Rate Rebalancing and Competition in Peruvian Telecommunications *

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Introduction

Rebalancing of telecommunications rates has great advantages. It can improve economic efficiency, raise productivity, make the national economy more competitive, and improve quality of life. When competition is allowed in telecommunications markets, rebalancing is essential to avoid wasteful arbitrage.

Nevertheless, most countries have traditionally had unbalanced telecommunications rates. Rapid rebalancing can therefore cause dislocations and may be politically unacceptable. The challenge is to find a way to rebalance rates rapidly enough to avoid serious economic consequences, while avoiding serious political consequences.

This paper presents a model that quantifies the economic benefits of alternative rebalancing scenarios. Scenarios are evaluated in terms of consumer surplus, incentives of the incumbent telecommunications operator to expand the network, and sustainability under competition. Competitive consequences are evaluated for both long-distance and international services. Policies regarding incoming international traffic are especially important. In many countries, revenues from incoming international services provide a major part of the funding of the incumbent telecommunications operator. Nevertheless, efficient competition has the potential to lower costs and encourage innovation in these services, which are critical for economic growth.

Peru has long had a commitment to rebalancing telecommunications rates. When the telecommunications sector was privatized in 1994, a rebalancing program was instituted. The incumbent carrier, Telefónica del Perú (TdP), is required to rebalance rates at specified rates. Long-distance and international rates have been declining, while local rates have been increasing. Installation charges were originally set at high levels to encourage TdP to expand the network, but the charges have been declining over time. The goal of the rebalancing program was (and is) to encourage expansion of the network and to facilitate efficient competition when full competition is permitted since July 1999.

The model described in this paper was designed for the Peruvian regulatory body OSIPTEL to use in analyzing the rebalancing program. This model can be used to address the key issue of whether the rebalancing program will suffice to facilitate efficient competition when TdP´s exclusivity period ends in 1999. The model is also useful for examining alternative policies that can potentially make competition more efficient.

Rebalancing Program 1994/98

In contrast to many countries which undertook privatization and liberalization processes in their telecom sectors, Peru decided to pre-announce the prices of the basic telephone services which were going to be binding for the period right after privatization would take place. Thus, in 1993, a price table of basic telephone services for the period 1994/98 was announced to all the competitors who were going to bid for the privatization of the local and long distance state owned firms: CPT and Entel, respectively. The winner of the contest, Telefónica del Perú - a subsidiary of Telefónica de España, would have the obligation to comply with the values of the prices, which were going to be part of its Concession Contract. These prices are shown in Table 1.

Table 1 – Peru, Prices of the rebalancing program for basic telephone services, as of December (in real US$, February 1994) *

	1994	1995	1996	1997	1998	Average annual change
Installation – Residential	426	368	310	252	194	-55%
Installation – Business	852	658	503	348	194	-77%
Monthly rental – Residential	5.1	6.5	8.6	11.7	14.7	191%
Monthly rental – Business	10.0	12.0	13.6	14.1	14.7	46%
Local call (3 minute pulse)	0.066	0.065	0.062	0.059	0.055	-17%
National long distance (min.)	0.265	0.239	0.211	0.192	0.171	-35%
International long distance (min.)	1.628	1.477	1.306	1.105	0.938	-42%

Source: Annex 3, TdP's Concession Contract. (*) The figures were originally expressed as real Soles of February 1994. These values were converted to US$ by using the exchange rate of February 1994, which was 2.17 Soles/US$.

The key characteristics of the Rebalancing Program are the following:

- It has the goal of bringing prices for each category of service to levels that more accurately reflect the costs of providing such services, while enhancing TdP's competitive position.
- It allows a gradual phasing out of cross subsidization from the long distance services to the local services. This explains why long distance prices decline over the period while rental is increasing.
- It includes installation, monthly rental, local service, domestic and international long distance.
- It is a five-year program. However, OSIPTEL had an opportunity to alter the Program at the end of three years if it found that there was a "serious and unforeseen disturbance of economic equilibrium."
- An implicit 2% annual productivity factor was considered into the design of the Program.
- The tariff adjustments are on a quarterly basis.

The Program has been implemented religiously since early 1994. Authorities expect to continue with the final remaining two quarterly adjustments. Immediately after privatization, the tariff structure encouraged TdP to expand the network rapidly. It did so by permitting continuation of relatively high installation fees. However, the Rebalancing Program now provides for declining installation fees and increasing monthly service charges. After 1998, the program tariffs will be rearranged into three new baskets. These baskets will be subjected to price caps, which will include factors for inflation and for productivity to be determined by OSIPTEL.

Economic Analysis

Economic Equilibrium

We define rates to be in economic disequilibrium if any of the following three conditions obtain:

- *TdP lacks the economic incentive to expand to provide telephone service to customers who can be efficiently served;*
- *Incentives for efficient competition are lacking; and/or*
- *Incentives for inefficient competition are present.*

Any of these circumstances is inconsistent with efficient long-run competitive (or contestable) equilibrium. If any of these circumstances were to persist in the long run, it would diminish the economic welfare of Peru and dampen economic growth.

Telefónica del Perú's Incentives to Expand Service

If rates are in economic equilibrium, as defined above, TdP will have the incentive to continue expansion until it has served all customers who it can serve efficiently. However, even if rates are *not* in economic equilibrium, it is possible that satisfactory results can be achieved in the short term. In that event, the disturbance of economic equilibrium is not yet serious. However, if a disturbance of economic equilibrium leads to unsatisfactory results in the short term, then that disturbance is serious. In particular:

- *There is a serious disturbance of economic equilibrium if TdP does not have the economic incentive to expand penetration in 1999*.

