



***The World's Largest Open Access Agricultural & Applied Economics Digital Library***

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from AgEcon Search may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

35th Annual Conference of the  
Australian Agricultural Economics Society  
University of New England, Armidale, 11-14 February 1991

## Major Influences on the Real Exchange Rate in the 1990s

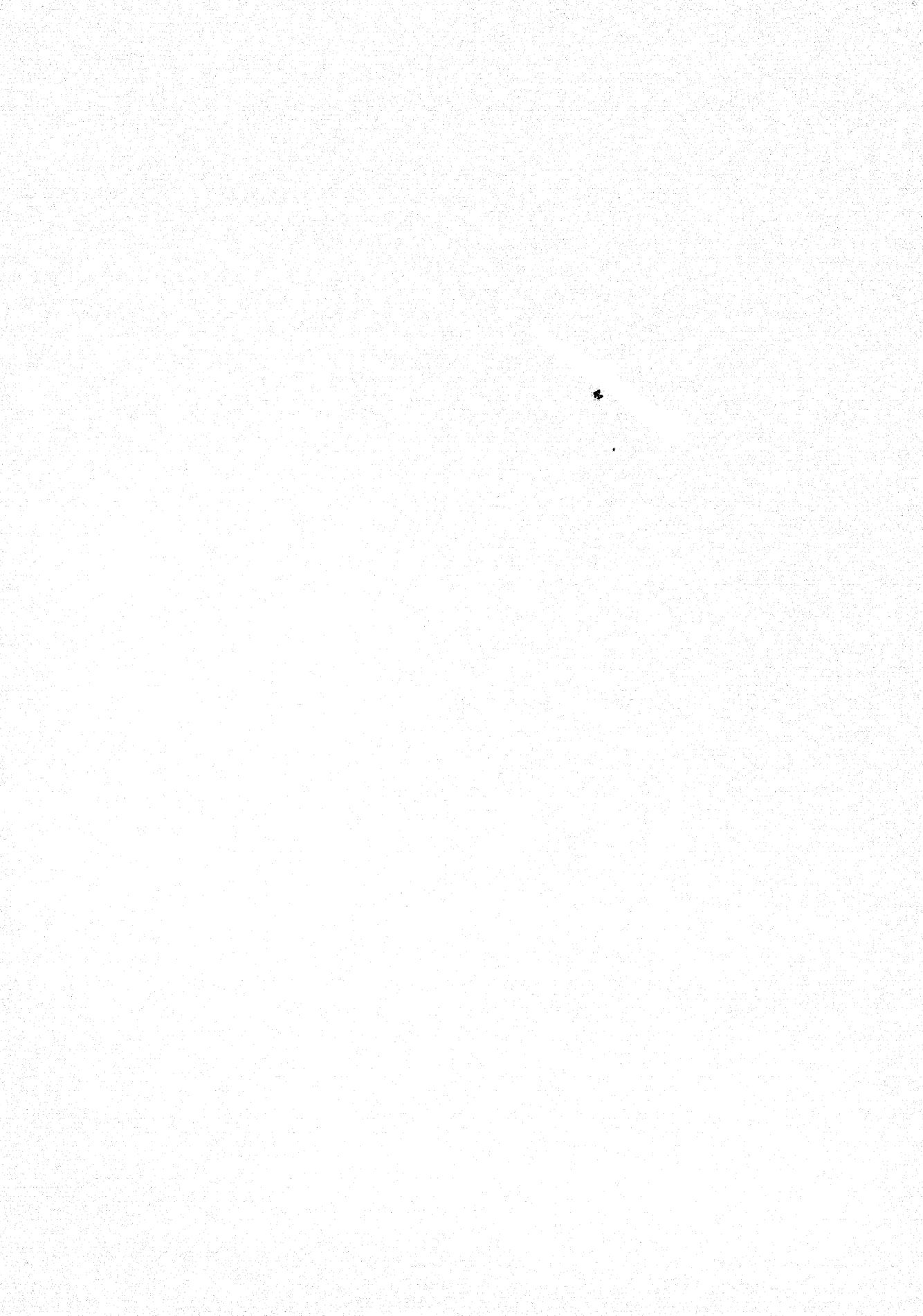
### A Simulation Analysis

Robert S. Wright and Jammie H. Penm

Australian Bureau of Agricultural  
and Resource Economics

GPO Box 1563 Canberra 2601

*The Murphy model of the Australian economy is used to assess the impact on the real exchange rate of a number of important economic developments expected to occur in the 1990s. Both the short run and long run implications for the real exchange rate are discussed. Changes in the terms of trade are found to have an important long run impact on the real exchange rate without inducing short run volatility. Conversely, changes in labour productivity, the stance of fiscal policy and world interest rates induce short term volatility while having little long run impact on the real exchange rate.*



## *Introduction*

The real exchange rate has occupied a central position in the Australian economic policy debate during the postwar period. Movements in the real exchange rate are of particular importance to primary industries because they are a key determinant of the prices received for Australia's commodity exports and hence have a major bearing on decisions about farm and mining investment (O'Mara, Crofts and Coote 1987). However, there has been little consensus on the measurement of the real exchange rate or the factors which influence it in either the short run or the long run. Dornbusch (1989) argues that, in the long run, the real exchange rate is determined by microeconomic factors such as resource endowments, tastes, technology, and intertemporal savings and investment decisions. In the short run, however, macroeconomic policy and the international economic environment could be important determinants of the real exchange rate.

