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Universal Service Auctions in Liberalized Postal Markets[1]

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Introduction

Before the liberalization of public utilities, monopolies were in charge of providing basic services to all citizens. These were funded through cross-subsidies from low cost to high cost regions, from business customers to private customers, and from high value services to basic services. In a liberalized market, however, firms will only provide unprofitable services in exchange for some kind of compensation. From an operator's view, universal service obligations (USO) impose binding restrictions on product definitions, network size, quality level and pricing flexibility that affect both cost structures and consumer demand. As USO operators are worse off when forced to provide uneconomic quality or suboptimal pricing structures, they require fair compensation for fulfilling their public mission. Such "subsidies" must compensate the firm for its loss in profit due to the USO (cf. Panzar 2000).[2]

Universal service auctions are an allocation mechanism with the purpose to find the most efficient USO provider at the minimum level of compensation.[3] First, the government defines the services that must be offered, afterwards firms bid for the concessions, and finally the USO provider is the firm that asks for the lowest compensation to deliver a specific set of universal services. Alternatively, firms might receive a fixed subsidy and bid for other aspects, such as the price of the service or the coverage level. Hence, auctions aim to introduce competition *for* the market. Potential operators are given incentives to reveal their true costs and enable government to select the best offer.[4]

In network industries, the application of subsidy auctions might impose some challenges. When few firms participate in an auction or there is the possibility of collusion, auctions become less attractive as a system to select the USO provider. Similarly, the size and specific cost and demand structure of these industries raises a variety of efficiency and distributive issues. Moreover, when auctioning off public

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

[2] In practice, it is difficult, however, to calculate the net cost of the universal service obligation (cf. Jaag and Trinkner, 2009).

[3] The first academic work about the use of auctions for the provision of public services is Chadwick (1859), who analysed several English markets. The author distinguished between the competition "for the market" and the competition "in the market", showing the advantages of the first option when the provision of services requires important investments. Several decades later, Demsetz (1968) reintroduced the discussion about auctions, emphasizing that they can substitute the traditional regulation of public services.

[4] Harstad and Crew (1999) and Sorana (2000) analyze the efficiency of USO auctions. Borrmann (2004) considers the use of USO auctions in the postal sector.

obligations in liberalized network industries, the USO operator might not receive the right to exploit the market in exclusivity. If this is the case, competition "for the market" is substituted by some kind of "competition for obligations" and several regulatory problems might arise (cf. Jaag and Trinkner, 2008).

USO auctions have been used recurrently in Latin America and African countries since the nineties to extend the coverage of basic services such as public telephony, electricity, urban transport and air transport to rural and remote areas. In developed countries, auctions have been used in the bus industry (UK, Switzerland and Scandinavian countries), in the airline industry (Sweden) and in telecommunications (Switzerland). Recently, such mechanisms have also been envisioned in the newly liberalized postal sector.

Wellenius (2002) shows that compared to other mechanisms for providing public services, the countries that have used auctions have offered lower subsidies, attracted more private investment and generated more transparency in the regulatory process. This may explain why USO auctions have quickly expanded from attractive services in low and medium income countries (telecommunications, electricity) to high income countries and less attractive services for investors (water, sewerage, urban transport).

The objective of this paper is to analyze the main features of USO auctions in liberalized markets and to discuss whether they are an efficient means to select and compensate the USO operator in the postal sector.

The paper proceeds as follows. Section 1 provides an overview on the basic options available to governments in public procurement. Auctioning off the USO is one regulatory instrument that has to be assessed against a considerable number of criteria. Sector 2 shows the main regulatory aspects that should be considered when designing a USO auction. Section 3 raises some potential problems arising from USO auctions. There are allocative and distributive concerns that might reduce the attractiveness of auctions. A further issue is the cost of regulatory restrictions that might limit future business options. Such cost can be calculated by (real) options models. Section 4 explains some recent applications of USO auctions in developed and developing countries. Section 5 discusses the use of reverse auctions in the postal sector in theory and practice. Finally, Section 6 summarizes the challenges involved in tendering universal service obligations in a liberalized postal market.

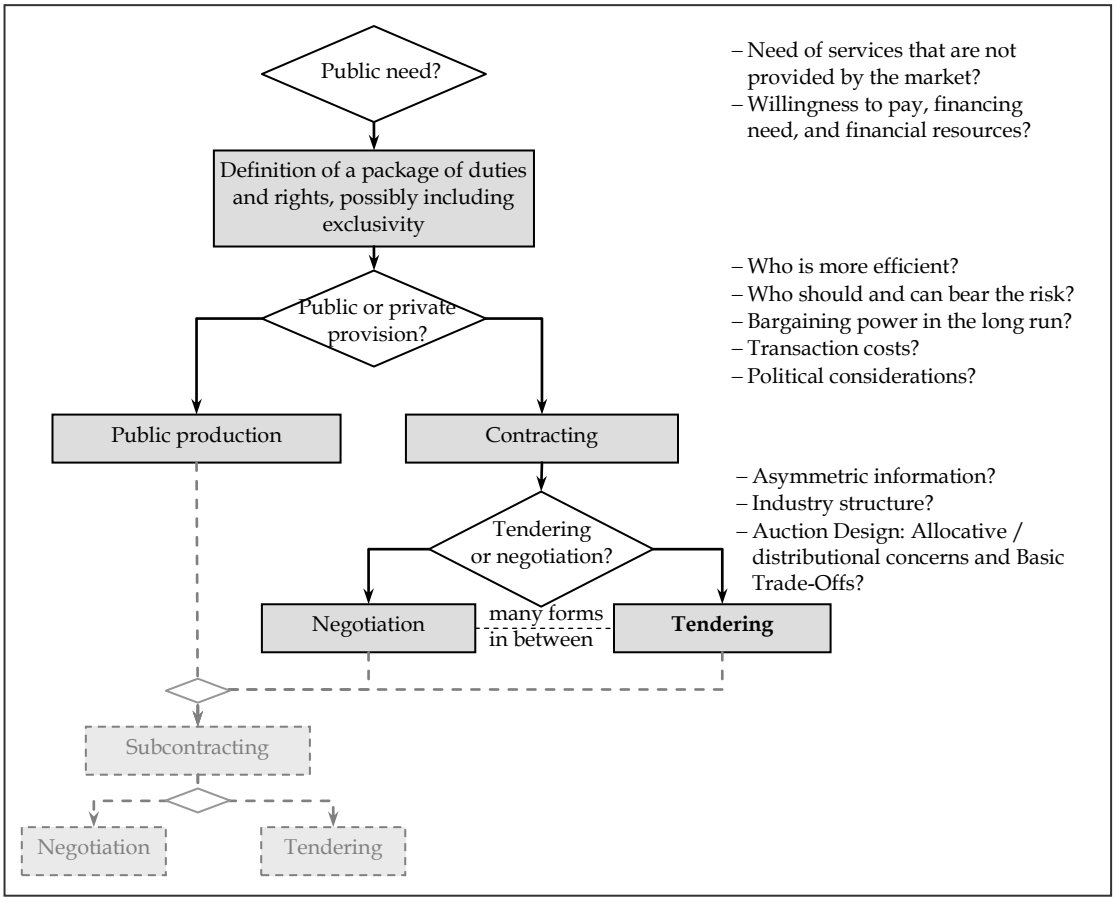
1. The role of tendering in public procurement

