The Dynamic Allocative Efficiency of a Public Utility: Swiss Telecommunications

ANTONIO MANZINI* and PHILIPPE THALMANN**

I. INTRODUCTION

PTT ("Poste-Télégraphe-Téléphone") is a public enterprise and the monopolist supplier of both mail and telecommunication services in Switzerland. Over the last 15 years, the mail branch consistently failed to cover its costs, but the deficits were more than offset by surpluses from the telecom branch. While PTT is expected to contribute to federal government revenue, the firm closed its books in 1991 with an overall deficit of SFr. 292 mio. (on total costs of SFr. 11.9 bn.).

That disappointing result was explained by the growing deficit in the mail branch. Outside PTT one questions the firm's efficiency at handling mail. PTT's management calls for federal subsidies for services which the firm is legally forced to supply at below-cost prices (newspaper delivery, over-land bus service). There is much less discussion of the performance of the telecom branch, even though the degree to which revenues cover costs in that area declined by 12 percentage points between 1985 and 1991: all of the decline is attributed to increased competition where it is possible, mainly for international calls.

It is not our purpose here to question the tariffs for PTT services, the cross-subsidizing of mail and telephone, nor the flow of funds between the government and its subsidiary. Rather, we would like to fill a gap and examine the firm's efficiency at producing telecom services. PTT is a public service monopolist whose prices are regulated and which must deliver universal service. As of May 1992, international services are open to competition, as well as some other of the most lucrative activities. Efficient production should thus be a growing concern for the firm. Indeed, PTT is very proud of its in-house development of new means and ways for saving resources and of its fast introduction of new technologies, particularly in the area of telecoms.

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The goal of this paper is to test the allocative (or cost) efficiency of PTT's telecom branch over the period 1957-1992. It takes account of installation costs when probing the accumulation of capital. It examines also whether politically imposed constraints on factor uses, particularly employment ceilings, were deleterious to the firm's efficiency.

The other important dimension of efficiency, technical (productive) efficiency, is assumed here rather than tested. Indeed, considering the pressure on PTT to rationalize, it is unlikely that the firm kept resources idle. The concepts are compared in figure 1:

Figure 1: Technical and allocative efficiency

Point A represents the observed combination of labor and capital in some year. We fit a production relationship using several input points and the corresponding observed output. The isoquant through A is labelled \( \hat{Y} \) for the fitted output level. The straight lines represent the relative factor price. To isolate allocative efficiency, we compare the cost of the actual factor bundle (A) with the minimum cost of producing \( \hat{Y} \) (at B).

Observed output \( (Y) \) associated with the observed input bundle A is not equal to fitted output \( \hat{Y} \). The isoquant labelled Y presents the input combinations that yield Y under the

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1. What we call allocative efficiency is FARRELL'S (1957) price efficiency. For discussions of technical efficiency, see that paper or those of FORSUND, LOVELL and SCHMIDT (1980) and THIRY and TULKENS (1989).
estimated production function. The fact that point A lies above (below) that isoquant suggests that the same output was attainable with less (more) input. The wedge between $Y$ and $\hat{Y}$ could be a measure of technical efficiency, but it could also be due to unsystematic measurement errors or unpredictable variations in factor performances. We retain the second interpretation and focus on allocative efficiency. The wedge between $Y$ and $\hat{Y}$ is assumed purely stochastic.

Our approach in testing allocative efficiency is original. The traditional procedure involves (1) assuming that the firm minimizes costs relative to a different set of factor prices, (2) postulating a relationship between those shadow prices and market prices, and (3) estimating the minimum cost function or the profit function.\(^2\) A limitation of the traditional approach is its requirement of a specific relationship between shadow and market prices. That leads to the estimation of an average level of allocative efficiency.\(^3\) Our approach allows for different deviations from efficiency at every point of the sample.

