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Some Implications of Microeconomic Reform for the Macroeconomy and the Commodities Sector

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A number of economic commentators have argued that the key to reducing Australia's current account deficit lies in improving the competitiveness of Australia's exporting sector through microeconomic reform which increases productivity and lowers relative costs. The macroeconomic effects of microeconomic reform are assessed and a range of possible microeconomic reforms in the commodities sector are reviewed. Although microeconomic reform is unlikely to make a contribution to reducing the current account deficit, it is still desirable because it will lead to higher standards of living by improving the efficiency of production.

Introduction

A key objective of the microeconomic reforms currently in progress in Australia is to maximise potential output through the removal of distortions which prevent the efficient allocation of resources within the economy and which thereby restrict productivity. Microeconomic reform is an attempt both to shift the production frontier outward and to move to the optimum point on the frontier; macroeconomic policy can be seen as the attempt to ensure that the economy operates continuously on its production frontier (Grenville 1990). In the early to mid 1980s the focus of microeconomic reform was the financial market. More recently, microeconomic reform has been directed toward improving the efficiency with which the markets for goods, services and labour allocate resources. This paper is concerned mainly with microeconomic reforms that may have effects on the primary industries.

Microeconomic reform has been hailed by some economic commentators as a panacea for the macroeconomic problems facing Australia (Macquarie Bank 1989; Business Council of Australia 1989; EPAC 1990). It is variously claimed that through microeconomic reform it is possible to: reduce inflation; increase competitiveness; accelerate economic growth; increase exports; reduce imports; and/or lower the current account deficit, thereby contributing to the stabilisation of Australia's net foreign debt. In reality, microeconomic reform is unlikely to have *lasting* effects on economic growth, inflation, or the current account deficit; but, depending on where the reforms occur, it may have a sustained effect on the competitiveness of some industries. Perhaps the most certain effect of successful microeconomic reform is that it raises the overall level of real income in the community relative to what would otherwise have been the case, and this is likely to be reflected in a *temporary* rise in the economic growth rate while the reforms are taking effect.

Males, Davidson, Knopke, Loncar and Roarty (1990) noted that productivity has been a key element in maintaining Australia's comparative advantage in primary production and increasing living standards. They found a diversity in the rates of productivity growth in Australia's major primary industries. They concluded that, while low productivity growth is not in itself a justification for policy action, there may well be a case for policy action where low productivity growth reflects market failures or regulatory impediments. A number of widely debated microeconomic reforms could have significant effects on primary industries. These include lowering protection for domestic manufacturing industry, deregulation of transport industries, the introduction of competitive marketing arrangements for primary commodities and the removal of restrictive work practices in a number of industries and occupational groups. The effects of microeconomic reform on primary industries will be both direct – that is, industry-

specific – and indirect, through the macroeconomic consequences of general microeconomic reform.

In the next section of this paper the current settings of macroeconomic policy are reviewed in the context of policy objectives stated over the latter half of the 1980s. It is argued that microeconomic reform is unlikely to make a significant contribution to achieving these macroeconomic objectives. In the third section, some of the likely effects of microeconomic reform are quantified using the Murphy model of the Australian economy. The fourth section contains key results from a number of studies on opportunities for further processing of primary industry output which might be realised given microeconomic reform in other sectors of the economy. Finally, estimates of the efficiency gains which have been, or could be, obtained in Australia's primary industries as a result of recent or potential microeconomic reforms are reviewed.

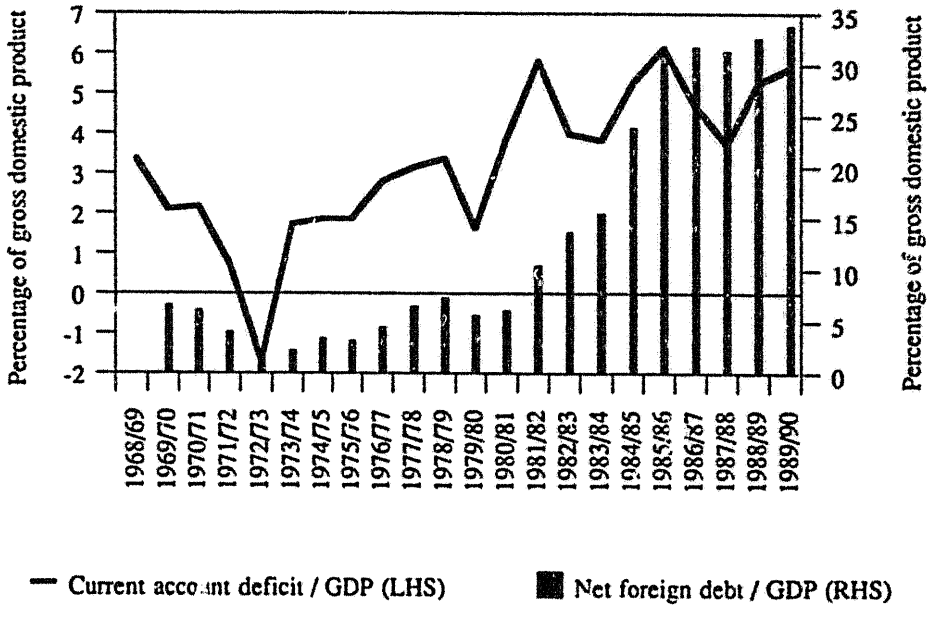
Macroeconomic Perspectives

Macroeconomic settings and policy objectives

Since the mid-1980s, macroeconomic policy has been largely directed toward reducing Australia's current account deficit. For that reason, it has had an important influence on exchange rates and interest rates. These are probably the two macroeconomic variables with the greatest potential to affect primary industries. The exchange rate is a major factor in determining the prices received for Australia's primary commodities, while interest rates are an important component of the costs of these industries as well as a key determinant of investment decisions and asset values.

As a share of gross domestic product, the current account deficit averaged about 4.8 per cent in the 1980s, as against 1.8 per cent in the 1970s. In the 1980s, the succession of large current account deficits, an increased reliance on debt rather than equity financing and the fall in the value of the Australian dollar resulted in a rapid increase in Australia's foreign debt (O'Mara, Hogan and Kirby 1988; EPAC 1989). Net foreign debt as a proportion of gross domestic product (Figure 1) has risen from around 5 per cent in the 1970s to 33.2 per cent at the end of September 1990. As a consequence, Australia's debt servicing costs have increased significantly.

Figure 1: Current account deficit and net foreign debt



Because a high level of borrowing by the public sector contributed to the increase in the current account deficit during the early 1980s, one of the main objectives of macroeconomic policy in recent years has been to reduce the size of public borrowing (Hogan, Thorpe and Kirby 1989: EPAC 1989). The net public sector borrowing requirement, as a proportion of gross domestic product, has declined sharply from its 1983-84 peak of 6.7 per cent. Indeed, the public sector became a net lender in 1988-89, although it is expected to once again become a net borrower in 1990-91 (Commonwealth of Australia 1990).

As the savings and investment undertaken by the public sector are now close to balance, the current account deficit of recent years largely reflects the shortfall of private savings relative to private investment expenditure (Table 1). A key issue in Australia at present is whether the current account deficit should continue to be a target of fiscal policy, since it now reflects private sector decisions. It is widely accepted that, in most circumstances, fiscal policy should be determined primarily by the state of public sector finances and by domestic economic conditions in the short term, not by the size of any current account imbalance (Makin 1989; Pitchford 1989; Sjaastad 1989). But it has also been argued that there may be some identifiable adverse effects or risks associated with Australia's high current account deficit and increasing foreign debt burden, and that economic policy should therefore aim to stabilise and then reduce

TABLE 1

Contributions to the Current Account Balance as Shares of Gross Domestic Product

Year	Balance of payments(a)			National saving-investment balance(b)						Negative of statistical discrepancy	Current account balance
				Private			Public				
	Trade in goods and services	Net income	Net transfers	Saving	Investment	Net lending	Saving	Investment	Net lending(c)		
	1	2	3	4	5	6	7	8	9	10	11
1970–71	0.0	–2.0	–0.1	16.8	18.2	–1.4	6.5	7.8	–1.2	0.5	–2.1
1971–72	1.1	–1.8	–0.1	18.3	17.7	0.6	6.7	8.0	–1.3	0.0	–0.7
1972–73	3.6	–1.7	–0.2	21.0	17.2	3.7	5.6	7.3	–1.7	–0.4	1.7
1973–74	0.0	–1.4	–0.3	17.8	17.0	0.8	6.3	7.1	–0.8	–1.7	–1.7
1974–75	–0.4	–1.1	–0.3	19.1	15.0	4.2	3.5	8.5	–5.0	–1.1	–1.8
1975–76	0.4	–1.8	–0.4	18.0	15.9	2.1	3.7	8.2	–4.5	0.6	–1.9
1976–77	–0.6	–1.8	–0.3	16.9	16.5	0.4	3.6	7.5	–4.0	0.8	–2.8
1977–78	–1.0	–1.9	–0.3	17.7	16.3	1.4	2.5	7.5	–5.0	0.4	–3.2
1978–79	–1.0	–2.0	–0.3	17.1	17.0	0.1	2.4	7.0	–4.7	1.2	–3.4
1979–80	0.7	–2.2	–0.1	17.4	16.6	0.8	3.2	6.9	–3.7	1.3	–1.6
1980–81	–1.8	–2.0	–0.1	17.0	18.5	–1.5	3.7	6.7	–3.0	0.7	–3.9
1981–82	–3.6	–2.0	–0.1	14.7	19.3	–4.6	3.8	7.3	–3.4	2.2	–5.8
1982–83	–2.2	–1.6	–0.1	16.9	16.4	0.5	1.9	7.7	–5.8	1.3	–4.0
1983–84	–1.3	–2.5	0.1	17.5	15.7	1.8	0.3	7.4	–7.0	1.4	–3.8
1984–85	–2.2	–3.2	0.1	16.1	16.8	–0.7	2.0	7.0	–5.1	0.5	–5.3
1985–86	–3.1	–3.3	0.3	14.4	17.4	–3.0	3.0	7.6	–4.6	1.5	–6.1
1986–87	–1.9	–3.3	0.5	15.3	17.2	–1.9	3.8	7.3	–3.5	0.7	–4.7
1987–88	–0.9	–3.4	0.6	14.8	18.5	–3.7	5.7	5.9	–0.2	0.2	–3.7
1988–89	–2.1	–3.9	0.7	14.2	20.1	–6.0	7.1	5.6	1.5	–0.9	–5.3
1989–90	–2.0	–4.4	0.7	14.1	18.7	–4.6	5.7	5.6	0.1	–1.3	–5.7
1990–91(e)	–0.8	–4.6	0.7	13.1	16.8	–3.7	na	na	–1.0	0.0	–4.7
1970–71 to 1979–80(d)	0.3	–1.8	–0.2	18.0	16.7	1.3	4.4	7.6	–3.2	0.2	–1.8
1980–81 to 1989–90(d)	–2.1	–3.0	0.2	15.5	17.8	–2.4	3.7	6.8	–3.1	0.6	–4.8

