Short Term Forecasting of Transport and Communications Activity

Working Paper

This Paper provides a description of the short-term forecasting models used in the Bureauís quarterly publication - Transport and Communications Indicators. For domestic freight, four models cover intercapital road freight, non-bulk government rail freight, bulk government rail freight and domestic air freight. Urban freight activity is not covered. For overseas trade there are also four models: bulk export tonnages, non-bulk import tonnages, air freight exports and air freight imports.

Bureau of Transport and Communications Economics

WORKING PAPER 2

SHORT-TERM FORECASTING OF TRANSPORT AND COMMUNICATIONS ACTIVITY

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FOREWORD

The Bureau of Transport and Communications Economics includes in its quarterly publication *Transport and Communications Indicators* short-term projections of selected activity variables.

In this paper, a brief description of the models now in use to compile these projections is presented. By their very nature, these models are preliminary in character. They are presented as a guide to the current state of the modelling.

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ABSTRACT

This paper provides a description of the short-term forecasting models used in the Bureau's quarterly publication *Transport and Communications Indicators*.

For domestic freight, four models cover intercapital road freight, non-bulk government rail freight, bulk government rail freight and domestic air freight. Urban freight activity is not covered. For overseas trade there are also four models: bulk export tonnages, non-bulk import tonnages, air freight exports and air freight imports.

In the motor vehicle area, sales of petrol and of new automobiles are modelled.

There are three models of aviation passenger activity: domestic airline activity, international airline foreign arrivals and international airline departures by Australians.

A single model covers interstate rail passengers. In the telecommunications area, two models covered the areas of OTC calls and Telecom trunk calls. The final model in the set is for urban public transport demand.

SUMMARY

The Bureau of Transport and Communications Economics recently started producing five to seven quarter ahead forecasts of transport and communications activity from a suite of short-term forecasting models.

These models were developed to enable projections to be presented in the Bureau's quarterly publication *Transport and Communications Indicators*. After requests from users of the publication, it became obvious there was a need to document the models underlying the short-term forecasts.

It has been found possible to create a suite of forecasting models that cover many areas within the transport and communications sector. The models have been designed to be simple, with a minimum of disaggregation. This has been done in accordance with a conscious strategy aimed at extending coverage widely over the sector.

The resulting models are simple demand equations that have proved useful in the Bureau of Transport and Communications Economics forecasting activities. Activity levels in the various areas were specified to be a function of national income and price factors applicable to the mode. The equations thus 'translate' exogenous forecasts of the latter two variables into forecasts of transport activity.

In the area of domestic freight, four models were constructed covering intercapital road freight, non-bulk government rail freight, bulk government rail freight and domestic air freight. Urban freight activity is not covered.

In the overseas trade area there were also four models. These covered bulk export tonnages, non-bulk import tonnages, air freight exports and air freight imports.

In the motor vehicle area, sales of petrol and of new automobiles were modelled.

Three models of aviation passenger activity were constructed. These were domestic airline activity, international airline foreign arrivals and international airline departures by Australians.

A single model covered interstate rail passengers, while in the telecommunications area, two models covered the areas of OTC calls and Telecom trunk calls. The final model in the set is for urban public transport demand.

In general, the models fitted the data extremely well. The average model explained about 95 per cent of the variation in activity, with turning points well predicted.

The Bureau of Transport and Communications Economics plans to maintain, develop and use these models for forecasting purposes. In addition, modelling is being extended to other areas of transport and communications activity. Models developed in the future will be the subject of further Working Papers.

CHAPTER 1 INTRODUCTION

The BTCE recently started producing five- to seven-quarter-ahead forecasts of transport and communications activity from these models. The forecasts have been used to make its *Transport and Communications Indicators* publication both analytical and forward-looking.

The models are the subject of ongoing development and maintenance activity and are presented as preliminary models only. They have been deliberately designed to be simple, with a minimum degree of disaggregation. This has been done as part of a conscious strategy aimed at allowing a small staff adequate time to refine, maintain and develop models which would give as wide as possible a coverage of the sector.

The simplicity in design extends to the choice of explanatory variables. In the basic model aimed at, activity is explained by a combination of national income and price factors applicable to the mode and competitive modes. Only if the basic model failed to provide an adequate explanation, were further mode-specific factors investigated. The aim was to keep the number of explanators in the total set to a minimum, and therefore the labour input by staff in obtaining forecasts also to a minimum. BTCE staff assemble data for many of the series used (from State authorities, transport companies, etc.). These data series reside in the Transport and Communications Indicators Database, which must also be updated regularly.

Thus, given the heavy workload for a small staff, the design aim has been simplicity. This means an avoidance of disaggregation and, wherever possible, a standardisation and commonality among explanators. These

considerations should be borne in mind when examining the specifics of the equations.

The following chapters present the details of the models constructed, starting with those in the domestic freight area.

CHAPTER 2 DOMESTIC FREIGHT

The four models developed in the domestic freight area all involve the non-urban freight task. The intercapital road freight model looks at trucking between the major mainland state capitals. Non-bulk government rail freight involves mostly intrastate non-bulk traffic. Bulk government rail freight measures the movement of such things as wheat and coal from inland areas to coastal terminals for export. Finally domestic air freight is dominated by movement between major urban centres.

The major areas of the domestic freight task not covered by these four models are urban and intrastate trucking and the private railways (such as the iron ore railways in Western Australia).

INTERCAPITAL ROAD FREIGHT

Movements of freight by road between the various capital cities in Australia are quite important in terms of tonnage. However, there have been few previous attempts at modelling them because of data difficulties. In the present paper the method used to overcome these difficulties is described in detail in appendix II.

It is estimated that road freight between the five major mainland capitals rose from about 1000 million tonnes per quarter in 1971-72 to about 2500 million tonnes per quarter in 1987-88. This represents a compound growth rate of about 4.7 per cent per year. By contrast, real growth in the economy over the same period averaged about 3.0 per cent per year.

During the same period since 1971-72 real road freight rates have approximately halved, with the carrying capacity of an

average truck increasing and travel time decreasing with better highways. The road freight industry has benefited from an increasing demand for door-to-door flexibility and speed in shipments, and has been increasing its modal share of traffic over this period at the expense of rail and coastal shipping.

Intercapital road freight equation

The dependent variable in this equation represents millions of tonnes of road freight both ways between Sydney-Brisbane, Sydney-Melbourne, Sydney-Adelaide, Melbourne-Brisbane, Melbourne-Adelaide, and the eastern States to Perth. The estimates are based on Australian Bureau of Statistics (ABS) partial survey data which is then inflated by a constant adjustment factor to account for that proportion of the traffic the ABS survey does not cover (see appendix II for details).

The main independent variable is the log of real non-farm gross domestic product at constant 1984-85 prices (ln RGNF85).

In addition, there are two sets of seasonal dummies. One set covers the period 1971 quarter 3 to 1979 quarter 2, and another the period 1982 quarter 3 to 1988 quarter 4. These two periods represent data sourced from an early experimental ABS survey of freight forwarders and the current survey respectively. It was felt that due to differences in data coverage, there were likely to be different patterns of seasonality in the two data sets.

All data used in the equation is listed in appendix I, and the variable mnemonics are listed in appendix III. The form of the equation was double-log, and due to a suggestion of autocorrelation, estimation was by the Cochrane-Orcutt iterative technique with a value for Rho of 0.57. The details of the estimated equation are given in table 2.1.

TABLE 2.1 ESTIMATED EQUATION FOR INTERCAPITAL ROAD FREIGHT

Variable	*Estimated coefficient*	*t statistic*
Constant	-8.4615	-9.3
ln RGNF85	1.4891	17.6
DT1	-0.1581	-10.4
DT2	-0.0804	-4.7
DT3	0.0061	0.4
DT11	-0.0872	-5.1
DT21	-0.0442	-2.3
DT31	-0.0264	-1.6

Dependent variable - ln TFRT.
Estimation method - Cochrane-Orcutt, Rho = 0.57.
Adjusted R^2 - 0.98.
Durbin-Watson statistic - 1.83.
Estimation period - 1971Q3 to 1979Q2 and 1982Q3 to 1988Q4.

Note For an explanation of variable mnemonics, see appendix III.

The fit of estimated and actual values is shown in figure 2.1. The fit is extremely close with an adjusted R^2 of 0.98 using only income as a major variable.

The elasticity of the income variable (1.4891) indicates that intercapital road freight tonnages grew with increasing national income, but they grew 46 per cent more quickly.[1] If one simply takes growth rates from 1971-72 to 1987-88 of 4.7 per cent for road freight and 3.0 per cent for the economy - a ratio of 1.57 is achieved. This is similar to the result obtained from the econometric estimation.

Road (own-price) and rail (cross-price) freight rate variables were tried in the estimation but were insignificant, and so were dropped. The problem from an econometric point of view is termed multicollinearity, which prevents an adequate 'disentangling' of the separate effects

1. Coefficients are presented to four decimal places of accuracy. This is because all of the models fitted in this paper are double-log models, which require such accuracy.

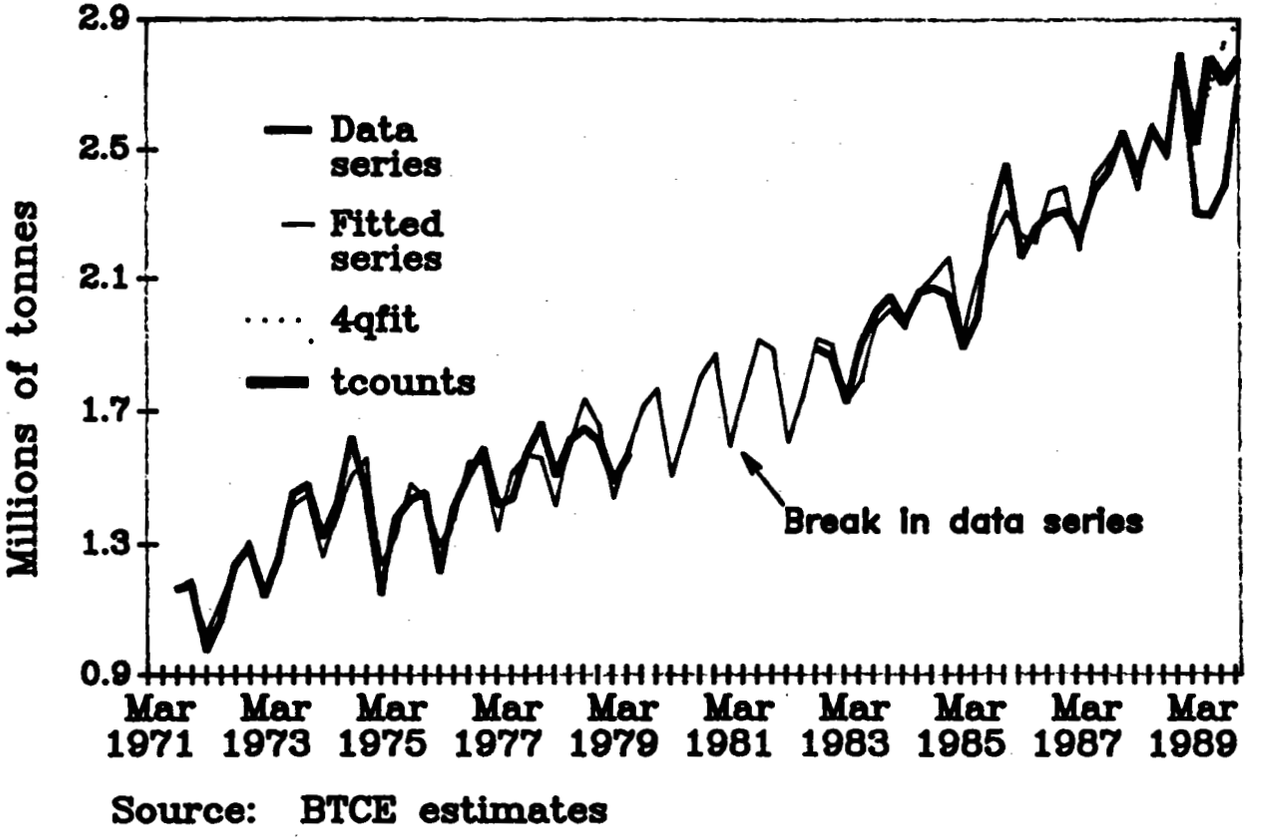

Figure 2.1 Intercapital road freight and fit

of price and income. These difficulties in estimation do not mean that the expected price effects would not be evident if, for instance, major changes in relative modal efficiencies were to emerge from micro-economic reform. For example, improvements in the cost or transit times of rail or sea relative to road, or increases in road cost recovery, could lead to changes in road freight tonnage that would not be predicted by the simple model based on income.

The high income elasticity (1.4891) might not be indefinitely sustainable. The income variable might well be picking up the effect of some technological diffusion or infrastructure development that will not persist in the long run. In addition, there might be a need in longer-term forecasting of the industry, to move to a corridor by corridor break-up to catch the effect of diverging longer-term regional economic activity trends.

However, for use in short-run forecasting the model is quite useful. Figure 2.1 presents the results of rolling four-quarter-ahead forecasts done by the BTCE. These are compared to estimates based on truck counts at Marulan, and to the ABS 'actual' data for March 1989 to December 1989. The comparison shows good agreement between the estimates from truck counts (in the past able to predict 95 per cent of the variation in the actual series) and the four-quarter-ahead BTCE forecasts. However, the ABS 'actual' data diverges markedly for the first three quarters of 1989, before returning to closer agreement in the December quarter. This raises the possibility of some unknown shift in the coverage of the ABS survey of freight forwarders in the three low quarters.

The four-quarter forecasting powers of the equation (measured against the truck movement estimates) is shown by a Theil coefficient of 0.02.

NON-BULK GOVERNMENT RAIL FREIGHT

Non-bulk freight currently constitutes only about 15 per cent of freight carried on the government rail systems.

Furthermore, of the total non-bulk task, only about a quarter of it involves shipping goods between the major State capitals. Thus for the government rail systems, the non-bulk freight task is small in terms of tonnages, and focused on intrastate traffic.

Non-bulk government rail freight equation

The dependent variable in this equation is the log of non-bulk government rail freight tonnages (ln NBULKRF). As can be seen from figure 2.2, the basic movement in non-bulk rail freight is a slow upward movement, interrupted by recessions such as that of 1982-83. In the model, this movement in tonnages was found to be best replicated by combining a high weighting on income with a negative time trend (TIME). Thus the high coefficients on the income (ln RGNF85) variables in table 2.2 should not be read in isolation as elasticities.

TABLE 2.2 ESTIMATED EQUATION FOR GOVERNMENT NON-BULK RAIL FREIGHT

Variable	*Estimated coefficient*	*t statistic*
Constant	-28.3918	-8.2
ln RGNF85	1.2354	2.5
ln RGNF85(-1)	1.9688	3.7
ln RGNF85(-4)	1.1015	3.3
TIME	-0.0371	-15.2
ln RINTER(-1)	-2.4542	-7.6
ln RROADPR	0.6628	3.3
RDISPDUM	-0.1754	-6.2
D1	-0.2157	-13.8
D2	-0.1409	-8.9
D3	-0.0175	1.1

Dependent variable - ln NBULKRF.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.94.
Durbin-Watson statistic - 2.38.
Estimation period - 1977Q4 to 1988Q4.

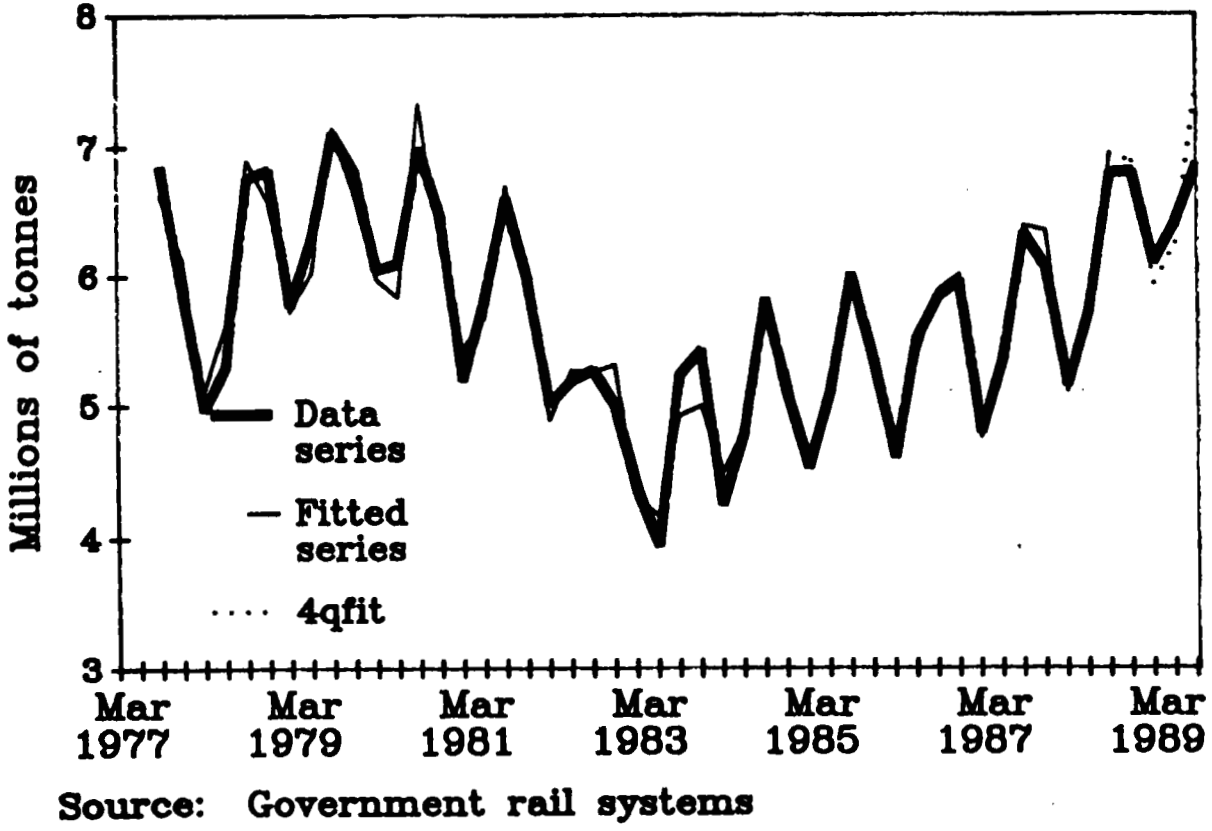

Figure 2.2 Non-bulk government rail freight and fit

There are two freight rate variables in the equation. The real interstate non-bulk freight rate (ln RINTER), lagged one quarter, has an elasticity of -2.4542, while the real subcontractors road freight rate (ln RROADPR) has an elasticity of 0.6628. There is also a disputes variable (RDISPDUM) which captures the negative effects on traffic of several large rail disputes. A set of seasonal dummies (D1 to D3) completes the model.

The fit of the equation is good (adjusted R^2 equal to 0.94) with good tracking ability (see figure 2.2) and no evidence of autocorrelation. The fit without the disputes dummy declines to an adjusted R^2 of 0.85. The four-quarter-ahead rolling forecasts for 1988-89 are shown in figure 2.2. They fit the data quite well with a Theil coefficient of 0.05. All variables are listed in appendix I and constructed variables are discussed in appendix II.

BULK GOVERNMENT RAIL FREIGHT

Movements of grain and coal generally are well over 75 per cent of all government bulk rail freight. As such, the bulk traffic on the government rail systems is closely tied to the volume of these exports from Australia. Moreover, as the raw materials must pass over the railways before they are exported, the volume of predicted exports should be a good predictor of bulk rail traffic. This is the approach that has been adopted in the present equation.

Bulk government rail freight equation

The dependent variable in this equation is bulk government rail freight tonnages (BULKRF). The major explanator is the tonnage of coal and grain exports (RAILEXP). The coefficient is less than 1.0 (0.6652) because there is also a time trend in the equation (see table 2.3). This formulation allows the time trend to catch the effects of the small volume of other bulk exports carried on government railways as well as the volume of domestic bulk traffics carried.

TABLE 2.3 ESTIMATED EQUATION FOR GOVERNMENT BULK RAIL FREIGHT

Variable	*Estimated coefficient*	*t statistic*
Constant	11 207 020	10.7
RAILEXP	0.6652	8.9
TIME	155 193	4.5
DB01	247 259	0.3
DB02	1 058 530	1.4
DB03	677 475	0.9
DB11	-1 976 952	-2.9
DB12	-275 305	-0.4
DB13	-1 226 260	1.8

Dependent variable - BULKRF.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.9577.
Durbin-Watson statistic - 1.79.
Estimation period - 1977Q1 to 1990Q1.

The link between bulk rail freight and grain exports should, if anything, become more direct in the future. This is because, with the advent of grain haulage deregulation, the major rail systems have developed the practice of tendering at discounted rates for the total carriage of the crop.

The other influences in the model are two sets of seasonal dummies to catch the differing seasonal patterns before and after the start of calendar year 1983.

The fit of the equation is good, with an adjusted R^2 of 0.96. The Durbin-Watson statistic does not indicate that serial correlation is a problem, and the tracking of the equation is good (see figure 2.3). Four-quarter-ahead rolling forecasts are also shown in figure 2.3. The value of the Theil coefficient is 0.03. A forecast bias in the upward direction came about through an overestimate of export volume growth. As the fit of the equation shows, when one uses the actual export volumes for 1988-89, the equation continues to 'postdict' well.

All variables are listed in appendix I.

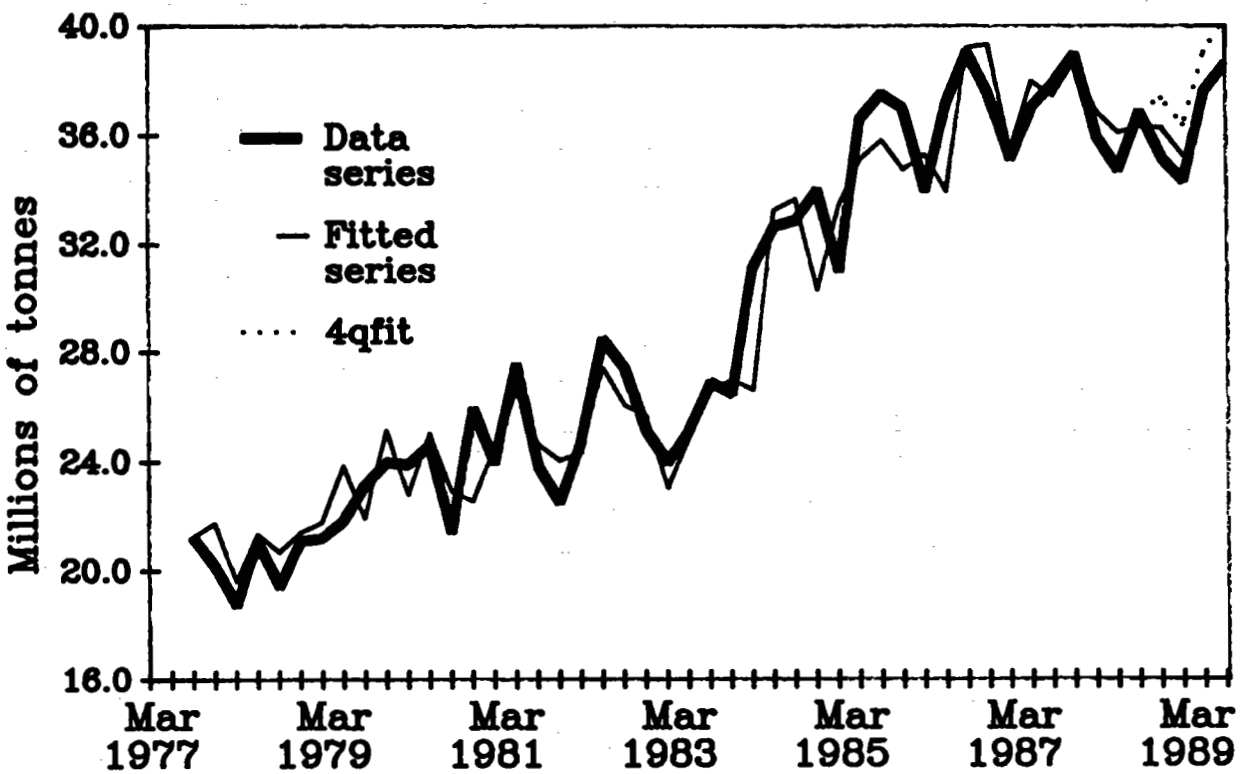

Figure 2.3 Bulk government rail freight and fit

DOMESTIC AIR FREIGHT

Air freight represents a very small component (in tonnage terms) of the total freight task in Australia. However, the share is estimated to be substantially higher on a value basis due to the high average unit value associated with air freight (BTE 1987). The substantially lower transit times in air transport attract a variety of perishable, high value, low bulk goods for which delivery time is of paramount importance. Air freight moves by one of three means - scheduled airline services (freight only or passengers and freight mixed), commuter services or charter services. Charter services were estimated to account for about 6 per cent of total tonnages in 1981-82 (Gawan-Taylor 1984), and commuter services about 3 per cent in the same year. The model presented below is of freight moved on scheduled airline services.

