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--Simulations of Bell Canada under various rate scenarios

SIMULATIONS OF BELL CANADA UNDER VARIOUS RATE SCENARIOS

INTERIM REPORTS 1, 2, 3
TO THE
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INTRODUCTION

The model presented in this report derives its ancestry from the various models of Bell Canada that were built at the IAER by V. Corbo, J. Breslaw, J.B. Smith and J.M. Dufour. (1,2,4). These previous models share with the present model a particular methodology of predicting the rate of return on average total capital based on the following plan:

a) Given a set of prices, predict quantities, through the use of demand functions;

b) Given a set of quantities, predict the level of factors through the use of a technology function, i.e. either a production function or a cost function;

c) Given the level of factor utilization, predict total operating expenses through the use of expense/factor functions;

d) From total revenues and expenses, predict the after tax income, and hence rate of return on capital, through the use of a set of financial statements.

Although the basic plan remains unchanged, there are a number of changes that have been implemented. These changes are summarized as follows:

a) The data-base has been updated to 1978, and 1979 has been used as an "indicator" year to test accuracy of prediction;

b) All equations have of course been re-estimated on the new data-base;

c) The cost function has been completely respecified, thus requiring a respecification of side order conditions and profit maximizing conditions;

c) The model now utilizes all the outputs, rather than scaling down inputs;

e)The equation linking economic and accounting capital has been respecified.

f)A complete income statement for Bell by year is produced.

The basic theory utilized in the model - cost minimization under an output constraint - is discussed fully in Breslaw and Smith (4), and will not be repeated here. Rather the basic equations used in each module are presented in Part I, and the rationale behind their choice disucssed. In Part II, the main changes in the data-base, and source of data are shown. The estimation of the equations is discussed in Part III, and historical validation in Part IV. Part V presents the forecast values for 1979 to 1982; a comparison between the predicted to the actual is shown in Part Va for 1979; and between the predicted values and Bell's predicted values for 1980-1983 in Part Vb. A summary is given in Part VI.

INTRODUCTION*

This project involved the simulation of Bell Canada under a set of different price scenarios. The results of these simulations give information on revenues, costs, and financial data including return on capital; in fact a full income statement is produced. The purpose of the project is two-fold.

a) Estimation of Bell's income statement under different price scenarios;

b) Comparison of Bell's predictions with these estimates, and the determination if possible, of the reasons for any differences.

In order to carry out these objectives a model of Bell Canada was constructed - B.S.M. (Bell Simulation Model). Much of the work involved has already been described in the Interim Report, and will not be requested. The Interim Report describes the various steps involved - in summary:

1) Formulation of the demand system, the cost system, the financial system and the income statement.

2) Creation of a data base.

3) Estimation of the parameters in the equations in each of the systems, over the historical period.

4) Historical validation (or tracking).

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* Much of the work on the demand, cost and financial systems has been built on previous studies undertaken at the IAER. I am thus indebted to both Vittorio Corbo and to J. Barry Smith. In addition, J. Barry Smith kindly provided the cost of capital methodology. All errors, of course, remain my responsibility. Typing and presentation by Melly Neufield is also gratefully acknowledged.

5) Prediction for 1979 and comparison with actual values, and forecast for 1980 to 1983 under two price scenarios -

   a) constant 1979 prices

   b) requested prices.

6) Summary.

This report has three additional sections: In part 7, the remaining scenarios are simulated, i.e.

   c) CRTC approved prices

   d) inflation prices.

The results from all 4 scenarios as well as the Bell predictions are then analysed.

In part 8, a comparison is undertaken to determine the relative productive powers of B.S.M. on one hand, and Bell's predictions on the other. Since this has to be retroactive, the most recent year - 1979 - is used.

In part 9, an analysis of the demand models utilized by Bell in the 1980 rate case is undertaken; effectively this compares the demand system used by Bell to that used by the B.S.M.

In the conclusion, a summary of the results is given, as well as some directions for future research.

INTRODUCTION

Report # 3 is the third report in a series describing the simulation of Bell Canada under a set of different price scenarios. The building and historical tracking of the model is described in Report # 1 (Interim Report), and a number of scenarios are simulated and described in Report #1 and #2, as shown below. Two further simulations are carried out in this report and are described in Part XI. Hence the following predictions have been carried out.

Report # 1
a) Constant 1979 prices
b) Bell's requested price

Report # 2
c) CRTC approved prices
d) Inflation price

Report # 3
e) Constant 1979 price for toll, inflation price for local
f) Constant 1979 price for toll, 13% p.a. price increase for local.

In Part XII, an additional analysis of demand is undertaken; demand functions for each of the components of message toll are estimated in order to compare price elasticities.

The results are summarized in Part XIII.

SIMULATIONS OF BELL CANADA UNDER VARIOUS RATE SCENARIOS

INTERIM REPORT

Jon Breslaw

July 31st, 1980

PART I THE BASIC MODEL

The model is effectively described by a system of equations; these are shown in the FRML statements on the attached computer printout (SIMU80B)*

a) The Demand System

The output produced by Bell Canada is represented by constant $1967 revenues of four aggregates:

QLOC - Local service revenue (primary and contract auxiliary)

QTOL - Message toll revenue, a divisia index of Intra, Trans-Canada, United States and Overseas, and WATS service.

QTPL - Toll private line revenue.

QMIS - Miscellaneous and Directory revenues.

These services account for >99% of Bell Canada's output, (in terms of current revenue).

Two services - QLOC and QTOL are estimated using demand functions; these are shown as DEML and DEMM respectively. Note that each of these is written in a ratio form, thus reducing problems of heteroscedasticity, and each is in the double logarithm form. The local equation relates quantity (QLOC) to real price (PLOC/CPI), real personal consumption expendutire (YD=PERCON/CPI), population in Bell territory (POPB), local conversations/person (CONVP), and three dummy variables:RATI - to account for the availability of direct distance dialing RAT2 - for the introduction of one minute charging, and RAT3 for the change in the Toronto EAS. Similarily for the Message Toll equation, QTOL is related to real price (PTOL/CPI), YD, POPB, and RAT1, RAT2 and RAT3.

*Since one of the objectives of this work is to introduce the model as a tool usable by DOC personnel, this description will use the computer printouts extensively.

PRINTOUT 1

EQUATIONS USED IN THE MODEL

```
COMMENT ************** DEFINE FORMULAE ***************$

COMMENT          ******  COST EQUATIONS ******          $

FRML COSTFN     ONE = (1/LOG(COST))*
                      (CC0+CW*WLN+CR*RLN+(1-CW-CR)*VLN+CT*TLN
                       +CQL*LOG(QLOC)+CQM*LOG(QTOL)+CQP*LOG(QTPL)
                       +CMIS*LOG(QMIS) ) $
FRML SCK         ONE = (1/LHK)*CR $
FRML SCL         ONE = (1/LHL)*CW $
FRML TOLPRM      ONE = (COST*CQM)/(PTOL*QTOL*(1+(1/B2)))   $
FRML TPLPRM      ONE = (COST*CQP)/(PTPL*QTPL*(1+(1/E2)))   $

COMMENT         ******  DEMAND EQUATIONS  ********            $

FRML DEML        ONE = (1/LOG(QLOC))*
           (A0+A1*LOG(PLOC/CPI)+A3*LYD+A4*LPOPB+A5*LCONVP+RL1*RAT1+RL2*RAT2
          +RL3*RAT3) $
FRML DEMM        ONE = (1/LOG(QTOL))*
           (B0+B2*LOG(PTOL/CPI)+B3*LYD+B4*LPOPB+RT1*RAT1+RT2*RAT2+RT3*RAT3)$

COMMENT           ** FINANCIAL DEMAND EQUATIONS ** $

FRML FINAN RAVAK=D0+D1*K+D2*ID-R04*(D0+D1*K(-1)+D2*ID(-1)-RAVAK(-1)) $
FRML EQUA1 RADEBT=X0+X1*(AIBARE)+X2*RAVAK-R05*(X0+X1*(AIBARE(-1))
     +X2*RAVAK(-1)-RADEBT(-1) ) $
FRML EQUA2 RAEQUI=Y0+Y1*(AIBARE)+Y2*RAVAK-R06*(Y0+Y1*(AIBARE(-1))
     +Y2*RAVAK(-1)-RAEQUI(-1)) $
FRML EQ6 RAPE=W0+W1*RAPE(-1) $

COMMENT      *  BEHAVIOURAL EQUATIONS FOR INCOME STATEMENT MODEL $

FRML STA10A RTOE = J0 + J1*RNKCAD + J2*RTOE(-1) $
FRML STA16A RINCTAX = K0+K1*RTAXBASE -R016*(K0+K1*RTAXBASE(-1)-RINCTAX(-1))$
FRML STA14A RINT=L0+L1*RADEBT+L2*RINT(-1) $
FRML STA20A RDIVPR = M0 + M1*RAPE $
```

A full discussion of the demand system for these two services is given in Breslaw and Smith, P. 19-22.(4)

Although a number of estimations were attempted to estimate the demand for Toll private line services, the results were considered unsatisfactory from an economic viewpoint. A discussion with Frank Kiss of Bell Canada suggested that the price index associated with TPL was not entirely satisfactory. For this reason, no further demand analysis for TPL was attempted. Instead for both TPL and MIS, predicted values were derived using an autoregressive technique.

b) The Cost System

In previous work, the cost models consistently predicted costs below the levels that actually occurred. This was unsatisfactory, and considerable analysis was undertaken to try to alleviate this problem. The most promising approach followed from an analysis of factor shares. As can be seen from Table 1 and Figure 1, there are two distinct regions; pre 1968 where some variation occurred, and post 1968 where factor shares were constant. It was decided to utilize this latter period, since the loss of data was more than offset by the gains from simplicity.

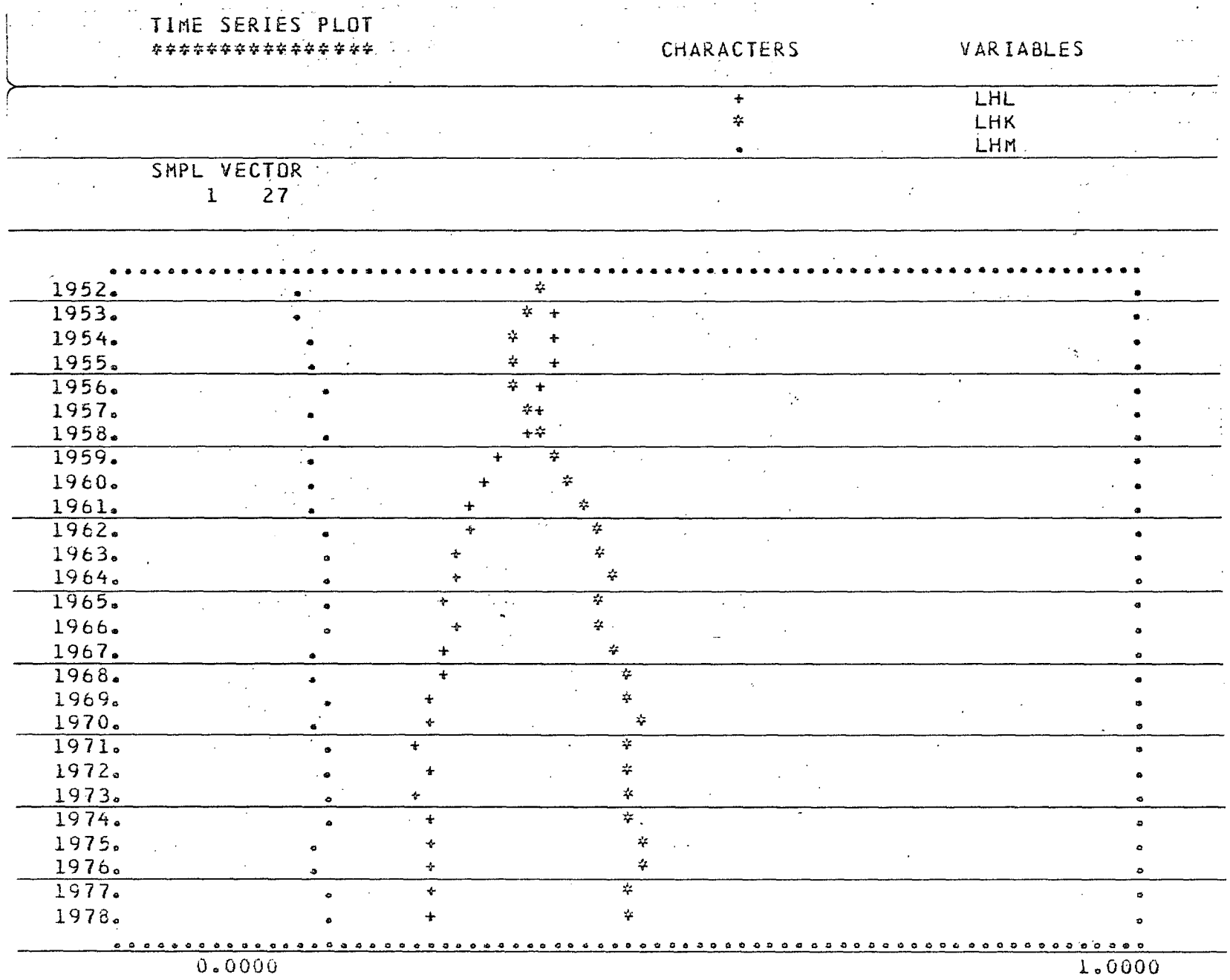
In Chart 4.2 in Breslaw and Smith, the derived cost minimization factor share equations are shown. For the latter part of the sample (1968-1978), since the factor shares are constant, it follows that a solution which satisfies Equations 4.2 to 4.4 is $C_{ij} = 0, \forall_{i,j}$. This clearly simplifies the translog function considerable, and, for this period permits very good fitting of the share equation. Effectively, this reduces the cost function to a Cobb-Doublas in input prices. In terms of simplicity, the cost function was maintained Cobb-Douglas in both inputs and outputs, since the additionof cross-terms resulted in little improvement in the likelihood function, but produced evidence of collinearity.

TABLE 1

FACTOR SHARES

	LHL	LHK	LHM
1952	.412535	.416195	.171270
1953	.426773	.399967	.173260
1954	.427386	.392378	.180236
1955	.432108	.381952	.185940
1956	.419688	.381445	.198867
1957	.412499	.398329	.189173
1958	.396668	.409277	.194055
1959	.373542	.434172	.192286
1960	.360387	.447520	.192093
1961	.345814	.461714	.192472
1962	.337626	.465419	.196955
1963	.331737	.471590	.196673
1964	.327885	.478981	.193134
1965	.320907	.478245	.200847
1966	.323725	.477228	.199047
1967	.319454	.489687	.190859
1968	.308494	.504576	.186930
1969	.296208	.505422	.198370
1970	.301778	.509607	.188616
1971	.290241	.504013	.205746
1972	.295951	.502353	.201696
1973	.289926	.504508	.205567
1974	.293407	.506101	.200492
1975	.298617	.513276	.188107
1976	.301517	.509021	.189462
1977	.304209	.500008	.195783
1978	.300908	.500124	.198968

FIGURE 1


TIME SERIES PLOT
****
CHARACTERS
VARIABLES
+ LHL
* LHK
. LHM
SMPL VECTOR
1 27
1952.
1953.
1954.
1955.
1956.
1957.
1958.
1959.
1960.
1961.
1962.
1963.
1964.
1965.
1966.
1967.
1968.
1969.
1970.
1971.
1972.
1973.
1974.
1975.
1976.
1977.
1978.
0.0000
1.0000

Thus the cost function utilized is shown in FRML COSTFN, and the two share equations in SCK and SCL. As with the demand system they are written in the ratio form. The cost function relates full cost to three-input prices, (w,v,r) four-outputs (QLOC, QTOL, QTPL and QMIS) and technology (Hicks neutral) (T), where T is the percent of main phones that have access to DDD. The restriction $C_w+C_v+C_r = 1$ constrains the cost function to be linear homogeneous in factor prices.

The derived profit maximizing conditions (MR=MC) are assumed to exist for QTOL and QTPL. These are shown in FRML TOLPRM and TPLPRM, and again are very simple because of the simplicity of the cost function. The respective elasticities of QTOL (B2) and QTPL (E2) appear in these equations.