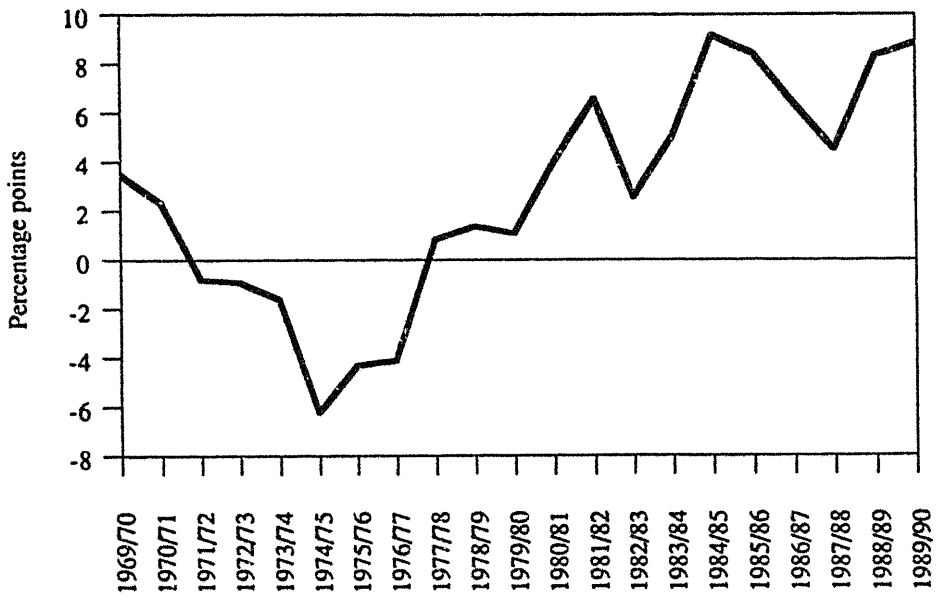
(a) Note that (11) = (1) + (2) + (3). (b) Several components of the saving-investment balance were derived residually: (6) = (11) – (9) – (10); (4) = (5) + (6); (7) = (8) + (9). (c) Negative of the net public sector borrowing requirement; (d) Period average. (e) ABARE estimate. na Not available.
Source: ABS cat.: 5203.03, 5206.0, 5302.0 and 5501.0.

foreign debt levels as soon as possible (EPAC 1989; Nguyen 1989; Reserve Bank of Australia 1989). In particular, it appears that these developments have prompted financial market participants to demand a risk premium on their Australian investments, thereby contributing to Australia's relatively high real interest rates (Figure 2).

Some of the shortfall in private savings relative to private investment can be attributed to the taxation system – particularly to its failure to distinguish between nominal and real interest receipts and payments. Overall the present taxation arrangements appear to be providing some incentives for private sector consumption in preference to saving, for investment projects to be undertaken which could be unviable in the absence of these taxation arrangements, and for capital to be raised in the form of debt rather than equity (EPAC 1989; Reserve Bank of Australia 1989; Freebairn 1990). These effects are probably adding to the concern of participants in financial markets and thus contributing to the creation of circumstances in which a risk premium is likely to be demanded on Australian investments.

Empirical evidence for such a risk premium suggests that it is quite volatile, and moreover that short term changes in its size have contributed to short term fluctuations in the exchange rate. There is some evidence that lenders demanded a sizeable risk premium on their investments in

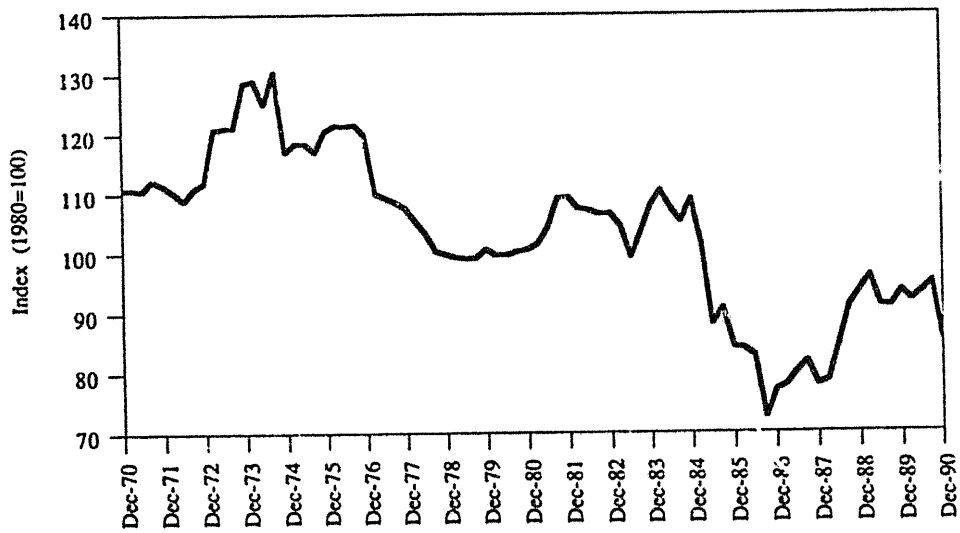
Figure 2: Real interest rate (90 day bank bill rate less inflation rate (CPI))



Australia in the mid-1980s, thus contributing to the substantial fall in the value of the Australian dollar and the increase in the domestic interest rates during this period (Thorpe, Hogan and Coote 1988; Smith and Gruen 1989; Tease 1988). The high interest rates during 1989 appear to have had only a very limited impact, if any, on the real exchange rate (Figure 3). In other words, they did not make Australia markedly more attractive for investors, implying some re-emergence of a risk premium during this period, probably reflecting the renewed deterioration in Australia's current account deficit.

However, the size of the risk premium appears to have declined since mi. -1990, following the onset of the crisis in Iraq and Kuwait. Participants in financial markets seem to have interpreted developments in the Middle East as being potentially favourable for the Australian economy in its capacity as a net exporter of energy. Australian short term interest rates, despite a 6.0 percentage point fall during the course of 1990, remained sufficiently in excess of rates in many other countries to encourage a sharp increase in capital inflow during the September quarter of 1990, with a consequent rise of 0.4 per cent in the real exchange rate in the September quarter (Figure 3).

Figure 3: Australia's real exchange rate



ABARE analysis indicates that, over the medium term, a real exchange rate about 20 per cent below the level of 1984 would be consistent with a current account deficit of 2–3 per cent of GDP, which would allow the stabilisation of Australia's net foreign debt to GDP ratio,

provided that domestic demand was sufficiently restrained (O'Mara, Wallace and Meshios 1987; O'Mara 1988). In fact, following its increase in the September quarter of 1990, the real exchange rate was around 10 per cent below the level of 1984. On this basis, the real exchange rate was moderately overvalued. In the December quarter 1990 interest rates declined further, and this, apparently coupled with some reassessment by financial markets of the benefits likely to flow to the Australian economy from the Middle East crisis, resulted in a sharp downward correction of the real exchange rate, to a level much closer to the abovementioned medium term equilibrium level.

An important dilemma facing Australian economic policy makers is whether or not to further reduce interest rates. By doing so, the severity of the current economic slowdown might be lessened although there is a risk that the strength of any subsequent upturn may be increased. One of the main arguments against doing so, at least in the short term, is that continued 'tight' monetary policy, accompanied by a period of much slower economic growth, is necessary to reduce inflation. A high real interest rate tends to reduce inflation through two main channels (Hogan and Sterland 1991). First, it will tend to restrain domestic consumption and investment expenditure, thus reducing the demand for goods and services and placing downward pressure on prices and wages. Second, it may put upward pressure on the real exchange rate, thus restraining increases in prices of traded goods and probably reducing economic activity and employment in export and import competing industries, thus further restraining prices and wages.

It is in this latter connection that the presence of a risk premium in the interest rate structure is of central importance in determining the influence which an increase in interest rates has on the inflation rate. For example, in the absence of a risk premium, domestic real interest rates would need to be only moderately higher than overseas real interest rates in order to attract capital inflow and hence to place upward pressure on the exchange rate. In contrast, if the risk premium is large, as appeared to be the case in the mid-1980s and again during 1989 and early 1990, a large real interest differential between Australia and other developed countries will place only limited upward pressure, if any, on the exchange rate. In that case, the exchange rate will play a more limited role in reducing inflationary pressure, and most of any deflationary effect of high domestic real interest rates will come through their direct impact on consumption and investment expenditure.