The critical test is whether revenues from new subscribers for all telecommunications services cover the costs of providing those services. This condition is assumed to be automatically satisfied if each service covers its long-run incremental cost (LRIC). The condition may *possibly* be satisfied, even if local services are priced below incremental costs; for example, the long-distance and international calls made by new users may provide enough profits for TdP to fund the deficit.

However, TdP's ability to fund such deficits will decline over time for three reasons:

- The new users may use competitive carriers for long-distance and international calls;
- Long-distance and international calls will become less lucrative over time as a result of rebalancing and TdP's need to lower prices to meet competition; and
- As telephone penetration increases, new subscribers are likely to have lower incomes and therefore less demand for long-distance and international usage.

If local services were priced below LRIC and (for the reasons stated above) TdP could not realistically expect to profit in 1999 by expanding telephone penetration, there would be a serious disturbance of economic equilibrium. Under such circumstances, further rebalancing would be necessary to restore TdP's incentives to expand the network.

Incentives for Efficient/Inefficient Competition

If TdP's rates are in economic equilibrium, as defined above, entry by competitors that are more efficient than TdP is encouraged. At the same time, entry by competitors that are less efficient is discouraged. An economic definition of efficient entry is that, after efficient entry, TdP and competitors provide their total output more efficiently than before. Efficiency generally encompasses service quality and diversity, as well as costs. For analysis of rebalancing, however, we can reasonably focus just on costs. That is, we focus on whether total output (TdP plus competitors) is produced at lower unit cost than TdP's unit cost before entry occurred.

This efficiency or inefficiency of competitive entry has great importance for Peru. The nation stands to enjoy great benefits from competition after telecommunications markets are opened in 1999. Efficient competitors with costs lower than TdP's can pass their cost savings on to their customers. Efficient competitors may also provide higher quality service than TdP's. In any event, customers will have a choice after competitors enter, and TdP will be afforded sharp incentives to improve its performance.

However, all these benefits could be much smaller if TdP is forced to (try to) maintain rates that are in economic disequilibrium. In particular, entry may not occur at all in markets where TdP's prices are lower than equilibrium prices. At the same time, open entry could lead to an influx of inefficient competitors where TdP's prices substantially exceed equilibrium prices. Such entry would increase the costs of the entire industry, considering TdP and competitors together. Furthermore, it would make the disequilibrium rate structure unsustainable in the long term. That is, as a result of competitive losses, TdP would ultimately be unable to cover its total costs at the disequilibrium rate structure, and that structure would collapse.

In a model with no economies of scale or scope, the conditions for economic equilibrium with respect to efficient/inefficient entry can be simply stated as follows:

- *TdP prices all services at long-run incremental cost (LRIC).*

Since economies of scale and scope are absent in this model (by assumption), such pricing suffices to recover TdP's total costs, including the cost of capital. At the same time, competitors are encouraged to enter if they have lower costs than TdP but are discouraged from entering if they have higher costs. These incentives are precisely appropriate for promoting economic efficiency.

In the real world, however, the solution is not as simple as in the above model. In particular, pricing all services at LRIC could yield either too much or too little revenue, relative to TdP's budget constraint, as defined by price caps.

An important pricing principle is that all *competitive* services be priced at or above LRIC. Otherwise, efficient competitors may be unable to operate profitably and would therefore be excluded from the market.

At the same time, there is the danger that some services may be priced *too* far above LRIC. In that case, inefficient firms would be encouraged to enter the market. In telecommunications, this danger applies primarily to international and long-distance services. Public-policy makers have traditionally required those services to be priced far above LRIC.

In theory, any price above LRIC may invite inefficient competition. In practice, however, small markups over LRIC are unlikely to result in significant inefficient entry; *i.e.*, the disturbance of economic equilibrium is not serious. To assess whether the disturbance is serious, we need to distinguish between the theoretical possibility and practical likelihood of substantial inefficient entry. We propose to make this distinction as follows:

- Suppose that an entrant is equally as efficient as TdP for any given scale. Suppose, however, it actually operates at one-tenth the scale of TdP and thereby loses scale economies. Therefore, we define that there is a serious disturbance of economic equilibrium if:
    a) Such a competitor (or an even less efficient competitor) can operate profitably; or
    b) TdP's price is below LRIC.

Condition (a) indicates that inefficient entry is excessively encouraged. Condition (b) indicates that efficient entry is discouraged. The above definition allows for a range of prices that do not constitute a serious disturbance of economic equilibrium. The width of the range depends on the degree of scale economies.

Equilibrium pricing (by TdP) according to the above definition allows full scope for efficient competition. In particular, any competitor whose average costs are lower than TdP's LRIC can operate profitably. Equilibrium pricing may also allow scope for competition that is only slightly inefficient; *e.g.*, a competitor that has lower cost than TdP for any given scale but loses slightly more than that advantage in scale economies. Equilibrium pricing does not, however, invite entry by competitors with no efficiencies to offset the loss in scale economies.

Interconnection

Telecommunications competitors must rely on the incumbent carrier for interconnection services. In particular, long-distance and international competitors will have to rely on TdP for local distribution of calls. They will presumably pay TdP for this service. Such payments are part of the competitor's costs that must be considered in determining economic equilibrium.

