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DOES DEREGULATION OF QUALITY STANDARDS IN TELECOMMUNICATIONS IMPROVE SOCIAL WELFARE? A METHODOLOGICAL NOTE

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Abstract

One of the main reasons behind the big difference observed in the per capita number of telephones between developed and developing countries is the high capital cost –a scarce resource in LDC's– of expanding telecommunications infrastructure. A reasonable question to raise in this context is the extent to which that high capital cost of investment could be diminished if international quality standards for telecommunications (which most developing countries comply) are relaxed. The present paper investigates on this issue and proposes a tentative methodology to assess the technical quality-capital cost trade-off generated. Such a method, combined with the appropriate technical studies on "physical" feasibility of quality relaxation, could shed some light on a way to increase telecommunication services in developing countries.

I. Introduction

In developing countries, there are on average 3 telephone per 100 inhabitants (5.5 in Latin America, 2.0 in Asia, and less than 1 in Africa, as of January 31, 1981)[1]. These figures compare with close to 45 telephones per 100 inhabitants on average in the case of developed countries. One of the main reasons for this big difference rests on the high capital cost of expanding telecommunications infrastructure, for capital is very scarce in developing nations. In this context, a reasonable question to raise is the extent to which that high capital cost of investment could be diminished if international quality standards for telecommunications (which most developing countries comply) are relaxed. The

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present paper investigates on this issue and proposes a tentative methodology to assess the technical quality-capital cost trade-off generated. Such a method, combined with the appropriate technical studies on "physical" feasibility of quality relaxation, could shed some light on a way to increase telecommunication services in developing countries.

II. The Model

There are not too many references on the effects of changes in quality in the literature on telecommunications. Curien (1987), for example, associates quality to the size of the telephone net, in the sense that people perceive a better service as the number of suscribers to whom they can call or receive calls from is greater. But this is not a technical notion of quality, our main concern. We are more interested on norms on transmission quality, time delays in waiting for a dial tone, the probability of completing a call, etc. Closer to this purpose it is an example cited by Saunders *et al.* (1983) about the measurement of a social welfare *gain* brought by an improvement of technical quality in Egypt's two largest cities, Cairo and Alexandria, in 1976-77. In the present paper, however, we try to model what the conditions are for a *reduction* in these measures of technical quality to *increase social welfare* through a decrease in the users' cost of telephone communications.

The model itself follows Mitchell (1978) classical distinction between demand for calls and demand for telephone lines. We concentrate on firms as demanders of telecommunication service as this service is assumed an input in the production function[2]. The model keeps from Mitchell the notion of a demand for telephone lines while we depart slightly from that framework in that instaed of a demand for calls, we use a demand for minutes of communication.

Let's take first a firm that already has a line and must decide how much minutes of communications to use for its own operations. This firm bought the line some time ago, so the price it paid for it is now considered a sunk cost. In the productive process, the firm combines labor (n) and other factor, say capital (k), according to a Cobb-Douglas production function like:

$$y = A\, n^{\alpha} k^{(1-\alpha)}, \qquad A > 0 \tag{1}$$

where n, k, and y are defined in units per *minute*. Labor is, however, a composite of two inputs: minutes devoted to the production of the firm's own product (denoted by 1), and minutes used in telephone communitation (m) necessary in the productive process. These two inputs are combined in fixed proportions[3] according to:

$$n = \min\,[(1/a), (m/b)], \tag{2}$$

where a and b are technical coefficients. Note that the latter, b, represents a quality parameter since if m is the restrictive factor, an increase in b implies more communitation minutes necessary to obtain the same "product" n. Moreover, since the time used in the production of the firm's product cannot be decreased (if it is fully employed), it is probable that the greater amount of time to be devoted to telephone communication also implies an additional cost in man-minutes.

It is easy to see that the cost function of this firm will be:

$$c(w_1, w_m, w_k, y) = A\,[a w_1 + b w_m]^{\alpha}\, w_k^{(1-\alpha)} y, \tag{3}$$

where w_i is the price of factor i = l,m,k. In particular, w_m represents the charge per minute of telephone communication. By applying Shepard's lemma we obtain the derived demand for minutes of communication:

$$\frac{\delta c}{\delta w_m} = m^d(w_1, w_m, w_k, y) = D\,[a w_1 + b w_m]^{(\alpha-1)} b, \tag{4}$$

where $D \equiv A\, w_k^{(1-\alpha)} y\, \alpha$

The reaction of m^d to changes (deterioration) in quality will have two faces. On one side, there will be a direct effect through an increase in b; on the other side, the increase in b needs of an increment in a, for more man-minutes are to be used in telephone communication. The induced change in a could be equal or greater than the change in b itself, depending on whether the worsening in quality translates only in more minutes of communication *counted as such by the telephone company* (resulting from more noise, for example), in which case the change in a and the change in b will be equal; or else, if on top of these greater number of charged minutes there are also more man-minutes lost due to, say, greater congestion or longer delays in getting dial tone (not charged for by the telephone company), in which case the increase in a will exceed that in b. Let's take a general case like:

$$da = \beta\, db, \text{ where } \beta \geqslant 1.$$

Thus, the changes in the quantity demanded for communication minutes after a quality worsening will be given by[4]:

$$\frac{\delta m^d}{\delta b} = D\left\{(\alpha-1)\,[a w_1 + b w_m]^{(\alpha-2)}[b\, w_m + \beta\, a\, w_1] + [a w_1 + b w_m]^{(\alpha-1)}\right\}. \tag{5}$$

