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UNIVERSAL SERVICE: AN ECONOMIC PERSPECTIVE*

by

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ABSTRACT:** *This paper discusses some important issues that feed the debate on the notion of Universal Service, namely, its definition, justification, cost and financing, within a unified economic framework. In view of the diversity of both the historical and forward looking situations under which the implementation of universal service is envisioned, we provide a systematic analysis of the economic trade-offs associated with various scenarios. We also draw on some actual universal service experiences that have reached some appreciable level of maturity, most notably in telecommunications and postal services, to illustrate and sometimes fine tune some of our arguments.*

1 Introduction

The universal service obligation (USO) is a cornerstone of industrial and regulatory policies in the major network industries of

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** *Résumé en fin d'article; Zusammenfassung am Ende des Artikels; resúmen al fin del artículo.*

most industrialized and developing countries. In particular, it occupies a prominent place in the policy debate within the EU and the United States. It is probably the major building block of the concept of *public service* which is central to regulatory policies in many European countries. In many instances, universal service was historically provided by a monopolistic public or regulated operator and its financing mechanism was designed accordingly. The ongoing liberalization process has made, to a large degree, these traditional arrangements obsolete.[1] While the need for monopoly protection has been questioned, the very idea of universal service remains relatively unchallenged. Most regulators express a strong commitment to universal service, which often motivates a large fraction of the remaining regulatory intervention in otherwise liberalized industries.[2] Consequently, new questions arise and regulating authorities face the problem of organizing the provision and financing of universal service in a competitive environment. In this paper, we address some of these questions by providing a systematic economic analysis of the USO.

The plan of the paper is as follows. The next section discusses the main economic arguments that can be brought up when thinking about the definition and the rationalization of universal service. This theoretical discussion sets the grounds for the remaining more policy-oriented sections. Section 3 deals with the notion of cost of the USO, an issue which has recently drawn much attention. We point out difficulties associated with the definition as well as the measurement of this cost and discuss some possible ways to alleviate them. Finally, in Section 4, we examine the process of financing of the USO. We consider and compare alternative financing arrangements in various types of environments for the purpose of analyzing their respective advantages and disadvantages.[3] An appendix discusses some economic aspects of a decision that has been made by the UK telecommunications regulatory authority (Oftel) concerning the financing of universal service.

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1 In the telecommunications, cross-subsidies from profitable to non-profitable segments of the industry have played, historically, a major role in the implementation of universal service. Today, competition on the profitable markets has come to threaten the feasibility of this traditional mechanism.

2 Telecommunications in the United States and the United Kingdom provide prominent examples.

3 At this stage, it is important to point out that while the so-called network industries that are concerned by the issue of universal service have a number of common features, they also differ in many significant respects. In this paper, however, we abstract from these differences and consider some generic form of a network industry.

2 The concept of universal service

2.1 Definition of the USO

Even though the precise definition of universal service is, to a large extent, country, industry and most likely even period specific, some crucial elements have consistently been associated with this concept.[4] From this perspective, one can generically view the USO as the obligation of an operator to provide *all* users with a range of *basic* services of *good* quality at *affordable* rates.[5] In many instances, uniform pricing is imposed as an additional requirement. Typically then, the operator may not differentiate its prices (or pricing policies) neither geographically nor between consumer types (households or firms). The above definition of universal service raises some practical difficulties that are discussed in the context of US telecommunications experience.

Four criteria have provided guidance in the determination of telecommunications services that should be considered for inclusion into the definition of universal service. These are the extent to which (i) the service is essential to education, public health or public safety; (ii) the service has been subscribed to by a substantial majority of residential customers; (iii) the service is being deployed in public telecommunications networks by telecommunications carriers; and (iv) the service is consistent with the public interest, convenience and necessity. Although all of these criteria should be considered in the process of identifying services that fall into the definition of universal

4 In the United States the concept may be traced back to 1907 when Theodore Vail, then President of AT&T, suggested that a single supplier should have the obligation to offer a telephone service to anyone requesting it in any particular geographical area.

5 For the case of telecommunications, the 1996 US Act incorporates in the universal service basket 'voice grade access to the Public Switched Network with the ability to place and receive calls, touch-tone signaling, single-party service, access to emergency services, access to operator services, access to inter exchange services and access to directory assistance'. In the United Kingdom, these services include 'basic telephony, message forwarding, directory and operator assistance, emergency services, phone book provision and the availability of public phones'. In the context of postal services, the European Commission has considered that universal service offering should at least include the clearance, transport, sorting and distribution of postal items up to 2 kg, the clearance, transport, sorting and distribution of postal packages up to 10 kg and the services for registered and insured items.

service, the Federal Communications Commission (FCC) can include services that do not necessarily meet all four criteria.

Several concerns have been expressed about this approach to defining universal service. A first is whether or not this definition concerns communications services or is limited to telecommunications services (the difference stemming from the fact that communications services can transform the content of transmitted information). This question is important in view of the rapid technological progress in the sector and the FCC adopted the view that the definition should be restricted to telecommunications services. Related to the dynamics of the industry, a concern has also been raised that the above detailed list of services would somehow *freeze* universal service in the current technology and the services made available by this technology. The FCC adopted the view that universal service should be an 'evolving level of telecommunications services that the Commission shall establish periodically taking into account advances in telecommunications and information technologies and services' (see FCC, 1996b).

Although voice grade access to the public switched telephone network (PSTN) was motivated by the need to ensure that consumers may access (local) areas in which essential public services are located, a concern was raised that subscribers in rural areas often need toll calling in order to reach essential institutions such as schools, health care providers and government offices. Hence, basic interexchange service has been included in universal service. Touch-tone service is motivated by the fact that it plays an important role in allowing users to connect to various voice-mail systems, on-line information services (e.g., community bus schedules) and product-ordering services, although the supply of this type of services varies from one state to another.

The inclusion of single-party, rather than sharing of line, service also reflects the forward-looking motivation in the design of the universal service package. Indeed, single-party service is considered as a prerequisite for Internet access. Even though some telecommunications actors recognize that upgrading multi-party service to single-party service might take some transitory time and involve some costs, the FCC has decided that it should be included, in particular, because it is consistent with the public interest, convenience and necessity. Most importantly, it allows access without delay to emergency services (such as basic 911, used to seek police intervention) which are considered as essential to public safety. Access to operator and directory services, viewed as services that assist consumers in the completion and billing of telephone calls (which are widely deployed and used), are considered as essential in public health and safety emergencies as well.

The FCC supported the view that the services included in the definition of universal service should be limited to those carried on a single connection to a subscriber's principal residence and declines connection to second residences even when those residences are located in high-cost areas. Single-connection of businesses in rural, insular and other high-cost areas are included in universal service because the FCC found that they share similar general telecommunications needs with residential subscribers, namely, access for health, safety and employment reasons.

The 1996 Act requires quality services. The FCC recognizes that it need not require specific technical standards of quality beyong those already adopted and enforced by State quality rules. Hence, the FCC relies on service quality data collected by the State commissions to check that quality service is acceptable. The 1996 Act also states that quality services should be available at just, reasonable, and affordable rates. The concept of affordability is taken in both its absolute and relative dimensions. Hence, the FCC considers that an evaluation that considers price alone is inadequate. Factors other than rates, such as calling area size, income levels, cost of living, population density, and other socio-economic indicators are important factors in examining affordability.

The FCC notes that a relatively high penetration rate suggests, but does not necessarily mean, that rate levels are affordable, while a declining penetration rate might be indicative of unaffordable rates.[6] While monitoring of demand (subscribership) constitutes a good tool for evaluating affordability, it does not say much about the hardship imposed by the purchase. The FCC considers that it is appropriate to use per capita income and the cost of living in a local or regional area when determining affordability. Because of the important role of these local factors, the FCC gives primary responsibility to the States in evaluating rate affordability.[7]

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6 Some caution needs to be taken with this procedure, as growth of the penetration rate might well come as a result of the strategic behavior of firms (this point is further discussed below).

7 In Germany, affordability of telephone service is given some further precision. Prices for basic telephony are considered as adequate if they do not exceed the (real) unit price that a representative household living in a non urban area (an area is considered as urban if it contains more than 100,000 inhabitants) pays given the current level of demand. This calculation of prices is aimed at ensuring the status quo level of demand by households.

As indicated above, access to the Internet has been considered by the FCC as a necessity and used as a justification for inclusion of single-party service in universal service. On the other hand, the usage of Internet is not included in the Universal Service definition despite the suggestion of some telecommunications actors that it should be. The FCC has considered that '... Internet service does not meet the statutory definition of a telecommunications service ...'. The FCC also has predicted that, increasing demand for Internet service will eventually circumvent the need to place toll calls to obtain this service and consumers will simply need to rely on access to the PSTN which is already part of universal service.