OSIPTEL will have a key role in determining the level of interconnection charges when telecommunications markets are opened in 1999. There are different possible outcomes one may expect regarding interconnection pricing schemes that will be in place in 1999 when full liberalization of the telecommunication sector takes place in Peru. Nevertheless, for pedagogic purposes we will assume competitors would be able to distribute long-distance calls by purchasing local calls. The test for a serious disturbance of economic equilibrium is therefore as follows:

- Suppose that a long-distance competitor is equally as efficient as TdP for any given scale but operates at one-tenth of TdP's scale. Suppose that for local distribution, the competitor purchases local calls from TdP in both the originating and terminating cities. There is a serious disturbance of economic equilibrium if:
  - a) Such a competitor (or an even less efficient competitor) can operate profitably; or
  - b) TdP's price is less than LRIC (imputing the price of local calls as the cost of local distribution).

Light-handed regulation has many advantages. It allows rapid competitive entry without the need to develop detailed access-charging policies. It also avoids inefficient "bypass" by customers seeking to evade access charges that are far above cost.[1]

International Services

Carriers of outgoing international calls must make settlement payments to carriers in

[1] In this regard, we note that U.S. access charging has led to substantial bypass, much of which is inefficient. Shooshan & Jackson (*Bypass and Growth of Demand for Switched Access,* February 17, 1989) and P.J. Grandstaff and J.S. Watters (Southwestern Bell Telephony Company, *Switched Access Competition in U.S. Telephony: Evidence and Interpretation*, August 29, 1988) have econometrically demonstrated the extent of bypass. Furthermore, the competitive local-exchange industry in the U.S. originally evolved — not to provide local service, for which they were generally not licensed — but to exploit the inefficient structure of long-distance access charges.

foreign countries. At the same time, international carriers receive settlement payments for distributing incoming calls within their own country. Settlement payments in both directions must be explicitly considered in our analysis of economic equilibrium.

In our analysis, we assume that all international carriers will be required to use the same accounting rates. However, since Peru's incoming international traffic is so much larger and more profitable than outgoing traffic, giving competitors a proportional share of return traffic could be destabilizing. Under that policy, the competitive prices of outgoing international calls would depend primarily on the prospect of getting return traffic, rather than the cost of handling outgoing calls. Prices would gyrate, as the ratio of outgoing calls to incoming calls varies.

When a competitive international carrier receives an incoming call, it must distribute that call within Peru. If the call is destined for Lima, the competitor can distribute the call by purchasing a local call; if the call is destined for elsewhere, the competitor may purchase a long-distance call. Alternatively, the international competitor may also be a long-distance carrier in Peru. If so, it would transport some calls to cities other than Lima and then purchase local calls. In either case, our definition of a serious disturbance of economic equilibrium is as follows:

- Suppose that an international competitor is equally as efficient as TdP for any given scale but operates at one-tenth the scale as TdP. There is a serious disturbance of economic equilibrium if:
  a) Such a competitor (or an even less efficient competitor) can operate profitably — regardless of whether it purchases or self-provides long-distance services within Peru; or
  b) The sum of TdP's revenues (from international telecommunications users) plus the settlement payments that TdP receives are less than the sum of LRIC for outgoing plus (proportional) incoming traffic plus the settlement payments that TdP makes.[2] If this condition obtains, TdP's international operations — considering incoming and outgoing calls together — do not cover their incremental costs.

If the competitor purchases long-distance services from TdP, the above conditions are applicable only if TdP's domestic long-distance rates are already in equilibrium. If TdP's long-distance rates are not in equilibrium, they should be adjusted to equilibrium levels prior to applying the above test.

Optimal Pricing

To achieve the best use of Peru's resources, prices of goods and services should generally be equal to or approximate the long-run incremental cost of producing them. Competition with open entry will generally achieve such a result in markets in which there are no entry barriers and in which minimum efficient scale is only a small fraction of market output. When large entry barriers impede competition, competition obviously cannot produce this result. Furthermore, if the industry has natural-monopoly characteristics, and if the monopoly operates in a region of increasing returns to scale, linear prices equal to incremental cost will not recover the firm's total costs.

Incremental Costs

Any attempt to determine the proximity of prices to their optimal level must begin with

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[2] As before, the price of local calls is imputed as the cost of local distribution.

measuring the incremental costs of production. The historical, accounting costs of an incumbent firm are likely to be very imperfect measures for such an exercise, particularly in an industry in which technology is changing rapidly. In addition, the accounting costs of TdP are undoubtedly still related to its operating practices when it was a government-owned firm that was not threatened by actual or potential competition. For purposes of assessing the optimal set of prices, the appropriate cost measure is the cost of attracting resources to provide additional output with today's technology because these prices affect today's decisions by consumers and businesses involving their level of consumption of telecommunications services.

Similarly, for the purposes of assessing disturbances from economic equilibrium, the relevant measure of costs must be based on the technology that TdP would use to meet growth or that new entrants would employ in attempting to compete with TdP. We assume that there are scale economies in delivering telephone services, but that entrants have access to the most modern technology, as does TdP.

The technology of modern telephony has spread widely throughout the world. Telephone companies in South America, North America, Europe and Asia may purchase transmission, switching, signaling, and terminal equipment from any of a number of world-class suppliers of this equipment. TdP's costs are therefore likely to be relatively similar to those of other telephone companies. The major differences between TdP's incremental costs and those of companies in North America are likely to derive from higher costs of capital, higher tariffs, but lower wage rates. We take all of these into account in calculating incremental costs.