Equation (5) shows two opposing forces: the second term in brackets is positive and reflects the fact that a quality worsening (an increase in b), prompts a greater demand for minutes of communication to sustain the same employment as before. But the first term in brackets is negative, that is, a more expensive labor (composed of minutes used in production and minutes used in telephone communication) after the increase in b and the induced increment in a, provokes the firm to move away from labor. However, it is easy to show that the net effect is still positive ($\delta m^d/\delta b > 0$).

But will the user firm benefit from this quality worsening? The answer will be a clear no if the firm is not compensated with a reduction in direct charges per minute of communication. To see this, let's take the cost function in equation (3) and ask what the reduction in that charge has to be such that the firm's total cost is not increased after b goes up. By also using equation (4), we get:

$$dw_m \leqslant -\,(w_m + \beta\, w_1)\,\frac{db}{b} \tag{6}$$

or, what is the same:

$$\hat{w}_m \leqslant -\hat{b}\,[1+\beta\,(w_1/w_m)], \qquad (6')$$

where the caret (^) represents rate of change. What remains unclear, though, is whether the charge per minute can really go down as much as indicated by equation (6'). That will depend both on the positive effect of the increase in b on the telephone company production and/or investment costs and on the effects on the demand for minutes of communication (also positive in our model). If equation (6') holds with strict inequality, then the user firm will be unambiguosly better off. If such a firm is representative of all commercial users of telephone service already connected, then also a social benefit could be derived from the quality reduction as long as the charge per minute is sufficiently reduced.

Let's take now the demand for telephone lines. What will make a firm identical to the one we have been assuming all along, except that *is not connected* to the telephone net, to buy a line? If the firm decides so, it is because its production costs are lower connected than not connected, and therefore it is better off. But will that mean a social benefit?

To answer the previous questions, let's suppose that our firm has two options to satisfy its telephone communication needs. The first one is to make all its calls from public booths, in which case the production function is still given by (1) while the cost function represents now both variable and total cost[5], such that:

$$CT_0 = CV_0 = c(.,.,.,.,.) = (D/\alpha)\,[a_0 w_1 + b w_m]^{\alpha}, \qquad (7)$$

where a_0 is the requirement of man-minutes to produce one unit of the firm's own product *plus* those minutes required to reach the public booth.

The other option open to the firm is to buy a line, in which case it will pay the line price by way of a fixed installment of L per minute, forever. Under this alternative, the firm's total cost will be given by:

$$(CT_1 = CV_1) + L = c(.,.,.,.,.) + L = (D/\alpha)\,[a_1 w_1 + b w_m]^{\alpha} + L, \qquad (8)$$

where a_1 is the counterpart of a_0 in this case in which the firm possesses a private line and $a_1 < a_0$. In making its decision on whether to buy the line, the firm will compare the present value of the savings it can make in its variable cost from now until a future date if it buys the line, with the presente value of accumulated installments L during the time spanning the same period[6]. If the firm's planning horizon is infinite and the discount rate is assumed constant, then the comparison above reduces to:

$$\left\{(CV_0 - CV_1) - L\right\} \gtrless 0 \qquad (9)$$

The firm will buy the line if the expression in (9) in greater than 0. How does this decision change if there is a reduction in the quality of service that reflects in an increase in b? To learn the answer, we differentiate (9) with respect to b, a, w_m and L, assuming as before that $da = \beta\, db$, to obtain:

$$\hat{b}\left[1+\beta\left(\frac{w_1}{w_m}\right)\right] + \hat{w}_m - \left\{dL/(w_m(m_d^0 - m_d^1))\right\} \gtrless 0, \qquad (10)$$

where m_i^d is the quantity demanded for minutes of communications in case the coefficient a is a_i. If the firm was indifferent between buying the line or remain unconnected

(that is, equation (9) held with equality), then it will decide to buy the line after the reduction in quality ($\hat{b} > 0$) if the following inequality holds:

