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Australia's Trade Linkages with the World

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This document is based on research and development work undertaken in recent years in the Modelling Section of The Treasury. It has been released in the interests of evaluating the research results and to encourage public discussion.

The views in this paper are those of the authors and are not necessarily those of the Government or the Treasury.

This document is one of a series presented at the June 1993 Treasury Conference on *The TRYM Model of the Australian Economy*. The full set of papers presented at the conference are listed below.

- *An Introduction to the Treasury Macroeconomic (TRYM) Model of the Australian Economy*
(TRYM Paper No.1)
- *Documentation of the Treasury Macroeconomic (TRYM) Model of the Australian Economy*
(TRYM Paper No. 2)
- *Employment, Inflation, Investment and Productivity: Decisions by the Firm*
(TRYM Paper No. 3)
- *Exports, Imports and the Trade Balance*
(TRYM Paper No. 4)
- *Savings, Dwelling Investment and the Labour Market: Decisions by Households*
(TRYM Paper No. 5)
- *Australia's Trade Linkages with the World*
(TRYM Paper No. 6)
- *The Macroeconomic Effects of Higher Productivity*
(TRYM Paper No. 7)

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1. INTRODUCTION

Australia is a small and relatively open economy in what is often a very volatile world. With exports and imports each accounting for around 20 per cent of GDP, and with a history of a very volatile terms of trade, it is perhaps inevitable that economic activity in our major trading partners will have a significant impact on domestic demand and output. Moreover, like many other developed nations, Australia's capital markets are integrated with global capital markets. It is therefore possible for international developments to affect economic conditions in Australia through both the traded sector and capital markets.

With integration of global goods and capital markets continuing to increase, it seems likely that the world economy will continue to be an important influence on the Australian economy. Indeed, as shown later in the paper, the correlation between Australian and world economic growth seems to have increased since the float of the Australian dollar in December 1983.

Trade with the Asia-Pacific region has become increasingly important for Australia. Of Australia's top sixteen major trading partners (representing around 80 per cent of merchandise exports), countries from the Asia-Pacific region are the destination for around 89 per cent of this trade. Government policy has increasingly become conscious of the importance of the Asia-Pacific region to Australia's economic prospects, and focused upon encouraging integration with these dynamic economies, particularly in Asia. The Treasurer has recently said in his 1993-94 Budget speech:

"...The destination of Australia's exports has also shifted dramatically, with Asia now taking almost 60 per cent of our merchandise exports. This partly reflects the much higher growth rates in Asia than in the older industrialised world...We must build on the progress to date and encourage greater engagement with the Asia-Pacific region."

Recent work by McTaggart and Hall (1993) has shown using single equation econometric techniques the significance of foreign (USA and Japan) GDP as a determinant of Australian GDP. This paper extends the research to that of Australia's major trading partners as a whole, and goes beyond partial analysis, considering the interlinkages using the TRYM structural model of the Australian economy.

This paper uses the TRYM model to examine the question of how foreign economic developments impact on the Australian economy. The paper concentrates upon one of these linkages to the world economy - the linkage between world demand, Australia's international trade and the terms of trade. Although financial and equity markets are important, they are not the focus of this paper.

We analyse trade linkages through a simulation of the TRYM model. The simulation consists of a permanent fall in the level of Australia's major trading partners' economic activity and its effect on the terms of trade. This shock is designed to demonstrate the importance of the trade linkage in the transmission of shocks in the world economy to the domestic economy.

2. AUSTRALIA'S LINKAGES WITH THE WORLD

2.1 Major Linkages With the World

Developments in the world economy can be thought as affecting the Australian economy through three major channels.

The first channel is through trade with the rest of the world. A slow-down in world growth will lead to lower demand for our exports and tends to lower export prices and volumes. The declining terms of trade and domestic incomes will tend to lower aggregate demand (via lower consumption and business investment). The exchange rate tends to fall as the prospective outlook for the economy deteriorates, and this pushes up import prices. This tends to increase consumer prices and wage pressures. Falling aggregate demand and rising producer real wages tend to lower business investment and employment.

This paper examines this first transmission mechanism.

The second channel is through financial sector linkages. With a floating exchange rate and capital mobility, foreign interest rates have an important influence on a small open economy like Australia. First, they affect the net transfers paid overseas on net foreign liabilities. Second, international arbitrage will ensure that real interest rates in Australia are equal to real interest rates in the rest of the world in the long run. Otherwise, rates of return would differ and profits could be made by moving capital into or out of Australia. Therefore a rise in world interest rates could be expected to eventually raise domestic interest rates and this would affect domestic saving and investment and therefore activity.

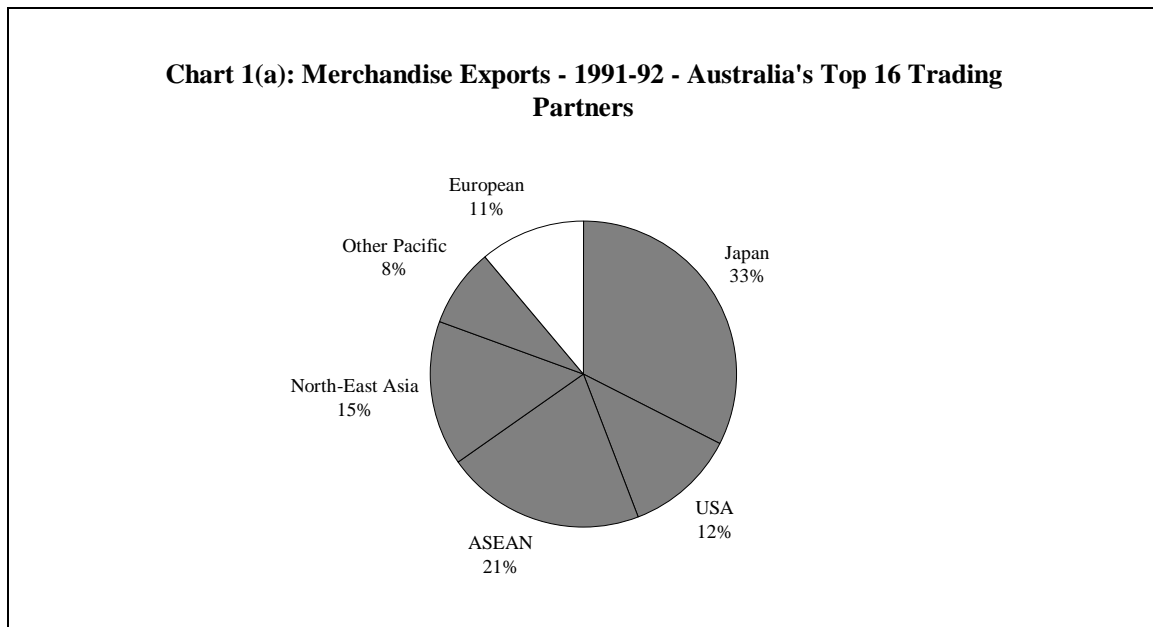
The third channel occurs through changes in expectations or 'animal spirits' that form an informal, though potentially powerful linkage between countries. One example of this connection is through foreign investment, by Australians abroad or by foreigners in Australia. Decisions made by people in one country will affect the resources they control in other countries. Australian multinationals, for example, may instruct their foreign branches to make decision that do not entirely reflect overseas conditions, and vice versa. Another linkage is that overseas economic conditions may affect the rate of return on Australia's overseas investments, income received from abroad, and the incentive to invest in equity abroad. Similarly, economic conditions in foreigners home markets may affect their incentive to invest in Australian subsidiaries or equities. These decisions affect domestic incomes and wealth, and therefore domestic demand.

This factor, though difficult to measure, may be growing in importance as Australia becomes integrated with the world economy. One indicator is that Australian equity investment abroad has grown in importance since the float of the dollar, rising from around 3 1/2 per cent of GDP to around 16 per cent of GDP. Foreign investment in Australian equity is around 27 per cent of GDP.

While these second and third channels are interesting and important in their own right, they are not the subject of this paper. Here we concentrate on the first channel of linkages through Australia's export and import links with its major trading partners.

2.2 Australia's Trade With the Asia-Pacific Region

An examination of Australia's major trading partners shows the importance of the Asia-Pacific region as a destination for Australian merchandise exports. Chart 1(a) shows the proportion of merchandise exports trade with Australia's top sixteen trading partners (representing over 80 per cent of the total) that is destined for Asia-Pacific countries. Over 89 per cent of merchandise exports trade heads for Asia-Pacific destinations. This suggests that it is largely the Asia-Pacific region that drives Australia's major trading partners growth and therefore the demand for Australian exports.

