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THE DEMAND FOR TELEPHONE SERVICES IN AUSTRALIA

AND THE WELFARE IMPLICATIONS OF ALTERNATIVE PRICING POLICIES

John J. Beggs

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by

John J. Beggs

Introduction

This paper focuses attention upon the separable demand for tele-
phone "connections" and telephone "calls" with a view to examining the
welfare implications of the marginal cost pricing of the services.

A simultaneous equation model is introduced to capture the inter-
action between the two types of demand described above, and the interaction
between the supply and demand sides of the market. Price and income
elasticities of demand are estimated and shown to be in good agreement
with those found in North American studies.

On the assumption that telephone services are currently priced
according to average costs, the final section of the paper derives those
prices which would prevail under a marginal cost pricing regime. It is
shown by consumer and producer surplus measures that considerable welfare
gains are available from a switch from average cost to marginal cost
pricing.

Issues in Market Definition

This study deals with the industry providing transmission of voice
messages, both local and toll, for Australia between 1953 and 1975. During
this period the industry was under the sole control of a single govern-

ment department, the Post-Master General's Department (PMG), which also administered postal and telegraphic services.

The industry, or rather market, definition is quite broad. First, local and toll calls have been combined into a single product category. This is purely a requirement of the data, for, since the gradual introduction in the late 1960s, of subscriber toll dialling the PMG has not kept statistics on the relative volumes of local and toll calling. This data deficiency will be remedied in the 1980's as computerized telephone switching is introduced and record keeping becomes a less expensive task. It should be noted that this data deficiency is not quite as serious as it would be, for example, in a North American context. The "rough" data which does exist suggests that toll calling represented only some 6 per cent of total telephone traffic in 1972 (Australian Year Book, 1972). This low toll traffic volume is the result of (i) the wide geographic dispersion of the major population centers and hence the low levels of communications interaction (Zipf (1946), Senecca and Clechetti (1969), Hammer and Ilke (1957)), and (ii) the practice of delineating very large "local" calling areas which have typically encompassed entire metropolitan areas and their peripheral suburban and semi-rural areas.

The industry definition is for the Australian market as a whole. This has some significance in view of the government policy of charging all telephone users similar service rates. This represented a considerable cross-subsidization from urban telephone users to rural telephone users. South (1975) suggests, as a rough "order of amgnitude" engineering estimate, that the cost of installing a new telephone service in a metropolitan area to be about $1,000. For comparison he suggests costs for Rockhampton (a coastal city of population of 50,000 people) to be about $8,000 and

for Longreach (a town of 2,000 people located in an isolated inland region) at about $24,000. It would require a very large study to geographically isolate each of these submarkets and analyze cost and demand conditions in each. Again the extent of the problem is slightly alleviated by the fact that 64 per cent of the population live in major urban areas having populations of 100,000 or more.

All data is on an annual basis. Daily and seasonal fluctuations in demand are not examined. It was policy of PMG to maintain the capacity of the telephone system to a level where it can handle all calls that are made at peak periods. In local calling areas, in which the great bulk of the traffic occurs there is no system of peak load pricing. All local calls pay a flat rate charge per call regardless of the time of day at which the call is made, and regardless of the time duration of the call.

Finally, the use of the telephone network for terminal-to-computer and computer-to-computer communications is a growing source of traffic especially on some long-distance routes (Hootman and Bowes). It would be anticipated that the demand for such special purpose traffic would be characterized quite differently from the more usual voice traffic. Again the issue will have to be put aside in our analysis as data is not available. While future growth in this sub-market may be important it is doubtful if in the time period of this study computer traffic was anything more than a very minor component of total traffic.

Models of Telephone Demand

The great bulk of the studies into the demand for telephone services have been time series studies of the Box-Jenkins type which have been primarily designed for the purposes of forecasting future traffic

loads (Shephard (1968), Naleszkiewicz (1970), Thompson and Tiao (1971), Dunn, Williams and Spivey (1971), Tomasek (1972), Athanassiou (1974)). It is not reasonable to criticize these studies out of context, but for the most part they are concerned with trend fitting of data with some allowance for seasonal adjustment. Several limited scope studies have been carried out with a specific view to isolating key economic parameters such as price and income elasticities (Jipp (1960), Bech (1970a), Bech (1970b), Wellenuis (1969)). These particular studies are cited independently of the following group because they can be considered as using only rudimentary economic and statistical methodology. However it would appear that Bech's data for Denmark may be amenable to reanalysis at some future date.

