THE EPA ECONOMETRIC MODEL OF
THE AUSTRALIAN ECONOMY:
COMMENTS AND SUGGESTED MODIFICATIONS

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# The EPA Econometric Model of the Australian Economy: Comments and Suggested Modifications

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A. INTRODUCTION

The following comments and suggestions relate to the 1981 version of the EPA Econometric Model of the Australian economy. Many of the observations are based on work that has recently been done for the NIF Model of the Australian economy which is a joint project of the Australian Treasury and the Australian Bureau of Statistics. I have made particular use of recent work by H. Pender and D. Russell, B. Jones, C. Murphy, B. Freeland, T. Howes and H. Bateman which will be documented in forthcoming papers that will be available on request from the Treasury. I have also been assisted by discussions with V. FitzGerald and D. Challen who prepared the 1981 version of the EPA model. Theirs, and the other assistance I have received is gratefully acknowledged although I must take responsibility for the following material. The views expressed should not necessarily be taken to represent those of the Treasury or the Australian Bureau of Statistics.

B. COMMENTS ON SPECIFIC EQUATIONS

B1 IMPORTS

An unsatisfactory feature of the multiplier properties of the 1981 version of the model is that the response to an expenditure stimulus shows little evidence of the stocks/imports cycle that is typical of other Australian models, and the multiplier shows no evidence of crowding out and an easing back in the activity response (see page 198 of write-up).
The specification of the imports equation seems to be a major source of that distortion. That is given as equation 7.1 on page 135 of the write-up, where it can be seen that the price elasticity of import demand has been constrained to unity but the elasticity with respect to domestic demand is estimated at the low value of around 0.25.

An alternative imports equation that has recently been constructed for the NIF model is shown as Attachment Bl. In order to get sensible long-run demand and price elasticities it has been found necessary to:

allow for the influence of the introduction of quota restrictions on imports of motor vehicles, clothes, textiles and footwear. The extent of the quotas is represented by a dummy variable which ranges between zero (no quotas) and unity (the severest quotas). The variable is illustrated in Attachment B2 and is denoted by "DUM". The equation assumes that full implementation of the quotas is sufficient to offset any unfavourable balance in international competitiveness, which in turn assumes, not unreasonably, that import demand for other goods is generally not price sensitive;

allow for a general increase in import penetration over the second-half of the 1970s as a result of changing tastes and the changing structure of domestic production. That effect is represented as the variable "TASTES" with a time trend between 1974.1 and 1979.2 and a constant value thereafter. The steady
increase in import penetration over that period, which is evident in the graph of the ratio of imports to sales in Attachment B3, has run counter to the substantial swing in international competitiveness that is illustrated in Attachment B4.

The alternative equation has demand and price elasticities that are close to unity; unconstrained, the demand elasticity is between 0.8 and 0.9. The equation could be implemented in the EPA model by setting SNP equal to IIP which can be identified from the estimated stocks equation, by setting \((GNM + MGS - SNN)\) equal to \((GDPNA + M - IIPNA)\), and by replacing \(PCOM\) with \(PCW/(TWI.PC)\), where the latter variables are defined and discussed further in Section B6 below. The suggested demand variable differs from that used in the present equation by the inclusion of the statistical discrepancy, exports, imports of civil aircraft and government goods, and by the exclusion of farm production and farm stocks. The suggested change, which is broader in its scope of domestic production, should provide a better indication of the demand for imports of intermediate goods.

Respecification of the imports equation would imply revised values for MEGD which would require re-estimation of the stocks equation.

B2 WAGES

The EPA model has followed the practice of other Australian model builders in setting the level of award wages exogenously and then allowing an endogenous response in average weekly earnings to award wages
and capacity utilisation (see pages 79 and 80 of write-up). The determination of award wages allows for the introduction of wage indexation in 1975, but prior to that there is no response in wages to the changing circumstances that might arise in counterfactual simulation and multiplier studies.

In order to obtain more realistic multiplier properties and to assist in forecasting wages now that wage indexation has been abandoned (formally in 1980 but effectively in late 1978), it is suggested that the existing wage equations be replaced with a single equation of the form presented in Attachment B5. That equation assumes that wage increases are comprised of:

- compensation for past and future expected inflation, in response to distributed lags on the four quarter rates of change in the CPI and M4;

- varying increases resulting from varying degrees of labour market pressure, as represented by average overtime hours worked in the manufacturing sector (denoted by ROT and illustrated in the Attachment B6) and labour market conditions more generally in the economy (represented by the rate of growth in M4); and

- the direct effect of changing levels of overtime hours worked.

With the dependent variable specified in terms of a four quarter rate of change, that effect will vary with the four quarter rates
of change in overtime worked and the overtime rate of pay
(approximated by the rate of change in the CPI), both multiplied by
the base level of overtime.

The equation allows for the period of indexation and indicates an average
rate of CPI indexation over the period 1975.3 to 1978.3 of 84 per cent.
A change in the rate of growth of M4 influences wages with a mean lag of
nearly two years while a changing level of overtime hours worked has a
mean lag in its impact of around 1 year. The mean lag on inflation is
around 2 to 3 quarters (Attachments B6 and B7 illustrate the relationship
between the variables in the equation). The estimated equation also has
the desirable long-run property of a unitary elasticity to a changing
rate of inflation.

