International Macroeconomic Policy Coordination: Implications for Australia

by

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ABSTRACT

Recent turbulance in the global economy has led to calls for greater coordination of macroeconomic policies between countries. If implemented, new international rules for setting domestic macroeconomic policies have potentially important implications for Australia. This paper explores the impact on Australia of certain shocks in the world economy as well as the optimal response of monetary and fiscal policy in Australia to these shocks. Techniques of dynamic game theory are applied to the model to examine the implications for the Australian economy of macroeconomic policy co-ordination in the rest of the world. The paper also examines whether Australia gains from being a "free rider" in the co-ordination process or whether it pays to commit itself to internationally coordinated rules for macroeconomic policy. An important factor in the analysis is the impact of a international coordination on the strategic interplay between policymakers and wage setters in Australia.

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I. INTRODUCTION

Major swings in economic activity in small open economies are often attributed to factors outside those economies. As a small open economy, Australia is particularly sensitive to external influences. Policy changes in the economies of Australia's major trading partners, oil cartel behavior and share market crashes have impacted the Australian economy through changes in demand for Australian exports, swings in world commodity prices, and fluctuations in world interest rates. Needless to say, sensitivity to external influences requires that policymakers in small open economies develop an understanding of how external influences are likely to impact on their domestic economies and how best to respond to them.

The awareness of the importance of global economic interdependence is not confined to small open economies. The recent turbulence in the world economy has prompted economists and policymakers within the major countries to call for greater coordination of macroeconomic policies. Such calls, if implemented, may have important implications for the Australian economy. Should Australia join an international agreement that places restrictions on the use of macroeconomic policy in Australia, or is there a case for "free riding" - i.e., receiving the possible benefits of coordination of the macroeconomic policies of the major industrialized countries without the cost in terms of some loss of sovereignty in policymaking.

These issues are addressed in this paper by examining the transmission of shocks from Australia's major trading partners to the Australian economy. The implications of coordination versus non-coordination of macroeconomic polices in the major countries in response to a sustained oil price shock are then examined. The analysis makes use of the MSG2 (McKibbin-Sachs Global) multi-country model. This particular version of the model is outlined in McKibbin and Siegloff (1991) and differs significantly from other versions in that

the role of commodities in Australia is explicitly taken into account[2].

Section II gives a brief overview of the model. Section III outlines the method by which we calculate policy rules in response to different assumptions about government behavior. Section IV examines the effects on Australia of changes in fiscal and monetary policies in the United States and Japan. In this section we also examine the effects within Australia, of changes in Australian fiscal and monetary policies. Given the shocks which are external to Australia, I then examine appropriate policy responses by finding an optimal "time consistent" policy rule for monetary and fiscal policies[3]. In section V dynamic game theory techniques are used to examine the implications for Australia of a coordinated versus non-coordinated response by the major industrialized economies to a rise in world oil prices of a similar scale to that experienced in the late 1970's and possibly the early 1990s. The choices facing Australia in this case are to enter the coordinated agreement or to choose an independent policy response. The first part of the paper assumes that only governments act strategically. In section VI the issue of strategic interaction of wage setters and a government within an open economy such as the Australian economy is examined in greater detail.

The analysis in this paper is model specific and preliminary. Nonetheless, it does provide some useful insights into the issues involved in very important and complex problems.

II. OVERVIEW OF THE MSG2 MODEL

(a) The MSG2 Model

The MSG2 model is documented in McKibbin and Sachs (1991). The version used in this paper is outlined in McKibbin and Siegloff (1991). The MSG2 model can be described as a dynamic general

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[2] See Blundell-Wignall and Thomas(1987) for an analysis of the crucial link between Australia's real exchange rate and changes in world commodity prices.

[3] See McKibbin (1989) for a discussion of time consistency.

equilibrium model of a multi-region world economy. In the present paper the regions modelled are the United States (U.S.), Japan, Australia, the rest of the OECD economies (denoted ROECD)[4], non-oil developing countries (LDCs)[5], and Oil Exporting Countries (denoted OPEC)[6]. The model is of moderate size (about three dozen behavioral equations per industrial region). It is distinctive relative to most other global models in that it is solved for a full intertemporal equilibrium in which agents have rational expectations of future variables. In conception, the model is close in design to the intertemporal dynamic models of fiscal policy outlined in Lipton and Sachs (1983) and Frenkel and Razin (1988). In those studies, like in the present model, the effects of fiscal policy are examined within an intertemporal perfect-foresight environment, where considerable attention is given to intertemporal optimization and intertemporal budget constraints.

The MSG2 model has been developed on the assumption that economic agents attempt to maximize intertemporal objective functions. This idea is similar to the class of models known as Computable General Equilibrium (CGE) models except that the concepts of time and dynamics are of fundamental importance in the MSG2 model[7]. The various rigidities that are apparent in macroeconomic data are taken into account by allowing for deviations from fully optimizing behavior. As with any modelling project that purports to describe reality, there is an inevitable tradeoff between theoretical rigor and the need to capture empirical regularities.

The model has a mix of Keynesian and Classical properties by virtue of a maintained assumption of slow adjustment of nominal wages in the labor markets of the United States, Australia and the ROECD (Japan

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[4] This block of countries consists of Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and the United Kingdom.

[5] Non-Oil developing countries are based on the grouping in the IMF Direction of Trade Statistics (1989).

[6] We use the definition provided by the 1989 IMF Direction of Trade Statistics (annual) for Oil Exporting Countries.

[7] Such models are the basis of the work by Dixon et.al. (1982), Whalley (1985) and Deardoff and Stern (1986).

is treated somewhat differently, as described below). The model is solved in a linearised form, to facilitate policy optimization exercises with the model using linear-quadratic dynamic game theory and dynamic programming solution techniques. We have experimented with the full non-linear model and found that the properties of this model correspond closely to those of the linearised model, particularly over the initial years of any shocks. The global stability of the linearised model can be readily confirmed by an analysis of the model's eigenvalues.

In fitting the model to macroeconomic data we adopt a mix of standard CGE calibration techniques and econometric time series results. In CGE models, the parameters of production and consumption decisions are determined by assuming a particular functional form for utility functions and production functions and then assuming that the data from an expenditure share matrix or an input-output table represent an equilibrium of the model. For example, if utility is assumed to be a Cobb-Douglas nesting of the consumption of different goods, then the parameters of the utility function (and therefore the demand functions for different goods) are given by the expenditure shares found in the data. In this example, the demand function for each good in the system will have price and income elasticities of unity. In most cases the data will determine the parameters of the model although in some cases additional econometric analysis is required. The question of calibrating the model is discussed further in McKibbin and Sachs (1989).

The model has several attractive features which are worth highlighting. First, all stock-flow relationships are carefully observed. Budget deficits cumulate into stocks of public debt; current account deficits cumulate into net foreign investment positions; and physical investment cumulates into the capital stock. Underlying growth of Harrod-neutral productivity plus labor force growth is assumed to be 3 percent per region. Given the long-run properties of the model, the world economy settles down to the 3 percent steady-state growth path following any set of initial disturbances.

A second attractive feature is that the asset markets are efficient in the sense that asset prices are determined by a combination of intertemporal arbitrage conditions and rational expectations. By virtue of

the rational expectations assumption and the partly forward-looking behavior of households and firms, the model can be used to examine the effects of anticipated future policy changes, such as the sequence of future budget deficit cuts called for by thecurrent debate in the United States Congress. Indeed, one of the difficulties of using the MSG2 model is that every simulation requires that the "entire" future sequence of anticipated policies be specified. In practice, forty year paths of policy variables, or endogenous policy rules, must be specified.

A third attractive feature of the model is the specification of the supply side. There are several noteworthy points here. First, factor input decisions are partly based on intertemporal profit maximization by firms. Labor and intermediate inputs are selected to maximize short-run profits given a stock of capital which is fixed within each period. The capital stock is adjusted according to a "Tobin's q" model of investment, derived along the lines of Hayashi (1984). Tobin's q is the shadow value of capital, and evolves according to a rational expectations forecast of future post-tax profitability.