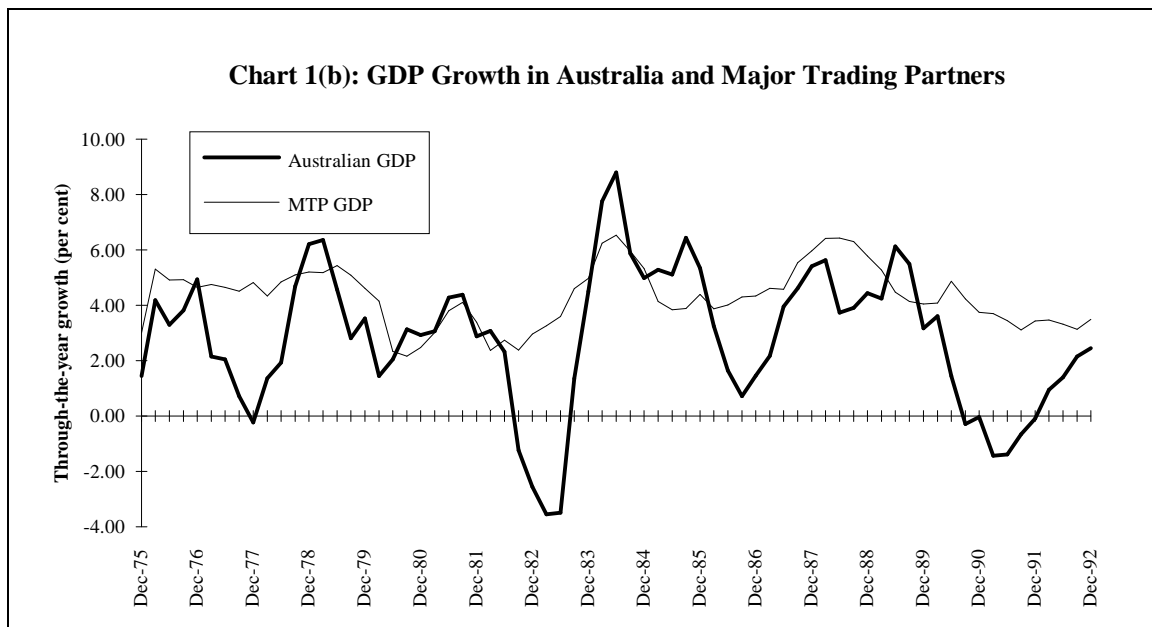


Of Australia's top sixteen trading partners, the Asia-Pacific region includes the United States, Japan, ASEAN countries (Malaysia, Thailand, Singapore and Indonesia), North-East Asian countries (China, Korea, Taiwan and Hong Kong), and Other Pacific countries (Canada and New Zealand). Japan remains Australia's most important trading partner. However, within this group of Asia-Pacific countries, 44 per cent of this merchandise export trade is purchased by Asia-Pacific countries excluding the United States and Japan and 36 per cent by Asian countries excluding Japan.

European countries (United Kingdom, Germany, France and Italy), are now only the destination for around 11 per cent of the merchandise exports trade with Australia's top sixteen trading partners.

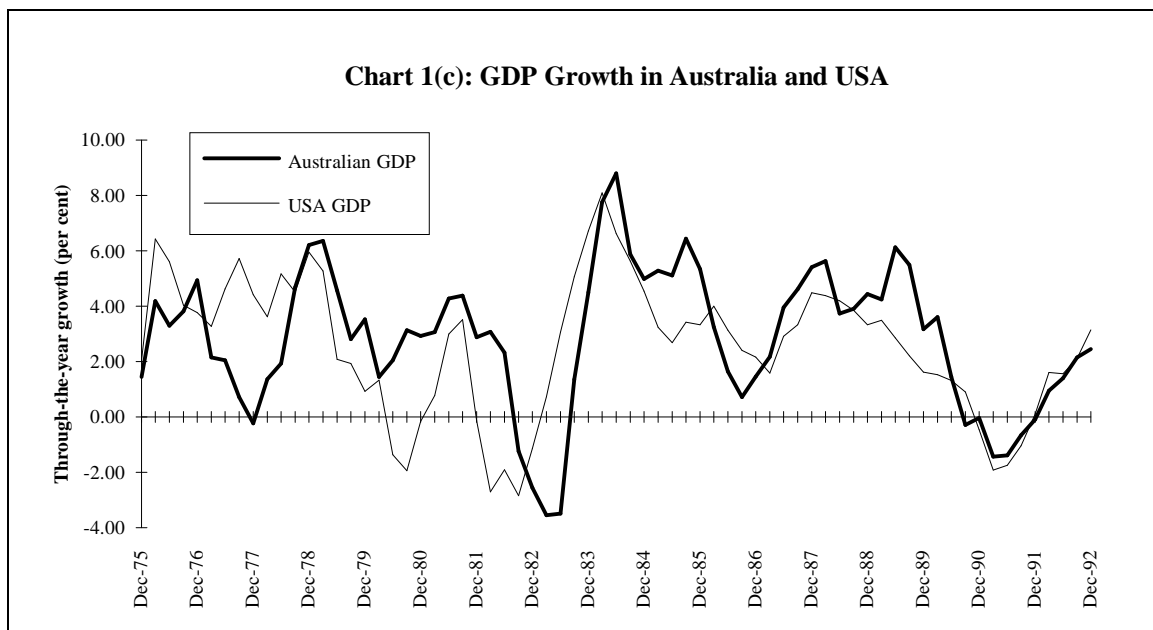
2.3 Past World Growth Cycles and Their Influence on Australia

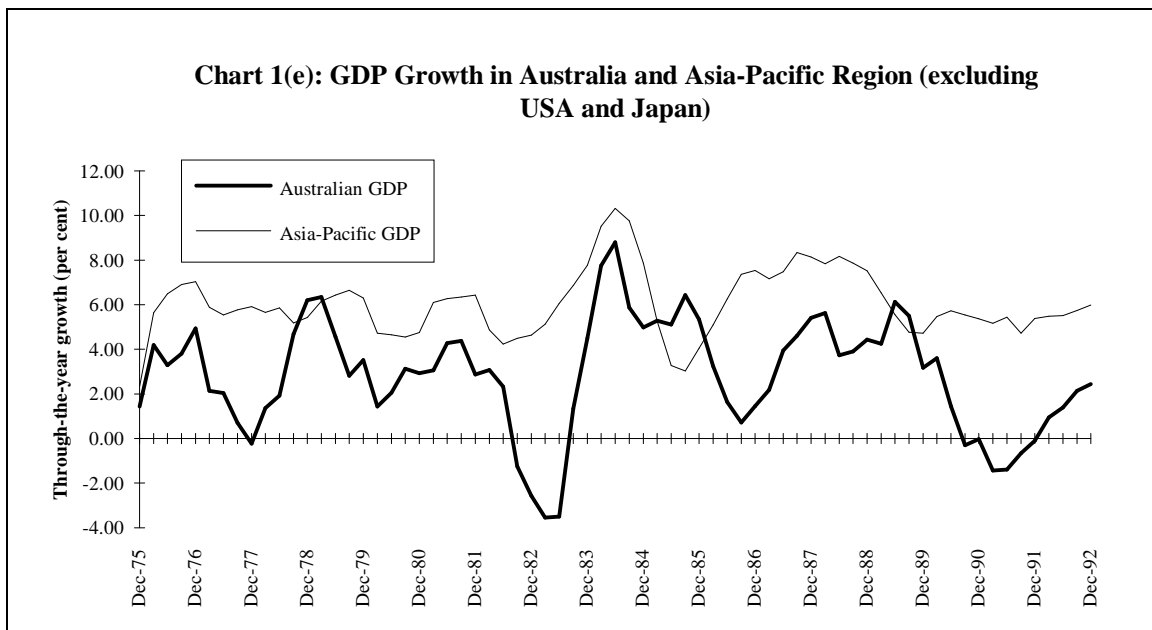
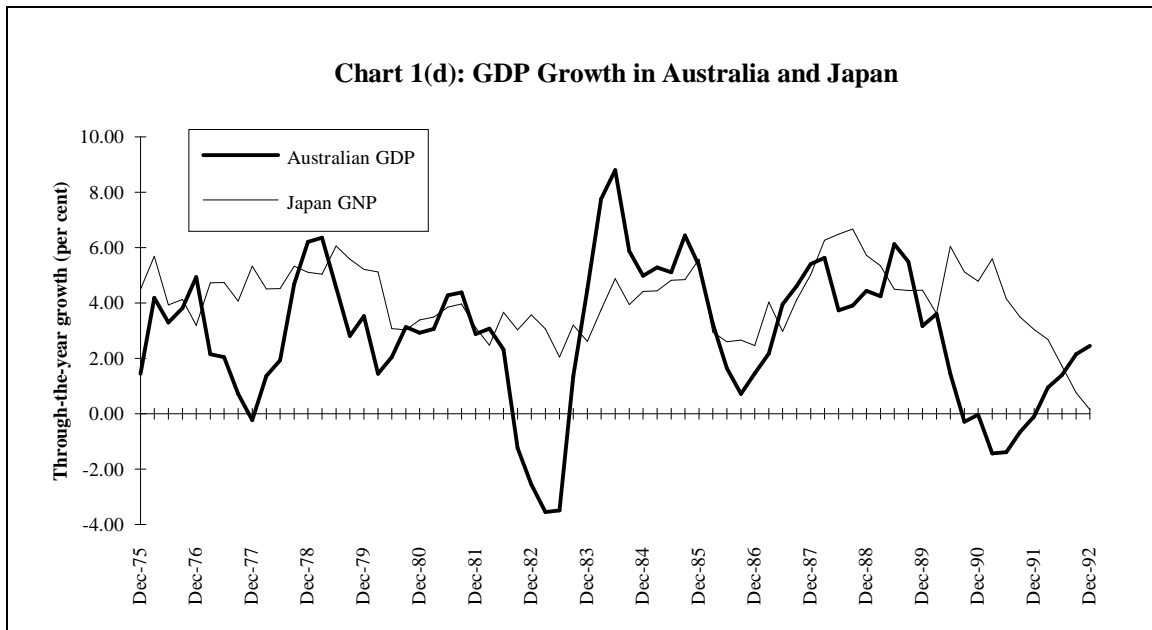
The TRYM model uses the GDP based WGTM variable to measure world growth. WGTM is based upon GDP data for Australia's major trading partners, weighted by annual data for their share in Australia's exports. Chart 1(a) shows the through the year growth in Australian GDP and in our major trading partners GDP since 1975. The chart suggests a positive correlation between Australian GDP growth and that of Australia's major trading partners. While Australian GDP growth has greater swings than WGTM growth, the timing of the respective cycles has been similar.



