uniform price used is above this level, it will yield a higher estimate of the cost of the USO under Entry Pricing (but a lower one under NAC) than with the appropriate benchmark price (and volumes). The converse will hold for both methodologies if a uniform price below this level is used.

**Specification of Service Levels**

In the statement of the Entry Pricing model, it has been (implicitly) assumed that the current service standard offered by the incumbent postal operator will be matched by any new entrants. It is possible that for certain mail flows, new entrants may offer lower service standards at lower prices - or effectively new routes. In determining the costs of new entrants, it is important to understand the relationship between the cost of delivering postal services and the quality of service offered. If on certain routes, consumers are willing to accept a lower service quality at a lower price and the incumbent remains constrained to offer the USO quality of standard, then new entrants costs on that route may be significantly lower than the incumbent’s costs and the incumbent may lose significant volumes of mail.

As the USO is defined as a set of constraints on both the price and quality of service offered by the incumbent, the cost of the USO may be higher if the current quality of service obligation is above that which consumers would choose given freedom to chose their supplier. The extent to which the government or regulator is willing to adjust the quality of service in response to market developments after liberalisation will have a significant impact on the estimate of the cost of the USO.\(^{26}\)

\(^{26}\) For a discussion of the appropriate quality of service standard see Elsenblast (1996).
7 Conclusions

The prospective liberalisation of parts of the European postal market from 2003 has heightened interest again in measuring the cost of the USO in posts. The reserved area currently allows PPOs to meet the obligation but liberalisation will undermine their ability to internally ‘fund’ the USO. It is clear that a methodology which is adequate to the task of costing the USO in this environment of radical change must be capable of dealing with the effects of its main impact - namely, the entry of competitors into a range of segments in the market.

Our starting point in addressing this is to define the USO in line with how the vast majority of countries, if not the Commission, view this - as an obligation to provide at least a defined minimum quality of service at a uniform price to all customers. The cost of meeting this obligation depends not only on the specification of the level of the universal service itself but also on the market and regulatory environment within which the universal service provider operates and the continued existence of the uniform price. There is no single cost to meeting this obligation which holds across all possible market and regulatory environments - different environments or degrees of liberalisation imply and, indeed, drive the cost of the USO (Gallet and Toledano (1997)).

Although there is a strong case for policy makers and regulators to take an economy-wide or welfare economic perspective on the cost of the USO, previous experience suggests that they have tended to follow a more narrowly based framework based on financial cost combined with a view that increased competition and price reductions for at least a subset of consumers will be sufficient to raise welfare overall. In particular, the Net Avoided Cost measure, which is of this class of models, has been developed in the telecommunications sector and carried across to some work in posts. NAC, which focuses on the cost to the operator of running loss-making routes, is an appropriate measure where the market is relatively stable. It is totally unsuited for application where rapid change is occurring or, worse still, as a way of assessing whether such a change should occur.

The paper develops and sets out an alternative, Entry Pricing, which focuses specifically on an evaluation framework where competition and entry are central to the methodology. The cost of the USO here is measured by the loss of contribution to support loss-making routes and the fixed costs of the network due to entry by competitors. Under this measure, a different liberalisation scenario would produce a different pattern of entry, impact on the profitability of a different set of routes (as defined widely in the paper) and hence produce a different cost of the USO.

We should stress that these alternative methods will not necessarily produce similar results and that, in general, the reverse is likely to be the case. A low estimate of the cost of the USO under NAC, because there are few loss-making routes, implies the potential for profitable entry on many routes. Consequently, because entry on a large scale would be likely to occur in these circumstances, a high cost of the USO would be estimated under Entry Pricing as volume and contribution loss due to entry undermines the PPO’s ability to support the fixed cost of the network and the number of loss-making routes at the pre-liberalisation uniform price rises as a result of consequential loss of economies of scale and scope.
The European Commission is seeking ways to evaluate the cost of the USO and the impact of alternative liberalisation scenarios. If it wishes to focus on a financial cost measure, the results of a calculation based on Net Avoided Cost will seriously mislead it and understate the effect of liberalisation on the financial viability of PPOs. Entry Pricing is a methodology which is appropriate to the task in hand and the Commission should adopt it. Although the paper focuses on this case, more generally, the approach we have developed in the paper has the potential for use in applications elsewhere where there is a requirement to estimate the cost of the USO in the context of market liberalisation and the entry of new competitors to an industry.
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