In the light of the above brief review of recent macroeconomic developments in Australia, it is evident that there are several key questions which need to be asked about the effects of microeconomic reform. First, can microeconomic reform reduce Australia's current account deficit and slow or reverse the growth in Australia's foreign debt, and consequently reduce

either the size of the risk premium in the Australian interest rate structure or the frequency and length of the periods in which a significant risk premium is present? If, on the other hand, microeconomic reform is not likely to have major effects on the current account deficit and the risk premium, then what benefits can reasonably be expected to flow from it?

Microeconomic reform and macroeconomic policy objectives

A current account deficit, by identity, reflects a level of investment which exceeds domestic savings (Dornbusch 1988). Therefore, microeconomic reform can influence the current account deficit only in so far as it changes the relative levels of investment and domestic savings. Microeconomic reform can increase real incomes and investment opportunities by permitting a more efficient allocation of factors of production. Higher real incomes will lead to higher levels of spending and savings; but savings as a proportion of income will not necessarily rise, nor will the savings-investment imbalance necessarily be reduced. These issues have been discussed at some length by Trewin and O'Mara (1989), Forsyth (1990a,b) and Males et al. (1990).

These points are demonstrated more formally, using theoretical models, in Appendices A and B. The model results imply that, in the long run, it is unlikely that microeconomic reform will result in a reduction in the current account deficit, and that in the short run, the deficit may change but the direction of change is uncertain. If there is a current expectation of higher real incomes in the future as a result of microeconomic reform, it is likely that consumption would increase in anticipation, immediately creating a trade deficit.

There is, however, one important exception to the general rule that microeconomic reform will not influence the current account deficit. Microeconomic reforms which address the distortions to savings and investment decisions which are generated by the interaction of the taxation system and inflation may reduce the current account deficit and foreign debt. The taxation of nominal rather than real interest receipts reduces the rate of return to savings held in the form of interest bearing assets, and may therefore result in a sub-optimal level of private sector savings. Likewise, the tax deductibility of nominal rather than real interest payments on business borrowings may have led to a supra-optimal level of investment, as well as increased reliance on debt rather than equity financing (although the system of dividend imputation should have removed a large part of the bias in the choice of financing). Since distortions arising from the interaction of the taxation system and inflation may obstruct optimal private sector savings and investment decisions, microeconomic reforms which remove these distortions may reduce the current account deficit and net foreign debt (Freebairn 1990).

In general, microeconomic reform is unlikely to change the long run rate of growth of output, since the gains are likely to be of a one-off nature, improving the level of productivity rather than its rate of growth. Likewise the rate of inflation will in the long run not be affected by one-off improvements in the level of productivity. However, during a transitional phase, the rate of economic growth may temporarily rise while the rate of inflation may fall temporarily, before returning to their respective long run rates. A temporary decline in the inflation rate would occur if the increase in the rate of economic growth during the transitional phase was not accompanied by a temporary increase in the rate of growth of the money supply, leading in effect to a temporary tightening of monetary policy.

The long run rate of economic growth may be increased in the special case of microeconomic reforms which permanently raise the rate of technical progress and hence the rate of productivity growth. Males et al. (1990) argue that low productivity growth may result from investment in research and development being sub-optimal due to the presence of market failures which prevent individual firms from capturing sufficient benefits from such investment. If such market failures are significant, microeconomic reform in the form of additional public investment in research and development or additional public subsidisation of private research and development might lead to a higher rate of technical progress, raising the long run rate of economic growth.

Although microeconomic reform in general is unlikely to reduce the current account deficit, it remains highly desirable from a macroeconomic perspective because it allows a rise in the real income obtained from the existing resources in the economy. Essentially, by permitting a higher level of output it results in higher incomes and living standards. Furthermore, by increasing the efficiency with which resources are allocated in the economy, it is likely to increase the adaptability and speed of adjustment of the economy to changing economic circumstances. Such developments are likely to be viewed favourably by financial market participants and may thus help to reduce the risk premium associated with any given current account deficit or foreign debt.

In the next section, the Murphy model of the Australian economy is used to quantify some of the effects of microeconomic reform which have been discussed above.

Murphy Model Structure, Simulations and Results

The Murphy model

The Murphy model (Murphy 1989a,b) is a small quarterly model of the Australian economy, estimated using data from the period 1976–89. It consists of five real sectors – household, dwelling provision, business (including public enterprise), general government, and foreign – plus a financial sector. The business sector combines labour, capital and imports in a production function (homogenous of degree one) with a constant elasticity of substitution (CES) of 0.8, to produce a domestic good and an exported good with an elasticity of transformation of 0.8. Harrod-neutral technical progress is assumed to occur at a rate of 0.8 per cent per annum. The rate of growth of the labour supply is fixed in the long run by the population growth rate, a natural rate of unemployment of 6.1 per cent and the absence of a real wage effect on the participation rate. However, improvements in labour productivity allow an increase in the long run labour force when measured in labour efficiency units. The efficiency-unit measure of any factor of production is the actual magnitude times an index of its productivity. There are no restraints on supply of capital or of the imported good.

The model structure is similar to the Dornbusch (1976) monetary overshooting model. In the short run, the properties of the model are Keynesian (demand-driven) in character; in the long run, they are consistent with the neoclassical approach. In particular, the price of the domestic good is sticky in the short run but flexible in the long run. Financial asset prices are flexible, and all assets other than money are perfect substitutes. Expectations in financial markets (only) are rational – that is, model-consistent. Capital is assumed to be perfectly mobile internationally; in consequence, any difference between domestic and foreign interest rates reflects expected movement in the exchange rate or a risk premium. The model does not explicitly include a risk premium in the interest rate structure, although one can readily be imposed exogenously by raising the (exogenously determined) foreign interest rate. In keeping with the monetary overshooting model, changes in money supply are neutral in the long run (in other words, they have no real effects in the long run), although they may have considerable real effects in the short run due to the sticky domestic price adjustment process.

Martin, Murphy and Nguyen (1987) noted that in the monetary overshooting model, as in the Swan-Salter model (see Appendix C), the equilibrium real exchange rate is required to be consistent only with internal balance. The state of external balance reflects domestic absorption relative to output. There is no presumption or mechanism in these models which ensures that in equilibrium the current account is balanced. Therefore the level of net foreign debt, or net foreign debt as a ratio to gross domestic product, could grow indefinitely. In the Murphy model, in

contrast, a rise in net foreign debt reduces private wealth, which in turn leads to a reduction in consumption expenditure as consumers attempt to rebuild their wealth. In this model, therefore, private consumption follows a sustainable path and the net foreign debt to GDP ratio is stabilised in the long run.

Simulation design

Microeconomic reform may deliver significant benefits to the economy in the form of increased productivity of either labour or capital or both. In the first simulation, a single permanent, unanticipated one per cent improvement in labour productivity is represented. (This could be conceptualised intuitively as arising from the widespread removal of inefficient work and management practices, or of impediments to the adoption of new technology. Other types of microeconomic reform, such as reductions in or removal of industry protection, cannot be analysed by means of a highly aggregated macroeconomic model because they involve a change in the sectoral composition of the economy, and hence were not considered here.) The improvement in labour productivity is represented as a rise in its rate of growth during one quarter only, which leaves labour productivity one per cent higher than in the baseline in all subsequent quarters. The simulation was constructed in such a way as to leave the terms of trade and the stance of fiscal policy (that is, the tax rate, and government expenditure as a share of GDP) unchanged in the long run.

The second simulation is an extension of the first, allowing for an accommodating monetary policy. The money supply is increased by the same percentage as the increase in labour productivity, in the expectation that the increase in productivity will raise real incomes and hence the demand for money balances.

Simulation results

Table 2 (panel A) shows the results of the first simulation. In the long run, a one per cent improvement in labour productivity increases real gross domestic product, and its components, by one per cent. Also in the long run, it expands the labour force measured in efficiency units. Although real wages per employee rise by one per cent, the real wage per efficiency unit of labour is unchanged in the long run. Since the terms of trade (by assumption) and interest rates are unchanged in the long run, the relative prices of all the factors of production in efficiency units are unchanged, and hence the optimal proportions of capital, labour and the imported good used in the production function are unchanged, when measured in efficiency units. The number of employees is unchanged, while the capital stock and the input of the imported good

TABLE 2

Murphy Model Results

Panel A: 1 per cent improvement in labour productivity

	Deviation	Year 1	Year 2	Year 3	Year 4	Year 5	LR
Consumption	%	0.14	0.36	0.64	0.89	1.02	1.00
Investment	%	0.33	1.05	1.41	1.31	1.04	1.00
Gross national expenditure	%	0.25	0.60	0.90	1.03	1.04	1.00
Gross domestic product	%	0.49	0.87	1.06	1.06	0.96	1.00
Terms of trade	%	–0.08	0.14	0.13	0.07	0.04	0.00
Real exchange rate	%	–1.12	–1.39	–0.93	–0.17	0.41	0.00
Real wages	%	0.18	0.45	0.61	0.77	0.91	1.00
Price level	%	–0.39	–1.11	–1.41	–1.38	–1.15	–1.00
Inflation rate	% pts	–0.04	–0.51	–0.12	0.12	0.24	0.00
90-day bank bill rate	% pts	–0.19	–0.72	–0.76	–0.52	–0.16	0.00
Unemployment rate	% pts	–0.05	–0.15	–0.19	–0.17	–0.10	0.00
Current account/GDP	% pts	–0.19	–0.24	–0.18	–0.09	–0.02	0.00
Net foreign debt/GDP	% pts	0.12	–0.07	–0.47	–0.82	–1.02	0.00

Panel B: 1 per cent improvement in labour productivity, with accommodating monetary policy

	Deviation	Year 1	Year 2	Year 3	Year 4	Year 5	LR
Consumption	%	0.18	0.52	0.81	0.97	1.00	1.00
Investment	%	0.54	1.37	1.38	1.04	0.76	1.00
Gross national expenditure	%	0.33	0.81	1.02	1.01	0.96	1.00
Gross domestic product	%	0.67	1.02	1.06	0.93	0.84	1.00
Terms of trade	%	0.01	0.15	0.04	–0.01	–0.05	0.00
Real exchange rate	%	–1.93	–1.10	–0.20	0.43	0.63	0.00
Real wages	%	0.19	0.50	0.71	0.84	0.90	1.00
Price level	%	–0.19	–0.48	–0.38	–0.11	0.15	0.00
Inflation rate	% pts	–0.46	–0.07	0.19	0.26	0.02	0.00
90-day bank bill rate	% pts	–1.23	–0.97	–0.54	–0.13	0.16	0.00
Unemployment rate	% pts	–0.10	–0.19	–0.18	–0.12	–0.05	0.00
Current account/GDP	% pts	–0.27	–0.22	–0.10	–0.02	0.02	0.00
Net foreign debt/GDP	% pts	0.28	–0.36	–0.81	–1.02	–1.04	0.00

rise by one per cent, leading to a one per cent rise in output (since the production function is homogeneous of degree one).