These five equations consist of the cost system; they will be estimated for 1968-1978, and the coefficient values used for prediction.

c) Financial System and Income Statement

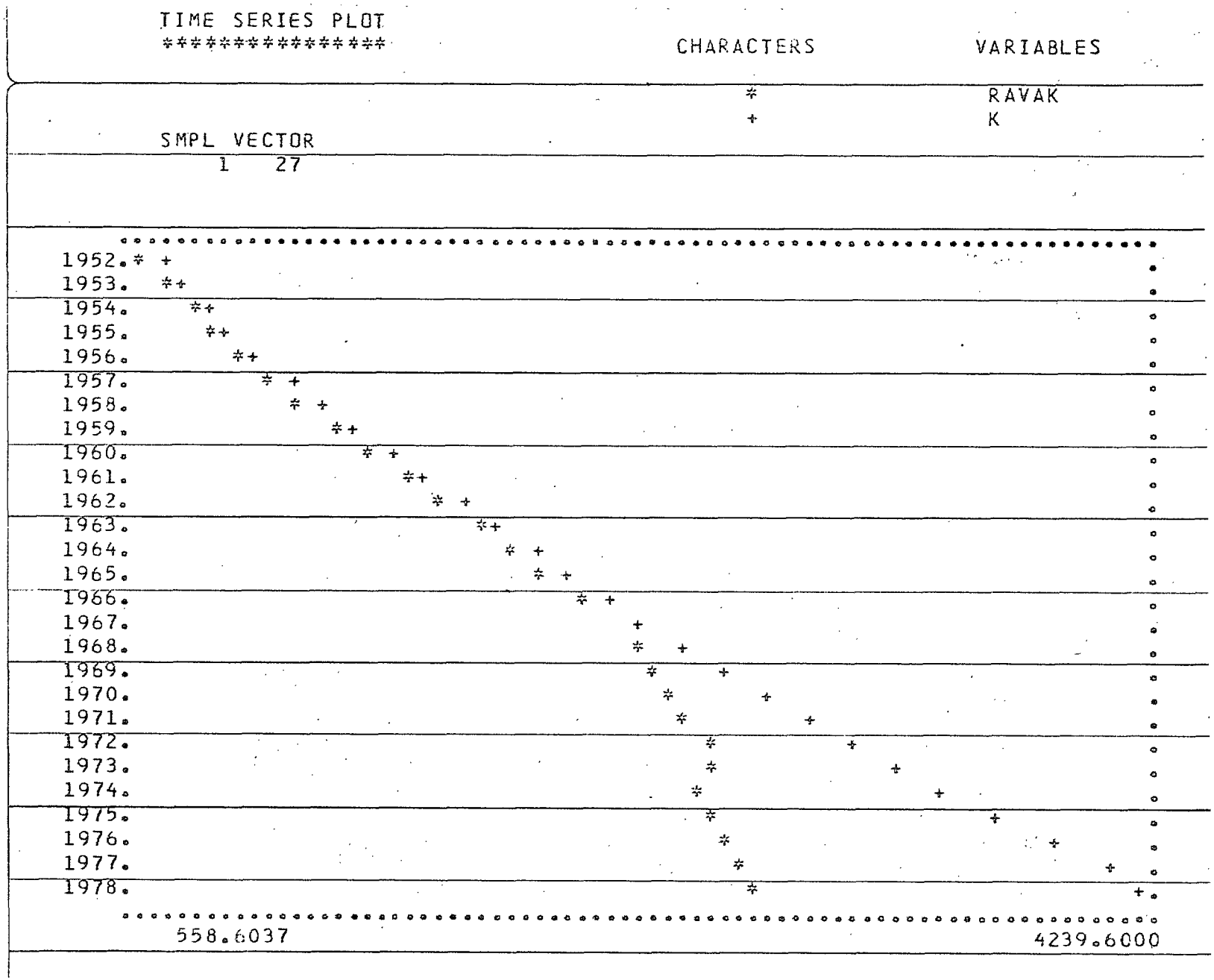
The system of financial equations remains basically unchanged from that reported in Corbo et al (2). Similarly the system of behavioural equations for the income statement remain unchanged. There is however one exception - FINAN, which links economic capital (K) with the accounting value of capital (RAVAK). In the previous study this equation was estimated using a sample period 1952-1976. As Table 2 and Figure 2 show, a distinct change occurs in the relationship between accounting and economic capital in 1967-68. (This is also the period when rate of return on average accounting capital came into effect.) Consequently, FINAN was estimated for the period 1967-1978, as opposed to the full period.

TABLE 2

ACCOUNTING (RAVAK) AND ECONOMIC (K) CAPITAL

	RAVAK	K
1952	558.604	660.900
1953	652.744	728.200
1954	745.855	795.800
1955	836.425	890.600
1956	927.963	996.200
1957	1049.78	1114.90
1958	1132.91	1244.20
1959	1288.22	1373.10
1960	1402.28	1506.70
1961	1550.23	1631.50
1962	1673.64	1753.50
1963	1809.37	1885.50
1964	1947.66	2013.70
1965	2051.83	2140.10
1966	2195.38	2279.10
1967	2377.76	2422.80
1968	2399.25	2561.90
1969	2476.59	2711.90
1970	2517.44	2856.70
1971	2566.84	3012.80
1972	2657.79	3180.60
1973	2677.72	3328.90
1974	2625.78	3499.50
1975	2682.21	3707.50
1976	2707.58	3910.60
1977	2746.90	4108.30
1978	2824.37	4239.60

FIGURE 2


TIME SERIES PLOT
CHARACTERS
VARIABLES
RAVAK
K
SMPL VECTOR
1 27
1952.
1953.
1954.
1955.
1956.
1957.
1958.
1959.
1960.
1961.
1962.
1963.
1964.
1965.
1966.
1967.
1968.
1969.
1970.
1971.
1972.
1973.
1974.
1975.
1976.
1977.
1978.
558.6037
4239.6000

/10

The four financial demand equations are:

FINAN - relates accounting capital (RAVAK) to economic capital (K).

EQUAI - relates bonds,(RADEBT) to accounting capital (RAVAK) and the ratio of return on bonds to return on equity (AIBARE).

EQUA2 - relates equity (RAEQUI) to RAVAK and AIBARE.

EQ6 - relates preferred equity (RAPE) to RAPE(-1).

In this section, a prefix of R denotes real values; without the R denotes nominal values.

d) Income Statement

As for the financial equations, the system of behavioural equations remain unchanged from the Corbo study.

The four behavioural equations are:

STAIOA - relates total operating expenses (RTOE) to RTOE(-1) and real economic cost (RNKCAD).

STAI4A - relates interest payments (RINT) to RINT(-1) and average debt (RADEBT).

STAI6A - relates income tax (RINCTAX) to the taxbase (RTAXBASE) with autoregressive structure.

STA2OA - relates preferred dividends (RDIVPR) to average preferred equity (RAPE).

The remaining relationships are all accounting identities. The income statement so produced is an exact copy of the income statement presented by Bell in B-80-200.

PART II DATA BASE

As a consequence of various interrogatories posed during the 1980 rate request, (in particular CAC-511), and the update of Bell Annual Charts to 1979, the complete model can be reestimated up to 1978. Reestimation was not undertaken to 1979, because

a) Capital and labour series were estimated, not actual data for 1979;

b) the year 1979 could be used to verify the model's predictive ability.

The complete data-base, with description and sources is shown on BELLIB1.

The main changes from previous year's work is as follows:

a) New capital series (K)

b) New price of capital series (PK)

c) New depreciation series (DECCUR,DECCON)

d) New price indeces for materials

e) New price indeces for miscellaneous services

f) New definition of access; this is used as the technology indicator.

The wage rate was derived form dividing employee expense (EMPEXP) by weighted man-hours. The cost of material inputs was derived from a divisia index of materials, revenue taxes and uncollectables. The user cost of capital was derived from the data-base; the methodology is contained in the program COFC, and is based on the Hall Jorgenson derivation. COFC is shown in TAble 3.

A number of variables are exogenous to the system, and thus values for these variables are required for the forecast period. For some variables, the values taken have been those forecasted by Bell. For others, an ARIMA process was estimated, identified and used for prediction. The ARIMA program, written in TSP is included.

The specification of the various processes used are shown in Table 4. The actual values used are shown in the LOAD module of SIMU8OB.

TABLE 3

USER COST OF CAPITAL

```
$$NAME,COFC$
SMPL 1 27$
GENR CC2=.035$
LOAD $
OPEN BELLIB$
SMPL 1 27$
GENR DEP=DECX*K$
GENR U=(INCTAX)/(TOREX-TOE+OTHIX-INT)$
GENR ECAPCU=PK*K$
GENR LTFT=ECAPCU/(CRED+DEPRE)$
GENR TFACT=CC2*LTFT$
GENR Z=(1/TFACT)*(1-((LTFT/(LTFT+TFACT))**LTFT))$
GENR LPK=PK(-1)$
SET LPK(1)=.87$
GENR THETA=(PK-LPK)/LPK$
GENR UCCB=LPK*(CC2+DECX*(1+THETA))*((1-Z*U)/(1-U))+CAPTAX/K$
PUNCH UCCB$
CLOSE BELLIB$
STOP $
END $
LOAD CRED $
0 0 0 0 0 0 0 0 0 0 0 .5 .5 .5 .5 28.9 28.8 30.7 32.3
52.7 98.3 96.7 72.4 78.1 87.5 102.7 68.9$
LOAD DEPRE$
22.5 25.343 28.087 31.109 35.5 48.953 55.754 64.874
72.09 78.902 86.881 97.314 106.224 116.107 127.459
138.943 151.906 170.486 183.85 198.438 229.342
258.559 289.824 341.396 385.41 427.85 473.99$
END $
```

CRED Deferred Income Taxes, BAC, 414

DEPRE Accounting depreciation, BAC, 317

TABLE 4

METHODOLOGY USED FOR PREDICTING EXOGENOUS VARIABLES

SERIES		
W	Arima* on log (1952-1979)	(1,1,0)
V	Arima on log (1952-1979)	(1,1,0)
r (COFC035)	Arima on log (1952-1978)	(1,1,0)
CPI	Arima on log (1952-1979)	(1,1,0)
PERCON	Arima on log (1952-1979)	(1,1,0)
POPB	Arima on log (1952-1979)	(1,1,0)
CONVS	Arima (1952-1979)	(1,1,0)
PK	Arima on log (1952-1979)	(1,1,0)
DECC	0.0606 Average 1975-1979	(Range .0604 to 0608)
ACCESS	Estimated. .995 in 1979	.999 in 1983
QTPL	Arima on log (1968-1979)	(2,1,0)
QMIS (QMISC+QDIR)	Arima on log (1972-1979)	(0,1,0)
ROTH (P5xOTR-RWATS)	Arima on log (1957-1979)	(0,1,0)
MNET	Use Bell's data	
NICON	Use Bell's data	
EXTRIX	Use Bell's data	
FXLTD	Use Bell's data	
OTHIX	Arima on log (1952-1978)	(0,1,0), Actual 1979
AIBARE (AIB/ARE)	Arima (1952-1978)	(1,0,0)

*For the Arima process, the terms (p,d,q) stand for:

p - order of autoregressive process

d - order of differencing

q - order of moving average process

PART III ESTIMATION

The demand module (QLOC,QTOL) exists over the full period 1952-1978, while the cost module as specified, covers only the period 1968-1978. Since equations covering different period cannot be estimated simultaneously, and not wishing to lose the information residual in the early sample for the demand module, the demand and cost modules were estimated separately.

1- The two demand equations were estimated simultaneously using SURE (seemingly unrelated regression estimation); the results are shown in Table 5. Since RAT3 was insignificant in the toll equation it was dropped.

Price elasticity was estimated at -.53 for QLOC and -1.30 for QTOL. There is no serial correlation (DW = 1.83 and 1.88 respectively). The fits are very high - the standard error gives a value of .16% for local, and .31% for toll.

2- The cost module consists of five equations - the cost function, two factor share equations* and two profit maximizing equations. A full information maximum likelihood estimation methodology was used, with the endogenous variables defined as

QTOL, QLOC, COST, LHK, LHL

LHK = capital share
LHL = labour share

The price elasticity for message toll was taken from the demand equation (-1.302). The price elasticity for toll private line could not be derived from a toll private line demand function for the reasons discussed above. Consequently E2 was left free, and in the

*The third is dropped since the shares add to unity.

TABLE 5

DEMAND ESTIMATION

MULTIVARIATE REGRESSION
****

TRACE OF MATRIX = 2.00000
LOG OF LIKELIHOOD FUNCTION = 253.228

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
A0	-3.70084	.645739	-5.731
A1	-.530269	.752772E-01	-7.044
A3	.403885	.916232E-01	4.408
A4	1.09174	.844797E-01	12.923
A5	.420235	.108279	3.881
RL1	.535089E-01	.100581E-01	5.320
RL2	.229597E-01	.107276E-01	2.140
RL3	.406053E-01	.117204E-01	3.464
B0	-5.34082	.900247	-5.933
B2	-1.30200	.780966E-01	-16.672
B3	.838492	.108069	7.759
B4	.745480	.115939	6.430
RT1	.304294E-01	.139536E-01	2.181
RT2	.100224	.167580E-01	5.981

EQUATION DEML
****

DEPENDENT VARIABLE ONE

R-SQUARED = *******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) = 1.8268
SUM OF SQUARED RESIDUALS = .726409E-04
STANDARD ERROR OF THE REGRESSION = .164025E-02
SUM OF RESIDUALS = .466139E-04

EQUATION DEMM
****

DEPENDENT VARIABLE ONE

R-SQUARED = *******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) = 1.8777
SUM OF SQUARED RESIDUALS = .254968E-03
STANDARD ERROR OF THE REGRESSION = .307299E-02
SUM OF RESIDUALS = .228936E-03

TABLE 6

COST ESTIMATION

FULL INFORMATION MAXIMUM LIKELIHOOD RESULTS
****

5 STOCHASTIC EQUATIONS — 8 PARAMETERS
0 IDENTITIES — 11 OBSERVATIONS

EQUATIONS	COSTFN	SCL	SCK	TOLPRM	TPLPRM
ENDGN. VARS	QTOL	QTPL	LHL	LHK	COST

LOG OF LIKELIHOOD FUNCTION = -9.50081

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
CCO	3.46486	.295081E-01	117.421
CW	.298114	.166616E-02	178.923
CR	.505409	.115584E-02	437.264
CT	-.607112	.103572	-5.862
CQL	.559300	.132464E-01	42.223
CQM	.869400E-01	.756416E-03	114.937
CQP	.577266E-01	.762343E-03	75.723
CMIS	.381660E-01	.304710E-02	12.525

TABLE 6 (cont'd

EQUATION COSTFN
****

DEPENDENT VARIABLE ONE

R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.6810
SUM OF SQUARED RESIDUALS =	.252827E-04
SUM OF RESIDUALS =	-.670341E-05

EQUATION SCL
****

DEPENDENT VARIABLE ONE

R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.3409
SUM OF SQUARED RESIDUALS =	.378230E-02
SUM OF RESIDUALS =	.292072E-02

EQUATION SCK
****

DEPENDENT VARIABLE ONE

R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.2842
SUM OF SQUARED RESIDUALS =	.633696E-03
SUM OF RESIDUALS =	-.161444E-02

EQUATION TOLPRM
****

DEPENDENT VARIABLE ONE

R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	.9424
SUM OF SQUARED RESIDUALS =	.919249E-02
SUM OF RESIDUALS =	-.644083E-02

EQUATION TPLPRM
****

DEPENDENT VARIABLE ONE

R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.2042
SUM OF SQUARED RESIDUALS =	.211566E-01
SUM OF RESIDUALS =	.391497E-02

resultant estimations took on high negative values (<-1000). Consequently E2 was taken as -1,000,000, to reflect an elastic demand curve. This results in the profit maximizing equation reducing to

Price = Marginal Cost

in the competitive situation. This seems entirely reasonable; the toll private lines services are classified by Bell as competitive, and in the TCTS hearings, it was shown that, for directly assignable cost, (i.e. variable costs) that revenues from toll services did not (CNCP) or barely did (Bell) cover total revenues from toll services. If scale is approximately unity, it follows that marginal cost equals price.

The results of the estimation of the cost module are shown in Table 6. It can readily be seen from the t-values how strongly the coefficients are estimated. The various equations all have good fits, ranging from a standard error of 2% for the toll private line profit max. (TPLPRM) to .0025% for the cost function (COSTEN).

Note that CW and CR correspond exactly to the factor shares shown in Table 1. All the coefficients have the expected sign, and the function is well behaved, in that the isocost surfaces are all convex to the origin with respect to input prices.

The marginal costs for 1976 for each output are:

QLOC - 1.418 ($1.16 per $1 revenue)

QTOL - .288 ($.23 per $1 revenue)

QTPL - 1.354 ($1.02 per $1 revenue)

QMIS - 1.726 ($1.37 per $1 revenue)

These are similar to the results obtained in Breslaw and Smith (4) for local and toll. For toll private lines, since MC = price the result is what would be expected. Miscellaneous services appear to have a marginal revenue well in excess of marginal cost.

3- The financial model consists of four equations - FINAN, EQ6, EQUA1 and EQUA2. As discussed above, FINAN was estimated for 1968-1978 EQ6 was estimated for 1971-1978, the only years for which data was available. The remaining equations were estimated for 1953-1978. The results are shown in Table 7.

The behavioural equations for the income statement - STAIOA, STAI4A, STAI6A, are estimated for 1953-1978, and STA20A for 1978. The results are shown in Table 8.

For the majority of these equations, satisfactory statistics are produced. R^2 is high, and the Durbin Watson Statistic is either close to 2, or in the indeterminate range. t-statistics are high, with the exception of the coefficients X1 and Y1 (for the variable AIBARE). For the forecast period, the implication that the debt/equity ratio is approximately constant is not unreasonable.