Domestic air freight equation

The dependent variable in this equation is the log of scheduled airline freight tonnages (ln DOMAFR).

From table 2.4 it can be seen that there are three main explanatory variables. The first is the log of real non-farm gross domestic product (ln RGNF85). Air freight seems somewhat inelastic with respect to income changes. The second is a dummy variable (AFDUM) equal to 1 from 1982Q2 to 1985Q3 which compensates for an unexplained increase in air freight during this period. This might be due to shifts in market share between the scheduled and charter sectors of the industry. The third variable is a dummy variable to account for periods of airline disputes (ADDUM).

Finally there are two sets of dummies: (DA10 to DA30) to account for seasonal variation before the start of 1985; and (DA11 to DA31) thereafter.

The fit of this equation is satisfactory (adjusted R^2 equal to 0.86), and the tracking suffers somewhat (see figure

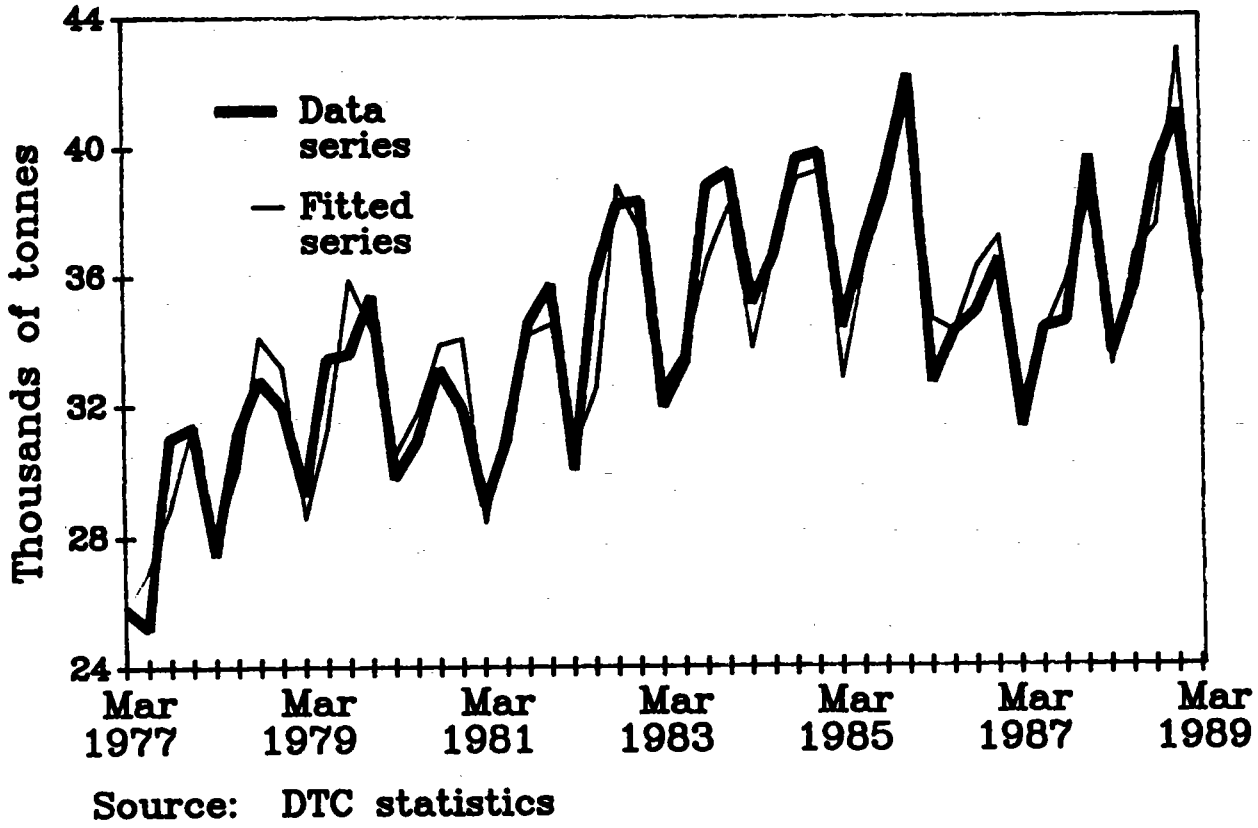

Figure 2.4 Scheduled domestic airline air freight and fit

TABLE 2.4 ESTIMATED EQUATION FOR SCHEDULED DOMESTIC AIRLINE AIR FREIGHT

Variable	*Estimated coefficient*	*t statistic*
Constant	2.5023	2.2
ln RGNF85	0.7400	7.0
AFDUM	0.0883	4.6
ADDUM	-0.0571	-1.4
DA10	-0.1442	-8.5
DA20	-0.0895	-4.8
DA30	0.0022	-0.1
DA11	-0.1904	-8.6
DA21	-0.1347	-5.2
DA31	-0.1008	-4.2

Dependent variable - ln DOMAFR.
Estimation method - Cochrane-Orcutt, Rho = 0.39.
Adjusted R^2 - 0.87.
Durbin-Watson statistic - 2.02.
Estimation period - 1977Q1 to 1989Q1.

2.4). Due to a suggestion of autocorrelation, the equation was estimated by a Cochrane-Orcutt iterative technique with Rho equal to 0.39. No forecast history is yet available with this model. The adjusted R^2 without the dummies AFDUM and ADDUM is 0.74.

CHAPTER 3 OVERSEAS TRADE

Australia is particularly dependent on overseas trade given its situation as a raw material supplier isolated from the major industrial nations. Australia's development has depended on a succession of export commodities - wool, wheat, meat, iron and coal. Similarly, a major portion of the equipment for its industries has been supplied by the industrial nations of the world.

Shipping remains the dominant carrier for both exports and imports. The modal split between sea and air, whether expressed in terms of value or volume, overwhelmingly favours sea (figure 3.1).

The relatively high value per unit of air freight means that air carries a considerably larger value of Australia's imports and exports (between 10 and 20 per cent) than volume (less than 1 per cent).

By value, the largest categories of exports, as at September 1988, were coal (11.6 per cent) and wool (10.7 per cent). Imports are more diverse, but the main component is manufactured goods. Australia's imports of resource based products are small, given our rich resource endowment.

Figure 3.2 shows that there is a large imbalance in tonnage terms between exports and imports. Furthermore, as different types of ships are generally used for exports (bulk ships) and imports (liner ships), there are frequently back-haul problems with Australian shipping.

The following chapter discusses four models of overseas trade. Bulk exports and non-bulk imports are modelled on a tonnage basis. Two separate models are then presented for inward and outward air freight tonnages.

BULK EXPORTS

The equation for bulk exports is basically a direct translation equation. It translates tonnages (and forecasts of tonnages) of seven major bulk exports (EXPQ) into a prediction of total bulk export tonnages. The seven major commodities used are iron, coal, alumina, oil/petroleum products, grain, sugar and meat.

As can be seen from table 3.1, the translation is almost direct with a coefficient on the log of EXPQ (the total of the seven commodities) of 1.0278.

TABLE 3.1 ESTIMATED EQUATION FOR BULK EXPORT TONNAGES

Variable	*Estimated coefficient*	*t statistic*
Constant	3760.0	2.4
EXPQ	1.0278	29.9

Dependent variable - BULKOUT.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.95.
Durbin-Watson statistic - 1.96.
Estimation period - 1977Q1 to 1989Q2.

The BTCE uses the equation to translate outside forecasts of individual commodity exports into consistent forecasts of total bulk exports (partly derived from ABARE data). The fit is good (adjusted R^2 of 0.95) and there is no evidence of autocorrelation (Durbin Watson statistic equal to 1.96). A forecast history is not available for the equation. The fit of actual and predicted is shown in figure 3.3.

NON-BULK IMPORTS

Most of Australia's non-bulk imports are final consumption manufactures: cars, whitegoods, electrical appliances, and capital equipment. Indeed, these items make up over 65 per

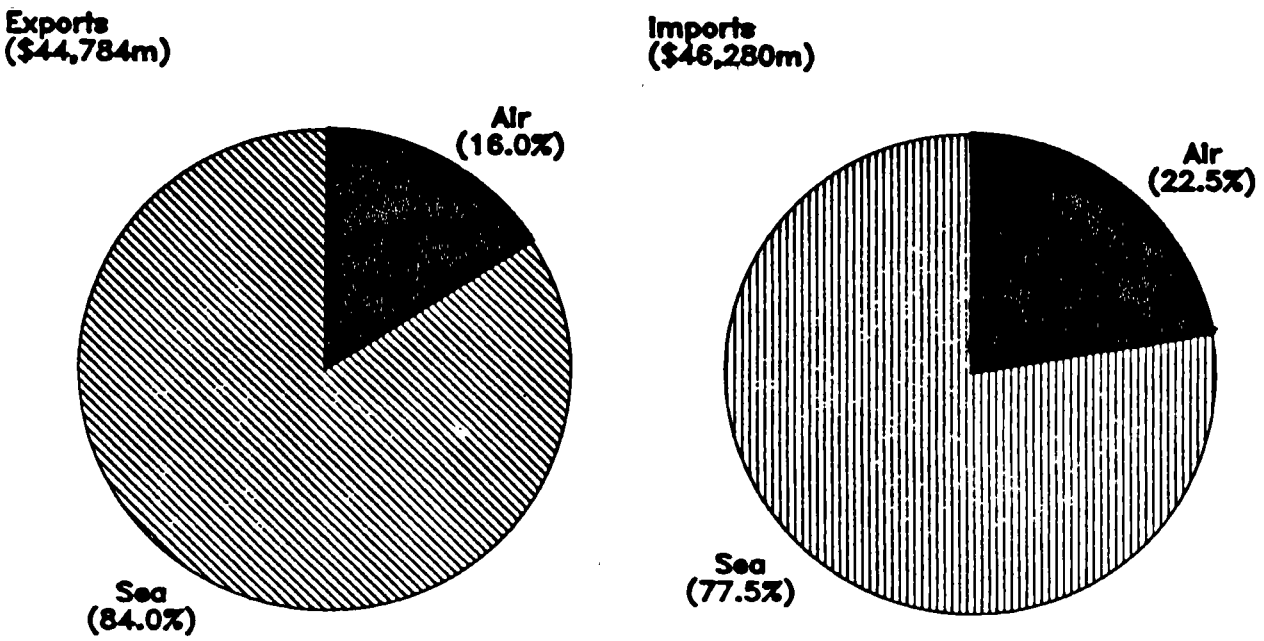

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Figure 3.1 Trade by mode in dollars, 1988-89

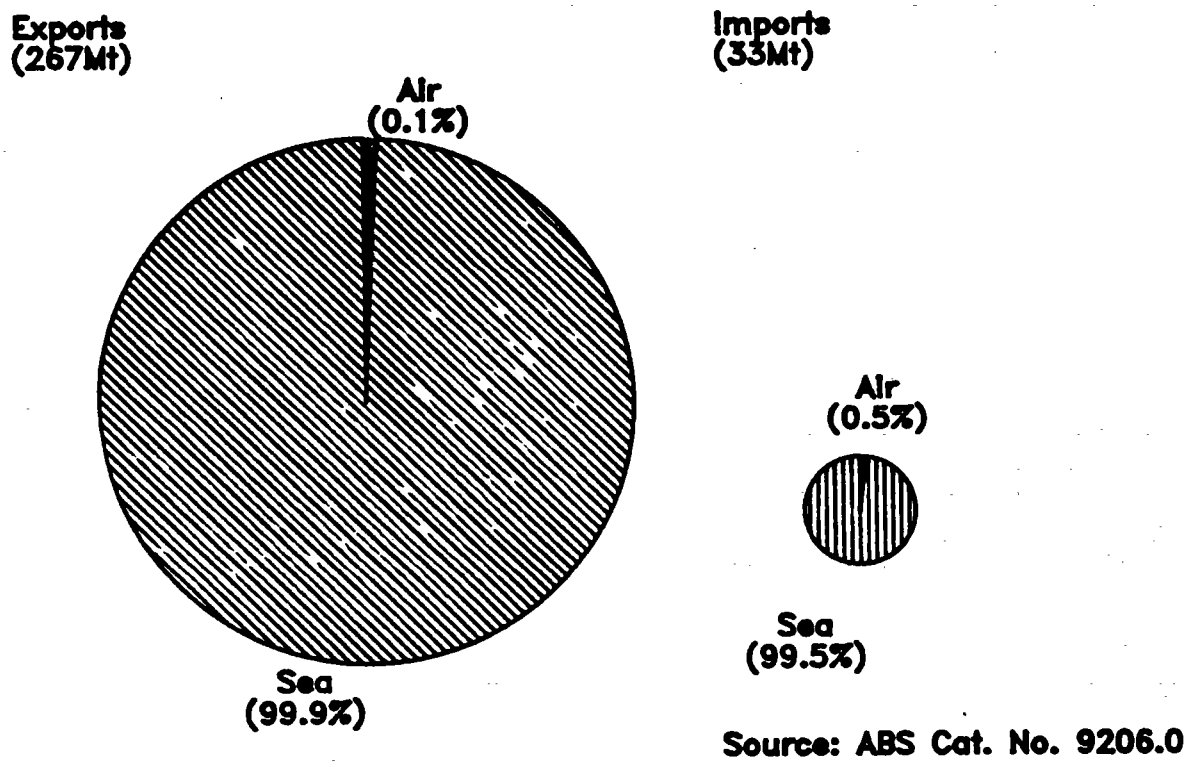


Figure 3.2 Trade by mode in tonnes, 1988-89

cent of the value of Australia's annual import bill. In recent times expenditure on imports has been above export earnings. This has mainly been due to a surge in imports late in 1988 accompanying exceptionally strong growth in the Australian economy.

Non-bulk imports equation

The dependent variable in this equation is the log of non-bulk import tonnages (ln NBULKIN).

The first main explanator is the log of constant (1984-85) dollar gross national expenditure (ln RGNE85). The coefficient on this variable (2.2462) indicates that there is about a 2 to 1 relationship between percentage changes in tonnages and in income (see table 3.2).

The second major explanator is the log of the real trade weighted exchange rate (ln RTWI). This variable has a very low elasticity (0.1558). An additional explanator is a time trend, which corrects for the declining long-term trend in the weight to volume ratio of our imports.

TABLE 3.2 ESTIMATED EQUATION FOR NON-BULK IMPORT TONNAGES

Variable	*Estimated coefficient*	*t statistic*
Constant	-17.4072	-2.8
ln RGNE85	2.2462	3.7
ln RTWI	0.1558	0.8
TIME	-0.0088	-1.5
IMPDUM	-0.2053	-3.8
D1	-0.0773	-2.6
D2	-0.0570	-1.9
D3	-0.0471	-1.7

Dependent variable - ln NBULKIN.
Estimation method - Cochrane-Orcutt, Rho = 0.33.
Adjusted R^2 - 0.82.
Durbin-Watson statistic - 1.96.
Estimation period - 1979Q3 to 1989Q3.

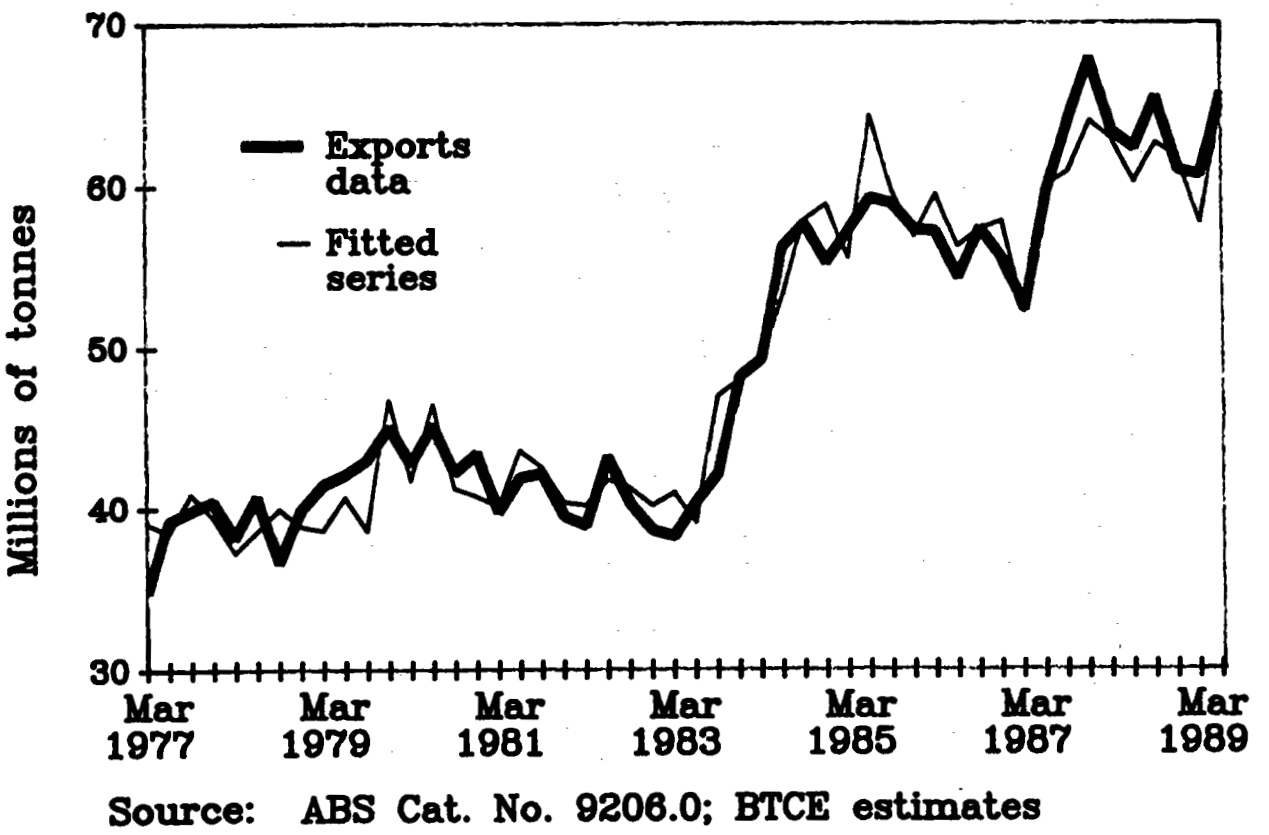


Figure 3.3 Bulk export tonnages and fit

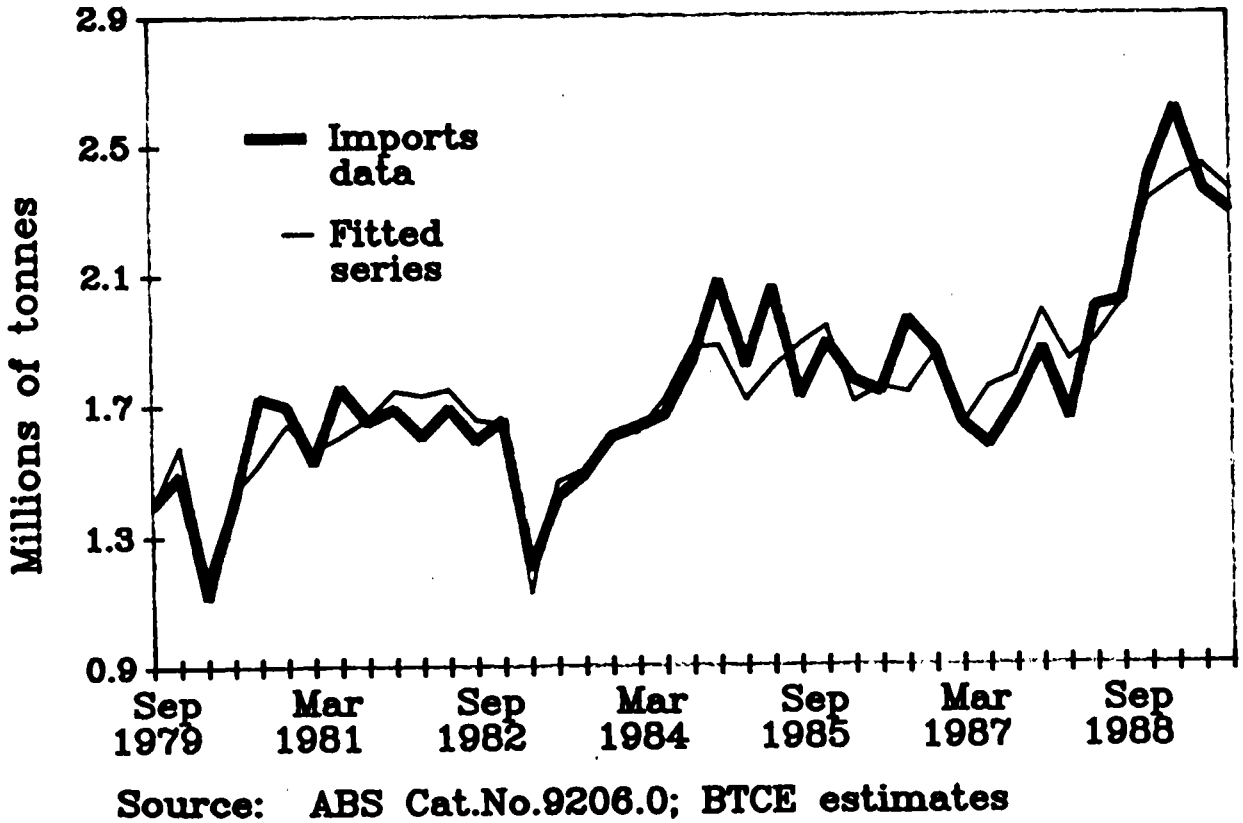


Figure 3.4 Non-bulk import tonnages and fit

A dummy variable (IMPDUM) captures sharp drops in the tonnage figures due to strikes in two quarters - 1980Q1 and 1983Q1. Seasonal dummy variables (D1 to D3) are included to adjust for seasonal variation in import tonnages that differs from the seasonal variation in the value series.

All data used is listed in appendix I and the variable mnemonics are contained in appendix III.

The fit of the equation is only fair (adjusted R^2 of 0.82) and there is no evidence of autocorrelation. As shown in figure 3.4, the tracking is also fair. No forecast history is available for this model. The adjusted R^2 without the dummy IMPDUM is 0.75.

AIR FREIGHT EXPORTS

The type of goods typically carried by air are high value, small volume and possibly perishable in nature. The time taken for the item to reach the hands of the purchaser is an important consideration. A portion of this freight carriage is undertaken by charter flights but a considerable amount of freight movement is carried on scheduled passenger services. Over the last decade the volume of air freight exports has shown a fairly strong rate of growth.

The bulk of Australian air freight exports are to New Zealand (50 per cent of total volume). The model currently maintained by the BTCE relates air freight exports to the strength of overseas gross domestic product, particularly New Zealand, and cost elements.

Air freight exports equation

The dependent variable in the air freight exports equation is the log of the volume of outward air freight tonnages (ln EXTON).

The equation consists of three main explanatory variables (see table 3.3). The first is the log of foreign gross domestic product, weighted by export share (ln AVGDP). The

TABLE 3.3 ESTIMATED EQUATION FOR THE VOLUME OF AIR FREIGHT EXPORTS

Variable	*Estimated coefficient*	*t statistic*
Constant	12.4800	13.6
ln AVGDP	5.5562	15.5
ln RTWI	-0.4463	-2.2
DEL3	-0.0237	-2.9
D1	-0.0562	-0.2
D2	-0.0371	-1.4
D3	-0.1119	-4.8

Dependent variable - ln EXTON.
Estimation method - Cochrane-Orcutt, Rho = 0.42.
Adjusted R^2 - 0.98.
Durbin Watson statistic - 2.01.
Estimation period - 1977Q3 to 1988Q3.

estimated coefficient (5.5562) reveals that air freight exports have a highly elastic response to changes in the level of foreign income.