In this paper, the influence on the real exchange rate of some economic developments which could occur in the 1990s are assessed using the Murphy model of the Australian economy (Murphy 1989a,b). These economic developments include changes in fiscal policy, world interest rates, microeconomic reform and the terms of trade. While these developments may change the long run real exchange rate, the dynamic adjustment of other macroeconomic variables may also cause significant and protracted deviations of the real exchange rate from its steady-state value and therefore exert considerable impact on the economy in the short run.

The real exchange rate is defined in the next section of this paper and some divergent views about recent movements in the real exchange rate are discussed. The Murphy model is then outlined and the structure of the simulation experiments is described. The simulation results are discussed in the final section.

## *The Real Exchange Rate*

The real exchange rate is often used as a proxy for the competitiveness of the traded goods sector of an economy. The traditional measure of the real exchange rate is expressed as

$$(1) \quad RER = \sum_{i=1}^n \frac{W_i * P * E_i}{P_{fi}}$$

where  $RER$  is the real exchange rate;  $P$  is the domestic price level;  $P_{fi}$  is the foreign price level in country  $i$ ;  $E_i$  is the bilateral exchange rate between the home country and the currency of

country  $i$  (measured as units of foreign currency per unit of domestic currency); and  $W_i$  is the trade weight for country  $i$ .

Hence, the change in the real exchange rate is approximately equal to the change in a trade weighted nominal exchange rate adjusted for the inflation differential between the domestic economy and its trading partners. For several years ABARE has compiled and published a series of the real exchange rate based on equation (1) using consumer prices as a measure of inflation (O'Mara, Carland and Campbell 1980).

The real exchange rate measures deviations from purchasing power parity, but is often used as an indicator of movements in the relative price of tradables and non-tradables. Dwyer and O'Mara (1987) and, more recently, Dwyer (1990) constructed a relative domestic price index which measures directly the price of traded goods relative to the price of non-traded goods. The relative domestic price index corresponds with the real exchange rate defined in the popular Swan-Salter (dependent economy) model and provides a measure of the incentive for resources to shift from the traded goods sector to the non-traded goods sector. Under certain conditions, movements in both the traditional measure of the real exchange rate and the relative domestic price index are identical (McKenzie 1986; Dwyer 1987; Dwyer and O'Mara 1988). In this paper, the real exchange rate given in equation (1) is used for consistency with the Murphy model and ease of interpretation of the simulation results.

Between the December quarter 1984 and the September quarter 1986, Australia's real exchange rate fell dramatically, by around 37 per cent. There is some evidence that the fall in the real exchange rate in the mid-1980s was one of the sharpest and carried it to the lowest level this century (McKenzie 1986). The simultaneous decline in Australia's terms of trade due to a decline in international commodity prices provided a popular explanation for the real exchange rate depreciation (Figure 1). However, there were, and still are, widely divergent views about prospects for the real exchange rate, highlighting the uncertainty about the impact of economic developments on this variable.

The Institute of Applied Economic and Social Research (Dixon and Parmenter 1987) maintained that all of the decline in the real exchange rate between 1984 and 1986 could be explained by the terms of trade, and that the rise in foreign indebtedness implied that a further sizable real exchange rate depreciation was warranted from the level of mid-1986. The Economic Planning Advisory Council (EPAC 1986, 1988) argued that the real exchange rate had moved to a new equilibrium level and that the depreciation to the level of mid-1986 was sufficient.

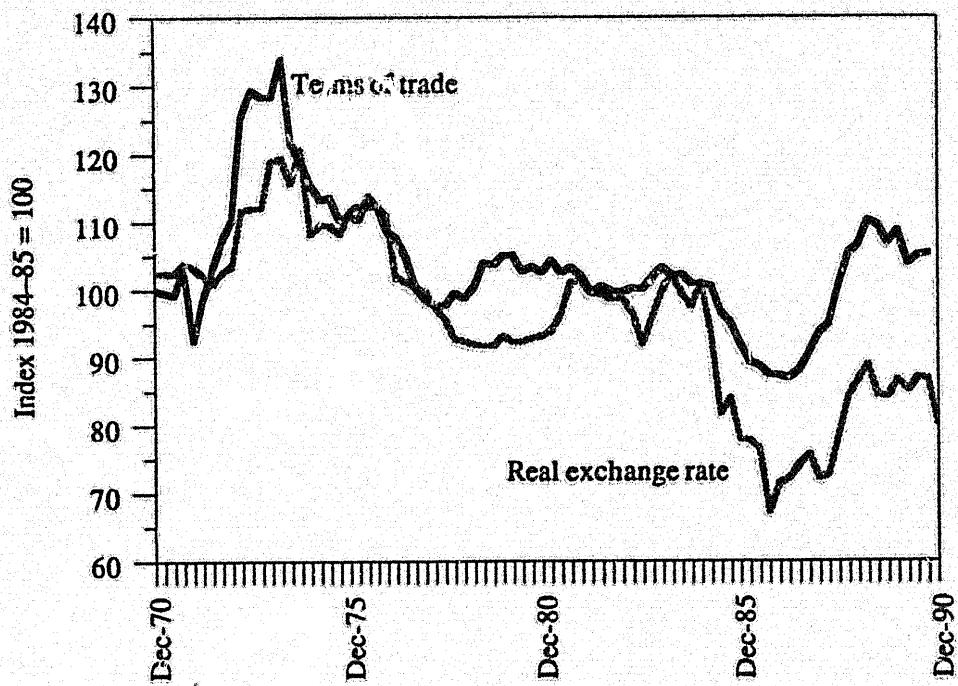


Figure 1—Australia's real exchange rate and terms of trade

In late 1989, Smith and Gruen (1989) argued that a further substantial depreciation of the real exchange rate was required to reduce Australia's current account deficit to a level consistent with the stabilisation of the ratio of net foreign debt to gross domestic product. They concluded that, in the absence of significant risk premiums, the differential between Australian and foreign interest rates must reflect the expectation of a large depreciation of Australia's real exchange rate in order to restore equilibrium. More recently, Syntec economic services has argued for an easing of monetary policy to allow a 28 per cent depreciation of the exchange rate to restore industry competitiveness to its level of 1986 (Stutchbury 1990).