Hence, the standard of living, as measured by output per person, rises in response to the rise in labour productivity. However, the rate of inflation, the real exchange rate, real interest rates and the current account deficit and net foreign debt as shares of gross domestic product, are unchanged in the long run.

In the first year, interest rates fall by 0.2 percentage points in response to a reduction of nominal gross national expenditure (a rise in real gross national expenditure is more than offset by a fall in the price level) relative to the unchanged money supply. Although the inflation rate falls by 0.8 percentage points in the first year, inflationary expectations adjust by less than 0.2 percentage points; hence the real interest rate, and not only the nominal interest rate, is reduced. During the process of adjustment, the unemployment rate falls despite a rise in real wages per employee. This outcome reflects a fall in real wages per labour efficiency unit, which occurs because nominal wages adjust only slowly to the improvement in labour productivity. By the fifth year, real wages per labour efficiency unit still remain slightly below the baseline values, thereby contributing to an unemployment rate lower than in the baseline simulation. Though the fall in real interest rates reduces the required rate of return on investment, the fall in the real wage per labour efficiency unit raises the actual rate of return on investment, thereby increasing investment and leading to an expansion of the capital stock.

The reductions in the current account deficit and net foreign debt, as shares of gross domestic product, occur because in the Murphy model consumers do not exhibit forward looking behaviour in assessing their permanent income.[1] Furthermore, because there is a redistribution of factor incomes toward profits in the short run, and profits enter the Ando-Modigliani consumption function only when capitalised into wealth, there are significant lags before consumption rises to match the increase in both profits and labour income. Hence, because consumers do not either obtain or perceive the full extent of the increase in income until well into the simulation, the initial response to the permanent improvement in labour productivity is only the same as to a temporary improvement. The initial improvement in the trade balance is associated with a real exchange rate depreciation. In essence, with output rising by more than domestic demand in the short term, a real exchange rate depreciation is required to encourage some of the resources which would otherwise be made idle to move into exporting and import competing industries. After the third year, consumers' income and wealth have risen sufficiently to produce a 1 per cent rise in

[1] The initial improvement in trade balance would have been less marked, if not eliminated, if consumers' behaviour were forward-looking in the model, as in the model described in Appendix B.

consumption. This leads to a brief rise in the current account deficit, which returns the long run ratio of net foreign debt to gross domestic product to its baseline value.

When a monetary response, which consists of a one per cent rise in the money supply, is added to the simulation specification, this has no real effects in the long run and all nominal magnitudes are one per cent higher than in the previous simulation, due to the property of monetary neutrality in the model (see Table 2, panel B). However, an accommodating monetary policy allows a faster adjustment of real variables in response to improved labour productivity. Private consumption and investment rise more rapidly in response to the lower real interest rate and real exchange rate. During the adjustment process both the price level and the inflation rate undergo less variation than in the previous simulation. The problems caused by the assumed sluggish short run adjustment of prices are alleviated, at least to some extent, by the monetary expansion. In other words, a reduction in the extent of the required downward price adjustment allows real variables to rise more rapidly than would otherwise be the case. Hence, an accommodating monetary policy can improve welfare during the adjustment process.

As was noted earlier, the simulations were constructed in such a way as to ensure that the terms of trade are unchanged in the long run. In other words, in the simulation design it was assumed that Australia is a small economy facing given world prices for exports. In practice, however, there is a risk that, where Australian production accounts for a large part of world production (as is the case for wool and possibly for some mineral commodities), an increase in Australian production would depress world prices and hence lead to a deterioration in the terms of trade. This effect, though likely to be very small, would tend to reduce the extent of the rise in real gross domestic product and consumption, and might lead to a slight fall in the long run equilibrium value of the real exchange rate.

The Murphy model simulation results support the conclusion that increased labour productivity is desirable in its own right because it leads to increased living standards through higher output and consumption per person, although it does not result in a lower current account deficit or net foreign debt as a share of gross domestic product in the long run. However, the Murphy model does not incorporate a link between, on the one hand, the current account deficit, net foreign debt and effects of microeconomic reform, and on the other, the risk premium. Thus the results do not provide additional insight into risk premium effects. Also tax reform is not modelled. Nor is the Murphy model sufficiently disaggregated to distinguish the implications for primary and resource industries. However, it is possible to outline the effects on primary industries of the key macroeconomic effects – namely higher real income and, possibly, lower interest rates (if financial market participants reduce the risk premium in response to the economy's improved speed of adjustment).

A rise in domestic income, since it has an insignificant effect on world demand for primary commodities, will in general likewise have a negligible effect on world or domestic primary commodity prices. (There is one exception: the domestic price of meat is likely to rise in response to a rise in domestic real incomes, because of the relatively large proportion of meat production which is consumed domestically: Dewbre, Shaw, Corra and Harris 1985.) In general, domestic consumption of primary commodities responds less than proportionally to a rise in domestic real income. However, domestic consumption of fuels tends to rise proportionally with an increase in domestic real income, reflecting their role as intermediate inputs in the production of consumer goods (Department of Primary Industry and Energy 1987).

The effects on primary industries of lower interest rates – that is, of reduction of the risk premium – can be quantified to some extent. The levels of indebtedness of the agriculture and mining sectors to financial institutions are around $11 billion and $10 billion respectively (Hogan and Sterland 1991). This implies that a 1 percentage point reduction in interest rates would reduce the interest costs of these sectors by around $210 million a year. Hence, if microeconomic reform reduced the risk premium in the Australian interest rate structure, the benefits in terms of reduced interest costs could be substantial.

The Murphy model, because it has a single production sector, is unable to provide insights on the economic implications of productivity improvements which are isolated to a specific sector of the economy. As an example of such improvements, the Industry Commission (1990b) has estimated that increases in productivity in government business enterprises (GBEs) through reductions in overstaffing and overcapitalisation is likely to account for half of the benefits to be obtained from the current program of microeconomic reform. In particular, improving the efficiency of GBEs involved in transport, communications, water supply and electricity generation could improve productivity in the non-traded goods sector of the economy and add to national income.

Using the simple general equilibrium model developed by Salter (1959) and Swan (1960) and refined by Snape (1977), the implications of sector-specific improvements in productivity are examined in Appendix C. In this model there are two production sectors: traded goods and non-traded goods. Productivity improvements may occur independently in either sector or simultaneously in both. Improved productivity in the traded goods sector is likely to cause an appreciation of the real exchange rate (in other words, a rise in the price of non-traded goods relative to the price of traded goods); the production of non-traded goods may either increase or decrease. Conversely, improved productivity in the non-traded goods sector is likely to cause the real exchange rate to depreciate, while the production of traded goods may either increase or decrease. An equiproportionate improvement in productivity in both the traded and non-traded

goods sectors – effectively the same as a productivity shock in a single production sector model such as the Murphy model – coupled with a homothetic set of preference orderings, will leave the real exchange rate unchanged while production of each class of good will increase proportionately. This conclusion holds provided that consumers' preferences between traded and non-traded goods do not vary with income. If the share of expenditure on non-traded goods rises as income rises, the real exchange rate will appreciate and the rise in the production of traded goods will be reduced or even eliminated.

Therefore, productivity improvements which occur in either the traded or non-traded goods sectors of the economy can have important implications for the real exchange rate and the production levels of traded goods industries, such as Australia's primary industries, despite having no effect on the current account deficit in the long run. In other words, improvements in productivity may change the industrial structure of the Australian economy.

Value-added Opportunities in Primary Industries

The main potential benefit of microeconomic reform, it has been argued above, is the increase in real incomes made possible either by raising productivity within the existing industry structure of the economy, as discussed in the previous section, or by changing the structure of the economy, reallocating resources to their most productive uses. Raw materials processing industries are likely to expand following a removal of distortions elsewhere in the economy, because Australia's resource endowment suggests that these are industries in which Australia has a comparative advantage.

Processing industries tend to be intensive in the use of raw materials, energy and capital, while the relatively standardised nature of their output and production processes means that they employ relatively little labour directly. Australia seems to meet these requirements for competitive processing industries. Because of the efficiency of Australia's agricultural and mining sectors, raw materials are competitively priced and readily available. Australia has abundant energy supplies and comparatively low electricity prices. The relative capital intensity of processing industries means that labour costs are not too great an impediment when competing with developing countries with similar natural resources (EPAC 1988). Furthermore, disposal of waste products of further processing may be less expensive in Australia than elsewhere (subject to satisfaction of environmental concerns), because of the low population density.