The questions raised in this paper are of wider interest than just assessing PTT’s management. They have to do with the possibility for a state monopoly to be efficient when it is kept on a “short lead”. Do constraints like universal service, ceilings on some factors, and the required financial surplus (all are present for PTT) not introduce cost inefficiencies?\(^4\)

**II. BACKGROUND INFORMATION**

The federal government lays charges upon PTT. The firm’s first obligation is to satisfy an ever expanding demand for postal and telecom services. The density of telephones in Switzerland was the fourth highest in the world in 1966 and even the third in 1970. In the international comparison of telephone companies size in terms of conversations carried (in minutes), PTT ranks in the sixth position. Second, PTT is expected to balance its budget and even to deliver a sizable surplus to the treasury, yet its tariffs are subject to approval by political authority. They were held constant (in nominal terms!) for telephone connection and communication for more than 50 years prior to 1972. Those factors continually forced PTT to limit costs. The Swiss telephone network was automated much faster than that of other countries. The replacement of operator-assisted calling by direct-dialling, initiated in 1922, was virtually completed by 1957.\(^5\) PTT

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2. See, for example, LAU and YOTOPOULOS (1971), TODA (1976) and ATKINSON and HALVORSEN (1984, 1986).
3. The work of DE BORGER (1991) constitutes an exception. The relationship he specifies between shadow and market price is not mere proportionality but, rather, it involves possible determinants of the wedge between the two.
4. Under those respects, PTT compares to a private utility subject to similar constraints, like those which supply telecom services in the USA and Canada. MELODY (1989) compares public utility and regulated monopoly through the experience of AT&T.
5. In Canada, direct-dialling was introduced in 1956, and the proportion of phones with access to direct distance dialling was 85 percent in 1977 [DENNY et al. (1981)].
continued to increase the transmission capacity of the existing wires and centrals. It buried telephone cables to save on maintenance. Over time, the firm gained a reputation for tough labor organization.

At the same time, PTT was almost permanently constrained in its use of some production factor. Hiring labor has been a continuing problem for PTT, due to its quality of a branch of the federal government. At some times, it was not allowed to adapt its package of compensation and labor conditions to the tight Swiss labor market or to hire foreigners. It is presently subject to recruitment ceilings that are designed to limit the growth of federal expenditures and employment. Thus, PTT automated the network and introduced every technical innovation as it became available, not only to save on costs but more specifically to keep labor hiring low in the face of growing demand for its services. As a result, the firm systematically substituted capital for labor.

PTT has been used as an instrument to stabilize the business cycle. After the war and in all later periods of economic over-heating, PTT was asked to postpone construction projects. During the recession of 1974-1976, on the contrary, PTT was expected to help business activity, but also to reduce its deficit, by far the largest ever. Needless to say, satisfying all these objectives and constraints is virtually impossible for PTT, except in years of particularly favorable economic conditions.

In June 1991, federal authorities adopted a new law on telecommunications, which became effective on May 1st 1992. That law confirms PTT’s monopoly over the national network and radio-wave frequencies. However, private suppliers may now transmit data (though not the spoken word) on rented lines. The new law introduces the possibility for customers to purchase their telecom equipment from private suppliers. PTT is forbidden to use profits from monopoly services to subsidize competitive services. The law did not split up PTT into a telecom firm and a mail firm, contrary to what was often requested in the debate surrounding the new law.

III. THE MODEL

It was possible to gather 36 years of consistent data (1957 to 1992). Since the series are rather short, we choose to save degrees of freedom by selecting a model of the production process which is parsimonious in estimated parameters. We estimate a COBB-DOUGLAS production function for a single output. As shown by DENNY et al. (1981), a more sophisticated model may not be robust to even small changes in the data base.

Students of telecoms, in Canada first, have come to prefer to estimate (translog) cost functions: see the surveys by FUSS (1983) and by KISS and LEFEBVRE (1987). However,
the arguments advanced by Fuss for estimating the cost function do not apply in our case. Indeed, our goal is not in comparing the average costs of different services with the rates charged — as is done for regulation purposes. Rather, we care about estimating the allocative efficiency of production. That prevents us from assuming at the outset that PTT minimizes costs. Furthermore, the greater ease at estimating a flexible cost function and deriving factor demands is not very pertinent for our short series of data and our concern with allocative efficiency.