Price Elasticities of Demand

Our model relies heavily on an accumulating body of statistical evidence on the price elasticities of demand for basic telephone services in a number of different countries. Unfortunately, there is only limited evidence on these price elasticities in Peru or in other countries with similar demographic characteristics. Uncertainties about these elasticities, however, are likely to affect only the degree of rebalancing necessary.

The Ramsey Criterion

In our analysis, we rely heavily upon the work of Ramsey (1927) and Baumol and Bradford (1970) to determine the optimal set of rates, given increasing returns to scale in telephone services. The Ramsey criterion requires that prices deviate from incremental costs in inverse relation to the (absolute value of the) price elasticity of demand. Services that are price-sensitive (price-elastic) in demand must be marked up less over their incremental costs than are services whose demands are relatively price-insensitive, or price-inelastic.

If, however, one or more services have rates that must be kept far above incremental costs for other policy reasons, then the rest of the rates may have to be, on average, below incremental costs. In such a situation, the degree to which prices depart from incremental costs must also be inversely related to the price-elasticity of demand. In such a situation, we shall find that the Ramsey criterion for optimally rebalanced rates requires that those services with the least price-elastic demand will be marked down from incremental costs most severely.

Network Externalities

Telecommunications differs from many other goods and services in having important external economies of consumption. When a new subscriber joins the network, he or she is not the only beneficiary. Existing subscribers also benefit by being able to communicate to the new subscribers *via* telephone. These additional benefits (to existing subscribers) are external, because the new subscriber may not take them fully into account in deciding whether to join the network.

The theory of network externalities was developed over 20 years ago in a series of articles in the *Bell Journal of Economics and Management Science*.[3] In general, economically-efficient prices are somewhat reduced where there are external economies of consumption. Thus, the optimal price of access is somewhat lower than would be indicated by Ramsey pricing that does not take account of the network externality.

The simulation model

In this section we outline the simulation model developed to approach the quantitative impacts on welfare coming from different pricing alternatives. We aggregate services into six separate categories:

1. Access
2. Installation
3. Urban calls
4. National calls
5. International calls — outgoing
6. International calls — incoming

We divide each of these services into five demographic groups:

1. Lima residential — highest income (A)
2. Lima residential — middle income (B)
3. Lima residential — low income (C)
4. Non-Lima (urbanized areas)
5. Business

Beginning with existing rates and 1999 projections of output levels, we simulate the effects of various changes in rates and output for TdP with three principal objectives:

1. Determining whether TdP has the incentive to expand service.
2. Determining whether smaller, less efficient competitors have the incentive to enter the markets for national and international services.
3. Analyzing the potential welfare gains from various rate rebalancing plans.

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[3] R. Artle and C. Averous, "The Telephone System as a Public Good: Static and Dynamic Aspects," *The Bell Journal of Economics and Management Science* (Spring 1973), pp. 89-100; S.C. Littlechild, "Two-Part Tariffs and Consumption Externalities," *The Bell Journal of Economics* (Autumn 1975), 661-70; J. Rohlfs, "A Theory of Interdependent Demand for a Communications Service," *Bell Journal of Economics and Management Science* (Spring 1974), 16-37; and L. Squire, "Some Aspects of Optimal Pricing for Telecommunications," *The Bell Journal of Economics and Management Science* (Autumn 1973), 515-525.

This simulation model draws upon available estimates of the price-elasticities of demand for each service. The estimates are from recent studies and from decades of econometric research. The simulation model also requires estimates of the incremental cost of each service to TdP. We base our cost analysis on a variety of estimates drawn from recent studies of telephone-service costs in the United States, the United Kingdom, Mexico and Peru.

Demand

There are numerous empirical studies of the telephone service from which we may draw. We survey these studies but rely most heavily on a recent study of Peruvian demand by Fry, *et al*. (1996). Because we are aware of no studies of Peruvian business demand or demand in urban areas outside of Lima, we must utilize our best judgment in estimating the price elasticities for these groups for each service. The own-price elasticities that we use are summarized in Table 2.

Table 2 - Estimated own-price elasticities used in study

Demographic Group	Access	Installation	Local Calling	National Long-Distance	International Calls Outbound	International Calls Inbound
Lima Residence A	-0.0025	N/A	-0.20	-1.40	-1.60	N/A
Lima Residence B	-0.044	N/A	-0.20	-3.00	-1.90	N/A
Lima Residence C	-1.00	N/A	-0.40	-3.00	-0.60	N/A
Non-Lima Residence	-0.044	N/A	-0.20	-3.00	-1.90	N/A
Business	-0.05	N/A	-0.10	-0.70	-0.80	N/A

The N/A designations indicate that own-price elasticities are not applicable to our model for these two services. The own-price elasticity of demand for installation is derived from the price elasticity of demand for access and the relationship between new installations and the installed access-line base, and it is therefore not entered separately. Inbound international calls are placed in foreign countries and are assumed not to be dependent on internal Peruvian rates in our model.

Incremental Costs

Since there is no estimation of incremental costs done for telecommunication services in Peru, we also obtain our estimates of incremental costs primarily from previous studies — in this case, primarily studies of telephone costs in the United States, United Kingdom and Mexico. We adjust these estimates for differences between countries in the cost of capital and labor, as well as our analysis of TdP's recent actual incremental operating and capital costs.