To be implemented in the EPA model, ROT would either have to be replaced
by a measure of capacity utilisation or some other indicator of the
business cycle, or an equation would have to be provided to determine ROT,
such as that presently included in the NIF model. Given the difficulties
in measuring capacity utilisation it might be advisable to minimise the
model's dependance on that constructed variable and ROT could serve that
purpose. More desirably, a production function derived measure of
capacity utilisation could be included in the model but that would
involve added equations and more developmental work.
The results of dynamic within sample simulation indicate that the lending for housing and housing investment equations are less reliable than they should desirably be given the importance of that linkage between the monetary and real sectors of the model.

The lending for housing equation (shown as equation 6.12, on page 126) might be improved by two changes.

The level of bank lending (LB) could be replaced by a more specific indication of the capacity of the Savings Banks to lend for housing since they provide the major portion of that lending. That could be obtained by multiplying the deposits of Savings Banks by one minus the prescribed LGS requirement for the Savings Banks which has varied as follows:

<table>
<thead>
<tr>
<th>Period</th>
<th>LGS Requirement</th>
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<tr>
<td>Prior to August 1963</td>
<td>70 per cent</td>
</tr>
<tr>
<td>Up to October 1970</td>
<td>65 per cent</td>
</tr>
<tr>
<td>&quot; September 1974</td>
<td>60 per cent</td>
</tr>
<tr>
<td>&quot; May 1977</td>
<td>50 per cent</td>
</tr>
<tr>
<td>&quot; August 1978</td>
<td>45 per cent</td>
</tr>
<tr>
<td>Since August 1978</td>
<td>40 per cent</td>
</tr>
</tbody>
</table>

Lending for housing is generally thought to be supply determined in the Australian economy subject to lending guidance from the Reserve Bank. Administered interest rates have generally been varied (or not varied) so as to support the intent of those guidelines but that has not always been
the case and when it has not, the guidelines have still tended to hold. While it will not greatly influence the results it would be more realistic to leave the differential between RSEC2 and RMORSB out of the equation.

B4 HOUSING INVESTMENT

The level of lending for housing by the banks and building societies leads directly into the equation for private dwelling investment, which is shown as equation 1.2 on page 60.

However, only a portion of that lending goes to the construction and purchase of new houses and some 70 per cent of the value of new housing investment is on average financed from other sources such as finance and insurance companies and household saving. The equation could therefore be improved by the addition of a more general measure of liquidity conditions such as the rate of growth in M4 to indicate the shifting importance in the different sources of finance. There can at times be a significant speculative and investment motive in housing construction that will also vary with liquidity conditions and the changing prospect of capital gains on that investment. The rate of growth in M4 should also capture some of those influences. Another important influence on the flow of funds to housing in recent years has been the incentive provided by the social welfare system to direct savings and lump sum retirement payments into housing investment. A decision by the Government to means test old age pensions or tax capital gains could have a significant impact on the level of housing investment.
The suggested change to the equation for lending for housing could also be used to improve the structure of the bank lending equation, which is shown as equation 6.5 on page 119 of the write-up. The existing equation allows specifically for the influence of the LGS requirement of the trading banks but not that applying to the savings banks. The two influences could be represented by replacing the variable \((\ln(KLGB) + 0.505 \ln(1.0 - RRLG))\) with the variables \((1.0 - RRLG) (1.0 - RSRD) \cdot DTB\) and \((1.0 - RSLG) \cdot DTB\), where RSLG denotes the LGS requirement of the savings banks that was referred to in Section B3 above. The trading bank variable has also been adjusted for the SRD requirement which does not qualify as an LGS asset but which similarly reduces the liquidity base of the trading banks. If multicolinearity problems prevent introducing the separate variables into the equation they could be added together and used in place of the existing composite variable. For comparibility with the equation for lending for housing, the bank lending equation should also allow for the influence of the lending guidelines to the savings banks as denoted by DSBLG. The existing equatin also includes the differential between the ten-year government bond rate and the ten-year United States bond rate as well as the exchange rate expectations variable \((FXS \cdot PGNPUS - PGDPNA)\) to represent the effects of capital inflow on the level of bank lending. If bank lending is more sensitive to variation in short-term capital flows, as is likely the case, it would be better to include the differential \((RCB - REUD)\) than the differential between the ten-year bond rates. An alternative approach might be to replace these variables with a direct measure of the level of private
capital inflow, FTCPN. That more direct representation of the influence of capital inflow would also make a clearer distinction between the effect of overseas interest rate differentials and exchange rate expectations on the level of capital inflow on the one hand, and the determination of domestic interest rates and domestic financial flows given that level of capital inflow on the other. The response in domestic interest rates would then lead back to influence the level of capital inflow, and so on.

The latter approach would suggest that the differential (RCB−RSEC2) should then also be included in this equation to indicate the tightness of domestic liquidity conditions, and the differential between RCEC2 and the rate on trading bank overdraft lending to reflect the influence of alternative sources of finance.