As regards the choice of a single aggregate output versus multiple outputs, the available data are not detailed enough to allow for disaggregation. That may not be too great a problem. Fuss sums up the available (Canadian) evidence as indicating that economies of scope are minor compared to aggregate costs. Kiss and LeFebvre conclude from their review of more recent literature that the evidence on economies of scope is mixed at best.

The production of telecom services is usually measured by the volume of communications made every year: the number of calls or total conversation time. In fact, the demand for telephone service is quite variable, with daily peaks, weekly and even yearly peaks. PTT thrives at always satisfying demand, even peak loads. It builds up capacity which remains idle for most of the time. If the greatest part of the factors of production hired by PTT have the nature of "capacity", i.e. they cannot be "laid off" in times of low demand, then the output by PTT is best measured by peak-load capacity. We believe that capital and most of labor and materials are specific to telecoms, in the sense that no good second-hand markets exist for them. Furthermore, much input consists of management and maintenance of the network, two activities that are independent of current demand.

The maximum number of calls that could be placed simultaneously would be a good measure of peak-load capacity. PTT does not publish that number but it discloses the number of telephone connections. It is likely that PTT estimates the communications capacity that it must make available (peak-load demand) as a fraction of the number of connections. If that fraction is constant through time, the number of connections is a good indicator of supply.8

The quantity of labor input is measured by deflating total labor expenses in the telecom exploitation offices (as computed for production costs) by the unit cost of labor. As an indicator of the unit cost of labor for PTT, we use the top salary in the federal pay class to which the vast majority of telecom employees belongs. Account is taken of class redefinitions and the successive reductions in working hours.

The stock of capital is estimated by the perpetual inventory method. Annual investments are added up, with corrections for linear depreciation at 10 percent and for the sale

8. Capacity is measured as the sum of available telephone connections and registered portable telephones. In 1989, PTT ceased to publish the increase in the number of available telephone connections. We replace it by the number of installed connections. In 1988, the number of available connections increased by 136,000 units and the number of installed connections increased by 133,156 units.
of used items. Data for investment goes back for enough years before the beginning of our sample period that we can estimate even the initial capital stock.

Capital enters the production function but not the cost function. Indeed, current outlays are for investment, as is described below. Thus, we need a measure of the price of investment goods rather than the usual user cost of capital. We use the price index of equipments as it is calculated by the customs office based on import prices.

Payments to third parties other than labor and capital costs constitute on average about 20 percent of total costs. They make a heterogenous bundle, the most important component being non-durable equipments. We call it materials and use the GDP deflator for a price index.

Throughout the 1960's and 1970's technological progress allowed an increase in the number of connections and communications that exceeded the expansion of the workforce and the network. Standard wire lines were replaced by coaxial wires. The number of communications that could be channelled through the same wire was raised several times by increasing the electric frequency. The capacity of switching centrals, most of which were already automatic in 1957, was augmented by introducing transistor technology and printed circuits as soon as they became available. One technology area where PTT was somewhat behind its neighbors was the automation of international calls: it was achieved between 1965 and 1975.

The proportion of telephones connected to direct-dial, the technology indicator favored by Denny et al. (1981), cannot be used for Switzerland. It was already close to one at the beginning of the sample period. The proportion of direct-dial international calls is not a good indicator for technological progress because it applies only to a very small part of telephone usage. Furthermore, it was constant before 1965 (zero) and after 1975 (one). More important, the selection of such a share variable imposes a logistic form for technological progress. Thus, in the absence of a better indicator for technology, we use an exponential time trend.

