

Estimating Costs for Universal Service Obligations

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ABSTRACT

Faced with the impacts of telecommunications market liberalization and privatization, many countries are in the process of revising their Universal Service Obligation (USO) policies. This paper describes UK, Australian, Chilean, and US experiences. It also provides standards for estimating costs for ongoing universal service obligations in telecommunications.

I. INTRODUCTION

Telecommunications market liberalization and privatization are prompting many countries to revise their Universal Service Obligation (USO) policies. USOs generally take the form of government requirements to charge subcompetitive, non-cost covering prices in certain markets to further some social objective, or obligations to provide a level of service quality that customers are not willing to pay for. Traditionally, governments have allowed service providers to fund the USOs by charging supercompetitive prices in other markets. Market liberalization makes this traditional funding system unworkable because competition drives down the supercompetitive prices.

When revising USO policies, governments must resolve the issue of the amount of money needed to fund the USO. This was not an issue under the traditional subsidy system. There are two basic types of USOs to consider: historical USOs and ongoing USOs. Historical USOs are those that have been fulfilled in the past and that may not have been fully compensated. Ongoing USOs include ongoing or future requirements to price some services at unprofitable levels, to maintain uneconomic levels of infrastructure in order to stand ready to serve, and to place an unremunerative technology in order to facilitate community or economic development.

Telecommunications regulators in the United Kingdom (UK), Australia, Chile, and the United States (US) have addressed issues related to USO costs, or are in the process of doing so. This paper

discusses these efforts and describes standards for estimating net USO costs.¹ The next section describes how regulators select either a single USO provider per area or multiple providers. Section III describes the UK, Australia, Chile, and US experiences. Section IV provides standards for estimating USO costs and contrasts these standards with events in the four countries discussed. Section V is the conclusion.

II. SINGLE VS MULTIPLE USO PROVIDERS

There are two basic paradigms for designating USO providers.² Most countries have a single USO provider in an area. Only this provider can obtain USO subsidies. Governments in Australia and the UK designated the incumbent service providers as the USO providers. Chile used a competitive process to select USO providers.³

In contrast, the US will have multiple USO providers in an area.⁴ In the US, the new subsidy framework under the Telecommunications Act of 1996⁵ targets customers. This means that the subsidy can go to any eligible service provider that the customer chooses. To be eligible, the relevant state

¹ Net USO cost is the difference between the provider's cost of the services in the USO and the provider's non-subsidy revenues from providing the USO services.

² Mark A. Jamison, "Estimating Costs for Universal Service Obligations," *Telecommunications Journal of Australia* 47(1): 51-58, 1997.

³ Björn Wellenius, "Extending Telecommunications Service to Rural Areas – The Chilean Experience," *Private Sector* 9: 35-38, (December 1996).

⁴ This may not be true for all USOs. The obligations in the US may not be symmetric among all competing USO providers. In the past, some regulators have required incumbent local exchange carriers (ILECs) to **maintain an uneconomic level of infrastructure in order to stand ready to serve or to place an unremunerative technology in order to facilitate community or economic development. Continuation of these obligations without either the regulator or the market placing a symmetric burden on new entrants, will make this portion of the US USOs be of the single-provider type.**

⁵ Pub. L. No. 104-104, 110 Stat. 56. The 1996 Act amends the Communications Act of 1934, 47 U.S.C. §§ 151 *et seq.* (Act). Hereinafter, all citations to the Act and to the 1996 Act will be to the relevant section of the United States Code unless otherwise noted.

Public Utility Commission (PUC) must find that the service provider offers the services targeted by the federal universal service support mechanisms throughout the area using at least some of its own facilities and advertises these services using media of general distribution.⁶

III. COUNTRY CASES

There are two USO providers in the UK: British Telecom (BT) and, in Hull, Kingston Communications (KC). These companies are obligated to provide voice telephony services to customers even when it is uneconomic to do so.