The second major explanatory variable is the log of the real trade weighted index of the exchange rate (ln RTWI). As is the case in the previous trade models, the responsiveness of air freight exports to changes in the exchange rate is relatively inelastic (-0.4463).

The third major explanatory variable is the three quarter average of the four quarter change in Australian real non-farm gross domestic product (DEL3). The coefficient (-0.0237) indicates that higher levels of growth in the Australian economy accompany lower levels of air freight exports.

The equation also includes a set of seasonal dummy variables (D1 to D3).

The form of the equation is double-log and estimation is by the Cochrane-Orcutt iterative technique. The final value of Rho is equal to 0.51. The fit of predicted to actual is

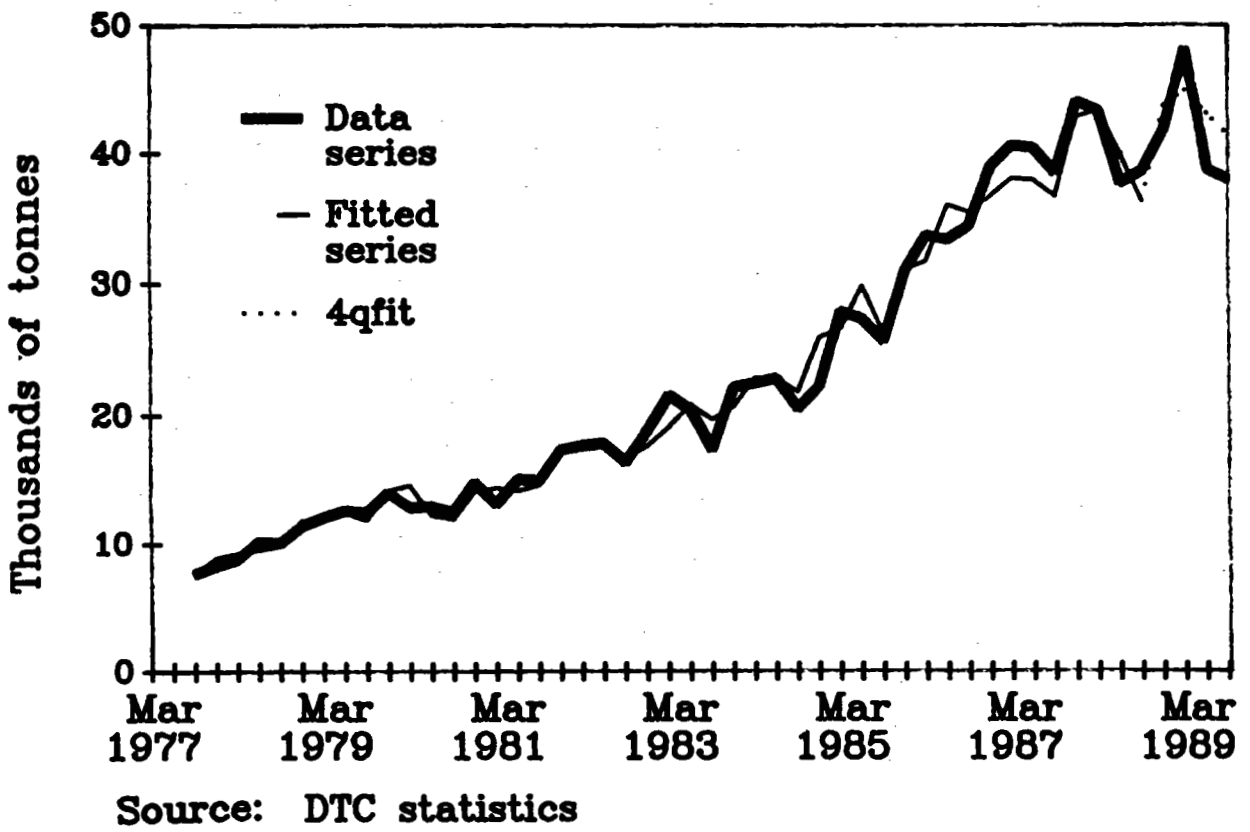


Figure 3.5 Air freight exports and fit

quite good (see figure 3.5). The adjusted R^2 statistic indicates that about 98 per cent of the variation in air freight exports is accounted for by the explanatory variables and seasonality.

The four-quarter-ahead rolling forecasts are also shown in figure 3.5. The Theil coefficient for the period 1988Q4 to 1989Q3 has a value of 0.04.

All data used is listed in appendix I, variable mnemonics are contained in appendix III, and the construction of the AVGDP variable is explained in appendix II.

AIR FREIGHT IMPORTS

Air freight imports are only a small proportion of the total volume of imports. The largest volumes of our air freight imports are from New Zealand, North America, and Western Europe. Over the last decade inward air freight volumes have fluctuated between 100 and 150 thousand tonnes per year.

The model presented below relates inward air freight volumes to Australian income levels and the prevailing freight rates.

Air freight imports equation

The dependent variable in the air freight imports equation is the log of the volume, by weight, of inward air freight (ln IMTON).

The equation consists of three main independent variables and a set of seasonal dummy variables (see table 3.4).

The first major explanator is the log of Australian seasonally adjusted gross national expenditure (ln RGNE85). The estimated coefficient (2.5974) suggests that a change in domestic spending will cause a much more than proportionate change in the level of inward air freight tonnages.

TABLE 3.4 ESTIMATED EQUATION FOR THE VOLUME OF AIR FREIGHT IMPORTS

Variable	*Estimated coefficient*	*t statistic*
Constant	-20.3160	-13.4
ln RGNE85	2.5974	22.9
ln RTWI	0.5689	6.9
ln RIFRATE	-0.1020	-6.9
D1	-0.1679	-7.8
D2	-0.1169	-5.3
D3	-0.0552	-2.6

Dependent variable - ln IMTON.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.96.
Durbin-Watson statistic - 1.56.
Estimation period - 1983Q1 to 1989Q3.

The second explanator is the log of the real trade weighted index of the exchange rate (ln RTWI). The coefficient on this variable (0.5689) suggests air imports are relatively inelastic with regard to changes in the exchange rate.

The third major explanatory variable is the air freight rate. The air freight rate used in this version of the equation is the real rate for air freight from New Zealand to Australia, converted into Australian dollar values (ln RIFRATE). The New Zealand freight rate is used because, for trade in air freight, New Zealand is our major trading partner. The coefficient of this variable (-0.1020) shows that air freight volumes are very inelastic with respect to changes in rates.

A set of seasonal dummy variables (D1 to D3) is also included in the equation.

The form of the equation is double-log and estimation is by ordinary least squares. The measure of the goodness of fit indicates that the equation predicts 96 per cent of the variation in air freight imports. The fit of predicted to actual is shown in figure 3.6. There is no forecast history for this equation.

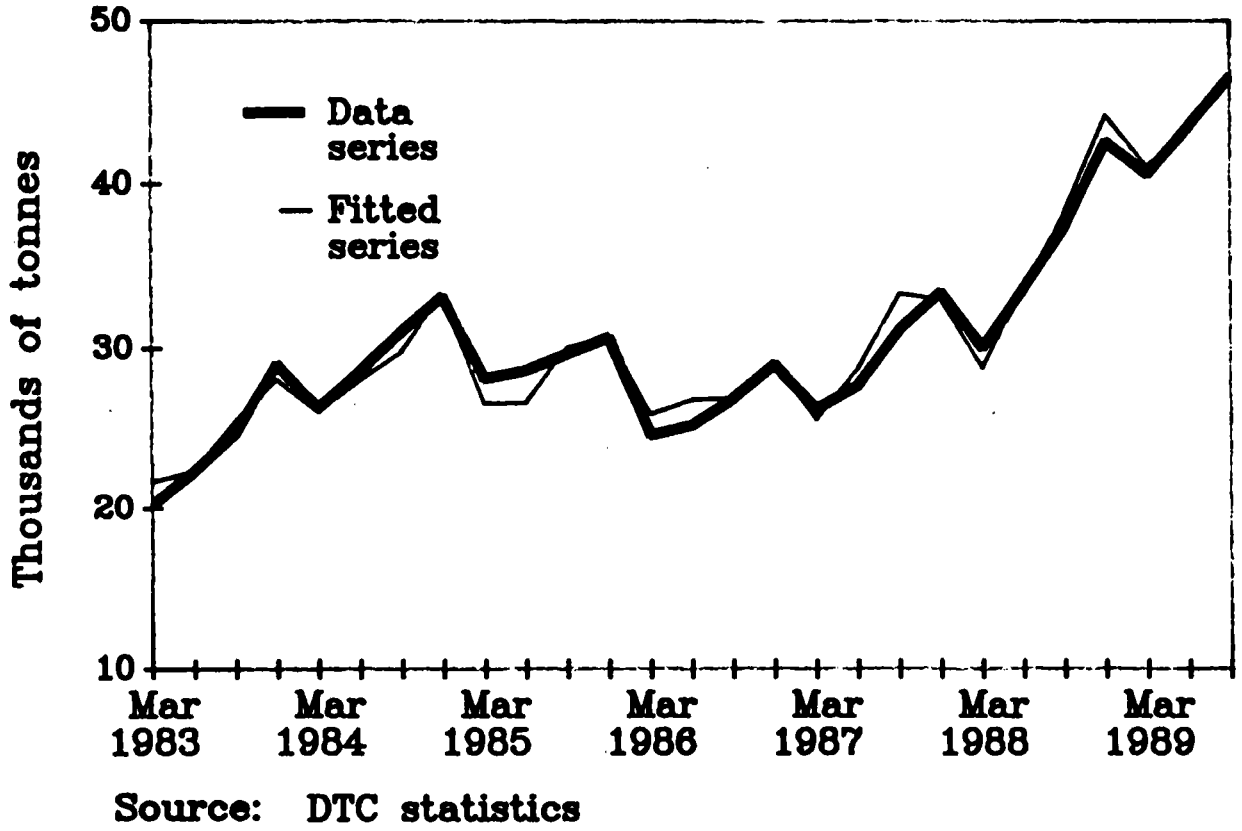


Figure 3.6 Air freight imports and fit

All data used is listed in appendix I and the variable mnemonics are contained in appendix III.

The relatively inelastic demand for air imports with respect to price indicates the different nature of air freight. Air freight tends to be for relatively small, urgent delivery cargo, for which price is a secondary consideration.

Air freight imports are largely dependent upon Australian spending, a 2.5 to 1 relationship existing between changes in national expenditure and changes in air freight imports.

CHAPTER 4 MOTOR VEHICLES

The two models developed in this area look at indicators of the use and purchase of motor vehicles. As one of the mainstays of the journey to work in urban areas of Australia, the motor vehicle holds a key place in the life of the country. There are somewhat over 7 million cars and station wagons on register in Australia as against almost 12 million persons of driving age in the Australian population.

PETROL SALES

Sales of petrol are perhaps the best ongoing indicator of the usage of motor vehicles. Over the years the trend has been to increasing fuel efficiency, but fluctuations in total sales are a good short-run indicator of variations in vehicle usage by Australians.

Petrol sales equation

The dependent variable is the log of Australian petrol sales (ln PETROL).

There are two main explanatory variables (see table 4.1). The first is the log of real non-farm gross domestic product (ln RGNF85). The low coefficient on this variable (0.4517) suggests that petrol sales have a fairly dampened positive response to income changes.

The second main explanator is the log of the real petrol price index (deflated by the consumer price index). The coefficient on this variable (-0.1110) suggests that price has even less of an effect than income in the short term. It must be remembered, however, that simple reduced form equations such as this will seriously underestimate the actual long-term elasticities. The long term is defined as

TABLE 4.1 ESTIMATED EQUATION FOR PETROL SALES

Variable	*Estimated coefficient*	*t statistic*
Constant	4.7029	13.7
ln RGNF85	0.4157	18.7
ln RPPI	-0.1110	-4.0
D1	-0.0463	-7.6
D2	-0.0248	-4.2
D3	-0.0272	-4.6

Dependent variable - ln PETROL.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.92.
Durbin-Watson statistic - 2.36.
Estimation period - 1979Q2 to 1988Q4.

that period of time in which the vehicle fleet itself is able to be modified in the light of price signals.

The last explanator is a set of seasonal dummies (D1 to D3).

The fit of the equation (adjusted R^2 equal to 0.92) and its tracking (see figure 4.1) are good. There is no evidence of autocorrelation.

NEW AUTOMOBILE SALES

The automobile industry (as represented by sales) grew quickly during the post-war period. But in common with many industries in Australia and worldwide, its growth slowed markedly during the 1970s. This maturity phase corresponded to the marked slowdown in economic growth of the Australian and world economies after 1975. After ten years of relative stability of sales, there was a pronounced fall in sales after the 1985 devaluation of the Australian dollar (see figure 4.2). This 30 per cent fall in registrations was largely due to a devaluation-induced real price rise of similar magnitude.

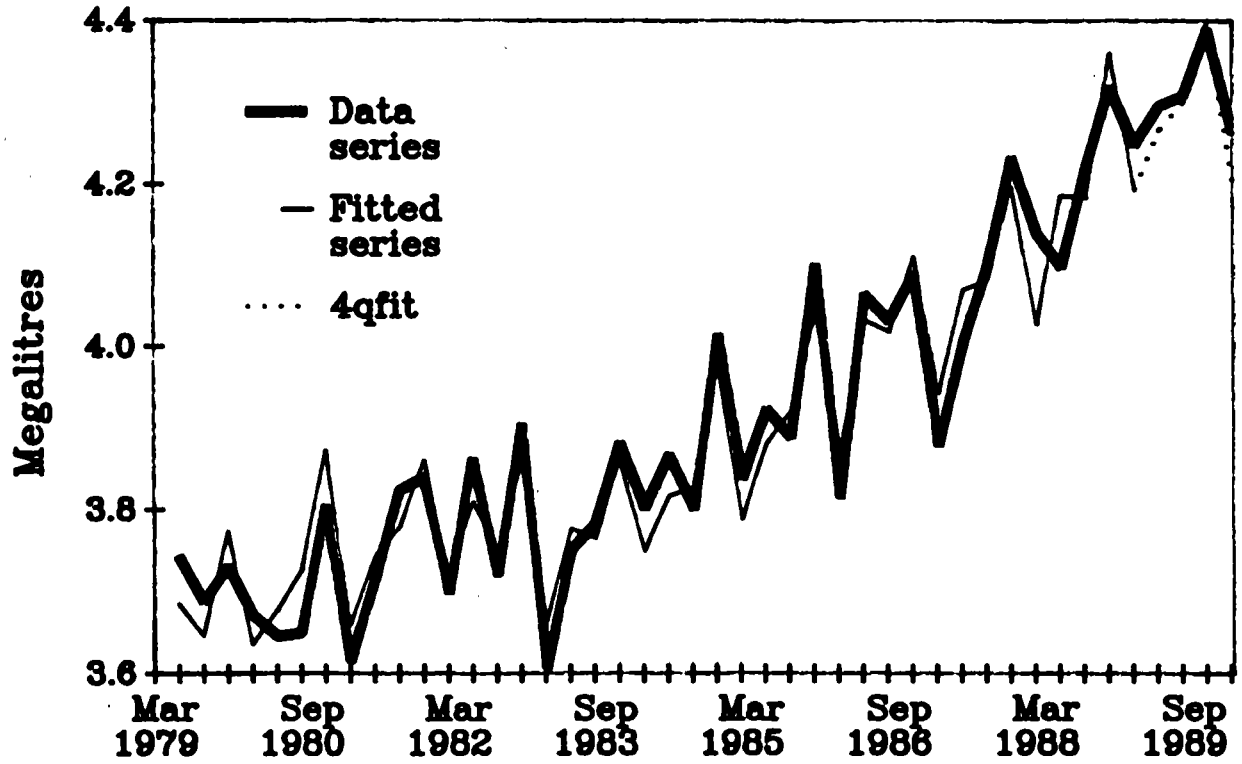


Figure 4.1 Retail petrol sales and fit

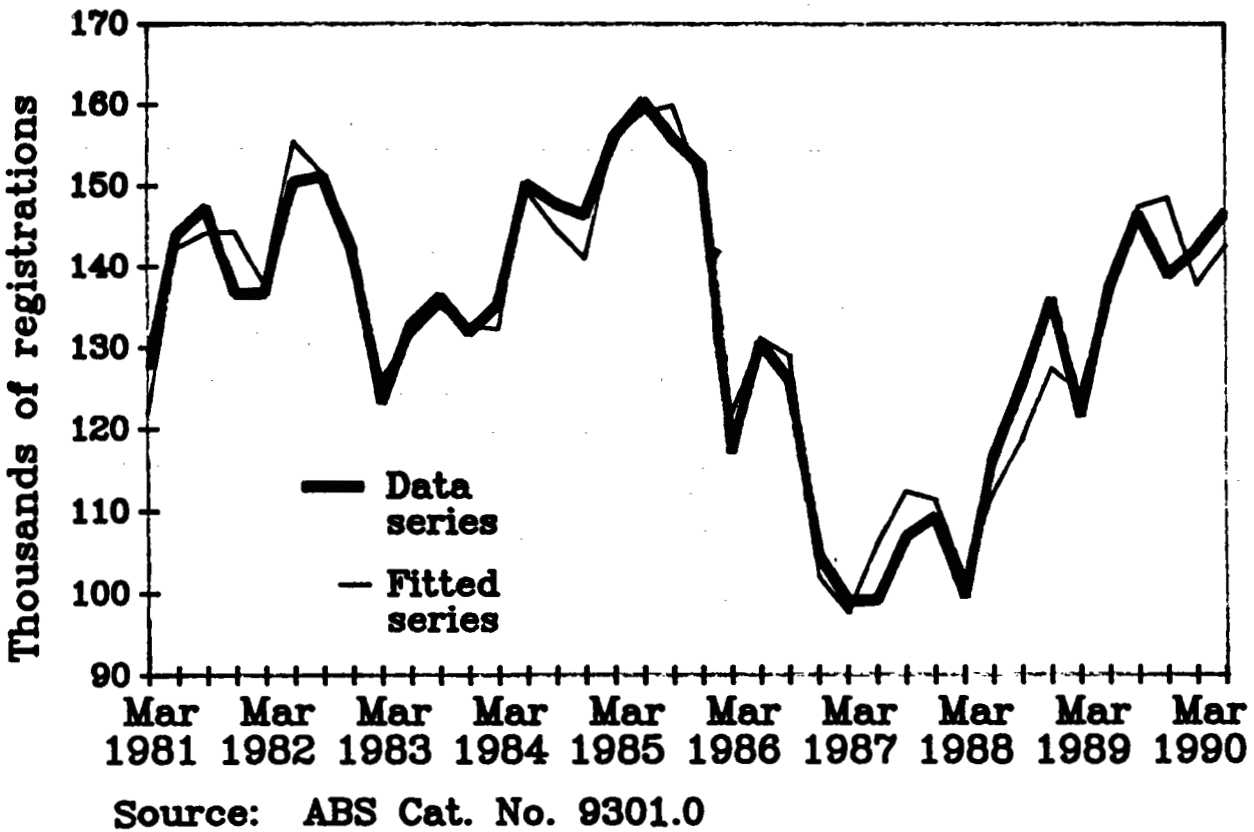


Figure 4.2 New automobile sales and fit

During 1988 there was a recovery in sales, led by booming economic growth and by an appreciation in the value of the Australian dollar. During 1990 sales have been plateauing as the economy slows.

New automobile sales equation

The dependent variable in this equation is the log of the quarterly registrations of new cars, station wagons, panel vans and utilities (ln REGO). This somewhat wider definition of 'automobile' was chosen to avoid the problem of a tendency in the past few years for motorists to switch between cars and light commercial vehicles in some areas of the market.

There are two main explanatory variables (see table 4.2). The first is the log of real gross national expenditure (ln RGNE85). The coefficient of this variable (1.8358)

TABLE 4.2 ESTIMATED EQUATION FOR NEW AUTOMOBILE SALES

Variable	*Estimated coefficient*	*t statistic*
Constant	-1.6716	-1.4
ln RGNE85	1.8358	14.0
ln RPRICE	-1.4288	-15.8
DUM85	0.1004	4.2
DUM851	0.0522	1.1
DC1	-0.0337	-1.5
DC2	0.0760	3.6
DC3	0.0562	2.7
DC1	-0.0863	-3.4
DC12	-0.0328	-1.3
DC13	0.0022	0.1

Dependent variable - ln REGO.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.95.
Durbin-Watson statistic - 1.59.
Estimation period - 1981Q1 to 1990Q2.

suggests that the reaction of automobile sales to income is somewhat more than 1 to 1.

The second main explanator is a price variable, the log of the real price of new imported automobiles (ln RPRICE). The price of imports is used because the majority of imports are in the small car category. It is the small car sales (mostly private) that have proved to be variable, while the larger car fleet sales have held more steady. The coefficient of this variable (-1.4288) also suggests a greater than 1 to 1 response in sales to changes in price.

The other explanators are a one-quarter dummy variable active only during the first quarter of 1985 (DUM851), a dummy active for all 1985 (DUM85) and two sets of seasonal dummies. The first set of seasonal dummies (DC1 to DC3) is active up to the beginning of calendar 1987 and the second set (DC11 to DC13) thereafter.

The fit of the equation is satisfactory (adjusted R^2 equal to 0.95), with no evidence of autocorrelation (see figure 4.2). This equation is a re-estimate of one done several years ago by the BTCE. The adjusted R^2 without the dummies DUM85 and DUM851 is 0.87.

The old equation, along with several other approaches to modelling the demand for new automobiles, has been reviewed by the Automotive Industry Council (AIC 1988).

The AIC in its review criticised the extensive use of dummies in the model. However, as was seen above, the dummies contributed little to the overall fit (although they satisfactorily adjust for the 1985 period). The AIC did acknowledge that the model was valuable in 'underpinning the major conclusions reached in the working party's report; that is, the major influences on demand are price and income related' (AIC 1988).

CHAPTER 5 AVIATION PASSENGERS

Australian air passenger activity has generally exhibited a positive growth trend over the last ten years. In more recent times the rate of growth in activity has increased markedly. The Bicentennial year of 1988 is perhaps unrepresentative, but the previous year will give an indication of recent trends. In 1987, international air passenger activity increased 15 per cent, with Australian departures growing 5 per cent to 1 622 300 and foreign arrivals growth a massive 25 per cent to 1 784 900. In the same year, domestic air passenger movements grew 6 per cent to 13 095 600.

Of particular note has been the exponential growth in the number of Japanese arrivals since 1985. In 1987, Japanese arrivals numbered 215 600, an increase of 48 per cent on the 1986 figure which in turn was an increase of 35 per cent on 1985 arrivals. As a result, Japan became the third major source country (behind New Zealand and the United States) of foreign arrivals to Australia, contributing more than 12 per cent of the 1987 total. Moreover, the potential for further substantial growth remains high, since Australia is a destination for only about 6 per cent of Japanese intercontinental departures.

In general, the major long-term influence on the growth of air travel comes from growing levels of income. Further influences are fares and, for international travel, the level of our exchange rate (which influences the ground costs of travel in Australia and overseas). With passenger travel by ship being negligible, international air travel has no competing mode. Domestic air travel, however, competes with car, bus and train. Thus some proxy for the price of competing modes is needed in a demand formulation for domestic air travel.

The following sections discuss the international air travel models (for Australian departures and foreign arrivals) and the domestic air travel model.

INTERNATIONAL AUSTRALIAN DEPARTURES

Travel overseas continues its popularity with Australians. The number of Australians taking trips overseas has grown at a 5 per cent annual rate over the last ten years. Even a large depreciation of the Australian dollar, experienced in 1985, has only served to slow the growth, not stop it.

There are three main categories of travel: short-term (less than 12 months stay), long-term movements, and permanent movements. In 1987, permanent and long-term departures were 6 per cent of total Australian departures.

The modelling below is done on the short-term Australian departure category.

Australian departures equation

The dependent variable for this equation is the log of the number of Australian citizens and residents who made a short-term outbound movement through Australian Customs (ln TOUTPAS).

There were three main explanatory variables (see table 5.1). The income variable was the log of real gross national expenditure (ln RGNE85). The coefficient on this variable (1.0257) suggests that overseas travel by Australians varies proportionately to income changes.

The fare variable was the log of a weighted average of real outbound overseas air fares (ln RAGGOFAR). Its coefficient (-0.2990) suggests that overseas travel by Australians is relatively unresponsive to the average level of fares.

The log of the real trade-weighted index of the exchange rate (ln RTWI) lagged three quarters was used to measure the relative cost to Australian tourists of overseas stays.