In a procurement process, public authorities choose the best mechanism to ensure the provision of a service. The decision process of the authority can be decomposed in several steps (Figure 1). In a first step, a package of duties and rights for the operators has to be specified. The definition of the package determines the market structure and the financial burden imposed on the operators. For example, the inclusion of exclusive rights, such as a regional monopoly, reduces the need for financing the operator with external resources and avoids inefficient bypass. On the other hand, this might limit innovation and efficiency incentives.

In a second step, the public administration must decide whether it will supply the service itself or if it will delegate the production to a private operator. The public provision of a service can be undertaken through two mechanisms: (1) *Public production*. This option is often chosen for some strategic goods such as police and military forces, or utilities such as water, power, or postal services; and (2) *Contracting*

for the services. The public administration can select the provider of the service through direct negotiations with selected parties, a beauty contest based on various criteria, or public tendering.

Figure 1: Decision-Tree for public procurement



Source: Based on Jaag and Trinkner (2008)

The decision of the authorities over self-production or contracting/outsourcing can be made taking into account the following five criteria.

(1) *Efficiency.* Who can provide a certain service more efficiently, a public or a private company? For example, public firms might face higher wages due to the presence of public-servant regulations. Private companies usually incur higher capital costs and profit margins but can be expected to be more innovative and cost aware.

(2) *Risk of the activity.* Private firms try to avoid large and risky investments over a long time horizon. Compared to public enterprises, they have a lower risk capacity and expect a higher compensation for their risk.

(3) *Public authorities' bargaining power.* If the threat of renegotiation of the contract is high (e.g. if the contractor obtains large bargaining power over time because of switching costs to an alternative supplier), the authorities might prefer self-provision of services.

(4) *Minimization of transaction costs*. Organizing and monitoring a tender is costly. If proper monitoring is not possible and if it is difficult to create incentives, contracting might not be appropriate.

(5) *Political considerations and national security*. Public authorities of the country will take into account what is, or what should be, the role of government in the production of services and concerns related with national security.

In case of market delegation, in a third stage public administrators can use various options to select the provider of the service: (1) *Direct negotiation*. This implies that each specific contract is directly negotiated between the authorities and a private enterprise; (2) *Public tendering*. Government institutions can tender a package of rights and duties, and virtually any candidate can apply for the contract; (3) *Intermediate options*. Regulators can use intermediate mechanisms between direct negotiation and tenders, such as competitive dialogue (or beauty contests), where a number of predetermined operators are selected and invited to participate in the tender.

Government institutions can use several criteria to decide the mechanisms for contracting out the provision of the service.

(1) Asymmetric information between the procuring body and the firms. The asymmetry of information determines how well the government can judge over the offers given by the candidates. The use of auctions is considered an efficient mechanism to overcome information asymmetries.

(2) Industry structure. The degree of competitiveness of tenders depends heavily on the industry structure. For example, only a sufficiently large number of participants will ensure a competitive tender that forces potential providers to uncover their true costs. Other relevant aspects of the market structure are the degree of integration of the operators, the regulation of access charges and the barriers to enter the market (e.g. sunk costs).[5]

(3) Auction Design. The design of the auctions requires decisions over several trade-offs that entail – among others – allocative effects.

Finally, in most circumstances a fourth stage is possible. State owned firms with public mandates as well as private operators can again subcontract parts of their mandate to third companies (Figure 1). Thereby, most of the options and criteria mentioned above can be applied to decide the degree of outsourcing of particular activities by operators. A practical example is New Zealand Post's outsourcing policy to ensure postal delivery in rural areas.

2. Basic features of Universal Service Auctions

In USO auctions, political institutions and/or regulatory authorities decide over several social, economic and financial aspects, such as the population benefitting from the universal service policy, the design of auctions, and the mechanisms used to finance the operators. The decisions over these aspects affect the behavior of firms. This section considers the main aspects that should be taken into account when designing USO auctions.

[5] Vickers and Yarrow (1988) have shown their skepticism about the use of auctions in presence of important sunk costs. They consider that auctions are only useful when contracts specify how the prices must be adjusted due to changes in the market. However, as pointed out by Williamson (1976), usually contracts are incomplete, because they cannot cover all possible contingencies.

2.1 Definition of the projects and selection of the areas auctioned

Political institutions must define the general objectives of the universal service policy: the municipalities or the population that will benefit from this policy, the package of services offered and the funding mechanism used. In parallel, industry regulators must define technical issues such as the regulation of the concessionaires. Detailed provisions relating to these aspects become increasingly problematic when contracts are signed for a long period, because markets change and the USO operators' commercial flexibility might be hampered unnecessarily.

The selection of the municipalities protected by the USO policy can be made along with the needs of the population and the resources available. This implies collecting information about the willingness to pay in the villages for the services in order to determine the interest of the program.

The authorities can also consider the possibility of introducing communal services when the population is not able to cover all the operating and maintenance costs of some services (Wellenius *et al.* 2004).

Another important aspect to be considered is the size of the regions auctioned. One must decide if the USO be auctioned globally or divided up into various pieces and procured in smaller tenders. If the size of the regions auctioned is small, consumers are more homogeneous and firms can better estimate the profitability of supplying the service. In addition, dividing the USO into several regions enables yardstick competition, which potentially results in a more efficient provision of the service.