The UK Office of Telecommunications (OFTEL) undertook an investigation of the costs that these obligations impose on BT and KC.⁷ OFTEL's consultant, Analysys, identified two aspects of BT's and KC's USOs that create USO costs: the cost of provision in uneconomic areas and the cost of provision to uneconomic residential customers in all other areas.⁸ In considering how to fund these USOs, OFTEL concluded that it is necessary to deduct USO benefits from USO costs so as not to advantage BT and KC. Specifically, OFTEL has stated that BT and KC might receive commercial advantage or financial benefit in the form of:⁹

- enhancement of corporate reputation
- marketing and brand recognition
- information on how customers use the telephone
- benefits associated with customer life cycles
- benefits associated with ubiquity
- the avoidance of loss of business through poor image and loss of trust due

⁶ 47 U.S.C. §§ 214(e).

⁷ Office of Telecommunications, *Universal Telecommunications Services: A Consultative Document on Universal Service in the UK from 1997* (December 1995).

⁸ Analysys, Final Report for Oftel: The Costs, Benefits and Funding of Universal Service in the UK (July 19, 1995).

⁹ OFTEL(1995).

to disconnecting or discouraging subscribers

- avoidance of the costs of disconnection, and
- minimization of planning costs.

Analysys estimated that the annual financial cost of serving uneconomic residential customers and uneconomic areas is between £58 million and £89 million for BT, and between £0.39 million and £0.41 million for KC. Taking into consideration the benefits, the net costs for BT are between £4 million and £25 million, or between £9 and £40 million depending on the interpretation of the USO. For KC, the net cost is approximately £400,000. Based on these estimates, OFTEL decided that the net costs of USOs are sufficiently small to merit no USO subsidy.¹⁰

Australia is now into its second estimate of net costs of Telstra's USOs. Telstra is the only USO provider in Australia. In its first estimate in 1989, Austel, the regulator at the time, examined both embedded, fully allocated costs and forward-looking incremental costs of USOs. Austel chose the incremental cost method and found costs of A\$237 million for general USOs, A\$8 million to A\$10 million for concessions to charitable organizations and the disabled, A\$4.5 million for emergency service, and A\$48 million for telephone rentals to pensioners.¹¹

Currently, the Australian Communications Authority (ACA, formerly Austel), is finalizing an engineering cost model for estimating net USO costs.¹² The three telecommunications carriers in Australia are funding the model development, but the developer (Bellcore) answers to Austel. The model will determine the net

¹⁰ Office of Telecommunications, *Universal Telecommunications Services: Proposed arrangements for Universal Service in the UK from 1997* (February 1997).

¹¹ Australia Bureau of Transport and Communications Economics, *The Cost of Telecom's Community Service Obligations* (Canberra, 1989).

¹² An engineering process model estimates costs by constructing telephone networks of specific technologies and with specific levels of productivity.

incremental cost (using LRIC principles) of providing 'standard' telephone services and payphones. Revenues and costs from providing 'non-standard' services are excluded. All carriers in Australia will help fund the subsidy by making a levy payment to Telstra on the basis of their share of total industry 'eligible revenue' for the same financial year. There likely will be four different costing groups: (1) very small exchanges will be costed on a whole of exchange basis; (2) larger exchanges will be broken down into two types of areas and costed separately -- rural townships where costs per customer tend not to vary too much within an individual township and rural townships where net costs can vary significantly; (3) payphones; and (4) radio and satellite customers.¹³

Chile has open competition in telecom markets. But in 1995, 10% of population had no access to a telephone. To remedy this, the government identified unserved areas and estimated potential profitability. It informed carriers of those that appeared could be profitable and auctioned subsidies for the apparently unprofitable areas. For the auction, the government set maximum subsidies and price caps for each area. The auction was conducted in 1995-96. In areas where there was competitive interest, subsidies were bid to zero. In areas with no or only token competition, subsidies were bid at or near maximum, or not bid at all. Prior to the auction, the government had estimated the necessary subsidy would be US\$4.2 billion. The auction resulted in actual subsidies of US\$2.2 billion granted, although not all of the areas in the US\$4.2 billion received bids.¹⁴

In the US, the Federal Communications Commission (FCC) and state PUCs are developing methods for estimating net USO costs that will be portable among eligible carriers. For the FCC, estimating these net costs involves four steps: (1) Estimate the forward-looking economic costs of providing universal service for rural, insular, and high cost areas; (2) Establish a nationwide revenue benchmark calculated on the basis of average revenue per line; (3)

¹³ Interviews with Neill Whitehead, ACA, 1997.