In a world of rapidly changing technology, incentives for actors to favor the enlargement of the universal service package might exist, as it will be clear from the examination of the financing of universal service in the next section. The FCC found, however, that an overly broad definition of universal service might offset the fundamental goal of the 1996 Act, namely, preserving the provision of universal service without hindering efficient competition. But the FCC also recognized that the definition of universal service should evolve and be reconsidered in the future. Indeed, the Commission recommended that it convened a Board no later than January 1, 2001, to revisit the definition of universal service on the basis of the available information, in particular, the Commission's collected data.

Whatever its precise definition, the USO can arguably be regarded as a set of restrictions on the operator(s) pricing policy.[8] Then, the

8 The USO might also take a form which is more implicit than discussed so far. In some countries, such as England, where the generation of power and its distribution are done by separate entities, there is a particular aspect of service obligation which is worth mentioning. Electricity generation firms are usually bound by a contract to provide some level of supply taking into account their capacity. If the supply level is inadequate, however, the very stability of the network may be called into question. Hence, even though these generating firms do not have a universal service obligation *per se*, the threat of breakdown of the network by itself puts them in a situation of a *de facto* obligation of continuous supply within their contractual commitment. The authority in charge of the generation pooling and dispatching has the ultimate obligation to monitor demand and supply. In case of foreseen shortage, it may rely upon alternative domestic generating firms and imports from France or Scotland. In Spain, a new (but not yet implemented) law allows the provision of power supply by an independent industry besides the integrated one. If the power generating firms of the independent industry cannot meet their delivery commitments, the integrated sector is in charge of fulfilling those commitments.

ubiquity constraint, i.e., the obligation to fully cover the market, is binding only because of the simultaneously imposed restrictions on the pricing policy. Indeed, if the operator had complete freedom in its pricing policy, clearly the USO would be violated since the operator would want to reflect the cost of serving various consumer groups in its pricing and this would imply zero demand for some of the *high-cost* consumer groups. This is no longer true if prices are restricted to be affordable and/or uniform across consumer types. In this case, prices are likely to be below cost for some high cost area consumers and the USO constitutes a binding constraint for the operator.

Making the requirement of affordable rates somewhat more precise is also necessary, but translating this normative principle into regulatory measures is a rather involved endeavor. One might rely on the empirical observation of demand for the service and penetration rates (see FCC, 1996) to infer some information on affordability, but clearly such information can only be deemed imperfect. Indeed, while a declining penetration rate in a given area may well indicate that rates are not affordable, a stable or even increasing penetration rate would not necessarily mean that they are. One would want to examine more closely how necessary the service is perceived by the concerned households and assess the burden that the use of the service imposes on their budget.[9] The analysis in this paper attempts to explore further this issue.

By considering the USO as a regulatory pricing policy, we argue in this paper that the different facets of this problem need to be addressed in an integrated framework. More specifically, an appropriate universal service policy should not be designed in a sequential manner, as the above institutional definition would suggest, but rather should pose simultaneously the questions of content, cost and financing of universal service. The fundamental issues then are the specification of the basic objectives of the policy and the setting up of the instruments that would help to achieve these objectives in the most effective way.

Before turning to a discussion of various economic justifications of the USO, we add a comment on the requirement of good quality included in the USO definition. Clearly, quality adds complexity to the

9 While monitoring of demand can be used to evaluate affordability, in order to assess the hardship that the purchase of the service imposes on the consumer, the FCC considers that it is appropriate to examine per capita income and the cost of living in a given local or regional area.

design of universal service policy. In practice, requirements on the operator's quality of service, ranging from *minimum quality standards* to a precise definition of a range of basic services, are appended to restrictions on pricing. These additional requirements may merely reflect the regulator's concern for quality.[10] Alternatively, they may be a way for the regulator to prevent bypassing of the price constraints by the operator through low quality service provision. In our analysis, we will focus on pricing policies but we will also keep quality issues in mind.

2.2 Alternative economic justifications of the USO

When it comes to justifying the USO, two different but complementary sets of questions arise. The first set of questions, that fall into what economists would qualify as normative, raise the issue of whether and how the USO as a public policy can be justified on welfare grounds, taking into account the various constraints that policy makers may face.[11] The positive approach, on the other hand, addresses a set of questions that investigate alternative explanations of why the USO is effectively implemented in most network industries. In this section, we review and discuss the major arguments which arise

10 Quality standards are of course to a large extent sector and country specific. In the postal service sector of the European Union (EU), a 1996 Directive proposal emphasizes standards of routing times, regularity and reliability. The specific nature of these quality standards are to be determined by Member States in the case of national services, and by the European Parliament and the Council in the case of intra-Community cross-border services. The quality objective of the Directive proposal was that, within the Community, 85% of all items should be delivered with 3 working days and 97% within 5 working days. The Directive proposal, however, notes that some exemptions to these quality standards might be given in some circumstances that may be justified by the specific infrastructure and geography of the concerned country. Concerning the water sector in the EU, standards of quality are set through European norms. The first of these norms (80/778/CEE) establishes the quality of water used for human consumption. It specifies some allowed concentration ratios for 62 parameters concerning drinking water. The second (91/27/CEE) concerns the processing of used water in urban areas, hence its purification. It requires that communities invest in equipment necessary to collect and purify used water (sewerage system) within a specified time frame.

11 In particular, one wants to know if the USO can be considered as an effective policy tool which ought to be included in the public authorities' optimal policy mix.

from both of these approaches. We characterize the conditions under which one can make a case for a USO on the basis of (social) welfare considerations. After a critical review of some of the arguments that have been advanced in favor of a USO policy in the literature,[12] we point to some important factors that have been neglected. We also show how a USO policy can be the result of the workings of the political process.

2.2.1 *USO as a remedy for a network externality*

Network externalities arise when the benefits from using a network depend on the number of individuals who are connected to the network.[13] For instance, in the case of telecommunications, the number of subscribers determines the number of individuals that any particular user can communicate with. Consequently, any individual's decision to subscribe to the network directly affects the utility of other individuals. However, when deciding upon participation, any particular consumer will only take his own (private) benefits into account.

It is often argued that such externalities may lead to an inefficient outcome in an unregulated market, namely, to low participation which, from a dynamic perspective, may adversely affect the development of the network. According to this line of reasoning, these types of inefficiencies may be attenuated, or even eliminated, through regulatory measures, such as the USO, aimed at providing access to the network at subsidized rates. Hence, here the USO is viewed as a policy aimed at correcting a market failure due to the presence of network externalities. While this argument has some appeal, especially in the early development of some of the public utilities such as telecommunications and postal services,[14] it has a number of limitations.

First, it does not apply to all the industries where a USO is imposed. For instance, network externalities can hardly be used to justify a USO in the electricity, gas or water sectors. Second, even in those sectors, such as communications networks, where network externalities do arise, a number of regulatory measures which are

12 See, e.g., Cave (1996), Cremer et al (1997), Curien and Dognin (1995), FCC (1996a) and Golay and Dobbs (1996).

13 More specifically, each individual user perceives that the *value* of the network to him increases with the total subscriber population.

14 This is also true of less industrialized economies.

usually associated with the USO do not appear to have a direct link to this phenomenon. Examples include the uniform pricing requirement imposed on postal operators or their obligation to maintain post offices in rural areas. Third, under closer scrutiny, it may not be self-evident that network externalities necessarily result in an inefficiently low degree of network participation. For instance, an operator may well find it profitable to *coordinate* consumers. In this case, the firm also benefits from the network externalities by increasing consumers' willingness to pay and a regulatory obligation such as the USO wouldn't be necessary.

2.2.2 *USO as a redistribution policy instrument*

The USO can be seen as a special case of *redistributive pricing*, that is a policy meant to affect redistribution through prices instead of (or in addition to) income taxation and/or direct transfers. From that perspective it bears some similarities with policies involving public provision of private goods, in-kind transfers, etc. The basic feature of these policies is that some essentially private goods like education, child care or health care are provided either free of charges or at (sometimes highly) subsidized prices.

The recent economic literature has shown that such policies can be optimal in a second-best sense, i.e., when policy makers do not possess the necessary information to implement (potentially) more efficient policies like direct transfers.[15] A detailed examination of this literature is beyond the scope of this paper and we shall restrict ourselves to reviewing the arguments which are most relevant for the problem under investigation.

The precise rationale of policies like public education or subsidized health care has for a long time been a puzzle to economists. Even though they may create some externalities, education and health care are not, strictly speaking, public goods. In particular, exclusion is usually possible and the marginal cost of serving an additional individual is generally not equal to zero (or negligible). Consequently, one may wonder why the government would find it beneficial to intervene in their provision. An often advanced argument is that public education or subsidized health care may be a way to reduce some of the most striking inequalities in society. However, because these instruments are not the only conceivable ones to achieve this goal, this argument

15 See, e.g., Boadway and Marchand (1995), Cremer and Gahvari (1997) and Guesnerie and Roberts (1984).

needs to be complemented by an analysis of their efficiency relative to some alternative instruments.