The differing nature of the current Australian recovery compared to past experiences is highlighted in the chart. In the current recovery, there has been little stimulus from our major trading partners as their growth has remained relatively low by their historical standards. The Australian economy would appear to be leading the economies of our major trading partners in this cycle. This is in contrast to the experience in 1983-84 and, to a lesser extent 1986-87, when robust major trading partner growth supported the growth phase of the Australian cycle after those downturns.

The preceding discussion on the destination of Australian exports highlights the importance of growth in the Asia-Pacific region for Australia's export performance. Charts 1(c), 1(d) and 1(e), show Australian GDP growth compared with that of the United States, Japan and Asian-Pacific countries (excluding the United States and Japan).





One striking feature of these charts is the apparent strong correlation between Australian growth with that of the United States, and the much weaker correlation with that of Australia's largest trading partner Japan, or indeed the non-USA, non-Japan, Asia-Pacific countries. Chart 1(c) suggests a one for one relationship between Australian and United States growth.

This stronger correlation may reflect the relative importance of United States interest rates for the Australian economy. If the United States interest rates are positively correlated with their GDP growth, then the apparently stronger relationship may reflect financial linkages as well as trade linkages.

However, this strong correlation need not imply causation. It could reflect the way that both Australia and the United States respond to some other influence, such as movements in world commodity prices, social developments or a common set of 'animal spirits'.

2.4 Correlations Between Australian and World Growth

Recent work by McTaggart and Hall (1993)¹, has highlighted the importance of foreign GDP as one determinant of Australian GDP. Their work used the estimation of reduced form equations to examine the significance of historical correlations between Australian GDP and that of USA GDP and Japanese GNP.

Tables 1(a) and 1(b) show simple correlation coefficients between growth in Australian GDP, the GDP of Australia's major trading partners and the United States (for comparison). The correlations are based upon calendar year growth rates, and are for the period 1975 and 1992 (Table 1(a)), and for the post float period 1984 to 1992 (Table 1(b)). The results suggest a positive correlation in both cases. Furthermore, this correlation appears to have increased since the floating of the exchange rate.

Table 1(a): Correlation Between Australia and Foreign Growth 1975 to 1992

	AUSTRALIA	MP	USA
AUSTRALIA	1		
MTP	0.593	1	
USA	0.645	0.815	1

¹ Doug McTaggart and Tony Hall (1993). *Unemployment: Macroeconomic Causes and Solutions ? Or Are Inflation and the Current Account Constraints on Growth ?* Draft of a paper presented at the conference, Unemployment: Causes, Costs and Solutions, held in Canberra in February 1993 by the Centre for Economic Policy Research, ANU, and the Department of Employment, Education and Training.

Table 1(b): Correlation Between Australian and Foreign Growth 1984 to 1992

	AUSTRALIA	MP	USA
AUSTRALIA	1		
MTP	0.759	1	
USA	0.928	0.760	1

An equivalent way of looking at this issue is to use regression analysis. A simple regression of Australian growth on foreign growth (using annual data) is shown below with t ratios in brackets. Results are reported for both the period from 1975 to 1992 and the post float period from 1984 to 1992. These results support the above observations with around 30 per cent of the variation in Australian growth correlated with world growth. This explanatory power rises to almost 50 per cent over the post float period.

Full sample: 1975 to 1992

$$\Delta \log(\text{GTM}) = -0.0124 + 0.977 \Delta \log(\text{WGTM})$$

$$(-0.794) \quad (2.66)$$

$$R^2 = 0.306 \quad DW = 1.86 \quad SE = 1.75\%$$

Post float: 1984 to 1992

$$\Delta \log(\text{GTM}) = -0.0436 + 1.69 \Delta \log(\text{WGTM})$$

$$(-1.46) \quad (2.58)$$

$$R^2 = 0.487 \quad DW = 2.06 \quad SE = 1.83\%$$

The results are even more striking if the TRYM model rainfall index is included in the same regressions in order to account for the effects of droughts on the Australian economy. These results suggest that over half of the variation in Australian annual GDP growth can be explained by a combination of droughts and world economic activity. This result is again consistent with McTaggart and Hall (1993) and their work with the Southern Oscillation Index as a measure of weather conditions.

Full sample: 1975 to 1992

$$\Delta \log(\text{GTM}) = -0.00229 + 0.770 \Delta \log(\text{WGTM}) + 0.0180 \text{RAIN}$$

$$(-0.176) \quad (2.52) \quad (3.08)$$

$$R^2 = 0.575 \quad DW = 1.67 \quad SE = 1.42\%$$

Post float: 1984 to 1992

$$\Delta \log(\text{GTM}) = -0.0371 + 1.43 \Delta \log(\text{WGTM}) + 0.0304 \text{RAIN}$$

$$(-1.44) \quad (2.46) \quad (1.87)$$

$$R^2 = 0.675 \quad DW = 2.56 \quad SE = 1.57\%$$

These simple correlations and regressions suggest that major trading partner GDP growth is an important determinant of Australian growth. McTaggart and Hall extend this partial analysis further using more sophisticated reduced form cointegration techniques to test these historical correlations. They do however say

" Without a specific structural model of the economy, and all its linkages, it is difficult to draw unambiguous conclusions from the above results. " (p 20)

The remainder of this paper is devoted to this goal. The TRYM structural model of the Australian economy is used to analyse the interlinkages between major trading partner GDP and Australian GDP. By focussing on trade response, this paper ensures that the relationships described below are not spurious, but based on economic fundamentals.

3. THE TRYM MODEL FRAMEWORK

3.1 World Activity and Exports in the TRYM Model

This paper focuses on the direct linkages between world activity and Australia's activity through the exports of goods and services in the TRYM model framework. Australia's exports are closely tied to growth in Australia's major trading partners (WGTM).

In the TRYM model, exports are broken down into two categories, commodities and non-commodities. Commodity exports consists of mining and agricultural goods, while non-commodities, which consist of manufactured goods plus services. Conceptually, each of these categories react to changes in world growth in quite different ways. Moreover, the timing, magnitude and speed of adjustment of volumes and prices of commodities and non-commodities, to shocks to the world economy differs substantially.

3.11 Commodity Exports and World Activity

World growth impacts on world commodity prices which, in turn, are a primary determinant of Australia's commodity export prices. In the TRYM model, these relationships are simplified by linking world activity directly with Australia's commodity export prices. The intermediate links between world activity and world commodity prices, and world commodity prices and Australia's commodity export prices are not necessary in this framework.

The framework for commodity exports in the TRYM model makes a clear distinction between demand and supply. It was found that the volume of commodity exports is largely determined by supply considerations while international demand determines the prices. It is assumed that Australia is a price taker in the international commodity market and therefore commodity export prices are determined in the long run by world prices and the exchange rate. In the short to medium term, however, fluctuations in world activity can have a significant effect on commodity exports prices, such that a fall in world growth will lead to a proportionately larger fall in commodity export prices, and consequently a large fall in the terms of trade (*ceteris paribus*). Over the longer term, the short run effects of world growth on commodity export prices diminish. Indeed, in the TRYM model, a change in world growth has no long run impact on commodity export prices.

This result is consistent with a long run world supply curve that is perfectly elastic. In the TRYM model the relative price of commodities is unaffected by the level of world activity in the long run because the world commodity supply curve moves in line with world non-commodity supply.

In the TRYM model, a one per cent permanent fall in the level of growth of Australia's major trading partners will reduce commodity export prices by about 3 per cent in the short run but no affect in the long run. The adjustment of commodity prices back toward equilibrium is slow, with a mean lag of about 4 years.

3.12 Non-commodity Exports and World Activity

In contrast to commodity exports, non-commodity exports are analysed in the TRYM model by assuming that supply determines price and demand determines volume. Therefore, fluctuations in world activity are (directly) linked to the volume of non-commodity exports rather than the price, which is determined by domestic non-commodity prices. The volume of non-commodity exports react fairly quickly initially to a change in growth of our major trading partners. Moreover a one per cent fall in world growth leads to a fall in non-commodity exports of 0.3 per cent in the short run; and a fall of one per cent in the long run. The adjustment to the long run after the initial impact response is however fairly slow.

Further details on the structure of the export equations can be found TRYM Paper Number 2, *The Documentation of the Treasury Macroeconomic (TRYM) Model of the Australian Economy*, and TRYM Paper Number 4, *Exports, Imports and the Trade Balance*.

3.2 Nature of the World Shock

The type of world shock examined in this paper is a shock through world demand, trade and the terms of trade. The other two linkages discussed may be important, however, are outside the scope of this paper and are grounds for future work.

World activity is assumed to fall permanently by one per cent. As outlined above, a feature of the TRYM model is the linkage between world activity and Australia's terms of trade (via export prices). A fall in world activity will necessarily entail some fall in the terms of trade. However, as the *growth* of world activity is relevant for commodity export prices; commodity prices react and then slowly unwind. This tends to unwind the shock to the terms of trade.

In the interests of presenting a widely familiar shock, the shock has been modified to ensure that not only is world activity lower, but commodity export prices and hence the terms of trade are also permanently lower. This has been constructed by having small further falls in world activity (after the initial one per cent fall in world activity), sufficient to offset the world supply response. This entails a further gradual fall in world activity of around one per cent over the remainder of the ten year simulation.

3.3 Response of Fiscal and Monetary Policies in Simulations

As outlined in TRYM Paper Number 1, *An Introduction to the Treasury Macroeconomic (TRYM) Model of the Australian Economy*, policy reaction functions are introduced in the TRYM model as *default* mechanisms for monetary and fiscal policy. By their very nature, these reaction functions are a highly simplified representation of the policy formation process, and do not represent how policy makers would or should act, but rather one plausible way that they could act. The primary reason for the introduction of these mechanisms is to ensure that the economy moves toward a stable growth path in the very long run.