¹⁴ Wellenius (1996).

Calculate the difference between the forward-looking economic cost and the benchmark; and (4) Estimate the federal support at 25 percent of that difference.¹⁵

The FCC has determined that proxy cost models will be used to estimate forward-looking economic costs.¹⁶ A proxy cost model is an engineering process model that estimates costs of a representative company as opposed to a specific company. Initially, three proxy cost models were considered: (1) BCPM; (2) the Hatfield Model, developed by Hatfield Associates; and (3) TECM developed by Ben Johnson Associates, Inc.¹⁷ The models varied in their engineering assumptions and input values, such as depreciation and cost of capital. The FCC dropped consideration of the TECM because it could not provide nationwide estimates of USO costs.

The FCC is in the midst of deciding details of its proxy cost model should work, with a target implementation data of January 1, 1999.¹⁸ So far the FCC has decided that a proxy cost model should meet the following criteria:¹⁹

1. The technology assumed must be the least-cost, most efficient, and reasonable technology for providing the supported services that is currently being deployed. Network topology, line counts, and average loop lengths should match ILECs' existing networks.
2. Any network function or element must have an associated cost.
3. Only long-run forward-looking economic cost may be included. All costs must be treated as variable and avoidable. The costs must be based upon the current cost of purchasing

¹⁵ Federal Communications Commission, Federal-State Joint Board on Universal Service, CC Docket No. 96-45, and Forward-Looking Mechanism for High Cost Support for Non-Rural LECs, CC Docket 97-160, *Further Notice of Proposed Rulemaking*, FCC 97-256 (rel. July 18, 1997) , par. 1 (FNPRM).

¹⁶ Federal Communications Commission, Federal-State Joint Board on Universal Service, CC Docket No. 96-45, *Report and Order*, FCC 97-157 (rel. May 8, 1997), par. 6 (Order).

¹⁷ U S West, Sprint, and Pacific Bell sponsored BCPM. The Hatfield model was sponsored by AT&T and MCI. There have been several different versions of the Hatfield model,. The New Jersey Ratepayer Advocate sponsored the TECM.

¹⁸ FCC, Order, par. 2.

¹⁹FCC, Order, par. 250.

facilities and equipment rather than list prices.

4. The rate of return must be either the authorized federal rate of return on interstate services, currently 11.25 percent, or the state's prescribed rate of return for intrastate services.
5. Economic lives and future net salvage percentages used in calculating depreciation expense must be within the FCC-authorized range.
6. The proxy model must estimate the cost of providing service for all businesses and households within a geographic region.
7. A reasonable allocation of joint and common costs must be included.
8. The proxy model and all underlying data, formulae, computations, and software must be available to all interested parties. All underlying data should be verifiable, engineering assumptions reasonable, and outputs plausible.
9. The proxy model must include the capability to examine and modify the critical assumptions and engineering principles.
10. The proxy model must deaverage support calculations to the wire center serving area level at least, and, if feasible, to even smaller areas.

IV. STANDARDS FOR ESTIMATING SUBSIDIES FOR ONGOING USOs

This section describes standards for estimating appropriate subsidies for ongoing USOs. These standards are selected to achieve efficient market competition and sufficient supply of USO services.

Standard 1. Taken together, the prices charged for USO services and the USO subsidy should result in sustainable effective prices for USO services.²⁰

²⁰ An “effective price” is the sum of the price charged to the subsidized customer and the subsidy; i.e., Price charged + Subsidy received = Effective price. A sustainable price is one that allows a company to earn its cost of capital and that does not attract competitors to a market unless the competitors are able to lower overall market costs. See John C. Panzar & Robert D. Willig, “Free Entry; and the Sustainability of Natural Monopoly,” *The Bell Journal of Economics* 8(1): 1-22 (Spring 1977); and William J. Baumol, Elizabeth E. Bailey, and Robert D. Willig, “Weak Invisible Hand Theorems on the

Sustainable effective prices are necessary to ensure effective fulfillment of the USOs and for market efficiency. USO providers will have incentives to discriminate against subsidized customers if the subsidy amount gives effective prices that are below a sustainable level. This happens because the low subsidy makes the subsidized customers less profitable than unsubsidized customers, encouraging companies to direct investments towards the unsubsidized markets.