ABARE research indicates that it is difficult to justify more than a 20 per cent depreciation of the real exchange rate from the level of 1984 on the basis of the decline in the terms of trade and the rise in the current account deficit and net foreign debt (O'Mara 1989). O'Mara therefore argued that shorter term factors had accounted for a large part of the depreciation of the real exchange rate between 1984 and 1986. This view is supported by Thorpe, Hogan and Coote (1988) who found that the emergence of a risk premium contributed to the depreciation of the Australian dollar in 1985. O'Mara (1989) concluded that a long run real exchange rate about 20 per cent below the level of 1984 would be consistent with a current account deficit which allows the eventual stabilisation of Australia's net foreign debt to GDP ratio, provided domestic demand was sufficiently restrained.

ABARE has argued that the shorter term influences contributing to the depreciation of the real exchange rate would dissipate and the real exchange rate would appreciate (O'Mara, Crofts and Coote 1987). This expectation has been largely upheld. Since the latter part of 1986, the real exchange rate has appreciated markedly such that, by the December quarter of 1990, it was estimated to have been around 20 per cent below the level of 1984, implying that the real exchange rate is around its medium term equilibrium level as assessed by ABARE.

In the 1990s both international and domestic economic developments are expected to influence the real exchange rate in the short and long run. Domestic fiscal policy is expected to remain tight and produce further reductions in government debt through the 1990s. The process of reform in Eastern Europe is expected to increase world investment opportunities while world savings are expected to be largely unchanged, placing upward pressure on world real interest rates. The process of microeconomic reform in goods and labour markets is likely to continue in the 1990s and could enhance labour productivity. The Australian terms of trade is expected to continue to reflect the decline in the price of primary commodities relative to manufactured goods (Commonwealth of Australia 1988).

## *Simulation Design*

### *The Murphy model*

The Murphy model is a small quarterly model of the Australian economy which consists of a financial sector and five sectors – household, dwelling provision, business (including public enterprise), general government and foreign – relating to the flows of goods and services. The model is documented in Murphy (1989a,b).

The model structure is similar to the Dornbusch (1976) monetary overshooting model. In the short run the model properties are Keynesian in character while in the long run the properties 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 are rational, that is forward looking and model consistent. Capital is assumed to be perfectly mobile internationally, which means that any difference between domestic and foreign interest rates reflects the expected movement in the exchange rate. In keeping with the monetary overshooting model, monetary policy is neutral in the long run (in other words it has no real effects in the long run), although it may have considerable real effects in the short run due to the sticky domestic price adjustment process. Finally, an expansion of exports in the Murphy model causes a slight deterioration in the terms of trade (and an associated depreciation of the real exchange rate relative to the level which would have ruled in the absence of the terms of

trade decline) because it is assumed that Australia is large enough to influence international prices for some primary commodities such as wool and mineral sands.

As to the relationship between the real exchange rate, current account deficit and foreign debt level, Dornbusch (1988) showed that there is no presumption that current accounts should be balanced over the short run or for extended periods of time and that the long run real exchange rate would be jointly determined with the optimal path for foreign debt. Martin, Murphy and Nguyen (1987) showed that, in a growing economy, a balanced trade account would be consistent with the stabilisation of the net foreign debt to GDP ratio if the international real interest rate were equal to the real rate of domestic economic growth and assets were perfect substitutes. In the Murphy model, the international real rate of interest exceeds the real rate of domestic economic growth; hence a small trade surplus is required to offset part of the interest bill in order to stabilise the net foreign debt to GDP ratio in the long run.

Martin, Murphy and Nguyen (1987) noted that, in common with the Swan-Salter model, the equilibrium real exchange rate in the monetary overshooting model is only required to be consistent with internal balance. The maintenance of external balance is left to the adjustment of domestic absorption relative to output. There is no presumption or mechanism in the theoretical models which ensures that the current account is balanced in equilibrium. Therefore, in principle, the ratio of net foreign debt to gross domestic product could grow indefinitely. However, an important feature of the Murphy model is that a rise in net foreign debt reduces private wealth, which in turn leads to a reduction in consumption expenditure (Murphy 1989b). Consumers attempt to rebuild their wealth, thereby ensuring that private consumption follows a sustainable path and the foreign debt to GDP ratio is stabilised in the long run. Therefore, the long run real exchange rate will be consistent with a trade balance which allows a current account deficit under which the ratio of net foreign debt to GDP is stabilised.

### ***Simulation structure***

A number of simulations using the Murphy model were undertaken to examine the response of the real exchange rate to changes in economic policy and the international economic environment. All the simulations consisted of permanent unanticipated shocks which were imposed from the first period of the simulation.