However, larger regions reduce the administrative costs of auctions and allow exploiting optimally the scale and scope economies in mail processing and distribution. Alternatively, firms may be allowed to take advantage of scale economies by bidding for several regions (Lehman, 2006). Another option is to use a combinatorial auction, which allows bidding for a group of regions through a unique monetary offer. In this case, firms win or lose an entire geographical area.[6]

Large areas also facilitate aggregating several services such as postal and financial services in the same concession. For example, the postman in charge of a geographic area can simultaneously distribute correspondence and offer financial services, insurance or microcredits to the population. In other cases, the simultaneous commercialization of several services is a technical requirement. For example, the operation of public telephones in rural communities requires the installation of photovoltaic panels or other electric equipments.

2.2 Design of auctions

USO auctions can take various forms: auctions can be simultaneous or sequential, with one or multiple rounds, open or with a sealed bid. Moreover, the regulator can establish maximum and minimum subsidies in order to guarantee the sustainability of the USO policy and the viability of firms for each project. Regulators must take into account the economic effects of each of these design aspects, as well as the possibility of collusion and the ability of firms to exploit scale economies.

Simultaneous and sequential auctions. In sequential auctions, firms initially do not know if they will be able to win adjacent regions in subsequent auctions. As they are

[6] Sepúlveda (2004) explains the use of combinatorial auctions for telecommunications in Perú and Cantillon and Pesendorfer (2006) assess their use in the London's urban transport system.

uncertain about the possibility of exploiting scale economies they will ask for higher subsidies.[7] This problem can be solved by auctioning all regions simultaneously. Furthermore, simultaneous auctions are more useful if they are open, because in this case firms can modify their bids according to the behavior of their rivals.

In the nineties, Chile, Peru, Mexico, Colombia and Guatemala used simultaneous USO auctions for rural telephony. Although the results of this strategy vary considerably from one country to the other, it allowed firms to acquire national conglomerates (Dymond and Oestmann, 2002).

One or multiple rounds auctions. Auctions of one round only allow one bid per region. By contrast, auctions with multiple rounds finish when any bidder offers to accept a lower subsidy, which allows firms to learn what the valuation of their rivals about the region is. As a result, they can modify their own valuation of each region.

The possibility of over- or underestimating the profitability of one region is one of the main justifications for using multistage USO auctions. Firms observe their rivals and understand that if they continue bidding, their own valuation for the region is not excessive. As a result, open multiple-rounds auctions reduce the firm's risk of being victims of the *winner's curse.* This is especially important when there is uncertainty about the cost and the demand in a market. For example, in 1999 the Peruvian government auctioned several telecommunications concessions. The winner offered 20 per cent of the maximum subsidy considered by the regulator, and later on ended up with important financial problems. The use of a multiple rounds auction could have shown the firm that it was underestimating the net cost of its services. ???

Another important aspect of multiple–round auctions is that firms have more opportunities to collude than one shot first-price sealed bid auctions. This occurs because in a multi-stage process firms have more opportunities to communicate and can agree not to reduce their bids in order to gain high subsidies.

Open and sealed bid auctions. Open auctions do not reveal the participants' willingness to pay. The winner observes the bids of its rivals and stops bidding when the last rival leaves the auction. As a result, the winner receives more or less the second lowest subsidy, and nobody knows if it would have accepted a lower subsidy.

However, an advantage of open auctions is that they generate more information about how firms valuate the region auctioned, and reduce the risk of a winner's-curse-situation. If one optimistic firm observes its rivals are abandoning the auction, it will adjust down its own valuation of the area auctioned and will ask for higher subsidy than in a sealed bid auction.[8]

Maximum subsidies. Usually, regulators define a maximum subsidy (reserve price) that they will be willing to grant for each region. This measure allows firms to estimate the minimum profitability they can achieve. The effect of a maximum subsidy depends on the design of the auction. In descending auctions, maximum subsidies reduce the

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7 Stegeman *et al* (2007) considers that sequential auctions generate higher bids when participants learn about the process. Peha (1999) explains that in the presence of scale economies simultaneous auctions generate higher subsidies than combinatorial auctions.

8 Klein (1998b) shows that open auctions reduce the risk of collusion when several firms participate in the market. However, if the number of participants is small, it is preferable to use first-price sealed bid auctions to avoid the possibility of collusion.

regulator's expected expenses of the project. The regulator is protected from the possibility that the winner has a low valuation of a region while the rest of firms have a high valuation. Nonetheless, the regulator must also consider the possibility that all firms give a high valuation to the project. In this case, a maximum subsidy might serve as a bidding anchor for bidders.

In USO auctions, the regulator's estimation of the maximum subsidy can be made following various approaches.[9] In Chile, the auctions for the universal service in the public telephony carried out in the 90s considered the present net value of the services less its expected commercial revenues. In Uganda, by contrast, the expected revenues of the telecommunications licenses were compared with the estimated costs. In general, in USO auctions in otherwise liberalized markets, the net costs of these obligations should be computed according to the "profitability cost approach" as introduced by Panzar (2000) and Crémer (2000). These methods aim at compensating the USP according to its loss in profits due to the USO.

2.3 Participants in the auctions

National and international firms participle in the auctions taking into account several aspects, such as the users' willingness to pay for the services, the expected growth of demand, the externalities generated by the services, the information about the estimated costs and revenues of the project, the expected profitability of the concessions, the number of firms that will provide the service in the region, and the bidding strategies that might have other firms.

Regulators are interested in having many participants in the auction in order to increase the efficiency of the process and to reduce the amount of the subsidy conceded. They can develop several strategies to increase the number of participants. For example, the Argentina's program of rural electrification (PAEPRA) initially failed to auction separate concessions for urban and rural areas in two provinces. However, later on, the regulator attracted several participants bundling in the same concession rural and urban regions.[10]

Another aspect to be considered is that the firms that might participate in USO auctions are not the traditional operators, but firms that have developed specific technologies adapted to the rural areas (e.g. VSATS and wireless telephony in the telecommunications auctions). Dymond and Oestmann (2002) explain that for these firms USO auctions are an excellent opportunity for promoting their technology. In fact, many firms have even renounced the subsidies to enter the market.