The two superior studies in this field are by Dobell et al. (1972) and Davis et al. (1973). Each of the studies has essentially attempted to build models of industry demand and cost conditions, employing data from Canada and the United States respectively. Both studies have offered a detailed treatment of production costs, and have employed capital stock series and attempt to explain changes in capital labor ratios in terms of changes in the relative prices of capital and labor.

The contribution of this paper is in the modelling of the demand for services, with its subsequent implications for pricing policy. The improvements occur in two areas. First, the Dobell and Davis studies were not able (for data limitations) to calibrate actual demand functions. The Dobell study employed simple expenditure functions to impute values of the various price and income elasticities (Houthakker and Taylor (1970)). In our study a distinction is made between

(i)   the demand for a telephone connection (i.e. to have

       the service installed on the premises), and

(ii) the demand to make a telephone call itself, in order

       to highlight the numbering so that what are the two

       goods can be treated separately, as they deserve.

Second, the study attempts to account for the simultaneous inter-actions of demand and supply. While there is no clear concept of a supply curve under conditions of a government run monopoly, it is hypothesized that the government sets prices along a cost curve. In a later section of the paper it is argued that "average" costs are used to set prices.

While the model offers an improved treatment of the nature of the product demand and by allowing for simultaneous equation interactions, future research could be directed towards a model which included a capital stock series and a cost of capital series. The problems involved in con-structing an accurate capital stock series are, for the most part, irregu-larities and inconsistencies in government accounting practices. In the case of a cost of capital series, it was only after 1958 that the PMG Department was charged interest on its annual budget allocation for capital works. The interest rate was then set annually in the budget and was not necessarily equated to the prevailing rate of interest in the bond market (indeed, it was typically set well below market rates). Further, the PMG Department was not allowed to borrow independently on the loan or bond market. Consequently there are three "cost of capital" variables which are relevant to the analysis.

(i)   the market interest rate,

(ii) the accounting interest rate which is levied on capital

      funds allocated from the budget, and

(iii)   the marginal revenue product of capital employed by

the PMG.

Ideally the three variables will all have the same values. Presumably

the PMG would not want funds once the marginal revenue product has fallen

below the accountant's interest rate, but would certainly seek funds

up to that point. If the government is efficiently allocating funds

it will allocate funds so that the marginal revenue product equates the

market interest rate. Given the complications involved in budget appro-

priations such an "efficient" allocation would only be a "fortuitous"

outcome. Indeed marginal revenue products of capital could fluctuate

rather widely from year to year depending on how national "stabilization"

policies affect budget allocations.

It would seem possible that some of the above data problems could

be resolved by a detailed investigation of actual government accounts.

The paper does offer a function in the style of a "supply" curve to cap-

ture the interaction between the demand and supply sides of the market.

In particular it is hypothesized that the cost of a telephone call and

the cost of a telephone connection depend on the number of calls being

made and the number of services already installed. This interacts with

our demand curves where demand for calls and service connections depends

on the price charged.

A Simultaneous Equation Model

The demand for telephone service has two components

(i)   the act of having a telephone service installed at one's

home or office. This act of consumption will necessarily

result in a half-yearly "rental" fee which is charged

irrespective of whether any calls are made from the
telephone or not. (This creates a virtual unlimited
capacity for receiving calls while incurring no addi-
tional costs.)

(ii) the act of making a telephone call. This act of con-
sumption will result in flat fee being charged for each
call. Notice however that it is not possible to make
a call without first incurring a service connection
fee of (i) above.

In a two dimensional diagram we can now draw the consumer's budget
line, Figure 1. Since the consumption possibility set is no longer con-
vex it is not possible to derive normal demand curves for the individual.
This is analogous to the case of block pricing observed in the electrical
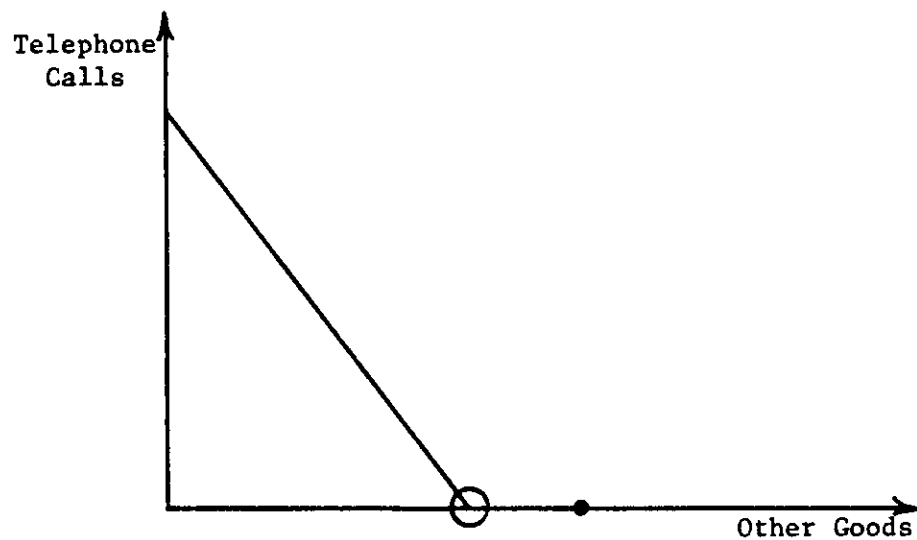industry.