3.31 Default Fiscal Policy Mechanism

The default fiscal policy response mechanism operates through general government (local, state or federal government) revenue collections and automatically ensures shifts in fiscal policy setting in response to changes in the economic environment. This process ensures, for example, that an unsustainable level of public debt is not allowed to accumulate in the model. The fiscal target is specified to be an exogenously predetermined public debt to GDP ratio, which is assumed to be achieved in the medium to long run. Government deficits are assumed to be debt financed in the short run. In moving toward this target debt to GDP ratio, all the adjustment is assumed to take place via changes in the rate of tax on labour income.

3.32 Default Monetary Policy Mechanism

The default monetary policy mechanism links the financial sector to the real economy via an equation incorporating a relationship between nominal transactions, money supply and the price of money (nominal short term interest rates). This relationship implies that a rise in nominal transactions relative to money supply will increase short term interest rates.

The default specification has simply been chosen for convenience and for its simplicity and transparency. Nevertheless, it represents a plausible mechanism that enables short term interest rates to respond to developments in both prices and real activity.

3.4 Expectations Behaviour in Simulations

In the TRYM model, expectations made by firms and households are backward looking. They only take into account current and past information about the economy, without working out the consequences for the future.

The TRYM model incorporates forward looking behaviour into the decisions of agents in the financial markets. Financial market expectations of the long run values of the exchange rate and the price level are calculated using the equilibrium values determined by the TRYM model. The steady state analogue of the TRYM model is simulated to find these long run equilibrium values.

These expectations for the exchange rate and inflation are therefore consistent with the rest of the model. They enter the equations for the exchange rate and inflationary expectations. The theoretical justification for this approach is that financial markets make unbiased estimates of the long run exchange rate and price level. For example, if the authorities change fiscal or monetary policy then financial markets assess the long run implications for these variables and adjust current exchange rates and expectations of inflation accordingly.

There are two ways of setting up the financial sector in the TRYM model. When short run, as well as long run, expectations are unbiased then this is called model consistent expectations or rational expectations (RE). It affects three TRYM model equations. The exchange rate is determined by uncovered interest parity where agents can make unbiased estimates of the future equilibrium exchange rate. Expectations of inflation over the long

run are influenced by an unbiased estimate of the expected price level. Long term bond yields are determined by the expected profile of short term interest rates.

When short run expectations are not consistent with the model, but long run expectations are, this is called quasi-rational expectations (QRE). In the TRYM model, the exchange rate is determined by the long run expected exchange rate and the long term interest differential between Australia and the rest of the world. Again, expectations of inflation over the long run are influenced by an unbiased estimate of the expected price level. However, the long bond yield is determined by current and past information about short term interest rates and foreign interest rates alone.

To illustrate the difference between these two frameworks, two sets of results are presented for the world demand shock. The first set shows the response of the economy when financial markets have model consistent or rational expectations (RE). A second set shows the response of the economy when the financial sector has only quasi-rational expectations (QRE).

3.41 Model Consistent or Rational Expectations

Under this approach financial markets determine expectations that are realised by future events. That is, their expectations eventuate. There are two justifications for using this approach.

First, under rational expectations, agents do not make systematic errors when assessing future outcomes. While individuals may make mistakes, the market view is right on average. Thus financial markets collect information, analyse the implications for future outcomes and then factor this information into their current decisions.

Second, financial markets may have a potentially imperfect understanding of the economy and this may bias their expectations. However, if the view of the world that they have is the same as the TRYM model view, then they will anticipate all the outcomes that the TRYM model will generate. Financial market expectations are model consistent, even though there may be unexpected developments that they do not foresee. This is a weaker assumption about the way that agents operate, but is operationally equivalent to rational expectations.

3.42 Quasi-rational Expectations

While many economists believe that agents have biased expectations and make mistakes concerning the future, there is no consensus about exactly what these biases or how these mistakes are made. If economists did know what these biases are then market behaviour would change to exploit this knowledge. For example, if the exchange rate is set too high due to biases in their expectations, then agents should be able to sell the currency and make supernormal profits. However, the action of these agents will itself tend to bring the exchange rate back down to a level consistent with unbiased expectations.

Faced with this dilemma in the specification of long bond yields, the TRYM model specifies backward looking expectations for the short run, while maintaining model consistent expectations in the long run. For example, long bond yields are set on the basis of past and current levels of short term interest rate and foreign interest rates. Any bias in these levels of long bond yields flows through into the current level of the exchange rate, but not the long run exchange rate.

The yield curve equation used was not estimated because the data for expectations is poor and estimation attempts provided parameters that generated implausible instability in TRYM. The specification adopted and the parameters chosen give an equation for long bond yields that mimics forward looking behaviour by extrapolating recent movements in short term interest rates in a sensible (but not model consistent) fashion.

4. A SHOCK TO WORLD ECONOMIC ACTIVITY

All results are presented in the form of deviations in levels from a steady-state baseline or control simulation. The economy is assumed to be in equilibrium prior to the shock, and growing along this steady-state balanced growth path. Since the response of the economy to this shock is somewhat cyclical and changes over time the following discussion is divided into a discussion of the short term (first 2 years), the medium term (3 to 5 years) and the long term (10 years).

Table 2(a): World Demand Shock Results (Model Consistent Expectations)

	Years After the World Shock								
	1	2	3	4	5	6	8	10	
Consumption	-0.1	-0.2	-0.5	-0.8	-0.9	-0.7	-0.3	-0.4	
Business Investment	0.0	-0.5	-1.8	-2.2	-1.2	0.2	0.6	-1.0	
Dwelling Investment	-0.2	-1.6	-2.7	-1.6	0.8	2.4	0.8	-0.8	
Public Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GNE	-0.1	-0.4	-0.8	-0.9	-0.6	-0.1	0.0	-0.4	
Exports	-0.2	-0.2	-0.3	-0.3	-0.2	-0.1	0.1	0.1	
- Commodities	0.0	-0.2	-0.4	-0.6	-0.6	-0.6	-0.2	-0.1	
- Non-commodities	-0.6	-0.3	-0.1	0.1	0.4	0.6	0.6	0.3	
Imports	-0.6	-1.1	-1.7	-1.8	-1.4	-0.9	-0.8	-1.3	
GDP	0.0	-0.2	-0.6	-0.6	-0.4	0.0	0.1	-0.2	
Employment	0.0	-0.2	-0.4	-0.6	-0.5	-0.1	0.2	-0.1	
Labour Supply	0.0	-0.1	-0.2	-0.4	-0.3	-0.2	0.1	-0.1	
Unemployment Rate	0.0	0.1	0.2	0.2	0.1	0.0	-0.1	0.0	
Nominal Wages	0.3	0.6	0.7	0.2	-0.4	-0.7	-0.2	0.2	
Consumer Prices	0.3	0.7	0.9	0.5	0.0	-0.3	0.1	0.4	
GDP Deflator	0.1	0.4	0.6	0.2	-0.3	-0.5	-0.2	0.2	
Terms of Trade	-1.2	-1.8	-1.9	-1.9	-1.9	-1.9	-1.7	-1.6	
90 day Bank Bill Rate	0.2	0.3	0.1	-0.3	-0.4	-0.2	0.1	0.0	
10 Year Bond Yield	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	
Exchange Rate	-1.7	-2.0	-2.3	-2.2	-1.9	-1.6	-1.5	-1.7	
CAD / GDP	0.2	0.3	0.2	0.0	0.0	0.2	0.3	0.1	
Private Wealth	0.1	0.1	0.3	0.5	0.4	0.1	-0.2	-0.1	
Business Capital Stock	0.0	0.0	-0.2	-0.4	-0.6	-0.5	-0.2	-0.3	
Dwelling Capital Stock	0.0	0.0	-0.1	-0.2	-0.2	-0.1	0.0	0.0	

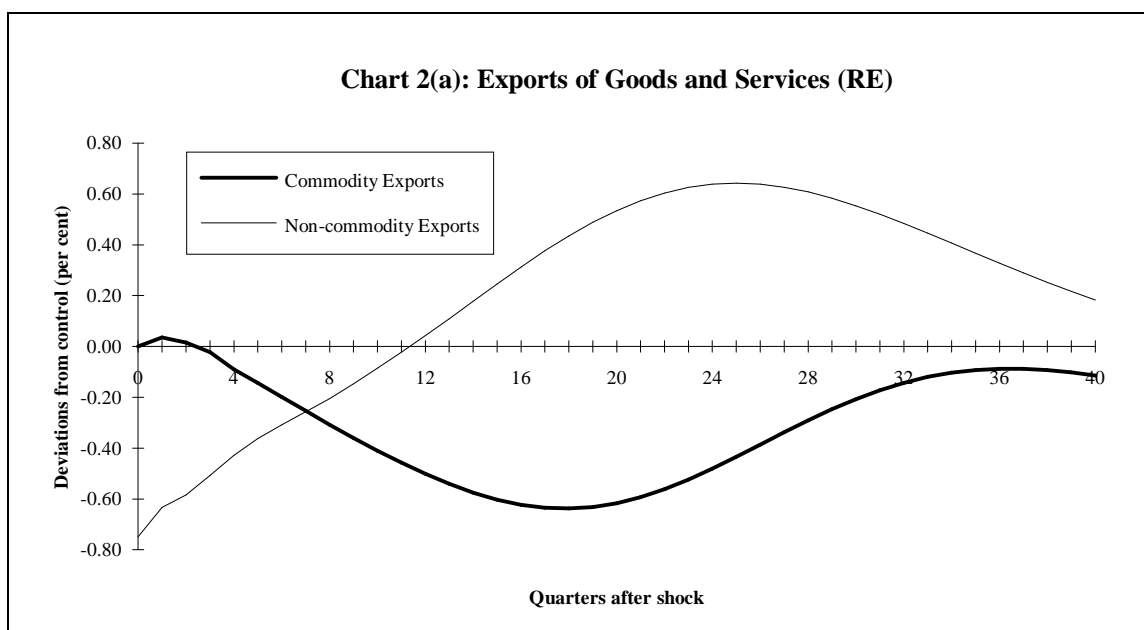
4.1 World Shock Under Rational Expectations

4.11 Short Run

The initial impact of this shock is to decrease the demand for Australian exports. The response to this fall in demand is different for commodity exports and non-commodity exports.