2.4 Winner of the auction

When considering public tendering as a means of delegating the provision of the universal service, a key issue is whether the operators will have exclusive rights in the respective market or not. In past USO auctions in the telecommunication, electricity or urban transport sectors, usually only one firm received the right to provide the service. However, competition in the market leads firms to offer better services, instead of putting all their effort in winning the auction (Pirsch, 1997).

Although from a technical viewpoint it is possible to implement auctions where several firms enter the market, firms can gain less scale economies and as a

[9] See Stegeman *et al.* (2007).
[10] Covarrubias and Reiche (2000).

consequence they might ask for higher subsidies. In spite of this, some technologies can sustain better than others the presence of more than one operator. For example, wireless telephony implies less sunk costs than traditional fixed telephony, and as a consequence it favours the introduction of more competitors (Lehman, 2006). In the electricity sector, the use of photovoltaic panels favours the presence of many competitors in the same neighbourhood.[11]

2.5 Regulation of the market

The regulation of the sector is a key element to increase the firm's interest to provide universal services. Indeed, firms want a clear and stable regulatory regime that allows them to estimate the costs and revenues of each project and that reduce their risks (Wellenius *et al*., 2004).

In some Latin American (Chile, Peru) and African (Uganda) countries, the regulator has introduced asymmetric prices in the fixed telephony to increase the attractiveness of concessions: prices in rural areas are higher than in urban regions. In addition, operators have more flexibility to adjust their retail prices to changes in the market and in technology. Another regulation in the telecommunications sector is the establishment of high interconnection prices for rural operators (Lehman, 2006). In Chile, Peru and Colombia, rural operators charge interconnection prices that are several times higher than the prices set by urban operators. This asymmetry increases the revenues of rural operators due to the differences in interconnection traffic (Dymond and Oestmann, 2002).

The concession's contract also reflects many regulatory aspects that affect the profitability and conduct of the operators. Concessions must indicate the mechanism used to regulate the prices and the quality, the technology that can be used and the coverage that must be attainted by operators. Contracts can establish that concessionaires are the owners of the infrastructure and support all the commercial risk of their activity. This occurs, for instance, in the telecommunications and the electricity sectors, which require large investments. In other sectors, concessionaires are only responsible of providing the service and regulators own all the equipments and infrastructures necessaries to offer the service. For example, in Barcelona, the regulator of the urban transport system owns the vehicles and garages that are used by private operators.

Concessions also define the duration of contracts. There are positive and negative aspects related with the duration of concessions. A short period reduces market risks and allows the regulator to adjust the contracts to changes in the technology and the demand. However, the longer the contract, the larger are the investment incentives for the winner operator (Nett, 1999 and Lehman, 2006). Hence, defining the optimal duration time of contracts is a complex task. Longer time horizons might be needed for dynamic efficiency considerations but this results in higher subsidies, as the bidders will request considerable risk premia.

In order to moderate this problem, Engel, Fisher and Galetovic (2001) suggest using an auction design where the regulator fixes the prices of the service and firms bid for the minimum present expected value of the revenues. In this context, the duration of

[11] Paul M. Milgrom was the first to suggest more than one operator in the same USO region. Others works on this topic are Pirsch (1997), Laffont and Tirole (2000), Stegeman *et al.* (2007) and Weller (1999).

the concessions can be adjusted taking into account the realization of the revenues by the operator.

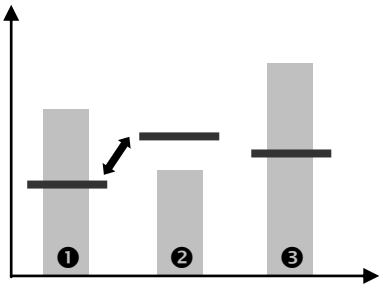
3. Some concerns about USO auctions

Apart from the issues related to their implementation, Universal Service auctions exhibit some general concerns that must be addressed. We briefly discuss some allocative and distributional concerns. Moreover, auctions have an effect on the cost of the USO which can be explained by real options.

3.1 Allocative Concern: Selection of the Winner

The allocative objective of tendering universal service obligations is to choose the most efficient producer with the most efficient technology. However, when there is uncertainty about future market outcomes, operators other than the current universal service provider may not have very precise knowledge of the net cost of the universal service. In Figure 3, the horizontal lines illustrate the operator's true net costs and the grey bars an estimate of these costs. Clearly, in this example operator 1 is most efficient, but it is bidder 2 who receives the lowest (cost) signal and therefore wins the auction. In the Figure, the resulting inefficiency is indicated by the arrow. Bulow and Klemperer (2002) show that common value auctions are always won by the bidder with the highest (in our case lowest) signal. In our setting, this leaves open the question whether it is the most efficient bidder who receives to lowest signal.

Figure 3: Bidding with heterogeneous bidders.



Source: Jaag and Trinkner (2008).

3.2 Distributional Concern: The winner's curse

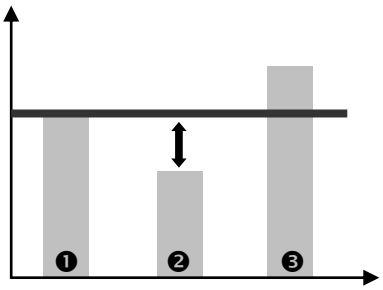
Tendering universal service obligations ideally guarantees that the winning bidder is not able to earn an excessive rent at the expense of the public. This is the major distributional concern. Consider an auction in which each bidder knows the net cost of the universal service obligation being auctioned only imprecisely, but that information is private and independent of other bidders' information. Under such circumstances, competitors will usually bid more aggressively as the number of bidders increases.[12]

To illustrate the idea, assume that the cost of the USO is the same for all potential providers. This "common value" is reflected by the horizontal line in Figure 2. Hence, from the point of view of productive efficiency it does not matter who will win. However, operators can be uncertain about their costs. Suppose that they have

[12] Cf. e.g. McAfee and McMillan (1987).

unbiased estimates of the real net cost, which are shown by the grey columns in Figure 2. If bids are a monotone function of this estimate, the auction will be won by bidder 2, since this is the operator that received the most optimistic estimate and hence requested the lowest subsidy. Therefore, the average winning estimate will be lower than actual cost. This is a well known result in auction theory that is called the "winner's curse".

Figure 2: The winner's curse with homogeneous bidders.



Source: Jaag and Trinkner (2008).