Another point of interest regarding the supply side is the specification of the wage-price dynamics in each of the industrial regions. Extensive macroeconomic research has demonstrated important differences in the wage-price processes in the United States, Europe, and Japan, and these differences are incorporated in the model. In particular, the United States and the ROECD (including Canada) are characterized by nominal wage rigidities arising from long-term nominal wage contracts. In Japan, on the contrary, nominal wages are assumed to be renegotiated on an annual, synchronized cycle, with nominal wages selected for the following year to clear the labor market on average. In the ROECD, nominal wages are assumed to be more forward looking than in the United States, though real wages adjust slowly to clear the labour market. In Australia we assume that wages are set one period in advance based partly on current inflation and partly on expected inflation with changes in labour market conditions also feeding into the choice of a nominal wage.

A more detailed derivation of the model can be found in McKibbin (1988a) and McKibbin and Sachs (1989). At this point it is worth providing details of the Australian model.

(b) The MSG2 model for Australia

Full details on the Australian MSG2 model can be found in McKibbin (1988a) with the extension focussing on the role of commodity prices in McKibbin and Siegloff (1991).

Some aspects of the modeling of the Australian economy which are worth highlighting include our assumptions about the degree of forward looking behavior. McKibbin and Siegloff (1988) estimated a model of investment which corresponds to the assumptions used in the MSG2 model. A proportion of investment is determined by current profits and a proportion by Tobin's q. In the empirical work, the q theory was statistically significant although it only explained a lower bound of 10 percent of aggregate investment. The greater the cost of adjustment used in calculating the capital stock data, the larger the role for Tobin's q. We assume that 20 percent of investment is determined by q. This does necessarily mean that q has a small effect on the results because q is more variable in response to shocks than short run profits. This variability depends on the shock but a small sustained change in long interest rates can have a large effect on the value of the firm directly through the discounting of the stream of future profits. This is the same effect that any change in the rate of return on a consol has on the value of the consol.

We also assume that consumption is partly driven by perceived changes in household wealth. Tests of the permanent income hypothesis on U.S. data (which allow for a part of consumption to depend on current disposable income and a part on permanent income), such as studies by Hayashi (1982) and Campbell and Mankiw (1988), find a large role for permanent income. McKibbin and Richards (1988) find a similar importance for permanent income using Australian data. We therefore assume that 30 percent of consumption is driven by forward looking unconstrained consumers and 70 percent by people who are either constrained in following their desired consumption decisions or have very high discount rates and essentially consume out of current disposable income.

III. CALCULATING POLICY RULES

In this section we outline the dynamic programming technique used to find optimal time-consistent policy rules for monetary and fiscal policies in response to shocks. The technique applied to single country optimization may also be used to solve dynamic games played between countries. Further technical details can be found in McKibbin (1987).

As in any policy optimization problem, we must specify an objective function for the policymaker; this is a problem in itself since there is no consensus about the targets nor the functional form or stability of the objective function[8]. We assume that policymaker(s) care about deviations in inflation, unemployment, and fiscal deficits from some desired levels. Specifically, we assume that the policymaker chooses rules for monetary and fiscal policies that minimize an intertemporal quadratic loss function in the three targets. Formally the problem can be written :

$$\underset{s=t}{\text{Min}} \sum^{\infty} \quad (\mu_1 U_s^2 + \mu_2 \pi_s^2 + \mu_3 DEF_s^2)\,(1+\delta)^{(t-s)} \tag{1}$$

subject to the structure of the economy given by the MSG2 model. The variables U_s, π_s, and DEF_s, are respectively, the deviations of unemployment, inflation, and the budget deficit from desired target levels. The parameters μ_i are weights on each target and δ is the rate of time preference assumed to be 10 percent per year.

There are various equilibrium concepts we can use to determine a solution for this problem. In a well known paper, Kydland and Prescott (1975) have shown that the optimal policy chosen by optimal control methods will be time inconsistent in an economy with a forward looking private sector. That is, if the government announces the optimal control policy and the private sector makes commitments based on the announcement, the policy maker will then have an incentive to deviate from the announced policy. If the private

[8] See Alesina (1988) for a discussion of the welfare function in a multiparty system where parties can alternate in power.

sector understands the incentives of the policymaker, the policy will not be credible. We therefore find a time consistent policy rule which is optimal given the condition that it is believed by the private sector.

The rule that we find is written as a feedback rule linking the instruments of policy (fiscal and monetary policy) to the inherited state variables (e.g. capital stock, debt, sticky prices etc) and to exogenous variables as well as expected future paths of exogenous variables. The feedback rules are written in the form:

$$U_t = \Gamma_1 X_t + \Gamma_2 E_t + \Gamma_{3t}$$

where U is the vector of control variables, X is a vector of inherited variables (states), E is a vector of exogenous variables, Γ_1 and Γ_2 are time invariant vectors of response rules and Γ_3 is a time dependent variable that is a function of the expected future paths of exogenous variables and the structure of the model.

We assume that the government and private sector know the structure of the economy and, given the same information set, form the same expectations.

We use this technique in the next section to calculate government reactions to foreign shocks. It can also be used when several governments are interacting with each other, enabling us to set up a game between different governments. We can then find time consistent policy rules for each government contingent on assumptions about the equilibrium of the games. For example if we assume that each country undertakes the optimization in equation (4) subject to the structure of the economy, and assuming that each government takes the actions of the other governments as given, then we can find a Nash equilibrium of a dynamic game. An alternative assumption is that countries undertake the optimization of some global welfare function which is a weighting of the individual governments' welfare functions. This is the notion of cooperation that is used below. Another alternative is to assume that one country is a "leader" and the other countries "followers" in the choice of policy. Still a further application of this methodology is used below in modelling the interaction between governments and unions. In this case the welfare function of the trade unions is assumed to be

concerned with maintenance of real wages whereas the government is concerned with some other set of macroeconomic variables.

IV. SIMULATION RESULTS

In this section, the implications for Australia of changes in fiscal and monetary policies in the United States, Japan and Australia are examined. The first subsection looks at exogenous policy changes. The second calculates optimal time-consistent fiscal and monetary policy responses in Australia, to a number of independent shocks including: a fiscal cut in the United States; a rise in OPEC oil prices; and a rise in commodity prices.

(a) Exogenous foreign shocks

The first shock we consider is a cut in U.S. real fiscal spending equivalent to 1 percent of U.S. real GNP. As with any policy change in the MSG2 model, we must specify the entire future path of policy or the policy rule. In the case of fiscal policy we must also be careful to specify the method of financing the deficit (or in this case the disposition of a surplus). We assume that any changes in servicing a higher (lower) deficit are eventually funded through lump sum tax changes on consumers. For example, a fiscal expansion today that raises the deficit by 1 percent of GNP must be met at some stage in the future by a tax increase to cover the cost of servicing the higher deficit. If there were no tax increase forthcoming, the higher debt and subsequently higher debt servicing cost would become explosive.

Table 1 presents summary results for the United States, Japan and Australia of a cut in U.S. fiscal spending of 1 % of U.S. GNP. The process of adjustment follows the familiar results of theoretical Mundell-Fleming-Dornbusch models. Interest rates in the United States (real and nominal, short and long) fall. This leads to a capital outflow which depreciates the U.S. dollar by 4.8 percent relative to the Yen and 4.4 percent

relative to the Australian dollar, and leads to a generalized reduction in world interest rates. The fall in U.S. domestic demand has a negative impact on world output in the first year but this is more than offset by the stimulating effects of lower world interest rates in subsequent periods. As mentioned above, we assume that commodities are priced in U.S. dollars. A weaker U.S. dollar implies higher world commodity prices in U.S. dollars because non-U.S. countries experience a fall in their own currency price of the goods and this increases the demand for these goods. Increased demand drives up the price of these goods in U.S. dollars. However, Australian exporters do not gain from the higher U.S. dollar price because the Australian dollar overshoots in the short-run. The effect of this is to lower export earnings in domestic currency terms. The supply of exports falls which accommodates the rise in domestic consumption in Australia. Inflation falls in Australia as the strong currency and lower demand feed into lower prices.

A U.S. monetary expansion is shown in table 2. This shock is a permanent 1 percent increase in the level of money balances. These results illustrate an important property of the MSG2 model. Monetary policy under floating exchange rates is transmitted very little between countries. The U.S. dollar depreciates by 1 percent relative to other currencies. The U.S. trade balance is relatively unaffected because exports rise due to the exchange rate depreciation but imports also rise due to stronger domestic demand. A similar result is found for monetary policy in other major countries.

The effect on world commodity prices is also quite intuitive. With the dollar depreciation, the foreign currency price of commodities falls and this increases the demand for these goods. The market reaches steady state when the dollar price has risen by approximately 1 percent. Australian commodity producers do not gain from the rise in commodity prices because they receive less in Australia dollar terms due to the appreciation of the Australian dollar.