TABLE 5.1 ESTIMATED EQUATION FOR INTERNATIONAL AIRLINE AUSTRALIAN DEPARTURES

Variable	*Estimated coefficient*	*t statistic*
Constant	0.9394	0.4
ln RGNE85	1.0257	5.1
ln RAGGOFAR	-0.2990	-2.7
ln RTWI(-3)	0.2142	2.7
BIDUM	-0.0362	-1.7
D1	-0.1735	-11.1
D2	0.0355	2.1
D3	0.0656	4.1

Dependent variable - ln TOUTPAS.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.97.
Durbin-Watson statistic - 1.9.
Estimation period - 1982Q1 to 1990Q1.

Again, the coefficient (0.2142) on overseas travel is much less responsive to cost variations than income variations. On the other hand, fluctuations in cost elements can be much more severe than income fluctuations, resulting in important short-run variations in the amount of travel.

Also included as an explanator was a dummy variable to catch the effect of expected abnormally low levels of demand over the course of the Bicentennial year (BIDUM).

Finally, a set of seasonal dummy variables (D1 to D3) was included to capture the seasonal variation in Australian overseas air travel.

The fit of the equation was excellent (adjusted R^2 of 0.97), as was the tracking (see figure 5.1). There was no evidence of autocorrelation. The four-quarter-ahead forecasting record is good, with a Theil statistic of 0.03. The adjusted R^2 without the dummy BIDUM was 0.96.

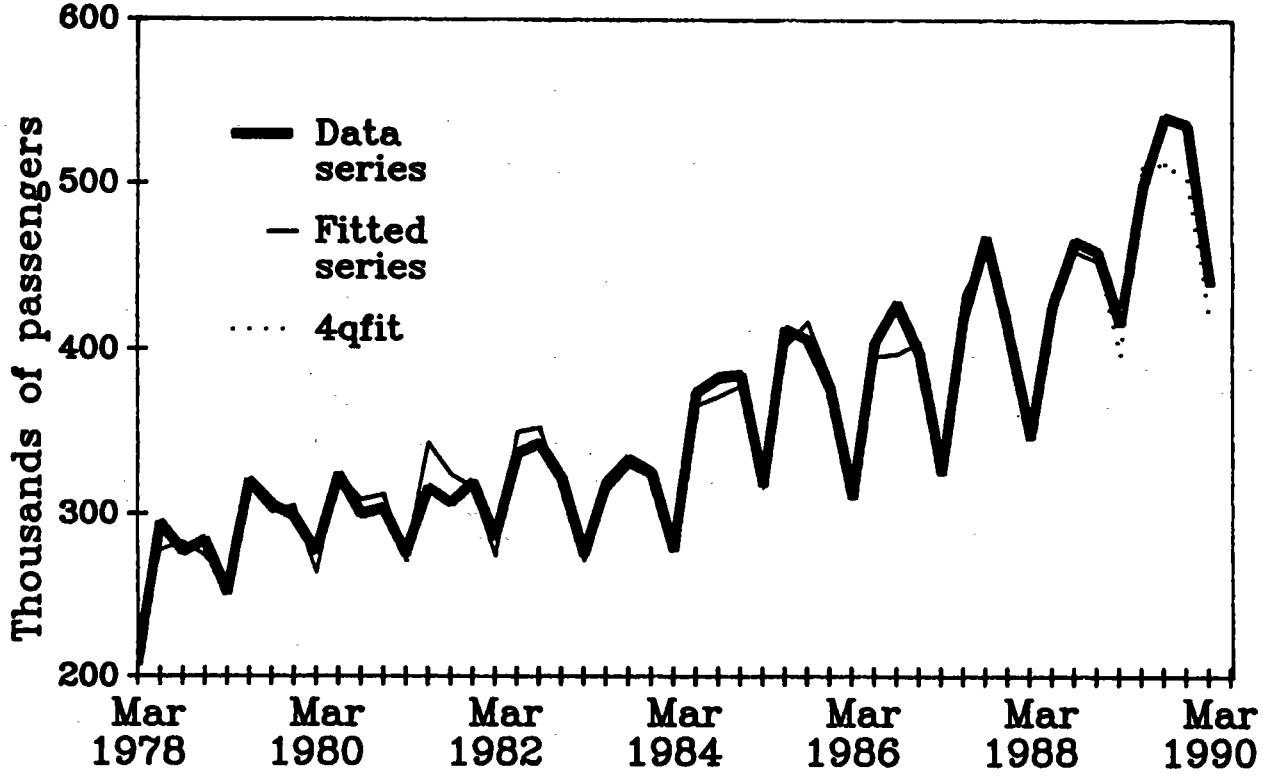


Figure 5.1 International airline Australian departures and fit

INTERNATIONAL FOREIGN ARRIVALS

Foreign tourism to Australia was, in the three years to 1988, the fastest growing sector of the aviation market, with growth averaging between 20 and 30 per cent per year.

There are many effects within Australia of such growth. The most direct effect is the positive impact on the domestic tourism and hospitality industries. There is also a flow-on of foreign arrivals from international to domestic airlines. However, this flow-on is not limited solely to the airlines. It also extends to rail, bus and most other domestic passenger transport sectors.

Of great significance, from a macro-economic perspective, will be the increasingly positive contribution to Australia's balance of payments which flows from the growing excess of foreign arrivals over Australian departures. Prior to 1987 the prevailing trend had been for Australian departures to outnumber foreign arrivals. However in that year the trend was reversed and this reversed trend should become further entrenched over the 1990s.

Foreign arrivals equation

The dependent variable for this model (ln TOTINPAS) was taken as the log of the quarterly number of foreign short-term visitors (that is, visitors whose expected stay was to be for a period of less than 12 months) who made an inbound movement through Australian Customs.

The income variable (ln G7GDP) was the log of the sum of real gross domestic product across the group of seven major OECD economies (the United States, Japan, Germany, France, Italy, the United Kingdom and Canada). Its coefficient (2.7862) suggests that overseas tourism to Australia is highly responsive to changes in overseas income levels (see table 5.2). This high degree of income sensitivity probably results from the combination of two factors brought into play by any increase in real income. These are:

TABLE 5.2 ESTIMATED EQUATION FOR FOREIGN ARRIVALS

Variable	*Estimated coefficient*	*t statistic*
Constant	2.5604	1.1
ln G7GDP	2.7862	7.9
ln RAGGINFA(-4)	-0.3336	-1.9
ln RTWI(-4)	-0.4361	-1.9
BIDUM	0.1588	2.9
D1	-0.1843	-7.9
D2	-0.3945	-14.4
D3	-0.2951	-13.5

Dependent variable - ln TOTINPAS.
Estimation method - Cochrane-Orcutt, Rho = 0.53.
Adjusted R^2 - 0.97.
Durbin-Watson statistic - 2.0.
Estimation period - 1978Q1 to 1989Q2.

- the increased affordability of international travel, and

- the relatively greater increase in the affordability of long-haul travel in comparison to short-haul (that is, intra-continental) travel.

In other words, because for most international travellers Australia is a long-haul option among a choice of short-and long-haul journeys, international travel to Australia falls into the category of being a 'super-luxury' good. In contrast, Australian departures overseas exhibit a much lower income sensitivity due mainly to the lack of choice between short- and long-haul destinations.

Two cost variables were also employed. The variable ln RAGGINFA(-4) was the log of the weighted average of real inbound overseas airfares, lagged four quarters. The lag is included to capture the long lead time foreign tourists have when planning to visit Australia. Its coefficient (-0.3336) suggests that foreign tourism is relatively non-responsive to fare changes. Similarly the coefficient

(-0.4361) on the log of the real trade weighted exchange rate lagged four quarters - ln RTWI(-4) - suggests that tourism to Australia is also relatively inelastic with regard to this second cost item.

The last explanators in this equation were a dummy variable for the Bicentennial year (BIDUM) and a set of seasonal dummy variables (D1 to D3).

Because of evidence of autocorrelation, this equation was estimated with a Cochrane-Orcutt technique (Rho equal to 0.53). The fit was good (adjusted R^2 of 0.97) and the tracking excellent (see figure 5.2). The four-quarter-ahead forecasting record is also good, with a Theil coefficient of 0.02 and a major turning point accurately predicted. The adjusted R^2 without the dummy BIDUM was 0.96.

DOMESTIC AIRLINE PASSENGERS

Domestic airline travel has been a growth industry in the last twenty years. The only serious threat to growth in the industry came in the early 1980s when rapidly increasing fuel prices lifted fares during the 1982-83 recession. The combined effect was that airline passenger numbers did not regain their 1981 levels until 1985. Unfortunately for the airlines the trough in passenger numbers during the recession came just as they were re-equipping their fleets.

Since 1985, growth has been rapid again, helped along in no small part by the boom in overseas tourism to Australia. The flow-on from international tourism has helped to lift growth rates in domestic airline passenger movements to around 10 per cent in 1988.

The growth in revenue passenger-kilometres (RPK) is consistently higher than that for passenger movements, as trips are getting longer with rising income levels. Accordingly, the income elasticity in the RPK model is expected to be higher.

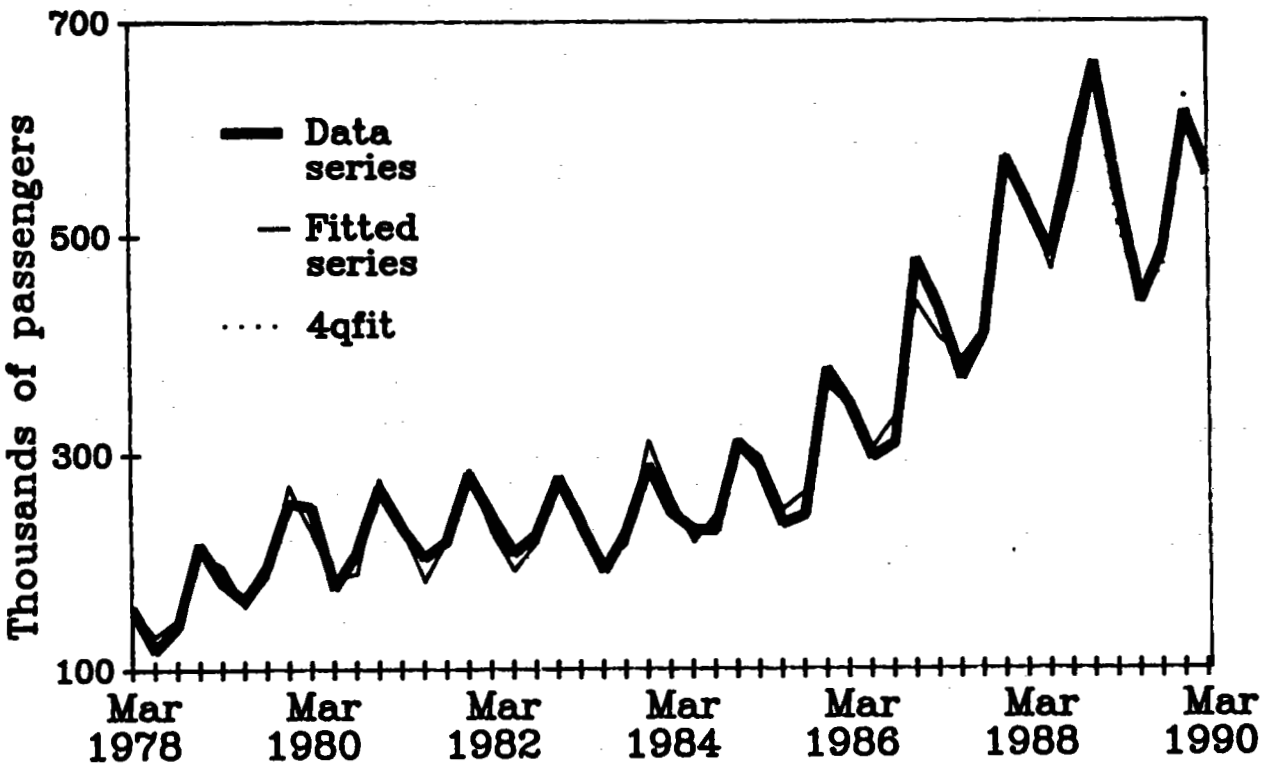


Figure 5.2 International airline foreign arrivals and fit

Models have been estimated for both domestic airline passengers and domestic airline revenue passenger-kilometres. The explanatory variables in both equations are identical, the main explanators being income, air fare level, and the price of petrol. The inclusion of quality of service variables such as flight frequency, although desirable in a complex modelling of the industry, was not possible given resources available. Some work within the BTCE on more complex models is being pursued.

Domestic airline passengers equations

The approach taken to modelling in this area was first to separate out an estimate of the 'foreign component' on domestic airlines. These were foreign tourists using the Australian domestic network. Thus if one subtracts from total passengers on the domestic network (DOMPAS) an estimate of the foreign component (DOMPAS1), an estimate is derived of the number of Australians travelling on the domestic network (DOMPAS2).

The number of foreign tourists travelling on the domestic network was represented by the identity:

$$DOMPAS1 = 0.75 * TOTINPAS$$

where 0.75 is an estimate of the average number of domestic air passenger movements generated by each short-term foreign arrival and TOTINPAS is the number of such arrivals. The 0.75 estimate was made on the basis of information contained in the Bureau of Tourism Research's *International Visitors Survey*.

Taking this foreign component away from total domestic network traffic gave the estimate of the number of Australians on the domestic network. This was then modelled as responding to domestic economic influences.

In order to estimate the number of domestic revenue passenger-kilometres (RPK) travelled by Australians on the domestic network, a similar approach was used. The estimate

TABLE 5.3 ESTIMATED EQUATION FOR AUSTRALIAN PASSENGERS ON THE DOMESTIC AIRLINE NETWORK

Variable	*Estimated coefficient*	*t statistic*
Constant	4.6220	4.0
ln RGNF85	1.0341	9.1
ln RMEDIUM	-0.6440	-7.3
ln RPPI	0.2256	3.7
STRIKE	0.0704	-1.7
CGDUM	0.0583	2.3
EXDU	0.0414	3.4
DA10	-0.0163	-1.0
DA20	-0.0001	-0.0
DA30	0.0969	5.7
DA11	-0.0143	-0.7
DA21	-0.0147	-0.7
DA31	0.0960	4.0

Dependent variable - ln DOMPAS2.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.86.
Durbin-Watson statistic - 1.9.
Estimation period - 1977Q4 to 1989Q2.

of the foreign component of passengers (DOMPAS1) was multiplied by the average kilometre distance travelled by all passengers on the domestic network. This gave an estimate of the foreign RPK component (DOMRPK1) which when subtracted from total RPK (DOMRPK) gave the estimate of RPK by Australians on the domestic network (DOMRPK2).

The dependent variables for the two domestic equations were thus the log of Australian passengers on the domestic network (ln DOMPAS2) and the log of RPK by Australians on the domestic network (ln DOMRPK2).

For both models (see tables 5.3 and 5.4), the list of explanatory variables was identical. The income variable was represented by the log of real seasonally adjusted non-farm gross domestic product (ln RGNF85).

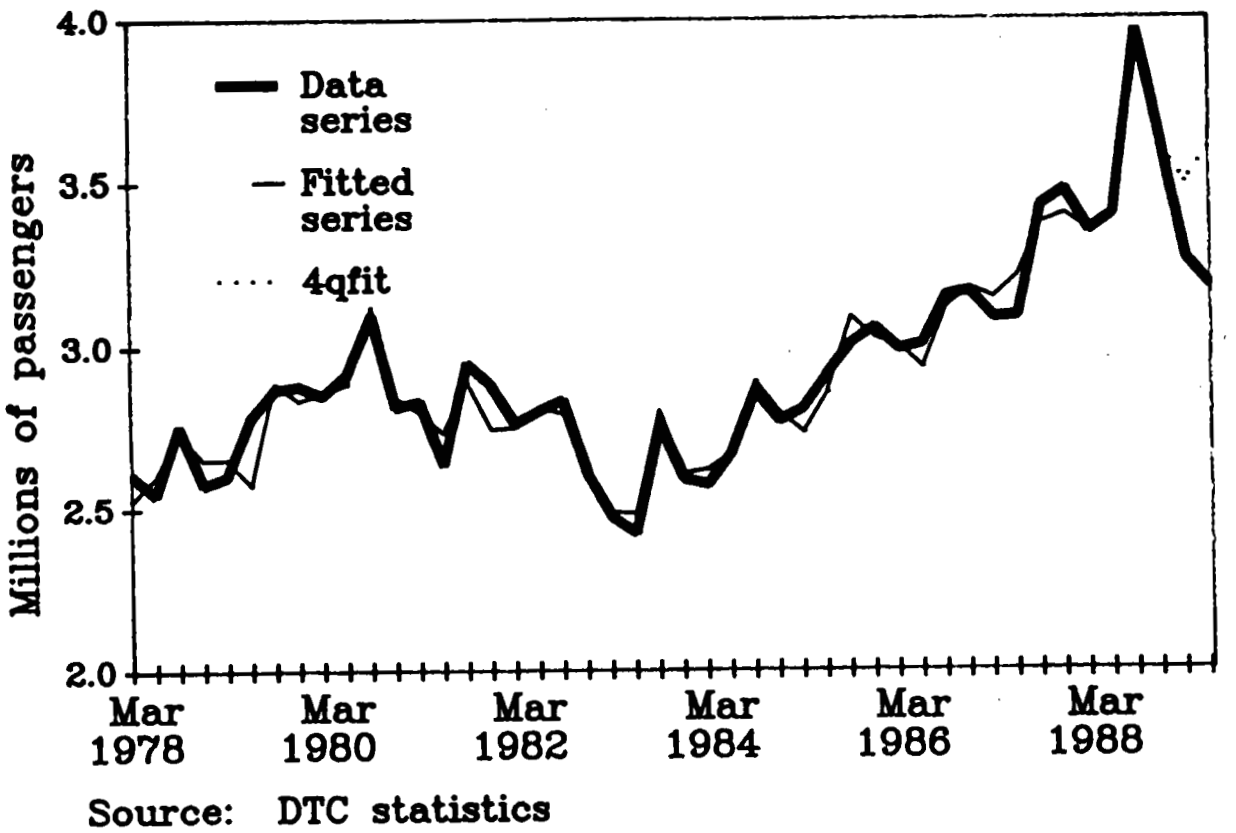


Figure 5.3 Australian domestic passengers and fit

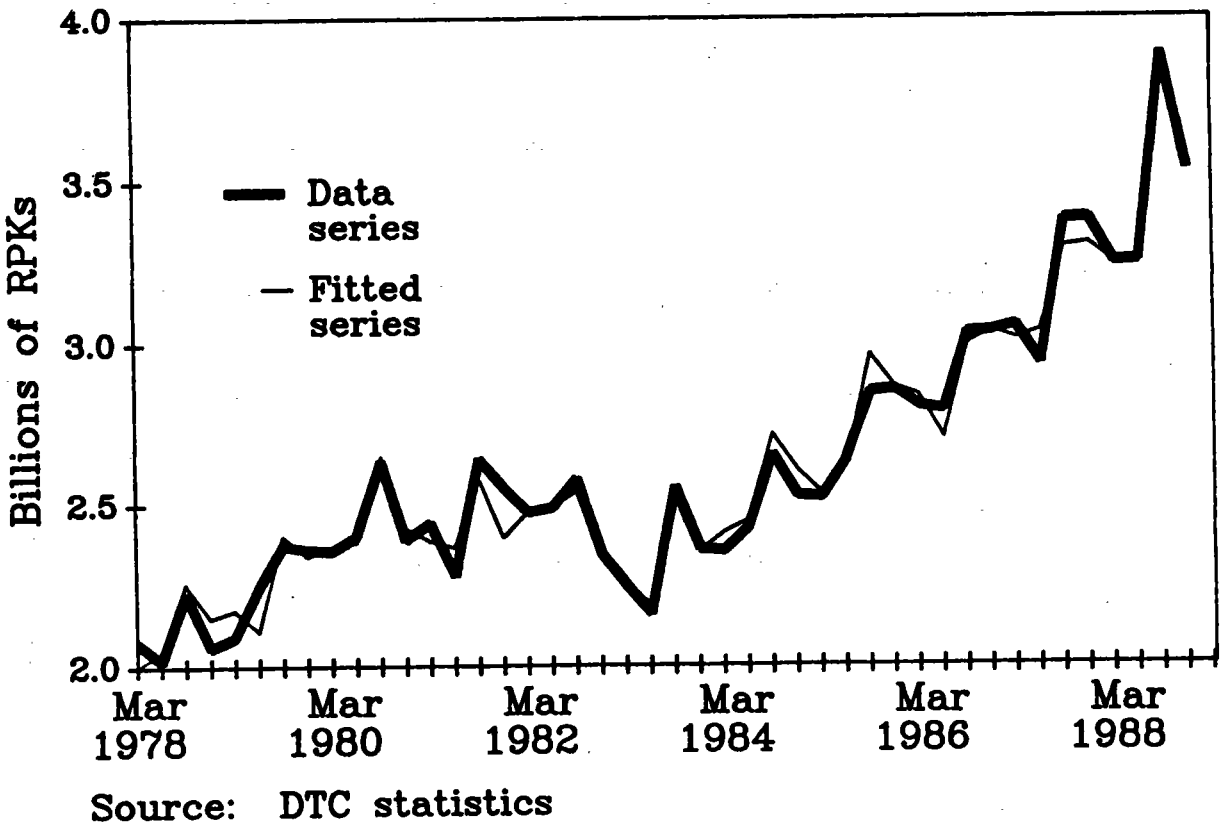


Figure 5.4 Australian domestic revenue passenger-kilometres and fit

TABLE 5.4 ESTIMATED EQUATION FOR REVENUE PASSENGER-KILOMETRES FLOWN BY AUSTRALIANS ON THE DOMESTIC AIRLINE NETWORK

Variable	*Estimated equation*	*t statistic*
Constant	-0.7868	-0.7
ln RGNF85	1.4488	12.8
ln RMEDIUM	-0.4491	-5.2
ln RPPI	0.2192	3.6
STRIKE	-0.0902	-2.2
CGDUM	0.0783	3.1
EXDUM	0.0387	3.2
DA10	-0.0134	-0.8
DA20	-0.0087	-0.5
DA30	0.1080	6.4
DA11	-0.0189	-0.9
DA21	-0.0330	-1.6
DA31	0.1049	4.4

Dependent variable - ln DOMRPK2.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.95.
Durbin-Watson statistic - 1.9.
Estimation period - 1977Q4 to 1989Q2.

Two price variables were employed. First, ln RMEDIUM was the log of the real medium-distance air fare. (For use in forecasting post-deregulation, the level of this variable has been lowered in an ad hoc fashion, to simulate the fall in average yield, an unknown variable.) Second, ln RPPI was the log of the real petrol price index (deflation done by the consumer price index). It was used as a proxy measure of the relative competitiveness of land-based transport alternatives. An administrative variation of air fares in 1981 substantially reduced possible multicollinearity with fuel prices.

A strike dummy (STRIKE) set at 1 for the third quarter of 1985 was included to capture the effects on demand of a strike in the industry during that period.

A Commonwealth Games dummy (CGDUM) was set at 1 for the first two quarters of 1982. It was included to capture the

effects on demand of the Commonwealth Games in Brisbane. An Expo dummy (EXDUM) was also included to catch the effect of increased demand during the Bicentennial and especially during Expo in the September quarter of 1988.

Seasonal dummy variables (up to and including 1985 DA10 equal to 1 in the March quarter, DA20 equal to 1 in the June quarter, DA30 equal to 1 in the September quarter; after 1985 DA11 equal to 1 in the March quarter, DA21 equal to 1 in the June quarter, DA31 equal to 1 in the September quarter) were included to capture the effects of seasonal variations in demand over the course of a given set of years. The change in seasonality may well be related to the change from a three- to a four-semester school term during the mid 1980s.

The results of the estimations (see tables 5.3 and 5.4) indicated that air passenger movements and RPK were income elastic, with the coefficient on income for passengers (1.0341) less than that for RPK (1.4488). This difference reflects the fact that rising income levels generate not only more trips, but longer trips as well.

Both models suggested that the short-term own-price elasticities are low (-0.6440 and -0.4491), as are the cross-price elasticities against the price of petrol (0.2256 and 0.2192), respectively.

The fit of both equations is good (adjusted R^2 of 0.86 for passengers and 0.95 for RPK). Tracking and prediction of turning points are also good (see figures 5.3 and 5.4). There was no evidence of autocorrelation problems. For passengers, the adjusted R^2 fell to 0.79 without the three dummies STRIKE, CGDUM and EXDUM. For RPK, the fit fell to 0.91 without the dummies.