TABLE 7

FINANCIAL MODEL

EQUATION FINAN
****

DEPENDENT VARIABLE RAVAK

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
D0	1955.21	151.153	12.935
D1	.200883	.417243E-01	4.815
RO4	.498861	.287553	1.735

LOG OF LIKELIHOOD FUNCTION =	-53.8403
R-SQUARED =	.9266
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.7205
SUM OF SQUARED RESIDUALS =	11489.3
STANDARD ERROR OF THE REGRESSION =	37.8967
SUM OF RESIDUALS =	.727596E-10
NUMBER OF OBSERVATIONS =	11.000
MEAN OF DEPENDENT VARIABLE =	2625.68

EQUATION EQ6
****

DEPENDENT VARIABLE RAPE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
W0	63.7351	17.7514	3.590
W1	.711068	.110674	6.425

LOG OF LIKELIHOOD FUNCTION =	-30.5604
R-SQUARED =	.8731
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	2.0988
SUM OF SQUARED RESIDUALS =	974.241
STANDARD ERROR OF THE REGRESSION =	12.7426
SUM OF RESIDUALS =	.727596E-11
NUMBER OF OBSERVATIONS =	8.000
MEAN OF DEPENDENT VARIABLE =	174.052

TABLE 7 (cont'd)

EQUATION EQUA1
****

DEPENDENT VARIABLE RADEBT

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
X0	0.	0.	0.000
X1	36.2025	75.0004	.483
X2	.488589	.457721E-01	10.674

LOG OF LIKELIHOOD FUNCTION =	-117.156
R-SQUARED =	.9968
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.3124
SUM OF SQUARED RESIDUALS =	12484.3
STANDARD ERROR OF THE REGRESSION =	23.2979
SUM OF RESIDUALS =	98.5227
NUMBER OF OBSERVATIONS =	26.000
MEAN OF DEPENDENT VARIABLE =	872.332

EQUATION EQUA2
****

DEPENDENT VARIABLE RAEQUI

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
Y0	0.	0.	0.000
Y1	-36.2025	75.0004	-.483
Y2	.511411	.457721E-01	11.173

LOG OF LIKELIHOOD FUNCTION =	-117.156
R-SQUARED =	.9958
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.3124
SUM OF SQUARED RESIDUALS =	12484.3
STANDARD ERROR OF THE REGRESSION =	23.2979
SUM OF RESIDUALS =	-98.5227
NUMBER OF OBSERVATIONS =	26.000
MEAN OF DEPENDENT VARIABLE =	1070.92

TABLE 8

BEHAVIOURAL EQUATIONS FOR INCOME STATEMENT

EQUATION STA10A
****

DEPENDENT VARIABLE RTOE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
J0	14.3091	4.93522	2.899
J1	.463918	.702585E-01	6.603
J2	.542898	.773351E-01	7.020

LOG OF LIKELIHOOD FUNCTION =	-84.7615
R-SQUARED =	.9982
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.8782
SUM OF SQUARED RESIDUALS =	1033.12
STANDARD ERROR OF THE REGRESSION =	6.70209
SUM OF RESIDUALS =	.409273E-10
NUMBER OF OBSERVATIONS =	26.000
MEAN OF DEPENDENT VARIABLE =	468.179

EQUATION STA14A
****

DEPENDENT VARIABLE RINT

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
L0	-.549361	1.03270	-.532
L1	.113052E-01	.382963E-02	2.952
L2	.875861	.556445E-01	15.740

LOG OF LIKELIHOOD FUNCTION =	-49.0167
R-SQUARED =	.9967
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	2.2631
SUM OF SQUARED RESIDUALS =	66.0715
STANDARD ERROR OF THE REGRESSION =	1.69490
SUM OF RESIDUALS =	.267164E-11
NUMBER OF OBSERVATIONS =	26.000
MEAN OF DEPENDENT VARIABLE =	50.6692

TABLE 8 (cont'd)

EQUATION STA16A
****

DEPENDENT VARIABLE RINCTAX

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
K0	-2.80269	4.00752	-.699
K1	.472784	.215964E-01	21.892
R016	.557524	.169430	3.291

LOG OF LIKELIHOOD FUNCTION =	-60.0486
R-SQUARED =	.9896
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.4673
SUM OF SQUARED RESIDUALS =	154.369
STANDARD ERROR OF THE REGRESSION =	2.59069
SUM OF RESIDUALS =	-.207942E-07
NUMBER OF OBSERVATIONS =	26.000
MEAN OF DEPENDENT VARIABLE =	76.2011

EQUATION STA20A
****

DEPENDENT VARIABLE RDIVPR

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
M0	-2.95839	1.43594	-2.060
M1	.969754E-01	.853071E-02	11.368

LOG OF LIKELIHOOD FUNCTION =	-12.6511
R-SQUARED =	.9486
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	.6985
SUM OF SQUARED RESIDUALS =	8.76447
STANDARD ERROR OF THE REGRESSION =	1.11896
SUM OF RESIDUALS =	0.
NUMBER OF OBSERVATIONS =	9.000
MEAN OF DEPENDENT VARIABLE =	12.8048

PART IV HISTORICAL VALIDATION

Given the goodness of fit in the estimation of the various equations, it would be expected that tracking, or historical validation would show a close correspondence between actual and predicted values. This indeed is observed.

Table 9 shows the actual values of output for local (QLOC) and toll services (QTOL), and the predicted values (QLOCS, QTOLS). Similarly actual and predicted revenues (RLOC, RLOCS, RTOL, RTOLS) are also shown. The tracking is very tight for local, and almost as tight for toll.

Table 10 shows the tracking for the cost model, based on the actual level of outputs. Again for all these factors (L-labour, K-capital and M-materials) and for cost there is a very tight correspondence between the actual and the predicted values. In Table 11, the procedure is repeated, but this time using the simulated levels of output (QLOCS, QTOLS). As would be expected, the tracking is not as tight as in Table 10, but is still close enough to be highly acceptable.

In Table 12, the simulation of the financial variables is undertaken. XRETATC and RETATC are the actual and simulated values of return to average total capital; XIBUI and IBUI are the actual and simulated values of income before underlisted items. Table 12 shows the simulation based on actual values of outputs and factors, while Table 13 repeats the procedure using simulated values of outputs and factors. Again the fit is good.

An analysis of XRETATC and RETATC suggests that an error of 0.5% in return to ATC is the outside bound error, while the mean absolute error is .30%.

TABLE 9

DEMAND MODEL VALIDATION

	QLOC	QLOCS	RLOC	RLOCS
1952	126.400	126.735	116.794	117.103
1953	137.000	136.916	127.821	127.742
1954	148.000	146.514	138.084	136.698
1955	162.900	163.335	151.986	152.391
1956	181.700	184.512	169.526	172.149
1957	200.600	199.616	187.160	186.241
1958	216.600	215.496	203.387	202.351
1959	233.600	237.678	233.600	237.678
1960	250.900	251.945	250.900	251.945
1961	269.500	264.083	269.500	264.083
1962	289.600	285.486	289.600	285.486
1963	308.700	305.389	308.700	305.389
1964	325.000	327.403	325.000	327.403
1965	350.800	352.349	350.800	352.349
1966	380.700	383.148	380.700	383.148
1967	410.000	409.124	410.000	409.124
1968	437.600	439.416	437.600	439.416
1969	471.400	473.648	472.814	475.069
1970	504.300	512.110	512.369	520.304
1971	538.000	538.123	568.128	568.258
1972	579.800	577.356	629.663	627.009
1973	625.500	621.989	698.058	694.139
1974	679.400	683.507	774.516	779.198
1975	734.300	727.329	878.223	869.885
1976	779.700	775.394	990.219	984.750
1977	820.500	832.506	1107.68	1123.88
1978	855.800	844.874	1263.08	1246.95

TABLE 9 cont'd

	QTOL	QTOLS	RTOL	RTOLS
1952	52.6125	52.3698	55.9947	55.7364
1953	56.7218	57.1667	60.4395	60.9136
1954	61.2035	61.8050	65.2626	65.9040
1955	70.1607	68.8056	74.7747	73.3305
1956	79.0097	77.3026	84.1415	82.3236
1957	86.2361	86.0137	91.5478	91.3117
1958	90.3221	93.2906	96.7413	99.9208
1959	98.6678	99.1107	110.239	110.733
1960	103.753	104.124	117.380	117.800
1961	110.218	109.925	123.437	123.110
1962	130.505	130.159	135.912	135.552
1963	138.747	141.731	144.208	147.309
1964	154.385	155.375	160.208	161.236
1965	175.738	171.870	182.148	178.140
1966	199.928	198.692	201.797	200.550
1967	223.800	222.072	223.800	222.072
1968	244.842	249.684	242.747	247.548
1969	280.957	275.726	279.465	274.262
1970	304.564	298.366	326.545	319.900
1971	320.106	325.377	348.192	353.925
1972	360.785	361.972	397.553	398.861
1973	421.576	412.370	474.033	463.680
1974	485.610	488.527	553.444	556.769
1975	553.053	559.801	652.761	660.726
1976	597.047	605.858	743.117	754.083
1977	649.905	664.580	830.222	848.969
1978	728.986	706.890	979.524	949.834

TABLE 10

COST VALIDATION-ACTUAL LEVELS OF OUTPUT

	L	LS	K	KS
1968	55.5000	56.2957	2561.90	2598.63
1969	56.6000	56.2959	2711.90	2697.33
1970	57.8000	58.2976	2856.70	2881.29
1971	57.4000	56.7738	3012.80	2979.93
1972	57.5000	57.2622	3180.60	3167.45
1973	60.4000	59.3321	3328.90	3270.05
1974	63.9000	63.4635	3499.50	3475.59
1975	64.1000	65.1872	3707.50	3770.38
1976	67.3000	68.1026	3910.60	3957.24
1977	69.8000	69.7725	4108.30	4106.68
1978	75.1000	74.6522	4239.60	4214.32

	M	MS	COST	COSTS
1968	123.239	125.005	677.808	687.526
1969	145.227	144.447	780.532	776.339
1970	147.384	148.653	864.213	871.652
1971	171.182	169.315	954.034	943.627
1972	179.509	178.766	1053.21	1048.86
1973	202.532	198.951	1215.48	1193.99
1974	214.275	212.812	1429.76	1419.99
1975	217.524	221.214	1687.45	1716.07
1976	237.008	239.835	1976.34	1999.91
1977	259.505	259.403	2255.69	2254.80
1978	280.835	279.160	2580.52	2565.14

TABLE 11

COST VALIDATION-SIMULATED LEVELS OF OUTPUT

	L	LS	K	KS
1968	55.5000	56.5226	2561.90	2609.11
1969	56.6000	56.3542	2711.90	2700.12
1970	57.8000	58.6962	2856.70	2900.99
1971	57.4000	56.8622	3012.80	2984.57
1972	57.5000	57.1435	3180.60	3160.88
1973	60.4000	59.0322	3328.90	3253.51
1974	63.9000	63.7108	3499.50	3489.14
1975	64.1000	64.9088	3707.50	3754.28
1976	67.3000	67.9784	3910.60	3950.02
1977	69.8000	70.4783	4108.30	4148.22
1978	75.1000	73.9196	4239.60	4172.96

	M	MS	COST	COSTS
1968	123.239	125.509	677.808	690.297
1969	145.227	144.596	780.532	777.142
1970	147.384	149.669	864.213	877.613
1971	171.182	169.578	954.034	945.095
1972	179.509	178.396	1053.21	1046.68
1973	202.532	197.945	1215.48	1187.96
1974	214.275	213.641	1429.76	1425.52
1975	217.524	220.269	1687.45	1708.74
1976	237.008	239.397	1976.34	1996.26
1977	259.505	262.026	2255.69	2277.61
1978	280.835	276.421	2580.52	2539.96

TABLE 12

FINANCIAL MODEL VALIDATION-ACTUAL LEVEL OF OUTPUTS AND FACTORS

	XRETATC	RETATC	XIBUI	IBUI
1952	6.13317	6.13317	53.4070	53.4070
1953	6.41500	5.72416	58.2172	53.4972
1954	6.05377	5.48185	61.8194	56.1252
1955	5.95566	5.58885	66.7967	63.4204
1956	5.81518	5.66139	73.4010	72.4345
1957	5.38762	5.45193	77.6972	79.3798
1958	5.36845	5.25021	83.4218	81.8748
1959	5.96272	5.99003	113.521	109.513
1960	6.08372	6.02481	124.704	118.733
1961	6.06585	6.10962	138.972	132.193
1962	6.32201	6.56895	156.411	154.384
1963	6.14612	6.57188	164.093	167.460
1964	6.46862	6.89324	185.710	190.385
1965	6.73961	7.37274	205.025	216.737
1966	6.69902	7.25053	220.460	232.695
1967	6.92127	7.09827	256.135	260.106
1968	7.07556	7.09953	277.618	278.444
1969	6.80915	7.41344	289.689	308.245
1970	7.17795	7.69736	337.290	342.589
1971	7.40507	7.73431	356.611	367.060
1972	7.78153	7.88807	393.883	394.527
1973	7.96675	8.42946	441.503	456.936
1974	8.06066	8.13623	477.496	480.110
1975	8.47032	8.06751	547.585	523.307
1976	8.66696	8.24774	601.475	583.606
1977	8.41735	8.02445	613.881	601.085
1978	9.14090	8.98410	769.721	762.712

TABLE 13

FINANCIAL MODEL VALIDATION-SIMULATED VALUES OF OUTPUTS AND FACTORS

	XRETATC	RETATC	XIBUI	IBUI
1952	6.13317	6.13317	53.4070	53.4070
1953	6.41500	5.76184	58.2172	53.8928
1954	6.05377	5.41948	61.8194	55.3802
1955	5.95566	5.51154	66.7967	62.3817
1956	5.81518	5.71424	73.4010	73.2397
1957	5.38762	5.38612	77.6972	78.2254
1958	5.36845	5.36190	83.4218	84.0177
1959	5.96272	6.19846	113.521	114.085
1960	6.08372	6.08606	124.704	120.197
1961	6.06585	5.89181	138.972	126.448
1962	6.32201	6.41193	156.411	149.910
1963	6.14612	6.56513	164.093	167.250
1964	6.46862	6.99539	185.710	193.816
1965	6.73961	7.30367	205.025	214.278
1966	6.69902	7.28111	220.460	233.896
1967	6.92127	7.04053	256.135	257.502
1968	7.07556	7.12507	277.618	280.995
1969	6.80915	7.34044	289.689	304.059
1970	7.17795	7.60501	337.290	338.852
1971	7.40507	7.85100	356.611	372.957
1972	7.78153	7.91341	393.883	395.356
1973	7.96675	8.41808	441.503	452.947
1974	8.06066	8.34752	477.496	495.662
1975	8.47032	8.00738	547.585	520.615
1976	8.66696	8.19867	601.475	581.215
1977	8.41735	8.23494	613.881	624.207
1978	9.14090	8.79629	769.721	723.259

Finally, Tables 14 and 15 show income statements for Bell for the years 1974-1978. In Table 14, actual levels of outputs and factors are utilized; in Table 15, all outputs and factors are estimated from the various equations.

TABLE 14

ACTUAL OUTPUTS AND FACTORS

INCOME STATEMENT - BELL CANADA

	1974.	1975.	1976.	1977.	1978.
TELECOM. OPERATIONS					
LOCAL REVENUE	774.52	878.22	990.22	1107.68	1263.08
TOLL REVENUE	637.73	753.74	867.80	970.55	1152.47
MISC. REVENUE (NET)	28.00	34.02	46.00	55.30	81.87
TOTAL OPERATING REVENUES	1440.24	1665.98	1904.01	2133.52	2497.42
TOTAL OPERATING EXPENSES	1004.76	1196.02	1385.63	1585.40	1791.49
NET OPERATING REVENUES	435.48	469.97	518.38	548.12	705.92
OTHER INCOME	44.63	53.34	65.23	52.96	56.79
INCOME BEFORE UNDER ITEMS	480.11	523.31	583.61	601.09	762.71
INTEREST CHARGES	139.59	163.51	184.67	205.54	224.94
INCOME AFTER INTEREST	340.52	359.80	398.94	395.55	537.77
AMORTIZATION FXLTD	0.00	0.00	0.00	0.00	-5.49
INCOME BEFORE INCOME TAX	340.52	359.80	398.94	395.55	532.29
INCOME TAX	156.56	165.08	183.10	181.05	245.30
NET INCOME - TELECOM.	183.95	194.71	215.83	214.50	286.99
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	0.00	0.00	0.00	0.00	0.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	183.95	194.71	215.83	214.50	286.99
EXTRAORDINARY ITEM	0.00	92.60	0.00	0.00	4.12
INCOME AFTER EXTRA. ITEM	183.95	287.31	215.83	214.50	291.11
PREFERRED SHARE DIVIDEND	21.26	25.28	28.49	31.78	35.41
INCOME APPLIC. TO COMMON	162.69	262.03	187.34	182.72	255.70
% RETURN ON AVE. COM. EQTY.	8.91	8.38	8.49	7.71	9.80
% RETURN ON AVE. TOT. CAP.	8.14	8.07	8.25	8.02	8.98

TABLE 15

SIMULATED OUTPUTS AND FACTORS

INCOME STATEMENT - BELL CANADA

	1974.	1975.	1976.	1977.	1978.
TELECOM. OPERATIONS					
LOCAL REVENUE	779.20	869.88	984.75	1123.88	1246.95
TOLL REVENUE	641.06	761.70	878.76	989.30	1122.78
MISC. REVENUE (NET)	28.00	34.02	46.00	55.30	81.87
TOTAL OPERATING REVENUES	1448.25	1665.61	1909.51	2168.48	2451.60
TOTAL OPERATING EXPENSES	997.22	1198.33	1393.52	1597.23	1785.13
NET OPERATING REVENUES	451.03	467.28	515.99	571.25	666.47
OTHER INCOME	44.63	53.34	65.23	52.96	56.79
INCOME BEFORE UNDER ITEMS	495.66	520.61	581.21	624.21	723.26
INTEREST CHARGES	139.47	163.48	184.73	205.69	224.91
INCOME AFTER INTEREST	356.19	357.13	396.48	418.52	498.35
AMORTIZATION FXLTD	0.00	0.00	0.00	0.00	-5.49
INCOME BEFORE INCOME TAX	356.19	357.13	396.48	418.52	492.86
INCOME TAX	163.97	163.83	181.95	191.91	226.66
NET INCOME - TELECOM.	192.22	193.31	214.54	226.61	266.20
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	0.00	0.00	0.00	0.00	7.72
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	192.22	193.31	214.54	226.61	273.92
EXTRAORDINARY ITEM	0.00	92.60	0.00	0.00	4.12
INCOME AFTER EXTRA. ITEM	192.22	285.90	214.54	226.61	278.04
PREFERRED SHARE DIVIDEND	21.26	25.28	28.49	31.78	35.41
INCOME APPLIC. TO COMMON	170.96	260.63	186.05	194.83	242.64
% RETURN ON AVE. COM. EQTY.	9.37	8.28	8.40	8.20	9.34
% RETURN ON AVE. TOT. CAP.	8.35	8.01	8.20	8.23	8.80

PART V PREDICTION

The model was utilized to estimate 1978-1983 levels of outputs, factors, expenses and other financial variables, based on a given set of exogenous variables described in Section II, and two price scenarios.

Scenario I: Constant 1979 nominal price remains in effect through 1983.

Scenario II: 1980 rate request is granted in September 1980, and these prices remain in effect through 1983. This involves an increase in local price by 23.8%, and toll by 9.5%.

Va- 1979 Forecasts

For 1979, data for many of the exogenous variables was available. In addition, the financial statement for 1979 for Bell has been published, and thus a comparison of actual and predicted values is possible.

The following results were obtained for 1979.

	ACTUAL	PREDICTED	ERROR(%)
Local Service (RLOC)	1392.7	1376.8	-1.14
Toll Service (RTOL)	1120.3	1072.0	-4.29
Total Revenue	2817.1	2753.1	-2.27
Labour Expense[1]	918.4	889.8	-3.1
Material Expense[2]	583.2	565.0	-3.1
Depreciation Expense[3]	530.9	530.1	-0.2
Total Operating Expense[4]	2054.5	2057.7	+0.2
Rate of Return on ATC	9.7%	9.1%	-6.2

Notes:
1- Including labour taxes
2- Including revenue taxes and uncollectables
3- Based on an economic depreciation rate in 1978 of .0551 (474/8606.8) in depreciation/value net capital stock; this seems reasonable since composite depreciation rate remained constant 1978-1979.
4- Total operating expense will not sum since it includes capital taxes and excludes uncollectables.