The results for a permanent Japanese fiscal expansion are shown in table 3. In terms of output, the policy has a small negative effect on Australia. The improvement in Australia's trade balance is offset by the effect of higher long-term interest rates on domestic demand. The Australian dollar appreciates about 1 percent

relative to the U.S. dollar but depreciates relative to the Yen by about 5 percent. Inflation rises in Australia due to the higher composition of Japanese goods relative to U.S. goods in Australian imports.

The next foreign shock we consider is a rise in OPEC oil prices. The shock is implemented such that without any demand response the price of OPEC exports would rise by 100% in the first year declining by 10 percent a year until it is dissipated by year 10. In practice there is a demand response which lowers the increase in the market clearing price to approximately 70 percent rather than 100 percent in the first year. The results

t1

t2

t3

given in table 4 show that the shock is stagflationary for Australia. In the first period, employment actually rises due to the substitution in production away from energy towards labour, which is reinforced by a fall in the real wage due to nominal wage rigidity and a rise in product prices. The real interest rate also rises reflecting this substitution away from energy into substitutes, since capital is fixed in the short run. In the second period after the shock the aggregate demand consequences are large enough to swamp the substitution effect and unemployment rises. Inflation is washed out of the system in 3 years due to the partly forward looking behavior of wage setters, who build the expected output decline into their nominal wage claims.

The final foreign shock we consider is a rise in world commodity prices resulting from a decline in supply from the LDC's. In this case world supply falls such that commodity prices rise permanently by approximately 11 percent in U.S. dollars. Note that in general the source of the commodity price shock is very important. It could come from a variety of demand or supply shocks. In the case reported here we are attempting to present results for the case which is net of any exogenous policy changes in the major countries. The consequences of this shock are shown in table 5. The industrialized countries that are net importers of commodities experience a stagflationary shock; output falls and inflation rises. The commodities are assumed to be primarily intermediateinputs in the production process in industrialized countries and therefore the aggregate supply curve in each country shifts down. The terms of trade of the industrial countries decline, reducing national wealth and therefore consumption. Australia on the other hand benefits from this shock. The trade balance improves and the exchange rate appreciates by 9.3 percent in the first year[9]. Output rises to a peak of 2 percent by the third year. Inflation falls due to the effect of a higher exchange rate in reducing import prices. Wages are assumed to be based on the CPI and fall in response to the exchange rate change. Domestic product prices rise as producers shift to exporting the domestic good. Thus the real wage facing domestic producers falls and labour demand rises. The strong growth in consumption due to the higher national wealth

[9] This effect is very close to the empirical evidence in Blundell-Wignall and Thomas (1987).

is not mirrored in investment expenditure. This is to be expected in a two sector model

t4

t5/t6

because expansion in the traded good sector is offset by contraction in the non-traded good sector. An interesting aspect of these results is that although the U.S. dollar price of commodities rises by over 11 percent, the strength of the Australian dollar reduces the Australian dollar gain to Australian producers to 2 percent.

(b) Exogenous domestic policy

Table 6 contains the results for an exogenous decrease in Australian government expenditure of 1 percent of GNP. As with the U.S. fiscal shock we assume that servicing costs (or gains) of the fiscal change are met (or offset) by future tax changes. The implications for the Australian economy again follow the standard Mundell-Flemming model. Interest rates fall due to the reduction in government dis-saving. This leads to a capital outflow which depreciates the exchange rate by 2.5 percent. The fall in demand reduces consumption and investment although this is offset by the effects of lower interest rates and the response of forward looking households to the declinein anticipated future taxes. The weaker dollar increases the return to exporters which crowds-in exports. The trade balance improves due to the fall in imports satisfying the short-run demand contraction and due to the rise in exports. The rise in supply by Australian producers on world markets has a small effect on world commodity prices which fall slightly.

An Australian monetary expansion is shown in table 7. As with the U.S. monetary shock, this is a permanent one off increase in the level of M3. The result is a temporary fall in real interest rates of .5 percent which stimulates consumption and investment for two years. The transmission mechanism does not work directly from short interest rates to economic activity in this model. The lower interest rates lead to a capital outflow which depreciates the Australian dollar by almost 1 percent. This is also a real depreciation which stimulates exports. The stimulus to net exports raises demand which, via standard multiplier and accelerator channels, raises domestic demand. As domestic prices rise, the fall in real interest rates and real exchange rate is reversed. The result is an eventual rise in prices of 1 percent and a nominal exchange rate depreciation

T7

of 1 percent. Money is neutral in the long-run.

© Time-Consistent Policy Responses to Foreign Shocks

We now apply the methodology outlined in section 3 to find appropriate responses for monetary and fiscal policy in the face of particular shocks. We assume that the objective of policy is to smooth fluctuations in inflation, unemployment and fiscal deficits. The weights we use in the welfare function are inflation (.4), unemployment (.4) and the fiscal deficit (.2).

Three of the foreign shocks discussed in the previous section are examined. The first is a U.S. fiscal contraction of 1 percent of U.S. GDP. The second is a 20 percent rise in commodity prices and the third is a 100 percent rise in oil prices. For each shock, we calculate the loss to Australia of three alternative policy responses. The first is no response (which are the results of the previous section). The second reaction is the optimal response with both monetary and fiscalpolicy available and the third is the optimal response when only monetary policy is available.

The loss under each shock for each policy response is summarized in Table 8. Each column for this table corresponds to a shock and each row to a reaction. The meaningful comparison is down each column (i.e. across responses) rather than across each row. Each loss is the present value of the sum of squared deviations of the three targets. Because this is difficult to interpret, the key comparison is a ranking of the

Table 8: Loss to Australia from Alternative Responses to Alternative Shocks

	Shock		
Response	U.S. Fiscal	Commodity Price	Oil Price
No Response	-.005	-.034	-.088
Monetary Policy Alone	-.002	-.029	-.030
Monetary and Fiscal Policy	-.002	-.031	-.034

losses and the relative size rather than the absolute size. More detailed results on the changes in individual targets are presented below.

Several points can be made from this summary table. Firstly, allowing policy to respond reduces the loss from each shock in Australia. Secondly, having two policy instruments to offset the shock does not necessarily lead to lower loss than having only one instrument. The reason is that this paper only considers time consistent policy rules. Removing a restriction on the use of an instrument may result in a suboptimal outcome relative to the case where an instrument is constrained by a credible (although time inconsistent) rule, because of the interaction of the private agents with rational expectations and the policymaker.

More detailed results for each shock are given in Tables 9 through 14.

Table 9 gives results for the policy response to a U.S. fiscal contraction when both monetary and fiscal policies are available. In this case, the appropriate response is a fiscal contraction and a monetary expansion. The logic of this action can be seen by considering the path of the economy with no policy response that were given in Table 1. The U.S. policy change lowers inflation and reduces labour demand in Australia. By following the policy mix of tight fiscal and loose monetary policy, the Australian dollar exchange rate depreciates; this raises inflation and unemployment is cushioned by the offsetting effects of the policies. When monetary policy is the only instrument available, it can be seen from Table 10 that a monetary expansion cushions the effects of the U.S. shock although it is less expansionary than when both instruments are available.

Table 11 gives the appropriate responses for fiscal and monetary policy for Australia in the face of an OPEC oil price shock. When both policies are available, the appropriate response is a monetary contraction coupled with a fiscal expansion. This policy mix reduces inflation through the effect of an exchange rate appreciation on import prices. Australia can export inflation today at the expense of re-importing it at some future time. It also has the advantage of having offsetting effects on employment. When the only available instrument is monetary policy, the appropriate response is a monetary contraction as shown

in table 12. In this case the monetary contraction is more severe to get the inflation gain. The result

9/10

11/12

13/14

is a smaller gain on both inflation and unemployment.

Table 13 contains results for a rise in commodity prices when both monetary and fiscal polices are available. In this case we find a monetary expansion followed by gradual contraction with little change in fiscal policy. This unusual result is due to the quadratic loss function we employ. Inflation falls as a result of the shock because of the strong currency. This is seen as undesirable and therefore a monetary expansion is used to slow the appreciation and raise inflation closer to its desired level.