B6 EXCHANGE RATE

A suggested alternative equation for the determination of the exchange rate is provided in Attachment B8. The equation differs in some respects from the present equation in the EPA model:

it is expressed in terms of the trade weighted index (TWI) which is the basis for setting the value of the $A:

it employs a fixed weight combination of the consumption deflators for Australia's major trading partners (PCW) to obtain a measure of international competitiveness relative to the domestic deflator (PC):
it allows the setting of the exchange rate to respond to the level of imports (MV); and

the adjustment of the exchange rate is generalised from a Koyck to a quadratic Almon lag, with a mean lag of around 6 quarters on both explanatory variables.

The weights for the TWI are not published but can be inferred to a reasonable degree of accuracy from the movements in the index and the bilateral exchange rates. The import weights for Australia's major trading partners can be used to provide an approximate formulation for the TWI:

\[
\text{TWI} = (0.3651 + 0.2045 \text{EXUK} + 0.3131 \text{EXJ} + 0.1173 \text{EXG})/\text{EXA} + \text{residual}
\]

where the weights are the average over the 1970's and variables denote the bilateral exchange rates with the $US, valued in $US, for the UK (EXUK), Japan (EXJ), Germany (EXG), and Australia (EXA). PCW is calculated using the same fixed weights.

An equation would also be required to generate the level of international reserves which can vary with net monetary movements (BPO) and the revaluation of reserve assets. Variation in the TWI will change the value of ORA but the foreign currency holdings of the Reserve Bank will
not necessarily be in the same proportions as the trade weights. In 1981
around half of ORA was comprised of overseas currencies (with over half
of that being held in $US) and most of the remainder was held as gold.
In very approximate terms:

$$\Delta \text{ORA} = 0.5(\text{ORA}_{-1}) \left( \frac{\text{TWI}_{-1}}{\text{TWI}} - 1.0 \right) + \text{BPO} + \text{residual.}$$

The fit of the suggested equation is illustrated in Attachment B9. The
major influences on the exchange rate in the 1970's were:

- a substantial build up in reserves in 1971 and 1972 which led to an
  appreciation of the exchange rate over 1972 and 1973; and

- a substantially worse inflation performance over the period 1974 to
  1978 which led to a depreciation of the exchange rate over that
  period.

As is shown in Attachment B4, purchasing power parity had been
substantially restored by 1979 although renewed appreciation of the
exchange rate led to a loss of competitiveness over the course of
1980–81. The recent experience would not be picked up by the suggested
equation, and that illustrates a typical weakness of official sector
reaction functions which can only indicate how policy has been set over
the sample period and not necessarily how policy will be set in the
future. In the recent experience the authorities have permitted the
exchange rate to appreciate to offset the strong rise in private capital inflow over that period. That is, the exchange rate has been adjusted in anticipation of the buildup in reserves that would have occurred if the rate had not been adjusted, rather than as a reaction to a buildup in reserves.

It may be more appropriate to set the exchange rate exogenously when the model is used for forecasting, although the equation is useful for simulation exercises.

B7 PRIVATE CAPITAL INFLOW

The present equation for private capital inflow combines the reduced form approach developed by Kouri and Porter (Journal of Political Economy, Vol 82, pp443–467) with a more structural formulation of the determinants of capital inflow like that included in the RBA79 model of the Australian economy. Pender and Russell in a paper that will shortly be available from the Treasury, have suggested that the reduced form approach is subject to statistical bias because the formulation so closely approximates an identity. They have estimated a structural model of monthly capital flows that is more akin to that in the RBA79 model but which implies a much more rapid response to changes in interest rate differentials.

The equation that is listed in Attachment B10 estimates the Pender and Russell equation in terms of quarterly data and omitting the cost of forward exchange cover since that variable could not be generated in the present version of the EPA model.
The dependant variable, which is denoted by PFLOW, is the level of net apparent private capital inflow, FTCPN, less the trade credit of marketing authorities and undistributed income. The equation allows for the following influences:

interest rate differentials, as represented by the difference between the three-month commercial bill rate and the three-month eurodollar rate. The underlying equation implies full adjustment within the quarter to a change in the interest rate differential except when exchange controls apply;

exchange rate expectations, as represented by the rate of change in the average TWI pertaining in each quarter. The TWI is measured as at the end of the quarter and TWI+1 denotes the one period ahead value of the TWI;

exchange controls, which have included use of a variable deposit requirement (VDR) and an embargo on overseas borrowing of terms of less than a prescribed maturity. FDUM1 denotes the period when the VDR applied from 1972.4 to 1974.3. FDUM3 denotes the period from 1972.4 to 1978.2 when the embargo on overseas borrowings has applied. The dummy has a single value although the embargo has varied from 2 years to a 6 month maturity over that period. FDUM2 is a dummy for the effect on capital inflow in 1972.3 in anticipation of the exchange controls;
the ratio of the level of mining investment to non-farm product, to represent the varying level of longer-term capital flows as well as associated portfolio and equity investment; and

a scale variable — in this case the level of gross non-farm product — to represent the long-term demand for net private capital inflow.