As can be seen the predicted local revenues are very close to actual levels. On the other hand predicted toll revenues are less than actual levels it is this difference which accounts for the majority of the difference between the 9.7% actual and 9.1% predicted rate of return on ATC.

However, this does not appear to be a systematic difference. In 1981, the difference between Bell's predictions and the predictions of this model for local and message toll revenues is $19.3m or .65%.

Predicted total operating expenses are very close to the actual values for 1979; had predicted outputs been estimated at the actual levels for 1979, the operating expenses would have increased by approximately 29m, or an error of 1.4%.

Vb- 1980-1983 Forecasts

The predicted level of outputs, revenues, factors and costs for the constant 1979 price is shown in Table 16, and the income statement for that scenario for 1979-1983 in Table 17. Tables 18 and 19 repeat this information, but for the requested price increase, implemented in September 1980. As would be expected, the return to capital is less in the constant 1979 price scenario than in the requested price increase scenario.

A detailed analysis is shown of the differences between Bell's predictions and this model's predictions. On the demand side (see Table 20) it can be seen that for local revenue this model consistently projects a little higher than Bell for the no price increase case, and consistently lower for the price increase case. This is a direct consequence of the difference between the zero elasticity assumption of Bell, against the -.53 price elasticity used here. For 1981,

TABLE 16

PREDICTED VALUES-CONSTANT 1979 PRICES

	PLOC	PTOL
1978	1.47590	1.34368
1979	1.57600	1.41455
1980	1.57600	1.41455
1981	1.57600	1.41455
1982	1.57600	1.41455
1983	1.57600	1.41455

	QLOCS	RLOCS	QTOLS	RTOLS
1979	873.619	1376.82	757.838	1072.00
1980	938.584	1479.21	866.243	1225.35
1981	1006.74	1586.62	987.768	1397.25
1982	1078.30	1699.41	1124.04	1590.01
1983	1153.50	1817.91	1276.87	1806.20

	LS	MS	KS	COSTS
1979	75.3802	283.408	4347.25	2907.20
1980	77.0909	311.948	4656.56	3388.20
1981	80.8835	331.488	4972.62	3917.50
1982	85.0899	350.265	5303.40	4504.52
1983	89.6198	369.102	5652.38	5159.29

TABLE 17

INCOME STATEMENT-CONSTANT 1979 PRICES

INCOME STATEMENT - BELL CANADA

	1979.	1980.	1981.	1982.	1983.
TELECOM. OPERATIONS					
LOCAL REVENUE	1376.82	1479.21	1586.62	1699.41	1817.91
TOLL REVENUE	1281.52	1468.46	1679.35	1917.35	2186.02
MISC. REVENUE (NET)	94.80	114.18	116.44	127.80	120.30
TOTAL OPERATING REVENUES	2753.14	3061.85	3382.41	3744.55	4124.24
TOTAL OPERATING EXPENSES	2057.73	2361.89	2718.87	3124.48	3583.42
NET OPERATING REVENUES	695.42	699.96	663.53	620.07	540.82
OTHER INCOME	80.84	73.01	82.78	93.87	106.43
INCOME BEFORE UNDER ITEMS	776.26	772.97	746.32	713.93	647.25
INTEREST CHARGES	264.55	297.59	334.10	373.67	416.72
INCOME AFTER INTEREST	511.71	475.37	412.22	340.26	230.53
AMORTIZATION FXLTD	-9.89	-10.01	-10.01	-10.01	-10.01
INCOME BEFORE INCOME TAX	501.82	465.36	402.21	330.25	220.52
INCOME TAX	226.71	210.18	180.43	146.17	93.81
NET INCOME - TELECOM.	275.11	255.19	221.77	184.08	126.71
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	31.18	34.43	34.82	35.00	36.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	306.29	289.62	256.59	219.08	162.71
EXTRAORDINARY ITEM	29.84	0.00	0.00	0.00	0.00
INCOME AFTER EXTRA. ITEM	336.12	289.62	256.59	219.08	162.71
PREFERRED SHARE DIVIDEND	40.93	44.62	48.67	53.10	57.94
INCOME APPLIC. TO COMMON	295.19	245.00	207.93	165.98	104.77
% RETURN ON AVE. COM. EQTY.	10.23	8.46	6.43	4.59	2.59
% RETURN ON AVE. TOT. CAP.	9.09	8.42	7.62	6.88	6.05

TABLE 18

PREDICTED VALUES-REQUESTED PRICE INCREASE

	PLOC	PLOT
1978	1.47590	1.34368
1979	1.57600	1.41455
1980	1.70102	1.45934
1981	1.95109	1.54893
1982	1.95109	1.54893
1983	1.95109	1.54893

	QLOCS	RLOCS	QTOLS	RTOLS
1979	873.619	1376.82	757.838	1072.00
1980	901.350	1533.21	831.789	1213.86
1981	898.979	1753.99	877.683	1359.47
1982	962.884	1878.67	998.768	1547.03
1983	1030.03	2009.68	1134.57	1757.37

	LS	MS	KS	COSTS
1979	75.3802	283.408	4347.25	2907.20
1980	75.0998	303.892	4536.29	3300.69
1981	75.1452	307.971	4619.84	3639.66
1982	79.0536	325.417	4927.18	4184.97
1983	83.2643	342.927	5251.54	4793.42

TABLE 19

INCOME STATEMENT-REQUESTED PRICE INCREASE

INCOME STATEMENT - BELL CANADA	1979.	1980.	1981.	1982.	1983.
TELECOM. OPERATIONS					
LOCAL REVENUE	1376.82	1533.21	1753.99	1878.67	2009.68
TOLL REVENUE	1281.52	1456.98	1641.57	1874.36	2137.19
MISC. REVENUE (NET)	94.80	114.18	116.44	127.80	120.30
TOTAL OPERATING REVENUES	2753.14	3104.37	3512.00	3880.83	4267.17
TOTAL OPERATING EXPENSES	2057.73	2333.44	2611.53	2956.73	3364.66
NET OPERATING REVENUES	695.42	770.92	900.47	924.10	902.51
OTHER INCOME	80.84	73.01	82.78	93.87	106.43
INCOME BEFORE UNDER ITEMS	776.26	843.93	983.25	1017.97	1008.95
INTEREST CHARGES	264.55	297.22	332.57	370.84	412.45
INCOME AFTER INTEREST	511.71	546.71	650.68	647.12	596.50
AMORTIZATION FXLTD	-9.89	-10.01	-10.01	-10.01	-10.01
INCOME BEFORE INCOME TAX	501.82	536.70	640.67	637.11	586.49
INCOME TAX	226.71	243.90	293.18	291.25	266.83
NET INCOME - TELECOM.	275.11	292.80	347.50	345.86	319.66
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	31.18	34.43	34.82	35.00	36.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	306.29	327.23	382.32	380.86	355.66
EXTRAORDINARY ITEM	29.84	0.00	0.00	0.00	0.00
INCOME AFTER EXTRA. ITEM	336.12	327.23	382.32	380.86	355.66
PREFERRED SHARE DIVIDEND	40.93	44.62	48.67	53.10	57.94
INCOME APPLIC. TO COMMON	295.19	282.61	333.65	327.77	297.71
% RETURN ON AVE. COM. EQTY.	10.23	9.86	10.62	9.35	7.61
% RETURN ON AVE. TOT. CAP.	9.09	9.03	9.45	8.95	8.23

for example, the two revenues are within 2% for the constant 1979 scenario, but under the requested price scenario, this model predicts a revenue 7% less than Bells. Since no curtailment is permitted under a zero price elasticity, this result is precisely what would be expected.

For message toll service, including WATS, the difference in 1981 under the constant 1979 price scenario is quite small - 1%. However under the requested price scenario, there is a very large difference - Bell's revenue increases compared to the constant price case, while this model predicts a fall in revenue compared to the constant 1979 case. The difference between Bell and this model under the requested price is 10.5%. Again this follows directly from the price elasticity assumptions. Bell postulates an inelastic demand for this service, and consequently an increase in price results in a gain in revenue, while this model postulates an elasticity of -1.3, (elastic), and hence an increase in price results in a fall in revenue.

Other toll service, excluding WATS, (ROTH) consists of toll private line, telex and other data services; toll private line is by far the largest component. Under either the no price increase, or the requested price increase, Bell's projections are considerably less than those of this model (for 1981, 20.6% constant price, 12.4% requested price). The series ROTH, current revenue is shown in Table 21 (LROTH is LOG(ROTH)), and a time series plot of ROTH is shown in Figure 3. That this is an exponentially increasing function is clear from the time series plot of LROTH in Figure 4, especially from 1957. Basically a forecast of $221.8m in 1980, assuming the requested price is granted, makes no sense unless Bell expects the interconnection results to significantly affect this market.

TABLE 20

DEMAND COMPARISONS-CURRENT REVENUES ($MILLIONS)

	1979 NOMINAL PRICE		REQUESTED PRICE	
	BELL	BRESLAW	BELL	BRESLAW
1-LOCAL (RLOC)				
1980	1486.2	1479.2	1615.1	1533.2
1981	1551.9	1580.6	1887.3	1754.0
1982	1627.2	1699.4	1972.9	1878.7
1983	1712.9	1817.9	2076.9	2009.7
2-MESSAGE TOLL[a] (RTOL)				
1980	1263.1	1225.4	1305.1	1213.9
1981	1412.7	1397.3	1519.6	1359.5
3-OTHER TOLL[b] (ROTH)				
1980	212.8	243.1[c]	221.8	243.1[c]
1981	223.8	282.1	247.0	282.1
4-TOTAL TOLL[d]				
1980	1475.9	1468.5	1526.9	1457.0
1981	1636.4	1679.4	1766.5	1641.6
1982	1808.8	1917.3	1950.7	1874.4
1983	1998.4	2186.0	2155.2	2137.2
5-TOTAL[e]				
1980	3076.2	3061.8	3255.3	3104.4
1981	3304.8	3382.4	3768.0	3512.0
1982	3563.8	3744.6	4049.2	3880.8
1983	3831.5	4124.2	4350.0	4267.2

a) Including WATS revenue

b) Excluding WATS revenue

c) Autoregressive prediction - hence only one prediction

d) 2 + 3

e) 1 + 4 + Net miscellaneous revenues (Bell's estimates)

TABLE 21

OTHER TOLL REVENUE

	RCTH	LRCTH
1952	1.65937	.506438
1953	2.30322	.834308
1954	2.94843	1.08127
1955	4.37181	1.47518
1956	6.40521	1.85711
1957	7.93026	2.07069
1958	9.45531	2.24658
1959	10.6753	2.36794
1960	12.7087	2.54229
1961	14.9455	2.70441
1962	17.9822	2.88938
1963	21.0447	3.04665
1964	28.0436	3.33376
1965	30.0951	3.40436
1966	31.4140	3.44725
1967	35.2200	3.56161
1968	41.9859	3.73733
1969	49.7824	3.90766
1970	55.7048	4.02007
1971	58.3131	4.06583
1972	67.4540	4.21145
1973	78.1201	4.35825
1974	84.2884	4.43424
1975	100.974	4.61486
1976	124.678	4.82574
1977	140.327	4.94397
1978	172.948	5.15299
1979	209.517	5.34481

FIGURE

TIME SERIES PLOT OF OTHER TOLL

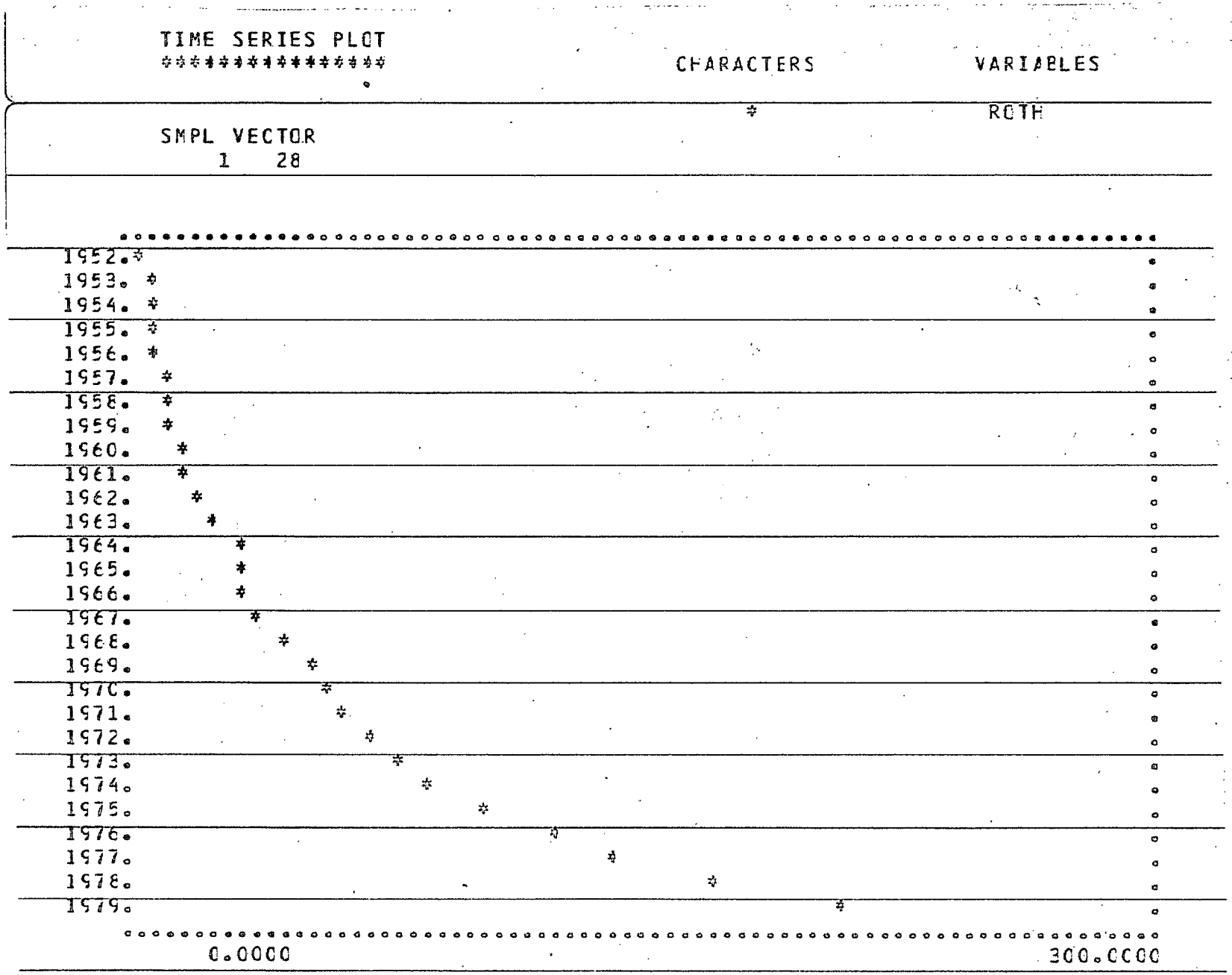


FIGURE 4

TIME SERIES PLOT OF LOG OF OTHER TOLL

TIME SERIES PLOT
****

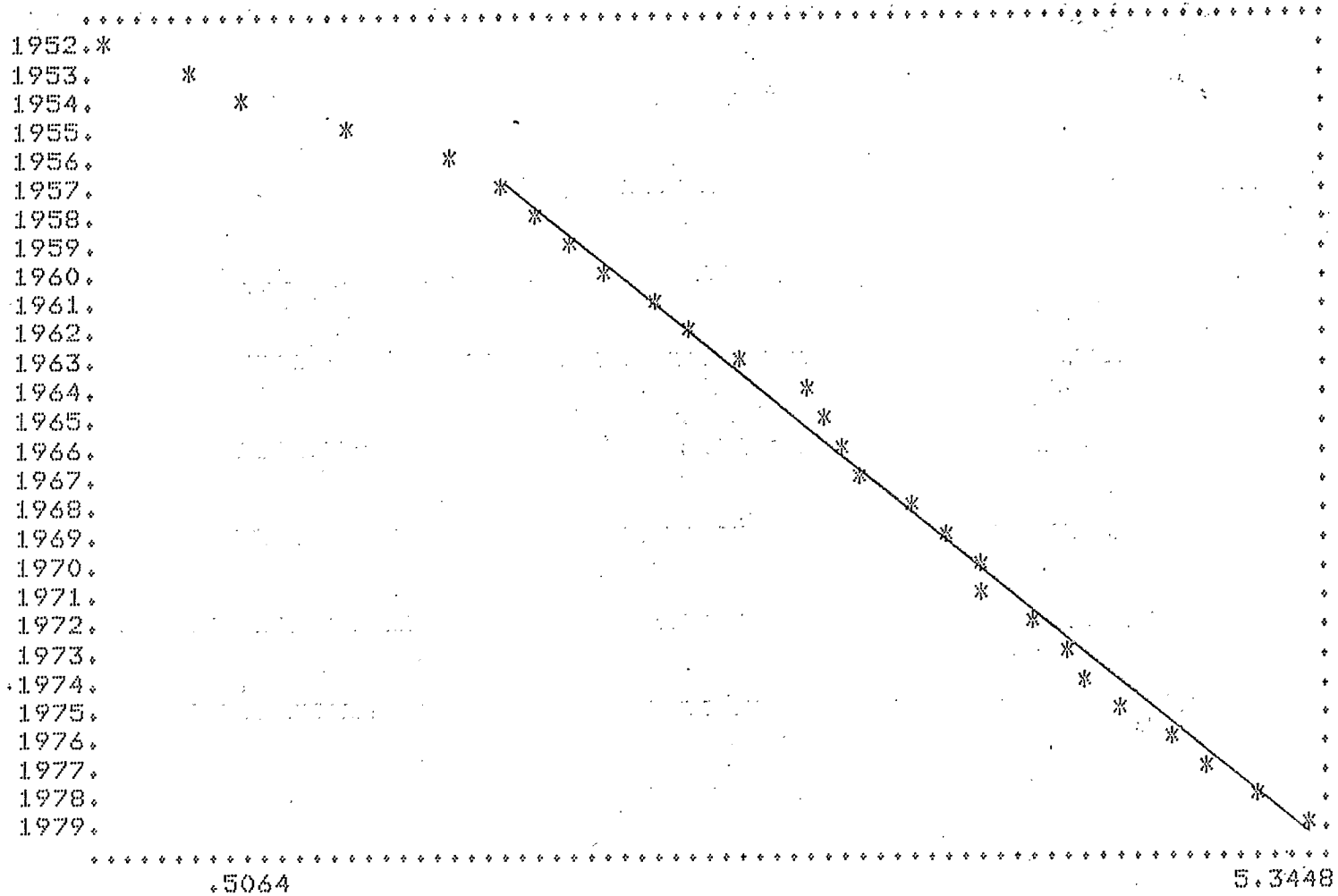
CHARACTERS

*

VARIABLES

LROTH

SMPL VECTOR
1 28



Toll revenue is the sum of message toll and other toll revenue. In the constant price case, since revenue predictions by Bell and this model coincide for message toll revenue, the difference is accounted for by the difference in predictions for other toll. In the requested price case, the message toll revenue dominates, and the difference is accounted for by this effect.