V. IMPLICATIONS FOR AUSTRALIA OF INTERNATIONAL POLICY COORDINATION

In this section we extend the techniques developed in earlier sections to the question of the impact on Australia of greater coordination of macroeconomic policies in the rest of the OECD.[10] There are different ways to assess this. One approach is that taken in Argy, McKibbin and Siegloff (1989) which examines the effects on Australia of alternative regimes, such as floating exchange rates versus fixed exchange rate regimes of the McKinnon variety, between the major economies. The approach taken in the current paper is similar to that in McKibbin and Sachs (1988b) where we look at cooperation and non-cooperation as general equilibrium concepts from the outcome of strategic interactions rather than formal regimes. Formal regimes are restrictions on the policy rules that we calculate. We assume that the world follows a floating exchange rate regime but that countries can formulate policy rules subject to this regime. It is worth noting that no outcome in this general problem would be a fixed exchange rate regime although for some shocks, nominal exchange rates may not change as a result of a policy response.

It is worth re-iterating that when we use the term non-coordination we refer to the solution of a Nash game, where each country minimizes a quadratic loss function subject to the structure of the economy and the assumption that each country takes the actions of the other country as given. Each country has the same

[10] See McKibbin (1989) for survey of the theoretical literature on policy coordination.

weights on the same domestic targets (except Japan where employment is not targeted by policy because the labour market always clears in expected terms). When we refer to coordination, we are assuming that a global planner chooses policies to minimize a weighted sum of each country's loss function, where the weights are defined as GNP shares of countries in the coalition. We assume that both monetary and fiscal policies are available in each region.[11]

We only consider one shock here; that is a rise in Opec oil prices. Australia has several alternatives. If the world coordinates, Australia can enter the agreement or it can optimize separately. If the world does not coordinate, then Australia can only optimize independently.

A summary of the outcomes in terms of loss for each country is given in Table 15. Each number reported is the loss to the country listed down the first column in response to an oil price shock, given that country's own response and the response of the rest of the OECD listed in each column. For example, if policies in each foreign country are assumed fixed, and Australia does not respond to the shock, then the loss to Australia is -0.088. If on the other hand, Australia adjusted policy given the calculated policy rule, then the loss to Australia is -0.034. As with the loss calculations reported above, the interpretation of the size of the numbers is problematic but a comparison of relative loss is meaningful.

It can be seen from Table 15 that Australia gains by adjusting macroeconomic policy relative to no response, independently from what the rest of the world does. If the OECD economies are cooperating, then the loss to Australia is reduced. Australia also gains marginally by joining the cooperative arrangement. That is, Australia is better off without "free riding" on the agreement followed by the rest of the world. This is partly because entering into the agreement binds the forward looking wage setters because it changes the set of credible policies that Australian policymakers can follow. It is also because the other countries in the agreement are forced to modify their policies to the benefit of Australia.

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[11] It is important to note that the cooperative arrangement we choose is only one among a very large number possible.

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Note that the payoffs to other countries do change with the inclusion of Australia even though the weight placed on Australia is small (i.e. the share of GDP in the coalition total). This occurs because Australia sells to a world market for commodities and large policy changes are required to change world prices for these commodities if Australia is to benefit. Entering Australia into the coalition is like entering all the developing countries because of the market structure assumed. This type of result suggests why international agreements on macroeconomic policies are usually confined to small coalitions of similar structured economies. Both points will be elaborated below.

It can also be seen from table 15, that the United States gains from cooperation relative to non-cooperation, which itself is an improvement over no response. Japan on the other hand loses from a cooperative agreement. This is because Japan has one less target which requires a policy response since the assumption of wage flexibility in Japan means that the Japanese labour market clear with a one year lag. Because Japan has the same number of instruments as the other countries in the coordinated agreement but less targets, it is forced to give up some gain in targets at the margin. It is also interesting that a coordinated agreement including Australia is worse for Japan than a coordinated agreement that excludes Japan. This is possibly due to the fact that Japan is Australia's largest trading partner and therefore bears most of the burden of supporting Australia in the agreement. A general point to draw from this is that some countries may have an incentive to prevent other countries from entering international agreements because of trading relationships etc..

More detailed results for each case summarized in Table 15 are available upon request. Here we only present detailed results for the case of non-cooperation and global cooperation which are contained in Tables 16 and 17.

Table 16 contains the results for non-coordination of fiscal and monetary policies in the OECD countries with no policy response in Australia. Sachs and McKibbin (1985) found that the policy mix

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resulting from this type of inflationary shock was one of fiscal expansion and monetary contraction in the major countries because of the gain on inflation that can be achieved through a strong currency and the offsetting effects of the policy mix on output. In table 16 the results are less clear. Monetary policy is contractionary in each country but fiscal policy differs significantly. In Australia and the ROECD (not shown), fiscal policy is expansionary, whereas in the United States there is a fiscal contraction followed by expansion and in Japan a more severe fiscal contraction followed by expansion. The focus here on employment rather than output as a target, together with the initial rise in employment due to factor substitution, explains this difference. Also it must be remembered that the share of oil in the production process in the 1986 data used to calibrate the model here differs substantially from the 1979 shares relevant for the actual historical experience.

Table 17 illustrates the result when all OECD countries, including Australia coordinate policies. Each country is better off except Japan. The reason is that Japan is assumed to have targets only for inflation and the fiscal deficit. Unemployment is not a target for policy because the flexibility of the Japanese labour market implies that it clears in each period except when an unanticipated shock occurs. Japan therefore has one less target and the same number of instruments as the other countries. As already mentioned, in the coordinated agreement the Japanese are forced to bear proportionately more of the burden of reaching other countries' targets.

VI. STRATEGIC INTERACTION BETWEEN GOVERNMENT AND UNIONS

In the above analysis we assumed that the government chose policy given that unions follow the assumed behavior. Unions based wage claims partly on past inflation, partly on expected inflation, and partly on labour market conditions. This section drops the assumption that unions follow a passive rule of wage setting and assumes instead that they actively pursue a target in direct conflict with government objectives. We assume that unions choose a nominal wage to target a real wage defined in terms of a

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consumption basket of goods. The government is assumed to choose monetary policy to reach targets for inflation and unemployment. Again we only examine the oil price shock.

There are several issues which we touch upon here. In the face of an oil price shock:

(1) Is the economy's welfare (assumed to be represented by the government's loss function rather than the union's) improved by cooperation with the trade union in the model?;

(2) Does it matter if the rest of the world is cooperating or not cooperating for the outcomes of the union-government strategic interaction?[12]

Table 18: Loss to Unions and Government of Alternative Responses

	Policy Response of OECD excluding Australia	
	Non-Cooperative	Cooperative
Australian Response		
Non-Cooperative		
Government	-0.221	-0.089
Union	-0.000	-0.000
Cooperative		
Government	-0.075	-0.032
Union	-0.024	-0.010

Table 18 provides some indications of answers to these questions in the case for a shock to OPEC prices and given the particular objective functions assumed for the government and union. This table contains the loss to the Australian government (which for discussion purposes assumed represents the loss to the economy) and the loss to unions under different assumptions about cooperation and non-cooperation between them and under different assumptions about the policy rules being followed in the OECD economies excluding

[12] Other questions which are not addressed here but will be the focus of future work in this framework include:
Is the government better off entering into an international agreement if unions are not cooperating than attempting to free ride on the other countries?;
Is this true irrespective of whether there is cooperation with the unions?

Australia. In brief, irrespective of the rest of the world, cooperation between the government and the union in the model reduces the loss to the economy of an oil price shock. Also, the reduction in the loss to the Australian economy from cooperation within the economy is larger if the rest of world is not cooperating than if it is.

Detailed results which illustrate the dynamics of adjustment in the cooperative and non-cooperative environments are available from the author. One key result is that when the world is not cooperating, the gains to cooperation between the government and unions are close to one half of one percent of GDP per year and a third of a percent on inflation.

VII. CONCLUSIONS

In this paper we have used the MSG2 model in an attempt to give insights into issues of fundamental importance for a small open economy such as Australia. The issues include how Australia is affected by shocks in the rest of the world and how monetary and fiscal policies should respond (in a perfect foresight world). We showed that a country like Australia may be omitted from international agreements, such as G7 meetings, because the structure of its economy is fundamentally different to that of the other industrialized countries in the coalitions. We found an example where large countries cooperating together with Australia selected policy modifications that benefitted Australia but caused one of the countries to incur surprisingly large costs. This outcome arose arises because, if a cooperative agreement is to benefit Australia, the large countries must follow policies to stimulate the world market for commodities which implies carrying a large number of commodity exporting developing countries.