The Murphy model does not provide an explicit real exchange rate variable. However, as the foreign price level is unchanged in the simulations (apart from the terms of trade shocks), the percentage deviation in the real exchange rate can be calculated from the percentage deviations in the domestic price level and the exchange rate (trade weighted index). The choice of the domestic price index is between the GDP deflator (a measure of the price of output) and the consumer price index (a measure of the price of absorption). It was decided to use the

consumer price index given that this is consistent with the definition of the real exchange rate and the approach adopted by ABARE over many years.

### **Fiscal policy**

In an attempt to boost national savings and reduce the current account deficit in Australia in the latter part of the 1980s, there were reductions in government consumption, investment and employment. The stance of fiscal policy is likely to remain tight in at least the early part of the 1990s.

In the simulations a reduction in government expenditure equivalent to 2 per cent of the baseline real gross domestic product arising from, first, a reduction in government consumption of the domestic good and, second, a reduction in government employment are considered. The Murphy model incorporates an income tax rate reaction function which increases the rate of tax when the ratio of public debt to gross domestic product exceeds a target ratio (around 20 per cent). This mechanism ensures that changes in government expenditure are bond financed in the short run, but tax financed in the long run. In formulating the fiscal policy simulations the target ratio of public debt to GDP was reduced by 10 percentage points of GDP over a five year period in order to accommodate the reductions in government expenditure.

### **World interest rates**

Recent developments in Eastern Europe and the process of German reunification may enhance international investment opportunities and increase competition for world savings, placing upward pressure on world real interest rates (International Monetary Fund 1990). However, attempts to reduce the size of the US Budget deficit may increase the supply of world savings, partly offsetting the higher demand. On balance, it is possible that real interest rates will be higher in the early 1990s than in the 1980s. In order to capture these developments the simulation experiment consists of a 2 percentage point increase in the foreign interest rate. The possibility of slower economic growth in the industrialised countries and falling commodity prices as a result of the rise in world interest rates is not addressed in this simulation.

### **Microeconomic reform**

A process of microeconomic reform could enhance labour productivity in the Australian economy during the 1990s. To capture the effects of microeconomic reform, the simulation was modelled as an immediate 2 per cent improvement in labour productivity. Since labour supply is essentially fixed by the natural rate of unemployment and a given population growth rate, an increase in labour productivity raises the long run labour supply in terms of labour efficiency units (a measure of the labour supply which combines the number of employees and the efficiency with which they work). In constructing these simulations it was assumed that the

government did not attempt to maintain its expenditure as a share of GDP or that productivity improvement also occurred in other countries simultaneously.

### **Terms of trade**

The Australian dollar has often been called a commodity driven currency because about 80 per cent of Australian exports are primary commodities and real and nominal exchange rate movements have been highly correlated with the terms of trade (Figure 1). Over the past forty years, Australia's terms of trade have been characterised by a long term downward trend, amounting to about 1 per cent a year, interrupted by large transitory shocks. Some of the factors which lie behind the downward trend include increased production of commodities by indebted developing countries in response to the weaker exchange rates engendered by their debt service commitment, and by the United States and the European Community in response to their agricultural price subsidy programs as well as continued improvements in technology which have reduced the metallic/mineral content of industrial products and increased commodity production (Commonwealth of Australia 1988). It is anticipated that the downward trend in the terms of trade will continue throughout the 1990s.

The Murphy model treats imports and exports as imperfect substitutes for each other and the domestic good. Imports are treated as an intermediate good used in the production of the domestic good which is then transformed into a home good and an exported good. Therefore changes in the terms of trade can come about from two sources, foreign currency import prices or foreign currency export prices. In the first simulation the foreign currency price of imports was increased by 5 per cent while in the second simulation the foreign currency price of exports was reduced by 5 per cent.

In the trade simulations, where the foreign currency price of exports or imports is changed, it is reasonable to assume that the foreign price level may also change. Therefore it was assumed that the foreign consumer price index corresponded to the foreign currency price of imports. Hence, the foreign consumer price index is assumed to be unaffected by the fall in the foreign currency price of commodity exports.

## *Simulation Results*

### *Fiscal policy*

In the long run, the reduction in government consumption of domestic goods lowers the domestic price level, appreciates the real exchange rate by more than 1.0 per cent and reduces foreign debt in line with the reduction in public debt (Table 1). The lower level of foreign debt requires a lower trade balance to service the interest payments, and hence a higher real

exchange rate is consistent with the stabilisation of the ratio of net foreign debt to gross domestic product. The slight fall in exports generates a rise in the terms of trade which also contributes to the appreciation of the real exchange rate. The reduction in foreign debt raises the level of private wealth, inducing increased private consumption expenditure.

TABLE 1  
*Simulated effects of a reduction in government consumption equivalent to 2 per cent of GDP*

	Year 1	Year 2	Year 3	Year 4	Year 5	Long run
Private consumption (a)	-1.73	-1.88	-1.17	-0.48	0.10	2.25
Private investment (a)	0.33	0.80	0.71	0.58	0.57	0.21
Gross national expenditure (a)	-4.33	-3.84	-3.03	-2.36	-1.73	0.19
Exports of goods and services (a)	0.73	0.85	0.73	0.58	0.45	-0.08
Imports of goods and services (a)	1.78	1.62	1.26	0.97	0.70	-0.16
Gross domestic product (b)	-1.82	-1.37	-1.04	-0.81	-0.58	-0.06
Current account deficit (c)	-2.92	-3.02	-2.69	-2.42	-2.15	-0.81
Net foreign debt (c)	5.41	0.35	-3.36	-6.32	-8.75	-12.26
Consumer prices (c)	0.64	1.24	0.79	0.04	-0.54	-1.07
TWI exchange rate (c)	-16.12	-12.36	-9.43	-6.85	-4.57	2.30
90-day bank bill (d)	-4.86	-3.68	-3.00	-2.65	-2.19	0.00
Real exchange rate (b)	-15.48	-11.12	-8.64	-6.82	-5.11	1.23
Real wages (b)	-0.20	-0.59	-0.44	0.09	0.48	0.06

(a) Percentage point contribution to deviation of GDP from baseline. (b) Percentage deviation from baseline.  
 (c) Deviation from baseline as a percentage of GDP. (d) Percentage point deviation from baseline.