The winner's curse in common value auctions implies that an increase in the number of bidders has two opposing effects on the bidding behavior: First, increased competition leads to more aggressive bidding. This effect is similar to the outcome in standard competitive situations and private value auctions. Second, bidders recognize that the potential for the winner's curse becomes more severe, which induces them to make larger upward adjustments to their cost assessment to avoid losses in the event they win.

Hence, there are two possible outcomes from a distributional point of view:

1. If operators bid irrationally, the winner receives a too small compensation for providing universal services.
2. If operators bid rationally, they shade their bid and claim a high compensation.

Which of these outcomes is more likely? Milgrom and Weber (1982) discuss the possibility of the winner's curse and propose an empirical test: In a common value auction, with a higher number of participants, bidders will rationally lower their bids to prevent a winner's curse from happening, while in a private value ascending auction (or if participants bid rationally in a common value auction), the number of bidders should not have an effect on bids.

Among others, Hendricks, Porter, and Boudreau (1987), Thaler (1988), Hong and Shum (2002), and Bajari and Hortacsu (2003) present mixed empirical evidence that companies rationally respond to avoid a winner's curse. See Jaag and Trinkner (2009) for a more detailed discussion.

At a first glance, participants in auctions seem to behave sub-optimally and irrational if they do not account for the possibility of a winner's curse (cf. Cox and Isaac, 1984). However, if a tender leads to a systematically underfunded provision of universal services, this will ultimately result in a costly renegotiation of terms, which in turn undermines further tendering. Indeed, bidding low in a USO tender may not be irrational after all: Once the auction is won, the terms can be renegotiated as the state will not want to do without universal service. This problem is especially important if

the need to establish new processes and infrastructure in order to provide the USO precludes potential other operators from stepping in.[13]

3.3 "Cost of USO concern": Real Options

Tendering universal service obligations requires that bidders know or estimate "the net cost" of the USO (i.e. the profit reduction resulting from a successful tender). Several factors render the calculation of the "net cost" a complex task. For example, if the USP does not receive exclusive rights for providing universal services, it will not know the number of future competitors. On the other hand, operators must take into consideration the evolution of several different and interdependent variables.

The calculation of the net cost involves the correct anticipation of the yearly market equilibria during the contract period (e.g. 7 years). As suggested by Jaag and Trinkner (2008), the operators can estimate the flexibility they lose due to the USO by use of real options theory. We now elaborate the issue in more detail.

Virtually any market player alters its service offerings from time to time. This could be a change in product features or pricing caused by changes in overall demand or competitor's offerings, a change in service coverage, an alteration in the quality of service, changes in the sales network that could be redesigned taking into account customer preferences, technology changes and costs. Most operators systematically implement a minimum amount of flexibility to adapt to the customer needs timely in their corporate strategy. Similarly, investments projects are often designed such that either cost efficient abandonments are possible or the investment can be used in alternative ways.

Such corporate flexibility to adapt to the market can be valued by use of real options analysis (ROA). A real option is the right - but not the obligation - to undertake some business decision. The "value" of such flexibility is often neglected in standard capital budgeting (e.g. NPV, DCF). These methods normally do not properly account for the risk patterns over a project's lifecycle and fail to appropriately adapt the risk adjustment. Real options provide a means to do so and can be valued similar as financial options (Trigeorgis, 1986). However, in contrast to financial options, real options are rarely tradeable and are difficult to calibrate. Moreover, a project may have a portfolio of embedded real options; some of them can be mutually exclusive. Some new methods have recently been introduced that simplify the calculation of real options (e.g. Datar-Mathews method (2004, 2007), "Fuzzy Pay-Off Method for Real Option Valuation" (2008)).

Auctioning off the USO raises the need for detailed ex ante regulations on all services that have to be provided during the contract period. Otherwise, companies could hardly predict their future costs of providing the USO and could hence hardly seal a substantiated bid. For example, a contract period of seven years requires detailed regulations on pricing, quality, products and coverage at the time of the auction and companies must predict market developments over long time horizons.

Winning a USO auction hence necessarily comes along with a substantial loss of corporate flexibility and quickly hampers a company's ability to adapt to changes in the market over time. Such flexibility might be of special importance in times of strong

[13] The bargaining position between the government and the USP will depend on the government's USO replacement costs compared to the USP's equity at stake. Typically, the latter will be significantly lower in size.

technological change (e.g. "e-substitution" in the postal sector). Most real options affected by USO regulations become worthless. This loss in value will be included in any ex ante net cost computation of companies that plan to participate in a bid. Note that these costs are raised by the auction mechanism itself as auctions require – compared to direct USP designation - a suboptimal high level of detailed ex ante USO regulations.

The value of the affected real options is high with long contract periods ("time to maturity"), detailed and extensive USO regulations (strike price), and various sources of market risk (volatility).

Hence, from welfare point of view, USO auctions should be designed in a way that the value of such real options is as small as possible. Otherwise they raise the social cost of the USO. A solution could be to establish shorter contract periods (e.g. three years). However, short time periods have again negative effects on investment incentives, as the USP must recover any investments in a shorter period of time. Such trade-offs are difficult to resolve (see for example Oxera (2007)).

4. Universal service auctions in network industries

In the last decade, several countries have used auctions to select the USO provider in the telecommunications, transport, electricity and water sectors.[14] The results of these experiences are mixed. Next we briefly describe some of these experiences.

4.1 USO auctions in developing countries

Latin America has pioneered the introduction of universal service policies in the World. Many initiatives created in this continent have later been adopted in Africa and Asia. In the telecommunications, most Latin American countries have created a Universal Service Fund that finances the diffusion of basic services in rural communities, specially telephony and electricity. Several of these Funds have used auctions to select the USO providers.[15]

En 1994, Chile was the first country to create a universal service fund and to use an auction to extend the public telephony to rural and low income urban areas. During the period 1995-2000 the fund used several auctions that benefit more than two million persons. The first auction only considered basic telephony, but most recent projects have also auctioned licenses for installing telecentres (telephony and Internet).

The success of the Chilean auctions rapidly influenced many Latin American countries such as Bolivia, Brazil, Colombia, Dominican Republic, El Salvador, Guatemala, Nicaragua and Peru (Table 1).[16] Latter on, several African countries such as Ghana, Senegal, South Africa and Uganda also introduced universal service auctions.[17]

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[14] Cantillon and Pensendorfer (2006) and Mathinsen and Solvoll (2008) analyze the use of auctions in the bus industry of London and Norway, respectively.