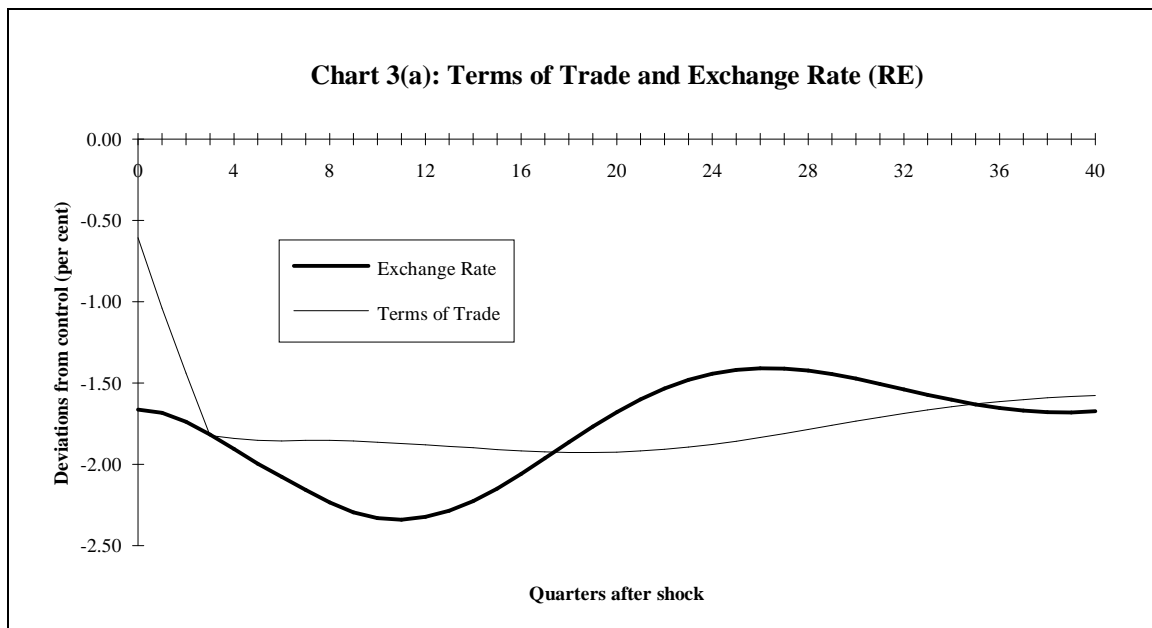
In TRYM, non-commodity export producers set a price and then supply whatever level of foreign demand is forthcoming at that price. The decline in world activity is reflected in a fall in export volumes rather than export prices. For example, when foreign incomes fall, less overseas tourists visit Australia, reducing tourism exports though the price of these exports remain unchanged.

In contrast, commodity export markets are initially characterised by lower prices, but unchanged supply. Commodity export supply is inflexible because of the high costs associated with making short run changes in the output of the agricultural and mining sectors. In contrast, the export prices can adjust quickly and bear most of the short run adjustment. Chart 2(a) shows how, in the first few quarters of the shock, commodity export volumes remain largely unchanged while non-commodity export volumes immediately fall.

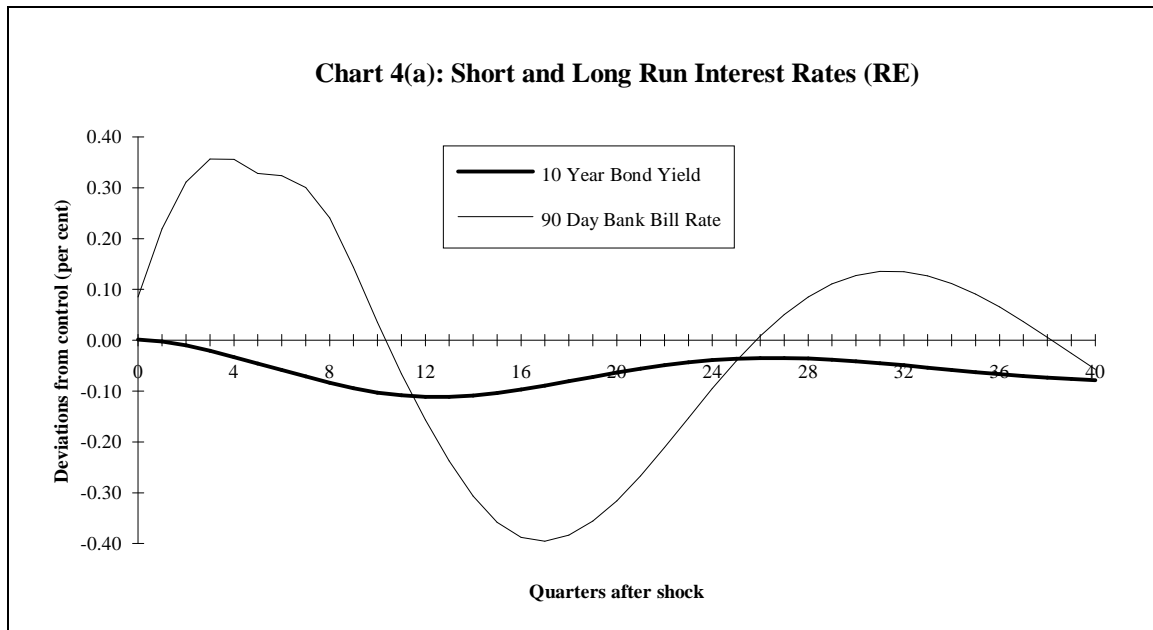


Although commodity export volumes are relatively unchanged in the first few quarters, there is a subsequent tendency for these to decline. Lower relative prices for agricultural and mining produce gradually encourage producers to shift resources out of these sectors.

The fall in the price of commodity exports lowers the terms of trade and this is associated with a fall in the exchange rate (see Chart 3(a)). The exchange rate must eventually fall when the terms of trade declines because, *ceteris paribus*, a decline in the terms of trade increases the current account deficit. If the economy is initially in equilibrium in the sense of having a stable ratio of foreign debt to GDP, then the higher current account deficit would lead to debt rising relative to GDP. The debt to GDP ratio can continue to increase for some years but is not sustainable indefinitely. Therefore the exchange rate must eventually fall to improve competitiveness. This will produce an increase in export volumes and a decline in import volumes sufficient to reverse the deterioration in the current account balance caused by the lower terms of trade. In the TRYM model, financial markets factor this eventual adjustment in the equilibrium exchange rate into their current decisions. This brings forward the long run adjustment.

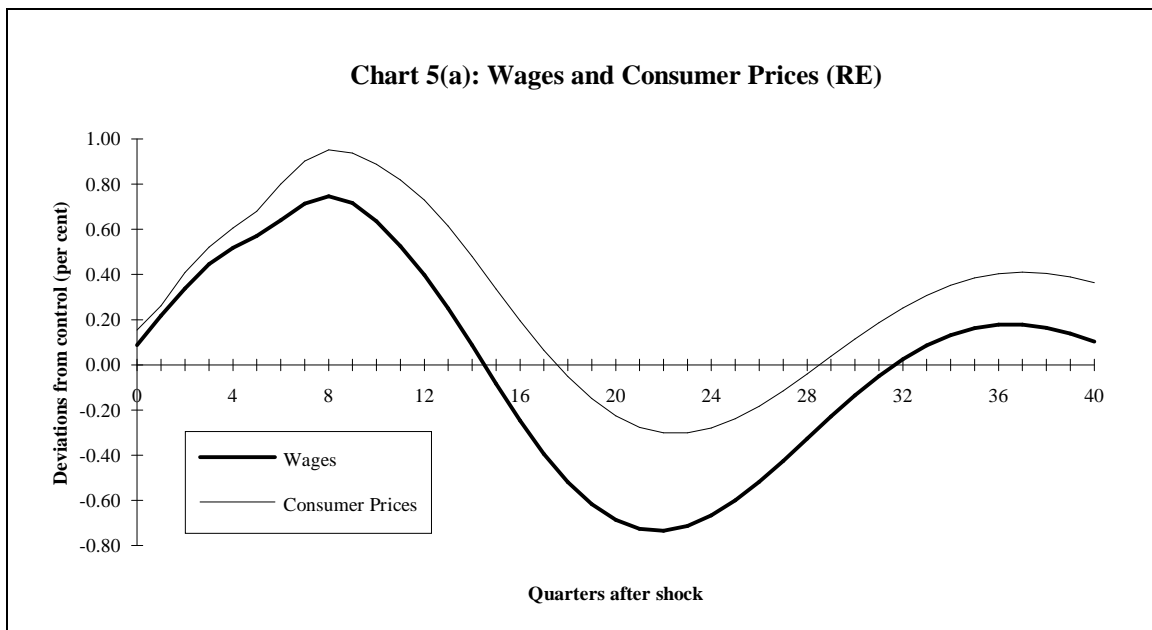


The initial depreciation in the exchange rate raises the prices of imported goods and this increases the price and value of domestic expenditure (GNE). Nominal interest rise in response to increasing nominal activity (see Chart 4(a)).