We also found that an improvement in economic performance, resulting from cooperation between government and unions, is potentially large, irrespective of conditions in the rest of the world.

The results of this paper and the research project in general are model specific and open to numerous criticisms. This is inevitable given the complexity of the economy we are attempting to understand. The principle motivation behind the project at this stage is not to give specific answers to fundamentally important questions (which is not yet possible) but rather to provide a framework for attempting to address these questions in a rigorous way. At this early stage in the research, the payoff is not only the quantitative results, but also the intuition which the analysis provides.

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Table 1: Sustained U.S. Fiscal Contraction (1% GNP)

Year		1	2	3	4	5
U.S. Economy						
Output	%	-0.82	-0.73	-0.49	-0.27	-0.15
Trade Balance	%GNP	0.31	0.31	0.30	0.28	0.27
Inflation	D	0.27	-0.14	-0.26	-0.21	-0.12
Int Rate (sh)	D	-1.01	-1.09	-1.11	-1.11	-1.10
Japanese Economy						
Output	%	-0.19	0.18	0.21	0.24	0.26
Trade Balance	%GNP	-0.35	-0.32	-0.31	-0.29	-0.27
Inflation	D	-0.40	-0.39	-0.04	-0.03	-0.02
Int Rate (sh)	D	-0.94	-0.98	-0.99	-0.99	-0.99
Exch Rate $/yen	%	4.75	4.67	4.56	4.44	4.33
Real Exch Rate	%	4.37	4.02	4.13	4.20	4.18
Australian Economy						
Output	%	-0.16	0.01	0.10	0.12	0.13
Priv Consumption	%GNP	0.06	0.19	0.26	0.28	0.28
Priv Investment	%GNP	0.19	0.26	0.29	0.30	0.30
Trade Balance	%GNP	-0.42	-0.44	-0.45	-0.46	-0.45
Inflation	D	-0.38	-0.22	-0.10	-0.03	-0.00
Int Rate (sh)	D	-0.49	-0.71	-0.81	-0.87	-0.91
Real Int Rate (sh)	D	-0.22	-0.58	-0.77	-0.86	-0.90
Real Int Rate (lg)	D	-0.77	-0.80	-0.81	-0.81	-0.81
Exch Rate $/aus	%	4.36	3.84	3.45	3.16	2.92
Real Exch Rate	%	4.05	3.39	3.14	3.01	2.88
$Aust. Commod. Price		-1.92	-1.59	-1.35	-1.19	-1.07
LDC Commod. Price		2.44	2.25	2.10	1.97	1.86

Table 2: Sustained U.S. Monetary Expansion (1%)

Year		1	2	3	4	5
U.S. Economy						
Output	%	0.58	0.21	-0.03	-0.13	-0.13
Trade Balance	%GNP	-0.03	-0.01	0.00	0.01	0.01
Inflation	D	0.36	0.40	0.28	0.12	-0.00
Int Rate (sh)	D	-0.08	-0.03	0.01	0.04	0.04
Real Int Rate (sh)	D	-0.50	-0.32	-0.10	0.04	0.10
Real Int Rate (lg)	D	-0.03	-0.01	0.01	0.01	0.01
Japanese Economy						
Output	%	-0.04	0.00	-0.00	-0.00	-0.00
Trade Balance	%GNP	0.01	0.01	0.01	0.00	0.00
Inflation	D	-0.05	-0.01	0.05	0.03	0.01
Int Rate (sh)	D	-0.14	-0.09	-0.01	0.03	0.04
Real Int Rate (sh)	D	-0.12	-0.13	-0.04	0.02	0.05
Real Int Rate (lg)	D	-0.01	-0.00	0.01	0.01	0.01
Exch Rate $/yen	%	0.89	0.94	1.00	1.02	1.03
Real Exch Rate	%	0.51	0.13	-0.06	-0.12	-0.10
Australian Economy						
Output	%	-0.02	0.02	0.01	-0.02	-0.04
Priv Consumption	%GNP	0.03	0.04	0.01	-0.02	-0.04
Priv Investment	%GNP	-0.00	0.01	-0.00	-0.01	-0.01
Trade Balance	%GNP	-0.05	-0.03	-0.01	0.01	0.01
Labour Demand	%	-0.06	0.02	0.01	-0.03	-0.05
Inflation	D	-0.07	0.01	0.06	0.05	0.02
Int Rate (sh)	D	-0.09	-0.05	0.00	0.03	0.03
Real Int Rate (sh)	D	-0.08	-0.10	-0.04	0.01	0.05
Real Int Rate (lg)	D	-0.00	-0.00	0.00	0.01	0.01
Exch Rate $/aus	%	0.97	0.98	0.99	1.01	1.01
Real Exch Rate	%	0.59	0.17	-0.06	-0.12	-0.09
Aust. Commod. Price		-0.29	-0.14	0.00	0.08	0.09
LDC Commod. Price		0.68	0.83	1.00	1.08	1.10

Table 3: Sustained Japanese Fiscal Expansion (1% GNP)

Year		1	2	3	4	5
U.S. Economy						
Output	%	-0.10	-0.25	-0.30	-0.31	-0.29
Trade Balance	%GNP	0.07	0.08	0.08	0.09	0.09
Inflation	D	0.24	0.16	0.08	0.02	-0.01
Int Rate (sh)	D	0.20	0.22	0.26	0.28	0.30
Real Int Rate (sh)	D	0.04	0.14	0.24	0.29	0.32
Real Int Rate (lg)	D	0.29	0.30	0.31	0.31	0.31
Japanese Economy						
Output	%	0.55	0.41	0.38	0.36	0.35
Trade Balance	%GNP	-0.69	-0.68	-0.66	-0.64	-0.62
Inflation	D	-0.43	0.14	0.05	0.04	0.03
Int Rate (sh)	D	0.33	0.33	0.37	0.41	0.43
Real Int Rate (sh)	D	0.19	0.28	0.33	0.38	0.41
Real Int Rate (lg)	D	0.43	0.44	0.45	0.45	0.45
Exch Rate $/yen	%	5.87	5.74	5.63	5.52	5.39
Real Exch Rate	%	5.44	5.29	5.15	5.05	4.97
Australian Economy						
Output	%	-0.03	-0.11	-0.13	-0.13	-0.13
Priv Consumption	%GNP	-0.05	-0.12	-0.14	-0.15	-0.15
Priv Investment	%GNP	-0.06	-0.09	-0.10	-0.11	-0.11
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.06	0.07	0.08	0.09	0.10
Imports	%GNP	-0.01	-0.03	-0.03	-0.03	-0.03
Trade Balance	%GNP	0.08	0.10	0.12	0.13	0.13
Budget Deficit	%GNP	-0.00	0.01	0.02	0.02	0.02
Labour Demand	%	0.07	-0.04	-0.07	-0.06	-0.04
Inflation	D	0.14	0.09	0.05	0.02	0.01
Int Rate (sh)	D	0.12	0.16	0.22	0.26	0.29
Real Int Rate (sh)	D	0.02	0.11	0.19	0.25	0.28
Real Int Rate (lg)	D	0.30	0.31	0.32	0.33	0.33
Exch Rate $/aus	%	0.79	0.87	0.93	0.97	1.00
Real Exch Rate	%	0.70	0.73	0.76	0.81	0.86
Money	%	0.00	0.00	0.00	0.00	0.00
Commodity q		0.83	0.60	0.46	0.35	0.24
Aust. Commod. Price		0.33	0.32	0.35	0.36	0.35
LDC Commod. Price		1.11	1.20	1.28	1.33	1.35