CHAPTER 6 RAIL PASSENGERS

Railways play only a minor role in the passenger transport task of the country. Although urban rail still forms an important part of transport systems in the major capital centres, the reliance on rail, for both urban and non-urban transit, is diminishing. Today, railways account for only 1.6 per cent of household expenditure on transport. The decline in rail transport share is mainly due to the motor car, which now accounts for over 90 per cent of the modal passenger-kilometre share of urban and non-urban passenger transport.

The BTCE has only one model of passenger rail transport, namely, interstate rail passenger movements. This is described below.

INTERSTATE RAIL PASSENGER MOVEMENTS

Interstate rail passenger movements are now largely made up of tourists, both domestic and foreign. The quicker services available by air, and cheaper more convenient road services have made it more profitable for business to substitute away from rail travel. Growth in interstate rail travel was interrupted in the early 1980s when deregulation of interstate coach services led to large declines in real coach fares relative to rail. In the late 1980s growth has resumed, albeit from a lower base.

Rail passenger services are the largest loss making activities of the rail industry. However, these losses arise largely from the provision of urban and country (intrastate) services. Interstate rail services, in contrast with urban and country rail, have a better cost recovery record.

Interstate rail passenger movements equation

The dependent variable in this equation is the log of the total number of interstate rail passenger movements in Australia (ln ERPAS). An interstate rail passenger movement is defined to be a movement departing from one State system and terminating in another.

The equation consists of three main explanatory variables (income, rail fares and bus fares) and a set of dummy variables (see table 6.1).

The first explanatory variable is the log of real, seasonally adjusted gross national expenditure at 1984-85 prices (ln RGNE85). The coefficient on income is 0.82367, which suggests that despite the slump in interstate rail patronage in the early 1980s (when bus competition intensified), rail travel retains a fairly elastic response

TABLE 6.1 ESTIMATED EQUATION FOR THE NUMBER OF INTERSTATE RAIL PASSENGER MOVEMENTS

Variable	*Estimated coefficient*	*t statistic*
Constant	4.33507	3.6
ln RGNE85	0.82367	7.2
ln RERFAR	-0.10319	-1.0
ln RBUSFAR	0.30596	4.7
BIDUM	0.08271	3.5
CGDUM	0.09668	3.4
DISPDUM	-0.10467	-3.9
DUM7980	-0.08930	-4.3
D1	-0.04170	-2.9
D2	-0.09235	-6.0
D3	-0.06050	-4.0

Dependent variable - ln ERPAS.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.8261.
Durbin-Watson statistic - 1.6.
Estimation period - 1978Q3 to 1989Q1.

to income. This bodes well for the longer-term trend in patronage.

The second main explanatory variable is the log of the representative rail fare, deflated by the consumer price index (ln RERFAR). The coefficient (-0.10319) is quite small and the relatively large error term suggests that the own-price effect on rail travel is not very significant.

The third independent variable is the log of the representative bus (coach) fare, deflated by the consumer price index (ln RBUSFAR). The estimated coefficient (0.30596) is also small, although the summary statistics indicate that it has a significant impact on the number of interstate rail passengers, especially given the large falls in real bus fares of the early 1980s.

The first dummy variable (BIDUM), equal to 1 in the March to September quarters of 1988 and 0 elsewhere, is used to adjust for increased interstate rail patronage during the Bicentennial year. The second dummy (CGDUM), equal to 1 in the March and June quarters of 1982 and 0 elsewhere, is included to compensate for the increase in rail travel during the Brisbane Commonwealth Games. Also in the equation is a dummy variable to account for industrial action (DISPDUM), equal to 1 in the September quarter of 1983, 1 in the March quarter of 1985, and 0 elsewhere. Finally, the dummy variable DUM7980, included for passenger rail, is equal to 1 in the four quarters of the 1979-80 financial year and 0 elsewhere, to account for the unusually low traffic levels of that financial year. The remaining variables (D1 to D3) are seasonal dummies.

The equation was estimated by the method of ordinary least squares. The fit of predicted to actual is only fair (see figure 6.1) with an adjusted R^2 value of 0.83. The model picks the general trend and the timing of the major turning points. The forecast history is good, with a Theil statistic of 0.03 and a major downturn adequately predicted (see figure 6.1). The adjusted R^2 fell to 0.55 without the four dummies BIDUM, CGDUM, DISPDUM and DUM7980. If the

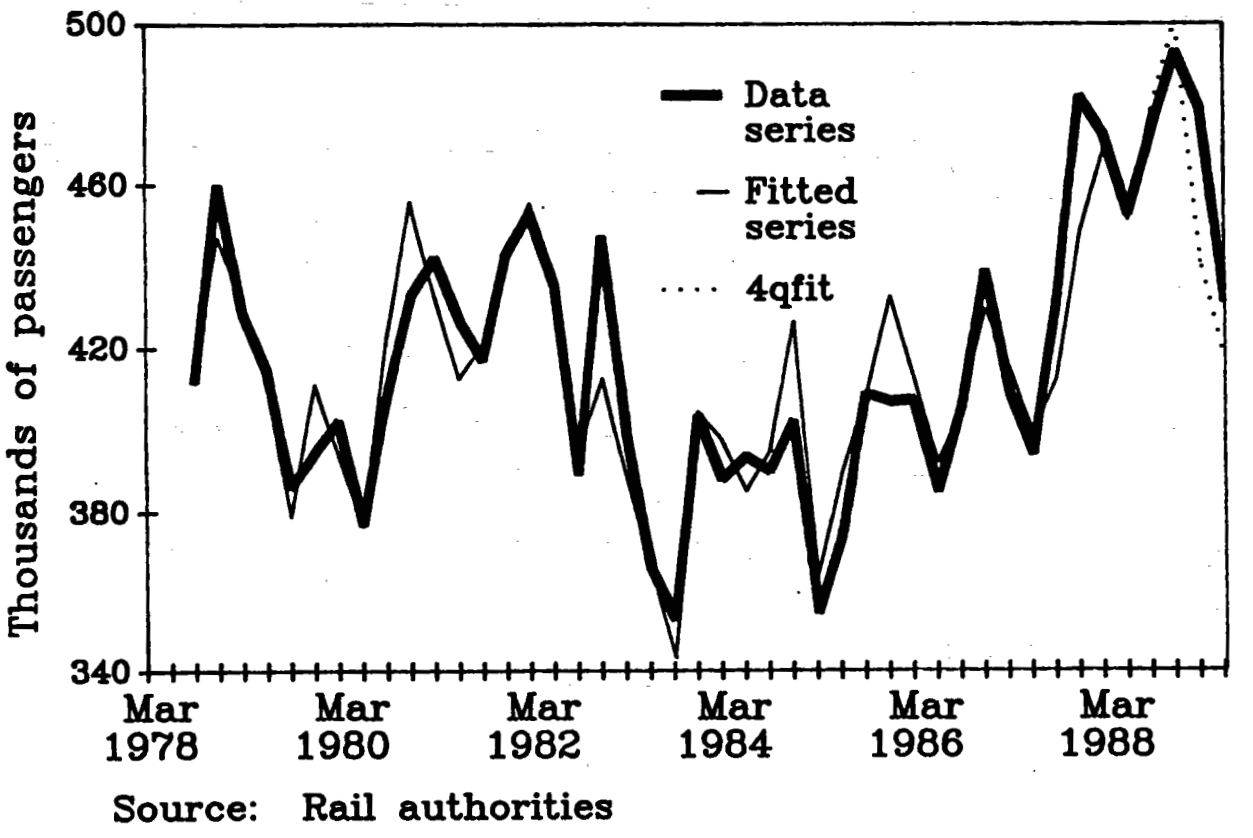


Figure 6.1 Interstate rail passengers and fit

quarters when the first three dummies were active were dropped from the sample estimation period (as being a prior regarded as atypical), the R^2 drops to 0.63.

All data used is listed in appendix I and variable mnemonics are in appendix III.

CHAPTER 7 TELECOMMUNICATIONS

The telecommunications sector is one of the most dynamic service industries in the economy. New and cheaper technologies have led to a greater availability and importance of telecommunications activity. Banking and financial services, retailing, and tourism, which together account for almost 30 per cent of annual gross domestic product, are heavily reliant upon telecommunications services and equipment.

The Bureau currently maintains two models of telecommunications activity. The OTC calls equation models the number of both-way (that is, inward and outward) international telephone calls. The Telecom trunk calls equation models the number of domestic trunk calls.

OTC CALLS

Advancing technology and decreasing costs has increased the importance of telecommunications to international economic activity. Since 1983 the number of both-way international telephone calls has been increasing at a compound rate of over 30 per cent per year. It is expected that growth in overseas telecommunications demand, fuelled especially by strong business demand, will continue to be strong.

OTC calls equation

The dependent variable in this equation is the log of the number of both-way international calls (ln OTC).

One of the two major explanatory variables used in the equation (see table 7.1) is the log of OECD real gross domestic product (ln OECDGDP). The estimated elasticity

TABLE 7.1 ESTIMATED EQUATION OF INTERNATIONAL BOTH-WAY TELEPHONE CALLS

Variable	*Estimated coefficient*	*t statistic*
Constant	-43.9172	-5.3
ln OECDGDP	6.7866	7.7
ln ROTCCH	-1.0139	-3.8
OTCDUM	-0.0533	-2.4
D1	-0.0638	-6.0
D2	-0.0391	-3.2
D3	-0.0283	-2.8

Dependent variable - ln OTC.
Estimation method - Cochrane-Orcutt, Rho = 0.76.
Adjusted R^2 - 0.998.
Durbin-Watson statistic - 1.45.
Estimation period - 1983Q2 to 1990Q1.

(6.7866) indicates that the number of international calls is highly responsive to changes in income levels.

The second major explanatory variable is the log of real OTC call charges (ln ROTCCH). The elasticity on this variable (-1.0139) suggests there is a one-to-one relationship between percentage changes in real OTC charges and percentage changes in OTC traffic.

The equation contains a dummy variable (OTCDUM), to account for the effects of industrial action in the December quarter of 1988. A set of seasonal dummies is also included in the estimating equation.

The form of the equation is double log and estimation is by the Cochrane-Orcutt iIterative technique (Rho equal to 0.76), due to a suggestion of autocorrelation in the equation. The fit of predicted to actual values is shown in figure 7.1. The resultant summary statistics reveal that the equation fits the data almost perfectly (adjusted R^2 equal to 0.998). In addition, the four-quarter-ahead forecasting experience is good, with a Theil statistic of

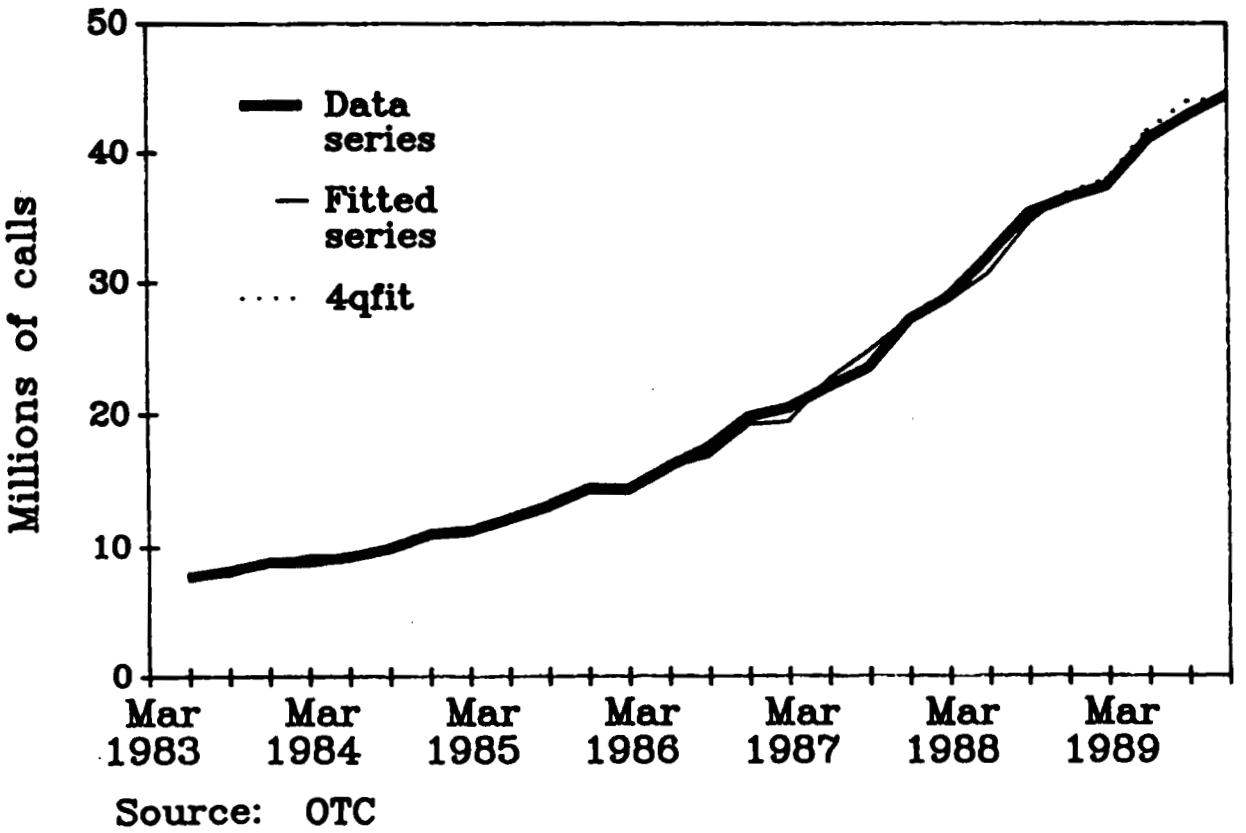


Figure 7.1 International both-way calls and fit

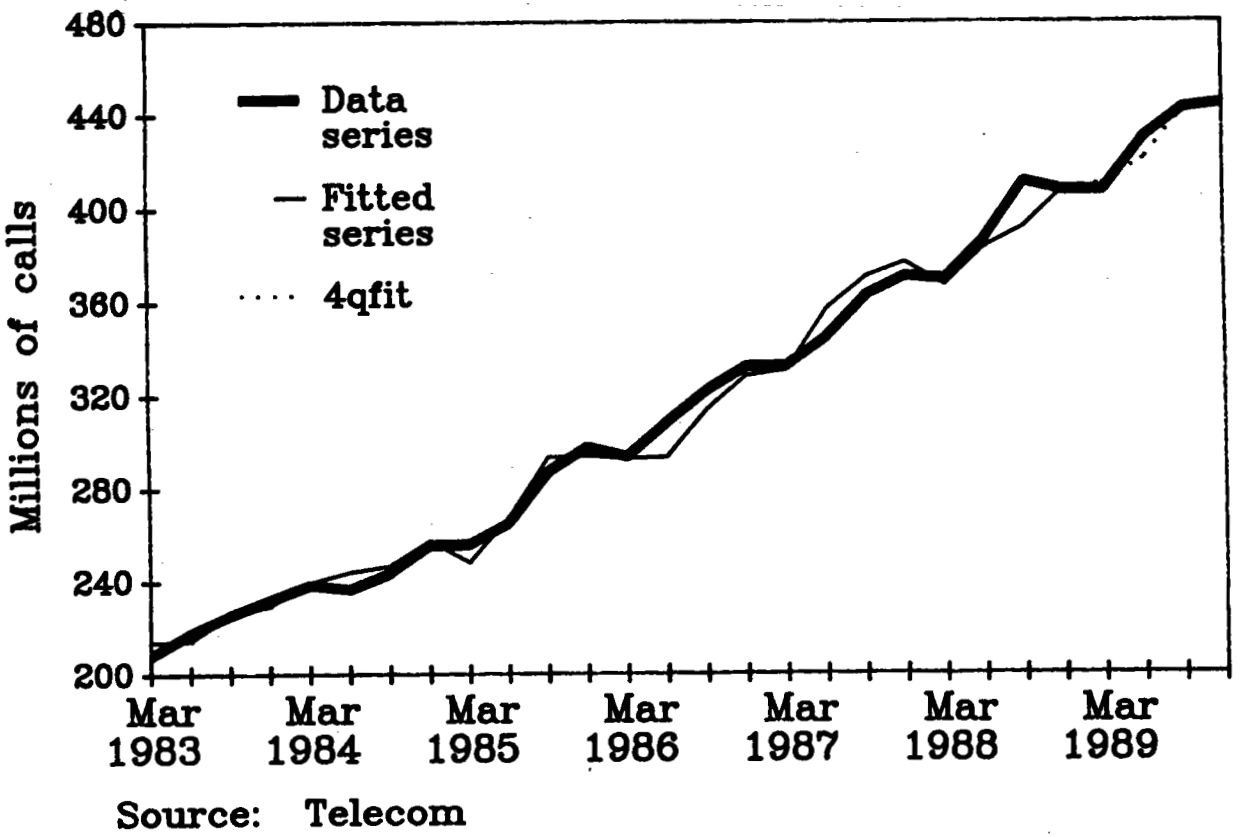


Figure 7.2 Domestic trunk calls and fit

0.008. The forecast record is shown in figure 7.1. If the dummy OTCDUM is dropped from the equation, the adjusted R^2 is 0.99.

All data used is listed in appendix I and variable mnemonics in appendix III.

TELECOM TRUNK CALLS

The high rate of growth in telecommunications activity over the past decade is reflected in the high rate of growth in the number of trunk calls in that period. Since 1981 the number of trunk calls has been growing at a rate of 10 per cent compounding yearly. It is expected that domestic telecommunications activity will continue to increase in the future.

Telecom trunk calls equation

The dependent variable in this equation is the log of the number of domestic trunk telephone calls (TRUNK).

There are two main explanatory variables in the equation (see table 7.2). The first is the log of seasonally adjusted real non-farm gross domestic product (ln RGNF85). The elasticity (1.9309) shows that, like international calls, domestic trunk calls are highly responsive to changes in income.

The second major explanatory variable is the log of the real Telecom tariff rate (ln RTEL), lagged one quarter. The estimated elasticity (-0.9298) reveals that there is a significant price effect, a 1 per cent rise in the real tariff rate producing a fall in the number of trunk calls of an almost equal proportion. A set of seasonal dummies is also included in the estimating equation.

The form of the estimated equation is double-log and estimation is by ordinary least squares. The fit of predicted to actual is shown in figure 7.2. The summary statistics show that the data fits the equation quite

TABLE 7.2 ESTIMATED EQUATION OF THE NUMBER OF DOMESTIC TRUNK CALLS

Variable	*Estimated coefficient*	*t statistic*
Constant	-15.5656	-11.29
ln RGNF85	1.9309	14.70
ln RTEL(-1)	-0.9298	-6.22
D1	-0.0358	-2.54
D2	-0.0242	-1.73
D3	-0.0008	-0.06

Dependent variable - ln TRUNK.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.987.
Durbin-Watson statistic - 1.5.
Estimation period - 1983Q1 to 1988Q4.

well, the adjusted R^2 statistic indicating that independent variables explain over 98 per cent of the variation in the number of trunk calls. The Durbin-Watson statistic obtained was 1.5. The test for positive autocorrelation is inconclusive. The Theil statistic has a value of 0.006, indicating an excellent fit of four-quarter-ahead forecasts to the actual traffic (see figure 7.2).

All data used is listed in appendix I and the variable mnemonics are listed in appendix III.

CHAPTER 8 URBAN PUBLIC TRANSPORT

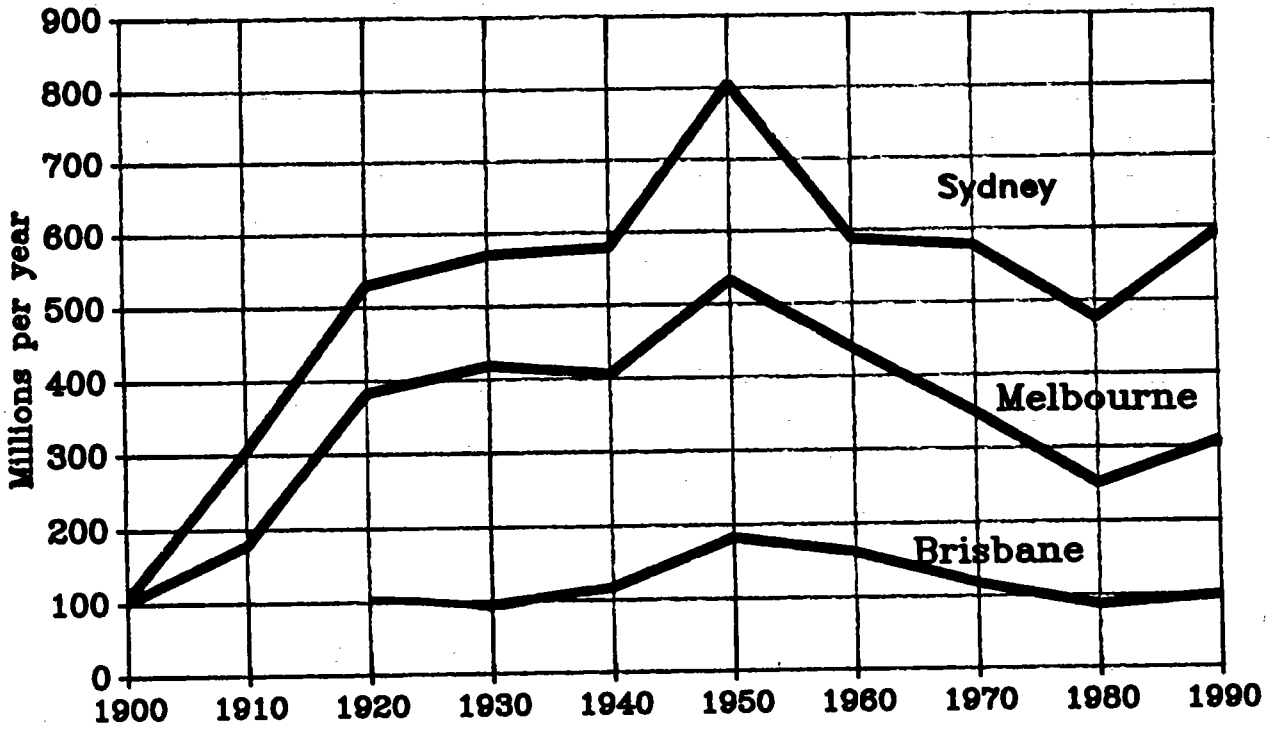
Urban public transport plays only a minor role in Australian cities, with a large part of urban travel being by private automobile. For example, in 1987-88 it is estimated that 94 per cent of all urban passenger-kilometres were by car, with urban public transport accounting for only 6 per cent of the urban passenger transport task (see table 8.1).

However, in the past the role of urban public transport has been much greater. As can be seen from figure 8.1, the number of passenger journeys on public transport reached a peak in Sydney, Melbourne and Brisbane just after World War II. Starting in the 1950s however, the number of private automobiles started to rise dramatically, and continued to

TABLE 8.1 THE URBAN PASSENGER TRANSPORT TASK, 1970-71 TO 1987-88

Year	*Car*	*Bus*	*Train*	*Tram*	*Ferry*	*Total*
Distance travelled (billion passenger-kilometres)						
1970-71	71.9	3.3	6.2	0.5	0.2	82.1
1975-76	91.3	3.0	4.9	0.5	0.2	99.9
1978-79	100.0	3.0	4.7	0.5	0.2	108.4
1981-82	111.3	3.0	5.4	0.5	0.2	120.4
1984-85	127.5	3.0	5.2	0.5	0.1	136.3
1987-88	144.7	3.1	6.1	0.5	0.1	154.5
Share of distance travelled (per cent)						
1970-71	87.6	4.0	7.6	0.6	0.2	100.0
1975-76	91.4	3.0	4.9	0.5	0.2	100.0
1978-79	92.2	2.8	4.3	0.5	0.2	100.0
1981-82	92.4	2.5	4.5	0.4	0.2	100.0
1984-85	93.5	2.2	3.8	0.4	0.1	100.0
1987-88	93.6	2.0	4.0	0.3	0.1	100.0

Source BTCE estimates.



Source: Neutze (1977) and BTCE estimates.