To illustrate this point, consider the case of health care. Its provision at subsidized prices may create incentives for over-consumption and thus imply an inefficient outcome. Consequently, if the objective of the public authorities is to help low-income individuals, it would appear more efficient to do so directly, through personalized transfers. Now, this is certainly true in a (hypothetical) world where public authorities can perfectly observe individual characteristics and identify the needy. In reality, this is hardly the case and direct transfers to the appropriate individuals may be difficult to make.[16] Hence, potential inefficiencies associated with price subsidies (or public provision at free or highly subsidized rates) need to be weighted against the difficulties of implementing, because of informational or some other requirements, alternative instruments such as personalized transfers.

The arguments presented so far can actually be used to justify various kinds of public policies ranging from direct intervention, such as the creation of a public service, to more indirect forms of price regulation. The USO falls into the second category and it can be used to achieve two types of redistribution. First, distribution may be directed towards high-cost consumers as in the case of rural users of telecommunications and postal services. This can be, for instance, achieved through uniform pricing. However, strictly speaking, prices need not be uniform and this type of redistribution occurs whenever price differentials between consumer groups do not reflect cost of service differentials. Second, redistribution may target low income (or otherwise needy) individuals. Prominent examples of measures aimed at affecting this type of redistribution include *social tariffs* in the telecommunications and electricity industries.

A document released by the FCC (see FCC, 1996) provides some interesting illustrations of both types of redistribution. It explicitly distinguishes *high-cost support* (subsidization of consumers in *high-cost areas*) from *support for low-income consumers* which, as is emphasized, is not limited to specific geographic areas. More

16 More specifically, if sick and needy individuals are entitled to some transfer, any individual would have an incentive to pretend that he is needy and the verification of these claims would be impossible or prohibitively costly. If, instead, health care expenses are subsidized, the redistribution appears to be better targeted, even though it may come at the expense of some inefficiency due to possible over-consumption.

specifically, as far as the second aspect is concerned, it advocates some modifications (and extensions) of the existing *Lifeline* and *Link Up* program. Quite interestingly, this document also recommends universal service support for institutions like schools and libraries irrespective of their location.[17] Here the redistributive character of the policy indirectly appears though the subsidization of other redistributive programs like public education.[18]

The telecommunications and electricity sectors are not the only examples that illustrate the redistributive dimension of the USO. Other sectors such as the postal sector may also be concerned with redistribution. In this sector, in which the paying customers are the senders, cost differentials arise mainly because of the locations and types of the addressees. Redistribution, between urban and rural households, say, can be operated through the USO only if its actual beneficiaries are the addressees rather than the senders, particularly, the high-cost households within this group. To see this, let us take a closer look at the redistributive effect of uniform pricing (treatment) in this sector.

In the postal service, the USO often embodies an obligation of the operator to visit the addressees' mailboxes at some reasonable frequency and this constraint by itself considerably affects the cost differentials according to location (rural delivery being more costly). In the absence of such an obligation, reduced frequency, post office box delivery or similar measures could be implemented by the operator in order to eliminate the excess costs due to rural delivery. Such measures would certainly have the greatest impact on rural households. Alternatively, in the absence of a uniform pricing obligation (included in the USO), the operator might want to charge rural households for the delivery cost differentials by imposing a periodic fixed fee, say, on those who opt for delivery at home rather then at some collective delivery point.[19] These *connecting charges* of a nonlinear nature are, of course, not implemented in practice (at least in Europe) and this can be interpreted as an implicit desire of the regulatory authority to operate

17 Support for health care providers is also advocated, but it is restricted to those serving rural areas.

18 See our argument on education and the general problem of public provision of private goods above. Public libraries have rather similar characteristics.

19 The period (as opposed to item based) nature of such a fee should be pointed out. It would thus not violate the traditional principle that the sender pays for the mail item.

some redistribution since allowing those schemes would impose the heaviest burden on high-cost customers. Finally, consider the effect of a removal of the uniform pricing constraint on business mail. A large proportion of letters (and mail items in general) are sent by businesses and in the absence of a uniform pricing requirement it is likely that these businesses, for competitive reasons, would shift part or all of the incremental costs due to location to their clients through price increases.[20,21] Again, the consequence of relaxing the uniform pricing constraint is very likely to have the largest adverse effect on high-cost customers.

The above arguments suggest that the USO does indeed benefit rural households which imply high delivery costs so that the first type of redistribution (from low to high-cost customers) is certainly as relevant in the postal sector as it is in other network industries such as communications. The relationship between USO and income based redistribution (the redistribution we referred to above as the second type) is probably weaker in the postal sector than in telecommunications and electricity. However, one can certainly think of the universal availability of *free* mail delivery as an in-kind transfer which, as indicated above, can be an integrated part of a redistributive policy.

So far our discussion brought up two important questions. The first question asks whether it is optimal to use the USO rather than any other more *standard* instruments, such as transfers and income taxes, for redistributive purposes. A deep theoretical investigation of this issue is beyond the scope of this paper and here we shall restrict our attention to presenting a simple framework that allows for an empirical evaluation of the costs and benefits of USO relative to an alternative policy of direct transfer.[22] The second question concerns the optimal design (and financing) of a USO conditional on the fact

20 The extent of shifting depends on the characteristics of demand and supply and on the market structure.

21 Under uniform pricing in the postal sector, banks for instance, have no reason to charge rural customers more for the mailing of their bank statements than they charge their urban customers. However, if mailing costs were different, a bank may find it profitable to differentiate fees according to the location of a customer. This is true of many other types of businesses and, in particular, of mail-order firms.

22 See Cremer and Gahvari (1995, 1996) for a formal analysis and a review of the relevant literature.

that public authorities have decided to use this instrument. This is the problem we shall focus on in Section 4 of this paper.

2.2.3 *USO as a means to supply a public good*

An argument that has sometimes been put forward is that a uniform and universal communications or transportation network (post, telecommunications, railroad) possesses some feature of a public good in the sense that it binds the nation together, it is essential for the functioning of a democracy and, for ethical reasons, society finds it unacceptable that anyone be excluded from communications services. This argument relies on the idea that, independently of the specific services it provides, the availability of the network is by itself valuable to society. Consequently, this is true even when the provided service is essentially a private good. The USO can then simply be seen as a way of contributing to the provision of this *public good*. As mentioned earlier, this argument can be combined with the previous one and it can then explain why redistributive pricing ought to be used in network industries rather than in other sectors where the public good aspect may not be present.

2.2.4 *USO as an instrument to conduct regional policy*

The USO can also be seen as an instrument of regional policies. For instance, uniform pricing can be a way to subsidize rural customers, in order to encourage households and firms to locate in rural areas or to prevent those already installed in the rural areas from moving away. Similarly, maintaining basic public services, like post offices or public phones, in small villages may contribute toward preventing the decline of rural areas. Though quite compelling, this argument needs to be taken with care as the effect of universal access to some networks on regional development may be quite complex. Indeed, some unwanted side-effects might be associated with this universal access. For instance, experience has shown that access to an efficient transportation network may speed up a region's decline instead of fostering its development.

2.2.5 *USO as an outcome of a political economy process*

So far our approach has been essentially normative. We have studied how a USO can be justified on welfare grounds, taking into account the various constraints that the policy makers may face. If the main concern of policy makers is effectively to maximize welfare, these

arguments also have a positive bearing and can explain why a USO is imposed in many network industries.

In reality, however, these policies may also emerge for different reasons, associated with the political process itself. For instance, *rural* pressure groups may advocate uniform pricing because alternative policies, such as direct transfers, are not considered as credible or because uniform pricing is less visible, and thus more easily accepted by the *public opinion*. Similarly, the existence and the scope of the USO could also be the result of regulatory capture. This would be the case if the entrants successfully lobby in favor of strict restrictions on the incumbent operator's pricing policy with the intent of weakening its competitive position. At the opposite extreme, one can also think of situations where the incumbent operator itself may use its leverage on the regulator to maintain a stringent USO as this may justify some of its privileges, e.g., monopoly protection in some market segments.

3. The cost of the USO

Much of the debate on the USO has concerned the measurement of its cost. However, it appears that the very notion of *the cost of the USO* is rather ambiguous and both its definition and measurement are problematic. In addition, as will be seen in Section 4, independently from its precise definition, the cost of the USO depends on the overall regulatory structure. Consequently, a general procedure for measuring the cost of the USO is yet to be developed. The current status on the question is that there are several competing concepts and the precise measure that must be used depends both on the question one wants to address and on the regulatory environment.

3.1 Definition of the cost of USO

The cost of the USO may be defined in terms of two factors: profit and welfare. Those two notions are discussed in turn.