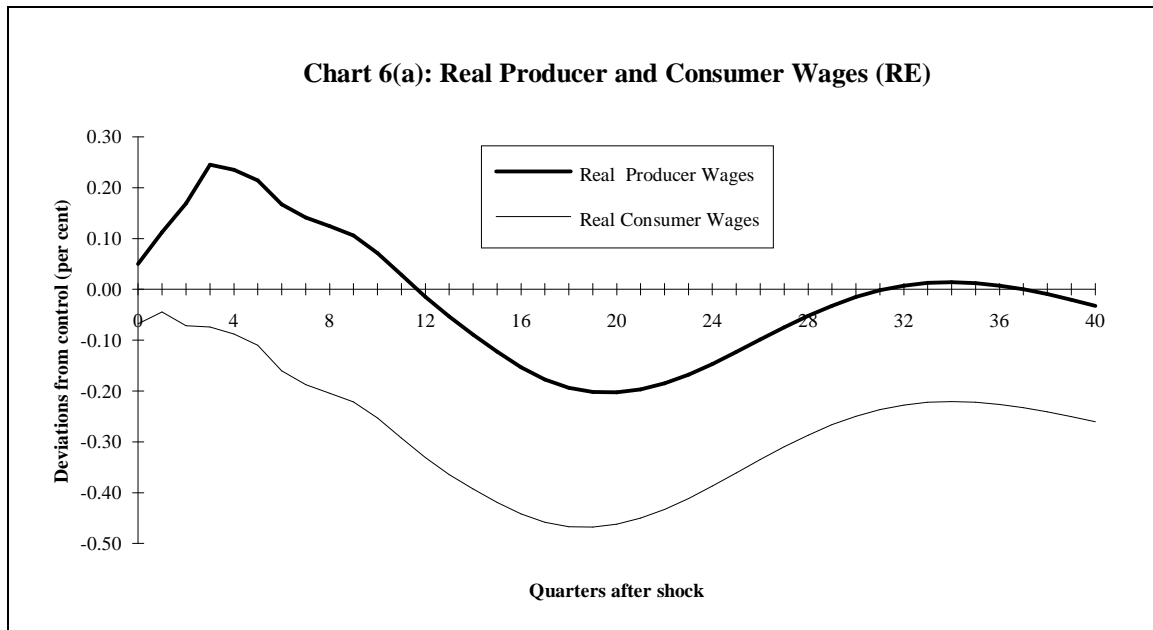


Long term bond rates gradually fall to a new lower level. This is because, under model consistent expectations, the financial markets correctly anticipate that, although short term interest rates initially rise, they will eventually fall as lower activity lowers the demand for money.

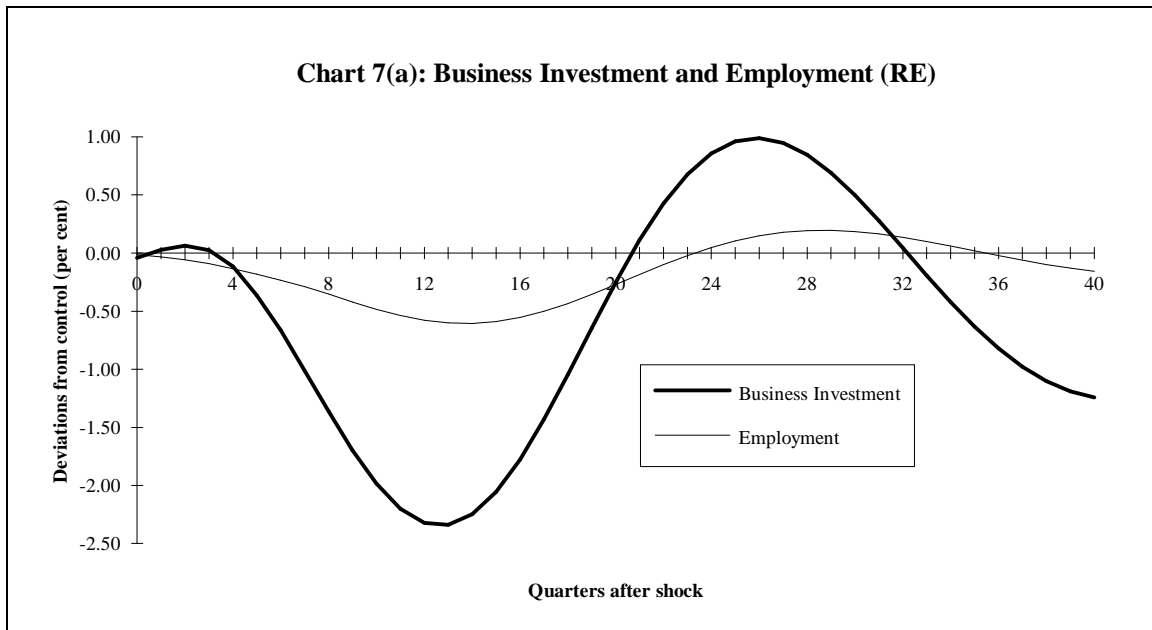
The increase in import prices has another important short run effect. The level of wages rises, because, in the short run, wage growth is primarily determined by consumer price inflation. Since the rise in import prices increases the price of imported consumer products and therefore the consumer price level, it also raises nominal wages (see Chart 5(a)).



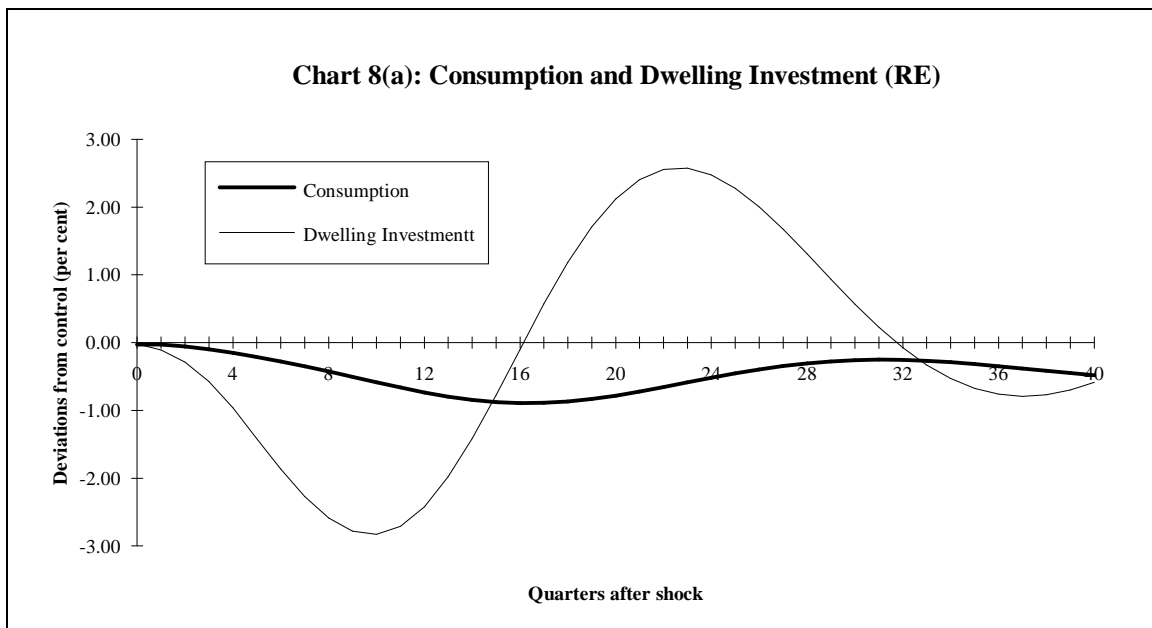
Although higher import prices may increase consumer prices, they do not increase the prices received by domestic business producers as measured by the GDP deflator. Therefore the depreciation raises consumer prices and nominal wages by more than the GDP deflator. This is important because it is the wage rate relative to the price received for domestic production that determines the profitability of employing more people. Therefore the depreciation results in an increase in the level of real wages facing firms even though real wages from the household's point of view have declined (see Chart 6(a)). Effectively the decline in the terms of trade has driven a wedge between producer and consumer real wages.



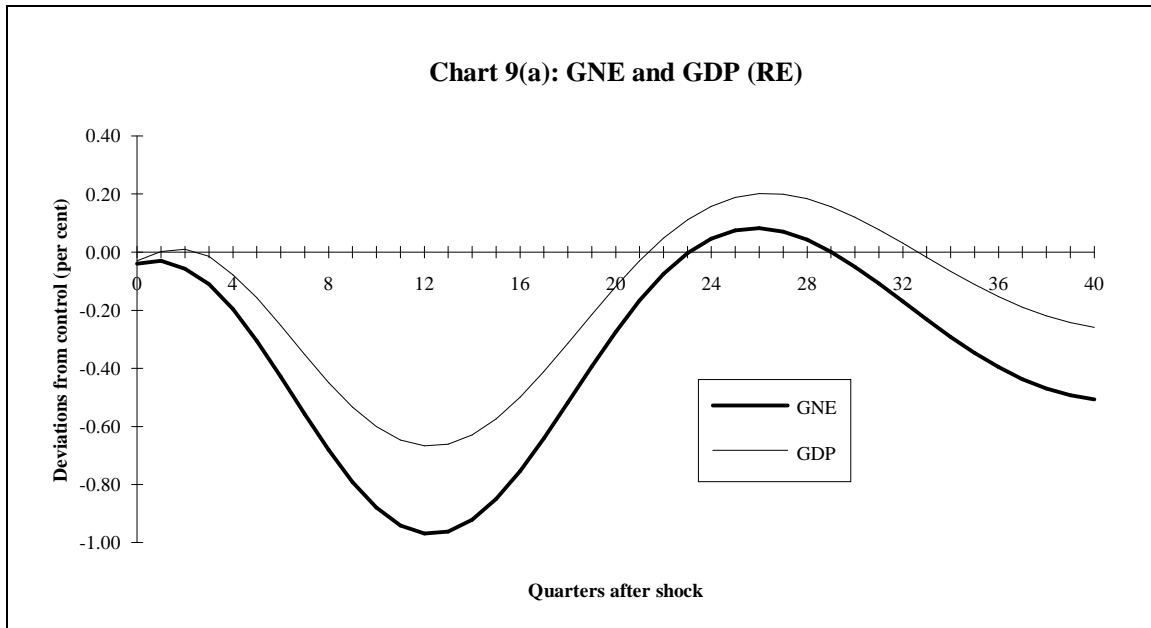
The fall in producer prices and the rise in wages lead to a decline in profitability and therefore the rate of return on capital. A further factor which reduces the rate of return on capital is the considerable proportion of business investment goods that are imported. Therefore the initial depreciation makes investment goods more expensive relative to producer prices. This makes investment in new capital equipment unattractive, especially when interest rates have risen. Therefore business investment and employment decline (see Chart 7(a)).