In the short run, a reduction in government consumption of domestic goods reduces aggregate demand and places substantial downward pressure on domestic interest rates, which in turn leads to a depreciation of the real exchange rate by more than 15 per cent in the first year of the simulation. The domestic price level rises in the first year of the simulation as the exchange rate depreciation more than offsets the downward price pressure following the reduction in aggregate demand. Private consumption expenditure falls in response to the cut in real wages and the rise in foreign debt, which reduces private wealth. However, the fall in interest rates reduces the required rate of return on private investment, inducing an investment expansion. An increase in net exports in response to the real exchange rate depreciation reduces the current account deficit and begins to reduce the ratio of net foreign debt to gross domestic product by the third year.

Alternatively the reduction in government expenditure could have been modelled as a reduction in government employment (Table 2).

TABLE 2

*Simulated effects of a reduction in government employment equivalent to 2 per cent of GDP*

	Year 1	Year 2	Year 3	Year 4	Year 5	Long run
Private consumption (a)	-2.65	-2.66	-1.61	-0.66	0.00	2.09
Private investment (a)	0.43	1.11	1.06	0.91	0.85	0.62
Gross national expenditure (a)	-4.97	-4.13	-2.93	-2.03	-1.36	0.57
Exports of goods and services (a)	1.15	1.55	1.46	1.26	1.03	0.65
Imports of goods and services (a)	1.65	1.42	0.93	0.52	0.18	-0.58
Gross domestic product (b)	-2.17	-1.16	-0.53	-0.25	-0.14	0.64
Current account deficit (c)	-2.93	-3.21	-2.78	-2.36	-1.96	-0.61
Net foreign debt (c)	6.76	1.14	-3.09	-6.43	-8.98	-9.35
Consumer prices (b)	1.00	1.11	0.26	-0.52	-0.08	-1.36
TWI exchange rate (b)	-18.84	-14.38	-10.54	-7.12	-4.42	1.05
90-day bank bill (d)	-5.72	-4.81	-4.08	-3.32	-2.25	0.00
Real exchange rate (b)	-17.84	-13.27	-10.27	-7.64	-5.22	-0.31
Real wages (b)	-1.97	-2.70	-2.24	-1.29	-0.62	-0.40

(a) Percentage point contribution to deviation of GDP from baseline. (b) Percentage deviation from baseline.  
(c) Deviation from baseline as a percentage of GDP. (d) Percentage point deviation from baseline.

In the short run, the pattern of results is similar to that from the reduction in government consumption of the domestic good. The fall in output is initially sharper but recovers more rapidly in later years. In the long run, real wages fall to allow the business sector to employ the labour released by the public sector. The increase in business sector employment requires a rise in the capital stock and generates a rise in output. The expansion of real output and exports generates a minor deterioration in the terms of trade which results in a slight depreciation of the real exchange rate in the long run.

In summary, these simulations indicate that a tightening of fiscal policy exerts substantial downward pressure on the real exchange rate in the short run. However, in the long run, wealth effects substantially reverse the short run exchange rate movements.

### ***World interest rates***

In the long run, the expected exchange rate and the spot exchange rate are equilibrated and the domestic interest rate rises to match the increase in the foreign interest rate (Table 3).

The higher interest rate increases the cost of capital and raises the required rate of return on business investment, hence lowering the equilibrium capital stock. Given the long run vertical labour supply curve (since there are no real wage effects on the labour force participation rate in the model) the real wage falls, raising the actual rate of return on capital to the required rate of return. The fall in the real wage and the rise in the cost of capital implies a reduction in the

TABLE 3  
*Simulated effects of a 2 percentage point rise in foreign interest rates*

	Year 1	Year 2	Year 3	Year 4	Year 5	Long run
Private consumption (a)	-0.44	-0.40	-0.38	-0.56	-0.75	0.04
Private investment (a)	-0.317	-0.69	-1.07	-1.20	-1.20	-1.61
Gross national expenditure (a)	-0.79	-1.34	-1.72	-2.04	-2.24	-1.74
Exports of goods and services (a)	0.40	0.32	0.13	0.03	0.03	0.49
Imports of goods and services (a)	0.58	0.64	0.67	0.76	0.85	0.49
Gross domestic product (b)	0.19	-0.37	-0.92	-1.25	-1.36	-1.68
Current account deficit (c)	-0.85	-0.91	-0.79	-0.78	-0.85	-1.32
Net foreign debt (c)	1.95	0.10	-0.92	-1.47	-1.84	-19.74
Consumer prices (b)	0.97	2.74	3.78	4.29	4.35	3.85
TWI exchange rate (b)	-7.95	-6.77	-6.77	-7.40	-8.11	-3.96
90-day bank bill (d)	0.19	1.61	2.55	2.88	2.60	2.02
Real exchange rate (b)	-6.97	-4.03	-2.99	-3.11	-3.76	-0.11
Real wage (t)	-0.06	-0.08	-0.07	-0.22	-0.60	-3.75

(a) Percentage point contribution to deviation of GDP from baseline. (b) Percentage deviation from baseline.  
 (c) Deviations from baseline as a percentage of GDP. (d) Percentage point deviation from baseline.

capital to labour ratio, which comes about through a fall in the capital stock. The lower capital stock, when combined with the existing labour force, leads to a fall in real output. The level of private consumption is maintained through a large decline in the ratio of net foreign debt to gross domestic product, which offsets the lower capital stock to produce a rise in the level of private wealth. The real exchange rate is unchanged in the long run since the level of foreign debt has adjusted to a level consistent with a flow of net interest payments and a level of absorption relative to output which allows foreign debt to stabilise.

