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ABSTRACT

In this paper we examine the structure and empirical results from several groups of linked econometric models. The main focus of the paper is on the international transmission of fiscal policies, monetary policies, and oil price shocks, under both fixed and flexible exchange rates. The linkage models are divided into four groups: projects based on available national models; projects using structural models designed with monetary and exchange rate linkages in mind; projects focussed mainly on trade linkages; and projects using very small national models with common structure. Each group comprises from two to four projects. Comparable results on the transmission of fiscal policy under fixed exchange rates are available for eight projects, while four projects provide evidence on the domestic and international effects of monetary policy and oil price shocks.

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EMPIRICAL STUDIES OF MACROECONOMIC INTERDEPENDENCE

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1. Introduction

In this chapter we present and compare some empirical results from studies of macroeconomic interdependence. We concentrate on studies that involve linked macroeconometric models of two or more countries. This restricts our attention to about a dozen research projects, and means bypassing studies based on partial models, general equilibrium trade models, and single economy models. We have chosen to specialize in this way so that we can focus in some detail on a few key issues. We have been fortunate in having the collaboration of many of the modellers in running and helping to interpret experiments that expose some of the main channels of international transmission. Since most of the models are continually changing, our survey can be only a partial snapshot that is bound to be outdated soon. This is a discouraging but inevitable feature of surveys of empirical work. To keep the rate of obsolescence as low as possible, we limit the amount of detail we present about specific versions of the models, and concentrate the analysis on broad questions of continuing importance, with special attention to the role of exchange rates in international transmission. We have also attempted, so far as possible, to collect results relevant to the 1970s and 1980s rather than the 1950s and 1960s.

In the next section, we classify the main linkage projects, paying special attention to those features of the models that have important bearing on the international transmission of

disturbances under fixed and flexible exchange rates. In the three subsequent sections we discuss the international repercussions of fiscal policy, monetary policy, and changes in world oil prices. After that, we provide some evaluation of the empirical results available to us and make some conjectures about the likely future course of research.

2. An Overview of Linkage Models

While not complete, our selection of models covers most of the projects for which model specifications and simulation results were published during the 1970s and early 1980s. We limit our attention to linked macroeconometric models. (1) In this section we outline the main features of the models, with special attention to those that provided the simulation results assessed in subsequent sections.

Table 2.1 divides the models into four groups. The first group includes Project LINK and the Eurolink Project, (2) both of which are based on national models that are regularly used for independent forecasting within the national economies. In the case of Project LINK, however, some of the newer models, especially those of the Eastern European Comecon countries, have been built and operated in international agencies, or at the Project LINK central office. The national models vary greatly in size, in theoretical conception, and especially in their treatment of international financial linkages. Project LINK has been producing world trade forecasts for more than ten years but, until very recently, there has been no mechanism for determining international capital flows and exchange rates.

(3) In the more recent Eurolink, initial efforts have also been directed to consistent explanation of bilateral trade flows, with the modelling of exchange rates and capital flows being developed subsequently.

Thus, for the purposes of our survey, the Project LINK and Eurolink results illuminate trade and price linkages under the assumptions of fixed exchange rates and full sterilization of reserve flows. Since Project LINK, among all the linkage models, contains the most detailed analysis of world trade, it is of especial use in the analysis of world-level shocks, such as changes in the world price of crude oil.

The second group comprises structural models designed with monetary and exchange-rate linkages in mind, and therefore able to cast light on the nature of international transmission under alternative exchange rate systems. Although they all make use of aggregate quarterly models of substantial scale, the three projects are nevertheless quite different in scope.

The Japanese Economic Planning Agency (EPA) world econometric model is the most comprehensive, as it includes nine country models and six regional trade models. The U.S. Federal Reserve Board's Multi-Country Model (MCM) contains five country models, completed by trading links with the rest of the world. The national models in both projects were constructed at the research centres in Tokyo and Washington, respectively. The Japanese group also made use of foreign country specialists seconded to Tokyo to assist with particular national models.