[15] ITU (2006) has shows that the 85 per cent of all Latin American countries use universal service funds. The rest of countries impose universal service obligations on some operators.

[16] See Wellenius (1997), Cannock (2001) and Sepúlveda (2004).

[17] In 2001, Uganda was the first African country to create a Universal Service Fund, and in 2004 it organized the first USO auction. OCDE (2004).

A common feature of all these experiences is the use of pilot projects before the auction of all the concessions. This strategy is useful for eliminating mistakes in the selection of the municipalities' beneficiaries of the USO policy and for estimating the maximum subsidies. In fact, in many cases the first auctions granted lower subsidies than the subsequent projects. This situation results from regulators having learned how to accurately estimate the maximum subsidy, and also because the first regions auctioned were the most profitable ones.

The design of USO auctions has evolved in the last decade. The design of auctions has become more complex and innovative. For example, while initially regulators used first-price sealed bid auctions, in the last years some countries have introduced combinatorial and simultaneous open auctions.

However, the use of auctions has not always been successful. The first auctions of telecommunication services carried out in India offered very poor results. The first auctions were launched in 2003 with the objective of installing public phones in 20 regions of the country that covered 520.000 municipalities (Kalra and Borgohain, 2004). Only the mobile operators that were operating in the regions and the incumbent fixed line operator BSNL were allowed to participate in the auction. The result was that BSNL won the concessions in 19 regions, obtaining the maximum subsidy offered by the regulator.

Noll and Wallsten (2005) and Stegeman *et al*. (2007) have summarized the main design problems of the Indian auctions: (1) The maximum subsidy was inadequately estimated because the main source of information was provided by BSNL; (2) BSNL participated in the auction having several advantages with respect to its rivals, such as a favourable interconnection regime; (3) Only incumbent operators could participate in the auctions; (4) the size of the regions was too large. In spite of these results, Wallsten (2008) explains that recent auctions carried out in India have been more successful.

Table 1. USO auctions in the telecommunications sector

Country	Name of the project	Funding mechanism	Regional monopoly	Length of concession	Year of the auction	Muni-cipalities served	Maximum subsidy (US$m)	Total Subsidies (US$m)	Subsidies per municipality (US$)
Chile	Fondo de Desarrollo de telecomunicación.	National budged	No	30	1995-97	4.504	24.2	10.2	2.256
					1998-99	1.412	14.4	9.8	6.919
					2000	143	1.9	1.8	12.727
Peru	Fondo de inversión en telecomunicación. (FITEL)	1% of firms revenues	No	20	1998	213	4.0	1.7	5.700
					1999	1.937	50.0	11.0	12.100
					2000	2.290	59.5	27.8	4.600
Colombia	Fondo de Comunicaciones (Compartel)	Firms revenues and government contributions		10	1999	6.865	70.6	31.8	4.600
Guatemala	Fondo para el desarrollo de la telefonía (FONDETEL)	Auctions of spectrum			1998	202	n.a.	1.5	7.587
					1999	1.051	n.a.	4.5	4.282
Dominican Republic	Fondo de desarrollo de las telecomunicaciones (FDT)	2% firms revenues			2001	500	3.8	3.4	6.800

Source: Dymond and Oestmann (2002), Sepúlveda (2003).

USO auctions have also been used in the electricity sector. In the next years, an important number of rural municipalities in developing countries will connect to the main electricity grid, but most of the rural population will remain disconnected of the electricity service due to the high cost of expanding the infrastructure. In spite of this, new advances in the technology used in the electricity sector allow to create autonomous electric systems disconnected from the grid.

Many developing countries have undertaken electrification programs disconnected of the main grid to cover the needs of residents (light, television, radio), business (pumping of water, refrigerators) and public services (schools, hospitals, social services, police stations).[18] Rural systems use different combinations of energies, including diesel generators, mini-hydroplans, photovoltaic, eolic, and biomass energy.[19] In order to undertake these electrification programs, some countries are using USO auctions. This is the case of Argentina, Bolivia, Chile, Colombia, and Peru in Latin America Latina, and Cabo Verde, Benin and Togo in Africa.

Table 2. Auctions in the electricity sector

Country	Name of the project	Regional monopoly	Subsidies	Length of concession
Argentina	Energía renovable en el medio rural	Province	Payment of the 35% of the cost of the system. This percentage is reduced in the following years.	15, renewable to 45.
Benin y Togo	Energía rural descentralizada	Selected projects	Annual payment during 5 years of the 25% of the cost of the system.	15, renewable to 45.
Cabo Verde	Reforma y desarrollo del sector de la energía y del agua	No	10-30% of the cost of the system, depending on the project.	10
Peru	Electrificación rural fotovoltaica	Communitarian projects, not necessarily monopolies	80%of system's installations cost	-
Bolivia	Electrificación rural basada en las energías renovables	Communitarian projects, not necessarily monopolies	20-35% of system cost, depending on the technology	-

Source: Martinot and Reiche (2000), Covarrubias and Reiche (2000), Del Sol (2002).

4.2 Selected Auctions in developed countries

In 2001, Australia organized an auction to increase the competition in two regions that cover 80 per cent of the remote and unpopulated areas of the country. No firm decided to participate in these auctions to compete against Telstra. Lehman (2006) summarises the factors that could have influenced this result: (1) the fear to compete against Telstra; Indeed, the most successful auctions in the world are generally those of regions that previously were not covered by any operator, or where the installed capacity was very small; (2) the winners were required to offer the service to all the population of the regions auctioned; and (3) the participants had difficulties in identifying other services that could complement their revenues in these regions. Bearing these arguments in mind, the Australian regulator concluded that a higher

[18] See Wellenius, et al (2004).

[19] Fuente and Alvarez (2004) analyse electrification models in Latin American rural communities using renewable energy sources.

subsidy would have increased the participation in the auctions. However, for the regulator it was not worthwhile to increase the subsidies to obtain more competition.