Although the raw materials processing industries are already large – the food, beverages and tobacco industries, for example, making up almost 20 per cent of total manufacturing – there would seem to be scope for expansion, especially in minerals processing. It is sometimes argued that assistance should be provided to these industries to facilitate their growth (Australian Manufacturing Council 1990). However, Australia's comparative advantage in such industries appears sufficient so that expansion could be achieved not through assistance, with its attendant distortionary effects, but through a removal of distortions elsewhere. Impediments include economywide problems such as in transport costs, disparities in assistance across industries and distortions in the financial and taxation systems. A number of factors bear more directly on raw materials processing industries, including, for example, the effects of mineral royalties and agricultural price supports on raw material inputs. While reforms in any one area might not lead to a great expansion in raw materials processing, the combined effect of such reforms could be substantial.

There have been a number of studies of the likely effects of various reforms on raw materials processing. Trewin and Morris (1987) used the ORANI model to analyse the effects of removing domestic agricultural pricing arrangements. Using 1984-85 data, they found that agricultural pricing and marketing arrangements do not significantly affect the competitiveness of food processing industries. When prices of agricultural inputs were set at world rather than domestic levels, the ORANI simulations showed a slight expansion of food processing activity. However, the different food processing industries do not, in such simulations, respond equally to a reduction in agricultural assistance measures. The Industries Assistance Commission (IAC 1989) used the ORANI model to simulate the implications for food processing industries of a 25 per cent reduction in levels of agricultural assistance. It was found that processing of milk products declined by 9.1 per cent while manufacture of sugar products expanded by 4.2 per cent. These results largely reflect the probable supply responses of different primary industries to reductions in the level of agricultural assistance. For example, reductions in agricultural assistance would be expected to result in lower domestic production of milk; it is then likely that, rather than importing milk for further processing, more of the final milk product would be imported. Thus, agricultural assistance has distorted not only the pattern of primary commodity production but the structure of the industry engaged in further processing of primary commodities.

Martin, Waters, McPhee and Jones (1988) used the ORANI model to examine the effects of removing a broad range of assistance measures in the agricultural, mining and manufacturing sectors. In the short run, individual reforms had varying effects, but when all assistance was removed the output of the food and beverage industries was found to increase by a little over

one per cent, mineral processing by around 3.5 per cent and the early-stage processing of wool and cotton by around 3 per cent.

The Industry Commission has been active in analysing the possible results of microeconomic reform. For example, the effects of the May 1988 tariff reduction program have been simulated (IAC 1988). This program is designed to bring those nominal tariff rates above 15 per cent down to 15 per cent, and rates between 10 per cent and 15 per cent down to 10 per cent. Notable exceptions to this program are the textile, clothing and footwear industries and the motor vehicle industry, which will still have substantially higher tariff rates than other industries when the phasing-in period is completed (by the mid-1990s). The Commission estimated that, when the tariff targets have been reached, food processing could expand slightly, while non-metallic minerals and basic and fabricated metals industries could both increase by over 1 per cent. The most significant beneficiary of these changes was found to be the mining industry, which could expand by 5 per cent.

More recently, the Industry Commission (1990a) has used a version of ORANI with a more detailed mining and mineral processing structure and an updated database to examine the long run effects of reforms in transport, electricity supply and industry assistance, with particular emphasis on mining and mineral processing industries. The reforms considered in the transport sector were improvements in the operation of railways and water transport, cheaper international shipping, and the removal of excess rail freight charges - that is, of the difference between the cost of supplying bulk rail freight services and the price which is actually charged to users. Minerals processing as a whole expanded by almost 1 per cent. Improved efficiency of electricity supply (modelled as an improvement in labour productivity, a reduction in excess plant capacity and full cost pricing) resulted in only a small increase in minerals processing, of 0.3 per cent. Industry assistance reform was represented as the removal of assistance to manufacturing and mining and mineral processing industries and a reduction of 25 per cent in agricultural assistance. Removal of manufacturing assistance caused an expansion of 1.5 per cent in minerals processing, while the removal of mining and mineral processing assistance had only a negligible effect. Reductions in agricultural assistance had a beneficial effect on all mineral processing industries.

The results reported for the effects on food processing and basic wool and cotton processing are less detailed, but broad tendencies can be seen. The effects of improved transport on processing of exported food and on basic fibre processing were negative. This was largely due to the effect that the removal of excess rail freight charges had on mining and minerals processing – especially black coal mining – making these industries more competitive and drawing resources away from other parts of the economy. Conversely, the removal of

manufacturing assistance made the relatively efficient export food and fibre processing industries more profitable relative to other manufacturing industries, causing an expansion of output. The effects of other reforms were small.

Microeconomic Reform and the Primary Industries

In the previous section consideration was given to how reductions in industry assistance could lead to an expansion of industries dedicated to the further processing of the output of Australia's primary industries. The implications arising from the direct application of microeconomic reform to a number of specific primary industries are now considered.

Deregulation

ABARE research has identified a number of instances in which deregulation would allow participants within an industry to optimise their production decisions. Borrell and Wong (1986) and Connell and Borrell (1987) highlighted potential major economic gains to the sugar industry from changes in regulations and controls affecting the planting, harvesting, transport and milling of sugar cane. In particular, they identify land assignments as a source of inefficiency since they create an artificial scarcity of land for sugar cane production, inducing growers to instead use more expensive inputs, such as fertilisers, to increase output. These two studies have identified potential industry gains well in excess of $200 million a year in today's monetary values from complete deregulation of the industry. Fitzpatrick, Watson and Soper (1990) have recently identified sufficient suitable land to increase sugar cane production by 50 per cent. In 1989-90, this expansion in sugar cane production would have increased the total value of Australian agricultural, fisheries and forestry output by around 1.5 per cent.

In the New South Wales dairy industry, quota arrangements for market milk require farmers to produce milk all year round to ensure continuity of milk supply to consumers. However, the production costs borne by such dairy farmers tend to vary with seasonal conditions, and during some periods may rise above the costs borne by dairy farmers who produce only manufacturing milk. Lembit, Topp, Williamson, and Beare (1988) estimated that the introduction of negotiable quotas for market milk, which dairy farmers holding these quotas could sell or lease at different times of the year, would reduce the annual costs of New South Wales dairy farmers by an average of $1000, or approximately $2.5 million statewide.

Assignment of property rights

The main cause of biological and economic over-exploitation of fish resources is the common-property nature of fisheries. The traditional approach to fisheries management in Australia has been to limit the number of boats permitted to fish – a form of input control. However, although this limited-entry licensing does provide fishermen with some property rights in the fishery, they are ill defined, because they do not limit the amount of fish which the licence holder can catch.

At ABARE, Geen and Nayar (1990) assessed the economic effects of the individual transferable catch quota (ITQ) system which was introduced in 1984 to improve the economic performance of the southern bluefin tuna fishery. In contrast to the inefficiencies imposed by input controls, the use of ITQs as the management system should foster economic efficiency as fishermen are given a clearly defined property right to a share of an annually determined total allowable catch from the fish stock. Since ITQs are transferable, fishermen are encouraged to acquire quotas up to the quantity of fish that their boats can harvest most profitably, and in the longer term to adjust their enterprises to the most efficient scale, thereby improving the productivity of the industry. Geen and Nayar found that under the ITQ management system far larger resource rents were generated, and that the average cost of catching a tonne of tuna has fallen by around 25 per cent. Other observed benefits of the ITQ scheme include: the encouragement to target larger fish (with its beneficial consequences for the maintenance of healthy fish stock); the facilitation of negotiation by the Japanese tuna fishing industry, in 1986, of an agreement whereby the Australian industry received payment for reducing its quota by 3 kt for three years; and the recent diversion of tuna catches from canneries to the more highly priced Japanese sashimi market – a clear response to the incentive for better marketing encouraged by the ITQ system.

Campbell and Haynes (1990, Table 1) provide a summary of the results of previous studies which estimated the potential resource rent gains from various Australian fisheries. The estimated potential and actual resource rents from these particular fisheries totalled approximately $100 million. This provides a lower bound for the nationwide value. Moreover, the authors argue that the estimated resource rents reported are likely to be conservative, since the data used were for fisheries whose management schemes provided inadequate property rights.

Market-based pricing of public resources

Studies undertaken by ABARE into the fishing, forestry and mining industries indicate that market forces can generate significant resource rents, which can be captured by the community through appropriate taxation structures, while still encouraging a more efficient industry than if market forces are not allowed to operate. The following are some examples of the gains that appear to be available from more efficient management and pricing schemes for public resources.

In an ABARE consultancy report to the Resource Assessment Commission, O'Regan and Bhati (1990) addressed the management of Australia's public forests. Inappropriate management techniques and the pursuit of non-economic objectives by state forest management agencies have resulted in the failure of forestry activities to provide a reasonable net return. It is estimated, for example, that in Tasmania, where the value of wood in public forests is around $1500 million, the net returns on this public resource have been low or negative (O'Toole 1989).

O'Regan and Bhati (1990) reported a number of approaches used to estimate the extent to which logs have been underpriced. In one approach, a residual price is calculated: that is, the difference between all distribution, processing and harvesting costs and the market prices of final products. On average, residual prices exceeded royalties by approximately 77 per cent of the latter. Another approach made use of the prices paid for the long term transferable log harvesting licences introduced in Victoria in 1987. It was found that the value of hardwood licences in Victoria was in every case both positive and substantial, with processors willing to pay 49–74 per cent above the royalty charges for low grade logs, 34–48 per cent extra for medium grade and roughly 27–40 per cent extra for the higher quality logs – a strong indication that log royalties in Victoria have been below implicit market prices in recent years.