Another notable feature of the EPA project is that it has provided what appears to be the most methodical comparative test

of the various methods for consistent estimation of international trade flows. (4) The EPA researchers used various alternative models to estimate relative price and activity elasticities of the alternative linkage methods applied to aggregate real exports of the fifteen EPA countries and trading regions. Seven methods are compared, and, for six of them, long-run price elasticities are calculated for each country and region. Even though the elasticities are long run, and are based on export prices, rather than on the less closely linked national output prices, only seven of the 90 estimated price elasticities are greater than 1.0 in absolute value. The preferred Hickman-Lau approach gives price elasticities for export shares of -0.38 for the U.S., -0.63 for Japan, and -0.59 for Germany, the three countries involved in the initial linkage experiments. Long-term price elasticities for imports of goods are -0.76 for the U.S., -0.40 for Germany, and -1.18 for Japan. The lags are such that there are substantial J-curve effects for the United States and Germany, but not for Japan. A structural approach is adopted for the explanation of exchange rates, with exchange rates determined so as to equilibrate continually the market for foreign exchange. A combination of official intervention and exchange-rate-stabilizing private capital flows provides exchange market stability.

The U.S.-based MCM model has bilateral trade flows and endogenous international capital movements. The model explains bilateral exchange rates between the U.S. and each of the other four national currencies. As explained by Hooper et al. (1982), early versions of several of the country models showed short-run

(and sometimes longer-term) J-curve effects in response to exchange rate changes. In conjunction with the directly estimated capital account equations and the use of the market-clearing method for determining the exchange rates, this gave rise to unstable exchange rate movements in the German and Japanese models. The MCM researchers found that these problems could be eliminated by forcing foreign prices and exchange rates to have symmetrical effects on the domestic economies, and inverting portfolio capital account equations and estimating them directly as exchange rate equations. The effect of the latter change is to make the capital account an automatic buffer for changes in the current account. In the presence of short-term J-curve effects, this is not only necessary for exchange market stability but is justifiably based on speculative arbitrage across the J-curve. The MCM simulation results analyzed in subsequent sections are based on a revised version of the model with directly estimated exchange rate equations.

The third Group II project involves only Canada and the United States. The two national models were built at about the same time, but all of the linkage was established from the Canadian side. The bilateral linkages were embedded in the Canadian RDX2 model, making use of variables explained by the U.S. MPS model. Both models were provided with trade linkages to the rest of the world. In addition, RDX2 contains bilateral capital account and migration linkages between the two countries and between Canada and the rest of the world. The endogenous exchange rate is the bilateral rate between Canada and the United States, with the exchange rates between the U.S. and the

rest of the world treated as exogenous and the triangular arbitrage condition used to determine the effective exchange rate between Canada and all third countries.

Several exchange rate regimes have been used to link RDX2 and MPS, including rigidly fixed rates, the Bretton Woods pegged-rate system with behaviorally-estimated official intervention within the 1% margins, a crawling peg, and a floating exchange rate without official intervention. Even though there were J-curve effects in the current account linkages between the two models, there were sufficient exchange-rate-stabilizing capital flows to ensure exchange market stability. As noted earlier in connection with the MCM results, this result may have to do with the fact that one of the capital account portfolio equations was renormalized and directly estimated as an exchange rate equation.

The projects in the third group all involve sets of country models with a common structure. They are all linked by trade and trade-price equations, with exogenous exchange rates and no monetary or capital account linkages. The OECD INTERLINK model started as a consistent explanation of trade flows, but has since been expanded to include domestic activity and price equations, and plans are underway to develop a more complete modelling of aggregate supply and to endogenize eventually capital movements and exchange rates. The COMET, DESMOS, and METEOR models are all primarily models of the major E.E.C. countries and the trade linkages between them.

Most of the group IV models use very small national models, based on quarterly data, with primary emphasis on monetary and

exchange rate linkages. The Fair multicountry model contains 64 separate national models, many more than any other linkage project. The model of the United States is large, but all of the other national models contain estimated equations only for imports, consumption, investment, output, GNP deflator, export price index, demand for money, long-term interest rate, and forward exchange rate, and estimated reaction functions for the short-term interest rate and the exchange rate. As in most of the linkage models in the first three groups, each national model determines imports and the price of output, with a trade share matrix being used to distribute world trade among competing suppliers, and to determine import prices as functions of exchange rates and suppliers' export prices. In some of the reported results (Fair 1981b), the real export shares matrix is treated as exogenous, while in subsequent work (Fair 1981c, 1982) it is made endogenous by direct estimation of the export quantity shares as functions of relative export prices. In subsequent unpublished work, Fair has moved to direct estimation of export flows from each country to each other country. The results confirm the relatively low price elasticities found by the Japanese EPA researchers. Like the Fair model, the Japanese EPA project uses data for aggregate exports and export prices, although from a much smaller sample of countries. Fair (1981c, p. 11) reports elasticities that in only one or two cases are greater than 1.0 in absolute value, although they are negative for all but three countries, and significantly different from zero for more than three-quarters of the 64 countries. For the seven largest OECD countries, the elasticities of export shares

range from -0.231 (for Germany) to -0.333 (for Canada), with an average value of -0.29 and an average t-ratio of 6.0.