To establish new cable lines or to set up switching centrals, PTT uses its own technicians and craftsmen. Those employees are continually trained in the new technologies that the firm keeps introducing. Thus, part of the workforce is drawn from the production of services to the setting-up of new capital. In addition, connecting new centrals and increasing the capacity of cable lines may require an interruption of service. In short, there are adjustment costs associated with investment, costs that take the form of foregone output. They depend on gross investment because depreciated capital is usually replaced by material of more recent technology. Unfortunately, we could not find any estimates of set-up costs. As a result, the estimation of the production function includes the parameters of a reasonably simple adjustment cost function.

We estimate the following Cobb-Douglas production function relating the capacity of the network ($Y$) to the use of labor ($L$), capital ($K$), and materials ($M$). That relationship

9. In 1957, international calls made only 1.7% of total usage.
depends on the state of technology measured by date $t$. It depends also on the gross rate of investment $I/K$ through set-up costs.

\[
\log Y_t = \alpha_0 + \alpha_L \log L_t + \alpha_K \log K_t + \alpha_M \log M_t + \alpha_T t + \alpha_{AC} \log \left(1 - \frac{I_t}{K_t}\right) + u_t \quad t = 0, \ldots, 36
\]

Factor quantities are likely to be correlated with the error term through the firm’s input optimization program. We therefore estimate that equation using instrumental variables. Factor prices are used as instruments for factor quantities, while time instruments take care of the dynamic structure of the model. The results of this estimation show that we cannot reject the hypothesis of constant returns to scale. Table 1 presents parameter estimates for the production function, with constant returns to scale imposed. The t-statistic computed against it (0.44) does not reject that plausible assumption.

**TABLE 1**

<table>
<thead>
<tr>
<th>COBB-DOUGLAS PRODUCTION FUNCTION OF SWISS TELECOM 1957-1992</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Coefficient</td>
</tr>
<tr>
<td>1. Constant $\alpha_0$</td>
<td>0.243 (3.63)</td>
</tr>
<tr>
<td>2. Labor $\alpha_L$</td>
<td>0.277 (2.79)</td>
</tr>
<tr>
<td>3. Capital $\alpha_K$</td>
<td>0.381 (3.40)</td>
</tr>
<tr>
<td>4. Materials $\alpha_M = 1 - \alpha_L - \alpha_K$</td>
<td>0.342 (3.56)</td>
</tr>
<tr>
<td>5. Trend $\alpha_T$</td>
<td>0.005 (2.78)</td>
</tr>
<tr>
<td>6. Adjustment costs $\alpha_{AC}$</td>
<td>1.416 (4.97)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.959</td>
</tr>
<tr>
<td>DW</td>
<td>1.116</td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td>31</td>
</tr>
</tbody>
</table>

t-statistics are included in brackets.
For comparing this production function with other estimates of telecom technologies, we may derive demand elasticities, even though we do not postulate that PTT minimizes costs. We estimate own price elasticities of factor demands that lie in the range of values obtained from the estimation of cost functions for foreign telecom companies [Kiss and Lefebvre (1987)]. The demand for capital, in particular, is much less elastic than the demand for labor and materials.

The importance of adjustment costs can be measured by the change in output caused by a change in investment through adjustment costs only. In elasticity form, a range of -.30 to -.52 obtains for the investment rates observed over time.\(^\text{10}\)

IV. ALLOCATIVE EFFICIENCY

Given the schedule of production possibilities, we test whether the factor mixes chosen by PTT over time are those that minimize costs. Before that, it may be helpful to examine more closely what factor mixes were chosen.

In 1975, Switzerland entered into an unusually deep recession, triggered by the first major energy price shock. The consequence for PTT was an interruption of the steady growth of demand for its telecom services, which took the firm by surprise.\(^\text{11}\) PTT reacted to the shock by cutting down on capital accumulation and even more on the purchase of materials. In 1976, PTT wrote that with only business objectives in mind it would have reduced investment even more, halting its purchases in some areas of telecom equipment. Instead, it was concerned about the survival of its private suppliers.\(^\text{12}\) PTT also tried to slow down labor hiring for a few years.

The reaction of PTT, which seems excessive when compared to the mere slowdown in network expansion, can be understood by looking at more volatile indicators of demand: the number of new connections fell by a third in 1975, the number of inter-city calls by 8 percent.