3.1.1 *Profitability cost of the USO*

An approach that focuses on the supply side may define the cost of the USO as the loss in profits incurred by the operator due to the USO. As such, it is supposed to measure the *burden* that the USO imposes on the operator. A proper way to evaluate this cost is then to compare the

profit levels of the operator under the alternative market equilibria: with and without USO. The task is for the least faint hearted for it requires a forward looking approach to determine the equilibrium of a hypothetical state in which the USO is removed.

Measures of this kind that are commonly used, such as that based on the *Net Avoidable Cost* approach, may at best be seen as reasonable approximations to the profitability cost. These measures are essentially based on accounting arguments and they coincide with the above definition only if prices and market structure do not change substantially when the USO is abandoned and if the operator has no direct benefits from serving certain *non-profitable* consumers (reputation, long term strategy, etc.).[23] In some specific contexts, however, these measures may have interesting interpretations. For instance, if the USO is financed through cross-subsidies (see Section 4 below) the methods based on *Fully Distributed Cost* essentially measure the total amount of cross-subsidies. This estimation may be of some interest but one has to keep in mind that it does not reflect a cost *per se*.

Note that if the operator is a regulated firm which faces a binding profit constraint (at whatever level), the profitability cost is, in principle, equal to zero.[24] In fact, this simply means that the profitability cost is not the appropriate concept to use in this context. In this case, the welfare cost defined below appears to be a more appropriate measure.

3.1.2 *Welfare cost of the USO*

The welfare cost can be defined as the deadweight loss implied by the USO. To keep the argument as simple as possible we assume here that the deadweight loss can be approximated by the loss in total (consumer plus producer) surplus. The welfare cost is then obtained by comparing the total surplus achieved at a hypothetical equilibrium without USO with the total surplus realized under the USO.

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23 The 1997 decision by Oftel concerning British Telecom (see Oftel, 1997) indicates that such benefits may indeed play a great role (see the Appendix).

24 As long as the USO does not make it impossible to meet its budget constraint; see Gallet and Toledano (1997) for a discussion of this point. The same argument extends (in the short run) to an operator subject to rate of return regulation. In the long run (when the capital stock is variable) the profitability cost under rate of return regulation is, however, not in general zero.

Let us illustrate this measurement technique through a simple example. Consider the case of a single operator that faces two types of consumers, high-cost (say rural) and low-cost (say urban) customers. From basic welfare economics, we know that total surplus is maximized when each type of consumer pays a price which equals marginal cost of serving that consumer.[25] Clearly, this marginal cost pricing would imply a higher price for rural customers than for urban customers. Next, assume that the USO is imposed and, in particular, that the operator faces a uniform pricing constraint. The applied price would then be some (weighted) average of the respective costs. Consequently, rural customers would face a price below their serving cost while urban customers would pay a price above theirs. By comparing the two scenarios above, it can be shown that the decrease in surplus of the urban customers exceeds the increase in surplus of the rural customers. Hence, aggregate surplus decreases as uniform pricing is imposed.[26]

One can cast this discussion within the traditional equity–efficiency trade-off framework. Redistributive policies which act through the price system create some (price) distortions that carry an efficiency cost. This cost has to be balanced against their redistributive benefits which depend on the weights of the different consumer groups in the public authority's social welfare function.[27] Because of these benefits, the overall impact of the policy on aggregate welfare may well be positive. Consequently, focusing solely on the cost of the USO may be somewhat misleading. Indeed, the cost is only part of the story and even if it can be properly defined and correctly measured it does give only a partial account of the overall impact of the policy. An exploratory attempt to fill this void is presented in the next section.

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25 Here, total surplus is merely defined as the *unweighted* sum of the surplus of the producer and that of the different consumer groups.

26 This discussion assumes away deadweight losses due to the possible disconnection of some consumers.

27 A regulator who is only concerned with efficiency and whose objective can be expressed as the maximization of total surplus in which all consumer groups are given equal weights, would favour marginal cost pricing. Redistributive objectives can explicitly be introduced by considering an objective function which puts higher weights on some specific consumer groups. In that case, marginal cost pricing continues to be efficient, but it may not be the welfare maximizing solution. If redistributional objectives are of concern, it may well be desirable to deviate from the efficient solution and implement a pricing policy which favours consumer groups with higher weights in the regulator's objective function, e.g., low-income or rural households.

3.2 Evaluating the net welfare impact of the USO: An example

The welfare benefits of the USO (through its redistributional impact) may be even harder to evaluate than its cost. They depend on the weights which the policy makers attach to the different groups of consumers and these weights are, in general, not observable.[28]

Cremer et al. (1997) suggest a simple and operational method, inspired by cost–benefit analysis, which allows one to measure the overall welfare impact of the USO even if the objective function of the policy makers is not known. The idea is to compare the USO with alternative (second-best) policies while holding the *redistributive effort* constant. No attempt to directly assess the redistributive benefits of the USO policy is made by the authors. Instead, they use an indirect approach which consists in a comparison of two policies (the USO and an alternative instrument), which achieve a given amount of redistribution, in terms of the efficiency costs they involve. The alternative policy against which the USO is tested is that of direct transfers financed through the general budget and involving some cost of public funds.

To illustrate this method, let us assume that there are only two consumer groups, respectively indexed r and u (rural and urban households, say).[29] Assume that the currently imposed USO benefits the r type consumers, for instance because prices are uniform even though the cost of serving these customers is higher. Next, consider the (hypothetical) equilibrium that prevails if the USO is removed. Let ΔU_r denote the difference in surplus of the r type consumers between the USO equilibrium and the equilibrium without USO. As the rs are the beneficiaries of the USO, one has $\Delta U_r > 0$. Similarly, let ΔU_u, $\Delta \pi^m$ and $\Delta \pi^c$, denote, respectively, the corresponding variations in the surplus of type u consumers, the profits of the USO operator (indexed by m) and the profits of the competitors (index by c). Note that $\Delta U_u < 0$ while the sign of the other variations is *a priori* ambiguous. Finally, consider a direct transfer to r type individuals, implying an efficiency cost of λ per unit (the so-called *marginal cost of public funds*), which is determined to exactly compensate the r type consumers for the removal of the USO (this ensures then that the redistributive effort is held constant). Cremer et al. (1997) show that the difference between the level of aggregate welfare achieved with the USO and that realized

28 This basically amounts to saying that the preferences of the public authority are, by definition, not observable.

29 See Section 4 for more details on this two-group specification.

under the alternative cash transfer policy (without USO), ΔW can be expressed as follows:

$$\Delta W = (1 + \lambda)\Delta U_r + \Delta U_u + (1 + \lambda)\Delta\pi^m + \Delta\pi^c.$$

This expression provides a simple and operational test for the relative efficiency of the USO compared to the alternative system of cash transfers. If ΔW is positive, then the USO is a more effective instrument of redistributive policy than the direct transfers. Intuitively, this means that the welfare cost associated with distorted prices is less than that associated with the financing of cash transfers through the general budget. If ΔW is negative, the conclusion is reversed and cash transfers are welfare enhancing.[30]

As far as data requirements are concerned, this test is not more demanding than the assessment of the welfare cost of the USO discussed in the previous section, with the sole exception that it requires an estimate of the cost of public funds λ which depends on the efficiency of the taxation system and is reported in the literature to range from 0.2 to 0.3 in developed economies to more than 1.0 in less developed countries.

Finally, it should be noted that the comparison presented here rests on the assumption that cash transfers are indeed feasible on informational grounds. In other words, the *needy* individuals can be identified in a costless way. As argued above, this may, in practice, not be the case and this problem has to be kept in mind when interpreting the result of the welfare test of USO. It is of no relevance if the calculated value of ΔW is positive, for the USO is then unambiguously the preferred policy. However, some precautions are necessary when the computed value of ΔW turns out to be negative. In that case, one needs to closely examine the feasibility of cash transfers in the context of the particular sector. If they are altogether not feasible, the comparison becomes meaningless. Nevertheless, if the implementation of transfers entails some (institutional) cost, the welfare evaluation should be adjusted accordingly and the welfare performance of the USO policy relative to the transfer policy reassessed.

30 An example of the empirical application of this test is provided by Cremer et al. (1997). This analysis is based on price and cost data, as well as demand estimates, for the French mail service (La Poste). It results in a positive value of ΔW (of about 1 billion FF), suggesting a positive welfare impact of universal service.

4. Implementation and financing of the USO

In this section, we discuss alternative financing schemes of the USO under both monopolistic and (partly or totally) liberalized market structures. Our approach relies on a unified analytical framework which integrates the building blocks established in the previous section, to highlight the economic trade-offs associated with the various USO scenarios.

The monopoly case is useful as a starting point but it also is of some interest in itself for it continues to be empirically relevant, and this is likely to remain so in some industries for some time. It allows us to introduce and analyze some important issues in the simplest possible way and this sets the ground for the analysis of liberalized industries which give rise to a large set of new issues.