The elasticities of national imports with respect to import prices are not constrained to be equal to the elasticities with respect to output prices, and they are significantly negative for only 6 of the 64 countries outside the U.S., and for none of the larger OECD economies (Fair 1981a, p. 20). The import price elasticities in the Fair model are substantially less than in any of the linkage models described above, and his combination of import and export price elasticities, along with the method for determining of export prices, are such that the Marshall-Lerner conditions are not met for most country models even in the long term. This means that the current account responses to exchange rate changes are destabilizing even with export shares endogenous. (Fair 1981c, pp. 18-19, shows this result for depreciation of the DM and the pound Sterling.) Under these circumstances, there would be little incentive for exchange-rate-stabilizing private capital flows. Instead of invoking such flows, Fair endogenizes the exchange rate by means of exchange-rate reaction functions for 22 countries; these depend on the lagged exchange rate and some subset of the following variables: the DM/$ exchange rate, relative prices, relative interest rates, demand pressure, and net foreign assets. Given this officially-set exchange rate, the current account balance is matched by some combination of private capital movements and changes in official reserves. The latter combination is never disentangled, since the private and government sectors are aggregated in Fair's model, and net foreign assets are defined

by accumulating current account surpluses.

The second model in this group is the International Transmission Model of Darby et al. (1982). The model is applied to the seven major OECD countries plus the Netherlands. In scale, the national models are about the size of Fair's non-U.S. models, with an equation for the price level (based on an inverted demand-for-money equation), an equation for the unemployment rate, a policy-reation equation for the money supply, a real interest rate equation intended to equilibrate savings and investment, an import demand equation, an export equation, an import price equation, a net capital outflows equation, and an exchange-market intervention equation (for use when the exchange rate is endogenous). Under floating exchange rates, the import demand equation is renormalized (for estimation as well as simulation) to make the exchange rate the dependent variable. The renormalization has very significant effects on the parameter estimates, and hence on the properties of the resulting model.

The international linkages in the Darby model are not as completely specified as in the other linkage models described earlier. There are no consistency checks forcing world exports to equal world imports, so the sum of the balances of payments for the eight linked countries is assumed to be passively financed by the rest of the world. The foreign real income and price variables are weighted averages of the income and price variables in the eight modelled countries.

The final project in this group is the Liverpool-based multilateral model of Patrick Minford and associates. There are

nine country models (the OECD major seven plus Belgium and the Netherlands) and trade equations for three other trading regions. The special focus of the model is on the use of forward simulations to generate expected future values of variables. The structure and estimation of this model are still at a very preliminary stage. The only estimated equations reported to date (in Minford, Ioannidis, and Marwaha, 1981) are for stock demands for fixed assets in eight countries, consumption functions for five countries, portfolio demand-for-money equations for seven countries, and trade equations for the three trading blocks.

All of the three models in the fourth group are at a more experimental stage than the other linkage models, and their parameter estimates and structure may be too preliminary to permit useful empirical inferences about the nature of international transmission. The Fair model is the most complete and empirically informative of the three, and so it will get correspondingly more attention in the subsequent sections.

3. Transmission of Fiscal Policy

What can be learned from a comparison of the various estimates of the cross-country effects of fiscal policies? Deardorff and Stern (1979) asked this question when they reviewed various estimates of cross-country government expenditure multipliers under fixed exchange rates. They began by constructing a simple expenditure multiplier for each of eight major OECD countries using marginal propensities to consume and to import equal to historical averages. Then they

linked these country multipliers, using fixed bilateral trade weights to spread each country's imports across supplying countries. A fiscal shock in country i thus influences country j according to the size of country i's multiplier, the size of country i's marginal propensity to import from country j, and the size of country j's multiplier in response to the induced change in its exports.