There are a number of benefits in ensuring that market prices are obtained for logs. An inadequate financial return on public forests implies a needlessly large tax burden on some other part of the economy. It has been estimated that if market prices were received on the quantity of sawlogs currently harvested annually in Victoria alone, the gain in state revenue would be between $11.7 million and $16.5 million a year. Furthermore, any mill that can be profitable only when underpriced raw materials are made available represents a net loss to the community. Private plantations have generally not been profitable under some current pricing arrangements, which have placed them in competition with large public log producers who set prices with little regard to overall marginal costs (including opportunity costs associated with alternative uses of the resource), and are often exempt from taxation requirements. The result is

that Australia has a particularly low level of private ownership of forest plantations compared to most other developed countries, with 30 per cent of the softwood plantation sector being privately owned.

A number of developments have occurred in recent years which indicate that state forest agencies are moving toward market-based pricing. The sale of logs by auction and tender is becoming more common, with up to 10 per cent of the sawlog harvest in Western Australia and up to 20 per cent in Victoria being sold by such methods. Royalty changes have risen significantly in all state forest agencies in the past 10 years. State forest agencies in Queensland and Victoria are required to earn real rates of return of 3 per cent and 4 per cent, respectively, on wood production activities. This gradual movement toward market pricing arrangements and the use of marginal cost criteria by state forest management agencies may, by raising log prices, increase the profitability of private plantation investments and thus lead in the long term to a greater supply of plantation logs.

In a submission to the Industry Commission on the mining industry, ABARE (1990a) focused on the important economic distinction between those 'taxes' which constitute a payment for access to the resource and taxes such as company tax, which are levied for fiscal purposes. The use of non-market methods such as the 'first come, first served' and 'work program bidding' systems to allocate property rights over minerals in Australia may have resulted in socially inefficient use of resources. Existing taxation mechanisms based on output, such as exercise, royalties and charges in excess of costs for the use of government infrastructure, are generally inefficient because they constrain the development of marginally efficient mines, and cause companies to cease some mining operations which still have positive economic benefits for society.

In a simulation study of oil exploration, development and extraction, Hogan and Thorpe (1990) show that profit-based taxes will generally distort investment decisions less than will production-based taxes. The excise tax was found to have the most distortionary impact on oil firms' investment and production decisions. The Brown tax and a modified resource rent tax, which provide for the costs and risks of failed exploration and development to be shared between the government and the private oil companies, were found to least affect the efficiency of resource allocation within the mineral resource industries. When governments reject any form of cash rebate, the implementation of the Brown tax is impossible. However, modifying the resource rent tax by allowing deductions on a company-wide basis rather than a project-specific basis for exploration and development expenditure generates an outcome which is not significantly different from that of the Brown tax. It is this modification that forms the basis of recent taxation reform in the oil and gas industries. In the 1990-91 Budget the Commonwealth

government replaced the excise tax and royalties which applied to Bass Strait oil with a resource rent tax which allows company-wide deductibility of exploration costs. It is envisaged that these changes will encourage a broadening of the exploration and development effort.

Thorpe, Anthony, and Croft (1990) undertook a related simulation study of resource rent collection in the black coal industry, assuming the taxation objective of collecting 40 per cent of the available resource rent. They found that, under conditions of a constant real coal price, a resource rent tax and the Brown tax both achieved the desired objective of collecting 40 per cent of the available resource rent without societal losses in economic rent or distortions to investor returns. When coal prices are falling, only the Brown tax has this property, since it provides full loss offset and therefore an adequate buffer to adverse price changes. However, though the Brown tax serves as a useful theoretical ideal, it would be unlikely to be introduced in practice; rather, some form of resource rent tax which allows for company-wide deductibility of exploration and development expenditure is likely to be the best practical solution.

A more recent ABARE (1990b) submission, to the Industry Commission inquiry on rail transport, which incorporated results of research by Freebairn (1988), indicated that replacing the present system of excess freight charges for coal with a non-distorting resource rent tax yielding the same revenue would result in an increase in coal production of around 30 per cent by the year 2000 and a welfare gain of some $140 million a year, measured in 1985–86 prices. Thus, a resource rent tax could be used to collect the same amount of revenue as at present while coal production and national income would both increase.

Conclusion

Although microeconomic reform has been hailed as a panacea for Australia's macroeconomic problems, it is unlikely to reduce either the current account deficit or net foreign debt, since the reforms concerned are unlikely, with one major exception, to change the fundamental savings and investment imbalances in the Australian economy. The exception is that type of reform that reduces distortions which, due to the interaction of inflation and the taxation system, artificially lower savings while raising investment. It is also unlikely that microeconomic reform will reduce the inflation rate in the long run, although, in the short run, it could cause a temporary reduction.

However, by improving the efficiency of resource allocation, microeconomic reform can raise real output and, hence, the standard of living. On these grounds alone microeconomic reform is

highly desirable. The Industry Commission (1990b) has estimated that the current program of microeconomic reform could raise national income by $22 billion, much of this increase arising from reforms to government business enterprises. This estimate does not include benefits which could arise from reforms to health services, education, construction and taxation.

Primary industries can benefit from microeconomic reform both directly and indirectly. Reforms which are directly applicable to primary industries can raise the output of those industries by improving the efficiency of production decisions, while allowing the community to capture resource rents which were previously captured by industry participants or simply lost. Removal of industry assistance and distortions in other sectors of the economy may release resources so as to enable an expansion of industries which undertake further processing of primary industry output.

Microeconomic reform is likely to change the industry structure of the Australian economy to accord with the country's comparative advantage. Some industries will contract in size and the resources that they release will be available for use in other industries. Overall, although some industries may be adversely affected by microeconomic reform, the efficiency and size of the remaining and new industries will be increased, resulting in a higher level of output than would otherwise have been the case.

APPENDIX A

Productivity, Absorption and the Trade Balance

The relationship between productivity, absorption and the trade balance can be considered using the very simple model developed in O'Mara (1989). The model was developed to consider the relationship between terms of trade changes, absorption and the trade balance.

Notation

Y = real GDP
C = aggregate private consumption expenditure
I = aggregate private investment expenditure
G = aggregate government expenditure
X = aggregate exports
M = aggregate imports
p_j = implicit deflators, where j = y, c, i, g, x, m for GDP, consumption, investment, government spending, exports and imports respectively.

Model

The national accounting identity can be expressed in nominal terms thus:

$$(A1) \quad p_y Y = p_c C + p_i I + p_g G + p_x X - p_m M$$

For simplicity, it is assumed that private consumption expenditure is a simple function of the effective spending power of GDP:

$$(A2) \quad C = a + b \left\{ \frac{p_y Y}{p_i} \right\}, b > 0$$

Similarly, a positive relationship is assumed between private investment expenditure and real GDP expressed in terms of investment goods. To the extent that an increase in productivity raises Y relative to p_i it would stimulate investment, although a simultaneous fall in p_y might partly offset the rise in investment. Thus:

$$(A3) \quad I = c + d \left\{ \frac{p_y Y}{p_i} \right\}, d > 0$$

The volume of imports is assumed to be a function of the real combined level of private consumption and investment expenditure expressed in terms of importables:

$$(A4) \quad M = e + f\left\{\frac{p_c C + p_i I}{p_m}\right\}, f > 0$$

For simplicity, exports and government expenditure are assumed to be exogenous:

$$(A5) \quad X = \bar{X}$$

$$(A6) \quad G = \bar{G}$$

Analysis

Substituting into (A1) and then solving out for imports and taking the first partial derivative with respect to exports, we obtain:

$$(A7) \quad \frac{\partial M}{\partial X} = \left\{\frac{f(b+d)p_x}{p_m(1+(b+d)(f-1))}\right\}$$

Suppose that $b + d = 1$. In other words, suppose that a change in $p_y Y$ induces an equal change in combined consumption and investment expenditure. Then:

$$(A8) \quad \frac{\partial M}{\partial X} = \frac{p_x}{p_m}$$

Defining the balance of trade, BT, to be

$$(A9) \quad BT = p_x X - p_m M,$$

then, using (A8),

$$(A10) \quad \frac{\partial BT}{\partial X} = 0$$

Hence, in this case, the balance of trade is invariant to an exogenous change in exports (such as could arise through improved productivity in exporting industries).

Conversely, if $b = d = 0$ (that is, consumption and investment are invariant with respect to a rise in $p_Y Y$) then :

$$(A11) \quad \frac{\delta BT}{\delta X} = p_X.$$

In other words, in this case, a change in exports is fully reflected in the balance of trade.

It follows that microeconomic reform which exogenously raises productivity in exporting industries will improve the balance of trade only if domestic spending (consumption and investment combined) rises by less than the increase in exports.

APPENDIX B

An Intertemporal Approach to Productivity and the Balance of Payments

The model

The following two-period model of a small open economy producing and consuming a single good, and facing a given world rate of interest, is largely drawn from Frenkel and Razin (1987, pp. 139–65). The economy is characterised by an initial sequence of output endowments, $\bar{Y}_1$ and $\bar{Y}_2$, where the subscripts 1 and 2 designate the first and second periods respectively. The first-period endowments may be consumed or, alternatively, invested in an intertemporal production process. Output in period two, Y_2, is linked to the first-period initial endowment $\bar{Y}_1$, through an intertemporal production function $F(I_1)$, where I_1 denotes investment (the output not consumed) in period one:

$$(B1) \quad Y_2 = \bar{Y}_2 + F(I_1); \qquad F'(I_1) > 0\,,\ F''(I_1) < 0,\ I_1 > 0$$

Firms maximise the present value of profits:

$$(B2) \quad \tilde{\Pi} = \max_{I_1} [\,\alpha_2 F(I_1) - I_1]; \quad \alpha_2 = \frac{1}{(1 + r_1)}$$

where α_2 denotes the present-value factor and r_1 is the one-period world interest rate. For a positive level of investment to occur, there must be a point at which $F'(I_1)$ is equal to $-(1 + r_1)$. It is possible for the interest rate and the production function to be such that a zero level of investment is optimal.