Total revenue includes net miscellaneous revenue; for the purpose of this simulation the values projected by Bell were utilized. Under the constant 1979 price scenario, both local and other toll are projected higher than Bell's estimates, leading to a total revenue higher than that forecast by Bell, especially for 1982 and 1983. Under the requested price increase, the lower predictions for local and message toll dominate, resulting in considerably lower predictions. For 1981, this model forecasts revenues 2.3% greater than Bells for the constant 1979 price scenario, and 6.8% less than Bells for the requested price increase scenario.

A comparison between the predictions of Bell and this model for total operating expenses and return on average total capital is shown in Table 22. For total operating expenses, the two predictions are fairly close for 1981 under constant 1979 price regime. (1.1% difference). However, under the requested price regime, Bell predicts slightly *higher* costs, even though less output is being produced, while this model predicts substantially lower costs, as would be expected. The difference between the two predictions is 5.3% in 1981.

From Table 22, it can be seen that under the constant 1979 price scenario, the expected rate of return to average total capital are very similar between the two models. However, under the requested

price increase, although both models suggest an increase in the rate of return, Bell's predictions are approximately 1% point higher than this models.

In 1980, Bell expects a 5.7% increase in revenue as a consequence of the rate request being granted, and no change in costs. This results in an expected increase in net operating revenue of 26%, and an increase of 1.3 points in return to average total capital. In contrast, this model predicts a lower increase in revenue (1.4%), as well as a decrease in costs of 1.2%. This results in an increase in net operating revenue of 10% and an increase of 0.6 points in return to average total capital.

For 1981 Bell expects a 14% increase in revenue as compared to the no rate increase scenario, and a .2% increase in expenses. This leads to an 82% increase in net revenue, and an increase of 3.0 points in return to average total capital. This model predicts only a 3.8% increase in revenue, and a 4% decrease in costs, yielding a 36% increase in net operating revenue; this yields a 1.9 point increase in return to average total capital.

TABLE 22

TOTAL OPERATING EXPENSE AND RATE OF RETURN COMPARISONS

$MILLION

	1979 NOMINAL PRICE		REQUESTED PRICE	
	BELL	BRESLAW	BELL	BRESLAW
TOTAL OPERATING EXPENSE				
1980	2384.4	2361.9	2384.4	2333.4
1981	2750.1	2718.9	2758.2	2611.5
1982		3124.5		2956.7
1983		3583.4		3364.7
RATE OF RETURN ON AVERAGE TOTAL CAPITAL				
1980	8.6%	8.4%	9.9%	9.0%
1981	7.5%	7.6%	10.5%	9.5%
1982		6.9%		9.0%
1983		6.1%		8.2%

PART VI SUMMARY

The model described above is able to track historical data well, and when used to predict 1979 does so such that the errors that are observed are of the same order as those that occurred over the historical data. In addition the forecasts made by this model and by Bell for 1980 and 1981 are reasonably close, under the constant 1979 price scenario.

However, under the requested price scenario, considerably lower revenues, and costs, are predicted by this model than by Bells; since the revenue effect is larger, the net outcome is lower predicted net operating revenue, and hence lower returns to average total capital.

This difference in revenues prediction is the heart of the matter; in economic terms the difference lies in the different values of price elasticity utilized by the two models.

It is difficult to undertake retroactive evaluation to differentiate between models unless the exact form of the model is specified, and can be evaluated using actual values of variables. This possibility now exists as a consequence of interrogatories, Bell (CAC) 03 Apr. 80-225, and Bell (CRTC) 03 Apr. 80-809. When the 1980 revenues become available, this exercise should certainly be undertaken. The policy consequences of message toll service being elastic is of sufficient impact for considerable effort to be undertaken to resolve this issue.

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SIMULATIONS OF BELL CANADA UNDER VARIOUS RATE SCENARIOS

Report Number 2

Jon A. Breslaw

September 5th, 1980

TABLE OF CONTENTS*

*continuation from Interim Report

INTRODUCTION*

This project involved the simulation of Bell Canada under a set of different price scenarios. The results of these simulations give information on revenues, costs, and financial data including return on capital; in fact a full income statement is produced. The purpose of the project is two-fold.

a) Estimation of Bell's income statement under different price scenarios;

b) Comparison of Bell's predictions with these estimates, and the determination if possible, of the reasons for any differences.

In order to carry out these objectives a model of Bell Canada was constructed - B.S.M. (Bell Simulation Model). Much of the work involved has already been described in the Interim Report, and will not be requested. The Interim Report describes the various steps involved - in summary:

1) Formulation of the demand system, the cost system, the financial system and the income statement.

2) Creation of a data base.

3) Estimation of the parameters in the equations in each of the systems, over the historical period.

4) Historical validation (or tracking).

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* Much of the work on the demand, cost and financial systems has been built on previous studies undertaken at the IAER. I am thus indebted to both Vittorio Corbo and to J. Barry Smith. In addition, J. Barry Smith kindly provided the cost of capital methodology. All errors, of course, remain my responsibility. Typing and presentation by Melly Neufield is also gratefully acknowledged.

5) Prediction for 1979 and comparison with actual values, and forecast for 1980 to 1983 under two price scenarios -

   a) constant 1979 prices

   b) requested prices.

6) Summary.

This report has three additional sections: In part 7, the remaining scenarios are simulated, i.e.

   c) CRTC approved prices

   d) inflation prices.

The results from all 4 scenarios as well as the Bell predictions are then analysed.

In part 8, a comparison is undertaken to determine the relative productive powers of B.S.M. on one hand, and Bell's predictions on the other. Since this has to be retroactive, the most recent year - 1979 - is used.

In part 9, an analysis of the demand models utilized by Bell in the 1980 rate case is undertaken; effectively this compares the demand system used by Bell to that used by the B.S.M.

In the conclusion, a summary of the results is given, as well as some directions for future research.

PART 7 PREDICTIONS

The B.S.M. was used to estimate the 1979 to 1980 level of outputs, factors, expenses and other financial variables, based on the same set of exogenous variables described in Section II of the Interim Report, and four price scenarios.

Scenario I: Constant 1979 nominal price remains in effect through 1983.

Scenario II: 1980 rate request is granted in September, 1980 and these prices remain in effect through 1983. This involves an increase in local prices by 23.8%, and MTS price by 9.5%.

Scenario III: The CRTC approved prices go into effect, and remain unchanged from August 18th 1980. This involves an increase in local prices by 17.03%, and MTS prices by 9.47%.

Scenario IV: In each year 1980-1983, a price increase equal to the percentage increase in CPI is in effect for both local and MTS. This involves an annual increase of 9.17%.

The predicted level of outputs, revenues, factors and costs for Scenarios I and II are shown in Tables 16 and 18 of the Interim Report, and the income statements in Tables 17 and 19.

The predicted level of outputs, revenues, factors and costs for Scenario III is shown in Table 23, and the income statement in Table 24. Tables 25 and Table 26 repeat this information, but for Scenario IV prices. The derivation of the values used (17.03%

TABLE 23

PREDICTED VALUES - CRTC PRICES

	PLOC	PTOL
1978	1.47590	1.34368
1979	1.57600	1.41455
1980	1.67600	1.46446
1981	1.84439	1.54851
1982	1.84439	1.54851
1983	1.84439	1.54851

	QLOCS	RLOCS	QTOLS	RTOLS
1979	873.619	1376.82	757.838	1072.00
1980	908.458	1522.58	828.002	1212.58
1981	926.191	1708.26	877.996	1359.59
1982	992.030	1829.69	999.124	1547.15
1983	1061.21	1957.29	1134.97	1757.51

	LS	MS	KS	COSTS
1979	75.3802	283.408	4347.25	2907.20
1980	75.4006	305.109	4554.46	3313.91
1981	76.4114	313.160	4697.68	3700.98
1982	80.3855	330.900	5010.19	4255.48
1983	84.6668	348.703	5339.99	4874.15

TABLE 24

INCOME STATEMENT - CRTC PRICES

INCOME STATEMENT-BELL CANADA

	1979.	1980.	1981.	1982.	1983.
TELECOM. OPERATIONS					
LOCAL REVENUE	1376.82	1522.58	1708.26	1829.69	1957.29
TOLL REVENUE	1281.52	1455.69	1641.68	1874.49	2137.34
MISC. REVENUE (NET)	94.80	114.18	116.44	127.80	120.30
TOTAL OPERATING REVENUES	2753.14	3092.45	3466.38	3831.98	4214.92
TOTAL OPERATING EXPENSES	2057.73	2337.74	2634.04	2993.05	3412.52
NET OPERATING REVENUES	695.42	754.71	832.34	838.93	802.40
OTHER INCOME	80.84	73.01	82.78	93.87	106.43
INCOME BEFORE UNDER ITEMS	776.26	827.72	915.13	932.80	908.84
INTEREST CHARGES	264.55	297.28	332.88	371.44	413.37
INCOME AFTER INTEREST	511.71	530.44	582.24	561.35	495.46
AMORTIZATION FXLTD	-9.89	-10.01	-10.01	-10.01	-10.01
INCOME BEFORE INCOME TAX	501.82	520.43	572.23	551.34	485.45
INCOME TAX	226.71	236.21	260.82	250.70	219.06
NET INCOME - TELECOM.	275.11	284.22	311.41	300.64	266.39
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	31.18	34.43	34.82	35.00	36.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	306.29	318.65	346.23	335.64	302.39
EXTRAORDINARY ITEM	29.84	0.00	0.00	0.00	0.00
INCOME AFTER EXTRA. ITEM	336.12	318.65	346.23	335.64	302.39
PREFERRED SHARE DIVIDEND	40.93	44.62	48.67	53.10	57.94
INCOME APPLIC. TO COMMON	295.19	274.03	297.57	282.55	244.45
% RETURN ON AVE. COM. EQTY.	10.23	9.54	9.41	8.00	6.20
% RETURN ON AVE. TOT. CAP.	9.09	8.89	8.93	8.37	7.62

TABLE 25

PREDICTED VALUES - INFLATION PRICE

	PLOC	PTOL
1978	1.47590	1.34368
1979	1.57600	1.41455
1980	1.72034	1.54410
1981	1.87811	1.68571
1982	2.05047	1.84041
1983	2.23871	2.00937

	QLOCS	RLOCS	QTOLS	RTOLS
1979	873.619	1376.82	757.838	1072.00
1980	895.967	1541.37	772.836	1193.34
1981	917.336	1722.86	786.118	1325.17
1982	937.849	1923.03	797.934	1468.53
1983	957.596	2143.78	808.480	1624.53

	LS	MS	KS	COSTS
1979	75.3802	283.408	4347.25	2907.20
1980	74.3719	300.946	4492.32	3268.69
1981	75.2751	308.503	4627.82	3645.95
1982	76.3919	314.461	4761.28	4044.06
1983	77.6176	319.671	4895.39	4468.34

TABLE 26

INCOME STATEMENT - INFLATION PRICES

INCOME STATEMENT - BELL CANADA

	1979.	1980.	1981.	1982.	1983.
TELECOM. OPERATIONS					
LOCAL REVENUE	1376.82	1541.37	1722.86	1923.03	2143.78
TOLL REVENUE	1281.52	1436.45	1607.27	1795.86	2004.35
MISC. REVENUE (NET)	94.80	114.18	116.44	127.80	120.30
TOTAL OPERATING REVENUES	2753.14	3092.00	3446.57	3846.69	4268.43
TOTAL OPERATING EXPENSES	2057.73	2323.04	2607.41	2908.31	3229.65
NET OPERATING REVENUES	695.42	768.96	839.15	938.38	1038.78
OTHER INCOME	80.84	73.01	82.78	93.87	106.43
INCOME BEFORE UNDER ITEMS	776.26	841.97	921.94	1032.25	1145.21
INTEREST CHARGES	264.55	297.09	332.47	370.14	410.38
INCOME AFTER INTEREST	511.71	544.88	589.47	662.11	734.84
AMORTIZATION FXLTD	-9.89	-10.01	-10.01	-10.01	-10.01
INCOME BEFORE INCOME TAX	501.82	534.87	579.46	652.10	724.83
INCOME TAX	226.71	243.03	264.24	298.33	332.23
NET INCOME - TELECOM.	275.11	291.83	315.23	353.76	392.59
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	31.18	34.43	34.82	35.00	36.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	306.29	326.26	350.05	388.76	428.59
EXTRAORDINARY ITEM	29.84	0.00	0.00	0.00	0.00
INCOME AFTER EXTRA. ITEM	336.12	326.26	350.05	388.76	428.59
PREFERRED SHARE DIVIDEND	40.93	44.62	48.67	53.10	57.94
INCOME APPLIC. TO COMMON	295.19	281.64	301.38	335.67	370.65
% RETURN ON AVE. COM. EQTY.	10.23	9.86	9.59	9.71	9.75
% RETURN ON AVE. TOT. CAP.	9.09	9.04	9.02	9.14	9.21

TABLE 27

CRTC PRICE INCREASES

	1981 REVENUES $m		
1- LOCAL	Without increase	%	With increase*
a) Contract Charges (500.1)			
Residential Primary	427.0	13	482.5
Business Primary	210.2	13	237.5
PBX trunk	68.6	13	71.0
X-radio	.4	13	.5
Semi-public	1.0	13	1.1
Centrex	50.3	20	60.4
Exchange wide PBX	8.4	20	10.1
Residential extension	44.9	0	44.9
Business extension	22.9	11	25.6
PBX extension	104.7	23	128.8
Contract auxilliary	308.5	23	371.3
Contract auxilliary	85.6	0	85.6
Data and Teletype	3.2	23	4.0
ISAL	2.5	13	2.8
Special facilities	22.5	25	28.2
Special facilities	4.4	0	4.4
Extra-exchange mileage	19.1	0	19.1
Individual tariff	.1	23	.1
Interconnent CNCP	.5	35	.7
	1379.0		1578.6
b) Message Charges (500.2)			
Mobile	1.2	0	1.2
Individual	.7	13	.8
Other	.2	0	.2
	2.1		2.2
c) Service, etc (500.3)			
Service Charge	85.5	32	113.1
d) Public Telephone (501)			
Public Telephone	32.6	100	65.1
e) Local Circuits, etc (504)			
Local Circuits	3.0	13	3.3
Other Circuits	3.3	23	4.0
Mobile Telephone	2.9	0	2.9
Other	.1	0	.1
Program Transmission	1.4	13	1.6
TV	.6	13	.7
Local data	6.0	13	6.8
Teletype	11.3	13	12.8
Equipment	1.4	23	1.7
Special facilities	5.5	25	6.8
Special facilities	9.2	0	9.2
Cable	4.9	0	4.9
	50.8		54.7

*Straight reprice

TABLE 27 (continued)

f) Other			
Service Tel. (503)	.1	0	.1
Directory (506)	4.1	33	4.9
	4.2		5.0
TOTAL LOCAL	1554.2		1818.9
	INCREASE 17.03%		
2- MESSAGE TOLL (INCL. WATS)			
MTS (intra)	780.3	15	897.3
MTS (adj. trans, USO)	457.3	0	457.3
WATS (Zones 1,2)	120.0	14	136.8
WATS (other)	55.1	0	55.1
TOTAL MTS AND WATS	1412.7		1546.5
	INCREASE 9.47%		

Sources: Bell (CRTC) 27 Dec. 79, 501,502
Bell (CRTC) 27 Dec. 79, 701
CRTC decision, Aug. 12 1980

local, 9.67% MTS) for the CRTC price increase for Scenario III is shown in Table 27. A comparison is shown in Table 28.

The results for Scenario III - the CRTC prices - are as would be expected; compared to the requested price increase, the revenues from MTS (including WATS) are almost identical, which follows since Bell received the requested price increase. For local services, Bell received 17% as compared to the 23% requested, and consequently, given the inelastic demand for local, receives less revenue under the CRTC price regime than under the requested price. On the other hand, lower prices for local results in larger quantities, and hence higher costs. Hence with lower revenues and higher costs, the return on average total capital is lower under the CRTC price regime than under the requested price regime - 8.93% vs 9.45% for 1981. A summary is shown in Table 28.

For Scenario IV - the inflation prices (where for each year 1980-1983 local and toll prices rise by the expected inflation rate) results not unsimilar to Scenario III occur for 1981. Local price has risen by 9% for two years (1980 and 1981) thus slightly exceeding the 17% specified by the CRTC, and hence producing slightly higher local revenues. For toll, a higher price will have come about than under the 9.5% increase specified by the CRTC, and, being elastic, results in lower revenues. Thus the total effects are similar, leading to similar values for % return to capital: 9.02 vs 8.93%.

However, a significant change has occured by 1983. Whereas Scenario I, II, and III show the return to ATC falling by between 1.2 and 1.6 points between 1981 and 1983, under Scenatio IV the return to ATC increases by .2 points.

TABLE 28

SCENARIO SUMMARY

SCENARIO	B.S.M. I	B.S.M. II	B.S.M. III	B.S.M. IV	BELL I	BELL II
1981						
Revenue:						
Local	1586.6	1754.0	1708.3	1722.9	1551.9	1887.3
Toll	1679.4	1641.6	1641.7	1607.3	1636.4	1766.5
TOTAL	3382.4	3512.0	3466.4	3446.6	3304.8	3768.0
1981						
Total Operating Expenses	2718.9	2611.5	2634.0	2607.4	2750.1	2758.2
% Return to Capital						
-1981	7.62	9.45	8.93	9.02	7.5	10.5
-1983	6.05	8.23	7.62	9.21		

Scenario I - constant 1979 prices

II - requested price increase

III - CRTC approved prices

IV - inflation prices

These results can be applied to Bell's predictions for return to average capital, in a rough and ready manner, (see Table 28). The change from Scenario II to Scenario III results in a fall of about 1/2 point; this would reduce Bell's estimate from 10.5 to 10.0, for 1981. The effect of no price increase after the CRTC decision results in a further fall of 1.3 points by 1983; applying this to Bell's results (10.0-1.3) results in a rate-of-return of 8.7%. This may be high since, under BSM, a fall in real price results in more revenue for MTS, an effect which does not occur under Bell's assumptions.