Figure 8.1 Urban public transport passengers: Sydney, Melbourne and Brisbane 1890-1990

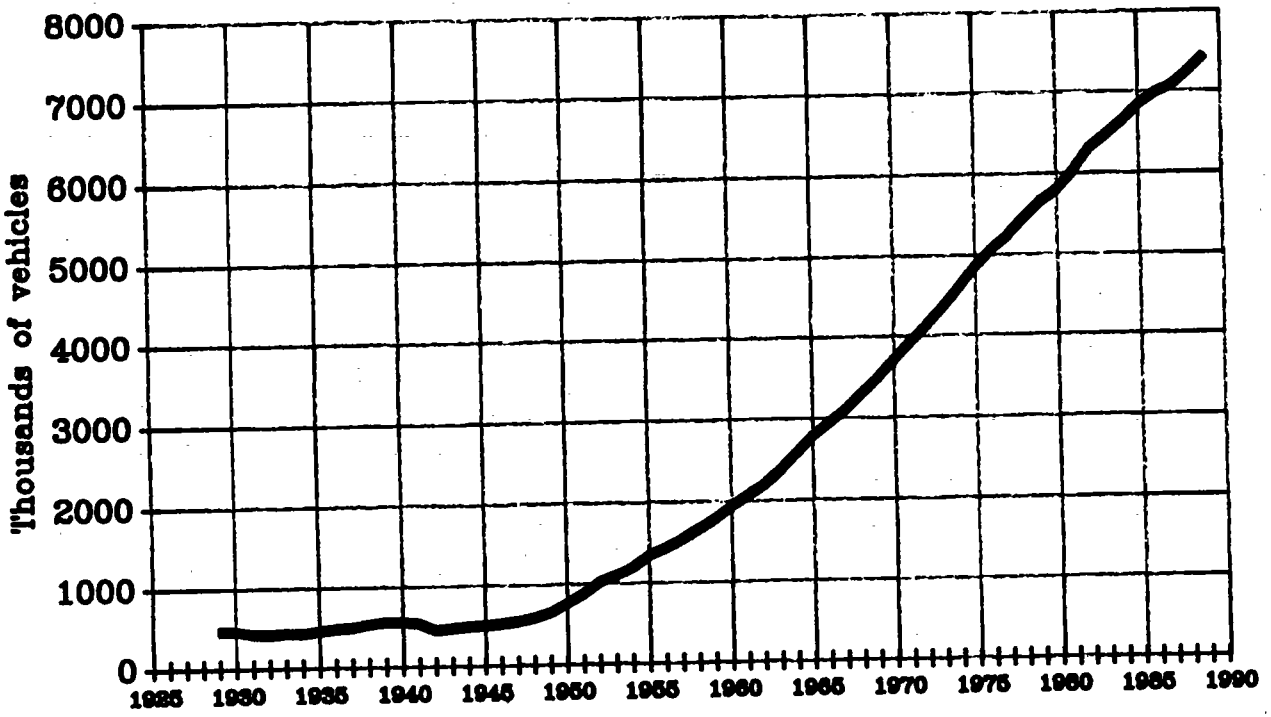
do so throughout the decades of the 1960s, 1970s and early 1980s (see figure 8.2). This dramatic rise in private automobile ownership meant a corresponding shift away from urban public transport. Thus, in spite of large increases in population and disposable income over this period, all three cities saw a steady downward trend in urban public transport patronage.

The late 1970s and early 1980s saw the end of this downward trend in patronage. Rising petrol prices, increasing congestion and parking problems, and (since the 1985 devaluation) sharply increased prices for new automobiles, have all been factors contributing to a resumption of growth in urban transport patronage in the 1980s. Thus, for the period for which the BTCE's models are derived, urban public transport was again trending upwards.

Rail grew more than other public transport modes during the 1980s. This is perhaps not surprising given the increasing job concentration in the developing central business districts of Australian cities during the decade. Trains are the basis for a rapid line-haul service and thus are favoured by centralisation of jobs in the central business district. Indeed the 1980s saw a resurgence in urban train systems around the world. Significant train services were initiated in Hong Kong, Singapore, Vienna, Brussels, Washington, Boston and Zurich (Newman & Kenworthy 1989).

Urban public transport equation

Using as a dependent variable the log of the aggregation of the bus, tram and train passenger numbers per 1000 population from seven cities (Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart and Canberra), an Australia-level model was fitted. The details of the equation are presented in table 8.2. Because the equation is of a double-log form, the coefficients represent elasticities. As can be seen from table 8.2, the coefficient of the log of Australian real income per person (ln RAUSIPP) implies an income elasticity of demand for urban public transport in Australia of about 0.6.



Source: ABS Cat No 9303.0

Figure 8.2 Number of cars and station wagons on register, Australia: 1929-1989

TABLE 8.2 ESTIMATED EQUATION FOR AUSTRALIA-LEVEL URBAN PUBLIC TRANSPORT

Variable	*Estimated coefficient*	*t statistic*
Constant	13.4905	37.6
ln RAUSIPP	0.6433	2.8
ln RAUSF14	-0.5448	-5.8
ln RAUSF58	-0.2519	-2.7
TIME	0.0019	2.3
AUSDISP	-0.0701	-8.8
BIDUM	0.0148	2.5
D1	-0.0103	-1.9
D2	0.0291	5.3
D3	0.0355	6.4

Dependent variable - ln AUSPPP.
Estimation method - ordinary least squares.
Adjusted R^2 - 0.8749.
Durbin-Watson statistic - 2.2.
Estimation period - 1979Q1 to 1989Q3.

The log of the real urban public transport fare has a coefficient of -0.55 for 1 to 4 quarters back (ln RAUSF14) and -0.25 for 5 to 8 quarters back (ln RAUSF58), implying a -0.8 elasticity in total after two years. This elasticity is quite high. However, it must be born in mind that data for the current estimation involved a mix of bus, train and tram travel, as well as travel in both peak and off-peak periods (off-peak and bus elasticities being generally higher).

A positive linear time trend of 0.00192 implies that each year public transport patronage grew by 46 passengers per thousand people per quarter, independently of changes in other causative factors. A real petrol price variable was tried, but came out insignificant with the wrong sign and was dropped from the analysis. The tracking of the model is shown in figure 8.3. Most of the variation is accounted for and there is no evidence of autocorrelation. If the two dummies AUSDISP and BIDUM are dropped from the equation, the adjusted R^2 drops to 0.65. However, if the two dummies are

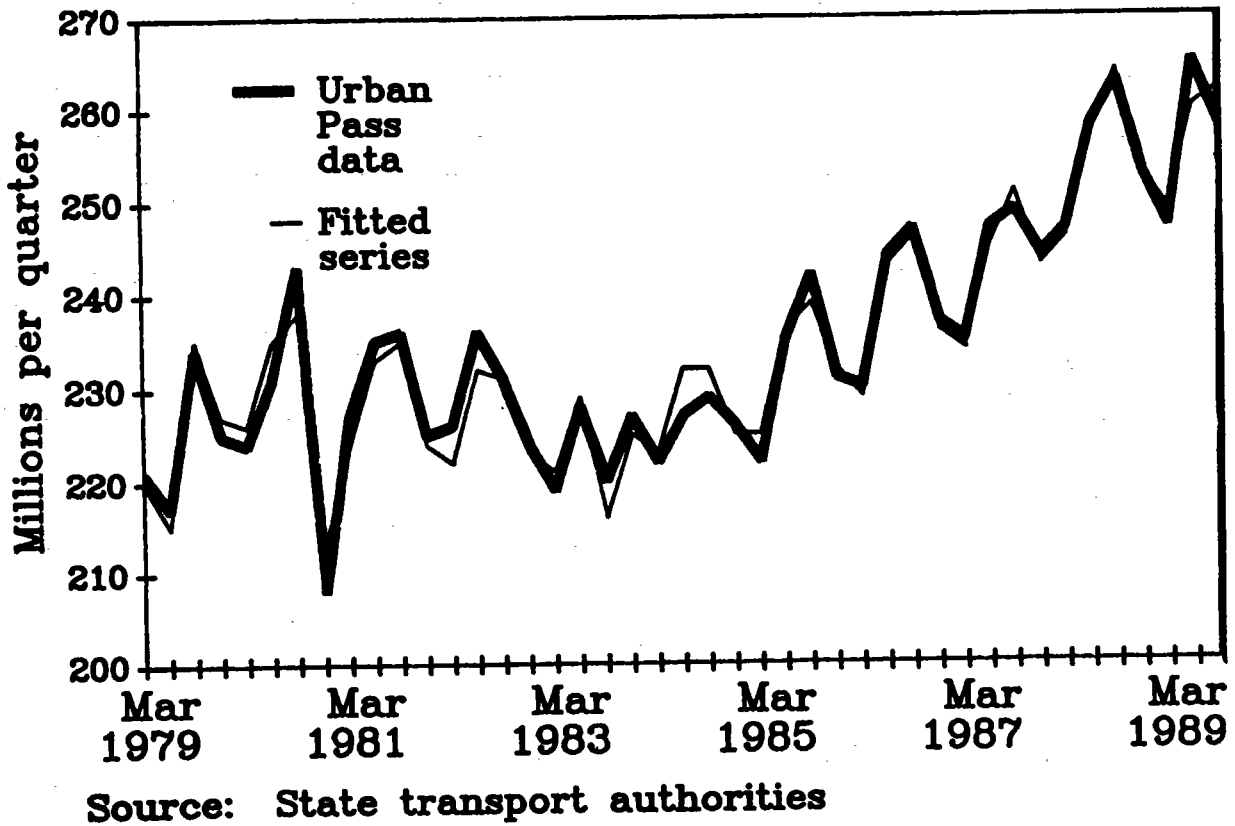


Figure 8.3 Australian urban public transport passengers and fit

dropped, and the quarters during which they are active are excluded from the estimation period (as being a priori atypical), the adjusted R^2 is 0.84. There is no forecasting history with this equation.

CHAPTER 9 CONCLUDING REMARKS

It has been found possible to satisfactorily estimate a suite of simple forecasting models, covering a range of transport and communications activities.

The models presented in this paper have been in use in BTCE forecasting for *Transport and Communications Indicators* since the December quarter of 1988. The experience using them has been relatively good, with major turning points in imports, automobile sales and foreign tourism predicted in advance of occurrence.

The BTCE plans to refine and maintain the models, as well as to develop others to expand coverage of the sector. Current plans are to develop models of coastal shipping, private rail freight and interstate coach travel among others. These future developments will be the subject of further Working Papers from the BTCE.

APPENDIX I DATA

ID	AGGINFA	AGGOFAR	AIFRATE	ALUMQ	AUS
1977Q1	5.54967	4.42562	1.11000	1369.00	2.141301E+08
1977Q2	5.64211	4.80808	1.15000	1450.00	2.253870E+08
1977Q3	5.67820	4.68493	1.15000	1611.00	2.277062E+08
1977Q4	5.21742	4.44631	1.20000	1689.00	2.232834E+08
1978Q1	5.24300	4.47371	1.20000	1400.00	2.162329E+08
1978Q2	5.40629	4.53619	1.20000	1668.00	2.307583E+08
1978Q3	5.26024	4.41816	1.20000	1548.00	2.247671E+08
1978Q4	5.00180	4.20357	1.20000	1636.00	2.253044E+08
1979Q1	4.27048	3.62116	1.20000	1488.00	2.207507E+08
1979Q2	4.21027	3.69987	1.20000	1654.00	2.173105E+08
1979Q3	4.41191	3.94433	1.28000	1670.00	2.338537E+08
1979Q4	4.28207	3.73963	1.26000	1664.00	2.247116E+08
1980Q1	4.00872	3.53099	1.35000	2064.00	2.237959E+08
1980Q2	4.23977	3.86255	1.35000	1874.00	2.308111E+08
1980Q3	4.65024	4.17083	1.68000	1289.00	2.428720E+08
1980Q4	4.64274	3.98054	1.77000	1767.00	2.082590E+08
1981Q1	4.26231	3.74524	1.89000	1578.00	2.268971E+08
1981Q2	4.49774	3.96936	1.89000	1780.00	2.345876E+08
1981Q3	4.46149	4.30367	2.09000	1646.00	2.356488E+08
1981Q4	4.48304	4.04394	2.19000	1506.00	2.254195E+08
1982Q1	4.26963	3.86893	2.19000	1642.00	2.260993E+08
1982Q2	4.09814	3.99015	2.30000	1377.00	2.326209E+08
1982Q3	4.22993	3.95615	2.30000	1452.00	2.312007E+08
1982Q4	4.92226	4.16251	2.45000	1481.00	2.237155E+08
1983Q1	4.33399	3.93877	2.50000	1232.00	2.189464E+08
1983Q2	4.25531	4.47183	2.50000	1565.00	2.275927E+08
1983Q3	4.41118	4.21107	2.68000	1820.00	2.195018E+08
1983Q4	4.48770	4.00634	2.68000	1761.00	2.269741E+08
1984Q1	4.42326	3.87554	2.68000	1468.00	2.222900E+08
1984Q2	3.81771	4.13874	2.68000	1839.00	2.266644E+08
1984Q3	4.39750	4.10370	3.16000	1775.00	2.285964E+08
1984Q4	4.71679	3.84537	3.16000	1779.00	2.260456E+08
1985Q1	3.84946	3.72744	3.16000	1797.00	2.220778E+08
1985Q2	3.64376	3.99471	3.48000	1664.00	2.347592E+08
1985Q3	3.86434	4.11002	3.72000	1798.00	2.418152E+08
1985Q4	3.99657	4.00022	3.72000	1910.00	2.314214E+08
1986Q1	4.06549	3.94921	3.72000	1831.00	2.299291E+08
1986Q2	3.59152	3.85301	3.72000	1892.00	2.435833E+08
1986Q3	3.76496	3.80146	4.02000	1894.00	2.468055E+08
1986Q4	3.91564	3.46613	4.02000	2071.00	2.371650E+08
1987Q1	3.92111	3.76105	4.02000	2069.00	2.347880E+08
1987Q2	3.50629	3.44503	4.02000	2083.00	2.469268E+08
1987Q3	3.67403	3.20944	4.02000	2129.00	2.493237E+08
1987Q4	3.49050	3.53042	4.22000	2020.00	2.436862E+08
1988Q1	3.89119	3.79180	4.22000	2220.00	2.473481E+08
1988Q2	3.50000	3.64000	4.22000	2172.00	2.583904E+08
1988Q3	3.60000	3.62000	4.22000	1841.00	2.617000E+08
1988Q4	3.90000	3.58000	4.22000	2180.00	2.520000E+08
1989Q1	3.77000	3.60000	4.22000	2058.00	2.456000E+08
1989Q2	3.43000	3.61000	4.28000	2211.00	2.637000E+08
1989Q3	3.59000	3.60000	4.30000	1834.00	2.566000E+08
1989Q4	3.83000	3.59000	4.30000	2163.00	2.500000E+08
1990Q1	3.41000	3.57000	4.36000	2020.00	NA
1990Q2	3.48000	3.58000	4.36000	2150.00	NA

ID	AUSFAR	AUSPFCS	AUSPOP	AVGDP	BULKOUT
1977Q1	66.0000	12895.0	14157.0	82.3288	34851.5
1977Q2	66.1000	13334.0	14192.0	82.7288	39192.6
1977Q3	66.8000	13647.0	14231.0	82.1980	39861.7
1977Q4	67.5000	13957.0	14282.0	80.6500	40458.6
1978Q1	71.7000	14245.0	14330.0	81.1845	38188.5
1978Q2	71.8000	14954.0	14359.0	82.1793	40717.6
1978Q3	72.6000	15356.0	14397.0	83.2912	36634.6
1978Q4	72.6000	15758.0	14431.0	84.6031	39892.7
1979Q1	75.6000	16248.0	14478.0	84.9273	41465.3
1979Q2	75.6000	16712.0	14516.0	85.4565	42064.5
1979Q3	79.0000	17262.0	14555.0	85.6273	42975.0
1979Q4	84.1000	17685.0	14603.0	86.0910	45025.0
1980Q1	87.4000	18459.0	14646.0	87.0340	42738.0
1980Q2	87.9000	18964.0	14695.0	86.2892	45161.0
1980Q3	94.9000	19596.0	14747.0	86.3892	42186.0
1980Q4	101.000	20228.0	14807.0	87.0529	43403.0
1981Q1	102.100	20783.0	14875.0	87.3892	39780.0
1981Q2	102.200	21591.0	14923.0	88.8682	41890.0
1981Q3	105.600	22426.0	14989.0	89.6061	42167.0
1981Q4	115.400	23036.0	15054.0	89.6198	39506.0
1982Q1	117.200	23658.0	15122.0	89.5887	38912.0
1982Q2	117.200	24717.0	15184.0	90.3214	43141.0
1982Q3	123.500	25383.0	15239.0	89.8128	40300.0
1982Q4	129.400	26160.0	15289.0	89.0613	38608.0
1983Q1	130.200	26871.0	15346.0	88.7441	38235.0
1983Q2	130.300	27224.0	15394.0	90.2061	40366.0
1983Q3	134.100	27976.0	15439.0	92.0059	42143.0
1983Q4	145.900	28761.0	15484.0	93.0540	48205.0
1984Q1	147.600	29434.0	15531.0	95.2590	49302.0
1984Q2	147.500	30013.0	15579.0	96.3313	56260.0
1984Q3	151.100	30587.0	15629.0	96.7313	57696.0
1984Q4	154.500	31345.0	15677.0	97.9777	55306.0
1985Q1	155.200	32359.0	15737.0	98.3381	57237.0
1985Q2	155.700	33484.0	15788.0	99.5000	59285.0
1985Q3	159.900	34510.0	15840.0	99.6414	58927.0
1985Q4	163.500	35476.0	15901.0	100.260	57333.0
1986Q1	166.300	35818.0	15962.0	99.9881	57220.0
1986Q2	166.800	37030.0	16018.0	101.224	54362.0
1986Q3	177.300	37965.0	16077.0	102.539	57381.0
1986Q4	181.000	38593.0	16139.0	101.136	55518.0
1987Q1	182.800	39266.0	16203.0	102.219	52387.0
1987Q2	183.300	40319.0	16263.0	102.719	59661.0
1987Q3	191.200	41833.0	16328.0	103.698	60946.0
1987Q4	193.800	42544.0	16398.0	104.319	67773.0
1988Q1	197.000	43757.0	16478.0	104.924	63298.0
1988Q2	198.100	44672.0	16538.0	104.821	62300.0
1988Q3	212.300	45760.0	16604.0	105.247	65381.0
1988Q4	215.400	47058.0	16677.0	105.736	60935.0
1989Q1	215.800	48868.0	16747.0	107.153	60626.0
1989Q2	216.600	50360.0	16807.0	107.757	65565.0
1989Q3	228.700	51443.0	16862.0	108.576	67116.0
1989Q4	232.700	NA	16922.0	109.727	60997.0
1990Q1	234.900	NA	16982.0	110.570	NA
1990Q2	236.100	NA	17042.0	111.174	NA

ID	BULKRF	BUSFAR	COALQ	CPI	DEL3
1977Q1	1.959005E+07	29.1700	8336.00	71.4000	NA
1977Q2	2.135076E+07	30.0300	9485.00	73.1000	NA
1977Q3	2.124831E+07	30.8900	8883.00	74.5000	.625783
1977Q4	2.017010E+07	31.7500	9637.00	76.3000	.665723
1978Q1	1.873778E+07	32.5900	9122.00	77.3000	1.08685
1978Q2	2.107679E+07	33.4300	10265.0	78.8000	2.48260
1978Q3	1.941813E+07	34.2700	8146.00	80.4000	3.54312
1978Q4	2.110436E+07	35.1000	10006.0	82.2000	4.58466
1979Q1	2.120383E+07	36.1100	9325.00	83.6000	4.27336
1979Q2	2.184185E+07	37.3000	10514.0	85.8000	3.28690
1979Q3	2.313976E+07	38.4800	9527.00	87.8000	2.80804
1979Q4	2.398818E+07	39.6700	11086.0	90.4000	2.35174
1980Q1	2.391298E+07	40.2700	10864.0	92.4000	2.93319
1980Q2	2.461977E+07	40.2900	11130.0	95.0000	2.85035
1980Q3	2.142524E+07	40.3100	8293.00	96.8000	3.66615
1980Q4	2.594222E+07	40.3300	11997.0	98.8000	3.85134
1981Q1	2.397711E+07	39.9200	11696.0	101.100	4.07152
1981Q2	2.754402E+07	39.0900	15431.0	103.400	4.10673
1981Q3	2.384663E+07	38.2600	11444.0	105.500	2.95022
1981Q4	2.252048E+07	37.4300	12226.0	109.900	1.65656
1982Q1	2.475582E+07	37.0600	9749.00	111.800	.102520
1982Q2	2.848032E+07	37.1500	12636.0	114.500	-1.778039E-0
1982Q3	2.741007E+07	37.2400	12492.0	118.500	-.164089
1982Q4	2.515586E+07	37.3200	11826.0	121.900	7.848044E-0
1983Q1	2.398003E+07	36.9900	14713.0	124.600	-.347012
1983Q2	2.516047E+07	36.2300	15665.0	127.300	-.515486
1983Q3	2.690521E+07	35.4700	14745.0	129.500	-.153614
1983Q4	2.647784E+07	34.7100	16072.0	132.500	1.95987
1984Q1	3.112872E+07	34.4400	18053.0	132.000	4.63323
1984Q2	3.264835E+07	34.6600	15339.0	132.200	6.34549
1984Q3	3.286979E+07	34.8700	21889.0	134.000	7.10586
1984Q4	3.397366E+07	35.0900	20856.0	135.800	5.64980
1985Q1	3.100858E+07	35.2900	20416.0	137.800	5.17143
1985Q2	3.658861E+07	35.4800	22991.0	141.100	5.25693
1985Q3	3.751781E+07	35.6600	22536.0	144.200	5.81073
1985Q4	3.700429E+07	35.8400	23230.0	147.100	6.22192
1986Q1	3.394103E+07	36.3100	22713.0	150.500	4.14174
1986Q2	3.709089E+07	37.0700	22004.0	153.000	2.66595
1986Q3	3.906164E+07	37.8200	23037.0	157.000	1.42793
1986Q4	3.748570E+07	38.5700	25030.0	161.500	1.75089
1987Q1	3.511412E+07	39.3400	22912.0	164.700	3.77922
1987Q2	3.703929E+07	39.8000	26739.0	167.200	4.59339
1987Q3	3.785993E+07	39.8000	23871.0	170.000	5.33481
1987Q4	3.896400E+07	41.5000	27360.0	172.900	4.62289
1988Q1	3.593600E+07	41.8000	26588.0	176.000	4.27016
1988Q2	3.469200E+07	41.8000	24242.0	179.000	3.86681
1988Q3	3.685200E+07	44.5000	23539.0	182.400	3.43871
1988Q4	3.513300E+07	45.5000	25945.0	186.200	3.38161
1989Q1	3.428200E+07	46.1000	21699.0	188.000	4.06327
1989Q2	3.759100E+07	46.6000	26127.0	192.600	5.05865
1989Q3	3.859500E+07	47.1000	25521.0	197.000	4.95224
1989Q4	3.864400E+07	47.6000	24401.0	200.700	4.68224
1990Q1	3.937400E+07	47.6000	28500.0	204.100	2.94994
1990Q2	NA	45.3000	26578.0	207.400	NA