Table 4: 100% Rise in OPEC oil Prices

Year		1	2	3	4	5
U.S. Economy						
Output	%	-0.40	-1.12	-1.32	-1.10	-0.71
Trade Balance	%GNP	0.15	0.17	0.14	0.10	0.05
Inflation	D	1.37	0.83	0.10	-0.39	-0.57
Int Rate (sh)	D	1.16	1.38	1.26	1.03	0.78
Real Int Rate (sh)	D	0.34	1.27	1.66	1.60	1.31
Real Int Rate (lg)	D	0.30	0.30	0.25	0.18	0.11
Money	%	0.00	0.00	0.00	0.00	0.00
Japanese Economy						
Output	%	-1.04	-1.37	-1.27	-1.16	-1.02
Trade Balance	%GNP	0.03	-0.04	-0.08	-0.12	-0.13
Inflation	D	2.15	0.51	-0.16	-0.30	-0.35
Int Rate (sh)	D	1.11	1.48	1.44	1.21	0.93
Real Int Rate (sh)	D	0.61	1.65	1.74	1.55	1.27
Real Int Rate (lg)	D	0.36	0.35	0.29	0.21	0.15
Exch Rate $/yen	%	0.91	0.96	0.86	0.69	0.51
Real Exch Rate	%	1.75	1.47	1.09	1.01	1.06
Australian Economy						
Output	%	-0.23	-0.98	-1.29	-1.16	-0.80
Priv Consumption	%GNP	-0.29	-0.89	-1.12	-0.99	-0.69
Priv Investment	%GNP	-0.22	-0.42	-0.47	-0.40	-0.26
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.09	-0.14	-0.18	-0.19	-0.17
Imports	%GNP	-0.37	-0.47	-0.48	-0.42	-0.32
Trade Balance	%GNP	0.28	0.33	0.30	0.23	0.15
Budget Deficit	%GNP	0.13	0.28	0.33	0.28	0.19
Labour Demand	%	0.82	-0.37	-0.88	-0.70	-0.22
Inflation	D	1.30	0.88	0.19	-0.32	-0.54
Int Rate (sh)	D	1.37	1.63	1.49	1.22	0.95
Real Int Rate (sh)	D	0.51	1.45	1.84	1.79	1.49
Real Int Rate (lg)	D	0.37	0.37	0.31	0.24	0.16
Exch Rate $/aus	%	1.39	1.18	0.93	0.70	0.51
Real Exch Rate	%	1.46	1.29	1.11	0.94	0.76
Money	%	0.00	0.00	0.00	0.00	0.00
Commodity q		-1.44	-1.21	-0.89	-0.45	-0.04
Aust. Commod. Price		1.13	1.92	2.00	1.71	1.29
LDC Commod. Price		2.52	3.10	2.93	2.41	1.80

Table 5: Sustained Rise in World Commodity Prices

Year		1	2	3	4	5
Australian Economy						
Output	%	1.26	1.94	2.00	1.83	1.65
Priv Consumption	%GNP	0.80	1.24	1.26	1.13	1.03
Priv Investment	%GNP	-0.10	0.07	0.07	0.03	-0.02
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.53	0.72	0.78	0.76	0.72
Imports	%GNP	-0.02	0.09	0.10	0.08	0.06
Trade Balance	%GNP	0.55	0.64	0.67	0.67	0.65
Budget Deficit	%GNP	0.03	-0.13	-0.14	-0.11	-0.07
Labour Demand	%	-0.18	0.88	0.94	0.63	0.32
Inflation	D	-1.05	-0.41	-0.02	0.11	0.10
Int Rate (sh)	D	-0.31	0.16	0.35	0.39	0.36
Real Int Rate (sh)	D	0.13	0.14	0.18	0.24	0.28
Real Int Rate (lg)	D	0.36	0.37	0.39	0.40	0.40
Exch Rate $/aus	%	9.25	10.03	10.51	10.79	10.94
Real Exch Rate	%	8.28	8.05	8.36	8.90	9.40
Money	%	0.00	0.00	0.00	0.00	0.00
Aust. Commod. Price		2.09	1.75	1.30	0.87	0.51
LDC Commod. Price		11.35	11.77	11.81	11.66	11.45

Table 6: Sustained Australian Fiscal Contraction (1% GNP)

Year		1	2	3	4	5
Australian Economy						
Output	%	-0.45	-0.33	-0.07	0.12	0.20
Priv Consumption	%GNP	-0.16	-0.08	0.11	0.27	0.34
Priv Investment	%GNP	-0.02	-0.01	0.04	0.08	0.09
Govt Consumption	%GNP	-1.00	-1.00	-1.00	-1.00	-1.00
Exports	%GNP	0.54	0.60	0.66	0.70	0.71
Imports	%GNP	-0.19	-0.16	-0.11	-0.08	-0.06
Trade Balance	%GNP	0.73	0.76	0.78	0.77	0.76
Budget Deficit	%GNP	-0.88	-0.89	-0.92	-0.94	-0.93
Labour Demand	%	-0.43	-0.32	0.04	0.30	0.38
Inflation	D	0.37	-0.12	-0.24	-0.17	-0.07
Int Rate (sh)	D	-0.72	-0.55	-0.41	-0.30	-0.22
Real Int Rate (sh)	D	-0.68	-0.35	-0.27	-0.26	-0.26
Real Int Rate (lg)	D	-0.13	-0.10	-0.09	-0.08	-0.07
Exch Rate $/aus	%	-2.55	-1.83	-1.30	-0.90	-0.63
Real Exch Rate	%	-2.42	-1.74	-1.40	-1.14	-0.90
Money	%	0.00	0.00	0.00	0.00	0.00
Aust. Commod. Price		2.46	1.72	1.15	0.74	0.45
LDC Commod. Price		-0.09	-0.12	-0.14	-0.16	-0.17

Table 7: Sustained Australian Monetary Expansion (1%)

Year		1	2	3	4	5
Australian Economy						
Output	%	0.64	0.21	-0.04	-0.12	-0.10
Priv Consumption	%GNP	0.47	0.15	-0.03	-0.09	-0.07
Priv Investment	%GNP	0.18	0.06	-0.01	-0.04	-0.03
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.09	0.03	-0.00	-0.02	-0.01
Imports	%GNP	0.10	0.03	-0.01	-0.02	-0.02
Trade Balance	%GNP	-0.01	0.00	0.00	0.00	0.00
Budget Deficit	%GNP	-0.14	-0.04	0.01	0.03	0.03
Labour Demand	%	1.01	0.29	-0.11	-0.22	-0.18
Inflation	D	0.44	0.39	0.22	0.06	-0.02
Int Rate (sh)	D	0.02	0.03	0.02	0.00	-0.00
Real Int Rate (sh)	D	-0.41	-0.21	-0.05	0.03	0.05
Real Int Rate (lg)	D	-0.03	-0.01	0.00	0.01	0.00
Exch Rate $/aus	%	-0.94	-0.96	-0.99	-1.01	-1.02
Real Exch Rate	%	-0.56	-0.15	0.06	0.11	0.08
Money	%	1.00	1.00	1.00	1.00	1.00
Aust. Commod. Price		0.94	0.96	0.99	1.01	1.02
LDC Commod. Price		-0.00	-0.00	-0.00	-0.00	0.00

Table 9: Sustained U.S. Fiscal Contraction (1% GNP) with Australian Monetary and Fiscal Response

Year		1	2	3	4	5
Australian Economy						
Output	%	0.08	0.07	0.08	0.09	0.11
Trade Balance	%GNP	-0.34	-0.38	-0.40	-0.41	-0.41
Budget Deficit	%GNP	-0.15	-0.11	-0.09	-0.08	-0.07
Labour Demand	%	0.13	0.06	0.03	0.02	0.01
Inflation	D	-0.13	-0.07	-0.05	-0.03	-0.03
Int Rate (sh)	D	-0.64	-0.80	-0.86	-0.91	-0.95
Real Int Rate (sh)	D	-0.55	-0.74	-0.81	-0.87	-0.91
Real Int Rate (lg)	D	-0.80	-0.81	-0.82	-0.82	-0.82
Exch Rate $/aus	%	3.62	3.24	2.94	2.69	2.49
Real Exch Rate	%	3.51	3.17	3.07	2.99	2.86
Money	%	0.51	0.47	0.44	0.43	0.42
Aust. Commod. Price		-1.19	-1.00	-0.85	-0.74	-0.64
LDC Commod. Price		2.43	2.24	2.09	1.95	1.85

Table 10: Sustained U.S. Fiscal Contraction (1% GNP) with Australian Monetary Response