FIGURE 1. Budget Line

Previously published studies have not paid attention to this joint consumption feature of telephone demand. Here, the two separate components of demand are modelled as separates simultaneous demand functions. While it is clear that "individual's" demand functions do not exist, it seems valid when aggregating over an entire population of consumers to suppose that there will be "netting-out" of individual divergent behavior to product an adequate overall picture.

The most difficult aspect of constructing the model is postulating the nature of the relationship is between output levels and the prices charged by the government. For example, a simple relationship could be of the form,

$$\begin{matrix} \text{Price charged} \\ \text{in period} \quad t \end{matrix} = f \begin{bmatrix} \text{Output level in period} \quad (t-1) \\ \text{Other cost factors in period} \quad (t-1) \end{bmatrix} .$$

Such a model postulates that in each period the government looks at the level of output and the associated costs in period $(t-1)$, and sets a price to be charged for the current period. Two such functions are required: one to describe the rental fee, and the other to describe the rate charged per call. It is assumed that the price charged for a call reflects the costs of operating and maintaining equipment, that is, the cost incurred by the calling traffic. The rental fee is assumed to reflect those costs associated with capital, and overhead costs the telephone network which are not specifically related to the wear and tear caused by telephone traffic itself.

Functions of the type described above will be termed "supply reaction" functions. They are no more than a statistical device that allows for a feed-back between price and output levels. They have not linked the price charged to any particular element of cost, be it average

cost, marginal cost or whatever.

These supply reaction functions together with the demand functions have been estimated and are shown in Tables 1, 2 and 3. Table 1 is shown so as to make the log-linear structure of the system clear. The supply reaction functions have been fitted with actual non-deflated prices as their dependent variables. These prices are subsequently deflated by identity equations to provide input and deflated rental fees. Curves were fitted on the non-deflated prices because it was believed that this would give a more accurate description of the actual decision making process that is used in setting prices. Consider a case where deflated price was used in the supply reaction function. Now consider a period in which real costs are expected to rise, but for various political reasons a rate hike is delayed for another year. Using deflated prices as the dependent variable would imply the real costs had fallen, i.e. the nominal rates were unchanged but inflation reduced these rates in real terms. As a result real costs and deflated prices charged would be moving in opposite directions so introducing additional serial correlation into the equation.

The system of equations in Tables 1 and 2 are recursive and can be estimated by ordinary least squares. It is possible to identify some intra-temporal sources of correlation between the residual terms in the equations. In particular, decisions regarding rate hikes for the "price charged per call" and for the "rental fee" are normally made simultaneously. It is unusual that one will be raised in one budget year and the other in another budget year. This problem arises as a result of under specification of the model. Since there was evidence of serial correlation in the equations due to the lagged dependent variables they were

TABLE 1. Simultaneous Equation Model with Supply Reaction Function*

Y1	Y2	Y3	Y4	Y5	Y6	X1	X2	X3	X4	X5	X6	X7
1	0	-0.17 (2.87)	0.84 (38.27)	0	0	-0.63 (4.80)	0.43 (6.96)	0	0	0	0	0
0	0	0	1	0	-0.01 (0.90)	0	0	0	0.99 (600.0)	0	0.002 (5.30)	0
0	0	0	0	1	0	-0.75 (1.70)	0	0	0.48 (2.25)	0.60 (2.21)	0	0
0	1	0	0	0	0	0	0	-0.80 (3.61)	0	1.48 (4.36)	0	0
**0	1	-1	0	0	0	0	0	0	0	0	0	-1
**0	0	0	0	1	-1	0	0	0	0	0	0	-1

*t-statistics shown in parentheses.