Consumers maximise lifetime utility subject to budget constraints. The budget constraint depends on the output endowments in each period and profits distributed by firms. In the first period, income is used for consumption and saving, and in the second period income is fully consumed. Hence the budget constraints are :

$$(B3) \quad C_1 = \bar{Y}_1 + B_1 - I_1 - (1+r_0)\,B_0$$

in the first period, and

(B4) $C_2 = \bar{Y}_2 + F(I_1) - (1+r_1) B_1$

in the second period, where C_1 and C_2 denote first and second period consumption respectively, B_0 denotes the pre-existing level of borrowing and B_1 denotes level of borrowing at the end of the first period. (In a two-period model, the solvency requirement is that all debt commitments are settled in the second period.) Borrowing is from abroad. Any difference between consumption and output, in either period, is supplied by imports or exports. It can be seen that the resulting trade balance is equal to the difference between saving and investment. Since the agents can borrow, (B3) and (B4) can be combined to form a consolidated present-value budget constraint:

(B5) $C_1 + \alpha_2 C_2 = \bar{Y}_1 + \alpha_2 \bar{Y}_2 + \bar{\Pi} - (1+r_0) B_0 = W_1$

where W_1 is the value of wealth in period one. Thus, increases in the output endowment in either period or improvements in the production technology increase the level of wealth, and hence allow the level of consumption to rise in both periods.

The consumer is assumed to have perfect foresight, and to maximise lifetime utility by choosing a path for current and future consumption subject to the consolidated budget constraint (B5):

(B6) $\bar{U} = \max_{(C_1, C_2)} U[C_1, C_2]$, subject to $C_1 + \alpha_2 C_2 = W_1$; $U[]' > 0$, $U[]'' < 0$.

Assume that the utility function is homothetic and takes the form:

(B7) $U(C_1,C_2) = U(C_1) + \delta U(C_2)$,

where δ, the subjective discount factor, is related to the marginal rate of time preference p according to $\delta = 1/(1+p)$. The assumption of homotheticity allows the subjective discount factor to be independent of the level of wealth. Maximisation of (B6) subject to (B5) produces the first order condition,

B(8) $\frac{U'(C_1)}{U'(C_2)} = \frac{\delta}{\alpha_2}$

From (B8) it can be seen that if $\delta = \alpha_2$ — that is, the marginal rate of time preference p is equal to the world interest rate r_1 — the utility function is maximised by maintaining a constant level of consumption.

Figure 4: Productivity improvements in an intertemporal model

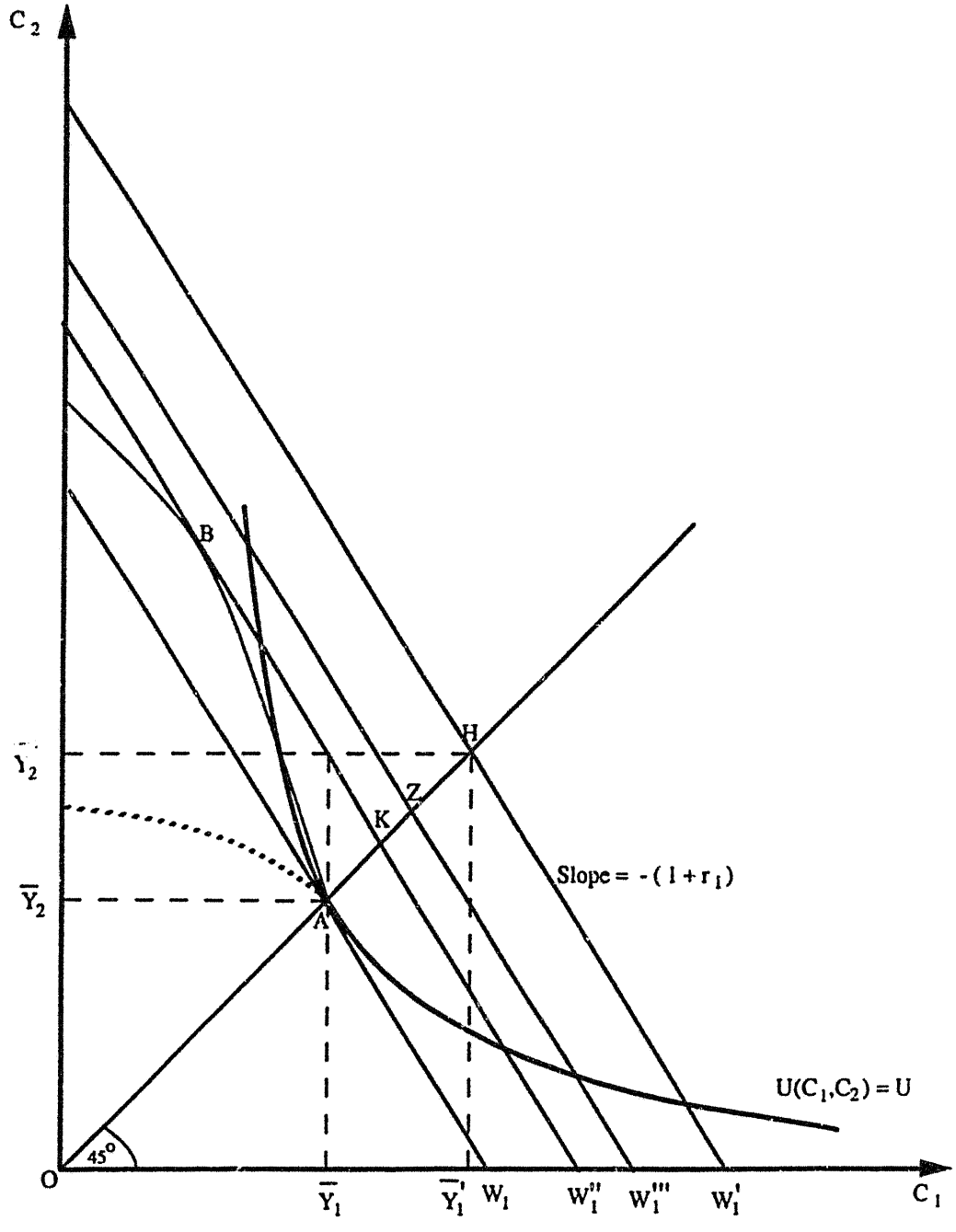


Figure 4 is a diagrammatic representation of the intertemporal general equilibrium model specified in the equations above. Consumption, output, and investment in the initial period are measured along the horizontal axis, while those in the subsequent period are measured along the vertical axis. The output endowments, $\bar{Y}_1$ and $\bar{Y}_2$, are assumed to be the same in both periods. The maximised level of utility is obtained at A – the tangency of the indifference curve U with the budget constraint W. The budget line emerges from a point W_1 (the level of wealth in the first period) and its slope is $1 + r_1$ in absolute terms.

Intertemporal adjustment to a rise in productivity

Frenkel and Razin (1987) distinguish three types of optimal path of consumption in the model set out above. When $\delta = \alpha_2$ and $\bar{Y}_1 < \bar{Y}_2$ consumption **smoothing** occurs: anticipating future increased output, consumers borrow from abroad, running a current account deficit, in the low income period in an attempt to maintain a constant level of consumption. When $\delta < \alpha_2$ and $\bar{Y}_1 = \bar{Y}_2$, consumption **tilting** occurs: because their marginal rate of time preference is higher than the world interest rate, consumers borrow against the future output endowment to increase their consumption in the current period at the expense of future consumption. Finally, consumption **augmenting** occurs provided that there is a point on the intertemporal production function $F(I_0)$ where its slope is $-(1 + r_0)$: a profitable return is generated from investment undertaken in the initial period. As consumers prefer a smooth consumption path (given the assumptions), rather than reducing current consumption, they borrow against the present discounted value of future profits from investment to increase their initial wealth, allowing a higher level of consumption in both periods than would otherwise be the case.

It is the **smoothing** and **augmenting** patterns of behaviour which underlie the response to the improvement in productivity analysed in this appendix.

The effects of microeconomic reform may be represented by either a rise in current and future output endowments, a rise in the future output endowment (assumed to be anticipated in the initial period) or a change in the technology which underlies the intertemporal production function $F(I_1)$. In constructing Figure 4, the following simplifying assumptions have been made: output endowments are the same in both periods; the initial level of debt is zero; the marginal rate of time preference is equal to the world rate of interest ($\delta = \alpha_2$); and investment is unprofitable given current technology and the world interest rate (as indicated by the slope of the intertemporal production function — the dashed curved line rising from A). The equilibrium obtained at A, given an initial level of wealth equal to W_1, is one in which the level

of consumption is the same in each period and equal to the output endowment in each period. Hence the trade balance is zero.

A permanent equiproportionate rise in the output endowments, to $\bar{Y}_1'$ in the current period and $\bar{Y}_2'$ in the future period, raises wealth to W_1' and allows a higher level of consumption. Given the assumptions that the utility function is homothetic and that the rise in output is proportionally the same in each period, the equilibrium moves from A to H, with consumption also rising proportionally in each period, leaving both the trade account and the current account balances unchanged. (If the assumption of a homothetic utility function is relaxed so that the rate of time preference is high at low levels of wealth and falls as wealth rises, then the permanent increase in the output endowments induces a trade account surplus in the first period, which is offset by a trade account deficit in the second. See Frenkel and Razin 1987, p. 153.)