The fit of the equation is illustrated in Attachment B11, both for the within-sample and post-sample periods.

The exchange rate expectations variable should in principle only appear in the equation when it cannot be offset by forward cover. That has been the case over much of the sample period because of the limitations applying to the availability of forward cover provided by the official market and because of the lack of depth in the unofficial market. As that market develops further, that variable can be expected to become less relevant, particularly if the authorities relax the present restrictions on dealing in foreign exchange.

B8 COMMERCIAL BILL RATE

The present equation for RCB emphasises the role of competing rates of return on domestic and overseas assets and the more general influence of the business cycle.
An alternative approach would be to perceive this prime short-term market determined interest rate as being directly determined by short-term domestic liquidity conditions which indirectly reflect the level of capital inflow and the pattern in competing interest rates. In the suggested equation, which is again based on work that has recently been done for the NIF model, the commercial bill rate is determined by:

- the ratio of excess LGS assets of the trading banks (XRLG) to the level of deposits with trading banks (DTB). The variable, which is illustrated in Attachment B12, represents the liquidity position of trading banks. It can be seen that the ratio has varied quite markedly over the course of the 1970's and most sharply in 1974 when it was associated with a sharp rise in the commercial bill rate. The latter is illustrated in Attachment B13;

- the rate of cash flow for the corporate trading enterprise sector (RCASH) which provides an indication of that sector's demand for short-term finance;

- the four quarter rate of inflation which will have an influence on the nominal rate of interest; and

- seasonal dummy variables to explain the variation in RCB over the course of the financial year in seasonally unadjusted terms.
A shortcoming of the estimated equation, which is provided in the Attachment B14, is that it does not provide an explanation for the rise in RCB over the past several years which has apparently reflected a general world-wide rise in real interest rates. That could be captured by including a short-term overseas interest rate in the equation but that would be inconsistent with the structural approach underlying the equation. Alternatively an indicator of business confidence could be used to the same effect, as is now done in the equation for the NIF model (which uses the difference between RSEC2 and the dividend yield on the stock market for that purpose). However, that would entail adding additional equations to the EPA Model.

The suggested equation could be implemented in the EPA model with the following approximations:

\[ ZRLG \approx KLGB - RRLG \cdot DTB - RSLG \cdot DSB \]

\[ RCASH \approx (YC + CCAC - TYC)/(KFP \cdot PGNEMC) \]

Constant adjustments could be used to represent the rising real rate of interest over the post sample period and for forecasting purposes.

B9 TWO-YEAR GOVERNMENT BOND RATE

The present equation for RSEC2 is formulated as a quasi structural equation rather than as an official sector reaction function which may be a more appropriate approach. Indeed, for many applications it will be more appropriate to set RSEC2 (and the exchange rate) exogenously to the model.
An alternative equation is provided in Attachment B15. It is formulated in terms of:

an "equilibrium" or long-run "desired" level for the bond rate which is expressed as a function of the market determined interest rate, RCB. In principle, other factors might impinge on the equilibrium rate such as a differential impact (from that on RCB) of the expected rate of inflation, general liquidity conditions, etc. However, their introduction is likely to lead to multicolinearity difficulties;

a reaction by the Government to the adequacy of international reserves with, for example, a tendency to tighten domestic monetary policy if reserves are too low. The variable is illustrated in Attachment B18;

a reaction to the degree of international competitiveness of the traded goods sector of economy with, for example, a tendency to tighten monetary policy as an alternative to devaluing the exchange rate; and

a reaction to the level of primary liquidity relative to the level of economic activity. Thus higher interest rates might be required to neutralise the effects of high budget deficits which add to primary liquidity and which would otherwise add to the LGS base of the money supply. The ratio of KLGP to GDPV is illustrated in Attachment B7 and the ratio is detrended for use in the estimated equation.
The equation has the desired signs on the estimated parameters and the statistical fit is quite good although it would be unwise to place too much reliance on the stability of such an equation. The bond rate (as distinct from the introduction of the ASB) has not been a particularly actively used instrument of monetary policy over the sample period, at least in so far as having been directed strongly against the direction of market forces, and the commercial bill rate provides most of the explanatory power in the equation. These results are therefore more fortuitous than convincing and should be used cautiously.

B10 NON-BANK TAKE-UP OF GOVERNMENT DEBT

Consistent with the comments that have already been made on the bank lending equation (see Section B5), and the suggestion that the structure of the model could be improved by distinguishing between the direct and indirect influences on financial markets, the following changes could be made to the present specification:

replace \((RSEC10 - RCLBUS)\) and the exchange rate expectations variable with a direct measure of private capital inflow;

include \((RSEC2 - RCB)\) as an indicator of the influence of short-term liquidity conditions; and

include the differential between \(RSEC2\) and the rate on bank overdraft lending.
Another change that might be tried is to replace KLGP by the variable (M4 + SECPG) to provide a better measure of the wealth of the non-bank private sector that is available for its portfolio allocation. As presently formulated, the equation is effectively explaining the split of LGS assets between the banks and the non-bank public without regard to the possibility of substitution out of other liquid assets of the non-bank public such as their deposits with the banks.