**Identities:
Y1 = number of calls made
Y2 = non-deflated price charged for a call
Y3 = deflated price charged for a call
Y4 = number of services connected
Y5 = rental charge non-deflated
Y6 = rental charge deflated

X1 = constant
X2 = GNP per head
X3 = number of calls made, lagged one period
X4 = number of service connections lagged one period
X5 = labor cost index
X6 = price charged for service connection
X7 = price deflator

All variables in logarithms.

TABLE 2. Simultaneous Equation Model with Supply Reaction Function

(1) $(\text{Call})_t = e^{-.63} \left[\begin{array}{c} \text{Price Charged for} \\ \text{Call, Deflated} \end{array} \right]_t^{-.17} \left[\begin{array}{c} \text{GNP per} \\ \text{Head} \end{array} \right]_t^{0.43} \left[\begin{array}{c} \text{Number of} \\ \text{Service Connections} \end{array} \right]_y^{0.84}$

(2) $\left[\begin{array}{c} \text{Number of} \\ \text{Service Connections} \end{array} \right]_t = \left[\begin{array}{c} \text{Number of} \\ \text{Service Connections} \end{array} \right]_{t-1}^{0.99} \left[\begin{array}{c} \text{Service} \\ \text{Connection Fee} \end{array} \right]_t^{-.002} \left[\begin{array}{c} \text{Rental Fee} \\ \text{Charged, Deflated} \end{array} \right]_t^{-.01}$

(3) $\left[\begin{array}{c} \text{Price Charged for} \\ \text{Call, Non-Deflated} \end{array} \right]_t = (\text{Calls})_{t-1}^{-.80} \left[\begin{array}{c} \text{Labor Cost} \\ \text{Index} \end{array} \right]_{t-1}^{0.60}$

(4) $\left[\begin{array}{c} \text{Rental Fee Charged,} \\ \text{Non-Deflated} \end{array} \right]_t = e^{-.75} \left[\begin{array}{c} \text{Number of} \\ \text{Service Connections} \end{array} \right]_{t-1}^{0.48} \left[\begin{array}{c} \text{Labor Cost} \\ \text{Index} \end{array} \right]_{t-1}^{1.48}$

(5) $\left[\begin{array}{c} \text{Price Charged for} \\ \text{Call, Deflated} \end{array} \right]_t = \left[\begin{array}{c} \text{Price} \\ \text{Deflator} \end{array} \right]_t \left[\begin{array}{c} \text{Price Charged for} \\ \text{Call, Non-Deflated} \end{array} \right]_t$

(6) $\left[\begin{array}{c} \text{Rental Fee Charged,} \\ \text{Non-Deflated} \end{array} \right]_t = \left[\begin{array}{c} \text{Price} \\ \text{Deflator} \end{array} \right]_t \left[\begin{array}{c} \text{Rental Fee Charged,} \\ \text{Non-Deflated} \end{array} \right]_t$

TABLE 3. Simultaneous Equation Model with Supply Reaction Function--Parameters Re-Estimated for Serial Correlation

(1) $(Calls)_t = e^{-.014} \left(\begin{array}{c}\text{Price Charged for}\\ \text{Call, Deflated}\end{array}\right)_t^{-.376} \left(\begin{array}{c}\text{GNP per}\\ \text{Haed}\end{array}\right)_t^{.152} \left(\begin{array}{c}\text{Number of}\\ \text{Service Connections}\end{array}\right)_t^{0.84}$

(2) $\left(\begin{array}{c}\text{Number of}\\ \text{Service Connections}\end{array}\right)_t = \left(\begin{array}{c}\text{Number of}\\ \text{Service Connections}\end{array}\right)_{t-1}^{1.011} \left(\begin{array}{c}\text{Service}\\ \text{Connection Fee}\end{array}\right)_t^{-.009} \left(\begin{array}{c}\text{Rental Fee}\\ \text{Charged, Deflated}\end{array}\right)_t^{-.016}$

(3) $\left(\begin{array}{c}\text{Price Charged for}\\ \text{Call, Non-Deflated}\end{array}\right)_t = (Calls)_{t-1}^{-1.212} \left(\begin{array}{c}\text{Labor Cost}\\ \text{Index}\end{array}\right)_{t-1}^{2.117}$

(4) $\left(\begin{array}{c}\text{Rental Fee Charged,}\\ \text{Non-Deflated}\end{array}\right)_t = \left(\begin{array}{c}\text{Number of}\\ \text{Service Connections}\end{array}\right)_{t-1}^{0.965} \left(\begin{array}{c}\text{Labor Cost}\\ \text{Index}\end{array}\right)_{t-1}^{-.042}$