Under monopoly, the USO and its financing create a number of distortions which affect overall efficiency. These implied efficiency losses have to be balanced against the benefits in terms of redistribution, public good provision, etc., in order to determine the appropriate level of subsidies that ought to be provided to qualifying consumers through the USO. Moreover, for a given level of benefits, the design of the policy and of the financing mechanism ought to be such that efficiency losses are as small as possible. As such, this problem shares many features with that of standard Ramsey pricing.

In the presence of competition, such further distortions may arise. The design of the USO and its financing mechanism may affect the very nature of competition that can be sustained in the sector. It can affect the viability of existing operators as well as the entry process in the industry. To take full advantage of efficiency gains from potential or actual competition it then becomes important to design the USO and its financing mechanism in a *competitively neutral* way. This implies that the regulatory policy must strike the right balance between two potentially conflicting objectives. On the one hand, competitive neutrality requires that no excessive protection ought to be granted to the USO operator for this might interfere with the entry process (and deter potentially efficient entry). On the other hand, if the USO is not compensated in an appropriate way, its viability may be threatened by possibly less efficient entrants (who may find a niche in the market because of phenomena such as *cream skimming*). This may be a threat to both the USO itself, and to the efficiency of the competitive process in the industry.

Our analysis demonstrates that the design of the financing mechanism is the crucial ingredient for the reconciliation of these

potentially conflicting objectives. The choice of the appropriate financing mechanism will involve various trade-offs which are, to a large extent, sector (and country) specific. Consequently, it is not possible to determine a single mechanism which would be appropriate in all sectors (and in all countries). A thorough analysis of the various policies is nevertheless useful in that it allows us to reach a better understanding of the advantages and disadvantages of the available mechanisms.

4.1 The case of a monopolistic sector

If there is a single operator in the industry, there are essentially only two ways to finance universal service: cross-subsidies and transfers from the regulator to the firm. Transfers raise the usual issue of whether or not the operator should be required to balance its budget. From that perspective a transfer to finance the USO is very much like a transfer to finance fixed costs and such transfers are often difficult to implement for a variety of reasons. To simplify the exposition, let us then start with the case of cross-subsidies. Transfers as a means to finance the USO will be reintroduced later and we shall also allow for a financing scheme that combines the two instruments.

For illustrative purposes, we consider a highly stylized model of a network industry in which the single regulated operator is required to balance its budget. Further, assume in a first step that production is characterized by a technology with constant marginal cost and no fixed cost (the case of more general technologies will be discussed below). For simplicity, assume that there are different types of consumers according to the cost of serving them or possibly some other individual characteristics such as income or preferences. More specifically, the (average and marginal) cost of providing service differs between consumer groups.[31]

A USO under which nonlinear pricing is ruled out would have, because of the budget balance constraint, some (or all) of the high-cost customers pay a price below their cost while some other individuals pay a price higher than their cost. Clearly, this amounts to implicitly running a subsidy from low to high-cost customers. Note that

31 In the case of the telecommunications or electricity sectors one can think, for instance, of rural and urban customers. Similarly, in the postal sector, costs (and especially the costs for mail distribution) depend on the location of the addressee (rural or urban) and differ between types of consumers (households or firms).

although uniform pricing would serve this universal service purpose, any policy in which cost differentials are not totally reflected in price would achieve this goal. Technically, the determination of optimal prices that would implement the USO is analogous to a Ramsey pricing (or *taxation*) problem with heterogeneous individuals and a generalized social welfare function that incorporates some redistribution objectives. The main feature of these schemes is that universal service is implemented through an implicit tax on the low cost customers.

These arguments remain valid under more general technologies, but the interpretations would then need to be modified accordingly. In particular, if fixed costs are introduced universal service (and specifically redistributive) considerations would result in prices different from the traditional Ramsey prices in which unweighted total surplus is maximized. If fixed costs are large it is possible that all consumers pay a price which exceeds their *marginal* cost. However, because of the redistributional concern, the high-cost customers pay less than they would if prices were set merely according to efficiency considerations.

So far, we have considered only linear pricing schemes.[32] However, in many network industries, particularly in the telecommunications and electricity sectors, tariff schedules comprise a periodic fixed fee and a variable charge.[33] The availability of such pricing policies does not invalidate the arguments presented above but rather adds some flexibility to both the design and the financing of a USO. For instance, in the telecommunications sector, most of the cost differentials between customers can be explained by variations in the cost of providing access to the network (which is sensitive to location) rather than by variations in the usage cost. The urban to rural subsidies may then be implemented through the application of different access fees for urban and rural subscribers.[34]

Whatever the specific intent of the policy and provided that the regulator is benevolent, the availability of nonlinear pricing can help

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32 Under linear pricing, the charge paid by a consumer is proportional to quantity, i.e., the per unit charge is independent of the consumption level.

33 In many instances, quite sophisticated nonlinear pricing schedules are used, including menus of two part tariffs, where the consumer can choose between different optional plans, implying different levels of fixed fees and variable charges.

34 See Cremer and Gahvari (1996) for a discussion of nonlinear pricing schedules as a means to support low-income customers.

to reduce the distortions associated with the financing of USO and to target the subsidies in a more effective way.[35] Nevertheless, the essential features of the financing mechanism described above remain unaffected. Under monopoly, and in the absence of a transfer from the regulator, a subsidization of some consumer groups is necessarily paid for by other consumers, be it through a higher linear price or through a higher fixed fee.

Let us now introduce the possibility of a transfer from the regulator to the operator. First, notice that for any given level of the transfer, the problem is essentially the same as above, i.e., cross-subsidies without any additional transfer, and the pricing rules are similar. Actual prices, and in particular the extent of the subsidies of high-cost customers by low cost customers, do, however, depend on the transfer. This illustrates a point made above, namely, that universal service *per se* and the mechanism used to finance it are inter-dependent.

The determination of the *optimal* transfer is a slightly more complicated problem and how the transfer itself is financed is a crucial factor. If lump-sum taxes were available, such a transfer could be financed without any efficiency loss. Since no additional charges would need to be levied, this type of transfer would be the dominant regulatory instrument. Under the more compelling assumption that the financing of the transfer is done through distortionary taxes that create some efficiency loss, the so-called marginal cost of public funds, the superiority of transfers over cross-subsidies is no longer clear. The optimal financing mechanism is likely to be based on both of these instruments and should account for their relative efficiency costs in terms of the marginal deadweight loss associated with surcharges and the marginal cost of public funds.

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35 The redistributive properties of non-linear pricing in the public sector are studied by Cremer and Gahvari (1995); see also Phlips (1983) and Sharkey and Sibley (1993). Cremer and Gahvari show that non-linear pricing (implemented for instance though a menu of linear contracts) may be an effective way to extract higher payments from large (high-income) consumers, thereby lowering the payments of small consumers. Note that, in general, such a policy implies a high *marginal* price for small consumers (but a low access fee) and a low *marginal* price for large consumers (combined with a high access fee). On the applied side, Phlips (1983) provides an enlightening discussion of *social tariffs* (based on pricing policy in the Belgian electricity sector).

4.2 The case of a liberalized sector

Many of the arguments presented in the previous section remain valid if service is provided by more than one firm. However, as discussed above, additional questions arise in such a context. Indeed, in addition to the efficiency losses due to the fact that, under a USO, some consumers are charged a price above the cost of serving them, the financing mechanism may create distortion if it interferes adversely with the market structure itself.

On the one hand, an inappropriate USO financing mechanism may be an obstacle to the entry of potentially more efficient operators in the industry. On the other hand, it may also give rise to the emergence of inefficient entry in that regulatory restrictions may foster the emergence of possibly less efficient operators in some market niches. A proper design of the financing mechanism, therefore, has to account for its impact on the very nature of the industry structure. An important implication is that, if the entry process is otherwise deemed to be efficient, the USO financing mechanism has to be implemented in a *competitively neutral* way and hence its interference with the market process *per se* be kept as small as possible.[36]

We shall distinguish settings where the operator (s) subject to the USO is designated, by historical reasons or others, outside of the universal service policy itself, from those where the designation of the universal service operator is part of the mechanism used to implement the policy. Regulatory settings under which the USO is imposed on *all* operators fall into the former category, but they give rise to specific problems which need to be addressed. Alternatively, the operator facing the USO can be endogenously determined, e.g., through an auction.

4.2.1 *USO imposed on a single, specified operator*

Two sub-cases are distinguished and examined in turn, depending on whether or not the operator under USO is solely responsible for its financing.

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36 This impact on market structure aspect has been given great attention in the 1996 US Telecommunications Act. The following quotation from the Act makes it quite clear: 'It replaces the paradigm of government-encouraged monopolies with one in which federal and state governments work in concert to promote efficient competition . . . At the same time, the statute directs the Commission and the states to work together to preserve and advance universal service, in ways consistent with the new, competitive paradigm.'