Deardorff and Stern then computed static "elasticity multipliers" defined as the percentage change in a country's GNP or GDP resulting from a spending shock equal to 1 per cent of GNP in the initiating country; for an own-country shock, the elasticity multiplier is the conventional GNP multiplier. They compared their "naive model" to values obtained from fiscal simulations under fixed exchange rates from five linkage projects: LINK, DESMOS, COMET, METEOR and RDX2-MPS. (See Table 3.1.) They found that their naive estimate often fell within the range of results from the linked model simulations, and they concluded that the information contributed by the linked models was quite limited.

We think that divergence of linked model results from simple linkage calculations is not a good guide to the information content of the models. After all, there are some reasons why the Deardorff/Stern multipliers are too small (for example, they ignore induced investment and feedback effects from the second country back to the first country) and there are other reasons why they are too large (they ignore the expenditure-reducing effects of induced inflation, induced higher interest rates, and other forms of supply constraint).

Since there is, a priori, no way of deciding whether the "true" dynamic multipliers, either on average or in any particular year, should be above or below the simple static multipliers calculated by Deardorff and Stern, it is not appropriate to use the extent of divergence as a measure of the information provided by the linkage projects.

Although the Deardorff and Stern calculations do not provide grounds for telling whether anything can be learned from the linked simulations, they do provide useful benchmark data on the strength of bilateral trade linkages. Fair (1979) compares fiscal multipliers for an overlapping but somewhat different set of linkage projects. In both surveys, only the RDX2-MPS results involve capital movements and alternative exchange rate systems, and neither of the surveys deal with the importance of feedback effects. We have attempted to supplement these earlier surveys of linkage results. Our survey of expenditure linkages is based on a larger set of linkage models, and it also attempts to show the effects of linkage feedbacks, of fixed and flexible exchange rates, and of the financing used for the government expenditures.

Table 3.1 shows the own-country and cross-country real income effects of bond-financed government spending in each of the seven major OECD countries. The models include all of those surveyed by Deardorff and Stern (COMET, DESMOS, LINK, METEOR, and RDX2-MPS) supplemented by results from a newer version of LINK, the EPA World Econometric model, INTERLINK, the Fair model, and the MCM model. The expenditure shock is generally a bond-financed increase in government spending equal to 1% of

GNP, although there is an implicit combination of bond and money finance employed in those cases where the interest rate is held fixed.

Each of the seven panels of Table 3.1 shows the results for all countries of an expenditure increase in one of the countries. To find the own-country multipliers for, e.g., Germany, look in the GE column (where the effects on Germany are shown) of the third panel (where the effects of the German fiscal policy are shown). This method of presentation makes it very easy to compare results from the different models. Anywhere from one to three years of dynamic multipliers are reported for each of the models.

The OECD results reflect accelerator effects but no changes in prices, interest rates, or exchange rates. All of the other models have endogenous prices, although the results reported in the table are all (except for MCM) obtained from fixed-exchange-rate versions of the respective models. In most of the models, the assumed monetary policy is an unchanged interest rate. The money supply is therefore altered by enough to keep the interest rate constant, implying that the increase in government expenditure (and any induced changes in the stock of foreign exchange reserves) is financed by some mix of money, debt, and induced taxes.

The assumed monetary policy differs from model to model in Project LINK, but in general involves unchanged interest rates (and hence some degree of monetary expansion) in response to increases in government expenditure. In the Japanese EPA world model, the official discount rate is the key monetary policy

variable in each model, and these interest rates are held constant in the fiscal policy experiments.

The MCM results involve a flexible exchange rate and generally fixed money supplies. The results for Canada and the U.S. are therefore more comparable to the RDX2-MPS results in the top panel of Table 3.5 than to the fixed-exchange-rate results shown elsewhere in Table 3.1. The UK model used in MCM has an interest-rate reaction function instead of a fixed money supply. The UK interest rate rises with the Canadian rate, and the resulting negative effects on GNP outweigh the positive effects from the UK share of induced Canadian imports.

The EPA and INTERLINK results are useful for giving some idea of the feedback effects running from the indirectly affected countries back to the country initiating the policy. The evidence on this is obtained by comparing own-country multipliers from unlinked and fully linked fiscal policy simulations. The INTERLINK model in its 1980 form is likely to provide relatively high estimates of these feedbacks, since it has a complete trade matrix, a fairly complete set of country models, and has no monetary or price effects, no exchange rate flexibility, and no supply constraints to limit the passing of aggregate demand among the trading partners.