(5) $\left(\begin{array}{c}\text{Price Charged for}\\ \text{Call, Deflated}\end{array}\right)_t = \left(\begin{array}{c}\text{Price}\\ \text{Deflator}\end{array}\right)_t \left(\begin{array}{c}\text{Price Charged for}\\ \text{Call, Non-Deflated}\end{array}\right)_t$

(6) $\left(\begin{array}{c}\text{Rental Fee Charged,}\\ \text{Deflated}\end{array}\right)_t = \left(\begin{array}{c}\text{Price}\\ \text{Deflator}\end{array}\right)_t \left(\begin{array}{c}\text{Rental Fee Charged,}\\ \text{Deflated}\end{array}\right)_t$

re-estimated by a two stages least squares instrumental variable technique developed by Hatanaka (1976). Coefficients are shown in Table 3. While Hatanak's procedure leads to asymptotic efficiency it may be very robust given the small number of observations and the large number of parameters being estimated.

The demand for telephone service connections is shown to be very highly correlated with connections in the preceding period. In statistical terms one might be inclined to reject this as no more than a trend effect in the data. However, Rohlfs (1974) has provided a strong a priori arguments to suggest that the size of the system (i.e., the number of telephone services connected into the network) is a key determinant of the growth of quantity demanded. The principle is simple. The larger the system is, the greater the incentive is to join the system because the more people you will be able to contact by joining. Rohlfs has described conditions where the system will experience self-generating growth, that is, the elasticity of demand with respect to the size of the system is greater than unity. Such a result is actually observed in Table 3.*

Since we are primarily seeking estimates of price elasticities of demand it is of interest to compare our estimates with the two other "superior" quality studies previously cited. These are shown in Table 4. It is encouraging to find that the elasticity estimates from our study are generally of the same order of magnitude as those observed by Davis in the U.S.A. and Dobell in Canada.

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*If the true parameter value was greater than unity the equations would be non-stationary and rather different econometric test would be required. The null hypothesis is then that this coefficient is indeed less than unity. The fact that Table 2 shows an estimate greater than unity is due to statistical sampling error.

TABLE 4. Price and Income Elasticities of Demand

Description	Price	Income
Table 2 (calls only)	-0.17	0.43
Table 2 (connections only)	-0.01	0.0
Table 3 (calls only)	-0.37	0.15
Table 3 (connections only)	-0.016	0.0
Davis et al. U.S. (total connections)	-0.017	0.08
Davis et al. U.S. (local services, connection plus calls)	-0.208	0.249
Dobell et al. Canada (short-run)	-0.11	1.43
(Total Bell System revenues) (long-run)	-0.39	1.57

Undoubtedly, the disturbing feature of these results is the statistical non-significance of the rental fee and of income in explaining the number of service connections. It is quite possible that the log-linear form of the demand function is not the most appropriate functional form to fit to the data. However, within the system of simultaneous equations that has been constructed we are restricted to forms that are at least log-arithmic in the dependent variable. Further testing with other forms of the explanatory variables may resolve this problem.

Some Economic Interpretations

Though the supply reaction functions were sufficient to resolve the identification problem in the statistical estimation of the demand function parameters, they have not yet been given any particular normative significance. By making some very strong assumptions about this "supply" function one can, using some appropriate approximations, carry the model

to the point where one can draw implications about pricing strategy.

First, assume that our supply reaction function is indeed an average
cost curve, and that the government prices telephone services according
to average cost. Then

$$(\text{Average Cost of Service})_{t-1} = f(\text{Quantity supplied}^{(t-1)}, \text{etc.})$$

$$(\text{Price Charged})_t = f(\text{Average Cost of Service})_{t-1}$$

Some justification is needed for the assumption that the government does
price telephone services according to average cost, and indeed since so
little is known about the true cost structure of this industry, the assump-
tion must be regarded as a thin reed in the argument. As an alternative,
the government may follow the enlightened approach of pricing according
to marginal cost. However, there is no evidence to suggest that, over
the period which this paper concerns itself with, any such enlightened
economic reasoning as marginal cost pricing had a foothold within the
PMG department. It seems more likely that the more time honored accounting
practices of charging average cost were the accepted norm (see Hazelwood
(1950)).

With such assumptions, the equation system in Tables 2 and 3 can
be rewritten adding two new variables; one for the average cost of a
service connection, the other for the average separable cost associated
with an individual call. The equation system is rewritten in Table 5.
Thus far no damage has been done to the model other than to make a strong
assumption about how the government sets prices.