The USO operator solely responsible for its financing

Even though this setting is similar to the monopoly case considered above, and hence cross-subsidies and direct transfers from the government might be relied upon to finance the USO, competition may limit the ability of the operator to use cross-subsidies. The surcharges levied on some consumer groups may open the door to cream skimming (by possibly less efficient competitors) which creates additional distortions and may threaten the viability of the operator and break down the USO.[37]

These problems can be alleviated, though not completely eliminated, through the definition of a *reserved sector*, that is a set of services or activities, e.g., mail distribution in the postal service, for which the operator enjoys monopoly protection. Nevertheless, the fundamental problem remains, namely, the *tax base*, i.e., the set of goods on which surcharges can be levied to finance subsidies to some consumer groups, is restricted in an artificial way. Since cross-subsidies can be viewed as implicit (commodity) taxes, optimal tax theory tells us that this exogenous restriction of the tax base is likely to bring about a welfare loss.[38]

All operators contribute to the financing of the USO

This essentially amounts to creating a universal service fund, financed through implicit or explicit taxes on all the operators.[39] The proceeds of this fund are then used to finance a transfer to (partially) compensate the universal service operator. Because the tax base is wider in this case, this financing procedure should, potentially, lead to a welfare improvement. In addition, the contributions imposed on the

37 The relative merits of transfers and cross-subsidies as a means to finance universal service under competition is explored in Gasmi et al. (1999).

38 For standard explicit commodity taxes, this point can be explained as follows. From standard microeconomic theory we know that the deadweight loss associated with a tax increases more than proportionally with its per-unit rate. Consequently, the welfare loss per unit of tax revenue increases as the tax rate increases. Now, this implies that for a given total tax revenue, the total welfare loss will be smaller if many goods are taxed at a low rate than if few goods are taxed at a high rate, i.e., the larger the tax base, the smaller the welfare loss.

39 The Appendix describes an experience in the UK telecommunications sector which is illustrative of the type of economic factors that need to be taken into account when setting up a universal service fund.

competitors may reduce the threat of cream skimming. Provided that the universal service taxes are properly designed, a competitor would, in principle, succeed in capturing a market segment only if its efficiency is superior to the incumbent operator. Consequently, the (proper) working of the entry process is not affected and universal service would be threatened only if the incumbent operator is not efficient.

There are several ways to levy the operators' contributions to the universal service fund: (i) universal service taxes (or fees), e.g., specific taxes levied on the competitors' sales; (ii) access surcharges, an option only available if the competing operators have to use (part of) the network of the operator under USO;[40] and (iii) lump sum entry fees, which can be implemented by selling or auctioning off licenses to operate in the sector.[41] Let us discuss these alternative ways of recovering the USO funds.

Some remarks concerning the first two of these options can be made. First, universal service taxes and access surcharges are equivalent if there is no possibility of bypassing the network and if the network constitutes an input which has to be used in fixed proportions, i.e., input substitution is not technologically feasible. Second, access surcharges appear to involve less transactions cost than taxes. This is so because access fees are levied anyway and it only suffices to increase them for USO purposes. It is, however, not clear how significant the difference between the two options really is, especially if the sales of the competing operators are already subject to some form of commodity taxation. Third, if bypass or input substitution are possible, access surcharges may induce inefficient bypass and/or production inefficiencies. Finally, universal service taxes seem more transparent since, in this case, the financing of universal service is clearly separated from other issues such as (marginal) cost of access, the financing of the network's fixed costs, etc., which may affect the determination of the access charge. To summarize our discussion of the first two options, if both are available, taxes appear to be a better instrument.

The third option amounts to a lump-sum tax on operators. In principle, it should not result in distorted prices since a sunk entry cost does not affect the pricing decisions of a profit-maximizing operator, but it may adversely affect entry. In other words, from a purely static perspective, i.e., for a given number of active

40 Cremer et al. (1995) provide a detailed analysis of this financing mechanism for the case of the postal sector.

41 This is, for example, the case of the postal sector in Germany.

operators, it appears to be tempting to resort to this instrument.[42] From a dynamic perspective, however, lump sum fees may have a negative effect on welfare as they may reduce the number of active operators and prevent the entry of otherwise efficient firms.

At this point, a very important remark about the *incidence* of universal service taxes (or entry surcharges) is in order. We have referred to taxes and access charges as being levied on the operators. However, one should keep in mind that their burden (or at least part of it) will eventually fall on consumers. In this regard, the literature on tax incidence is very insightful. An established result is that the extent to which the tax is passed onto consumers through prices depends on market fundamentals, i.e., market structure, demand and technology characteristics, rather than on whom the tax is formally levied. More specifically, whether a tax is levied on the operators or their consumers does not affect the way its burden is eventually split between the agents. In other words, the price paid by consumers at the after-tax equilibrium solely depends on the market fundamentals and is independent of purely regulatory or legal definitions.

It should also be pointed out that *pay or play* type taxes, where a competitor has the option of not paying the tax if he accepts to comply with the USO himself, are a variant of the policies under investigation in this section. They have two additional features. On the one hand, they may have the additional advantage of enhancing efficiency. In particular, they can prevent the designated operator from engaging in (universal service) cost padding for, otherwise, its competitors would choose to play instead of to pay for the USO. In that sense, a pay or play system shares some features with the franchising policy that will be discussed below. On the other hand, they may impose some additional monitoring costs on the regulator who may have to enforce the USO on several operators.

Finally, let us say a few words about the issue of how the level of the universal service taxes, or access surcharges, should be determined. At first, one might be tempted to argue that the tax ought to offset the surcharge, i.e., the gap between price and marginal cost, imposed by the universal service operator on its own clients.[43] However, on closer scrutiny one realizes that this is not true in general. Optimal taxes and

42 It should be pointed out though that, in a second-best world, the relative efficiency of different outcomes cannot simply be assessed on the basis of a mere counting of the number of distortions.

43 This argument assumes that costs can be accurately determined which, as discussed above, is not a trivial task.

surcharges can easily be shown to depend on elasticity of demand, technology and market structure. Generally speaking, taxes and surcharges are equal only under some specific conditions, namely, a perfectly competitive market in which the operators (the universal service provider and its competitors) use the same technology to supply perfectly substitutable goods.

4.2.2 *Franchising of the universal service obligation*

So far, we have discussed cases where the choice of the operator(s) under the USO is made separately from that of the right instrument to implement it. Specifically, the choice of the USO operator (s) has really not been analyzed and it has simply been assumed to be exogenous to the analysis. This has been indeed the case in many industries. However, over the last few years, different arrangements have been proposed and are now being experimented in several countries. The essential feature of these alternative policies is that the designation of the universal service operator becomes itself part of the financing mechanism. For the perspective of our analysis, this choice of the operator(s) becomes endogenous.

The mechanism in which the regulator defines the USO and then organizes an auction for it has been debated and experimented in many instances. Under this scheme, operators submit a bid consisting of a subsidy they require to fulfill the universal service obligation and the franchise is awarded, for a given time period, to the least demanding operator. An additional feature of this mechanism is that auctions may be local, that is, pertaining to the USO in a given geographical area.[44]

44 The Australian system in the telecommunications sector comes close to such an arrangement (see Cave, 1996, for more details). However, it differs in one respect, namely, that the USO is, in a first step, granted to one (or several) operator(s) designated by the government. Every year, the Universal Service operator then announces its *net cost areas*, areas where the USO imposes some losses. Based on this report, the regulator (AUSTEL), calculates the cost of the USO according to the avoidable costs method (see, e.g., Cave et al., 1994). This cost constitutes the basis for the compensation of the USO, which is financed through levies on all participating carriers based on proportions of interconnection time. The regulator publishes the results of its calculations and the other operators can then compete for the USO. Specifically, if an alternative operator can credibly document that it will be able to fulfill the USO at a lower cost, it may become the designated USO operator, thereby being entitled to compensation from the other operators. Note that, even though it falls short of a fully fledged auction-based franchising scheme, the Australian system does make the supply of USO contestable.

The franchising system appears to have a number of attractive features. Conditional on its good organization, in particular assuming that collusion and other imperfect competition difficulties are not a problem (see below), it tends to ensure that the USO is assumed by the most efficient operator at a (close to) minimum cost. It also allows one to avoid a number of distortions associated with the mechanisms based on cross-subsidies, namely, cream-skimming, inefficient bypass and adverse impact on entry.[45] Finally, this mechanism has the advantage of escaping the transactions costs implied by the levying of a universal service tax (although the cost of organizing the franchising process has to be kept in mind) and is less demanding than the alternative arrangements in terms of information on cost and demand.

Franchising possesses, however, a number of specific drawbacks. The regulator's expected payment for the discharge of the obligation will, in general, be lower the larger the number of (non-colluding) bidders. If the number of expected bidders is small and/or if collusion amongst bidders cannot be ruled out, franchising becomes less attractive. Whether or not this problem is likely to arise depends, to a large degree, on factors related to the specific industry such as the technology, the number of potential actors, etc. It also depends on the particular auction which is used. For instance, the specification of a *reservation price* can be expected to mitigate that problem.[46] In addition, the local character of the auctions which tends to reduce an operator's start-up costs may also enhance the number of potential bidders.