Year		1	2	3	4	5
Australian Economy						
Output	%	0.13	0.07	0.06	0.08	0.10
Trade Balance	%GNP	-0.42	-0.44	-0.45	-0.46	-0.45
Budget Deficit	%GNP	-0.05	-0.03	-0.03	-0.02	-0.02
Labour Demand	%	0.16	0.05	-0.00	-0.01	-0.01
Inflation	D	-0.18	-0.08	-0.04	-0.03	-0.03
Int Rate (sh)	D	-0.54	-0.73	-0.82	-0.88	-0.93
Real Int Rate (sh)	D	-0.43	-0.66	-0.77	-0.84	-0.89
Real Int Rate (lg)	D	-0.79	-0.80	-0.81	-0.81	-0.81
Exch Rate $/aus	%	3.93	3.46	3.10	2.81	2.58
Real Exch Rate	%	3.80	3.34	3.18	3.05	2.91
Money	%	0.49	0.40	0.36	0.35	0.34
Aust. Commod. Price		-1.49	-1.22	-1.00	-0.84	-0.73
LDC Commod. Price		2.44	2.25	2.10	1.97	1.86

Table 11: 100% Rise in OPEC oil Prices with Australian Fiscal and Monetary Response

Year		1	2	3	4	5
Australian Economy						
Output	%	-1.16	-1.03	-0.88	-0.73	-0.58
Trade Balance	%GNP	0.20	0.13	0.04	-0.05	-0.13
Budget Deficit	%GNP	0.45	0.53	0.55	0.53	0.48
Labour Demand	%	-0.67	-0.44	-0.23	-0.05	0.08
Inflation	D	0.60	0.46	0.32	0.19	0.09
Int Rate (sh)	D	1.43	2.04	2.04	1.77	1.40
Real Int Rate (sh)	D	1.05	1.76	1.87	1.70	1.41
Real Int Rate (lg)	D	0.43	0.40	0.33	0.25	0.18
Exch Rate $/aus	%	3.06	2.78	2.12	1.35	0.62
Real Exch Rate	%	2.55	1.82	1.32	1.11	1.02
Money	%	-1.53	-1.34	-0.87	-0.34	0.13
Aust. Commod. Price		-0.53	0.35	0.85	1.12	1.24
LDC Commod. Price		2.53	3.13	2.97	2.46	1.86

Table 12: 100% Rise in OPEC oil Prices with Australian Monetary Response

Year		1	2	3	4	5
Australian Economy						
Output	%	-1.19	-1.11	-0.96	-0.79	-0.61
Trade Balance	%GNP	0.30	0.33	0.30	0.23	0.15
Budget Deficit	%GNP	0.34	0.30	0.25	0.20	0.14
Labour Demand	%	-0.70	-0.52	-0.30	-0.09	0.08
Inflation	D	0.64	0.54	0.38	0.22	0.08
Int Rate (sh)	D	1.70	2.17	2.05	1.70	1.29
Real Int Rate (sh)	D	1.27	1.84	1.85	1.62	1.32
Real Int Rate (lg)	D	0.41	0.37	0.30	0.22	0.15
Exch Rate $/aus	%	2.82	2.28	1.49	0.71	0.04
Real Exch Rate	%	2.32	1.39	0.82	0.63	0.61
Money	%	-1.72	-1.45	-0.86	-0.23	0.31
Aust. Commod. Price		-0.30	0.82	1.44	1.70	1.76
LDC Commod. Price		2.52	3.10	2.93	2.41	1.80

Table 13: Sustained 20% rise in World Commodity Prices with Australian Fiscal and Monetary Response

Year		1	2	3	4	5
Australian Economy						
Output	%	1.95	1.84	1.75	1.68	1.63
Trade Balance	%GNP	0.52	0.64	0.70	0.73	0.73
Budget Deficit	%GNP	-0.09	-0.09	-0.10	-0.13	-0.15
Labour Demand	%	0.90	0.67	0.51	0.39	0.30
Inflation	D	-0.60	-0.45	-0.35	-0.27	-0.21
Int Rate (sh)	D	-0.96	-0.22	0.11	0.23	0.23
Real Int Rate (sh)	D	-0.56	0.08	0.34	0.41	0.38
Real Int Rate (lg)	D	0.33	0.38	0.39	0.40	0.40
Exch Rate $/aus	%	8.36	9.79	10.66	11.18	11.50
Real Exch Rate	%	7.78	8.24	8.62	9.01	9.35
Money	%	1.47	0.56	0.01	-0.33	-0.55
Aust. Commod. Price		2.99	1.99	1.15	0.47	-0.05
LDC Commod. Price		11.35	11.78	11.81	11.65	11.44

Table 14: Sustained rise in World Commodity Prices with Australian Monetary Response

Year		1	2	3	4	5
Australian Economy						
Output	%	1.92	1.82	1.75	1.70	1.65
Trade Balance	%GNP	0.54	0.64	0.68	0.67	0.65
Budget Deficit	%GNP	-0.11	-0.10	-0.09	-0.08	-0.07
Labour Demand	%	0.86	0.66	0.52	0.41	0.32
Inflation	D	-0.60	-0.46	-0.37	-0.30	-0.25
Int Rate (sh)	D	-0.99	-0.28	0.03	0.15	0.16
Real Int Rate (sh)	D	-0.58	0.04	0.29	0.36	0.34
Real Int Rate (lg)	D	0.33	0.38	0.40	0.40	0.40
Exch Rate $/aus	%	8.26	9.72	10.65	11.24	11.63
Real Exch Rate	%	7.68	8.16	8.58	9.01	9.40
Money	%	1.45	0.57	0.02	-0.32	-0.57
Commodity q		7.48	5.11	3.25	1.86	0.89
Aust. Commod. Price		3.09	2.05	1.17	0.42	-0.18
LDC Commod. Price		11.35	11.77	11.81	11.66	11.45

Table 15: Loss to Australia, United States and Japan from Alternative Responses to Oil Price Shock*

	Response of OECD Economies		
	No Response	Non-Cooperative	Cooperative
Australia			
No Response	-.088	-.087	-.029
Non-Cooperative	-.034	-.044	-.020
Cooperative	-	-	-.019
United States			
No Response	-.091	-	-
Non-Cooperative	-	-.06	-
Cooperative without Australia	-	-	-.026
Cooperative with Australia	-	-	-.023
Japan			
No Response	-.116	-	-
Non-Cooperative	-	0	-
Cooperative without Australia	-	-	-.096
Cooperative with Australia	-	-	-.098

* Note that the numbers shown are the loss to the countries listed in column 1 given their response and a response of all of the OECD economies.

Table 16: Non-Cooperative response to Oil shock

Year		1	2	3	4	5
U.S. Economy						
Output	%	-1.91	-1.43	-1.13	-0.91	-0.76
Trade Balance	%GNP	0.45	0.36	0.26	0.19	0.14
Budget Deficit	%GNP	0.12	0.28	0.37	0.40	0.39
Inflation	D	1.14	0.68	0.41	0.24	0.13
Int Rate (sh)	D	0.69	1.58	1.95	2.01	1.82
Real Int Rate (sh)	D	-0.03	1.15	1.70	1.86	1.75
Real Int Rate (lg)	D	0.79	0.83	0.82	0.78	0.72
Money	%	-1.52	-0.85	-0.33	0.13	0.56
Japanese Economy						
Output	%	-8.00	-2.08	-1.95	-1.79	-1.62
Trade Balance	%GNP	1.28	0.50	0.43	0.36	0.29
Budget Deficit	%GNP	0.00	0.00	-0.00	0.00	-0.00
Inflation	D	-0.00	-0.00	0.00	0.00	-0.00
Int Rate (sh)	D	-1.50	1.43	1.83	1.90	1.68
Real Int Rate (sh)	D	-1.57	1.44	1.83	1.89	1.67
Real Int Rate (lg)	D	0.69	0.80	0.77	0.72	0.66
Exch Rate $/yen	%	-0.83	1.36	1.50	1.63	1.74
Real Exch Rate	%	-1.93	-0.39	-0.67	-0.80	-0.83
Money	%	-7.86	-3.50	-3.55	-3.37	-3.01
Australian Economy						
Output	%	-1.23	-1.08	-0.95	-0.83	-0.71
Trade Balance	%GNP	0.28	0.31	0.27	0.23	0.18
Budget Deficit	%GNP	0.55	0.62	0.63	0.60	0.54
Labour Demand	%	-0.71	-0.48	-0.28	-0.11	0.02
Inflation	D	0.65	0.51	0.38	0.25	0.15
Int Rate (sh)	D	1.33	2.11	2.39	2.35	2.09
Real Int Rate (sh)	D	0.86	1.77	2.16	2.21	2.03
Real Int Rate (lg)	D	0.90	0.90	0.86	0.79	0.72
Exch Rate $/aus	%	4.07	3.43	2.90	2.47	2.13
Real Exch Rate	%	3.96	3.07	2.45	1.98	1.64
Money	%	-1.51	-1.38	-1.05	-0.63	-0.18
Aust. Commod. Price		-0.44	0.72	1.34	1.67	1.84
LDC Commod. Price		3.63	4.15	4.24	4.14	3.96