It would thus appear clear that the return on ATC will not exceed 10% in 1981, and will be significantly less in 1983 (≃8.7 Bell, 7.6 BSM). The corresponding return on common equity for 1983 (BSM) is 6.2%. The CRTC in its decision (P89) expected that the return on common equity for 1980 will be between 11.2% and 11.6%, and this is far below what Bell considers to be a reasonable rate-of-return on common equity (for 1979, 13.5-14.5%, B78-50,P5). Thus it is certain that another rate request will be initiated by Bell in the near future. The results from Scenario IV suggest that a constant return to ATC and common equity can only be achieved by increasing the price of Bell's services by at least the rate of inflation, or equivalent (ie. raise one price more and another less).

PART 8 MODEL COMPARISONS

In the previous section, a number of scenarios were simulated, and the results analysed; the simulation results were shown for the BSM, and were contrasted with the values predicted by Bell. Since the results differ, the natural question that is raised is which is likely to be closer to the "truth" - ie. which model has the better predictive power.

A comparison of the predictive power of the model presented in this report (BSM), and of Bell's own predictions is possible, to some extent, by comparing the predictions made in 1978 by each model for the 1979 year, and comparing the predicted results with the actual data. However, since the predictions use predicted values of exogenous variables, a fair experiment involves "running" the two models to predict the endogenous variables for 1979, while using the actual values of the exogenous variables. Im this way, any differences that occur between actual and predicted values is a consequence of model design, and not of varying assumptions as to the values of exogenous variables.

1) Revenues

The experiment is thus to take the 1978 rate case, and to compare the projections that Bell would have predicted had the actual level of exogenous variables for 1979 been known, with the projections of BSM, and the actual values of the endogenous variables. The design of the BSM has already been described in the Interim Report (Part 1). Bell's 1978 model is described in B-78-170. Essentially the starting point is the level of economic activity (real GNP). Given the expected growth in level of economic activity, forecasts are made of

the total telephones in service, and total long distance messages. These quantities then become the basis for projections of local and long distance revenues.

The data shown in Table 29 - Bell's 1978 rate case projections - are derived from published data in the sources shown. Curtailment is only calculated for message toll, this being Bell's position at that time.

In Table 30, the requested price increase and the actual price increase is shown for four service aggregates. The requested price increase was calculated from the ratio of the reprice increase to no rate increase shown in Table 29. The actual price increase was calculated from the 1978 and 1979 prices, given that the rate increase went into effect on August 15th, 1978, and no rate increase occurred in 1979. As can be seen, for MTS (intra) and for WATS the CRTC approved price is almost identical to the requested price, and for the total MTS + WATS the approved price increase is also very close to the requested price increase.* As in the 1980 rate case, the CRTC approved price increase for local was well below the requested price increase.

For each of the four service aggregates shown in Table 30, the following information appears:

a) The actual level of revenue for 1979
b) The revenues that Bell predicted, assuming the requested price increase was granted and the economic conditions specified held; these are the "with curtailment" revenues shown in Table 29.

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*The difference is due to the price increase for U.S. and Overseas MTS.

TABLE 29

1978 RATE CASE PROJECTION (by Bell)

	INCREASE			
	No rate increase	Straight reprice	With curtailment	Actual
1977				
Local	1107.6			1107.6
MTS	746.9			746.9
WATS	83.3			83.3
MTS + WATS	830.2			830.2
Other Tel.	140.3			140.3
Misc. Net	55.3			55.3
TOTAL	2133.4			2133.4
1978				
Local	1226.3	1356.4	1356.4	1263.1
MTS	829.5	N/A	854.9	873.9
WATS	90.5	99.4	99.4	105.6
MTS + WATS	920.0	N/A	954.3	979.5
Other Tel.	164.3	171.5	171.5	173.0
Misc. Net	69.4	68.6	68.6	81.8
TOTAL	2380.0		2550.7	2497.4
1979				
Local	1298.5	1602.2	1602.2	1392.7
MTS	914.2	991.4	970.9	990.4
WATS	108.0	118.6	118.6	129.8
MTS + WATS	1022.2	1110.0	1089.5	1120.2
Other Tel.	175.9	203.8	203.8	209.5
Misc. Net	78.0	76.2	76.2	94.7
TOTAL	2574.7	2992.2	2971.8	2817.1

SOURCES: B-78 - 100
B-78 - 182
B-78 - 177
P(NAPO) 3 Mar. 78 - 727
P(CRTC) 26 Jan. 78 - 404 p 13,14

c) The revenues that Bell would have predicted had the CRTC prices been known, under Bell's assumptions on economic conditions. For local, since there is no curtailment, this just involved repricing the revenues using the CRTC approved prices. For the other service aggregates, the CRTC price and the requested price increases are very close, and consequently repricing produces only marginal changes, on the assumption that curtailment remains approximately constant. Comparing line (a) with line (c) in Table 30, it appears that Bell has over-estimated local revenue (1446.9 vs 1392.7) and under-estimated toll revenues (1091.6 vs 1120.2). However this assumes the level of economic activity that Bell used as exogenous actually occurred. This indeed was not the case. Bell used a growth rate of 4 1/2 % for 1978 and 5% for 1979 for real GNE (1971$) (B-78-175). The actual rates that occurred were 3.4% and 2.9% for 1978 and 1979 respectively. As a consequence, by 1979 Bell estimated an increase of 9.725% in real GNE as compared to an actual increase of 6.4%, a difference of -3.325%.

d) The revenues that Bell would have predicted had the CRTC prices and future economic conditions been known. This is the retrospective simulation. To derive the relationship between economic conditions and projected revenues information in B-78-171 is used. Here Bell shows the difference between the 1977 estimates of revenue, after correction for the Commission's Decision of June 1st, 1977, and the actual revenues. The relevant data is given in Table 31. Using these elasticity estimates and the difference of -3.325%, an estimated revenue based on actual prices and economic conditions is derived.

e) The revenues predicted by the B.S.M. using actual prices and GNE - see p.35 in Interim Report.

TABLE 30

BELL REVENUE PROJECTIONS UNDER DIFFERENT ASSUMPTIONS

	LOCAL	INTRA	WATS	MTS + WATS
1978 RATE CASE				
Requested Price Increase (%)	23.29	13.20	9.80	8.59
Actual Price Increase (%)	11.43	13.35	9.88	8.80
1979 REVENUES $m				
a) Actual	1392.7	647.9	129.8	1120.2
b) Predicted - requested price, predicted GNE	1602.2	641.2	118.6	1089.5
c) Predicted - actual price, predicted GNE	1446.9	642.0	118.7	1091.6
d) Predicted - actual price, actual GNE	1396.6	607.2	112.3	1032.4
e) Predicted - B.S.M., actual price, actual GNE	1376.8			1072.0

TABLE 31

BELL'S 1977 FORECAST REVIEW (Source: b-78-171)

	Jan. 1977 view of 1977*	Actual 1977	Diff-erence	Elasticity**
% change real GNE	5.0	2.4	-2.6	
Revenues $m				
Local service	1138.6	1107.6	-30.9	1.045
Long Distance	1013.4	970.5	-43.0	1.631

* Adjusted for estimated effects of rates implemented pursuant to CRTC decision June 1st, 1977.

** (% change in revenue)/(% change in real GNE)

ANALYSIS

1) Revenues

a) Local

Both models do very well in predicting local, and the difference between the two predictions in percentage terms is very small. Bell overestimates local revenue by .28%, while BSM underestimates by 1.14%. *A priori* one would expect lower revenue predictions from BSM, *ceteris paribus*, than from Bell, since the former assumes some positive curtailment - an own price elasticity not equal to zero, while Bell assumes zero price elasticity for local services. However, since the difference between the predictions and the actual values are so small, it is not possible to state whether there is a significant difference between the models.

b) Message Toll

For the aggregate of MTS and WATS, both models underestimate 1979 revenues; BSM by 4.30% and Bell by 7.84%. Given the assumption utilized (that the elasticity derived in Table 31 for long distance applies to MTS and WATS) the difference between these two predictions is quite large. Some insight is gained by inquiring why the Bell estimate is below the BSM estimate.

Bell's estimation of the effect of GNP on the demand for telephone messages during a period where no nominal price increases occur would capture two components - the effect of increased level of economic activity, and the fall in the real price that comes about through inflation. Providing the relationship between increased economic activity and inflation remains constant, this is fine - the problem effectively is internalized. However in the 1978 case, the rate of inflation was high, while the rate of growth of the economy was low. Thus the net effect is to "miss" much of the effects of

inflation when looking at just the GNE. Hence as the CPI increased, the real price fell, resulting in higher demand. Since the nominal price is fixed, this results in an increase in revenue, irrespective of the elasticity. The BSM model captures this while the Bell model (of 1978) misses it. The need to specify such relationships have been recognized by Bell, and incorporated in their 1980 demand models. This represents a significant improvement in their modelling technique.

2) Operating Expenses

A fundamental difference in methodology exists between the two models for predicting operating expenses. In BSM, the factors required to produce a given output at minimum cost is estimated, and these factors, when transformed through wage and factor prices (and depreciation rate for capital) become total operating expenses.

Bell takes the estimated outputs as the starting point, but then uses these as inputs for the estimation of work load volumes in the various primary operating departments. Productivity ratios are then used to convert these work volumes into required hours of work and subsequently into departmental expense. Other expenses are estimated based on the work to be undertaken during the budget period.

The results for estimation of total operating expenses is shown below:

1979 Total Operating Expense

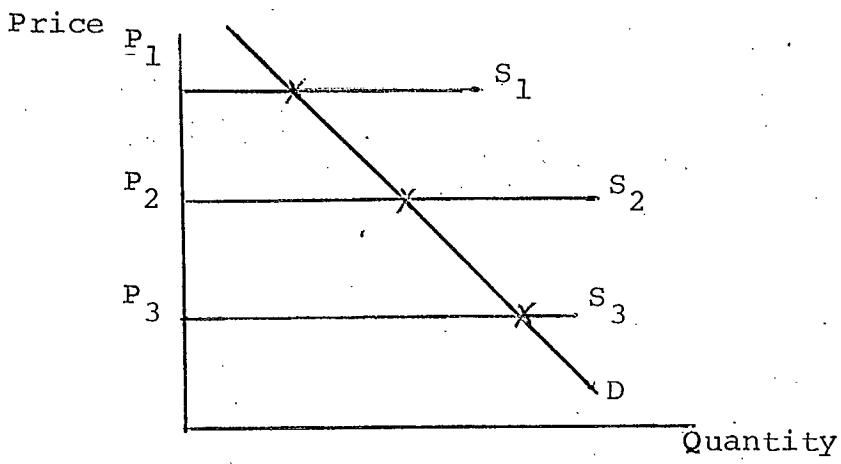
	$m	
Actual	2054.5	
BSM	2057.7	
Bell	2025.1	- no rate increase
	2037.1	- requested rate increase

Although BSM is closer to the actual value than Bell, the difference is quite small, and BSM had the advantage of the use of the 1978 data. Few conclusions can be drawn. It is however worth noting that Bell's expense curtailment is negative, both in the 1978 rate projections and in the 1980 rate projections. In its 1980 decision, the Commission directed Bell to further its research on objective methods of estimating expense curtailment.

Until a more clearly defined model of expenses is derived by Bell, it is not possible to do much more with costs.

PART 9 ELASTICITY ANALYSIS

In the 1980 rate case, Bell presented a detailed set of demand models for various components of local and toll services (Bell (CRTC) 03 Apr. 80-809), Bell (CAC) 03 Apr. 80-227). In addition in the 1980 TCTS hearing, Bell also presented a demand model for long distance messages (Bell/BCTEL (CRTC) 04 Feb. 80-219). These models are of the same type as described in the demand section of Part 1 of the Interim Report. Since they are estimated separately from the supply side, they assume a perfectly elastic supply curve - as much output can be supplied at a given price as is necessary to satisfy demand.



Given this assumption, the demand models are very similar - double logarithm; dependent variable constant dollar output; independent variables: constant, real price, real income. However there are three dissimilarities:

a) Period. The BSM models demand from 1952 to 1978, while Bell models from 1973 to 1979.

b) Periodicity. The BSM model uses annual data, while the Bell model uses quarterly data, and three seasonal dummies.

c) Other exogenous variables. The BSM uses POPB (the popu-

lation in Bell territory as a message of market-size; Bell uses different variables with consequently different results.

To ascertain the differences between the models, the Bell model for long distance message service, customer-dialed (101 + miles) was analysed in detail. The model Bell utilizes is shown in Equation 1, Table 32,

where:

QDDL = Non holiday customer-dialed revenues (101 + miles) divided by PDDL, the price index

S1,S2,S3 = 1st, 2nd, and 3rd quarter seasonal binary variable

RCENT = Step binary variable to account for rate centre shifting, 1976 Q4

WKDYS = Number of Saturdays and Sundays in each quarter

PDDL = Price index for 101 + miles customer-dialed

QEMPL = Number of employed persons in Ontario and Quebec

MAIN = Residential and Business main telephones

RAWPGNE = Implicit price deflator of GNE

PDICAN = Personal disposable income, Canada, in current $

CPIOQ = Consumer price index for Ontario and Quebec

All data in quarterly; the regression was run from 1973, Q3 to 1979, Q1.

The results of this regression are shown in Table 32; they are very similar to those shown in Table 9 of Bell (CRTC) 03 Apr.-80-809, Attachment 1. The difference is due to the fact that Bell estimated the three long distance equations simultaneously (SURE) while in this exercise OLS was used.

TABLE 32

ORDINARY LEAST SQUARES

DEPENDENT VARIABLE LQDDL

SUM OF SQUARED RESIDUALS =	.819922E-03
STANDARD ERROR OF THE REGRESSION =	.765283E-02
MEAN OF DEPENDENT VARIABLE =	3.56585
STANDARD DEVIATION OF DEP. VARIABLE =	.192790
R-SQUARED =	.9990
ADJUSTED R-SQUARED =	.9984
F-STATISTIC(8., 14.) =	1743.50
LOG OF LIKELIHOOD FUNCTION =	85.1451
NUMBER OF OBSERVATIONS =	23.000
SUM OF RESIDUALS =	.532907E-11
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	2.2345

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	-35.3560	1.86065	-19.002
QD1	-.103350E-01	.976644E-02	-1.058
QD2	.870664E-02	.560203E-02	1.554
QD3	-.564515E-01	.113467E-01	-5.151
RCENTRE	.148919E-01	.786335E-02	1.894
QDAY	.355046E-02	.394346E-02	.900
LPDDL	-.287533	.651278E-01	-4.415
LQEMPLOQ	.387424	.251973	1.538
LMAIN	2.29819	.231703	9.919

Equation (1)

$$\text{Log (QDDL)} = C0 + C1.S1 + C2.S2 + C3.S3 + C4.RCENT + C5.WKDYS + C6.\ \text{Log(PDDL/RAWPGNE)} + C7.\ \text{Log(QEMPL)} + C8.\ \text{Log(MAIN)}$$

There are a number of problems with Equation (1), and these show-up in the regression results in Table 32.

1) The nominal price is deflated by RAWPGNE, the implicit price of deflator of GNE. However the consumer price index for Ontario and Quebec (CPIOQ) is probably a better index for deflating prices - it measures price trends in consumer goods purchased at the retail level, and so well reflects changes in prices faced by residential users, as well as the change in costs faced by many businesses. (Bell deflated by CPIOQ for Business Main Service).

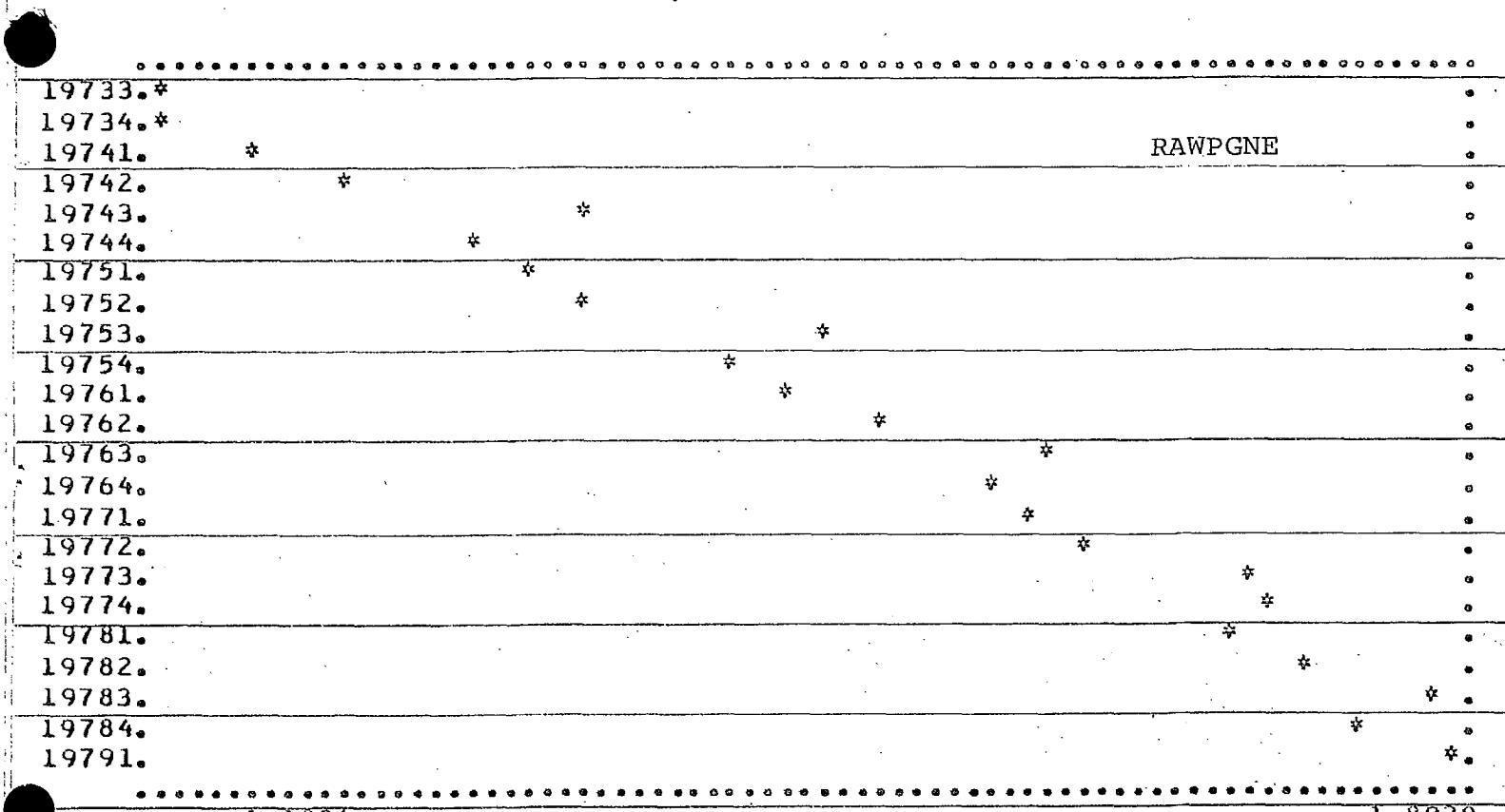
Over the period, both CPIOQ and RAWPGNE increase by the same amount (60%); however while CPIOQ increases smoothly, RAWPGNE has a peak in the 3rd quarter of each year (see Figure 5). All values are seasonally unadjusted (Bell (CRTC) 04 Apr. 80-809, Attachment 1, P.4). There do not appear to be good reasons why a deflator should peak in this manner, and in a previous rate application, the price deflator used by Bell increased monotonically over the sample (Bell (CRTC) 04 Feb. 80-219, Attachment 4, P.5).