The trough of the period of slower growth was reached in 1980, much later than for the rest of the economy. The contraction was then perceived to have been excessive. PTT attempted to catch up rapidly in the second half of the eighties. The growth rate of the capital stock, which was negative in 1978, 1979 and 1980, averaged 2.4 percent between 1981 and 1985, and even 7.2 percent between 1986 and 1991. Rapid capital accumulation took place just when the Swiss economy was overheating, particularly in the construction

10. A more general formulation of adjustment costs could take the form \(Y = Ya(b-ct/K)^d\). If we require the adjustment cost to be zero for zero investment, the general form is observationally equivalent to the simple form used for the estimation. It yields the same elasticities of output to investment.

11. The rate of growth of the number of connections fell from a steady 5 percent to less than 2.5 percent by 1987.

12. PTT, Rapport de Gestion 1975, Berne, 1976. There is no word about an expected recovery that would justify maintaining a smooth investment path.
sector. The strong recruitment effort in 1987-91 also hit an extraordinarily tight labor market.

Casual examination shows that PTT was overreacting to the turmoil of the seventies, like a giant dulled by easy life in the two previous decades. Its pro-cyclical behavior on factor markets and the swings in its accumulation of capital in spite of adjustment costs let us already suspect that PTT's performance could have been better. The next paragraphs propose alternative growth paths and compare the resulting costs with those actually incurred by PTT.

The alternative paths for factor demand are obtained by minimizing factor acquisition costs under the constraint of producing the same (fitted) output as in the benchmark:

$$\min \sum_{t=0}^{36} (w_{L_t} L_t + w_{I_t} I_t + w_{M_t} M_t) \mu(t)$$

s.t. \[AL_t^{\alpha_L} K_t^{\alpha_K} M_t^{\alpha_M} e^{\alpha_I} (1 - \frac{I_t}{K_t})^{\alpha_C} = Y_t\]

\[K_{t+1} = (1-\delta)K_t + I_t, \quad t = 0,\ldots,36\]

The new variables in this program are the prices for labor, investments and materials. The rate of economic depreciation is written $\delta$. The discount factor $\mu(\cdot)$ is based on the rate of return on government bonds.

Current investment increases current costs through the purchase price of the equipments and through the additional inputs that are required to install them. A higher capital stock lowers costs next year (1) by increasing the productivity of the other factors, (2) by lowering the need for further investment, and (3) by reducing the marginal cost of tomorrow's investment via lower marginal adjustment costs. The value of that latter effect depends on planned investment for next year, which depends itself on expected production and prices in the following years. Thus, optimal investment for one year cannot be determined separately from the full inter-temporal path of capital accumulation.

We solve for the optimal path of investment which has the property that each year's investment is consistent with the decisions of the other years. The path of capital starts at the actual capital stock of 1957 and is forced to converge to the actual stock at the end of 1992 (which is the stock of 1993). That eliminates the influence of different "endowments" or "legacies". When solving for the intermediate years, we assume that expected prices and output are the same as those observed. Thus, we solve a dynamic model for

13. The theoretical foundations for such an approach can be found in LUCAS (1967) and TREADWAY (1971).
14. We may be underestimating the inefficiency of PTT by constraining the optimal path of capital accumulation to converge to the actual stock at the end of 1992. On the other hand, differences in expectations about future output will not affect the assessment of PTT's allocative efficiency.
Figure 2: Observed and Optimized Capital Stocks  
1957-1992

![Graph showing Observed and Optimized Capital Stocks](image)

Figure 3: Factor Prices  
1957-1992

![Graph showing Factor Prices](image)

- Observed
- Dynamic optimum
- Labor
- Materials
- Capital
Figure 4: Observed and Optimized Use of Materials
1957-1992

Figure 5: Observed and Optimized Employment
1957-1992
the inter-temporal paths of factor inputs that minimize production costs under perfect foresight.