A currently anticipated rise in the future output endowment from $\bar{Y}_2$ to $\bar{Y}_2'$, leaving $\bar{Y}_1$ unchanged, increases the level of wealth from W_1 to W_1''', such that an equilibrium is obtained at Z. Consumption rises in the first period although the output endowment is unchanged, resulting in trade account and current account deficits of equal size (represented by the horizontal difference between Z and $\bar{Y}_1$). In the second period, consumption is less than the output endowment, generating a trade surplus covering the previous trade deficit, and a slightly larger current account surplus (represented by the vertical difference between Z and $\bar{Y}_2'$) to pay back the borrowings and interest which were incurred to finance the trade deficit in the first period.

An improvement in the technology underlying the intertemporal production function may result from microeconomic reform. In Figure 4 the dashed curved line rising from A represents an intertemporal production function which does not permit profitable investment at the current world interest rate. However, an improvement in technology, giving a production function represented by the solid curved line rising from A, allows profit maximising investment equal to the horizontal difference between $\bar{Y}_1$ and B to produce output equal to vertical distance OB in the second period. The rise in future output raises the level of wealth to W_1''. The equilibrium moves from A to K, as consumers maintain a smooth consumption path by borrowing in the first period, generating a current account deficit, to finance consumption (as above) plus investment which in the second period produces a profit and a current account surplus to pay back the initial borrowings.

In summary, the implications of improved productivity in an intertemporal model depend on the form of the utility function and on the relationship between the marginal rate of time preference and the world rate of interest.

APPENDIX C

The Swan/Salter Model

The model developed by Salter (1959) and Swan (1960) allows consideration of the economic implications of sector-specific productivity improvements in a small open economy which produces traded and non-traded goods (Figure 5). The terms of trade is exogenous, by assumption, allowing exports and imports to be combined into a composite commodity. Given the assumption of a small open economy the price of the traded good is exogenously determined on world markets. The price of the non-traded good is determined by supply and demand factors in the domestic economy. The levels of production of traded and non-traded goods are indicated, respectively, by T on the horizontal axis and NT on the vertical axis. The subscripts 1 and 2 refer to the initial and final levels of production respectively. In equilibrium, the economy operates at the tangency point between the indifference curve and the production possibility frontier, that is A in the initial equilibrium and B in the final equilibrium. The real exchange rate, defined as the price of non-traded goods relative to the price of traded goods, is given by the slope of the tangent.

The economic implications of productivity improvements are shown in Figure 5 for six cases: equiproportionate improvements in productivity in both sectors, an improvement in traded goods productivity and an improvement in non-traded goods productivity, each under conditions of homothetic and non-homothetic preference orderings. Homothetic preference ordering is characterised by indifference curves with linear income expansion paths, and non-homothetic preference ordering by nonlinear income expansion paths; in the case shown the non-homothetic income expansion path is biased toward consumption of non-traded goods.

In the case of an equiproportionate sectoral productivity improvement under homethetic preferences (Figure 5A), the production of traded and non-traded goods unambiguously rises proportionately to the productivity improvement, and the real exchange rate is unchanged. However, if preferences are non-homothetic in the assumed direction (Figure 5B), an equiproportionate improvement in productivity results in an appreciation of the real exchange rate. In that case, the rise in the production of non-traded goods may be accompanied by either an increase or a decrease in the production of traded goods (the diagram depicts the case where there is a small increase in traded goods production).

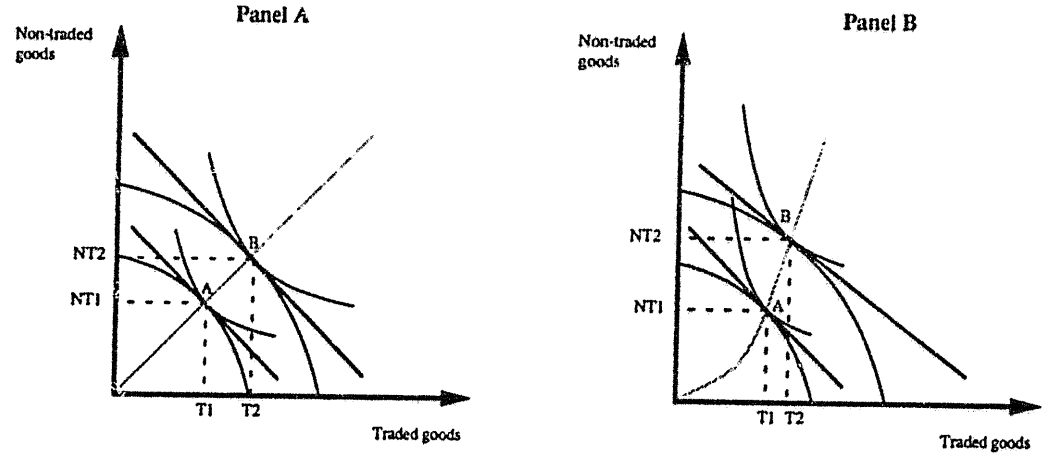
Gregory (1976) and Snape (1977), in their assessments of the growth of the minerals sector, have examined the economic implications of a productivity improvement biased in favour of the traded goods sector. Figure 5C shows the situation where productivity increases only in the

Figure 5: Productivity improvements in the Swan/Salter model

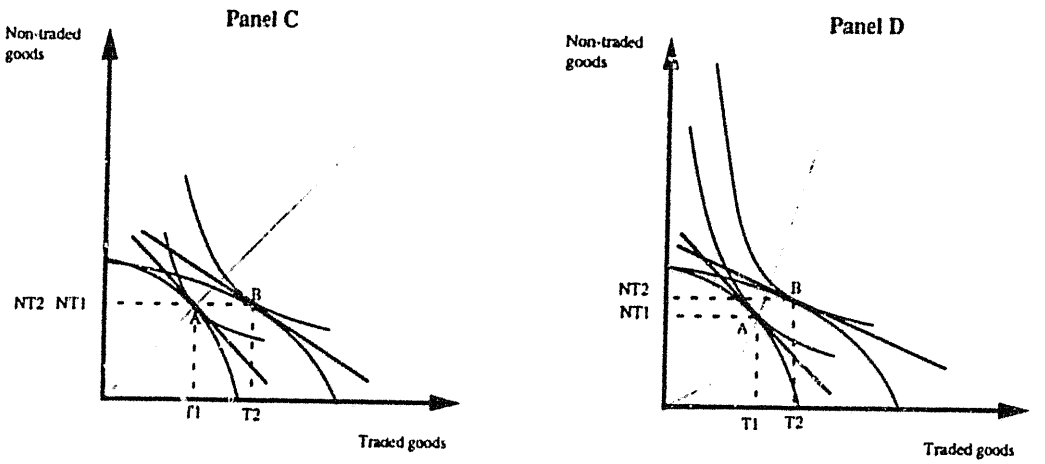
Homothetic preferences

Non- homothetic preferences favouring non-traded goods

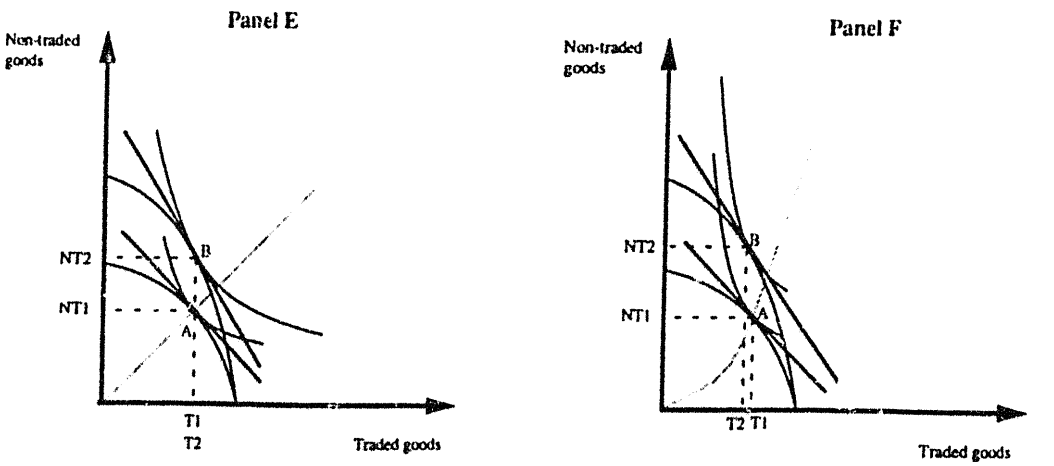
(i) Equiproportionate sectoral productivity improvements



(ii) Traded goods sector productivity improvement



(iii) Non-traded goods sector productivity improvement



traded goods sector. The output of traded goods rises, and the relative price of non-traded goods rises – that is, the real exchange rate appreciates – through either nominal exchange rate appreciation or inflation in the price of non-traded goods. The output of non-traded goods may either increase or decrease (the diagram depicts the case where there is no change in non-traded goods production). If, however, preferences are non-homothetic in the assumed direction (Figure 5D), the appreciation of the real exchange rate is larger. Output of traded goods expands to a smaller extent, while output of non-traded goods expands relative to the case in which preferences are homothetic.

If the productivity improvement is isolated to the non-traded goods sector (Figure 5E) – for example, in the provision of services in the public sector – the real exchange rate depreciates (through either nominal exchange rate depreciation or non-traded goods price deflation), the output of non-traded goods rises, and the output of traded goods may either increase or decrease (the diagram depicts the case where there is no change in traded goods production). If preferences are non-homothetic, favouring non-traded goods (Figure 5F), the required depreciation is reduced, while the expansion of the non-traded goods sector is greater, and the output of the traded goods sector lower, than in the case of homothetic preferences.

Hence, the sectoral composition of productivity improvements can have important implications for the real exchange rate and the level of output in a traded goods sector, such as Australia's primary industries.

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