Subsidies that cause effective prices below a sustainable level decrease market efficiency by causing USO providers to suffer a financial disadvantage compared to their competitors. **Competition and service unbundling will eventually remove service providers' abilities to charge supercompetitive prices in other markets to cover the economic costs of USOs. Service unbundling allows arbitrage and component competition. These remove a service provider's ability to use revenues from one component or service to cover the costs of another.** This financial disadvantage would lower market efficiency by unnecessarily hindering the competitive efforts of the USO provider and perhaps causing the USO provider to withdraw from the market.

In the single USO provider case and in the multiple USO provider case where there is no prospect of competition in USO services, a subsidy that gives effective prices above a sustainable level could harm market efficiency by giving USO providers a financial advantage over their competitors. **The subsidy excess would protect the USO providers' overall profitability during times of intense price competition in other markets. This improves their financial viability relative to their competitors.**

In the multiple USO provider case where markets are competitive, a subsidy excess would cause market prices to decrease to unnecessarily low levels. For

Sustainability of Multiproduct Natural Monopoly," *American Economic Review* 67(3): 350-365 (June 1977). Sustainability developed as a pricing concept for natural monopolies. However, the principles apply to any firm that is a member of an efficient market structure.

example, if the unsubsidized market price of a service is \$25 and the regulator chooses a USO price of \$15, the subsidy amount should be \$10 (\$25 - \$15). However, if the subsidy is \$18, competition will push prices to subsidized customers down to \$7, far below the regulator's affordability benchmark. This would decrease the efficiency of the USO system.

$$(1) \quad \text{Net USO Cost}_{\text{single provider}} = \text{Incremental Revenues}_{\text{USO}} - \text{Incremental Costs}_{\text{USO}}$$

where the incremental revenues and costs triggered by the USO include all cross-elastic effects with non-USO services.

OFTEL applied Equation 1 as its avoidable cost approach.²¹ OFTEL considered the net USO cost to be the sum of the negative net revenues resulting from the USO. The relevant costs were considered to be the long run avoidable costs of serving the unprofitable customer, including costs that are shared among groups of unprofitable customers. The relevant revenues were all of the revenues forgone assuming the customers were not connected, including incoming calls.²²

Also in applying Equation 1, OFTEL added benefits associated with ubiquity, avoidance of the costs of disconnection, and minimization of planning costs. These benefits should have already been reflected in a lower incremental cost of the USOs. If they were, then OFTEL may have double counted these benefits by netting them against the USO cost estimate.

²¹ OFTEL (December 1995).

²² Office of Telecommunications, *A Framework for Effective Competition: A Consultative Document on the Future of Interconnection and Related Issues* (December 1994), as cited in David Gabel, *Improving Proxy Cost Models for Use in Funding Universal Service*, NRRI 96-34, National Regulatory Research Institute: Columbus, Ohio (December 1996).

Standard 2. When markets are competitive in multiple USO provider cases, the subsidy should be the difference between the competitive market price and the maximum price allowed by the regulator.

Assuming that competitive market prices are sustainable in the long run, Standard 1 implies that the subsidy in multiple USO provider cases should be equal to the difference between the competitive market price and the maximum price allowed by the regulator for the subsidized services. This means that Standard 2 can be applied in lieu of estimating USO costs. To illustrate application of Standard 2, assume the competitive market resulted in a price of \$25. Further assume that the regulator determines that some set of customers who would otherwise be charged \$25 can only afford a price of \$15. In this case, the subsidy provided to the carrier providing service should be \$10 for each subsidized customer. This subsidy would send the same price signal to companies and have the same financial impact on companies as the competitive \$25 price.

Standard 3. When markets are to be competitive in multiple USO provider cases, the proxy for the competitive market price should be the incremental cost of the USO plus a contribution to shared costs.

Standard 3 is necessary for cases where a competitive price is not yet known, a proxy can be developed by estimating the incremental cost of the USO and adding to it a portion of shared costs. Some analysts have argued that contributions to shared costs are inappropriate in this situation.²³ There are at least two problems with this. The first problem is that the resulting subsidy may not result in a sustainable effective price. A price is sustainable only if it is subsidy free. Subsidy-free prices exceed incremental cost (by covering some portion of shared costs) when markets are characterized by multilateral rivalry with economies of scope.²⁴ Multilateral rivalry occurs when firms face different

²³ See, for example, Gabel (1996).