In Europe, the Swiss telecommunications Act[20] envisions competitive tendering of selected universal services. Such services include call boxes and most recently a nationwide provision of broadband internet based on ADSL technology. As in Australia, the auction takes place even if the requested service level is already provided in the market. Indeed, no substantial exclusive rights are involved in the auctions. On the other hand, in the Swiss auctions the winner does not receive its winning bit. Instead it can receive a subsidy that the state considers appropriate based on the cost of a hypothetical efficient operator. This is somewhat in contrast to the economic reasoning of auctions that aim to implicitly reveal the lowest need of subsidies through competition. The law foresees that all telecom operators, including the USO operator, contribute to a compensation fund.

So far two tenders have been organized in Switzerland. In both cases only the incumbent Swisscom participated in the tender, and it did it "for free", i.e. its bid was CHF 0. However, the regulator did not accept this (quite favorable) bid. Instead it canceled the auction and designated Swisscom as the USP. Even so Swisscom did not request any compensation, the regulator subsequently obliged Swisscom to open its books.

Competitive tendering is also frequent in the bus industry several countries such as Denmark, Norway, Sweden, Switzerland and UK have used auctions to select the industry operators. After a progressive implementation during the 1990s, today almost all public bus services in the Nordic countries use competitive tendering (Hershen and Wallis, 2005). Interestingly, several papers suggest that when contracts are tendered, the saving in average total cost per vehicle/km is quite important.

In Norway, tendering has continuously increased in the urban transport since 1994 A study of the 70 contracts put out to tender from 1995 to 2006 shows that the number of bidders generally has been around three to five. During this period, both the average duration of the contracts and the number of vehicle/km have increased. On the other hand, Mathisen and Solvoll (2008) explain that in the long-term, the many takeovers and increasing ownership links among transport Norwegian firms may reduce the competitive element of auctions and lead to an unwanted concentration of the market.

5. USO auctions in the postal sector

In this section we discuss the application of subsidy auctions in the postal sector. Thereby we try to identify the main problems and advantages relative to other mechanisms.

5.1 USO auctions in the postal sector

In the postal sector, subsidy auctions are a means to *allocate universal service obligations* to one or more operators as well as to delegate the *determination of the cost of the USO* to the market. Note, however, that the cost of the USO itself still has to be funded by a funding mechanism like government subsidies or compensation funds.

[20] Fernmeldegesetz (FMG), issue of April 1st 2007

Table 3 depicts the four basic subsidy auctions designs are thinkable in the postal industry.

Table 3. Basic Auction Designs and applications in the postal sector

	Exclusive rights	No exclusive rights
One winner	Franchise bidding Demsetz (1968). Example: Lebanon	USO subsidies in liberalized markets (Jaag et al. 2009). Example: Germany
More than one winner	Franchise bidding and competition in the market, Milgrom (1999), Sorana (2000)	Multiple USO subsidies in liberalized markets

The last row of the table (more than one winner) is a solution reserved to cases where there are no relevant economies of scale in the provision of the service. In the postal sector, this is certainly not the case. Indeed, governments will not be prone to subsidize more than one delivery network in rural areas or two post offices side by side.

The top left box (franchise bidding) is the standard setting in auction theory and the solution that has been applied in general in other network industries. To our knowledge, the only government that has procured exclusive rights in the postal sector (i.e. a postal monopoly) has been Lebanon. In 1998, the postal monopoly was transferred to a private company that had won a beauty contest. Since then, LibanPost has shown a remarkable and successful transformation process. Note that postal administrations themselves quite often procure some exclusive rights to suppliers and third parties (Step 4 in Figure 1). E.g. New Zealand Post has for years successfully procured rural deliveries (see Oxera, 2007). The question here is substantially simplified compared with auctioning the USO (and is essentially a standard outsourcing decision).

In the European Union, exclusivity rights will not be allowed under the third postal directive after 2013. Therefore, the most relevant field in these postal markets is the gray shaded area in Table 3. Various auctioning designs are available (cf. Section 2). To achieve efficient subsidies, the choice over the auction design is crucial to minimize or overcome potentially negative effects of tendering as outlined in Section 3. Efficient subsidies can be expected if the auction takes place under "perfect competition" with a sufficient number of non-collusive and rational bidders that compete truly for the subsidy. This will be hard to achieve in the postal sector, as USO requirements are nationwide defined (products, quality, uniform pricing…) and production exhibits substantial economies of scale and scope. Market entries at that scale are more risky than in other sectors (e.g. tenders of bus lines). In a national auction, one will find hardly ever more than two or three interested operators (including the incumbent). The auction design must account for this problem.

Hence, a first concern relates to the lack of potential bidders. Two complementary measures (or a combination of the two) might mitigate this problem: (a) Splitting up the USO into smaller pieces to reduce bidding asymmetries in favor of the incumbent and to decrease the cost of market entry (see WIK (2008) for a recent suggestion). (b) Setting a maximum subsidy ("reservation price") to reduce the negative effect of collusion or market dominance. Both solutions come along with new challenges:

(a) Splitting up the USO into various regions raises various interconnection issues, the question of how to enforce uniform pricing without enabling cherry picking

(inefficient bypass), and administrative costs. According to Oxera (2007) it is not possible to sustain uniform prices in such a system. A further issue relates to production externalities. Postal USO requirements include traditionally nationwide uniform products (collection days, points and times; quality; distribution days and times, price and stamps). If the USO was split up into various regions and served by various local USP's, these local USPs might be forced to adapt their processes in other (non-USO) regions too for logistical reasons (e.g. time windows). This might result in uniform processes between the various operators and thereby indirectly hamper innovation and foster collusion. More generally, from an operator's point of view, winning an auction has cross effects on services offered in other areas. The auction model implemented in Germany might resolve some of these issues: It foresees that only the components of the USO that are not (anymore) supplied by the market will be procured by the regulatory authority (cf. Section 5.2).

(b) For the procuring body, setting a maximum subsidy raises the need to calculate the net costs of the USO. Thereby, the authority should consider the cost and earning effects of all USO elements in question, such as the list of services covered by the USO; the accessibility of post offices and the area covered in delivery; frequency of service (e.g. five times per week); prices (prices must be uniform for USO services, at least for single piece items of private customers); quality (e.g. E+1); infrastructure (obligation to operate certain infrastructures, such as post offices). This requires extensive information on sensible market data (and is exactly what auctions are intended to avoid through the endogenous determination of the USO costs by the market mechanism itself).