Our estimates of the incremental cost of each service category are shown in Table 3. Our principal sources of cost data are from the United States. First, we utilize recent estimates of local-exchange company (LEC) costs submitted to the Federal Communications Commission (FCC) in the access-charge proceeding.[4] These estimates are "top-down" estimates based on actual facilities deployed by U.S. LECs and actual operating expenditures. They differ from recent "bottom-up" estimates based on a hypothetical network using the most recent technology.[5]

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[4] Strategic Policy Research (1997).

[5] These estimates are proliferating as the U.S. implements the 1996 Telecommunications

Obviously, the latter estimates are lower than those based on actual LEC experience. The Telmex study, is also a bottom-up model. It is very well known that bottom up estimations come from assuming hypothetical, idealized costs of a network built instantaneously to reflect today's technology and service demands.[6]

Second, for national and international calls we rely on estimates of U.S. long-distance carriers' costs. Until AT&T was formally deregulated in 1995, the FCC published annual information on AT&T's costs of long-distance operations. The most recent of this information was published in 1995 and was based on 1994 data.[7] It is this report upon which we rely.

Third, OFTEL has recently completed a comparison of top-down and bottom-up estimates of British Telecom's costs.[8] Since British Telecom has been privatized for more than a decade and is now subject to local competition from the new U.K. cable companies and to long-distance competition from Mercury (Cable & Wireless), its cost experience should provide a useful check on the estimates derived from U.S. companies.

Fourth, we examine an incremental cost study prepared by Teléfonos de México (Telmex) for its regulator. This study has special relevance because Mexico, like Peru, is a developing country.

The cost estimates derived from U.S. and U.K. experience are clearly too low to apply without adjustment to TdP because TdP's cost of capital is substantially above that of U.S. or U.K. telecommunications companies. The cost of capital in Mexico, however, is closer to that in Peru. In a final section of this chapter, we adjust all of our estimates to allow for TdP's higher cost of capital.

Installation

To install new residential or business access service requires at the very least the processing of an incoming order, the establishment of a billing record, and the programming of the network software to activate the service and commence billing. In addition, new service may require a technician's visit to the residence or business to extend a drop line from the nearest company pole or conduit to the new subscriber. However, the costs of drops are usually capitalized and considered part of the cost of access — not installation.[9]

It is our judgment, based on discussion with U.S. LECs, that the incremental cost of installation without a visit to the new subscriber is approximately $95. Lower wages in Peru than

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Act. For a version of the bottom-up model that appeared before the 1996 Act, see the "Benchmark Cost Model" developed in MCI, *et al*. (1995). *See* also Davies, Carter, McIntosh and Stefanescu, "Technology and policy options for the telecommunications sector" (*Telecommunications Policy*, March 1996, at pp. 108-111).

[6] As we explain elsewhere, our results regarding optimal prices are not very sensitive to the use of top-down, rather than bottom-up, cost models.

[7] FCC, *Statistics of Communications Common Carriers*.

[8] OFTEL (1996).

[9] The cost of drops is implicitly included in our top-down estimates of access costs, discussed below.

in the United States reduce this estimate, but this reduction may be partially offset by less efficient procedures for setting up billing mechanisms, checking credit information, and confirming the order.

In our demand analysis, we added the price of access to the annualized price of installation. We posited that long-run demand for access depends on this sum. We use a similar procedure in our cost analysis. We posit that the long-run marginal cost of access equals the sum of the recurring marginal cost of access (discussed below) and the annualized marginal cost of installation. In this framework, both costs and demands are treated on a consistent long-run basis.

Access

The U.S. top-down model estimates that the incremental cost of a loop of average U.S. length is approximately $26 per month.[10] These costs include the nontraffic sensitive portion of the cost of local switching plus the monthly cost of amortizing and maintaining a local line to the subscriber's premises. This estimate substantially exceeds the recent forward-looking, bottom-up estimates of the cost of providing local loops with the most efficient current technology and arbitrarily low operating costs. It is also lower than the FCC's interim "proxy" measure of $14.32 per month. That proxy is guiding state commissions until their bottom-up estimates are completed. However, we believe our top-down estimate is likely to be more representative of TdP's actual cost of extending local service because it is based on actual U.S. operating experience, not some idealized measure of the hypothetical "efficient" network.

Local Calls

The incremental cost of local calling has declined to very low levels because of the technological changes in switching and transmission. The U.S. LECs' top-down model estimates that a local call costs $0.0015 on each end for switching.[11] In addition, there are some trunking (transmission) costs for all calls that move between wire centers. At most, according to the top-down analysis of U.S. LECs, the incremental cost of local calls is $0.005.[12] This probably corresponds to a marginal cost of no more than $0.01 per pulse. Although a pulse is nominally three minutes during peak calling hours, many calls are shorter than the maximum limit for a pulse. The $0.01 estimate reflects our estimate of the marginal cost of the average actual minutes per pulse.

National Long-Distance

The cost of national long-distance calls includes the cost of local switching and trunking

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[10] Strategic Policy Research (1997).

[11] Strategic Policy Research (1997). OFTEL (1996) estimates that the marginal cost of switching per minute of usage is three times this amount because OFTEL assumes that a larger share of switching costs depend on usage rather than on access lines. Our assumptions about the relative cost of usage versus access lines is consistent with our knowledge of the technology used by U.S. LECs.

[12] We ignore the fact that incremental costs are higher during peak periods and essentially zero off-peak.

as well as the cost of transmitting and switching the call on the national network. We have already estimated that the marginal cost of the local switching and trunking is about $0.005 per minute. The best evidence on the remaining costs may be derived from the U.S. market, where prices have recently been totally deregulated and will soon be opened to the Bell Operating Companies.