In the short run, the rise in the foreign interest rate generates a depreciation of both the nominal and real exchange rates. Since all assets other than money are considered to be perfect substitutes in the Murphy model and capital is mobile internationally, any international interest differential must reflect expected exchange rate movements. The fall in the real exchange rate leads to a rise in net exports which more than offsets the initial decline in private consumption and investment, producing a rise in real output in the first year. This is reversed in subsequent years and in the long run.

In response to a rise in foreign interest rates there is substantial real and nominal exchange rate adjustment in the short run, although the long run real exchange rate is virtually unchanged. The major burden of adjustment is borne by the capital stock and the level of foreign debt which adjust at a slower rate than most other variables in the model. There is some possibility

that if the process of adjustment in foreign debt is not of sufficient pace to satisfy financial market participants, then an additional increase in interest rates in the form of a risk premium may be imposed (Thorpe, Hogan and Coote 1988; O'Mara 1989).

### *Microeconomic reform*

In the long run, an improvement in labour productivity raises the level of output and exports, resulting in a slight deterioration in the terms of trade and a depreciation of the real exchange rate (Table 4). The real wage per efficiency unit of labour falls slightly in order to maintain the rate of return on capital following the terms of trade decline. Since there is only a slight rise in the price of capital relative to labour, when measured in efficiency units, the optimal ratio of capital and labour, measured in efficiency units, falls only slightly. However, in actual terms, a rise in the capital stock is required for a given labour force to maintain the ratio in efficiency units. Wright, Gilmour, Mathews and O'Mara (1991) have shown that, in the absence of a decline in the terms of trade, improved labour productivity has no effects on the real exchange rate, the current account deficit or the ratio of net foreign debt to gross domestic product in the long run.

In the short run, improved labour productivity increases real output relative to absorption, leading to a 3.0 per cent real exchange rate depreciation, overshooting the required long run adjustment. Output increases at a faster rate than absorption because consumers have backward looking expectations when assessing their permanent income and hence it takes time before

TABLE 4  
*Simulated effects of a 2 per cent improvement in labour productivity*

	Year 1	Year 2	Year 3	Year 4	Year 5	Long run
Private consumption (a)	0.11	0.34	0.63	0.89	1.03	0.98
Private investment (a)	0.11	0.33	0.44	0.41	0.32	0.31
Gross national expenditure (a)	0.19	0.70	1.14	1.39	1.44	1.35
Exports of goods and services (a)	0.30	0.52	0.55	0.47	0.36	0.37
Imports of goods and services (a)	0.21	0.11	-0.06	-0.21	-0.30	-0.24
Gross domestic product (b)	0.70	1.33	1.63	1.65	1.50	1.48
Current account deficit (c)	-0.41	-0.51	-0.39	-0.23	-0.09	0.01
Net foreign debt (c)	0.64	0.11	-0.71	-1.41	-1.83	0.05
Consumer prices (b)	-0.80	-2.02	-2.47	-2.43	-2.10	-1.81
TWI exchange rate (b)	-2.32	-1.44	-0.04	1.22	1.97	1.21
90-day bank bill (d)	-0.54	-1.39	-1.43	-0.99	-0.35	0.00
Real exchange rate (b)	-3.11	-3.46	-2.51	-1.21	-0.13	-0.60
Real wages (b)	0.31	0.74	1.03	1.32	1.56	1.74

(a) Percentage point contribution to deviation of GDP from baseline. (b) Percentage deviation from baseline.  
(c) Deviation from baseline as a percentage of GDP. (d) Percentage point deviation from baseline.

they realise that the level of income has permanently risen. The improvement in labour productivity raises the actual rate of return on capital, hence increasing investment to adjust to the higher capital stock required in the long run.

Hence, improved labour productivity could depreciate the real exchange rate slightly in the long run as the increased level of exports associated with the rise in output leads to a slight deterioration in the terms of trade. However, in the short run the real exchange rate overshoots its long run adjustment because absorption adjusts only slowly to the rise in output.

In this simulation the improvement in labour productivity was assumed to be economywide. Wright et al. (1991) show that sector specific improvements in productivity may result in changes to the long run real exchange rate. Improved productivity in the traded goods sector is likely to cause an appreciation of the real exchange rate, although the production of the non-traded good may either increase or decrease. Similarly, improved productivity in the non-traded goods sector is likely to cause the real exchange rate to depreciate. Hence, productivity improvements confined to a specific sector can result in either an appreciation or depreciation of the real exchange rate.

### *Terms of trade*

O'Mara (1989) noted that the relationship between the terms of trade and the real exchange rate depends on the interaction of the terms of trade and domestic demand. If the change in the terms of trade reduces consumers' perception of their permanent income then domestic demand should fall and a real exchange rate depreciation would be expected.