Now an empirical assumption is made that the average cost curve
in period (t-1) is a good approximation of the average cost curve for

TABLE 5. Simultaneous Equation Model with Assumption that Prices are Charged in Accordance with Average Cost

Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	X1	X2	X3	X4	X5	X6	X7
1	0	-.17	.84	0	0	0	0	-.63	.43	0	0	0	0	0
0	0	0	1	0	-.016	0	0	0	0	0	.99	0	.002	0
0	0	0	0	0	0	0	1	-.75	0	0	.48	.60	0	0
0	0	0	0	0	0	1	0	0	0	-.80	0	1.48	0	0
*0	1	-1	0	0	0	0	0	0	0	0	0	0	0	-1
*0	0	0	0	1	-1	0	0	0	0	0	0	0	0	-1
*0	0	0	0	.1	0	0	-1	0	0	0	0	0	0	0
*0	1	0	0	0	0	-1	0	0	0	0	0	0	0	0

*Identities

Y2 = non-deflated price charged for a call
Y7 = average cost of a call lagged one period
Y5 = non-deflated rental charge
Y8 = average cost of providing the connected service lagged one period

period t . If the government does indeed price along the average cost curve (and it does so in such a way that markets always clear) then using the above approximation one can draw what are the equivalent of industry supply and demand curves.

The analysis which follows requires that prices are being set at the intersection of the "supply" (or average cost curve) and the demand curve; i.e., that markets are clearing. On the supply side of the system it is not easy to observe when excess equipment has been installed as there is no opening for public scrutiny of the physical plant and equipment. Furthermore, there may be excess capacity simply as a result of certain indivisibilities in the incremental units of capital equipment. As a practical matter then, even a survey of existing equipment may have difficulty distinguishing between excess capacity resulting from poor planning (or poor price setting) and the certain amount of excess capacity which is normally associated with the incremental growth of the system. On the other side of the market, conditions of excess demand are readily observable. They appear in the form of delays in having a telephone service connected, or in the case of telephone calls, "drop-outs," where a call is terminated because of congestion on the telephone network. Of these situations, the problems of delays in having telephone services connected would appear to be the more often encountered. An "average" wait time for the point of applying for a service connection and actually having a telephone service installed, has historically been of the order of two weeks to one month. This suggests some market failure, but since this study employs annual data it seems likely that delays of the order of one month will not cause much distortion of the results.

The configurations of the demand and average cost curves are shown in Figure 2.