²⁴ Mark A. Jamison, "General Conditions for Subsidy-Free Prices," *Journal of Economics and Business* 48:371-85 (1996).

mixes of diverse competitors in different markets. This certainly characterizes today's telecommunications markets. It is not clear that the telecommunications multilateral rivalry results from scope economies, but the potential should be investigated before attempting to apply Equation 1.

The following example illustrates how prices equal to incremental cost may not be sustainable.²⁵ Assume a company has three major service lines - A, B, and C, and that:

- The company's total cost is \$250 million;
- The incremental cost (total service long run incremental cost or TSLRIC) for A is \$50 million, for B is \$60 million, and for C is \$70 million; and
- There are shared costs of \$70 million.

For this company to be able to charge its TSLRIC of \$50 million for A and remain financially viable, the company must be able to charge \$200 million for B and C. This \$200 million is (by definition) the stand-alone cost of B and C.

If regulators base subsidies on TSLRIC with no contribution to shared costs, then service provider revenues for USOs services will be only TSLRIC (i.e., $\text{Price} + \text{Subsidy} = \text{TSLRIC}$). This forces the USO providers to charge stand-alone costs for other services. It is unlikely the USO provider could do this and earn a reasonable profit overall because competitors from other markets should be able to add these services to their existing service lines at less than stand-alone cost. Therefore, revenues ($\text{Price} + \text{Subsidy}$) for USO services need to make a contribution to shared costs.

The second problem with using only incremental costs to estimate the subsidy is that it makes the subsidized customers less profitable than non-subsidized customers, and perhaps even unprofitable. Making the subsidized customers less profitable (or even money losers) could lead to the discrimination problems described in the discussion of Standard 1.

Two of the FCC's policies regarding USO subsidies address Standard 3. In one requirement,

²⁵ Jamison (1997).

the FCC requires that proxy models estimate costs based on a full range of services. This requirement is necessary to accurately reflect service providers' incremental and shared costs. In the other requirement, the FCC states that proxy cost models should incorporate a contribution to shared costs in their estimates of USO costs.

It might appear confusing that, *ceteris paribus*, the subsidy under the multiple USO provider case would be higher than under the single USO provider case. This result occurs because the competitive markets in the multiple USO provider case force a spreading of shared costs across services, including USO services. The net effect in the multiple USO provider case is that prices for non-subsidized services cover less shared cost than in the single USO provider case, forcing the subsidized services to cover more.

Standard 4. When the USO affects the demand for the USO provider's non-USO services, the incremental revenues and costs of this demand should be reflected in the subsidy.

Cross-elasticities between USO services and non-USO services affect sustainable prices. This includes both types of cross-elastic effects: those that increase demand for non-USO services and those that decrease demand. In the single USO provider case, cross-elastic revenue effects could include some of the demand-stimulating benefits identified by OFTEL and Analysys; i.e., the enhancement of corporate reputation, marketing and brand recognition, information on how customers use the telephone, and the avoidance of loss of business through poor image and loss of trust due to disconnecting or discouraging subscribers. However, such demand enhancements need to be carefully quantified and netted against the additional costs of serving this demand. It is unclear whether OFTEL included these additional costs in its decision on net USO costs.

If market competition is used to size the subsidy, the subsidy will already

incorporate Standard 4. Chile's auctions created a market mechanism that at least had the potential of including these cross-elastic effects in the subsidy in a single USO provider framework. Standard 2 incorporates Standard 4 in the multiple USO provider case.

Because US markets are not yet competitive, the FCC is attempting to effect Standard 4 by including all customer revenues in its revenue benchmark and, in its proxy costs, all of the associated costs. Standard 5 addresses this issue.

Standard 5. When multiple USO provider markets are competitive or are to become competitive, the incremental revenue and cost estimates should be based on post-competition cross-elasticities rather than pre-competition cross-elasticities.

Standard 5 is necessary to ensure that effective prices are sustainable when they are in effect. Pre-competition cross-elasticities do not ensure this result.