In the long run, a 5 per cent decline in foreign currency export prices causes the real exchange rate to fall by around 5.5 per cent relative to the baseline (Table 5). The lower permanent income of the domestic economy resulting from the 5 per cent decline in the terms of trade leads to a decline in the level of aggregate demand relative to output, generating a slight rise in net exports. Following the decline in export prices, a larger volume of net exports is required to stabilise the ratio of net foreign debt to gross domestic product.

In the short run, the real exchange rate depreciates by about 4.0 per cent as both absorption and the level of output fall in response to the rise in foreign debt and the decline in the terms of trade. The domestic price level rises following the depreciation of the nominal exchange rate. Although a fall in real wages partly offsets the effects of higher prices for the imported intermediate good resulting from the exchange rate depreciation, the rate of return on capital still falls in response to higher import prices and lower export prices, generating lower investment which leads to lower output.

TABLE 5

*Simulated effects of a 5 per cent fall in currency price of exports*

	Year 1	Year 2	Year 3	Year 4	Year 5	Long run
Private consumption (a)	-0.40	-0.78	-1.12	-1.41	-1.56	-1.10
Private investment (a)	-0.10	-0.35	-0.49	-0.45	-0.33	-0.29
Gross national expenditure (a)	-0.69	-1.42	-1.94	-2.21	-2.23	-1.65
Exports of goods and services (a)	-0.19	-0.40	-0.42	-0.33	-0.19	-0.23
Imports of goods and services (a)	0.58	0.80	1.00	1.17	1.25	1.03
Gross domestic product (b)	-0.30	-1.02	-1.36	-1.37	-1.17	-0.85
Current account deficit (c)	0.62	0.56	0.41	0.20	0.02	0.02
Net foreign debt (c)	2.05	2.40	3.21	3.92	4.26	0.30
Consumer prices (b)	1.18	2.96	3.55	3.41	2.90	2.04
TWI exchange rate (b)	-5.16	-6.08	-7.65	-8.99	-9.70	-7.54
90-day bank bill (d)	0.54	1.65	1.71	1.13	0.30	0.00
Real exchange rate (b)	-3.98	-3.12	-4.09	-5.57	-6.80	-5.50
Real wages (b)	-0.45	-1.13	-1.52	-1.84	-2.10	-2.14

(a) Percentage point contribution to deviation of GDP from baseline. (b) Percentage deviation from baseline. (c) Deviation from baseline as a percentage of GDP. (d) Percentage point deviation from baseline.

TABLE 6

*Simulated effects of a 5 per cent rise in currency price of exports*

	Year 1	Year 2	Year 3	Year 4	Year 5	Long run
Private consumption (a)	-0.20	-0.51	-0.85	-1.14	-1.29	-1.05
Private investment (a)	-0.11	-0.36	-0.48	-0.44	-0.33	-0.27
Gross national expenditure (a)	-0.45	-1.12	-1.63	-1.89	-1.93	-1.57
Exports of goods and services (a)	-0.23	-0.44	-0.46	-0.36	-0.23	-0.21
Imports of goods and services (a)	0.45	0.65	0.86	1.02	1.12	0.97
Gross domestic product (b)	-0.24	-0.90	-1.23	-1.23	-1.04	-0.81
Current account deficit (c)	0.60	0.58	0.43	0.24	0.07	0.02
Net foreign debt (c)	0.00	0.55	1.46	2.26	2.73	0.33
Consumer prices (b)	1.02	2.59	3.15	3.06	2.62	1.94
TWI exchange rate (b)	1.01	-0.07	-1.74	-3.18	-4.00	-2.59
90-day bank bill (d)	0.68	1.67	1.71	1.17	0.40	0.00
Real exchange rate (b)	-2.97	-2.48	-3.59	-5.12	-6.38	-5.64
Real wages (b)	-0.40	-0.99	-1.37	-1.72	-2.00	-2.01

(a) Percentage point contribution to deviation of GDP from baseline. (b) Percentage deviation from baseline. (c) Deviation from baseline as a percentage of GDP. (d) Percentage point deviation from baseline.

The long run simulation results for the 5 per cent increase in foreign currency import prices (Table 6) are similar to the the decline in foreign currency export prices. However, the nominal exchange rate appreciates slightly in the short run to produce the gradual adjustment in the real exchange rate following the sudden rise in foreign prices. The appreciation of the nominal exchange rate also leads to a reduction in the ratio of net foreign debt to gross domestic product due to valuation effects in the first year. The domestic price level rises in response to the rise in import prices and the depreciation of the nominal exchange rate in subsequent years.

In summary, a change in the terms of trade does not generate a larger fluctuation in the exchange rate in the short run than would occur in the long run. This indicates that terms of trade shocks, while having a major influence on the long run real exchange rate, are not a major source of short term exchange rate volatility except insofar as commodity price shocks can be sizable and more frequent than some other shocks influencing the Australian economy. In the long run, the adjustment to the net foreign debt to GDP ratio is minimal in each of the simulations.

## *Conclusion*

The Murphy model of the Australian economy was used to simulate the implications for the real exchange rate of a number of domestic and international economic developments which could occur in the 1990s. The real exchange rate is not a policy instrument, but rather an endogenous reflection of the settings of policy and the underlying circumstances of the economy (Tease 1990). As such, in the long run the real exchange rate will be consistent with the levels of savings and investment in the economy. Hence, the only factors which can influence the real exchange rate in the long run, apart from structural changes in the economy such as sector specific productivity improvements, are those factors which influence savings and investment decisions. In the short run, the real exchange rate may also be influenced by macroeconomic policy and the dynamic process of adjustment.