ID	DISPWS	DOMAFR	DOMPAS	DOMPAS1	DOMPAS2
1977Q1	7.10000	25785.0	2.371738E+06	NA	2.261009E+06
1977Q2	13.5000	25200.0	2.251595E+06	NA	2.169411E+06
1977Q3	17.5000	30991.0	2.622751E+06	NA	2.531951E+06
1977Q4	14.6000	31334.0	2.512850E+06	138747.	2.374103E+06
1978Q1	8.60000	27474.0	2.609597E+06	117569.	2.492028E+06
1978Q2	57.9000	31091.0	2.544710E+06	88545.0	2.456165E+06
1978Q3	49.6000	32805.0	2.758015E+06	104993.	2.653022E+06
1978Q4	15.2000	31971.0	2.575563E+06	161838.	2.413725E+06
1979Q1	8.00000	29315.0	2.602849E+06	135186.	2.467663E+06
1979Q2	34.1000	33439.0	2.782664E+06	122625.	2.660039E+06
1979Q3	72.4000	33594.0	2.869321E+06	146195.	2.723126E+06
1979Q4	8.80000	35364.0	2.880057E+06	191003.	2.689055E+06
1980Q1	26.2000	29800.0	2.850248E+06	188676.	2.661572E+06
1980Q2	17.3000	30951.0	2.916823E+06	131676.	2.785147E+06
1980Q3	25.3000	33116.0	3.097574E+06	156121.	2.941453E+06
1980Q4	7.20000	31898.0	2.813545E+06	201945.	2.611600E+06
1981Q1	15.1000	28974.0	2.831898E+06	174425.	2.657473E+06
1981Q2	23.2000	30967.0	2.637781E+06	152636.	2.485146E+06
1981Q3	13.7000	34553.0	2.950442E+06	164223.	2.786219E+06
1981Q4	38.9000	35704.0	2.882722E+06	211261.	2.671461E+06
1982Q1	8.50000	30061.0	2.761898E+06	182198.	2.579701E+06
1982Q2	8.30000	35932.0	2.801448E+06	156011.	2.645437E+06
1982Q3	9.80000	38208.0	2.835480E+06	169050.	2.666430E+06
1982Q4	5.90000	38314.0	2.606929E+06	208725.	2.398204E+06
1983Q1	5.50000	31984.0	2.470351E+06	176325.	2.294026E+06
1983Q2	8.60000	33347.0	2.420146E+06	143700.	2.276446E+06
1983Q3	4.90000	38812.0	2.759300E+06	170775.	2.588525E+06
1983Q4	3.40000	39228.0	2.590800E+06	217200.	2.373600E+06
1984Q1	5.20000	35157.0	2.573900E+06	184200.	2.389700E+06
1984Q2	5.10000	36682.0	2.673600E+06	172125.	2.501475E+06
1984Q3	3.00000	39639.0	2.859600E+06	171900.	2.687700E+06
1984Q4	9.80000	39811.0	2.768400E+06	233100.	2.535300E+06
1985Q1	8.60000	34406.0	2.806100E+06	215100.	2.591000E+06
1985Q2	3.40000	36997.0	2.911100E+06	176250.	2.734850E+06
1985Q3	21.2000	39246.0	3.006400E+06	182475.	2.823925E+06
1985Q4	5.00000	42167.0	3.056800E+06	283200.	2.773600E+06
1986Q1	4.20000	32693.0	2.988800E+06	259125.	2.729675E+06
1986Q2	18.3000	34243.0	3.005300E+06	222900.	2.782400E+06
1986Q3	10.3000	34883.0	3.153500E+06	232200.	2.921300E+06
1986Q4	2.00000	36459.0	3.166400E+06	357825.	2.808575E+06
1987Q1	4.50000	31335.0	3.084300E+06	324600.	2.759700E+06
1987Q2	5.20000	34346.0	3.089000E+06	277500.	2.811500E+06
1987Q3	3.70000	34539.0	3.425400E+06	307875.	3.117525E+06
1987Q4	9.00000	39616.0	3.474100E+06	428700.	3.045400E+06
1988Q1	4.30000	33565.0	3.348700E+06	395175.	2.953525E+06
1988Q2	9.10000	35603.0	3.399400E+06	361050.	3.038350E+06
1988Q3	9.20000	39212.0	3.961200E+06	434925.	3.526275E+06
1988Q4	1.50000	41020.0	3.612300E+06	549000.	3.063300E+06
1989Q1	2.70000	35386.0	3.263411E+06	396250.	2.865161E+06
1989Q2	6.10000	36117.0	3.176440E+06	329550.	2.846890E+06
1989Q3	6.30000	19095.0	2.167652E+06	365025.	1.802627E+06
1989Q4	4.50000	13527.0	1.837043E+06	460650.	1.376393E+06
1990Q1	6.00000	26944.0	2.825392E+06	418575.	2.406817E+06
1990Q2	3.30000	29129.0	3.048353E+06	366225.	2.682128E+06

ID	DOMRPK	DOMRPK1	DOMRPK2	ERFAR	ERPAS
1977Q1	1.736431E+06	NA	1.655362E+06	32.5600	415651.
1977Q2	1.642350E+06	NA	1.582404E+06	32.5600	430849.
1977Q3	2.093273E+06	NA	2.020803E+06	33.1900	432808.
1977Q4	1.993933E+06	110095.	1.883838E+06	33.1900	442909.
1978Q1	2.076173E+06	93537.1	1.982636E+06	33.3700	409319.
1978Q2	2.017538E+06	70201.7	1.947336E+06	33.3700	426441.
1978Q3	2.225566E+06	84723.8	2.140842E+06	33.5500	411842.
1978Q4	2.057767E+06	129302.	1.928465E+06	33.5500	459897.
1979Q1	2.090484E+06	108575.	1.981909E+06	34.1500	428789.
1979Q2	2.244769E+06	98921.3	2.145848E+06	34.1500	414789.
1979Q3	2.370938E+06	120802.	2.250136E+06	39.3300	386174.
1979Q4	2.358676E+06	156425.	2.202251E+06	39.3300	394527.
1980Q1	2.353414E+06	155787.	2.197627E+06	41.5300	402321.
1980Q2	2.399767E+06	108334.	2.291433E+06	41.5300	376957.
1980Q3	2.634607E+06	132787.	2.501820E+06	46.9200	408175.
1980Q4	2.387534E+06	171368.	2.216167E+06	46.9200	432627.
1981Q1	2.441717E+06	150393.	2.291324E+06	49.5800	442284.
1981Q2	2.278537E+06	131848.	2.146689E+06	49.5800	427103.
1981Q3	2.640812E+06	146989.	2.493823E+06	54.5100	417158.
1981Q4	2.552435E+06	187056.	2.365380E+06	54.5100	443098.
1982Q1	2.473875E+06	163197.	2.310678E+06	62.2800	453109.
1982Q2	2.488256E+06	138570.	2.349686E+06	62.2800	435311.
1982Q3	2.578866E+06	153751.	2.425115E+06	68.7800	389374.
1982Q4	2.344097E+06	187681.	2.156416E+06	68.7800	447334.
1983Q1	2.245043E+06	160243.	2.084800E+06	68.7800	399941.
1983Q2	2.159183E+06	128205.	2.030978E+06	68.7800	365962.
1983Q3	2.550862E+06	157875.	2.392988E+06	68.7800	352803.
1983Q4	2.357394E+06	197632.	2.159762E+06	68.7800	403500.
1984Q1	2.352059E+06	168324.	2.183735E+06	69.5000	388065.
1984Q2	2.424281E+06	156074.	2.268207E+06	69.5000	393661.
1984Q3	2.654698E+06	159583.	2.495115E+06	73.4900	390064.
1984Q4	2.524302E+06	212547.	2.311755E+06	73.4900	402253.
1985Q1	2.518566E+06	197654.	2.325507E+06	78.0500	354486.
1985Q2	2.636562E+06	159810.	2.476934E+06	78.0500	374011.
1985Q3	2.846445E+06	173131.	2.673679E+06	80.0000	408849.
1985Q4	2.853930E+06	263787.	2.589525E+06	80.0000	406905.
1986Q1	2.803176E+06	242652.	2.560144E+06	80.0000	407293.
1986Q2	2.789824E+06	203085.	2.582906E+06	80.0000	385040.
1986Q3	3.028749E+06	224223.	2.805735E+06	85.6100	405494.
1986Q4	3.033310E+06	342240.	2.690525E+06	85.6100	438842.
1987Q1	3.051685E+06	321087.	2.730518E+06	85.6100	409329.
1987Q2	2.932891E+06	262458.	2.669415E+06	93.7400	394057.
1987Q3	3.378816E+06	302705.	3.075128E+06	92.0300	431042.
1987Q4	3.382867E+06	415566.	2.965425E+06	92.0300	481897.
1988Q1	3.254849E+06	381754.	2.862811E+06	92.0300	472179.
1988Q2	3.250655E+06	346317.	2.905312E+06	97.4400	452600.
1988Q3	3.888139E+06	426670.	3.461130E+06	97.2600	473300.
1988Q4	3.532099E+06	540765.	3.046958E+06	97.3000	493000.
1989Q1	3.196542E+06	393471.	2.914379E+06	103.400	478600.
1989Q2	3.115916E+06	305395.	2.847430E+06	103.400	431000.
1989Q3	2.204476E+06	354750.	1.849726E+06	114.300	497600.
1989Q4	1.904494E+06	477513.	1.426981E+06	114.300	620600.
1990Q1	2.831512E+06	395281.	2.436251E+06	118.300	505000.
1990Q2	3.020522E+06	311924.	2.708599E+06	119.000	NA

ID	EXNZA	EXPQ	EXTON	GRNQ	G7GDP
1977Q1	1.15000	34371.0	6818.00	2939.00	79.5000
1977Q2	1.15000	33763.0	7454.00	2939.00	80.3000
1977Q3	1.14000	36155.0	7661.00	3264.00	81.3000
1977Q4	1.12000	34709.0	8281.00	3264.00	81.7000
1978Q1	1.12000	32578.0	8804.00	3264.00	82.5000
1978Q2	1.11000	33857.0	10194.0	3264.00	84.4000
1978Q3	1.10000	35229.0	10092.0	2771.00	85.1000
1978Q4	1.09000	34160.0	11409.0	2771.00	86.2000
1979Q1	1.06000	33903.0	12087.0	2711.00	86.4000
1979Q2	1.11000	35937.0	12648.0	2771.00	87.1000
1979Q3	1.12000	33870.0	12472.0	5026.00	87.8000
1979Q4	1.13000	41810.0	14030.0	5026.00	88.1000
1980Q1	1.15000	36959.0	12889.0	5026.00	89.0000
1980Q2	1.17000	41523.0	12980.0	5026.00	87.6000
1980Q3	1.19000	36453.0	12534.0	3387.00	87.8000
1980Q4	1.23000	35993.0	14832.0	3387.00	88.5000
1981Q1	1.27000	35351.0	13148.0	3387.00	89.8000
1981Q2	1.35000	38728.0	15093.0	3387.00	89.8000
1981Q3	1.39000	37724.0	14965.0	3573.00	90.2000
1981Q4	1.37000	35629.0	17347.0	3573.00	89.6000
1982Q1	1.37000	35442.0	17660.0	3573.00	89.0000
1982Q2	1.38000	36982.0	17849.0	3573.00	89.3000
1982Q3	1.32000	36502.0	16370.0	2986.00	89.0000
1982Q4	1.34000	35431.0	18772.0	2939.00	89.2000
1983Q1	1.33000	36130.0	21540.0	2707.00	90.0000
1983Q2	1.34000	34410.0	20423.0	1415.00	91.4000
1983Q3	1.36000	42060.0	17361.0	1474.00	92.4000
1983Q4	1.38000	43075.0	22153.0	2970.00	93.6000
1984Q1	1.40620	44117.0	22446.0	6010.00	95.5000
1984Q2	1.35870	48251.0	22822.0	6011.00	96.3000
1984Q3	1.70380	52718.0	20518.0	5097.00	97.1000
1984Q4	1.73430	53645.0	22244.0	5245.00	97.8000
1985Q1	1.51960	50416.0	27885.0	6630.00	98.7000
1985Q2	1.38500	58906.0	27334.0	5845.00	99.5000
1985Q3	1.28960	54435.0	25668.0	3984.00	100.500
1985Q4	1.36040	51718.0	30944.0	4751.00	101.200
1986Q1	1.33940	54215.0	33670.0	7029.00	102.000
1986Q2	1.25000	51112.0	33347.0	5639.00	102.500
1986Q3	1.28300	52138.0	34388.0	4054.00	102.800
1986Q4	1.26280	52607.0	38916.0	4390.00	103.400
1987Q1	1.23250	47128.0	40594.0	4803.00	104.400
1987Q2	1.20770	54721.0	40379.0	5209.00	105.400
1987Q3	1.11200	55557.0	38453.0	4558.00	107.000
1987Q4	1.09450	58532.0	44046.0	3791.00	108.600
1988Q1	1.11820	57464.0	43294.0	3889.00	109.900
1988Q2	1.17520	54947.0	37666.0	2651.00	110.500
1988Q3	1.22630	57256.0	38607.0	2489.00	111.800
1988Q4	1.35110	56362.0	41784.0	2512.00	112.600
1989Q1	1.33290	52480.0	38745.0	3371.00	114.000
1989Q2	1.30000	59310.0	38742.0	5046.00	114.400
1989Q3	1.27000	62552.0	38238.0	4000.00	115.500
1989Q4	1.24000	56249.0	NA	2900.00	116.100
1990Q1	1.22000	58763.0	NA	4200.00	116.800
1990Q2	1.20000	59929.0	NA	3917.00	117.200

ID	IFRATE	IMTON	INTER	IRONQ	MEATQ
1977Q1	1.351845E-02	11777.0	100.000	20420.0	296.000
1977Q2	1.367989E-02	11527.0	100.000	18582.0	296.000
1977Q3	1.354056E-02	12970.0	102.000	21092.0	342.000
1977Q4	1.404231E-02	14325.0	102.000	18814.0	342.000
1978Q1	1.386065E-02	12886.0	103.300	17487.0	342.000
1978Q2	1.371930E-02	14110.0	103.300	17355.0	342.000
1978Q3	1.356852E-02	16215.0	105.400	21638.0	355.000
1978Q4	1.339316E-02	17560.0	105.400	18621.0	355.000
1979Q1	1.354157E-02	15320.0	108.700	19253.0	355.000
1979Q2	1.260001E-02	16471.0	108.700	19872.0	355.000
1979Q3	1.301659E-02	18073.0	113.100	16387.0	317.000
1979Q4	1.233456E-02	19052.0	113.100	22774.0	317.000
1980Q1	1.270469E-02	15925.0	119.300	17745.0	317.000
1980Q2	1.214575E-02	16564.0	119.300	22233.0	317.000
1980Q3	1.458434E-02	18112.0	130.700	22209.0	296.000
1980Q4	1.456502E-02	19154.0	130.700	17567.0	296.000
1981Q1	1.471997E-02	15919.0	136.300	17415.0	296.000
1981Q2	1.353965E-02	19057.0	137.800	16855.0	296.000
1981Q3	1.425210E-02	22445.0	147.600	19806.0	277.000
1981Q4	1.454541E-02	24593.0	147.600	17069.0	277.000
1982Q1	1.429821E-02	21317.0	147.600	19105.0	277.000
1982Q2	1.455604E-02	21506.0	147.600	18094.0	277.000
1982Q3	1.470400E-02	23304.0	158.100	17887.0	326.000
1982Q4	1.499884E-02	23662.0	158.100	17724.0	319.000
1983Q1	1.508587E-02	20236.0	164.700	16611.0	283.000
1983Q2	1.465571E-02	22333.0	164.700	14539.0	274.000
1983Q3	1.521690E-02	24699.0	164.700	22521.0	248.000
1983Q4	1.465682E-02	29015.0	163.600	20417.0	265.000
1984Q1	1.443822E-02	26288.0	167.600	17380.0	204.000
1984Q2	1.492038E-02	28569.0	167.600	22957.0	231.000
1984Q3	1.384088E-02	31002.0	174.000	21486.0	240.000
1984Q4	1.341724E-02	33200.0	174.000	23664.0	223.000
1985Q1	1.509067E-02	28135.0	174.000	19318.0	219.000
1985Q2	1.780748E-02	28632.0	182.500	25493.0	352.000
1985Q3	2.000427E-02	29659.0	182.500	23031.0	237.000
1985Q4	1.858933E-02	30674.0	191.100	19073.0	275.000
1986Q1	1.845424E-02	24585.0	191.100	20494.0	247.000
1986Q2	1.945098E-02	25196.0	197.600	19932.0	286.000
1986Q3	1.995721E-02	26861.0	197.600	21044.0	302.000
1986Q4	1.971147E-02	28997.0	205.700	18207.0	321.000
1987Q1	1.980366E-02	26175.0	205.700	14944.0	297.000
1987Q2	1.990814E-02	27680.0	209.400	18960.0	310.000
1987Q3	2.126534E-02	31163.0	209.400	22345.0	307.000
1987Q4	2.229984E-02	33451.0	213.600	22344.0	327.000
1988Q1	2.144274E-02	29983.0	213.600	22459.0	360.000
1988Q2	2.006077E-02	33608.0	214.000	23258.0	328.000
1988Q3	1.886648E-02	37331.0	218.000	26130.0	264.000
1988Q4	1.677433E-02	42532.0	222.000	23121.0	317.000
1989Q1	1.684058E-02	40533.0	223.000	22994.0	281.000
1989Q2	1.709402E-02	43485.0	227.000	23759.0	267.000
1989Q3	1.718694E-02	46540.0	232.000	28464.0	270.000
1989Q4	1.727824E-02	NA	236.000	24094.0	280.000
1990Q1	1.750990E-02	NA	240.000	21262.0	300.000
1990Q2	1.751848E-02	NA	246.000	24000.0	306.000

ID	MEDIUM	NBULKIN	NBULKRF	NZGDP	OECDGDP	OECDCPI
1977Q1	46.5800	NA	6.628426E+06	95.0000	7111.24	52.5667
1977Q2	46.5800	NA	6.951965E+06	95.0000	7149.05	53.9667
1977Q3	48.5900	NA	8.352715E+06	92.7000	7218.24	54.9000
1977Q4	47.7100	NA	7.174059E+06	88.8000	7268.81	55.7667
1978Q1	49.7900	NA	6.060794E+06	89.1000	7327.73	56.7000
1978Q2	49.7900	NA	6.464547E+06	89.2000	7469.56	58.0333
1978Q3	56.6900	NA	8.245833E+06	90.9000	7515.27	59.1667
1978Q4	56.6900	NA	8.321871E+06	92.6000	7610.13	60.2000
1979Q1	56.6900	NA	7.037850E+06	93.1000	7623.34	61.4333
1979Q2	62.8900	NA	7.669422E+06	93.5000	7708.64	63.3000
1979Q3	62.9200	1398.00	8.663290E+06	93.1000	7762.77	65.1667
1979Q4	62.9200	1492.00	8.305724E+06	93.8000	7799.82	66.9333
1980Q1	68.2200	1113.00	7.378731E+06	94.9000	7888.79	69.5000
1980Q2	71.2700	1399.00	7.436664E+06	94.8000	7765.92	72.0000
1980Q3	74.8300	1723.00	8.525603E+06	94.8000	7794.40	73.5000
1980Q4	74.8300	1697.00	7.873694E+06	95.5000	7845.88	75.2667
1981Q1	74.8300	1527.00	6.343791E+06	94.8000	7923.73	77.3000
1981Q2	85.0100	1755.00	7.076496E+06	98.1000	7932.21	79.3000
1981Q3	91.8100	1650.00	8.054899E+06	99.3000	7963.29	81.2000
1981Q4	91.8100	1689.00	7.287447E+06	100.000	7939.65	82.8667
1982Q1	97.9000	1604.00	6.115321E+06	100.600	7910.07	84.2067
1982Q2	97.9000	1691.00	6.329581E+06	101.900	7937.90	85.8333
1982Q3	112.480	1592.00	6.431646E+06	101.100	7909.87	87.3000
1982Q4	112.480	1654.00	6.101268E+06	99.2000	7929.29	88.3000
1983Q1	118.890	1199.00	5.330592E+06	97.6000	7995.18	89.0333
1983Q2	118.890	1422.00	4.812764E+06	99.3000	8091.88	90.4333
1983Q3	120.330	1487.00	6.382903E+06	102.200	8165.06	91.5333
1983Q4	127.690	1601.00	6.613306E+06	103.200	8254.59	92.8000
1984Q1	127.690	1633.00	5.188907E+06	106.000	8415.37	94.0333
1984Q2	130.290	1669.00	5.843333E+06	107.500	8459.37	95.2667
1984Q3	134.960	1828.00	7.092481E+06	107.500	8543.04	96.2333
1984Q4	134.960	2079.00	6.217740E+06	109.500	8601.46	97.3000
1985Q1	134.960	1819.00	5.521397E+06	109.300	8683.40	98.3667
1985Q2	134.960	2058.00	6.233775E+06	111.000	8746.90	99.8000
1985Q3	143.230	1725.00	7.328720E+06	110.200	8831.90	100.433
1985Q4	143.230	1891.00	6.527865E+06	110.800	8892.80	101.433
1986Q1	143.230	1773.00	5.614961E+06	109.300	8940.30	101.967
1986Q2	143.230	1738.00	6.703609E+06	111.500	9015.30	102.233
1986Q3	155.180	1959.00	7.104487E+06	114.100	9045.00	102.733
1986Q4	155.180	1864.00	7.263361E+06	110.300	9098.90	103.467
1987Q1	155.180	1641.00	5.841620E+06	111.600	9164.90	104.333
1987Q2	155.180	1570.00	6.528911E+06	111.600	9264.20	105.633
1987Q3	165.250	1698.00	7.710988E+06	112.000	9376.50	106.400
1987Q4	165.250	1866.00	7.382220E+06	111.600	9471.30	107.300
1988Q1	165.250	1651.00	6.283364E+06	111.500	9587.70	108.033
1988Q2	165.250	1994.00	6.968640E+06	110.600	9625.60	109.367
1988Q3	174.930	2013.00	8.280140E+06	110.100	9700.00	110.567
1988Q4	174.930	2395.00	8.291120E+06	110.300	9780.00	111.900
1989Q1	174.930	2608.00	7.431020E+06	111.900	9830.00	113.067
1989Q2	174.930	2355.00	7.812880E+06	112.800	9879.00	114.800
1989Q3	187.930	2288.00	8.355000E+06	113.400	9874.00	116.100
1989Q4	187.930	NA	8.508000E+06	115.300	9941.00	116.400
1990Q1	197.500	NA	7.429000E+06	116.400	10020.0	117.300
1990Q2	197.500	NA	NA	117.300	10100.0	118.800

ID	OILQ	OTC	OTCCH	PETROL	PPI
1977Q1	300.000	NA	NA	NA	1872.00
1977Q2	300.000	NA	NA	NA	1842.00
1977Q3	300.000	NA	NA	NA	1871.00
1977Q4	300.000	NA	NA	NA	2046.00
1978Q1	300.000	NA	NA	NA	2024.00
1978Q2	300.000	NA	NA	NA	2028.00
1978Q3	300.000	NA	NA	NA	2030.00
1978Q4	300.000	NA	NA	NA	2456.00
1979Q1	300.000	NA	NA	NA	2528.00
1979Q2	300.000	NA	NA	3742.70	2780.00
1979Q3	300.000	NA	NA	3687.70	3010.00
1979Q4	300.000	NA	NA	3730.44	3327.00
1980Q1	300.000	NA	NA	3671.87	3246.00
1980Q2	300.000	NA	NA	3645.66	3718.00
1980Q3	300.000	NA	NA	3649.63	3568.00
1980Q4	300.000	NA	1.95000	3804.73	3647.00
1981Q1	300.000	NA	1.93750	3614.95	3934.00
1981Q2	300.000	NA	1.92500	3716.17	4313.00
1981Q3	300.000	NA	1.91250	3823.97	4042.00
1981Q4	300.000	NA	1.90000	3839.87	4227.00
1982Q1	418.000	NA	1.89750	3699.14	4144.00
1982Q2	347.000	NA	1.89500	3861.84	4268.00
1982Q3	251.000	NA	1.89250	3720.53	4789.00
1982Q4	343.000	NA	1.89000	3904.41	4797.00
1983Q1	348.000	NA	1.88500	3607.37	4986.00
1983Q2	310.000	7.698583E+06	1.88000	3751.12	4755.00
1983Q3	581.000	8.166301E+06	1.87500	3784.06	5106.00
1983Q4	677.000	8.842544E+06	1.87000	3882.42	5350.00
1984Q1	734.000	8.867219E+06	1.88250	3802.53	5323.00
1984Q2	1107.00	9.247591E+06	1.89500	3867.54	5516.00
1984Q3	1072.00	9.915317E+06	1.90750	3801.62	5566.00
1984Q4	1184.00	1.102093E+07	1.92000	4014.81	5516.00
1985Q1	1525.00	1.125015E+07	1.90000	3839.19	5628.00
1985Q2	1864.00	1.219532E+07	1.88000	3923.41	6173.00
1985Q3	1968.00	1.317547E+07	1.86000	3889.36	6324.00
1985Q4	1716.00	1.449290E+07	1.84000	4100.40	6100.00
1986Q1	1399.00	1.442602E+07	1.83250	3815.76	6251.00
1986Q2	571.000	1.614014E+07	1.82500	4064.48	5543.00
1986Q3	1043.00	1.756577E+07	1.81750	4032.60	5891.00
1986Q4	1918.00	1.981096E+07	1.81000	4090.05	6289.00
1987Q1	1497.00	2.047759E+07	1.82500	3879.67	6420.00
1987Q2	1393.00	2.204500E+07	1.84000	4005.93	6231.00
1987Q3	1450.00	2.349300E+07	1.85500	4097.94	6200.00
1988Q1	1438.00	2.884600E+07	1.86500	4140.66	6490.00
1988Q2	1532.00	3.192700E+07	1.86000	4097.51	6096.00
1988Q3	1847.00	3.523800E+07	1.85500	4217.30	6061.00
1988Q4	1526.00	3.659900E+07	1.85000	4318.70	5910.00
1989Q1	1507.00	3.744700E+07	1.84500	4247.30	5910.00
1989Q2	1141.00	4.103100E+07	1.84000	4295.00	6405.00
1989Q3	1475.00	4.324300E+07	1.83500	4308.00	6506.00
1989Q4	1575.00	4.541300E+07	1.83000	4389.00	6811.00
1990Q1	1949.00	4.491500E+07	1.82500	4261.00	7252.00
1990Q2	2257.00	NA	1.82000	NA	7259.00