In most cases, the franchisee will have to invest in some specific assets to fulfill the USO. This raises the question of how to compensate the firm for these investments, particularly in cases where the concession would not be renewed. If the regulator cannot credibly commit to an appropriate compensation scheme, the franchisee might under-invest in the specific assets (anticipating the danger of

45 The size of an area to be franchised is not without having some economic impact. If it is too large, it involves a significant amount of heterogeneity and some types of consumers will suffer from the lack of competition within the area if bidding has been done only in terms of the uniform tariff. In contrast, if the size is too small, low cost consumers may find it easy to bypass the USO operator.

46 There is, however, a commitment problem and the announced reservation price may not be perceived as credible. In that case, it may fail to effectively deter collusion.

expropriation at the term of the franchising contract) and significant production inefficiencies may result.

A related problem is the appropriate evaluation of (sunk) assets of the incumbent that may be used by the franchisee. The relevance of this problem, once again, crucially depends on some specific aspects of the industry. It appears less important in a sector like telecommunications where existing infrastructures may have become obsolete and where alternative technologies are readily available (copper, fiber optics and wireless access). However, even in those cases, the pricing of existing assets is important as it determines the speed of adoption of new technologies. At the other extreme, for instance, in the railroad sector, if the USO concerns the operation of, say, a train between towns A and B at a given frequency, there does not appear to be a reasonable alternative to using the existing rail infrastructure.

The potential role of local communities and administrations raises an additional set of questions. Consider, for instance, the case of the postal sector where the USO which is to be auctioned off may involve the operation of a post office in a small village. Should the municipality be allowed to participate in such an auction? If the affirmative, on what terms? An argument in favor of its participation is that because of economies of scope, the municipal administration may well be the most efficient provider of such a service. However, given the complexities of public accounting systems, it appears difficult to organize such on auction on *fair* terms.

Finally, it should be pointed out that there is no compelling reason to believe that franchising different areas will result in uniform pricing. While uniform pricing within a given area can be imposed as part of the franchising contract, it appears to be much more difficult to ensure uniformity of prices throughout an entire country.[47] Consequently, it may not be the appropriate solution when (for reasons alluded to above) public authorities intend to avoid geographical price differentials.

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47 In telecommunications, for instance, franchising the USO would concern mainly high-cost (low-demand) areas. In urban areas, where demand is sufficiently high, there may be room for several competing operators. Now, the price level can, of course, be part of the franchising contract, but it is hard to predict what will be the evolution of prices in the competitive areas (and prices may well differ across areas).

Appendix

In the late nineties, the office of telecommunications (Oftel) in the UK initiated two consultative rounds that led to a decision concerning the funding of universal service. At the end of 1995, Oftel published an initial consultation document in which it proposed a levy on all telecommunications operators to finance a Universal Service Fund. In February 1997, Oftel issued a consultative paper in which it rejected the idea of a fund to which the historical operator British Telecom's (BT) competitors would contribute to compensate it for providing universal service. The purpose of this Appendix is to summarize the economic arguments that led to such a decision. The decision has been based on an evaluation of the cost and benefits to BT of providing universal service and the main features of this cost–benefit analysis are reviewed below. Since at the time of the decision some room was left for a possible institution of a universal service funding mechanism, Oftel has laid down the basic principles that should govern such an arrangement. Some of these guiding principles are discussed below.

In order to determine whether or not the universal service provider (BT) needs to be compensated, Oftel has analyzed both the costs and benefits associated with holding the obligation of providing universal service. Oftel considers that direct financial costs are only one part of the story and, indeed, argues that there exists benefits associated with the obligation, although it recognizes that more work needs to be done to evaluate those benefits. Let us examine the costs and benefits sides of Oftel's argument in turn.

Oftel considers that there exists a gross universal service cost (from which the benefits, that will be discussed below, should be substracted out), if the operator's revenues from serving a customer or a group of customers do not cover the costs it incurred in providing service to those customers. This universal service *deficit* might arise because the operator has to apply a uniform tariff both across customers and geographical areas, even though the costs of serving them differ. Oftel considers that these direct financial costs of universal service should be measured by the difference beween foregone revenues and long run avoidable costs. It particularly draws attention to the fact that revenues should take account of, besides line rentals and connection charges, both incoming and outgoing calls.

The elements of universal service that are costed are *uneconomic-area* customers, i.e., unprofitable to the operator, and public call boxes. Other components of universal service which are not included in the costing analysis are BT's maritime services, emergency services and

services for the disabled; the reasons for not including them being that they are funded from other sources or they are an obligation upon all operators. Based on available data for 1995–96, Oftel estimates that less than 0.5% of the total number of UK lines are uneconomic and impose a gross cost of universal service of £10m to £15m. Uneconomic subscribers and public call boxes represent 6% to 7% of the total UK subscribers' base and about 20% of the total number of BT public call boxes, with estimated net financial cost of £45m to £55m and £10m to £15m, respectively. Hence, an estimate of net cost to BT of universal service of £65m to £85m has been obtained by Oftel.

Oftel has argued that the cost of universal service should be adjusted for efficiency of production, the reason being that if such a cost constitutes the basis for determining the contributions of other operators to the funding mechanism, those operators should not be expected to pay for the inefficiency of the universal service provider. A downward adjustment factor of 5% has been applied to the above total cost (to obtain an estimate of the efficiency level of avoidable costs), based on the estimation that BT's operating costs are 5% higher than the costs of the local exchange company (LEC) in the United States with the highest performance (also, the assumption that the same inefficiency factor applies to capital costs has been made). Given that the efficiency adjustment factor reduces avoidable costs (and that universal service cost is the difference between revenues and avoidable costs), the impact on cost of universal service can be substantially higher. Oftel has estimated universal service cost adjusted for efficiency in the range of £45m to £65m.

Oftel has also conducted a study aimed at estimating the cost of universal service in the future. Concerning the servicing of the uneconomic areas, Oftel considers that, given the technological developments for which BT has access, forward-looking calculation of avoidable costs should reduce those costs by about 50%. For the economic customers, the main change in the universal service cost in the future might come as a result of the introduction of new services into the universal service package. An estimate of the impact of this variation of the universal service basket has led Oftel to adjust the cost of universal service due to uneconomic customers upward from £30–40m in 1996–97 to £40–60m in 1998–99. As to future universal service cost of uneconomic public call boxes, Oftel has considered that since BT has been given more flexibility to re-site its public call boxes, these costs should be reduced. Overall, Oftel has come up with an estimate of the total cost of universal service adjusted for efficiency, for 1998–99, that ranges from £45m to £80m. Recall that these cost

estimates are gross of benefits of providing universal service and that those benefits are considered as important by Oftel. Let us now outline some of these benefits.

In order to evaluate the net cost of universal service, Oftel considers that some current or future benefits stemming from the provision of universal service should be subtracted from the above estimated costs. Oftel realizes, however, that quantifying those benefits is a difficult task and the only thing one can hope for is a rough estimate.[48] The precise nature of these benefits, Oftel realizes, might be different between uneconomic areas and customers, on one hand, and uneconomic public call boxes, on the other hand.

Three types of beneficial effects are identified by Oftel as possibly related to the servicing of noneconomic areas and customers: *life cycle effects*, *ubiquity* and *brand enhancement and corporate reputation*. Life cycle beneficial effects to an operator servicing uneconomic areas and customers might exist because providing service to those areas and customers now might increase the probability of servicing them later when they become profitable. Because new households to an area might not be aware of the existence of BT's competitors, Oftel (and BT, although there was a disagreement on the size of the effect) considers that BT obtains an advantage from ubiquity. Oftel considers that servicing uneconomic areas and customers has the effect of enhancing the brand image and, more generally, the corporate reputation of the service provider. This might translate into beneficial effects on overall current and future profitability, e.g., by slowing down the loss in BT's market share due to competition. Oftel's estimates led it to conclude that '. . . the size of the benefits in aggregate is likely to be sufficiently large to offset the estimated universal service costs of serving uneconomic areas and customers ' (see Oftel, 1997).

Concerning benefits of serving uneconomic call boxes, Oftel identifies two types of effects: life cycle effects (motivated here by the existence of a significant variability in revenues from individual call boxes over time) and the value of advertising of BT's logo on call boxes and the subsequent positive effect on the corporate reputation. Again, Oftel concludes that these benefits would certainly offset the universal service cost of public call boxes.

48 Interestingly, Oftel notes that '. . . in principle, the scale of these benefits would be revealed in a competitive auction for the minimum subsidy that an operator would require to take on the responsibility for providing specified elements of universal service obligation . . .'. Furthermore,'. . . Oftel intends to explore the possibility of tenders for parts of universal service . . .' (Oftel, 1997).