The comparison of the minimum cost of production with the actual cost for PTT over the 36 years in the sample period yields a cumulated difference of 2.1 billions (in francs of 1992). That represents foregone savings of 1.5 percent of the total present value of actual costs. Thus, PTT's average cost inefficiency is relatively small, which confirms LEIBENSTEIN's (1966) view that estimates of allocative efficiency are generally small. The decomposition by input type shows that 2.9 percent of cost savings could have been made on labor and 4.2 percent on investments, against higher costs of 5.5 percent for materials.

We find that the stock of capital lay below its optimum up to 1964, after which it started to grow excessive (figure 2). The strong acceleration in capital accumulation from 1971 up to 1974 was unwarranted. PTT was right in slowing down the rate of accumulation from 1975 to 1982, even though the user cost strongly declined over that period (figure 3). Not all of the overhang was removed, and the stock of capital remained excessive ever after.

The observed decreases in materials usage between 1975 and 1977 and towards the end of the observation period cannot be explained with reference to the price index we use and the evolution of output (figure 4). The purchase of materials declined much further than the purchases of any other factor in 1975 and 1976, even though the price of materials did not grow significantly faster than that of labor. It may be that PTT put the knife at those costs which could be pared down most rapidly and with the least harm. It may also be that the firm enjoyed such market power that the decline in its purchases actually caused a slowdown of price growth. In that case, too much should not be made of the ex-post observation that PTT should have taken advantage of lower prices to buy more materials.

Employment was almost always excessive over the observation period (figure 5). The cost minimization program shows that it should have declined in the early eighties and not in 1986 and 1987 as it did. Marked accelerations in compensations, calling for substitution of labor by materials (out-sourcing), occurred in 1980-1982 and again in 1990-1992. That such substitution did not happen in due time is surprising. Indeed, PTT is closely watched by politicians who strive at tying down the size of the public sector by limiting employment. In fact, the ceilings are imposed on the growth of the labor force, quite independently of what is needed by PTT. In such conditions, the firm may

15. What we call actual costs are not those reported in PTT's accounts but the economic cost recalculated with the factor inputs we used for estimation of the production function and our measures of factor prices.

16. The user cost of capital in figure 3 is measured as \((1+r)pi(-1) - (1d)pi\), where \(r\) is the current interest rate paid on government debt, \(d\) is the rate of economic depreciation, and \(pi\) is the price index for investment goods, current and lagged by one year. It leaves out the marginal adjustment cost.
want to "hoard" labor when it can hire it, as during a recession. The allowed growth rate of employment seems to have become a target...17

The dynamic analysis does not allow for assessment of PTT's performance in individual years. Costs may be high in one year because the firm invested extensively for the following years. Still, one can estimate a "maximum" inefficiency by adding up costs over the ten year period 1972 to 1982, a period over which the observed paths of capital and materials use deviate largely from their optimum. That interval has the virtue that the observed and the optimal stocks of capital are fairly close at both extremities (figure 2). We find that production costs for 1972-1982 could have been lower by 2.4 percent. Perhaps surprisingly, PTT's cost inefficiency was not much greater in the years of economic turmoil than in the years of steady growth. The pressure on PTT to help business activity during the recession by maintaining investment was not very harmful to the firm. It did not perform better in the eighties because employment continued to grow steadily instead of responding to productivity gains.

Perfect foresight is a strong assumption for PTT but it is acceptable. Factor prices and the demand for its services grow quite smoothly. Still, an alternative model for PTT decisions is developed. It assumes that the firm takes adjustment costs as given. Then, optimal investment depends only on current magnitudes: the interest rate and the price of investment goods. The firm minimizes costs under the constraint of producing enough gross output that output net of resulting adjustment costs be equal to the level of net output actually observed. That model focuses on the static cost saving problem, leaving out investment smoothing.