ID	PRICE	RAILEXP	REGO	RGNE85	RGNFP85
1977Q1	54.8883	11275.0	126143.	44078.0	41001.0
1977Q2	57.4409	12424.0	129353.	44393.0	41349.0
1977Q3	59.9936	12147.0	135673.	43558.0	41151.0
1977Q4	62.5463	12901.0	126280.	42873.0	40948.0
1978Q1	64.7098	12386.0	117402.	44071.0	41611.0
1978Q2	66.8732	13529.0	139342.	44804.0	42266.0
1978Q3	69.0367	10917.0	144718.	45718.0	42691.0
1978Q4	71.2001	12777.0	131017.	46015.0	42860.0
1979Q1	71.9124	12036.0	121547.	46307.0	43834.0
1979Q2	72.6247	13285.0	139713.	46100.0	43453.0
1979Q3	73.3370	14553.0	143112.	45229.0	43421.0
1979Q4	74.0494	16112.0	128572.	46221.0	44534.0
1980Q1	77.8281	15890.0	124385.	46592.0	44465.0
1980Q2	81.6068	16156.0	130233.	47079.0	44954.0
1980Q3	85.3856	11680.0	139758.	47705.0	45009.0
1980Q4	89.1643	15384.0	135908.	48812.0	46265.0
1981Q1	90.0328	15083.0	127653.	49129.0	46248.0
1981Q2	90.9014	18818.0	144034.	49854.0	46895.0
1981Q3	91.7699	15017.0	147375.	50334.0	47086.0
1981Q4	92.6385	15799.0	136692.	50679.0	46844.0
1982Q1	94.4789	13322.0	136737.	50432.0	46812.0
1982Q2	96.3192	16209.0	150495.	50538.0	46932.0
1982Q3	98.1596	15478.0	151201.	49787.0	47039.0
1982Q4	100.000	14765.0	142155.	49159.0	46712.0
1983Q1	107.100	17420.0	123362.	48700.0	46653.0
1983Q2	114.600	17080.0	132851.	48628.0	46523.0
1983Q3	116.100	16219.0	136382.	49731.0	47234.0
1983Q4	117.500	19042.0	131920.	50332.0	47795.0
1984Q1	120.000	24063.0	135333.	52193.0	49661.0
1984Q2	121.900	21350.0	150302.	53138.0	50113.0
1984Q3	124.600	26986.0	147869.	53123.0	50567.0
1984Q4	126.900	26101.0	146421.	54217.0	51106.0
1985Q1	130.100	27046.0	156151.	54145.0	51432.0
1985Q2	139.800	28836.0	160541.	55036.0	52862.0
1985Q3	145.000	26520.0	155872.	56441.0	54396.0
1985Q4	148.800	27981.0	152497.	56458.0	53690.0
1986Q1	159.700	29742.0	117207.	56271.0	54307.0
1986Q2	165.000	27643.0	130551.	55897.0	53628.0
1986Q3	170.500	27091.0	125838.	56287.0	54259.0
1986Q4	198.200	29420.0	104613.	56184.0	54841.0
1987Q1	199.300	27715.0	99045.0	56884.0	55137.0
1987Q2	203.200	31948.0	99213.0	57957.0	56245.0
1987Q3	207.000	28429.0	106881.	58796.0	56985.0
1987Q4	215.000	31151.0	109333.	59546.0	57601.0
1988Q1	221.400	30477.0	99638.0	59992.0	57997.0
1988Q2	224.300	26893.0	116471.	61222.0	58879.0
1988Q3	227.600	26028.0	125500.	61722.0	58427.0
1988Q4	230.200	28457.0	135900.	63770.0	59504.0
1989Q1	231.986	25070.0	121600.	65892.0	60497.0
1989Q2	234.962	31173.0	137500.	66985.0	61573.0
1989Q3	236.450	29521.0	146500.	67395.0	62102.0
1989Q4	236.747	27301.0	138900.	66849.0	61879.0
1990Q1	238.700	32700.0	142100.	66800.0	62775.0
1990Q2	241.800	30495.0	146700.	65511.0	62246.0

ID	ROADPR	RTWI	BUGG	TEL	TFRT
197103	NA	NA	NA	NA	1164.00
197104	NA	NA	NA	NA	1176.00
197201	NA	NA	NA	NA	976.000
197202	NA	NA	NA	NA	1068.00
197203	NA	NA	NA	NA	1235.00
197204	NA	NA	NA	NA	1293.00
197301	NA	NA	NA	NA	1144.00
197302	NA	NA	NA	NA	1257.00
197303	NA	NA	NA	NA	1453.00
197304	NA	NA	NA	NA	1478.00
197401	NA	NA	NA	NA	1322.00
197402	NA	NA	NA	NA	1417.00
197403	NA	NA	NA	NA	1618.00
197404	NA	NA	NA	NA	1456.00
197501	NA	NA	NA	NA	1150.00
197502	NA	NA	NA	NA	1375.00
197503	NA	NA	NA	NA	1434.00
197504	NA	NA	NA	NA	1453.00
197601	NA	NA	NA	NA	1217.00
197602	NA	NA	NA	NA	1412.00
197603	NA	NA	NA	NA	1510.00
197604	NA	NA	NA	NA	1586.00
197701	21.8000	125.640	711.000	NA	1419.00
197702	22.1000	125.295	711.000	NA	1438.00
197703	22.4000	124.167	663.000	NA	1573.00
197704	22.7000	122.317	663.000	NA	1662.00
197801	23.0000	119.290	663.000	NA	1506.00
197802	23.4000	117.046	663.000	NA	1613.00
197803	23.8000	113.602	471.000	NA	1648.00
197804	24.2000	112.923	471.000	NA	1607.00
197901	24.6000	111.996	471.000	NA	1488.00
197902	25.1000	112.638	471.000	NA	1569.00
197903	25.5000	112.501	643.000	NA	NA
197904	26.0000	112.505	643.000	NA	NA
198001	26.4000	112.209	643.000	NA	NA
198002	27.9000	112.153	643.000	NA	NA
198003	29.3000	112.999	679.000	NA	NA
198004	30.1000	114.333	679.000	NA	NA
198101	31.0000	116.141	679.000	NA	NA
198102	33.2000	121.133	679.000	NA	NA
198103	33.2000	121.871	678.000	88.2000	NA
198104	35.7000	120.024	678.000	90.0000	NA
198201	35.7000	117.899	678.000	92.0000	NA
198202	35.7000	117.657	678.000	93.3000	NA
198203	35.7000	113.749	1108.00	95.0000	1889.00
198204	35.7000	115.135	799.000	96.6000	1866.00
198301	35.7000	106.500	236.000	98.3000	1730.00
198302	35.7000	109.376	642.000	100.000	1905.00
198303	35.7000	113.749	671.000	101.700	1998.00
198304	37.3000	115.795	913.000	103.400	2048.00
198401	37.3000	116.372	268.000	105.100	1968.00
198402	38.4000	109.905	767.000	106.800	2060.00
198403	38.4000	111.814	1159.00	107.700	2073.00
198404	39.5000	113.469	694.000	108.600	2052.00
198501	39.5000	96.9410	511.000	109.500	1893.00
198502	41.2000	91.8988	697.000	110.400	1983.00
198503	41.2000	93.0384	881.000	110.900	2298.00
198504	42.3000	88.0280	763.000	111.300	2455.00
198601	42.3000	90.1819	502.000	111.900	2170.00
198602	45.7000	84.2573	788.000	112.400	2258.00
198603	45.7000	79.3151	764.000	112.600	2300.00
198604	45.7000	85.8489	670.000	112.800	2312.00
198701	45.7000	87.4541	606.000	113.000	2229.00
198702	45.7000	89.5884	27.0000	113.200	2375.00
198703	46.8000	89.7932	897.000	115.600	2434.00
198704	46.8000	83.7912	777.000	117.900	2556.00
198801	46.8000	86.3437	510.000	120.300	2425.00
198802	46.8000	93.2917	764.000	122.700	2568.00
198803	46.8000	100.446	1146.00	123.100	2488.00
198804	49.6000	104.332	761.000	123.400	2797.00
198901	49.6000	104.420	570.000	123.800	2304.00
198902	50.8000	100.662	759.000	124.200	2299.00
198903	50.8000	100.960	988.000	124.200	2392.00
198904	53.1000	104.316	836.000	124.200	2703.00
199001	53.1000	103.529	532.000	124.200	2172.00
199002	55.6000	105.620	721.000	124.200	2097.00

ID	TOTINPAS	TOUTPAS	TRUNK	TWI	URBPOP
1977Q1	147639.	205116.	NA	92.5000	9044.95
1977Q2	109579.	262694.	NA	92.5000	9067.68
1977Q3	121067.	250700.	NA	91.5000	9090.30
1977Q4	184996.	252743.	NA	89.4000	9112.97
1978Q1	156759.	207088.	NA	87.5000	9135.95
1978Q2	118060.	294400.	NA	86.2000	9158.13
1978Q3	139991.	276622.	NA	83.6000	9180.30
1978Q4	215784.	284125.	NA	82.7000	9200.40
1979Q1	180248.	250939.	NA	82.3000	9220.80
1979Q2	163500.	320353.	NA	83.1000	9240.70
1979Q3	194927.	305960.	NA	83.5000	9260.80
1979Q4	254670.	298516.	NA	83.3000	9283.00
1980Q1	251568.	276410.	NA	84.4000	9305.00
1980Q2	175568.	323779.	NA	85.0000	9326.90
1980Q3	208161.	299824.	NA	85.8000	9349.10
1980Q4	269260.	303679.	NA	87.1000	9376.58
1981Q1	232567.	275097.	NA	88.8000	9403.35
1981Q2	203514.	316083.	NA	92.9000	9430.13
1981Q3	218964.	306808.	188.791	93.8000	9457.60
1981Q4	281681.	319311.	197.959	90.5000	9493.17
1982Q1	242930.	285214.	200.005	88.8000	9529.55
1982Q2	208015.	336797.	199.527	88.2000	9566.42
1982Q3	225400.	343057.	201.680	83.8000	9602.10
1982Q4	278300.	321840.	209.573	83.4000	9632.30
1983Q1	235100.	274909.	208.103	76.1000	9663.30
1983Q2	191600.	319257.	217.815	77.7000	9694.30
1983Q3	227700.	333408.	225.466	80.4000	9724.40
1983Q4	289600.	325400.	232.050	81.1000	9751.25
1984Q1	245600.	277800.	238.455	82.9000	9777.70
1984Q2	229500.	373400.	236.638	79.2000	9804.25
1984Q3	229200.	383000.	243.577	80.3000	9830.40
1984Q4	310800.	384520.	255.585	81.3000	9860.30
1985Q1	286800.	317800.	256.903	69.2000	9891.10
1985Q2	235000.	412500.	265.068	65.0000	9922.80
1985Q3	243300.	406000.	287.093	64.8000	9953.90
1985Q4	377600.	375700.	297.575	60.7000	9989.73
1986Q1	345500.	310200.	293.306	61.1000	10024.5
1986Q2	297200.	404100.	308.085	56.3000	10059.4
1986Q3	309600.	428105.	321.712	51.9000	10094.5
1986Q4	477100.	397162.	332.014	55.0000	10134.8
1987Q1	432800.	324700.	332.041	55.4000	10175.4
1987Q2	370000.	418700.	344.335	56.6000	10215.5
1987Q3	410500.	467500.	362.257	56.2000	10255.9
1987Q4	571600.	411400.	370.547	52.0000	10300.9
1988Q1	526900.	346200.	369.800	53.0000	10346.3
1988Q2	481400.	427300.	386.700	57.0000	10391.2
1988Q3	579900.	465500.	410.700	60.9000	10435.2
1988Q4	661200.	458800.	407.000	62.7000	10475.8
1989Q1	540000.	415300.	407.600	62.8000	10517.1
1989Q2	438000.	497500.	429.400	60.0000	10557.4
1989Q3	486700.	540900.	442.100	59.5000	10597.9
1989Q4	614200.	536100.	443.800	60.5000	NA
1990Q1	558100.	439700.	440.600	59.5000	NA
1990Q2	488300.	571100.	NA	60.5000	NA

APPENDIX II VARIABLE CONSTRUCTION METHODOLOGY

Several of the variables used in the modelling have complicated methods of construction. The following list explains how each variable is constructed from its components.

Variable *Construction methodology*

AUSIPP Australian private final consumption per person. The numerator is Australian price final consumption expenditure (AUSPFCS); *source* ABS Cat. no. 5206.0. The denominator is Australian total population (AUSPOP); *source* ABS Cat. no. 3101.0.

AUSPPP Urban public transport passenger per person. The numerator is urban public transport passengers aggregated over seven major cities - Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart and Canberra (AUS); *source* State transit authorities, personal communications. The denominator is the aggregate of the seven cities' populations (URBPOP); *source* ABS Cat. no. 3101.0.

AVGDP Average real GDP (1985 = 100). This is the simple average of G7GDP (an index of real GDP for the G7 countries of the OECD - the United States, Japan, Germany, France, Italy, the United Kingdom and Canada) and NZGDP (an index of real GDP for New Zealand).

AVGDP = (NZGDP/1.10325 + G7GDP)/2

DEL3 Growth rate of the Australian economy. The three quarter centred average of the four quarter percentage change in Australian real non-farm gross domestic product.

DOMPAS1 Foreign passengers travelling on the Australian domestic air network.

```
DOMPAS1 =  0.75 * TOTINPAS
```

DOMPAS2 Australians travelling on the Australian domestic air network.

```
DOMPAS2 = DOMPAS - DOMPAS1
```

DOMRPK1 Revenue passenger-kilometres performed by foreign tourists on the Australian domestic air network. The average distance travelled by foreign tourists is taken as equal to AVKM, the average distance travelled by all passengers on the domestic network.

```
AVKM = DOMRPK/DOMPAS
DOMRPK1 = DOMPAS1 * 0.75 * AVKM
```

DOMRPK2 Revenue passenger-kilometres performed by Australians on the domestic network.

```
DOMRPK2 = DOMRPK - DOMRPK1
```

EXPQ Quarterly exports of seven major bulk commodity exports.

```
EXPQ = IRONQ + COALQ + ALUMQ + OILQ + GRNQ
       + MEATQ + SUGQ
```

IFRATE Air freight rates from New Zealand to Australia, expressed in Australian dollars.

```
IFRATE = AIRFRATE * EXNZA
```

RAILEXP — Exports of the two major rail-associated bulk commodity exports.

RAILEXP = COALQ + GRNQ

RTWI — Real trade-weighted index of the Australian dollar.

RTWI = TWI * CPI/OECDCPI

TFRT — Estimated both-ways freight tonnages on the six major intercity corridors in Australia. ABS Cat. no. 9214.0 publishes partial freight tonnages derived from a survey of freight forwarders. The BTCE applies adjustment factors based on calculations of survey coverage on the seven routes. The adjustment factors and corridors are: Sydney-Melbourne, divide by 0.467; eastern States to Perth, divide by 0.530; Melbourne-Adelaide, divide by 0.599; Melbourne-Brisbane, divide by 0.577; Sydney-Adelaide, divide by 0.572; Sydney-Brisbane, divide by 0.589. These fractions are applied to the total of both-way traffic and the resulting numbers summed to give TFRT. For an explanation of the rationale behind the fractions, consult BTCE 1990.

APPENDIX III VARIABLE MNEMONICS AND SOURCES

The following list of mnemonics gives an explanation of each variable and the source of data. Note that wherever these variable mnemonics are preceded by an 'R' in the model specifications, this is to be interpreted as a 'real' variable (that is, the nominal variable has been divided by the consumer price index and multiplied by 100).

Variable	*Description and source*
AGGINFA	Aggregate average of economy and minimum air fares into Australia in Australian dollars; *source* Department of Transport and Communications.
AGGOFAR	Aggregate average of economy and minimum air fares out of Australia; *source* Department of Transport and Communications.
AIFRATE	Freight rate in New Zealand dollars for air imports from New Zealand (see appendix II under IFRATE).
ALUMQ	Tonnages of alumina exported quarterly; *source* ABS Cat. no. 5404.0.
AUSF14	Urban public transport fares, averaged over quarters -1 to -4; *source* urban fares sub-index of the consumer price index, ABS Cat. no. 6401.0.

AUSF58	Urban public transport fares, averaged over quarters -5 to -8; *source* urban fares sub-index of the consumer price index, ABS Cat. no. 6401.0.
AUSIPP	Australian private final consumption per person (see appendix II).
AUSPPP	Urban public transport passengers aggregated over seven major cities, divided by the aggregate population in the seven cities (see appendix II).
AVGDP	A simple average of two indexes of real gross domestic product: for the G7 countries and for New Zealand (see appendix II).
BULKOUT	Tonnages of bulk exports; *source* ABS Cat. no. 9206.0.
BULKRF	Bulk rail freight tonnages on government rail systems; *source* BTCE Transport and Communications Indicators Database.
BUSFAR	Sydney to Melbourne bus fare, average of normal-price and discount operators; *source* BTCE Transport and Communications Indicators Database.
COALQ	Tonnages of coal exported quarterly; *source* ABS Cat. no. 5404.0.
CPI	Consumer price index; *source* ABS Cat. no. 6401.0.
DEL3	The three quarter average of the four quarter change in Australian real non-farm gross domestic product (see appendix II).
DOMAFR	Tonnages of domestic air freight (including mail) carried on scheduled airline services;

source Department of Transport and Communications.

DOMPAS — Total passengers on the Australian domestic trunk and regional air network; *source* Department of Transport and Communications 1991.

DOMPAS1 — Estimate of foreign passengers on the Australian domestic trunk and regional air network (see appendix II).

DOMPAS2 — Australian passengers on the Australian domestic trunk and regional air networks (see appendix II).

DOMRPK — Total revenue passenger-kilometres on the Australian domestic trunk and regional air network; *source* Department of Transport and Communications 1991.

DOMRPK1 — Revenue passenger-kilometres by foreign passengers on the Australian domestic trunk and regional air network (see appendix II).

DOMRPK2 — Revenue passenger-kilometres by Australians on the Australian domestic trunk and regional air network (see appendix II).

DISPWS — Waterside disputes, hours lost; *source* ABS personal communication.

ERFAR — Weighted interstate economy rail fare; *source* BTCE Transport and Communications Indicators Database.

ERPAS — Interstate rail passenger movements on government rail systems; *source* BTCE Transport and Communications Indicators Database.

EXNZA	Exchange rate between Australian and New Zealand dollars (in $A per $NZ); *source* Reserve Bank of Australia.
EXPQ	Quarterly tonnages of seven major bulk commodity exports (see appendix II).
EXTON	Tonnages of air freight exports; *source* Department of Transport and Communications.
GRNQ	Tonnages of wheat, barley and oats exported quarterly; *source* ABS Cat. no. 5404.0.
G7GDP	Index (1985-86 = 100) of real gross domestic product for the group of seven major economies (G7) of the OECD; *source* OECD 1991.
IFRATE	Freight rate in Australian dollars for air imports from New Zealand (see AIFRATE and appendix II).
IMTON	Tonnages of air freight imports; *source* Department of Transport and Communications.
INTER	Non-bulk freight rates for government rail systems; *source* BTCE Transport and Communications Indicators Database.
IRONQ	Tonnages of iron ore exported quarterly; *source* ABS Cat. no. 5404.0.
MEATQ	Tonnages of beef and mutton (meat and live animals) exported quarterly; *source* ABS Cat. no. 5404.0.
MEDIUM	Weighted average of air fares on medium length air routes; *source* Department of Transport and Communications.
NBULKIN	Non-bulk import tonnages; *source* ABS Cat. no. 9206.0.

NBULKRF Non-bulk rail freight tonnages on government rail systems, including both intra- and inter-state traffic; *source* BTCE Transport and Communications Indicators Database.

NZGDP Index (1981-82 = 100) of real gross domestic product for New Zealand; *source* IMF 1991.

OECDGDP Real OECD gross domestic product; *source* OECD 1990.

OECDCPI Consumer price index for the OECD; *source* OECD 1990.

OILQ Tonnages of oil, LNG, LPG and petroleum products exported quarterly; *source* ABS Cat. no. 5404.0.

OTC Both-way international telephone calls; *source* BTCE Transport and Communications Indicators Database.

OTCCH OTC call charges per minute; *source* OTC 1990.

PETROL Australian retail petrol sales in megalitres; *source Quarterly Mineral Statistics*, ABARE.

PPI Retail petrol (automotive fuel) price index, sub-index of the consumer price index; *source* ABS Cat. no. 6401.0.

PRICE Index of the price of new imported automobiles; *source* Automotive Industry Authority, Melbourne.

RAILEXP Rail export bulk tonnages, taken as the sum of coal and grain export tonnages (see appendix II).

REGO	Registrations of new cars, station wagons and light commercial vehicles; *source* ABS Cat. no. 9301.0.
RGNE85	Real (1984-85 prices) gross national expenditure; *source* ABS Cat. no. 5206.0.
RGNF85	Real (1984-85 prices) gross non-farm product; *source* ABS Cat. no. 5206.0.
ROADPR	Sub-contractors road freight rates, average of intercapital routes; *source* BTCE Transport and Communication Indicators Database.
RTWI	Real trade-weighted index of the Australian dollar exchange rate (see appendix II).
SUGQ	Tonnages of sugar exports quarterly; *source* ABS Cat. no. 5404.0.
TEL	Trunk call tariff index; *source* BTCE Transport and Communications Indicators Database.
TFRT	Estimated intercapital road freight tonnages hauled both ways over the Sydney-Melbourne, Sydney-Brisbane, Melbourne-Brisbane, Melbourne-Adelaide, Adelaide-Sydney and eastern States-Perth corridors; *Source* ABS Cat. no. 9214.0 and BTCE estimation methods (see appendix II).
TOTINPAS	Total short-term foreign arrivals in Australia; *source* ABS Cat. no. 3401.0.
TOUTPAS	Total short-term Australian departures from Australia; *source* ABS Cat. no. 3401.0.
TRUNK	Number of trunk calls on the Telecom network; *source* BTCE Transport and Communications Indicators Database.

TWI	Trade-weighted index of the Australian dollar; *source* Reserve Bank of Australia.

REFERENCES

Abbreviations

ABARE Australian Bureau of Agricultural and Resource Economics
ABS Australian Bureau of Statistics
AGPS Australian Government Publishing Service
AIC Automotive Industry Council of Australia
BTCE Bureau of Transport and Communications Economics
BTE Bureau of Transport Economics
IMF International Monetary Fund

ABARE 1991, *Quarterly Mineral Statistics*, ABARE, Canberra.

ABS 1991a, *Australian Demographic Statistics*, Cat. no. 3101.0, ABS, Canberra.

ABS 1991b, *Australian National Accounts: National Income and Expenditure*, Cat. no. 5206.0, ABS, Canberra.

ABS 1991c, *Consumer Price Index*, Cat. no. 6401.0, ABS, Canberra.

ABS 1991d, *Exports Australia*, Cat. no. 5404.0, ABS, Canberra.

ABS 1991e, *Interstate Road Freight Movement, Australia*, Cat. no. 9214.0, ABS, Canberra.

ABS 1991f, *Overseas Arrivals and Departures, Australia*, Cat. no. 3401.0, ABS, Canberra.

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ABBREVIATIONS

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AIC	Automotive Industry Council of Australia
BTCE	Bureau of Transport and Communications Economics
BTE	Bureau of Transport Economics - now BTCE
GDP	Gross domestic product
G7	Group of seven major countries in the OECD (United States, Japan, Germany, France, Britain, Italy and Canada)
IMF	International Monetary Fund
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
OECD	Organisation for Economic Co-operation and Development
OTC	Overseas Telecommunications Commission
RPK	Revenue passenger-kilometres (1 RPK is equal to 1 paying passenger carried 1 kilometre)
4qfit	A series of forecasts made four quarters ahead of the latest data