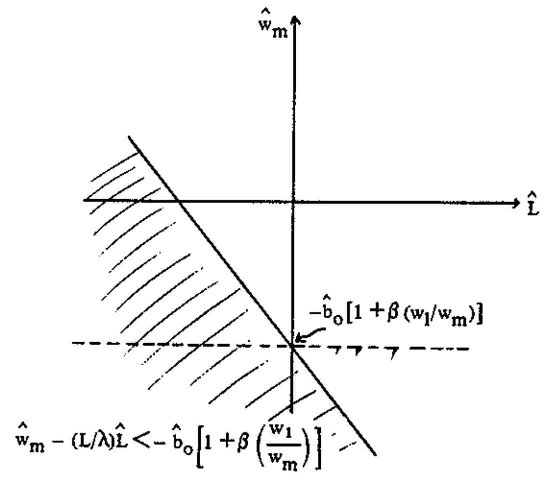
$$\hat{w}_m - (L/\lambda)\hat{L} < -\hat{b}\,[1+\beta\,(w_1/w_n)] \qquad (11)$$

where $\lambda \equiv w_m(m_0^d - m_1^d) < 0$ (since the quantity demanded for minutes of communication is lower if the public booth option is taken, as it can be easily derived from equation (3)). To illustrate the point, Figure 1 shows in a shaded area all combinations of changes in charges per minute and in the fixed connection installment (e.g., the price of the line), such that the marginal firm decides to buy the line after a given quality reduction (say, $\hat{b}_o$). Combinations in that area will imply more suscriptors. Of course, the question remains as to whether those combinations are technically feasible (in the sense that the telephone company really can reduce costs as much).

Now remember that equation (6') teaches us that to reduce the production costs of a firm already connected we need to reduce the charge per minute by more than $\hat{b}\,[1+\beta\,(w_1/w_m)]$. It can be seen in Figure 1 that to obtain this result and in addition that the number of suscribers is increased, we need to restrict combinations of $\hat{w}_m$ and $\hat{L}$ to the shaded area below $-\hat{b}\,[1+\beta\,(w_1/w_m)]$. These combinations guarantee that both already connected firms and firms that decide to buy the line after the price cuts have now lower production costs. What about firms that even after the reduction in prices remain unconnected and using public booths? These firms can be treated exactly like those already connected, except for the technical parameter a. Thus, as long as w_m is common for both public booth calls and private calls, they will also be better off with a reduction in the charge per minute that satisfies equation (6'). If (some of) those combinations in the shaded area below $-\hat{b}\,[1+\beta\,(w_1/w_m)]$ are technically and economically feasible (from the telephone company point of view), then we could talk of a social welfare gain after the worsening in technical quality[7].

FIGURE 1

COMBINATIONS OF $\hat{w}_m$ AND $\hat{L}$ THAT INDUCE NEW SUSCRIPTORS AFTER A $\hat{b}_o > 0$



Finally, there is, as usual, the potential of a welfare gain even for feasible combinations above the line given by restriction (6') if some type of cross compensation (tax-subsidy) scheme might be put in place.

Final Remarks

This note has tried to design a simple methodology to assess under what reductions in telephone communication prices, a worsening in technical quality could imply a social welfare improvement. Doing so, we have attempted to contribute to the issue of high capital costs of telephone expansion, specially in developing countries.

An extension of this proposition should take into account residential demand more explicitly and also more complex price schemes (like charges per call and differences in prices depending upon the time of the day, for example). A formal treatment of the technical and economical feasibility of price reductions (accruing for instance to economies of scale) would be also a neccesary complement.

Notes

1 Data from Saunders *et al.* (1983).

2 We are not taking into account residential demand for telephone services, altough the model could be easily adapted such that it generates that demand by assuming the houselhold as a leisure producer and where leisure production has telephone communication as an input. This will become evident below.

3 This could be the case of the firm's sales department, where the number of telephone communication minutes is proportional to the sale effort and, thus, to man-minutes available.

4 We will indistinctly use db and δb, where $\delta a = \beta\ \delta b$.

5 This notion of total cost excludes the cost of capital.

6 We are assuming that the same price per minute of communication, w_m, is charged both in the public booth and to the private line.

7 Remember that we are not considering residential lines, at least explicitly.

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BRASIL 1986-1989: NOTAS SOBRE LAS POLITICAS DE ESTABILIZACION

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Abstract:

In this note, we make a critical review of the Brasilian experience with heterodox stabilization programs (Cruzado; Bresser and Verano), emphasizing those factors which were more important to explain the failure of these programs. The basic insight is that a balanced combination of orthodox with heterodox policies does not guarantee the success of these plans because they do not consider the stock financial disequilibrium of the public sector.

A. Introducción

Este trabajo se propone revisar críticamente los planes de estabilización llevados a cabo en Brasil durante el período 1986-89, y discutir los factores que han dificultado su éxito en controlar la inflación.

Durante el período 1967-85 la economía brasileña experimentó sucesivos aumentos del nivel de precios. Desde 1967 a 1973 la tasa media anual de inflación fue alrededor de 20 por ciento. Con las presiones de demanda y el shock de los precios del petróleo, en el período 1974-78 la tasa media anual de inflación se duplicó, llegando a un nivel cercano al 40 por ciento. En 1979 nuevos shocks elevaron la inflación a tasas próximas al 100 por ciento al año, nivel que permaneció durante 1980-82. Luego, en 1983, la tasa de inflación nuevamente se duplicó, alcanzando un 200 por ciento, nivel que se mantuvo hasta 1985. En definitiva, el comportamiento de la inflación en Brasil hasta 1985 se puede describir como una sucesión de aumentos y relativa estabilidad a esos nuevos niveles.

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