We find that PTT is still inefficient relative to the optimum of a "myopic" firm, but only by 0.7 percent of total capitalized costs. Table 2 compares observed and optimal expenditures for the three factors. The "myopic" firm and the "forward-looking" firm use similar factor mixes. The latter manages to use more capital than the former and still to incur less adjustment costs, as is suggested by lower expenses on labor and materials. Indeed, by smoothing capital accumulation it can keep its adjustment costs low. Still, the table shows that half of the cost savings could have been obtained on the static factor allocation margin the cost advantage of the "myopic" firm. Investment smoothing contributes the other half of the cost savings.

17. In other situations one might explain excess employment by a public enterprise by the fact that it faces a shadow cost of labor inferior to the market wage. That would typically be the case in the presence of unemployment. However, the Swiss labor market was characterized by excess demand much more often than by excess supply.
TABLE 2

CAPITALIZED FACTOR COSTS (SFr. mio. in 1992)
1957-1992

<table>
<thead>
<tr>
<th>Expenditures for</th>
<th>Labor</th>
<th>Materials</th>
<th>Capital</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed</td>
<td>37276</td>
<td>33562</td>
<td>67282</td>
<td>138120</td>
</tr>
<tr>
<td>Dynamic optimum</td>
<td>33301</td>
<td>41159</td>
<td>61528</td>
<td>135988</td>
</tr>
<tr>
<td>“Myopic” optimum</td>
<td>35464</td>
<td>43833</td>
<td>57835</td>
<td>137132</td>
</tr>
</tbody>
</table>

V. FINAL COMMENTS

This paper estimates excessive costs for PTT of 1.5 percent in present value between 1957 and 1992. That result should be taken with care. Indeed, we compare the firm's performance with that of an ideal firm which is endowed with qualities that the real firm could not have. The ideal firm enjoys perfect foresight, so it can plan its accumulation of capital, smooth adjustment costs and buy capital against the price cycle. The comparison with a "myopic" firm that would ignore the disruptions due to an irregular path of capital accumulation shows that half of the cost savings are to be gained by smoothing the investment rate and the other half by choosing the appropriate mix of "flexible" factors (labor and materials). That result is valid even if the problems we encountered with estimating appropriate factor prices call for caution in the comparison of actual and optimal input paths. However, (marginal) investment smoothing might be given too much weight as compared to (infra-marginal) capital intensity by our assumption that the initial and terminal stocks of capital are intertemporally optimal. That problem might also account for the fact that our estimates of cost inefficiency are of rather second-order magnitude.

The analysis further shows that the recruitment difficulties, about which PTT always complained, did not hurt its efficiency except insofar as they induced the firm to hoard labor when it could hire some. Nor were the ceilings on employment or the pressures to help the construction branch during the recession very harmful to PTT.

A further development would involve testing the assumption of technical efficiency. It should not change our estimation of cost inefficiency as long as the fitted output is used in the production constraint: we would just reinterpret the residuals not as observation errors on output but as inefficiencies in output.
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SUMMARY

Public utilities are typically endowed with the following characteristics that are likely to affect their performance: (1) no competitors, (2) political pressures and regulation, (3) soft budget constraints. This paper explores the efficiency of such a utility, the Swiss telecommunication monopolist, which should supply universal service at minimum cost. It develops a new approach that makes it possible to handle the dynamics introduced by capital accumulation under adjustment costs. Excessive costs are estimated at 1.5 percent for the 1957-1992 period. One half of the cost savings were obtainable by better intra-temporal input choice, the other half by smoothing the path of capital accumulation.

RESUME

Les entreprises de service public ont typiquement les caractéristiques suivantes qui sont susceptibles d’affecter leur performance: (1) absence de concurrence, (2) pressions politiques et réglementation, (3) contraintes budgétaires souples. Cette étude examine l’efficacité d’un tel service public, le monopole des télécommunications en Suisse. Elle développe une approche nouvelle destinée à traiter la dynamique introduite par l’accumulation du capital en présence de coûts d’installation. L’excédent de coût est estimé à 1,5% pour la période 1957-1992. La moitié des économies de coûts pouvait être réalisée en combinant mieux les facteurs chaque année, l’autre moitié en lissant le sentier d’investissement.

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