The FCC's decision to include nationwide residential customer revenues into its revenue benchmark assumes the continuation of the traditional subsidies that competition and network unbundling are making unsustainable. US regulators have used price averaging between rural and urban areas, local loop cost allocations between services, value of service pricing for business services, and other means to keep residential local services at their current levels. Barriers to competition in local markets kept these sustainable for many years. Now, competitors are able to target profitable market segments and arbitrage prices by purchasing network elements. Without actual experience with competitive markets, it is difficult to tell the boundaries of these market segments so as to know to what extent these traditional prices will remain sustainable. However, it seems clear on its face that the market segments will have a smaller geographic reach than the entire nation, and include fewer than all of the services ILECs currently provide to all residential customers.

OFTEL also included benefits associated with customer life cycles in its USO benefits. This is covered by Equation 1 in the single USO provider case because incremental revenues and incremental costs are both present values of future cash flows. In the multiple USO provider case, life cycle benefits are more problematic. First, they may not materialize if customer churn is high. Also, the lack of competition in the past keeps the US from having reliable data for estimating life cycle revenues and costs. Lastly, no explicit recognition is needed if competitive markets exist and Standard 2 is used.

Standard 6. In multiple USO provider cases, cost estimates should be representative or proxy rather than firm specific.

One advantage of using proxy costs is that the subsidy amount looks just like price regulation to the service provider. The USO providers can affect neither the prices nor the subsidy by inflating or misreporting costs. This gives providers price-regulation-like incentives to operate efficiently and to report accurately financial and operational data.

Also, proxy costs are consistent with competition because they look just like marketplace prices to the service provider and do not skew the competitive market. Proxy costs look just like marketplace prices because:

- USO providers cannot raise or lower the subsidy amount, just as individual service providers cannot set prices in competitive markets; and
- the subsidy amounts are easily portable among service providers just as revenues from prices are portable in competitive markets.

Proxy costs do not skew the competitive marketplace because all service providers are treated the same. A service provider's revenues from the subsidy are based on the provider's ability to get and keep customers, just as would happen in a competitive market.

In contrast, subsidies based on company-specific cost information are inconsistent with price regulation and competition. One type of company-specific costs, embedded costs, may overestimate or underestimate economic costs, resulting in unsustainable effective prices. Also, using embedded costs could hold onto some elements of rate of return regulation, such as a disincentive to be efficient. The other prevalent company-specific cost, computer model-based incremental costs, would allow USO providers to determine their subsidy revenues through their own cost estimates. This gives the USO providers an opportunity and incentive to overestimate costs. Any resulting high estimates would be hard to detect because the computer models are generally complex and proprietary.

Standard 7. Geographic boundaries for estimating subsidies should match the geographic boundaries that competitive markets would follow for uniform prices.

Applying Standard 1 implies that effective prices must be deaveraged in the same way that a competitive market would deaverage market prices. This means that, unless USO providers are allowed to de-average prices, subsidy amounts will need to be de-averaged so that customer revenues closely match customer costs.

In the single USO provider case, this means that the geographic boundaries should follow the USO boundaries because these are de facto the market boundaries. This appears to be what OFTEL did in identifying unprofitable areas as the USO obligation and as the bases for estimating net USO costs. Chile followed the same pattern by estimating costs separately for individual unserved areas and auctioning the subsidies by area. Australia is also addressing different costing groups. The FCC is addressing Standard 7, but has not reached a final decision.²⁶

²⁶ See FCC, FNPRM, par. 39.

Standard 8. Efficiency assumptions in economic cost estimates should reflect known productivity levels and ongoing technology mixes.

In the single USO provider case, the net USO cost estimate needs to reflect the USO provider's actual operations. Reflecting what the USO provider actually spends going forward provides the USO provider's economic costs. Economic costs are necessary for identifying sustainable effective prices.

In the multiple USO provider case, proxy costs should be based on the incumbents' efficiency level as reflected in current methods of operation until data are available on entrants' efficiency levels. Incumbents' methods of operation provide the most reliable information on companies' forward looking incremental and shared costs. Even though incumbents' operations will change because of competition, any forecast of that change can be little more than speculation.