Table 3.2 shows the ratios of the linked to the unlinked fiscal multipliers for both the OECD and EPA models. The ratio rises with the size of the country, with the degree of its openness to trade, and with the ratio of other-country to own-country multipliers. The last factor is more likely to vary with the structure of the country models. Both the OECD and the EPA

results show linked multipliers to be generally 5% to 15% higher than the unlinked multipliers for the five largest OECD economies. The linked and unlinked multipliers are almost the same for Canada, reflecting its relatively small size. The EPA results for Italy, and most of the other intercountry differences reveal the importance of model structure in determining the results. The very large effects of linkage on the Italian multiplier and on the second-year U.K. multiplier in the EPA results appear to be a consequence of a very low own-country multiplier coupled with fairly high multipliers in the EPA models of the main trading partners.

Tables 3.3 to 3.5 help to show the effects of alternative exchange rate and monetary policies. Table 3.3 shows the effects of exchange rate flexibility in the EPA model by reporting the ratio of the flexible-exchange-rate to the fixed-exchange-rate own-country and cross-country multipliers. With key interest rates held fixed, as in the EPA simulations in Tables 3.3 and 3.4, and in one set of RDX2-MPS results in Table 3.5, an expansion of government spending leads to an induced trade deficit, a loss of foreign exchange reserves under fixed exchange rates, and a depreciation of the currency under flexible exchange rates. The depreciation of the domestic currency typically increases the size of the own-country multiplier and lowers cross-country multipliers. The domestic price effects of the fiscal policy are greater under flexible rates than under fixed exchange rates, given a monetary policy that holds key interest rates constant. As shown by the EPA results in Table 3.4, the effects on foreign inflation (still

assuming fixed interest rates) are substantially greater under fixed than under flexible exchange rates.

The chief exception to these generalizations is provided by the United States, but only in the current version of the EPA model (Amano et al, eds., 1982). EPA model. In this case, expansionary fiscal policy, even with unchanged US interest rates, leads to a strengthening of the US dollar, which then increases the expansionary effects on other countries. This result was not evident in the earlier EPA trilateral linkage results (Amano et al., eds., 1981); it appears to be a consequence of an implausibly large induced devaluation of the DM, which in turn appears to be due to an implausibly large outflow of capital from Germany.

When countries hold their money supplies rather than their interest rates fixed, the effect of exchange rate flexibility is rather different, as shown by comparing the various cases in Table 3.5. If the domestic balance of payments moves into incipient surplus, leading to an appreciation of the domestic currency, the domestic output effects of an expansive fiscal policy will be smaller, and the foreign effects larger, under flexible exchange rates. In terms of the familiar IS-LM diagram with a balance-of-payments or exchange-rate equilibrium curve added, this will happen if the BP curve is flatter than the LM curve. The RDX2-MPS results shown in Table 3.5 reveal that this condition is met in the Canadian-U.S. case, so that fiscal contraction weakens (and fiscal expansion strengthens) the domestic currency under flexible exchange rates. Thus exchange-rate flexibility slightly reduces the domestic GNP effects, and

increases the foreign effects, of changes in bond-financed government expenditure under flexible exchange rates. This result is what follows if money supplies are held equal to their control values in both countries, and reverses the effects of exchange rate flexibility derived from the case where nominal interest rates are pegged while the fiscal shock takes place.

Having emphasized that the international transmission of fiscal shocks depends heavily on the nature of the accompanying monetary and exchange market policies, we turn now to consider the available evidence on the international effects of monetary changes on their own.

4. Transmission of Monetary Policy

Many of the linkage models primarily emphasize trade linkages and have not paid equivalent attention to the mechanisms whereby monetary impulses are transmitted. The EPA model is one that does, and Table 4.1 shows its own-country and cross-country effects of separate increases in the official discount rates of each of the seven major OECD countries. For all of these countries except the United States, flexible exchange rates lead to greater negative effects of the contractionary monetary policy on own GNP, and lesser (and frequently positive) effects on others' GNP, compared to the situation with fixed exchange rates. Furthermore, the decrease in own-country effects for the U.S. is very small. The increase in own-country GNP effects among the other countries tends to be greater for the more open economies, although the pattern is not

very clear. In all cases, the changes in the cross-country effects are fairly small in absolute terms, but large relative to their values under fixed exchange rates.