Dollars

D

AC

Number of Telephone Calls

Dollars

D

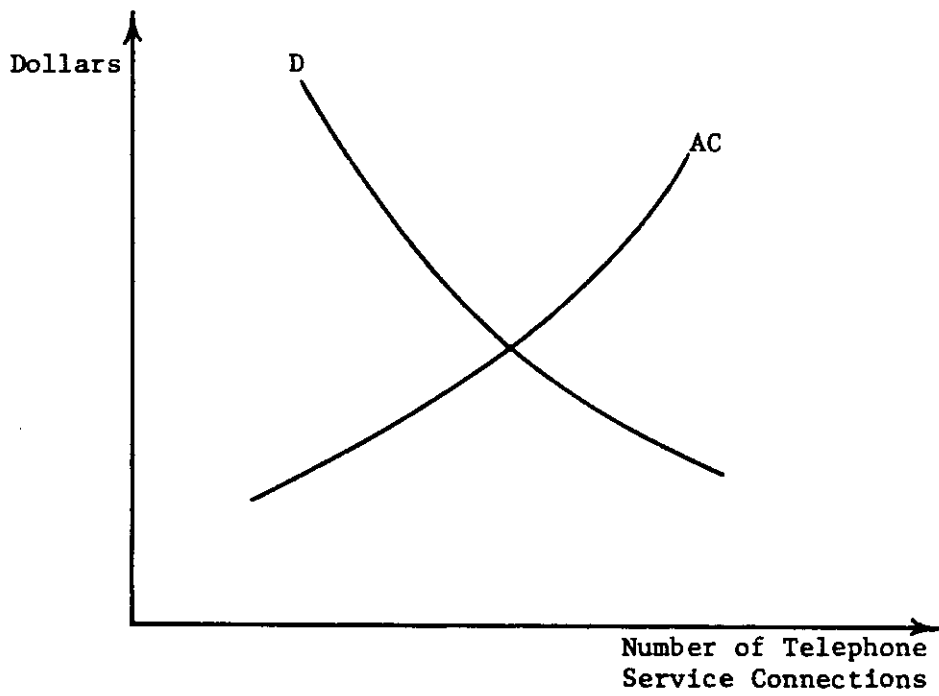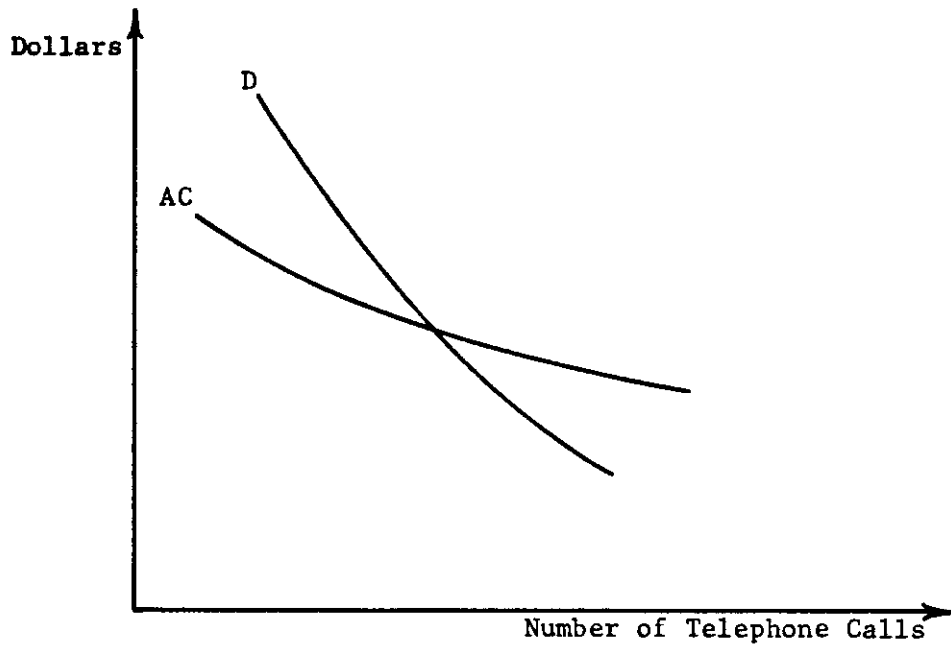AC

Number of Telephone
Service Connections

FIGURE 2. Demand and Average Cost Curves

The curves have been drawn to reflect the fact that the average costs of providing additional services connections are rising, while the average costs of handling call traffic is falling. It is apparent from the diagrams that a shift to marginal cost pricing would cause a contraction in the number of service connections and an expansion in the amount of call traffic on the telephone network.

The marginal costs curves were derived from the average cost curves in the usual manner, and, on the assumption that the government could now price along the marginal cost curves, new equilibrium market clearing solution's were derived. The results are shown in Table 6 below.

TABLE 6. Comparison of Average Cost and Marginal Cost Pricing Solutions

	Existing Average Cost Conditions	Potential under Marginal Cost Conditions
Price Charged for a Service Connection (per half year)	$41	$61
Number of Service Connections	3,539,000	3,524,844
Price Charged for Telephone Call	$0.06	$0.009
Number of Telephone Calls	3,905,000,000	5,350,000,000

There is little extra difficulty involved in making an estimate of the welfare gain if one moved from average cost pricing to marginal cost pricing. The welfare gain is shown as the shaded areas in Figure 3. It is estimated by integrating under the demand and average cost curve. The estimates are, of course, subject to all the usual qualifications of consumer surplus welfare measurements.

TABLE 7. Potential Welfare Gain from Marginal Cost Pricing
(See Figure 3 Shaded Areas)