If that change is made it might also be necessary to include a time trend to explain the declining share of wealth that is being held in government securities, although that share was bolstered with the introduction of ASB's.

B11 EMPLOYMENT

While wage and salary earner employment is the relevant concept for determining the level of wages and salaries in household income and the level of PAYE income tax, this variable is influenced during the sample period by a significant switching between wage and salary earner employment on the one hand and self-employment under contract on the other. It might be more suitable for forecasting purposes to model the demand for total non-farm employment in the above equation and then obtain the share of wage and salary earner employment by applying an exogenous ratio as is currently done in the NIF model. The ratio exhibited a strong declining trend over the course of the mid to late 1970's but has since stabilised.
The capacity utilisation variable would be explaining that shift in the present equation, whereas the shift was more related to the acceleration in wages in the mid-1970's and to the rising cost of labour over-heads associated with higher superannuation provisions, workers compensation insurance and the level of payroll tax. The shift to contract employment helped to reduce the severity of those cost pressures. The present equation would be misleading in its implication that the structural shift would be reversed with an improvement in capacity utilisation.

Given the problems in the measurement of capacity utilisation it might be advisable to omit the variable and replace it with an alternative such as the rate of growth of business fixed investment or output. Admittedly that approach is less appropriate from a conceptual viewpoint, but it is likely in practice to be more reliable.

C GENERAL COMMENTS

C1 INSTRUMENTS OF GOVERNMENT POLICY

The present version of the EPA model provides a reasonably comprehensive representation of the influence of instruments of Government policy on the Australian economy although that could be enhanced by adopting some of the modifications suggested above.

The major channels by which Government policy has been implemented over the past decade are summarised in Attachment C1 and these are considered in more detail below.
Fiscal Policy

All the major instruments of policy are well represented in the current version of the model and should provide sufficient detail for EPA purposes.

External Policy

As explained in Section B1, changing levels of industry protection and, in particular, the introduction of quota protection for the motor vehicle, textile, clothing and footwear industries appears to have had a major effect on the level of imports and their responsiveness to changing international competitiveness. The suggested modifications to the imports equation would allow specifically for the influence of quota restrictions. Desirably some allowance should also be made for the changing level of tariff protection but that seems to have been a less critical influence on international competitiveness in the 1970's than the differential rates of wage and price inflation. The suggested measure of international competitiveness \( \frac{PCW}{TWI \cdot PC} \) would not reflect the influence of changing levels of tariff protection. If that factor becomes more important at some future date it could be allowed for in the same way as in the present version of the NIF model.

The present version of the EPA model treats the exchange rate in terms of the bilateral rate with the $US. The suggested alternative equation modelling the determination of the TWI would provide a more precise representation of the institutional arrangements although that change, of
itself, would not make much difference to the properties of the model. The changes to the specification allowing for lags in the setting of the exchange rate and for a response to the level of international reserves should influence those properties to a greater extent. For some purposes, particularly as Government objectives change, it will be more appropriate to leave the exchange rate exogenous to the model.

A variable deposit requirement and embargoes on overseas borrowing have been used with a varying degree of success to control the level of private capital inflow over the course of the 1970's. A 25 per cent deposit requirement applied to approved overseas borrowing from the March quarter 1973 to the December quarter 1974. An embargo on overseas borrowing of less than two years duration, applied over the same period and that limit was then reduced to 6 months until the end of 1976. In the March quarter 1977, the old VDR and embargo on overseas borrowing was re-introduced and that was maintained in the June quarter. The VDR was then removed and the embargo reduced to borrowing of 6 months or less and that restriction was maintained until early in the June quarter 1978.

One of the difficulties in representing the influence of these restrictions is that their effectiveness has varied with the circumstances. The suggested alternative equation for capital inflow indicates where those restrictions can be shown to have had a statistically significant impact, at least when the relationship is estimated in terms of monthly data. Considerable care would need to be exercised in using these variables in simulation and forecasting.
Monetary Policy

There are essentially three means by which the authorities can influence domestic financial conditions:

- by varying the prescribed liquidity requirements of the banks;

- by issuing lending guidelines on the extent of bank lending; and

- by changing the settings of official and administered interest rates.

The present version of the model identifies, in an approximate way, the influence of the SRD and LGS requirements that apply to the trading banks but not the LGS requirement of the savings banks. The latter has been varied over the sample period but more in sympathy with market pressures than as a constraint on the banks' desired portfolio behaviour. Nevertheless, the requirement could potentially be used more actively and the suggested changes to the model would allow for that influence. They would also more fully reflect the influence of the liquidity requirements applying to trading banks.

The Reserve Bank also from time to time issues lending guidelines to the banks. There has been a statistically significant effect on the level of mortgage lending by the savings banks but not on the overdraft lending of the trading banks. The difference would seem to be that the former has
frequently been backed-up by interest rate settings encouraging the saving banks to adjust their portfolios in the desired direction, whereas that has frequently not been the case for the lending guidelines to the trading banks. There is thus no statistical basis at this stage for incorporating the lending guidelines to the trading banks as an effective instrument of monetary policy.