In the U.S. market, large resellers of long-distance services are reportedly purchasing wholesale service at rates as low as $0.01 to $0.02 per minute. These rates exclude local access, billing, and marketing expenses. In 1994, the last year before it was deregulated, AT&T reported total operating expenses (exclusive of access expense and depreciation) of $14.8 billion, of which $6.9 billion were marketing and customer-service costs.[13] We assume that approximately 90 percent of these costs are attributable to domestic long-distance services and domestic distribution of international calls. Assuming that AT&T accounted for approximately 210 billion conversation minutes of intrastate, interstate, and international calling, its average costs were about $0.034 per minute excluding marketing and customer-service costs and $0.063 per minute including these customer operations expenses. Given the relatively high price-cost margin in the U.S. long-distance market, marketing and customer-service costs have been very high as carriers spend substantial resources trying to bid customers away from each other.

AT&T's capital costs must be added to its operating costs to obtain an estimate of its unit costs of long-distance service. In 1994, AT&T reported an average gross plant of $23.8 billion, of which we assume that 90 percent is attributable to domestic long distance. Thus AT&T's gross plant per minute of calling was $0.10. If we assume an annualizing factor for gross plant of 0.2, we may estimate AT&T's capital costs at $0.02 per minute. This would provide a unit cost of long-distance calling of $0.054 per minute without marketing and customer-services expense to $0.084 per minute with these customer expenses. We use the higher number in our pricing analysis, because it includes marketing costs that are recovered in a competitive long-distance market (as the Peruvian market will be after 1999).

A comparison of AT&T's and MCI's capital investment per dollar of revenues suggests that there are economies of scale in using capital in this sector of about 30 percent. We, therefore, assume that AT&T's marginal costs are 70 percent of its unit costs, or between $0.038 and $0.059 per minute. To this we add $0.005 in local access costs to obtain a range of marginal cost of $0.043 to $0.064 per minute. These estimates are considerably higher than recent reported wholesale prices of $0.02 per minute and below average retail rates. The low wholesale rates may reflect temporary excess capacity, or they may suggest that long-run incremental costs are falling to levels substantially below AT&T's embedded average costs. Given substantial excess capacity at AT&T, its short-run incremental costs may be significantly lower than the top-down estimates we have developed here.

International Calls

The international market has been the least studied of all telecommunications markets. An international call requires the same operations as a national call up to the point that it is delivered to the international transmission medium. Calls within South America may simply be delivered to other carriers directly by terrestrial facilities, but calls to locations outside South America must be transmitted by satellites or underwater cables.

A major difference between national and international calls, however, is that the latter are

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13 U.S. Federal Communications Commission (1995).

subject to international agreements on accounting rates. TdP must pay one-half of the negotiated accounting rate to each foreign carrier. These accounting rates can be very high, often exceeding $1 per minute, but the United States is attempting to force them down.

We assume that the actual incremental costs of international calls before settlement charges with the foreign carrier are equal to TdP's incremental cost of national calls with local access at only one end plus $0.02 in additional transmission costs for the international link plus one-half the accounting rate. The transmission cost of $0.02 per minute applies to both cable and satellite transmission. To this we must add the cost of transmission and switching in Peru. For calls within Lima, we use the incremental cost of an urban call. For all other locations, we use the incremental cost of national calls. Therefore, our estimate based on U.S. costs is $0.031 to $0.051 per minute plus termination (settlement) costs.[14] When traffic is in balance, the incremental cost is simply $0.031 to $0.051 per minute. As before, we use the higher number in our pricing analysis, because it is more representative of costs in a competitive market.

Table 3 – Incremental costs assumed in simulation model (in US$)

	International costs		Cost for TdP	
	Top-down (1)	Bottom-up (2)	Top-down (3)	Bottom-up (4)
Monthly Rental	26.0	14.3	34.6	19.1
Installation	95.1	95.1	71.4	71.4
Local (min.)	0.008	0.008	0.010	0.010
DLD(min.)	0.045	0.045	0.060	0.060
ILD-out. (min.)	0.038	0.038	0.050	0.050
ILD-inc. (min.)	0.038	0.038	0.050	0.050

(1) SPR's top-down estimations.
(2) Rental cost comes from bottom-up estimation.
(3) Values of Column (1) are adjusted by a factor of 1.33, except Installation, which has a factor of 0.75.
(4) Values of Column (1) are adjusted by a factor of 1.33, except Installation, which has a factor of 0.75.

Adjusting for Telefónica del Perú's Higher Costs

Our point estimates of the incremental cost of each service, based upon U.S. and U.K. data, are summarized in Table 3. These cost estimates reflect cost conditions in a highly-developed economy in which the cost of capital is much lower and wages are much higher than in Peru. We must, therefore, adjust for differences in factor prices.