Although Oftel realizes that the results of its attempt to quantify the cost of universal service, net of benefits to the universal service provider, heavily depends upon the quality of the data (which it invites BT to improve by supplying more precise figures), it came to the conclusion that, for the time being, '. . . there is no proven case that there is an undue financial burden on BT that would justify setting in place new universal service funding arrangements.' (see Oftel, 1997).

We have discussed above how Oftel has reached the conclusion that there is currently no need to set up funding arrangements to finance universal service. However, Oftel recognizes that this need might arise in the future. Indeed, if an undue cost burden on the universal service provider were proven to exist, Oftel considers that it would be appropriate to put in place funding arrangements in which all public operators would contribute to the net cost associated with universal service.[49] In the event these arrangements are to be made, some important issues associated with their implementation are explored by Oftel. Let us say a few words about each of these issues.

First, there is the obvious question of who the contributors to the funding mechanism would be. Oftel considers that, since universal service concerns society as a whole, if any cost burden were to arise for its provider, it should be spread over as wide a cross-section of operators as possible (that is to say, over the largest possible cross-section of users). Hence, Oftel's view is that '. . . all public network operators with an individual Telecoms Act licence could be potential contributors . . .'.[50]

Second, what would be the basis for the calculation of contributions? Two directions are explored. One might take the view that contributions ought to be set according to revenues, more specifically, in relation to as wide a revenue base (from telecommunication services) as possible. Alternatively, one might challenge the formidable task of relating the contributions to the benefits that universal service brings to users.[51]

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49 Such a funding mechanism is not expected to be set up before the review of the net cost of universal service by Oftel in 1999.

50 For the rationale behind such a widening of the contributors base, see the text.

51 An effect of the universal service obligation is to increase the number of users of the network relative to a situation without universal service obligation. Hence, this creates a positive externality on the profitable subscribers as they can access and be reached by a larger network, in particular, the network of unprofitable (universal service) subscribers. For more on this point see the justification of universal service section in the text.

Although, some operators have suggested the use of call minutes as a basis for determining contributions, for reasons related to ease of information collection and auditing, Oftel has favored the use of revenues.[52]

Third is the issue of how would the funding mechanism be administered. Oftel has explored two alternatives. One which would require the settling of an actual fund administered by an independent body. Another which wouldn't require the creation of such an independent institution, but rather would rely on the compliance of all concerned operators to some specified rules of organization of the financing of universal service. Oftel refers to the latter option as a *virtual fund*. In both options, Oftel has the responsibility of specifying the costing methodology to be used, the concerned operators and the basis for the calculation of contributions. Clearly, a virtual fund approach has the feature of being more decentralized than an actual fund approach. Although the actual fund approach has had the support of Oftel in its December 1995 consultative document, the potential high costs of administering such an actual fund has recently (as of February 1997) led Oftel to favor the virtual fund approach.

Finally, as competition is leading the way in the telecommunications industry, Oftel has considered the possibility of using market forces as a means of inciting the provision of universal service in the economy. As the principle that universal service is both costly and necessary, and, hence, *someone has got to pay for it*, is generally well accepted, the introduction of competition in the delivery of universal service would ensure that this is done in the most efficient way. Oftel has explored two incentive-based mechanisms: the *auction* and the *pay or play* mechanisms. These mechanisms are formally discussed in the text. Here, we describe some of the practical aspects of these two methods as highlighted by the BT–Oftel debate.

Competitive tendering for areas could, potentially, be a useful means of testing whether or not there exists a net universal service cost of serving uneconomic areas.[53] In practice, the idea is to auction off the universal service responsibility for specific areas that include both potentially profitable and nonprofitable subareas. This would

52 A further justification is that, broadly speaking, two customers with the same telecommunication bill would make the same contribution to the fund under a revenue-based contribution system, which is not necessarily the case under a usage-based contribution system.

53 The critical assumption here is that of a truly competitive auction which, in practice, might be violated as discussed below.

encourage the most efficient delivery of service in those areas. The same scheme might be used for public call boxes. In practice, the responsibility to provide reasonable access to public call boxes can be merely incorporated in the contract for servicing an area which is tendered. But, strictly speaking, a group of economic and uneconomic call boxes can be subjected to a tender process.[54] Because areas might include both profitable and unprofitable customers, tenders can also be used for some residual obligations such as the provision of new services included in the universal service package.

The performance of the tendering mechanism described above depends crucially upon the organization of a genuinely competitive auction. One difficulty might arise from the fact that there might be relatively few bidders in any given area, in particular, if it is considered as uneconomic. Indeed, in practice, only the operators that have, or are willing to invest in, a costly infrastructure in the area in question might be interested in the tender. The process is therefore vulnerable to strategic behavior on the part of the bidders. Oftel has explored some ways of designing the process so that the undesirable effects of market imperfection are minimized.

In order to counter collusive bidding, Oftel has explored the idea of fixing a reserve price based on its estimation of net cost of universal service to the current provider (BT). If no better tender bid has been made, the status quo is maintained, i.e., BT continues to provide universal service. Also, Oftels considers that a single-round auction of sealed bids might be preferable to a multi-round auction that might leave some room for collusion. Sequential tenders for different areas have been considered by Oftel as useful for bidders to learn from the conduct of the earlier tenders, but might well invite collusive behavior.

Oftel draws attention to the *winner's curse* problem which might arise because of the asymmetric information between bidders on the costs of servicing some given areas. Indeed, because of the large demand of disaggregated data needed to evaluate the net cost of universal service, the incumbent (BT) might be at an advantage, with respect to its competitors, when formulating the size of its bid. Hence, because of this informational disadvantage, a competitor would only win the tender at a subsidy (for the provision of universal service) insufficient to cover its net costs. Finally, Oftel has anticipated the situation in which, because of the high entry (infrastructure) cost, no

54 In theory, an auction might be organized for each individual call box. However, this process is most likely to be impracticable.

operator competes with BT for a tender as it might likely be the case for uneconomic areas. One possible way considered by Oftel then is to have BT transfer or lease assets to potential universal service providers. Besides the legal and practical difficulties that needs to be taken care of, this option might put the incumbent (BT) in an advantageous position when bidding against operators relying on transfers or lease of assets from their competitor.

An alternative method of using market incentives for the delivery of universal service that has been explored by Oftel is the idea of pay or play whereby an operator could choose voluntarily to provide service to uneconomic customers and get in return the eligibility to receive universal service funding. Naturally, in a context where all operators make contributions, this funding would be discounted off the operator's contribution to the net cost of universal service.

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Service universel: une analyse économique

Cet article traite, dans un cadre économique unifié, de quelques questions importantes qui nourrissent le débat récent relatif à la notion de service universel: sa définition, sa justification, son coût et son financement. Etant donné la diversité des situations passées et futures dans lesquelles la mise en oeuvre du service universel est envisagée, nous proposons une analyse systématique des arbitrages économiques associés à divers

scénarios. Nous examinons également quelques cas où des mesures concernant le service universel ont été mises en place, notamment dans les secteurs des télécommunications et des services postaux, afin d'illustrer et d'affiner certains de nos arguments.

Universaldienstleistungen: ein perspektivischer ökonomischer Überblick

In diesem Beitrag werden einige wichtige Fragen diskutiert, die die Debatte über den Begriff der Universaldienstleistung vorantreiben, insbesondere seine Definition und Rechtfertigung sowie die Kosten und Finanzierung innerhalb eines vereinheitlichten ökonomischen Rahmens. Im Hinblick auf die Diversität sowohl der historischen als auch zu erwartender künftiger Situationen, in denen die Implementierung von Universaldienstleistungen vorgesehen wird, bieten wir eine systematische Analyse der ökonomischen Trade-offs, die mit den verschiedenen Szenarien verbunden sind. Wir beziehen uns auch auf einige aktuelle Erfahrungen mit Universaldienstleistungen, die einen beträchtlichen Grad an Reife erreicht haben, am deutlichsten im Bereich der Telekommunikations- und Postdienstleistungen, um einige unserer Argumente zu illustrieren und diese einer Feinabstimmung zu unterziehen.

Servicio universal: un análisis económico

Este artículo trata, en un marco económico unificado, algunas cuestiones importantes que alimentan el reciente debate relativo a la noción de servicio universal: definición, justificación, coste y financiación. Conocida la diversidad de situaciones pretéritas y futuras en las que se ha previsto la puesta en marcha del servicio universal, se propone un análisis sistemático de los arbitrajes económicos asociados a diversos escenarios. Asimismo, se examinan algunos casos en los que las medidas relativas al servicio universal se han llevado a la práctica, particularmente en los sectores de las telecomunicaciones y de los servicios postales, ello con la finalidad de ilustrar y de afinar algunos planteamientos.