The results reported in this paper indicate that a number of economic developments in the 1990s could induce short run fluctuations in the real exchange rate without necessarily generating a substantial change in the long run equilibrium value of the real exchange rate. Moreover, the results support the conclusion that while changes in economic policy may influence the short run real exchange rate, they are unlikely to result in a sizable shift in the long run equilibrium value.

A continued tightening of fiscal policy and a reduction in government debt could induce a short run depreciation of the real exchange rate while having little influence in the long run. Although

the effects are small, the long run real exchange rate appreciates if the tightening of fiscal policy arises from a reduction in government consumption of goods and depreciates if the tightening of fiscal policy arises from a reduction in government employment. A rise in world interest rates is likely to induce a significant depreciation of the real exchange rate in the short run but have no influence on the long run value. Improvements in labour productivity, flowing from microeconomic reform, could also lead to a greater depreciation of the real exchange rate in the short run than would be required in the long run. In contrast to the above, while a continued decline in the terms of trade is likely to cause a depreciation in the long run real exchange rate of a similar magnitude to the terms of trade decline, in the short run, the real exchange rate is likely to depreciate by less than the decline in the long run value.

## References

Commonwealth of Australia (1988), *Budget Statement No. 2*, AGPS Canberra.

Coughlin, C.C. and Koedijk, K. (1990), 'What do we know about the long-run real exchange rate', *Review (Federal Reserve Bank of St. Louis)* 72(1), 36-48.

Dixon, P.B. and Parmenter, B.R. (1987), Australia's real exchange rate: 1985 to 1990. Paper prepared by the Institute of Applied Economic and Social Research, University of Melbourne, for a public seminar, 'The Debt Crisis', Sydney, 15 May.

Dornbusch, R. (1976), 'Expectations and exchange rate dynamics', *Journal of Political Economy* 84(6), 1161-76.

— (1988), 'The adjustment mechanism: theory and problems', in Fielke, N. (ed.), *International Payments Imbalances in the 1980's*, Federal Reserve Bank of Boston, October.

— (1989), 'Real exchange rates and macroeconomics: a survey', *Scandinavian Journal of Economics* 91(2), 401-32.

Dwyer, J. (1987), Real effective exchange rates as indicators of competitiveness. Paper presented at the 16th Conference of Economists, Surfers Paradise, 23-27 August.

— (1990), Australia's traded goods sector: its size, composition and competitiveness. Paper presented at the 19th Conference of Economists, University of New South Wales, Sydney, 24-27 September.

— and O'Mara, L.P. (1988), 'Measuring Australia's competitiveness', *Quarterly Review of the Rural Economy* 10(1), 54-9.

EPAC (1986), *External Balance and Economic Growth*, Council Paper No. 22, Office of EPAC, Canberra.

— (1988), *Australia's Medium Term Growth Potential*, Council Paper No. 30, Office of EPAC, Canberra.

International Monetary Fund (IMF) (1990), *World Economic Outlook*, Washington DC, October.

Martin, W.J., Murphy, C.W. and Nguyen, D.T. (1987), *Influences on the Australian Real Exchange Rate: An Analysis Using the AMPS Model*, CEPR Discussion Paper 177, Australian National University, Canberra.

McKenzie, I.M. (1986), 'Australia's real exchange rate during the twentieth century', *Economic Record*, special issue, 69-78.

Murphy, C.W. (1989a), The Murphy model in detail. Australian National University, Canberra (mimeo).

——— (1989b), The macroeconomics of a macroeconomic model. Australian National University, Canberra (mimeo).

——— (1989c), 'The budget strategy and the foreign debt', *Australian Economic Review* 89(4), 32-51.

O'Mara, L.P. (1989), Exchange rates, interest rates and agriculture: a macroeconomic view. Paper presented at the 33rd Annual Conference of the Australian Agricultural Economics Society, Christchurch, New Zealand, 7-9 February.

———, Carland, D. and Campbell, D. (1980), 'Exchange rates and the farm sector', *Quarterly Review of the Rural Economy* 2(4), 358-67.

———, Crofts, B. and Coote, R. (1987), 'Prospects for exchange rates and interest rates: implications for farmers', *Quarterly Review of the Rural Economy* 9(4), 440-8.

Smith, J. and Gruen, D.W.R. (1989), *A Random Walk Around the \$A: Expectations, Risk, Interest Rates and Consequences for External Imbalance*, Reserve Bank Discussion Paper 8906, Reserve Bank of Australia, Sydney.

Stutchbury, M. (1990), 'How to bring down the exchange rate', *Australian Financial Review*, 10 October.

Tease, W. (1990), 'The balance of payments' in Grenville, S. (ed.), *The Australian Macroeconomy in the 1980s*, Proceedings of a conference sponsored by the Reserve Bank of Australia, Sydney, 20-21 June.

Thorpe, S., Hogan, L.I. and Coote, R. (1988), Risk premiums - implications for the exchange rate and interest rates in Australia since 1984. ABARE paper presented at a Department of Treasury Seminar, Canberra, 19 October.

Wright, R.S., Gilmour, K.G., Matthews, L.E. and O'Mara, L.P. (1991), Some implications of microeconomic reform for the macroeconomy and the commodities sector. ABARE paper presented at the 35th Annual Conference of the Agricultural Economics Society of Australia, University of New England, 11-14 February.