To adjust for differences in the cost of capital and the efficiency in using capital, we begin by comparing the real cost of capital in Peru with that of the United States. In the United States, the FCC's recent estimate of telephone-companies' cost of capital is 11.25 percent. Assuming economic depreciation that varies from 6.7 percent to 12.5 percent and current taxes, the "annualizing factor" that must be applied to gross investment to cover the cost of capital is 17

[14] As with national long-distance calling, the upper end of the range includes $0.02 per minute for the marginal cost of customer operations.

percent in the United States, an economy with very little inflation.[15]

We use Bear-Stearns' estimate of TdP's weighted cost of capital of 15.5 percent. In addition, the marginal tax rate on capital and the cost of worker participation appears to be about 12.3 percent of net plant[16] and depreciation accounts for another 8 percent of (new) capital. Thus, the annual charge to capital is estimated to be 35.8 percent of net investment.[17]

In 1997, TdP's capital expenditures are estimated to be $493 million and depreciation expense is estimated at $182 million.[18] Assuming that depreciation expense accurately reflects capital consumption, incremental investment is projected at $311 million. If 80 percent of this investment is for the domestic telephone network, $249 million reflects net additions to the capital stock of the network, or $800 per access line added in 1997.[19] Assuming a 35.8 percent capital charge, the annual cost of this new investment is $286 per line.

Bear-Stearns (1996) estimates TdP's average operating expenses (exclusive of depreciation) will increase by $83 million between 1996 and 1997. Assuming that the telephone network accounts for 80 percent of this increase, the increase in cash operating expenses will be $214 per access line. This is a lower bound to estimated operating costs because it fails to account for productivity gains in the existing network. Bear-Stearns predicts that TdP's future operating expenses per line will be about $270 per year per line. However, given that incremental operating costs are less than average operating expenses, we use the $214 per line estimate.

Our estimate of the incremental capital and operating costs per line is therefore $286 plus $214, or $500 per line. This is approximately one-third higher than the top-down incremental costs per line for U.S. telecommunications carriers.[20] We therefore adjust all of our U.S. incremental cost estimates, except for installation, by a factor of 1.33 to reflect TdP's higher costs. Installation, however, is labor-intensive, and we assume that TdP's lower labor costs allow it to service new requests for access lines at 25 percent lower costs than in the United States. Therefore, we assume that installation costs $75 per line. All of our estimates are reproduced in Table 3.

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15 The LEC annualizing factor is somewhat lower than AT&T's primarily because the LECs have relatively more cable and wire investment. Cable and wire depreciates more slowly than switching equipment and circuit equipment.

16 The Balance Sheet of TdP for June 30, 1996 showed net plant to be equal to $1,628 million while Bear-Stearns (1996) estimated that taxes on capital and worker participation costs were $200 million.

17 In Chapter 5, we present sensitivity analysis, based on a somewhat lower estimate of cost. A lower cost estimate could be attributable, in part, to a lower assumed cost of capital.

18 Bear-Stearns (1996).

19 TdP's June 1996 balance sheet indicates basic telecommunications-related assets (excluding data transmission and international transmission) comprise 80 percent of total assets.

20 Strategic Policy Research (1997).

Assessment of Economic Equilibrium in 1999

Perú is going to fully liberalize its telecommunication sector in 1999. This section applies the simulation model in order to assess the likely impact that such a process would have on long distance markets in terms of welfare change, TdP´s incentives to expand the network and whether there could be opportunities for efficient or inefficient entry in those markets. In principle, one may expect there would be less need for OSIPTEL to alter the Rebalancing Program to the extent that TdP is projected to earn more than its cost of capital. In particular, it is possible that in 1999, TdP may be able to:

- Lower long-distance and international rates to levels that do not constitute a serious disturbance of economic equilibrium;
- Increase local rates by only the amount called for in the Rebalancing Program; and
- Still cover its total costs, including the cost of capital.

The expectation may be that in 1999, TdP will have to reduce its long-distance and international rates substantially below the price cap in order to meet competition. TdP should certainly be permitted to do so, so long as the rates remain above the relevant incremental costs. However, so long as TdP can continue to cover its total costs, including the cost of capital, there is no need to raise local rates above the levels called for in the current Rebalancing Program.

It is possible for current accounting profits to be positive while incremental returns from expansion of operations are negative. In that case, there would be a serious disturbance of economic equilibrium. Also the markets for national and international calling in Peru will be opened to competitors in 1999. At this time, TdP will face serious problems if its rates are out of balance because competitors — even inefficient competitors — may be able to enter selectively the markets that are substantially over-priced. Such entry would generate economic waste and destabilize the market. In this section, we examine whether such entry would create a serious disturbance of economic equilibrium. We specifically seek to determine if there is a possibility of successful entry by small, inefficient competitors.

Scenarios

We develop three scenarios in terms of likely evolution of tariffs for the services of the Rebalancing Program. As we know the tariffs of the current Program are binding until the end of this year, after which OSIPTEL will set up a productivity factor for three baskets of basic services: (i) rental and local service, (ii) installation and, (iii) national and international services. We take the 1998 values for these services and construct three scenarios of tariffs for 1999, which are:

a) Pessimistic Scenario. This assumes an across the board decline in each of the tariff by 2% in 1999. In other words, this scenario assumes that the price cap regime in 1999 will set up the same productivity factor of 2% for each basket of services.
b) Intermediate Scenario. This assumes that rental, local and installation tariffs decline 2%, but the long distance services tariffs diminish 10% each.
c) Optimistic Scenario. This assumes that rental, local and installation tariffs decline 2%, but the long distance services tariffs diminish 30% each.

It is important to notice that the proposed tariff changes in long distance services in each scenario were constructed taking into consideration tariffs currently in place in very competitive countries such as Chile, México and some European countries. Thus the tariffs assumed under a

30% decline in the optimistic scenario are very similar to those in place in the most competitive countries around the world.