A crucial second issue for successful tendering is the design of the contract. For example, as we have emphasized in section 3, the determination of the contract length is a key aspect: longer time periods increase the investment incentives but require extensive ex ante regulations that raise the cost of the USO (real options issue).

It would be beyond the scope of the paper to resolve these issues in detail and to derive a "one size fits all" auction design for the postal sector. Instead, we briefly explore the most recent developments and examples from the EC.

5.2 Applications of subsidy auctions in the European Union

The third European postal directive (2008/6/EC) envisages full market opening by 2013 and allows for competitive USO tendering: Article 7(2) of the directive states that "*… Member States may ensure the provision of universal services by procuring such services in accordance with applicable public procurement rules and regulations*". According to Article 4, the directive allows to divide the USO into various single obligations: "*Member States may designate different undertakings to provide different elements of universal service and/or to cover different parts of the national territory*."

Somewhat unclear is the meaning of Art. 7(3) in relation to the tendering option. The article states that compensation or sharing mechanisms might only be implemented if a "net cost" arises. These net costs have to be calculated taking into account Annex I of the directive which states that *"the responsibility for verifying the net cost lies with the national regulatory authority. The universal service provider (s) shall cooperate with the national regulatory authority to enable it to verify the net cost.*"[21]

[21] Annex I further establishes that "The net cost of universal service obligations is any cost related to and necessary for the operation of the universal service provision. The net cost of universal service obligations is to be calculated, as the difference between the net cost for a

According to Article 14, the USP is moreover subject to detailed accounting requirements even if the subsidy was the result of a subsidy auction.

As they stand, these provisions might make the result of any subsidy auction superfluous as the successful bid might not be accepted *per se*. The designated USP will receive a subsidy equal to its bid only if detailed computations of the regulatory authority lead to the same result as the auction. As a consequence, operators participating at the bid are aware that winning the auctions means opening the books to the regulator. This might not be an attractive prospect.

The EC provisions that do not accept the successful bid *per se* can be interpreted as a presumption of the EC policy makers that reverse auctions will likely not result in efficient subsidy levels in the postal sector.

So far, no subsidy auctions have been organized under the postal directive framework. In Germany, a tendering mechanism for universal postal services was implemented in 2008 when the market was completely liberalized. In case USO elements as defined by the German postal law are not provided by the market, the law foresees to auction the lacking USO elements. Since 2008, the historic incumbent operator Deutsche Post has not announced to change or reduce its services in a way that would have resulted in a public tender. Consequently, no auction has taken place in Germany yet. Two interpretations are possible: Either the USO in Germany entails no considerable net costs, or other reasons prevent DHL Deutsche Post from reducing the USO, such as the underlying funding mechanism.

In light of the challenges of subsidy auctions in the postal sector, the main strength of the German model is that the USO is neither tendered as a whole nor divided up into several regions. Only those parts of the USO not provided by the market will be tendered, e.g. a post office, a specified quality level for basic letter service, or services in a number of remote islands. Such "incremental subsidy auctions" might result in more bidders - and eventually in a USO provision that is less costly.

6. Summary and Conclusion

Traditionally, Universal Services have been provided by state-owned operators that had a public mission. Operators were compensated with extensive exclusive rights, which allowed them to use cross-subsidization between different regions, customers, and services. In liberalized markets, such a policy cannot be sustained any longer to finance the USO. Therefore, alternative mechanisms should be envisioned to guarantee the efficient provision of basic (postal) services in rural regions and to small customers. One such option is the use of auctions that have been used in other network industries for more than two decades with mixed results.

In theory, under efficient market conditions, subsidy auctions allow for finding the most efficient provider for the required service at the minimum level of compensation. In practice, the design of auctions is complex and requires to solve several trade-offs. A

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designated universal service provider of operating with the universal service obligations and the same postal service provider operating without the universal service obligations. The calculation shall take into account all other relevant elements, including any intangible and market benefits which accrue to a postal service provider designated to provide universal service, the entitlement to a reasonable profit and incentives for cost efficiency."

first trade-off relates to the *duration* of the contract period. Contracts could range between three and ten years. The longer the contract, the larger are the investment incentives for the winning operator. However, the longer the contract the fewer are the possibilities to adapt the USO over time to the customers' needs. Therefore, although long time horizons might be needed for dynamic efficiency considerations (investments and innovation), they might result in higher compensation needs as the bidders will request considerable risk premia.

A second problem is the determination of the optimal *level of aggregation*: Should the USO be tendered globally or divided up into various pieces and procured in smaller tenders? A global approach allows exploiting scale and scope economies. However, dividing the USO up into several pieces, for example various regions, enables yardstick competition which could result in a more transparent provision of the USO. Such a disaggregated approach involves complex practicability issues (e.g. the regulation of interconnection), and might not be able to sustain uniform prices and services.

A third trade-off relates to the level of *concreteness* of the specific USO requirements. Tenders increase information asymmetries between governments and contractors compared to public provision. Hence, the relatively loose and open missions of the state-owned enterprises have to be replaced by detailed, precise and measurable USO provisions. Detailed definitions on quality levels, accessibility criteria etc. increase both the operators' and regulator's legal certainty and provide a clear basis for any USO cost calculations. However, detailed contracts might unnecessarily hamper the commercial flexibility of the USO operator.

The use of subsidy auctions might also entail various political challenges for the regulator. First, tendering might require *privatizing* some of the activities that previously were provided by a state-owned incumbent monopoly. Otherwise, conflicts of interests are prevalent and a level playing field between the various USO candidates is not guaranteed. Hence, governments must assess whether they are ready and able to privatize their state-run undertakings. Second, USO tendering requires funds to pay the winning bid. In the absence of such funds, USO requirements should be redefined accordingly. Third, governments must be aware of the hold-up risk that is involved in tendering. In case the winner of the auction did underestimate the cost of the USO (winner's curse) or in case of bankruptcy, the government loses its invested compensation and is likely to be forced to enter into costly renegotiations of the concessions.

We conclude that tendering can be an option for procuring the provision of universal service obligations. The design of a tender should consider the relevant sector-specific aspects, such as the industry structure and changing consumer needs. One size will not fit all. In order to ensure the frictionless functioning of universal services in liberalized markets, these issues should be thoroughly assessed and resolved before a tender or other procurement mechanisms are introduced.

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