The RDX2-MPS results support the EPA finding that the effects of exchange rate flexibility on the domestic impacts of monetary policy are much greater for the more open economies. For example, after two years of tighter monetary policy in Canada, sufficient to appreciate the Canadian dollar by 3%, the real output effects are two and a half times as great under flexible exchange rates as under the Bretton Woods system (Helliwell and Maxwell, 1974, p. 95). The effects of exchange rate flexibility on the U.S. were not material in these experiments, in part because all of the other U.S. bilateral exchange rates were held constant.

The RDX2-MPS linkage experiments also indicated that tighter U.S. monetary policy would lower Canadian GNP much less under flexible than under fixed exchange rates (Helliwell and Maxwell, 1974, p. 97), but lower it nonetheless. This contradicts the well-known result from the Meade-Fleming-Mundell model (e.g., Mundell, 1963) that tighter monetary policy should lower GNP at home and raise it abroad. The Mundell result comes about if capital flows are responsive only to interest-rate differentials. In order to balance the capital account inflow to the tight-money home country, there has to be an offsetting current account deficit, induced by the higher value of the domestic currency, leading to a higher demand for the real output of the foreign country. The RDX2-MPS results for U.S. monetary policy (but not for Canadian monetary policy) reversed

this result. The essential reason was that exchange-rate-stabilizing capital flows broke the tight link between the current account and the interest-induced capital flows, permitting there to be simultaneously a strengthening of the current account of the home country and interest-induced capital inflows, with the sum of these two net inflows offset by speculative outflows. The argument was made that the same exchange-rate-stabilizing speculative capital movements that are required to "look through" the widely prevalent J-curve effects also permit international transmission of tight-money-induced drops in GNP.

The EPA model shows some positive and some negative GNP cross-effects in response to monetary policy under flexible exchange rates. Amano, et al (1981) describes how the capital flow equations of the EPA models are equipped with exchange-rate-stabilizing features that would permit them, in principle, to have positive cross-country GNP effects. In addition, the exchange rate mechanism used in solving the models involves a considerable amount of active official exchange market intervention. This official intervention also raises the possibility of regaining the fixed-exchange-rate result, that tighter monetary policy lowers GNP both at home and abroad. It is interesting to note that even with private and official stabilizing intervention, some of the EPA results show own-country and cross-country income effects of opposite sign. This illustrates, as do the RDX2-MPS results, that the transmission process need not be symmetric when counties of different size and structure are linked together.

Tables 4.2 and 4.3 show the effects of coordinated and uncoordinated monetary expansion in the LINK and MCM models. For the five countries that appear in both models, Table 4.2 shows the real income and price level consequences of initial 1% reductions in the key interest rates in all of the countries. The LINK and MCM results for real income are fairly similar, and both models show proportionate increases in real income that are greater than the proportionate increases in the price level for each of the first three years. However, LINK is more optimistic with respect to prices; the US Wharton model used in LINK even suggests a lower domestic price level after four years of an expansionary monetary policy starting in 1980.

Table 4.3 contrasts the effects of coordinated monetary expansion with the consequences of isolated policies. The table shows the amount of price increase per percentage point increase in output for the fourth years of isolated and coordinated monetary expansions. For Project LINK, which is operated with fixed exchange rates in these experimants, the coordination does not make much difference. For the MCM models, however, with their flexible exchange rates, the coordination avoids the currency depreciation and resulting additional inflation that would arise if a country were alone in adopting an expansionary monetary policy. Thus the coordinated expansion provides a given increase in real income with a smaller amount of induced inflation, although the effect differs substantially from one country to another.

5. The Impact of Changes in World Oil Prices

One of the most interesting and as yet unsettled issues is how changes in world oil prices influence real output, national prices, and exchange rates throughout the world. It is an issue that almost demands the use of international linkage models, since the indirect effects coming through changes in the volume and prices of non-oil world trade are often more important, for any individual country, than the direct effects of higher oil prices. For example, simulations of the Bank of Japan model reported by Yomo (1982) show that a 10% increase in the world oil price lowers real GNP by .05% if other foreign variables are unchanged, but lowers it by .28% if the real GNP of partner countries is assumed to drop by .5% as a consequence of higher oil prices. Thus most of the likely real GNP effects (but not the price effects) flow from assumed effects on other countries. In these circumstances, it is important to obtain more information about the direct impacts on other countries, and on the transmission mechanisms between countries.