The FCC has decided that US proxy models should assume a level of technology and cost that represented the "...least-cost, most efficient and reasonable technology for providing the supported services that is currently available for purchase...". This recommendation could cause the proxy models to underestimate economic costs. There are two reasons why this is true. First, most USO providers for the foreseeable future will be ILECs. ILECs' networks generally have a mix of technologies whose ongoing costs are greater than what might be purchased off the shelf today if the networks could be instantaneously rebuilt.

The second reason is that no service provider could ever reach the level of efficiency assumed in this decision. There are two reasons for this. First, network deployment takes time. Costs are incurred over time, so the total cost of a network reflects an averaging of prices across investment periods, not the lowest prices at every point in time. Maintenance cost levels also reflect this averaging of technologies across periods. Second, it is unlikely that a company would invest if its revenues were tied to least-cost, most efficient technology at every point in the future. Any company investing in this arrangement would never recover its costs as long as technology continued to improve.

All indications are that the FCC will not change its technology assumption. Based on this, a corresponding assumption needs to be made with respect to depreciation. If a company is to always have the most efficient, readily available technology, then its depreciation lives need to reflect that rate of capital turnover. Doing this could actually make the most-efficient-technology assumption give a higher cost estimate than the assumption recommended in Standard 8.

Standard 9. Proxy cost estimates should be checked against actual company operations.

Regulators' use of cost models in this context is unique in telecommunications regulatory history. Regulators have traditionally relied upon companies for cost estimates or tied costs to specific company's operations, as in the case of using embedded costs. Regulators' control of cost models raises an issue of credibility.

Two FCC cost model requirements raise this issue. First, the FCC requires that all underlying data, formulae, computations, and software are to be available to all interested parties for review and comment, and all underlying data is to be verifiable. Second, the FCC requires that the model include means by which regulators can examine and modify critical assumptions and engineering principles, including the cost of capital, depreciation rates, fill factors, input costs, overhead adjustments, retail costs, structure sharing percentages, fiber-copper cross-over points, and terrain factors. These recommendations are in line with the policies proposed in this paper for not allowing companies to manipulate the cost model. However, the ease of changing critical assumptions in the model places an additional burden on policy makers to ensure that parties or regulators do not strategically use the model. Such manipulation has been the case in Chile where proxy models are used to estimate electricity distribution costs. Distribution costs are estimated every four years. The procedure involves the calculation of the costs of an efficient firm and then setting prices to cover these costs. Both the industry and the regulator (CNE) calculate costs of an efficient firm. The industry's estimate is given a weight of 33% and the CNE's estimate is given a weight of 67%. Even though this approach is

supposed to make cost studies relatively objective and technocratic, the fixed-weight averaging creates incentives for strategic behavior on the parts of the industry and CNE. Both have an incentive to bias their own estimate, subject to what they think the other will estimate, so that the weighted average achieves their objectives. As a result, discrepancies between the industry's and CNE's estimates have exceeded 50% in some cases.²⁷

Regulators should use reality checks to verify that their model assumptions will have the intended market and universal service effects. One way this can be done is by comparing their model's results against actual company operations. This is not to say that actual company operations are the "correct answer." Indeed, part of the discussion above demonstrated why it is inappropriate to base USO subsidies on actual company operations. However, checking model results against multiple company operations removes the perverse incentives and may, in some circumstances, remedy problems with embedded cost allocations.

V. CONCLUSION

This paper describes UK, Australian, Chilean, and US experiences with estimating costs for ongoing USOs. Several lessons can be learned. One lesson is that standards for estimating costs in a single USO provider context are different from standards in a multiple USO provider context. Subsidies in the multiple USO provider case may be higher because, all other things being equal, the subsidy will cover some shared costs. However, non-subsidized prices in the multiple USO provider countries will cover fewer shared costs, so the net impact on customers should be approximately the same.

The multiple USO provider case is also complicated by the need to have geographic and service boundaries, and cross-elastic effects, match post-competitive markets before these boundaries and

²⁷ E. Bitran and Pablo Serra, "Regulatory Issues in the Privatization of Public Utilities: The Chilean Experience," *The Quarterly Review of Economics and Finance* 34 (1994): 179-197; and Warrick Smith and Michael Klein, *Infrastructure Regulation: Issues & Options for East Asia*, The World Bank (December 1994).

effects are known. The FCC appears to be addressing the geographic issue, but has failed to adequately address the service boundary and cross-elasticity issues.