The Government controls a number of official and administered interest rates. By varying the amount of Treasury Notes that are put out to tender the authorities can influence short-term interest rates. However, those rates will substantially reflect the variation in short-term liquidity conditions, as will the variation in the commercial bill rate. The suggested changes to the equation for the commercial bill rate would strengthen the representation of those linkages although they would not allow for the ability of the authorities to vary the degree of reliance it places on short, medium and long-term paper to achieve its desired level of non-bank take up of Government securities. Since Treasury Notes are primarily used to ease the seasonal swing in liquidity conditions over the course of the financial year, the omission of that interest rate from the model is not a serious deficiency.

The model presently includes both the two year and ten year bond rates and includes a dummy variable to represent the effect of the introduction of Australian Savings Bonds early in 1976. As a general comment it is doubtful whether the term structure of the two and ten year bond rates has varied sufficiently to identify their separate influence over the sample period. For this reason, it has already been suggested that the
ten year bond rate could be removed from the model without detracting from its performance. However, the potential is there for the authorities to vary the term structure in a way that does influence the extent and composition of non-bank take-up and caution will have to be exercised in forecasting on the basis of the 1970’s. The same comment applies to the representation of the introduction of the ASB’s by a single dummy variable which makes no allowance for the variation in the rate on ASB’s relative to competing rates of return that are available to household savings. It is not possible to make much improvement on that approach given the available interest rate and portfolio experience, but considerable care will need to be exercised in using the equations for forecasting.

The setting of administered interest rates will also influence domestic financial conditions although the direction of that influence can be perverse. Thus a lift in savings bank deposit and mortgage interest rates can lead, other things given, to a more rapid growth in deposits, and because there is generally an excess demand for housing finance, the level of mortgage lending would then also tend to rise as would the level of activity in the housing industry. On the other hand, if there is a general rise in both official and administered interest rates, the relative position of the banks will be unchanged vis-a-vis the level of non-bank take-up, and deposit and lending flows will be much less affected. On balance there may still be some tightening in liquidity conditions because of the improved position of Government securities relative to private non-bank paper (at least initially) and investment in real assets (over the short to medium-term) so that, overall, there would tend to be a decline in the demand for money (say M3 or M4) and a lower level of economic activity than would otherwise be the case.
The control of bank and building society interest rates is not as straightforward as assumed in the model but that does not present serious problems:

・ building society interest rates are controlled by the State governments rather than the Federal government and the Reserve Bank, however, those rates are now generally kept competitive with the ASB rate and can be forecast on that basis;

・ since December 1980 there has been less constraint of bank deposit rates, however, the continued control of lending rates has limited the extent to which the banks have been able to vary those rates;

・ the authorities only control the rate on overdraft lending of less than $100,000 which has meant that over time the trading banks have favoured growth in other types of lending. Nevertheless, because bank credit is generally less expensive than alternative sources of finance, the level of bank lending is principally supply rather than demand determined. That has meant that the level of bank lending has been most sensitive to the liquidity position of the banks and it is the control of that which provides the most effective means of controlling the rate of growth in the money supply.

The removal of the controls on bank lending rates could lead to a significant change in the structure and behaviour of the monetary formation process. The usefulness of the model could be severely
constrained if that and other institutional changes are implemented after
the Government has finished considering the report of the Campbell
Committee into the Financial System.

C2    LINKAGES BETWEEN THE MONETARY AND REAL SECTORS

The strength of the linkages between the monetary and real sectors of the
economy is an important empirical issue that has been a focus for model
builders' attention in Australia in recent years.

The model allows for the influence of financial conditions on consumption
expenditures by the inclusion of the real rate of growth of M4 in the
consumption equation. The equation implies that a 1 per cent increase in
the real rate of growth of M4 leads to a 0.1 per cent rise in the desired
real level of consumption expenditures. There would, as well, be
indirect effects via the influence of the stance of monetary policy on
the rate of inflation and the rate of growth of personal disposable
incomes.

The stance of monetary policy has a much more direct and significant
effect on the level of housing investment, at least in so far as the
variability of that expenditure is concerned.

Where the influence of financial conditions is possibly less well
represented than it could be is in the determinatin of the level of
business fixed investment. The difficulty in this area is that the
complexity of the investment process precludes a clear discrimination
between competing hypotheses on the determinants of business fixed
investment. The results quoted by Challen and FitzGerald in the write-up on the 1981 version of the model agree with those quoted more recently by Pagan, Perrin, Perazzelli and Gray, in their paper on "Inflation and Investment" (ANU 1981). Both studies have found that the rate of return on existing investment or, equivalently, the rate of cash flow, provides the best explanation of plant and equipment investment in the 1970's. They find that addition of the relative cost of capital to labour, as in the neo-classical model of investment, is statistically insignificant. In principle, the neo-classical model allows for the influence of financial conditions through its impact on the cost of capital and that has been the justification for retaining the neo-classical formulation in the NIF-10 model of the Australian economy. An alternative that has not been tested against the recent experience is the Tobin-q formulation of investment spending. Higgins, Johnston and Coghlan in their paper on "Business Investment: The Recent Experience" (Treasury, 1976) found that the Tobin-q formulation was inferior to the accelerator and neo-classical models, however, that may be less true of more recent experience. Enhanced investor confidence appears to have contributed to a significant increase in investment spending in the last several years and that influence is not readily captured in the accelerator and cash flow cum rate of return models. The neo-classical model does allow for that influence but possibly with too rigid a theoretical framework. It may be worth experimenting once again with a Tobin-q formulation possibly augmented with a cash flow variable in the same way as Higgins, et al. If that approach were taken it would be necessary to generate a measure of the required rate of return on equity capital in the model, possibly by including a similar construction to that employed in the NIF model.
Some allowance might also be made for the influence of the cost of finance on the desired level of non-farm stocks. Higher interest rates will tend to encourage economies in stock holding, although there are no empirical results showing such an effect for the Australian economy. The recent trend to higher real rates of interest may mean that such an effect will be more evident in the data than it has been. That could be tested by including the two year bond rate, deflated by the expenditure deflator, in the formulation of the desired level of non-farm stocks, IIP.
ATTACHMENT B1