Given the tariff structure in each scenario, the model estimate the key indicators relative to welfare changes, net marginal income per line, average profit for small competitors and estimate and imputation test. In all the cases it is assumed that the changes in welfare are entirely due to changes in consumer surplus. In other words, the simulation exercises assume that TdP profits do not change. A summary of the results is shown in Table 4 and Table 5.

Table 4 – Results of the model: illustration of scenarios for Peru 1999

		Scenarios 1999		
	1998	Pessimistic scenario	Intermediate scenario	Optimistic scenario
Assumptions on tariffs				
Monthly rental	14.2	14.0	14.0	14.0
Var. %		-2%	-2%	-2%
Installation	187.3	183.6	183.6	183.6
Var. %		-2%	-2%	-2%
Local (3 min. pulse)	0.050	0.049	0.049	0.049
Var. %		-2%	-2%	-2%
DLD (min.)	0.170	0.166	0.153	0.119
Var. %		-2%	-10%	-30%
ILD (min.)	0.910	0.890	0.819	0.639
Var. %		-2%	-10%	-30%
Bottom-up costs				
Change in welfare (in millions of US$ per year)		5.7	19.1	75.6
Marginal income by line (in US$ per subscriber per year)		214	212	204
Top down costs				
Change in welfare (in millions of US$ per year)		5.7	18.1	75.7
Marginal income by line (in US$ per subscriber per year)		27	25	17

Welfare change

Table 4 depicts the assumptions in terms of tariffs for each scenario, the change in total welfare that results from the tariff vector, and the marginal income per line. Since there are two cost structures ("bottom-up" and "top down"), the results on welfare and marginal income per line are also considered for each cost structure. For the bottom-up cost structure, we observe that the annual welfare change is US$ 6 millions under the pessimistic scenario, equivalent to US$ 4 for each subscriber.21 The lower the long distance tariff, the higher the welfare. Thus, under the

21 It is interesting to contrast these results with a similar estimation done for Chile. A private investment bank estimated that the long distance liberalization in Chile generated an annual

optimistic scenario the welfare change is US$ 76 millions, or around US$ 48 for each subscriber. The results are similar when a top-down cost structure is assumed.

TdP´s incentive to expand its network

Under a bottom-up cost structure, the marginal income per line for TdP would still be important, so there would be incentive to expand its network by TdP. However, the levels of these marginal incomes, even though positives, would be significantly reduced when a consideration of top-down cost is done. Our conclusion would be that TdP still benefits expanding service at the projected 1999 rates in any of the three scenarios. So, we conclude that with regard to expansion of service, there is no serious disturbance of economic equilibrium.

Table 5 – Results of the model: small competitor analysis

	Scenarios 1999		
	Pessimistic scenario	Intermediate scenario	Optimistic scenario
(in US$)			
Domestic long distance			
Average revenue	0.166	0.1530	0.1190
Average cost	0.187	0.1869	0.1869
Average profit	-0.021	-0.0339	-0.0679
Imputation test	0.072	0.0587	0.0247
International long distance - outgoing			
Average revenue	0.470	0.3990	0.2170
Average cost	0.150	0.1504	0.1504
Average profit	0.320	0.2486	0.0666
Imputation test	0.403	0.3318	0.1498
International long distance - incoming			
Average revenue	0.420	0.4200	0.4200
Average cost	0.150	0.1504	0.1504
Average profit	0.270	0.2696	0.2696
Imputation test	0.353	0.3528	0.3528

Competitive Entry

In 1999, entry barriers will be relaxed for national and international long distance services. At this time, new competitors may emerge to challenge TdP. In Table 5, we show the effects of such likely entry by efficient or inefficient competitors. For each potential market, i.e. domestic, international outgoing and incoming, a set of indicator is shown in Table 5: average revenue, average cost, average profit and an imputation test.

The average revenue, cost and profit rows show whether a small inefficient competitor would be able to operate profitably. The results depend crucially on the assumed scale economies in producing telephone services. As discussed before, the inefficient competitor is assumed to

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welfare change of US$ 116, or US$ 64 for each subscriber. See. Flemings Research (1996), CTC de Chile, January.

have the same costs as TdP for any given level of output. However, the competitor operates at one-tenth of TdP's scale and thereby loses substantial scale economies. We previously estimated scale economies of 30 percent in long-distance and international telecommunications. It follows that the inefficient competitor's average costs are almost three times TdP's marginal costs. That cost difference represents the economic waste for every minute of use that such a competitor takes from TdP. In an unregulated competitive market, such an inefficient competitor could not survive. It would have strong incentives not to enter in the first place and generate the economic waste. However, entry by inefficient competitors may be possible and profitable if regulated rates are in serious disequilibrium.

The results coming of the three scenarios considered indicate the following:

- There would not be incentive for inefficient entry into domestic long market under any of the scenarios.
- There would be incentives to inefficient entry into international long distance market due to the high margins under the scenarios. This finding would suggest that a further rebalancing is needed in the international long distance tariff for 1999. Otherwise there may be a disequilibrium in the international market.

The imputation-test row shows whether the 1999 price structure would allow efficient competitors to operate profitably. It is assumed that competitors distribute local calls by buying local usage from TdP at tariffed rates.22 Failure of the imputation test would indicate a serious disturbance of economic equilibrium. The table shows that efficient competitors would, indeed, be profitable. The imputation test is therefore passed.

22 Since local calls are denominated in pulses, we need to make an assumption about the duration of long-distance and international calls in minutes. We assume that all such calls have a duration of 2.21 minutes. We understand that this assumption is consistent with the interconnection agreement between TdP and Tele2000.

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