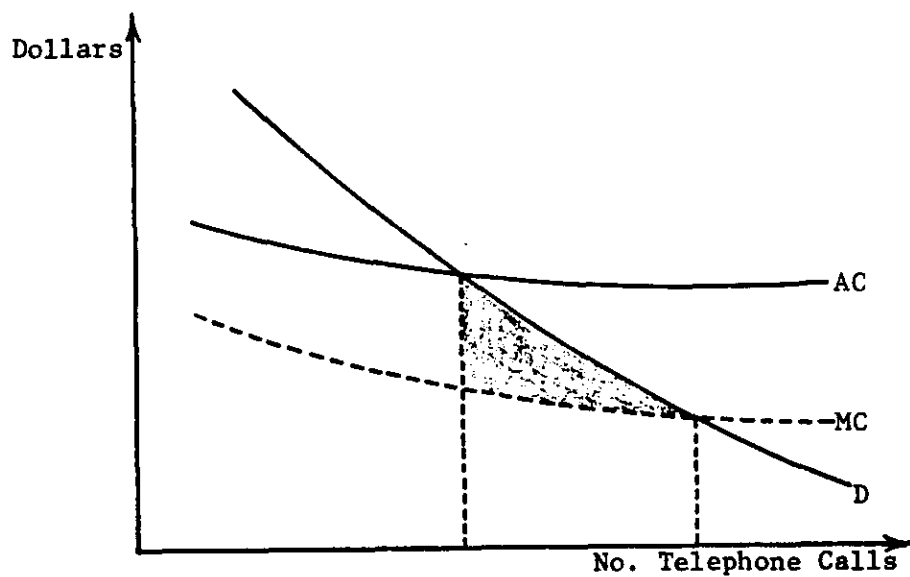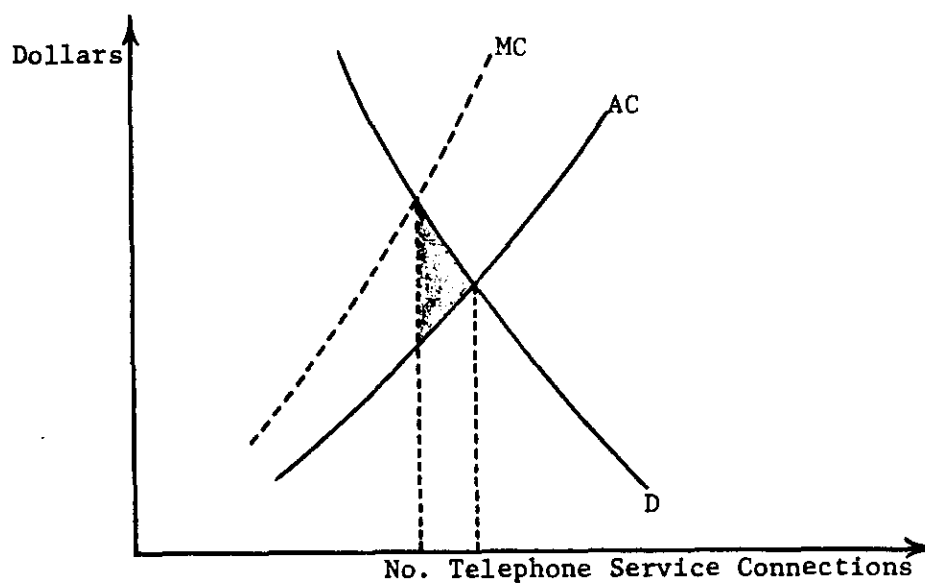|	Welfare Gain in Dollars per Year
Marginal Cost Pricing of Calls	$22.8m
Marginal Cost Pricing of Service Connection	$ 0.6m
Total Gain	$23.4m

FIGURE 3

The results indicate strong welfare gains to be made by pricing tele-
phone calls at their marginal costs. The marginal cost of an additional
telephone call on an existing telephone system must be very low. It
would include no more than the small amount of electricity consumed and
a small amount of wear and tear on the switching equipment. This marginal
cost is certainly well above the rates that are currently charged for
a telephone call. As long as marginal telephone calls are being made
in the off-peak periods the marginal costs will be those described in
the above paragraph. However, if the extra calls are made during peak
hours additional capacity in the form of more central switching capacity
will be required to handle the extra calls. This may add substantially
to the cost of the marginal telephone call. The analysis carried out
here using annual data is clearly not adequate to handle the peak-load
pricing problem. This peak-load problem requires more detailed data and
considerably more refinement than has been attempted in this paper (see
Meyer (1966), Vickery (1971), Littlechild (1971)). Similar qualifications
apply to increments to demand coming from isolated rural regions where
costs are much above the metropolitan areas.

Conclusion

This paper was primarily aimed at developing a model to explain
the joint demand for telephone service connections and telephone calls
so as to investigate marginal cost pricing policies. The model developed
is rather modest in view of the complexities of the problems involved.
In recognizing that joint telephone demands can be well handled by simu-
taneous equation models, the paper seems to have made some contribution
over and above existing literature in this area.

A first attempt has also been made at handling the identification problem caused by the interaction of supply and demand variables. Important questions remain to be answered regarding the most appropriate manner in which to characterize "supply" in government and private monopolies where it is known that no true supply function exists.

On the assumption that the government currently engages in average cost pricing, an attempt was made to draw some of the welfare implications of a shift to marginal cost pricing. The results have good agreement with common sense expectations, but must be qualified by the presence of peak-load congestion problems.

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