ALTERNATIVE IMPORTS EQUATION

$$\text{MEG} - \text{QDOK} = 1358 - 1738 \text{DUM} + 27.39 \text{TASTES} + 0.845W_1(L)\text{SNP} \quad (2.89) \quad (3.27) \quad (3.84) \quad (2.55)$$

$$- 1437 (1 - \text{DUM}).W_2(L).\text{PCOM} + 0.0900W_3(L)(\text{GNM}+\text{MGS} - \text{SNN}) + 0.2856\hat{e}_{-1}$$

$$R^2 = 0.9184 \quad SE = 77.3 \quad DW = 1.93$$

Sample period: 1968(2) to 1980(2)

Elasticities at Sample Mean

- PCOM $= 1.03$
- GNM + MGS $= \text{SNN} = 1.0$ (constrained)

<table>
<thead>
<tr>
<th>Lag Weights</th>
<th>$W_1(L)$</th>
<th>$W_2(L)$</th>
<th>$W_3(L)$</th>
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<tr>
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<td>0.1646</td>
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<tr>
<td>$-4$</td>
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<td>0.1812</td>
<td>0.0652</td>
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<td>$-5$</td>
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<tr>
<td>$-6$</td>
<td>0.0010</td>
<td>0.0796</td>
<td>$-0.0171$</td>
</tr>
</tbody>
</table>

Variable names are as denoted in NIF-10 model

Critical PCOM for quotas to be binding $= 1.21$
THE TIME PROFILE OF QUOTA RESTRICTIONS

TIME BOUNDS: 66 3RD TO 81 3RD
DATA NAMES: DUM
RATIO OF ENDOGENOUS GOODS IMPORTS TO SALES

TIME BOUNDS: 66 3RD TO 81 3RD
DATA NAMES: RATIO
MEASURE OF INTERNATIONAL COMPETITIVENESS USED IN NIF MODEL

TIME BOUNDS: 66 3RD TO 81 3RD
DATA NAMES: PCOM
AN EQUATION FOR AVERAGE WEEKLY EARNINGS

\[ D4WARS = DUMW (-0.3119 + W_1(L) \cdot ROT_{-1} \]
\[ (-1.71) \]
\[ + W_2(L) \cdot D4$LM_{-4} + W_3(L) \cdot D4PCPI_{-1} \]
\[ + (1 - DUMW) \cdot (0.8399 \cdot D4PCPI_{-1}) \]
\[ (12.29) \]
\[ + 0.06672 \cdot (ROT - ROT_{-4} + ROT_{-4} \cdot D4PCPI) \]
\[ (2.37) \]

\[ R^2 = 0.9187 \quad SE = 0.0189 \quad D.W. = 1.70 \]

Sample Period: 1969(3) to 1980(2)

Lag Weights

<table>
<thead>
<tr>
<th></th>
<th>(W_1(L))</th>
<th>(W_2(L))</th>
<th>(W_3(L))</th>
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<td>0.575</td>
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</table>

\(D4\) denotes four quarter rate of change.

Variable notation is that for NIF model.
A MEASURE OF LABOUR MARKET PRESSURE — AVERAGE OVERTIME HOURS WORKED.

TIME BOUNDS: 67 3RD TO 81 3RD
DATA NAMES: ROT
THE RELATIONSHIP BETWEEN MONEY, PRICES AND WAGES

TIME BOUNDS: 67 3RD TO 81 3RD

SYMBOL SCALE NAME

- #1 D4PCPI
- #1 D4WARS
+ D4$LM4
ALTERNATIVE EXCHANGE RATE EQUATION

\[ TWI = 8.6332 + W_1(L) \left( \frac{ORA_{-2}}{MV_{-2}} \right) \\
+ W_2(L) \left( \frac{PCW_{-2}}{PC_{-2}} \right) \]

\[ R^2 = 0.848 \quad SE = 3.84 \quad D.W. = 0.88 \]

Sample period: 1970(3) to 1979(2).