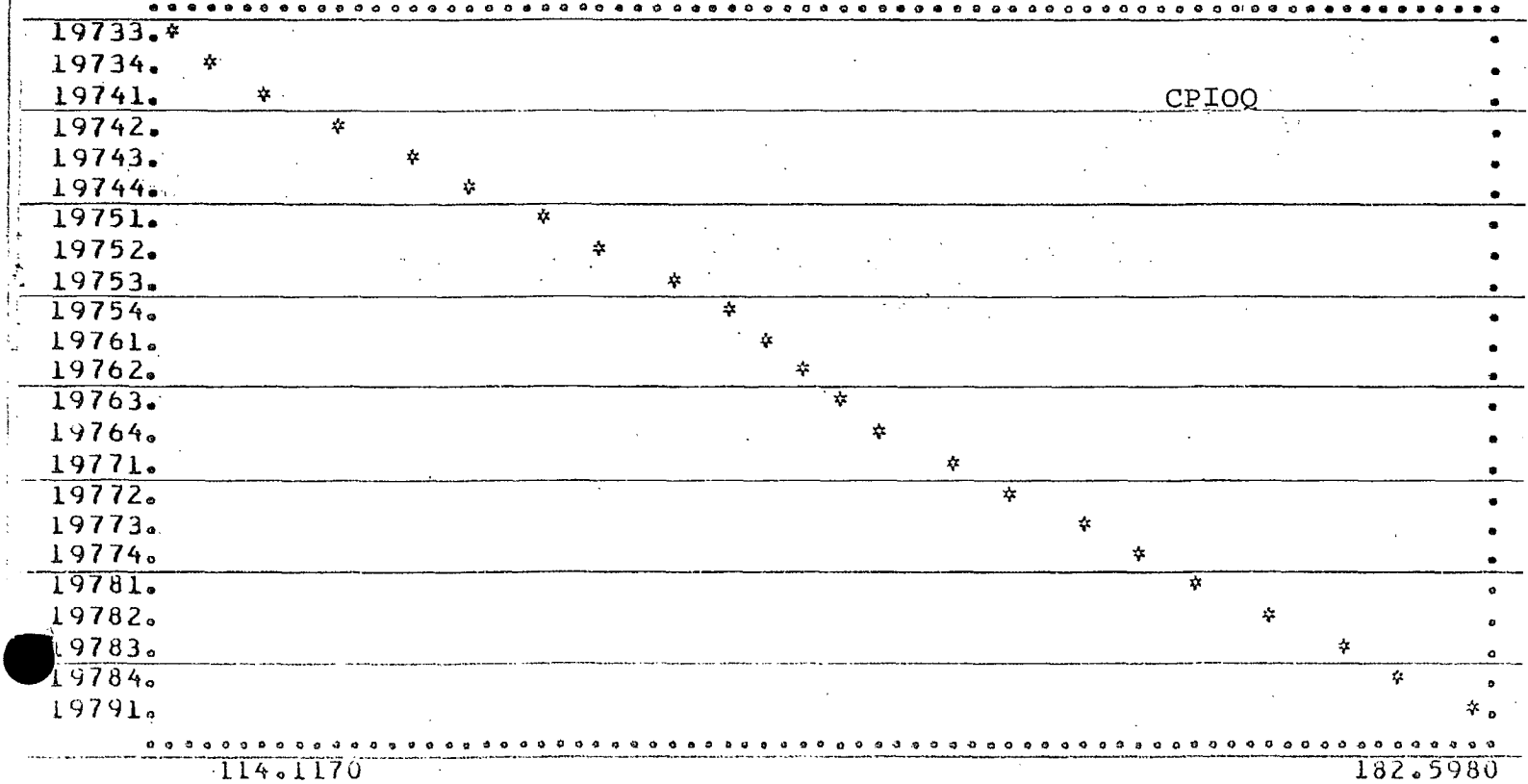
Thus, for these reasons, the regression using Equation (1) was rerun, but using CPIOQ in place of RAWPGNE. Similar results were obtained, except for changes in the seasonal dummies and a change in the price coefficient from -.32 to -.46.

2) From Table 32, the coefficient for the variable QEMPL is not significantly different from zero at the 5% level. This is unacceptable, since this variable is a proxy for the level of economic activity, which Bell has previously stated as being the most important determinant for the demand for long distance messages. Replacing QEMPL by a more usual measure of economic activity - YD, real disposable income in Canada - results in a negative coefficient for the economic

FIGURE 5

TIME SERIES PLOTS OF RAWPGNE AND CPIOQ





activity coefficient (Log (YD)), and a t-statistic of -.15 (see Table 33). Thus the choice of variable for economic activity is not the main problem. Rather, another variable is mopping-up much of the explanation for economic activity. This variable is Ln(MAIN), the number of main telephones.

The use of Ln(MAIN) as a proxy for market-size creates considerable problems in terms of interpretation of the coefficients in the model. The reason is simple; Ln(MAIN) is itself a function of economic activity.

Hence, if

$$Ln(QDDL) = CO + \cdots + C6\ Ln(PDDL/CP1) + C7\ Ln(YD) + C8\ Ln(MAIN)$$

$$\text{then } \varepsilon_{YD} = \frac{\partial Ln(QDDL)}{\partial Ln(YD)} = C7 + C8\ \frac{\partial Ln(MAIN)}{\partial Ln(YD)}$$

and clearly C7 is a biased measure of ε_{YD}.

$$\text{Similarly } \varepsilon_{p} = \frac{\partial Ln(QDDL)}{\partial Ln(PDDL)} = C6 + C8\ \frac{\partial Ln(MAIN)}{\partial Ln(PDDL)}$$

$$= C6 + C8\ \frac{\partial Ln(MAIN)}{\partial Ln(PMAIN)} \cdot \frac{\partial Ln(PMAIN)}{\partial Ln(PDDL)}$$

$\frac{\partial Ln(MAIN)}{\partial Ln(PMAIN)}$ is the own price elasticity of MAIN; $\frac{\partial Ln(PMAIN)}{\partial Ln(PDDL)}$ is close to unity since the correlation between local price and long distance prices over the period is very high.* Thus clearly C6 is a biased measure of ε_{p}. Some idea of the true value of ε_{p} can be determined by evaluating the expression above. Assume that the own price elasticity of local service (including vertical service) is -.53 (from Table 5, Interim Report). If one assumes that the own price elasticity of primary services (MAIN) is say, 1/2 of the own price elasticity of local service, a value for $\frac{\partial Ln(MAIN)}{\partial Ln(PMAIN)}$ of -.26 results.

*Correlation coefficient between local price and price for MTS-intra, 1973-1979 is .9942.

TABLE 33

ORDINARY LEAST SQUARES

DEPENDENT VARIABLE LQDDL

SUM OF SQUARED RESIDUALS =	.916403E-03
STANDARD ERROR OF THE REGRESSION =	.809057E-02
MEAN OF DEPENDENT VARIABLE =	3.56585
STANDARD DEVIATION OF DEP. VARIABLE =	.192790
R-SQUARED =	.9969
ADJUSTED R-SQUARED =	.9982
F-STATISTIC(8., 14.) =	1559.76
LOG OF LIKELIHOOD FUNCTION =	83.8657
NUMBER OF OBSERVATIONS =	23.000
SUM OF RESIDUALS =	.487432E-11
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	2.1406

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	-35.4697	2.19028	-16.194
QD1	-.260311E-01	.819063E-02	-3.176
QD2	.933953E-02	.695143E-02	1.344
QD3	-.334366E-01	.174027E-01	-1.921
RCENTRE	.100901E-01	.759459E-02	1.329
QDAY	.321428E-02	.413400E-02	.778
LPDDL	-.435800	.122744	-3.550
LYD	-.204923E-01	.136819	-.150
LMAIN	2.40035	.184800	12.989

Equation (2)

$$\text{Log(QDDL)} = C0 + C1.S1 + C2.S2 + C3.S3 + C4.RCENT + C5.WKDYS + C6.\ \text{Log(PDDL/CPIOQ)} + C7.\ \text{Log(PDICAN/CPIOQ)} + C8.\ \text{Log(MAIN)}$$

$$\text{Hence, } \xi_p = C6 + C8 \frac{\partial Ln(MAIN)}{\partial Ln(PMAIN)} \cdot \frac{\partial Ln(MAIN)}{\partial Ln(PDDL)}$$

$$= -.4166 + 2.7021. -.26. 1$$

$$= -1.12$$

This is obviously not a rigorous estimation; rather it shows a ballpark estimate of the own price elasticity when the effect of terms non-orthogonal to price is taken into account. This point is discussed in a similar vein in Bernstein* (1980).

What alternatives exist for variables describing market-size. The population of Ontario and Quebec, fifteen years and older is of no use in this sample since, in this sample it is very highly correlated with the number of main telephones (correlation coefficient .998).

Suppose the variable is dropped entirely, on the grounds that effectively full penetration exists; this results from the regression shown in Table 34, (Equation(3)). As can be seen, the coefficient for the income elasticity (.798) is very reasonable, and the price elasticity (-1.20) is in the range that was expected. This regression assumes that market-size and economic activity are effectively represented by the level of total real economic activity in Canada. If the population in Ontario and Quebec grew at the same rate as in Canada, no bias is introduced.

There are grounds for objecting to this approach. The most cogent is that statistically the regression explains less than when MAIN is introduced, as is evident from the lower log of likelihood function. Hence clearly the number of phones does play a role in

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*Jeffrey I. Bernstein. A Corporate Econometric Model of the British Columbia Telephone Company. McGill University Working Paper 80-7, February 1980.

TABLE 34

ORDINARY LEAST SQUARES

DEPENDENT VARIABLE LQDDL

SUM OF SQUARED RESIDUALS =	.119598E-01
STANDARD ERROR OF THE REGRESSION =	.282309E-01
MEAN OF DEPENDENT VARIABLE =	3.56585
STANDARD DEVIATION OF DEP. VARIABLE =	.192790
R-SQUARED =	.9854
ADJUSTED R-SQUARED =	.9785
F-STATISTIC(7., 15.) =	144.365
LOG OF LIKELIHOOD FUNCTION =	54.3239
NUMBER OF OBSERVATIONS =	23.000
SUM OF RESIDUALS =	.439115E-11
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.5850

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	-7.16553	.771324	-9.290
QD1	.213316E-01	.256204E-01	.833
QD2	-.443893E-01	.194983E-01	-2.277
QD3	-.143881	.529934E-01	-2.715
RCENTRE	.731017E-01	.203936E-01	3.585
QDAY	.228540E-01	.134284E-01	1.702
LPDDL	-1.20099	.375822	-3.196
LYD	.798259	.423814	1.884

Equation (3)

$$\text{Log(QDDL)} = C0 + C1.S1 + C2.S2 + C3.S3 + C4.RCENT + C5.WKDYS + C6.\ \text{Log(PDDL/CPIOQ)} + C7.\ \text{Log(PDICAN/CPIOQ)}$$

explaining the demand for message toll services, and incorporating that variable will lead to better fit and (presumably) better predictions, provided that the relationship between local and toll prices remains constant. However, the cost of introducing MAIN is the loss of interpretation of the coefficients for the price and income terms as elasticities; thus the use of such coefficients as measures of elasticity is clearly incorrect.

Hence it is the maintained hypothesis that the demand for toll services is elastic. It is not possible to reject this hypothesis, using Bell's model; indeed, as described above the interpretation of Bell's coefficient supports this hypothesis.

PART 10 SUMMARY

In this report, the building, estimation and validation of a model of Bell Canada (B.S.M.) has been described, and the simulation of this model using four different price scenarios has been undertaken. In addition, the predictive power of this model compared to Bell's 1978 model was undertaken, and a comparison of Bell's 1980 models of demand for toll (101 + miles) with the BSM demand system was also undertaken.

Although both the Bell model and BSM predict similarly for the no rate increase case, there are large differences with respect to the other scenarios. These differences occur largely as a consequence of different elasticity assumptions. This has a significant public policy impact, since with an elastic demand for toll, increased revenues come about from reducing prices; while if the demand is inelastic, increased revenues come about from raising prices.*

These simulations do however suggest that, even with the CRTC rate increase, Bell will face declining returns to capital and common equity in 1981 to 1983, and that, as a consequence, Bell will be forced to reapply for yet another rate increase in the near future. In times of inflation, it may be worth while to reconsider whether a full rate hearing is necessary every year. Indeed, it may be socially desirable to allow a certain degree of indexing, and to reserve full rate hearing for restructuring rates.

The comparison of the Bell model and BSM showed that both models predicted 1979 local revenues well, (though Bell was more accurate than BSM), but that BSM performed distinctly better than Bell in the case of message toll. The results do not necessarily hold for the

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*See J. Breslaw and J.B. Smith, Equity, Efficiency and Regulation; The Case of Bell Canada. IAER, 1980.

1980 prediction, since the models employed by Bell on the demand side for 1980 are much more sophisticated than those used in 1978.

The analysis of the toll demand model constructed by Bell for the 1980 predictions showed that they would correctly predict revenues for toll provided the relative prices of local and toll remained approximately unchanged. However, the analysis also showed that the coefficients could not be interpreted as elasticities, and that curtailment estimates based on such coefficients are biased.

It is reasonable to predict that the evaluation and comparison of econometric models will become a feature of future regulatory hearings. It thus becomes essential for the regulatory body to have in-house capability both for the formulation, estimation and simulation of models, as well as for the evaluation of models proposed by Bell. Eventually the technical differences that ensues from such a process will generate discussion at the technical level between personnel from Bell and from the regulatory body. This process should be activly encouraged, since such discussion produces a cooperative approach to modelling Bell, and, eventually, to regulating Bell. It is much healthier to regulate in such a spirit than in the antagonistic atmosphere generated through the legalistic nature of present regulatory hearings.

SIMULATIONS OF BELL CANADA UNDER VARIOUS RATE SCENARIOS

Report # 3

Jon A. Breslaw

September 30th, 1980

TABLE OF CONTENTS*

*Continuation from Report # 2

INTRODUCTION

Report # 3 is the third report in a series describing the simulation of Bell Canada under a set of different price scenarios. The building and historical tracking of the model is described in Report # 1 (Interim Report), and a number of scenarios are simulated and described in Report #1 and #2, as shown below. Two further simulations are carried out in this report and are described in Part XI. Hence the following predictions have been carried out.

Report # 1 a) Constant 1979 prices
b) Bell's requested price

Report # 2 c) CRTC approved prices
d) Inflation price

Report # 3 e) Constant 1979 price for toll, inflation price for local
f) Constant 1979 price for toll, 13% p.a. price increase for local.

In Part XII, an additional analysis of demand is undertaken; demand functions for each of the components of message toll are estimated in order to compare price elasticities.

The results are summarized in Part XIII.

PART XI PREDICTION (COND)

From the results shown in Table 28, it is clear that even under the most favourable scenario (inflation prices for local and message toll, taken as an annual increase of 9.17%) the % return on capital is only in the order of 9%, and the % return on average common equity is only 9.6% in 1981 and 9.75% in 1983. The CRTC in its 1980 decision expected a return on common equity for 1980 to be between 11.2% and 11.6%. What price changes would permit such a rate of return?

By studying the four previous scenarios, the following points are observed:

a) The effect on net revenue of a price increase on local services is positive. This follows from an inelastic demand, and hence an increased revenue from a price increase, and a decreased cost, since less local output is produced.

b) The effect on net revenues of a price increase or message toll is negative. This follows from an elastic demand, and hence a demand revenue from a price increase, and a decreased cost, since less toll output is produced. The revenue however declines faster than cost, resulting in a decline in net revenues.

Thus to increase net revenues, the necessary strategy is to increase the price of local services, and to decrease (or at least not increase) the price of message toll services. Two scenarios were undertaken.

SCENARIO V: In each year 1980-1983, a price increase equal to the percentage increase in CPI (9.17%) is in effect for local services, while the constant 1979 nominal price remains in effect for MTS.

SCENARIO VI: In each year 1980-1983, a 13% price increase is in effect for local service, while the constant 1979 nominal price remains in effect for MTS.

The predicted level of outputs, revenues, factors and costs for Scenarios V is shown in Table 35 and the income statement in Table 36. Tables 37 and 38 repeat this information, but for Scenario VI.