Lower employment, profits and a decline in real (consumer) wages all act to reduce consumption spending. This effect is re-inforced through lower real wealth. The rise in nominal wealth through higher asset prices (via lower long bond yields), is offset by relatively higher consumer prices. The decline in consumption demand and rise in interest rates also reduces the demand for dwellings and therefore reduces dwelling investment (see Chart 8(a)).



One factor that tends to cushion the fall in activity is a decline in the volume of imports because of the lower level of the exchange rate and domestic demand. Overall, however, GNE falls by around 1 per cent and GDP falls by around 0.6 per cent after about three years (see Chart 9(a)).



4.12 *The Medium Term*

The initial fall in demand and output associated with the fall in foreign demand generates some expansionary forces which tend to reverse the initial contraction after about 2 to 3 years.

The main expansionary force is a decline in real wages. This occurs because the initial contraction in employment raises the unemployment rate above the non-accelerating inflation rate of unemployment (NAIRU). Real wages decline as long as the actual rate of unemployment is above the NAIRU. This increases profits and lowers the inflation rate. The increase in profits tends to restore some of the incentive to invest while the fall in the inflation rate reduces interest rates.

Overall, after about 3 to 4 years after the initial shock the economy has lower wages and real interest rates. This leads to a recovery in economic activity, especially in dwelling and business investment. There is some overshooting with activity rising slightly above

control in year 6. However this is purely cyclical and activity starts to fall back below control.

4.13 The Long Run

In the long run, the lower value of the dollar means that the relative price of investment goods is higher. This reduces the rate of return on capital. However in the long run capital in Australia must earn a rate of return equal to the real world interest rate and a fixed risk premium. Otherwise there would be an incentive to withdraw funds from Australia and invest them elsewhere.

Therefore, in the long run, the economy must adjust so that the initial fall in the rate of return to capital (due to higher capital goods prices) is reversed. There are two ways in which this adjustment can occur. Real wages may fall and this will increase profitability and therefore the rate of return on capital. Additionally, the ratio of capital to labour may decrease and this will increase the marginal productivity of capital and therefore the rate of return on capital (because more output is now produced for each unit of capital). Both of these adjustments occur in the TRYM model so that the long run equilibrium is characterised by lower real wages and a lower capital stock.

Real wages fall by enough in the long run to return the unemployment rate to its NAIRU. Therefore employment is largely unchanged in the long run. The unchanged level of employment, together with the lower level of capital means that equilibrium output is lower.

Therefore the long run equilibrium is characterised by unchanged employment, lower capital and output, lower real wages and a lower exchange rate.

One interesting feature of these results is that the size of the dwelling sector remains unchanged. The economy as a whole is smaller, so the relative size of the dwelling sector has increased. This is because dwellings are close to being non-traded goods with a very low import penetration ratio. The lower exchange rate does not tend to increase the costs of constructing houses. However, general consumer prices rise with the increase in import prices. This produces a fall in the relative price of dwellings and encourages households to devote a larger proportion of their spending to dwellings rather than other consumer goods. In this way the fall in the relative price of dwellings helps to insulate this sector from the general decline in activity.

4.2 World Shock Under Quasi-rational Expectations

The second simulation presented below has backward looking expectations in the real and wage price sectors, and quasi-rational expectations in the financial sector.

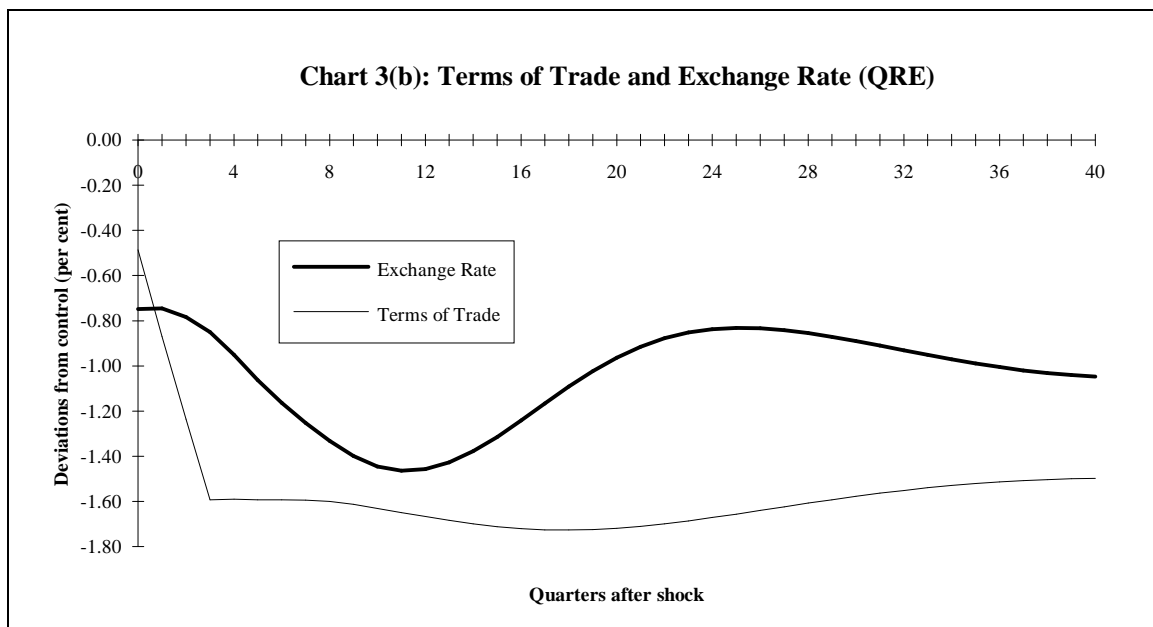
Table 2(b): World Demand Shock Results (Quasi-Model Consistent Expectations)

	Years After the World Shock								
	1	2	3	4	5	6	8	10	
Consumption	-0.1	-0.3	-0.6	-0.7	-0.6	-0.4	-0.2	-0.3	
Business Investment	-0.2	-1.0	-1.7	-1.3	-0.2	0.6	0.2	-0.6	
Dwelling Investment	-0.1	-0.6	-0.4	1.0	2.6	3.0	2.0	1.5	
Public Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GNE	-0.1	-0.4	-0.6	-0.5	-0.1	0.1	0.0	-0.1	
Exports	-0.4	-0.5	-0.6	-0.6	-0.6	-0.4	-0.3	-0.2	
- Commodities	0.0	-0.3	-0.6	-0.8	-0.8	-0.7	-0.3	-0.2	
- Non-commodities	-0.9	-0.8	-0.7	-0.4	-0.2	-0.1	-0.1	-0.3	
Imports	-0.5	-1.1	-1.4	-1.2	-0.9	-0.6	-0.8	-1.0	
GDP	-0.1	-0.3	-0.5	-0.4	-0.1	0.1	0.1	0.0	
Employment	-0.1	-0.3	-0.5	-0.5	-0.2	0.0	0.1	0.0	
Labour Supply	0.0	-0.2	-0.3	-0.3	-0.2	-0.1	0.1	0.0	
Unemployment Rate	0.0	0.1	0.2	0.2	0.0	-0.1	-0.1	0.0	
Nominal Wages	0.1	0.2	0.1	-0.4	-0.8	-0.9	-0.5	-0.3	
Consumer Prices	0.2	0.4	0.3	0.0	-0.4	-0.5	-0.3	-0.2	
GDP Deflator	0.0	0.1	0.0	-0.3	-0.6	-0.7	-0.5	-0.4	
Terms of Trade	-1.0	-1.6	-1.6	-1.7	-1.7	-1.7	-1.6	-1.5	
90 day Bank Bill Rate	0.1	0.0	-0.2	-0.4	-0.4	-0.3	-0.1	-0.2	
10 Year Bond Yield	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	
Exchange Rate	-0.8	-1.1	-1.4	-1.4	-1.1	-0.9	-0.9	-1.0	
CAD / GDP	0.2	0.2	0.1	0.1	0.2	0.3	0.3	0.2	
Private Wealth	-0.4	-0.2	0.3	0.4	0.1	-0.4	-0.7	-0.6	
Business Capital Stock	0.0	-0.1	-0.3	-0.4	-0.4	-0.3	-0.1	-0.2	
Dwelling Capital Stock	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4	

In the TRYM model, under quasi-rational expectations, financial sector agents still know the steady-state equilibrium level of the exchange rate. In the short run, the exchange rate will again jump to reflect movements in its equilibrium level. Long bond yields will now be influenced by the current level of short term domestic interest rates.