Lag Weights

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<th>W_2(L)</th>
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</thead>
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<tr>
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</tr>
<tr>
<td>-7</td>
<td>0.5923</td>
<td>5.0005</td>
</tr>
</tbody>
</table>
FIT OF ALTERNATIVE EXCHANGE RATE EQUATION
ALTERNATIVE CAPITAL INFLOW EQUATION

\[
\left(\frac{\text{RFLOW}}{\text{GDPNAV}}\right) (100.0) = -0.0949 + 0.8468 \left(1 - \frac{\text{FDUM}1}{\text{FDUM}1}\right) [\text{RCB} - \text{REUD}] + (\text{RCB}_{-1} - \text{REUD}_{-1})]/2.0 \\
(0.08) \quad (3.24)
\]

\[
+ 0.4959 (1 - \frac{\text{FDUM}1}{\text{FDUM}1}) \Delta [\text{RCB} - \text{REUD}] + (\text{RCB}_{-1} - \text{REUD}_{-1})]/2.0 \\
(2.22)
\]

\[
+ 10.9774 \Delta [(\text{TWI}_{1+1} + \text{TWI})/(\text{TWI} + \text{TWI}_{-1})]^4 - 1] \\
(3.76)
\]

\[
+ 163.775 \left(\frac{\text{IFPPEM} + \text{IFPOBM}}{\text{GDPNA}}\right)/GDPNA \\
(3.01)
\]

\[
+ 0.8343 (\text{FDUM}2 - 0.3135(\text{FDUM}3) \\
(0.50) \quad (1.25)
\]

\[R^2 = 0.6808 \quad \text{SE} = 1.53 \quad \text{D.W.} = 2.39\]

Sample period: 1969.1 to 1979.2

Variables are defined in Section B7.
FIT OF SUGGESTED EQUATION
RATIO OF EXCESS LGS ASSETS FOR TRADING BANKS
TO DEPOSITS WITH TRADING BANKS

TIME BOUNDS: 66 3RD TO 81 2ND
DATA NAMES: XLGS
COMMERCIAL BILL RATE (RCB)

TIME BOUNDS: 66 3RD TO 81 2ND
DATA NAMES: RBILL
EQUATION FOR THE COMMERCIAL BILL RATE

\[
\text{RCB} = 1.9747 + -0.0375 \text{ QSM} + 1.522 \text{ QSM}_{-1} \\
(0.69) \quad (0.57) \quad (2.66) \\
+ 0.3923 \text{ QSM}_{-2} - 3.9591 \ln (XRLG/DTB) \\
(0.57) \quad (5.44) \\
+ 11.6011 \text{ D4PCON} - 173.99 \text{ RCASH} \\
(1.52) \quad (3.55)
\]

\( R^2 = 0.768 \quad \text{SE} = 1.39 \quad \text{DW} = 1.49 \)

Sample period: 1967(3) to 1979(2)

Variables are defined in Section B8.
ALTERNATIVE EQUATION FOR RSEC2

\[ \Delta \text{RSEC2} = 0.4419 \times (8.4384 + 0.6751 \times \text{RCB}) \]
\[ - 0.9344 \times (\text{ORA/MV}) - 499.72 \times \frac{\text{PCW/(TWI.PC)}}{(3.04)} \]
\[ + 9.6013 \times (\text{KLGP/GDPV} - \exp[1.5654 - 0.01135 \times \text{TIME}]) \]
\[ - \text{RSEC}_{2-1} \]

\[ R^2 = 0.66 \quad \text{SE} = 0.45 \quad \text{DW} = 1.95 \]

Sample period: 1968(1) to 1979(2)
COMPARISON OF TWO YEAR BOND RATE AND THE COMMERCIAL BILL RATE

TIME BOUNDS: 66 3RD TO 81 2ND

SYMBOL SCALE NAME

□ #1 RGS
● #1 RCB
RATIO OF PRIMARY LIQUIDITY TO GROSS DOMESTIC PRODUCT AND TREND

TIME BOUNDS: 66 4TH TO 81 2ND
DATA NAMES: ZL ZLPT
THE RATIO OF FOREIGN EXCHANGE RESERVES TO IMPORTS

TIME BOUNDS:  67 3RD TO  81 2ND
DATA NAMES:  RES
INSTRUMENTS OF GOVERNMENT POLICY

1. **FISCAL POLICY**
   - Rates of taxation — personal
     - corporate
     - indirect (sales and excise taxes)
   - Levels of expenditure
     - current
     - capital
     - cash benefits

2. **EXTERNAL POLICY**
   - Protection policy — tariffs
   - Exchange Rate
   - Exchange Controls — Variable deposit requirement (VDR)
     - Embargo on overseas borrowing

3. **MONETARY POLICY**
   - Liquidity requirements — SRD requirement for Trading Banks
     - LGS requirement for Trading Banks and Savings Banks
   - Lending guidelines — for Savings Bank mortgage lending
     - for Trading Banks overdraft lending
   - Interest Rates — interest rates on government securities (Treasury notes, Bonds and Savings Bands).
• Interest Rates (cont'd) — administered interest rates
  • Savings Bank deposit and mortgage interest rates
  • Trading Bank deposit rates and lending rate on overdrafts of less than $100,000
  • Building Society mortgage lending rates (controlled by State Government).