A comparison of Table 26 (income statement under inflation prices, Scenario IV) and Table 36 shows identical local revenue, since in both cases local prices increased by the rate of inflation. Toll revenue now has increased in Table 36, compared to Table 26, as expected - indeed it is identical to the revenue shown for Toll in Table 17 (constant 1979 prices). Thus total revenue has increased in Scenario V compared to Scenario IV). Since more output (of MTS) is produced in Scenario V, higher expenses would be expected, and indeed occur. The revenues from MTS have increased faster than the expenses, resulting in higher net operating revenues in Scenario V than Scenario IV. The net effect is to increase the % return on both average common equity and average total capital, though not by a huge amount; by 1983 the % return on average total capital has increased by .4 points from 9.2% to 9.6%, and the % return to average common equity has increased by 1 point, from 9.75% to 10.78%. Thus this set of prices does not produce sufficient

TABLE 35

PREDICTED VALUES-SCENARIO V

	PLOC	PTOL
1978	1.47590	1.34368
1979	1.57600	1.41455
1980	1.72034	1.41455
1981	1.87811	1.41455
1982	2.05047	1.41455
1983	2.23871	1.41455

	QLOCS	RLOCS	QTOLS	RTOLS
1979	873.619	1376.82	757.838	1072.00
1980	895.967	1541.37	866.243	1225.35
1981	917.336	1722.86	987.768	1397.25
1982	937.849	1923.03	1124.04	1590.01
1983	957.596	2143.78	1276.87	1806.20

	LS	MS	KS	COSTS
1979	75.3802	283.408	4347.25	2907.20
1980	75.1133	303.946	4537.10	3301.28
1981	76.7844	314.688	4720.61	3719.05
1982	78.7018	323.969	4905.25	4166.34
1983	80.7631	332.626	5093.79	4649.42

TABLE 36

INCOME STATEMENT-SCENARIO V

INCOME STATEMENT - BELL CANADA

	1979.	1980.	1981.	1982.	1983.
TELECOM. OPERATIONS					
LOCAL REVENUE	1376.82	1541.37	1722.86	1923.03	2143.78
TOLL REVENUE	1281.52	1468.46	1679.35	1917.35	2186.02
MISC. REVENUE (NET)	94.80	114.18	116.44	127.80	120.30
TOTAL OPERATING REVENUES	2753.14	3124.01	3518.64	3968.17	4450.10
TOTAL OPERATING EXPENSES	2057.73	2333.64	2637.49	2966.00	3322.98
NET OPERATING REVENUES	695.42	790.37	881.16	1002.18	1127.12
OTHER INCOME	80.84	73.01	82.78	93.87	106.43
INCOME BEFORE UNDER ITEMS	776.26	863.38	963.94	1096.04	1233.55
INTEREST CHARGES	264.55	297.23	332.91	371.09	412.06
INCOME AFTER INTEREST	511.71	566.15	631.03	724.95	821.49
AMORTIZATION FXLTD	-9.89	-10.01	-10.01	-10.01	-10.01
INCOME BEFORE INCOME TAX	501.82	556.14	621.02	714.94	811.48
INCOME TAX	226.71	253.09	283.89	328.05	373.20
NET INCOME - TELECOM.	275.11	303.05	337.14	386.90	438.28
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	31.18	34.43	34.82	35.00	36.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	306.29	337.48	371.96	421.90	474.28
EXTRAORDINARY ITEM	29.84	0.00	0.00	0.00	0.00
INCOME AFTER EXTRA. ITEM	336.12	337.48	371.96	421.90	474.28
PREFERRED SHARE DIVIDEND	40.93	44.62	48.67	53.10	57.94
INCOME APPLIC. TO COMMON	295.19	292.86	323.29	368.80	416.34
% RETURN ON AVE. COM. EQTY.	10.23	10.21	10.21	10.54	10.78
% RETURN ON AVE. TOT. CAP.	9.09	9.17	9.25	9.45	9.60

TABLE 37

PREDICTED VALUES-SCENARIO VI

	PLOC	PTOL
1978	1.47590	1.34368
1979	1.57600	1.41455
1980	1.78088	1.41455
1981	2.01255	1.41455
1982	2.27417	1.41455
1983	2.56888	1.41455

	QLOCS	RLOCS	QTOLS	RTOLS
1979	873.619	1376.82	757.838	1072.00
1980	879.685	1566.61	866.243	1225.35
1981	884.314	1779.73	987.768	1397.25
1982	887.742	2018.87	1124.04	1590.01
1983	890.227	2286.89	1276.87	1806.20

	LS	MS	KS	COSTS
1979	75.3802	283.408	4347.25	2907.20
1980	74.3468	300.844	4490.81	3267.59
1981	75.2260	308.302	4624.81	3643.57
1982	76.3219	314.172	4756.91	4040.35
1983	77.5349	319.330	4890.18	4463.58

TABLE 38

INCOME STATEMENT-SCENARIO VI

INCOME STATEMENT - BELL CANADA

	1979.	1980.	1981.	1982.	1983.
TELECOM. OPERATIONS					
LOCAL REVENUE	1376.82	1566.61	1779.73	2018.87	2286.89
TOLL REVENUE	1281.52	1468.46	1679.35	1917.35	2186.02
MISC. REVENUE (NET)	94.80	114.18	116.44	127.80	120.30
TOTAL OPERATING REVENUES	2753.14	3149.25	3575.52	4064.02	4593.21
TOTAL OPERATING EXPENSES	2057.73	2322.69	2606.43	2906.52	3227.04
NET OPERATING REVENUES	695.42	826.57	969.09	1157.51	1366.17
OTHER INCOME	80.84	73.01	82.78	93.87	106.43
INCOME BEFORE UNDER ITEMS	776.26	899.58	1051.87	1251.37	1472.60
INTEREST CHARGES	264.55	297.09	332.45	370.11	410.33
INCOME AFTER INTEREST	511.71	602.49	719.42	881.26	1062.28
AMORTIZATION FXLTD	-9.89	-10.01	-10.01	-10.01	-10.01
INCOME BEFORE INCOME TAX	501.82	592.48	709.41	871.25	1052.27
INCOME TAX	226.71	270.27	325.67	401.94	487.04
NET INCOME - TELECOM.	275.11	322.21	383.74	469.31	565.23
CONTRACT OPERATIONS					
NET INCOME - CONTRACT	31.18	34.43	34.82	35.00	36.00
NON-CONSOLIDATED					
INCOME BEFORE EXTRA. ITEM	306.29	356.64	418.56	504.31	601.23
EXTRAORDINARY ITEM	29.84	0.00	0.00	0.00	0.00
INCOME AFTER EXTRA. ITEM	336.12	356.64	418.56	504.31	601.23
PREFERRED SHARE DIVIDEND	40.93	44.62	48.67	53.10	57.94
INCOME APPLIC. TO COMMON	295.19	312.02	369.89	451.21	543.28
% RETURN ON AVE. COM. EQTY.	10.23	10.93	11.77	13.06	14.30
% RETURN ON AVE. TOT. CAP.	9.09	9.48	9.92	10.53	11.11

revenue to satisfy the CRTC's goal of 11.2 - 11.6% on common equity, even by 1983. Indeed in 1981, the return to common equity is only 10.2%.

A comparison of Tables 36 and 38 shows the effect of Scenario VI. In this scenario local price increased by 13% in each year 1980-1983. The effect is to increase local revenue and to decrease total operating expenses; toll revenue remains unchanged. Thus net revenues increase substantially.* The effect is dramatic; by 1981 the return on average common equity (11.77%) exceeds the CRTC's goal of 11.2 - 11.6%, and by 1983 the return to common equity (14.3%) falls in the range that Bell considers to be "reasonable" (13.5 - 14.5%) (B 78-50, p.5, reference to 1979).

Simulations V and VI suggest that it is not impossible for Bell to achieve rates of return on common equity significantly higher than achieved in 1979. There are however questions of equity to be considered. The CRTC must necessarily balance the needs of Bell as a viable corporation, with stockholders to satisfy, and also the needs of both residential and business users. This will always involve a trade-off. However, there exists two methods for achieving any given level of rate of return on average common equity that the CRTC may decide on as necessary for the financial health of the company.

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*Note, however that the model is not well-behaved with respect to toll, since the marginal revenue curve crosses the marginal cost curve from below. Although this does not significantly affect the estimates of costs in the observed region, it does imply that net revenues are increasing as toll quantity increases, over the entire range. This is not reasonable, and consequently the return on on capital and common equity will be biased high. This problem has been resolved in the model currently being developed at the IAER, Montreal.

a) Adjust prices so as to achieve the necessary net operating revenues.

b) Adjust the taxing mechanism (accelerated depreciation, tax credits, etc) so as to achieve the necessary after tax income.

The details of alternative b) are beyond the scope of this study, though clearly the implication of such tax changes should be investigated.

There exist many sets of prices that will guarantee the same level of net operating revenue. Since Bell is indifferent to which set is chosen, the set chosen should be those which maximize welfare. A partial study of this problem is undertaken in Breslaw and Smith (1980). In this work, the question asked was what direction should prices move to maximize the welfare of residential users, given a constraint of a given net revenue, or alternatively, a constraint of a given rate of return on average total capital. The conclusion drawn was that message toll rates should decline considerably, and that local rates should increase by a small amount. This result is obviously similar to Scenario VI.

PART XII DEMAND ESTIMATION

In Part III, the estimation of the demand system is described. To recapitulate, the two demand equations for local and message toll services were estimated simultaneously, using seemingly unrelated regression estimation (SURE); the results were shown in Table 5. There are some problems using this methodology, since the supply side of the problem is ignored; effectively this assumes a perfectly elastic supply curve (see discussion in Part IX).

Given this proviso, this method provides estimates of elasticity, ie. -.53 for QLOC, and -1.30 for QTOL. QLOC and QTOL however are highly aggregate measures of output, and it was considered interesting to investigate the price elasticity at a finer level of disaggregation.

QLOC consists of both residential and business local service. The separate estimation of each of these is described in Breslaw and Smith (1980), Section 5.1, and the results are shown in Table 5.2 of that report, and are reproduced in Table 39. As can be seen residential demand shows a lower price elasticity than the aggregate (-.395) and business demand shows a higher price elasticity (-.706). However the hypothesis that the price elasticity is -.53 cannot be rejected in either case.

A more interesting analysis of QLOC would be the separate estimation of basic primary service, and of vertical services. Unfortunately the necessary data was not available, and thus this exercise could not be undertaken. Given the importance of basic primary service in the regulatory process, this data deficiency should be corrected.

TABLE 39

BUSINESS AND RESIDENTIAL LOCAL DEMAND EQUATIONS

RESIDENTIAL

Parameter	Estimate	Standard Error
RA_0	-3.365*	1.067
RA_1	-.395*	.115
RA_2	.337*	.153
RA_3	.924*	.141
RA_4	.429*	.179
RD_1	.039*	.016
RD_2	.027*	.015
D.W. 1.05	LOG OF LIKELIHOOD	75.068

BUSINESS

BA_0	-5.492*	.815
BA_1	-.706*	.104
BA_2	.492*	.126
BA_3	1.140*	.109
BA_4	.434*	.165
BD_1	.062*	.016
BD_2	.028*	.014
D.W. 1.56	LOG OF LIKELIHOOD	77.071

Source: Table 5.2, Breslaw and Smith (1980)

In the case of message toll, disaggregation is possible. QTOL is an aggregate* of four separate services; these are:

a) INTRA - Intra Bell territory toll

b) TRANS - Adjacent and Trans Canada toll

c) USO - U.S. and Overseas toll

d) WATS - Wide area toll service

All outputs are in constant $1967 revenues.

Five separate demand estimations were undertaken, using ordinary least squares. The form of the demand equation is exactly of the form of FRML DEMM, in Printout 1, p.4, except the output variable (QTOL in the printout) is changed to the respective output, and the price term (PTOL) is similarly changed. The results are shown in Tables 40 to 44, and are summarized below:

Output	Period**	Table	Price Elasticity & t-statistic	
QTOL	1952-1978	40	-1.208	(8.5)
INTRA	1952-1978	41	-1.012	(6.2)
TRANS	1957-1978	42	-1.609	(5.5)
USO	1952-1978	43	-1.328	(4.8)
WATS	1967-1978	44	-0.982	(1.1)

In each of five equations, B2 is the coefficient for real price (nominal price deflated by CPI), B3 is the coefficient for the real income term (personal consumption expenditure deflated by CPI) and B4 is the coefficient for the population in Bell's territory. All variables are expressed as logarithms. RT1 and RT2 are step binary variables for the introduction of DDD (1959) and the introduction of the one minute charged call (1971).

*It is in fact a quantity divisia index of intra, trans, USO and WATS.

**The initial years were excluded for WATS and TRANS, since the services were new and the demand had not yet stabilized. Judgement was used to establish the initial year of estimation.

TABLE 40

DEMAND ESTIMATION - QTOL

DEPENDENT VARIABLE ONE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
B0	-7.55763	1.84394	-4.099
B2	-1.20817	.142527	-8.477
B3	1.10582	.225586	4.902
B4	.502706	.245572	2.047
RT1	.220696E-01	.234674E-01	.940
RT2	.322513E-01	.363978E-01	.886

LOG OF LIKELIHOOD FUNCTION =	107.110
R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.6048
SUM OF SQUARED RESIDUALS =	.566461E-03
STANDARD ERROR OF THE REGRESSION =	.519368E-02
SUM OF RESIDUALS =	.566462E-03
NUMBER OF OBSERVATIONS =	27.000
MEAN OF DEPENDENT VARIABLE =	.999999

TABLE 41

DEMAND ESTIMATION - INTRA

DEPENDENT VARIABLE ONE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
B0	-5.77616	2.07554	-2.783
B2	-1.01225	.164286	-6.162
B3	.911508	.254243	3.585
B4	.461421	.282235	1.635
RT1	.264646E-01	.291176E-01	.909
RT2	.369888E-01	.461953E-01	.801

LOG OF LIKELIHOOD FUNCTION =	99.8885
R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.4194
SUM OF SQUARED RESIDUALS =	.967118E-03
STANDARD ERROR OF THE REGRESSION =	.678625E-02
SUM OF RESIDUALS =	.967119E-03
NUMBER OF OBSERVATIONS =	27.000
MEAN OF DEPENDENT VARIABLE =	.999999

TABLE 42

DEMAND ESTIMATION - TRANS

DEPENDENT VARIABLE ONE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
B0	-9.32405	3.37260	-2.765
B2	-1.60900	.292455	-5.502
B3	1.04208	.360201	2.893
B4	.533949	.267868	1.993
RT1	.798176E-01	.223547E-01	3.571
RT2	.188169E-01	.373234E-01	.504

LOG OF LIKELIHOOD FUNCTION =	75.5229
R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.5477
SUM OF SQUARED RESIDUALS =	.134340E-02
STANDARD ERROR OF THE REGRESSION =	.916310E-02
SUM OF RESIDUALS =	.134340E-02
NUMBER OF OBSERVATIONS =	22.000
MEAN OF DEPENDENT VARIABLE =	.999999

TABLE 43

DEMAND ESTIMATION - USO

DEPENDENT VARIABLE ONE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
B0	-12.9260	3.49269	-3.701
B2	-1.32794	.277064	-4.793
B3	1.29933	.445167	2.919
B4	1.11722	.516663	2.162
RT1	.392149E-01	.361442E-01	1.085
RT2	-.357913E-01	.608731E-01	-.588

LOG OF LIKELIHOOD FUNCTION =	80.7804
R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.2739
SUM OF SQUARED RESIDUALS =	.398279E-02
STANDARD ERROR OF THE REGRESSION =	.137716E-01
SUM OF RESIDUALS =	.398279E-02
NUMBER OF OBSERVATIONS =	27.000
MEAN OF DEPENDENT VARIABLE =	.999999

TABLE 44

DEMAND ESTIMATION - WATS

DEPENDENT VARIABLE ONE

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
B0	-30.6494	10.3398	-2.964
B2	-.981973	.871440	-1.127
B3	1.78342	.974409	1.830
B4	5.71770	1.31233	4.357
RT2	.508944E-02	.644660E-01	.079

LOG OF LIKELIHOOD FUNCTION =	40.3436
R-SQUARED =	*******
DURBIN-WATSON STATISTIC (ADJ. FOR 0. GAPS) =	1.8260
SUM OF SQUARED RESIDUALS =	.844383E-03
STANDARD ERROR OF THE REGRESSION =	.109830E-01
SUM OF RESIDUALS =	.844383E-03
NUMBER OF OBSERVATIONS =	12.000
MEAN OF DEPENDENT VARIABLE =	.999999

In general, these results confirm the accepted wisdom - the longer the mileage band, the more elastic the demand. The shortest mileage band, on average, will be intra Bell territory toll (INTRA), with a price elasticity of -1.012. USO is a mix of calls to the U.S. and Overseas; TRANS is a mix of calls to Nova Scotia and Manitoba (Adjacent) and the remaining provinces (Trans-Canada). It is not possible to state which has the longer mileage band without additional data; however both will have longer hauls than INTRA, and both show considerable higher price elasticities (-1.328 and -1.607). The results for WATS was inconclusive, since the price elasticity of -.982 was not statistically significantly different from zero. Note that the aggregate elasticity of QTOL (-1.208) falls nicely in the range of the disaggregated estimated service price elasticities.

PART XIII SUMMARY

In this, the 3rd report of the series "Simulations of Bell Canada under Various Rate Scenarios", two additional scenarios were evaluated. These consisted of holding the price of toll constant at the 1979 level, and allowing the price of local to increase by 9.17% (inflation rate) and 13% per annum respectively for each year 1980-1983. Although the first simulation showed an improvement in % return to common equity compared to the previous best "simulation" (Scenario IV), it is only in the last simulation that a rate of return to common equity approaches a level that Bell has stated as acceptable (13.5 - 14.5%, reached in 1983). An increase in the price of local, and a decrease in the price of toll is also just the strategy suggested by Breslaw and Smith (1980) in attempting to maximize the welfare of residential users, consistant with a given net revenue (or rate of return to average total capital) for Bell. Thus there appear to be good reasons for applying this strategy in practice.

Finally, an estimation of the price elasticity of the components of QTOL was carried out. The results supported in general the accepted wisdom - ie. a longer haul results in a larger absolute price elasticity.