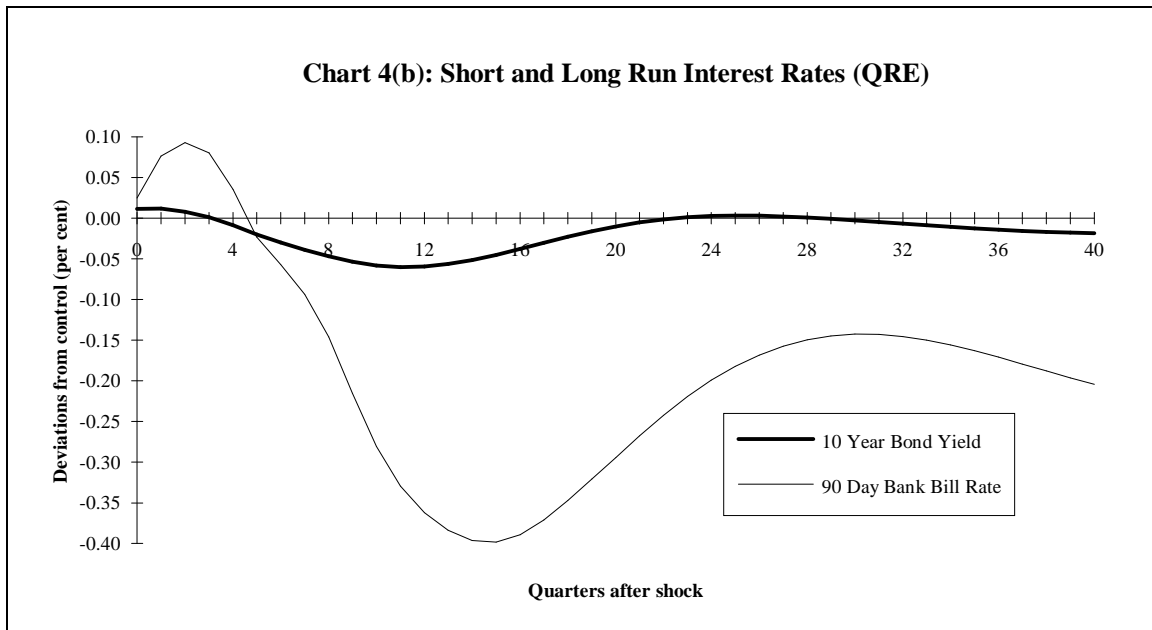
The main difference between the rational and quasi-rational expectations versions of a world activity shock relate to the movement of interest rates. This has implications for the exchange rate and the behaviour of domestic demand and net exports. The following discussion presents charts of the main difference between the two simulations.

Additional charts depicting the quasi-rational expectations simulation are in Appendix A.



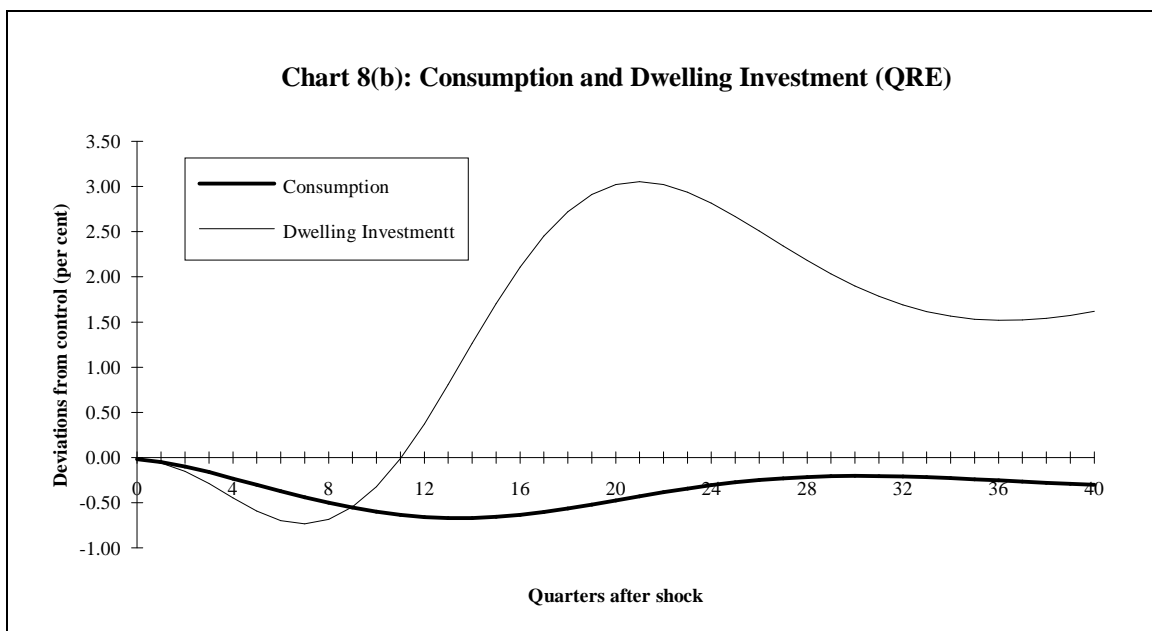
With quasi-rational expectations in the TRYM model, long term bond yields will follow the path of short term interest rates. In this simulation, this implies that long bond yields will initially increase slightly as the short term interest rates increase.

This tends to offset some of the impact of the decline in the equilibrium exchange rate. There is a smaller depreciation in the exchange rate and partly as a consequence, a slightly smaller decline in the terms of trade.



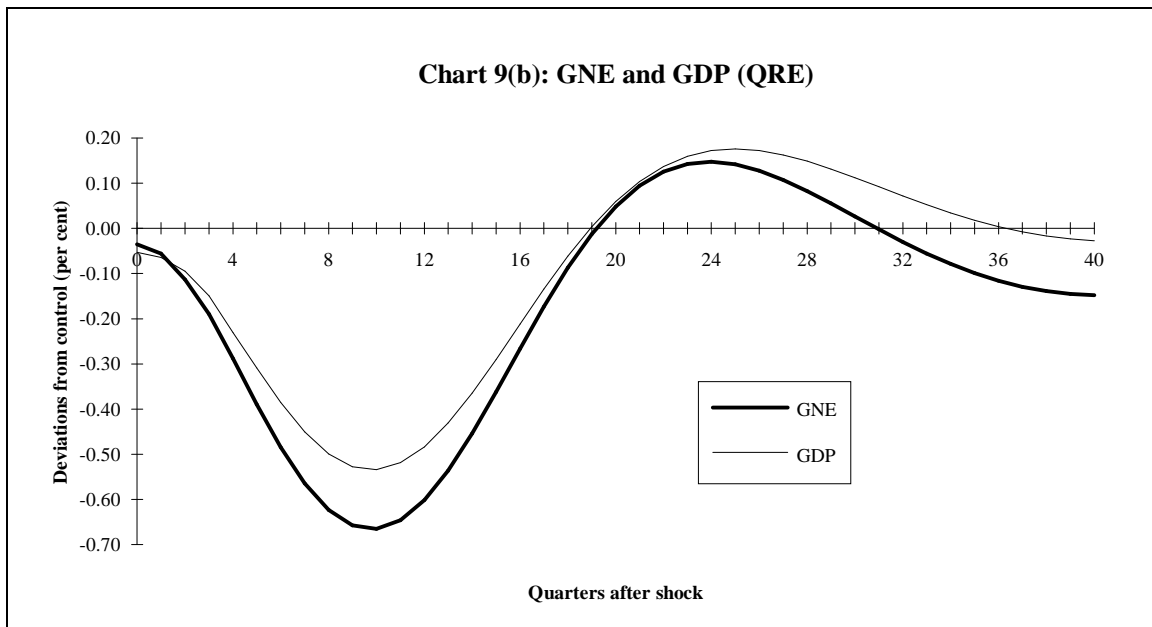
The rise in long bond yields tends to reduce interest sensitive components a little sooner. This, together with a smaller depreciation induced rise in import prices and therefore expenditure prices, implies that nominal transactions do not increase as much initially. This leads to a lesser increase in short term interest rates initially.

The smaller rise in short term interest rates, results in smaller falls in dwelling investment.



With a smaller fall in dwelling investment, there are smaller adverse flow-on effects into business investment through less excess capacity. Real wages are little changed between simulations and therefore the fall in business investment is not as large.

Overall, GNE does not fall by as much under quasi-rational expectations, although it falls sooner. Overall, around 2 1/2 years after the shock to world activity GNE falls by around 0.7 per cent. GDP, however, falls broadly the same amount as under rational expectations and sooner. GDP falls by around 0.6 per cent, around 2 1/2 years after the shock to world activity. The smaller response from net exports compared with that of the rational expectations simulation largely reflect the smaller exchange rate depreciation.



5. CONCLUSIONS

Analysing the linkages between Australia and its major trading partners is a difficult task. The relationship seems to have become stronger in the past ten years. While the cyclical correlation with growth in the United States is close, that with Japan is weaker, even though they are both major trading partners. These are indications that there are many complex issues involved.

There are a number of possible channels by which world developments affect the Australian macroeconomy. This paper focuses on the linkage through the traded sector. Other potential transmission mechanisms may also make a contribution but are not analysed here.

The results of the simulations presented here seem plausible and illustrate the mechanisms at work when Australia reacts to changes in world activity. Given the strong presence of the Asia-Pacific region as a major trading partner for Australia, this analysis shows the importance of this region for Australia's economic prospects.

6. APPENDIX A: OTHER SIMULATION RESULTS

Below are charts of results from the quasi-model consistent simulation of a shock to world activity not presented in the main body of this paper.