Table 17: Global Cooperative Response to Oil shock

Year		1	2	3	4	5
U.S. Economy						
Output	%	-1.19	-0.97	-0.73	-0.54	-0.40
Trade Balance	%GNP	0.16	0.18	0.12	0.07	0.04
Budget Deficit	%GNP	-0.02	-0.00	0.02	0.03	0.04
Labour Demand	%	-0.76	-0.41	-0.12	0.06	0.17
Inflation	D	0.69	0.46	0.24	0.09	0.00
Int Rate (sh)	D	-0.17	0.42	0.38	0.29	0.21
Real Int Rate (sh)	D	-0.60	0.19	0.29	0.29	0.27
Real Int Rate (lg)	D	0.09	0.13	0.12	0.12	0.11
Money	%	-0.66	-0.33	0.21	0.58	0.80
Japanese Economy						
Output	%	-9.29	-2.32	-2.08	-1.84	-1.61
Trade Balance	%GNP	2.27	1.22	1.05	0.89	0.75
Budget Deficit	%GNP	-1.67	-1.41	-1.23	-1.06	-0.91
Labour Demand	%	-10.21	-0.00	-0.00	-0.00	-0.00
Inflation	D	-0.15	-0.13	-0.11	-0.09	-0.08
Int Rate (sh)	D	-4.31	-0.67	-0.52	-0.49	-0.50
Real Int Rate (sh)	D	-4.29	-0.58	-0.44	-0.43	-0.45
Real Int Rate (lg)	D	-0.37	-0.17	-0.15	-0.14	-0.12
Exch Rate $/yen	%	-9.83	-5.68	-4.59	-3.69	-2.91
Real Exch Rate	%	-11.07	-7.38	-6.60	-5.86	-5.14
Money	%	-7.62	-2.75	-2.66	-2.47	-2.25
Australian Economy						
Output	%	-1.09	-0.90	-0.72	-0.57	-0.45
Trade Balance	%GNP	0.19	0.16	0.06	-0.01	-0.07
Budget Deficit	%GNP	0.05	0.15	0.19	0.22	0.23
Labour Demand	%	-0.66	-0.40	-0.17	-0.01	0.10
Inflation	D	0.55	0.39	0.22	0.11	0.03
Int Rate (sh)	D	-0.19	0.60	0.58	0.48	0.38
Real Int Rate (sh)	D	-0.52	0.42	0.51	0.48	0.43
Real Int Rate (lg)	D	0.15	0.18	0.17	0.15	0.13
Exch Rate $/aus	%	1.21	1.23	1.05	0.84	0.65
Real Exch Rate	%	1.29	1.21	0.98	0.76	0.57
Money	%	-0.55	-0.50	-0.07	0.27	0.50
Aust. Commod. Price		-0.55	0.41	0.74	0.91	1.00
LDC Commod. Price		0.66	1.64	1.79	1.75	1.65

Table 19: Global Cooperative response to Oil shock
Australian government and unions Non-Cooperative

Year		1	2	3	4	5
Australian Economy						
Output	%	-1.66	-2.01	-2.15	-2.20	-2.19
Trade Balance	%GNP	-0.02	0.06	0.02	-0.01	-0.03
Budget Deficit	%GNP	0.44	0.52	0.54	0.55	0.53
Labour Demand	%	-1.61	-2.09	-2.27	-2.33	-2.32
Inflation	D	0.21	0.26	0.28	0.29	0.28
Int Rate (sh)	D	-0.30	0.84	0.91	0.86	0.79
Real Int Rate (sh)	D	-0.46	0.63	0.68	0.62	0.55
Real Int Rate (lg)	D	0.17	0.20	0.18	0.16	0.14
Exch Rate $/aus	%	2.81	2.71	2.24	1.70	1.12
Real Exch Rate	%	2.66	2.25	1.76	1.35	1.02
Nominal Wage		0.21	0.47	0.75	1.04	1.32
Real Wage		-0.00	-0.00	-0.00	-0.00	0.00
Money	%	-1.21	-2.12	-2.06	-1.81	-1.47
Aust. Commod. Price		-1.99	-0.77	-0.16	0.34	0.80
LDC Commod. Price		0.81	1.94	2.09	2.04	1.92

Table 20: Global Cooperative response to Oil shock
Australian government and unions cooperative

Year		1	2	3	4	5
Australian Economy						
Output	%	-1.43	-1.68	-1.77	-1.78	-1.73
Trade Balance	%GNP	-0.02	0.06	0.03	0.00	-0.02
Budget Deficit	%GNP	0.39	0.45	0.46	0.45	0.43
Labour Demand	%	-1.24	-1.60	-1.71	-1.73	-1.69
Inflation	D	0.00	0.00	0.00	0.00	0.00
Int Rate (sh)	D	-0.55	0.55	0.61	0.56	0.50
Real Int Rate (sh)	D	-0.45	0.62	0.67	0.61	0.54
Real Int Rate (lg)	D	0.17	0.20	0.18	0.15	0.13
Exch Rate $/aus	%	2.92	3.07	2.89	2.64	2.35
Real Exch Rate	%	2.54	2.13	1.64	1.24	0.92
Nominal Wage		-0.14	-0.17	-0.18	-0.18	-0.18
Real Wage		-0.14	-0.17	-0.18	-0.18	-0.18
Money	%	-1.05	-2.11	-2.26	-2.25	-2.17
Aust. Commod. Price		-2.11	-1.13	-0.81	-0.61	-0.45
LDC Commod. Price		0.81	1.93	2.08	2.03	1.91

Table 21: Global Non-Cooperative response to Oil shock
Australian government and unions non-cooperative

Year		1	2	3	4	5
Australian Economy						
Output	%	-2.53	-2.87	-3.07	-3.15	-3.15
Trade Balance	%GNP	0.46	0.55	0.54	0.49	0.42
Budget Deficit	%GNP	0.62	0.70	0.74	0.75	0.74
Labour Demand	%	-2.67	-3.10	-3.32	-3.39	-3.35
Inflation	D	0.34	0.39	0.41	0.42	0.42
Int Rate (sh)	D	1.25	2.14	2.53	2.58	2.44
Real Int Rate (sh)	D	0.91	1.77	2.14	2.17	2.05
Real Int Rate (lg)	D	0.90	0.90	0.86	0.79	0.73
Exch Rate $/aus	%	4.50	3.95	3.38	2.80	2.23
Real Exch Rate	%	4.10	3.16	2.54	2.10	1.79
Nominal Wage		0.34	0.73	1.14	1.56	1.98
Real Wage		0.00	-0.00	-0.00	-0.00	-0.00
Money	%	-3.08	-3.66	-3.70	-3.37	-2.84
Aust. Commod. Price		-0.88	0.21	0.86	1.34	1.74
LDC Commod. Price		3.63	4.15	4.24	4.14	3.98

Table 22: Global Non-Cooperative response to Oil shock
Australian government and unions cooperative

Year		1	2	3	4	5
Australian Economy						
Output	%	-2.15	-2.38	-2.50	-2.53	-2.48
Trade Balance	%GNP	0.45	0.55	0.55	0.51	0.44
Budget Deficit	%GNP	0.54	0.60	0.62	0.61	0.59
Labour Demand	%	-2.08	-2.37	-2.49	-2.50	-2.42
Inflation	D	0.00	0.00	0.00	0.00	0.00
Int Rate (sh)	D	0.85	1.72	2.10	2.14	2.02
Real Int Rate (sh)	D	0.91	1.76	2.12	2.15	2.04
Real Int Rate (lg)	D	0.90	0.90	0.85	0.79	0.72
Exch Rate $/aus	%	4.67	4.51	4.37	4.23	4.09
Real Exch Rate	%	3.91	2.97	2.37	1.94	1.65
Nominal Wage		-0.23	-0.26	-0.27	-0.27	-0.26
Real Wage		-0.23	-0.26	-0.27	-0.27	-0.26
Money	%	-2.82	-3.66	-4.02	-4.05	-3.90
Aust. Commod. Price		-1.05	-0.36	-0.14	-0.10	-0.13
LDC Commod. Price		3.62	4.15	4.23	4.13	3.96