Many of the established national and multinational econometric models were designed before the price of oil changed so dramatically as to force a re-thinking of the aggregation, pricing, production, and factor utilization assumptions in econometric models. Thus, many of the linkage models are not ideally suited to depict the national effects of changes in world energy prices. They are likely to feed imperfect information back into the system of international prices, trade flows, capital movements, and exchange rates. There is a further complication at the national level, posed by the complex and diverse taxing and pricing arrangements that link world oil

prices to the prices paid by final energy users in various countries. Since the prices to final users, especially of transportation fuels, are often several times as high as the price of the crude oil content, and the proportionate changes in crude oil and final energy prices are often very different, the modelling of these margins becomes very important.

At the international level, it is clearly important to work with a group of models large enough to encompass a substantial share of the output of the trading world and to close the system by realistic assumptions about the amount and nature of increased OPEC spending, as well as the likely investment pattern for OPEC current-account surpluses caused by the higher oil prices. Hooper and Tryon (1982) have reported alternative simulations of the MCM model showing that, even in their 5-country-plus-OPEC model, raising OPEC's induced imports has substantial impact on the real GNP effects of the 1979-80 increase in world oil prices. For example, they estimate that raising OPEC imports by 50% (or US$ 50 billion) in 1982, and by similar proportions in 1979, 1980 and 1981, would have eliminated the loss of GNP in Japan due to the oil price shock and would have turned the German loss into a gain. The figures: Without the increased OPEC spending, the price shock reduces Japanese GNP by 2.2 per cent; with the extra spending, GNP is virtually unchanged. Without the spending, German GNP drops .5 per cent; with it, GNP rises by 1.6 per cent.

We have thus far been unable to develop easily comparable oil price results from the various linkage projects, and the models continue to differ importantly in coverage and in the

likely accuracy and completeness of their modelling of the impacts of oil prices on the various national economies. We have nevertheless tried to draw together in Table 5.1 some of the estimates of the second-year real GNP and price effects of a hypothetical 10% increase in world oil prices. Since we have often had to scale results down, and to draw approximate second-year results from a longer and more complicated set of responses, we also reproduce some of the primary material in subsequent tables.

A rough summary of the results, putting greater weight on the more complete models, is that a 10% increase in world oil prices lowers real GNP in a typical industrial country by between .5% and 1%, in the second year, and increases the consumer price by somewhat more. The results pertaining to pre-1979 increases need to be scaled up somewhat to apply to the early 1980s, because the world oil price doubled between 1979 and 1981, and oil spending has become a larger share of total costs, and because most models estimate the price elasticity of the demand for crude oil to be substantially less than 1.0 in absolute value.

The Japanese EPA results in Tables 5.1 and 5.2 are especially useful in showing how exchange rate flexibility alters the nature of the transmission process (5) . In the Japanese case, the oil price increase triggers a substantial depreciation of the yen, which reduces the real GDP losses but induces much higher domestic inflation. Given the significant export dependence of the German and Japanese economies and the significant swings in their current accounts after the two oil

price shocks of the 1970s, it is not surprising that the EPA linkage results for oil price increases were significantly altered (and became more stagflationary on average) when the original three-country system was expanded. Indeed, the GNP cuts in Table 5.1 are .1 to .4 per cent deeper than those calculated with the three-country version (Amano, et al., eds., 1981), and the price impacts are slightly greater. The current EPA trade linkage model for OPEC imports involves a .21 propensity to import from current increases in export revenues plus a .52 propensity to spend the previous period's foreign exchange reserves. Since the EPA model is quarterly, this implies a substantial re-spending of OPEC oil revenues, although apparently about one quarter of the incremental oil revenues are invested abroad in some more permanent form. (6)

The two sets of Project LINK results reported in Table 5.3 suggest that model revisions between 1978 and 1980 have somewhat increased the GNP responses of the system to world oil prices. If we compare the 1980 responses from the 1979-85 simulation with the 1979 responses from the 1978-79 simulation, we see GNP and consumer price level responses that are about as large, although the size of the shock is much smaller - a 12 per cent oil price increase relative to control in the second year of the 1979-85 simulation, compared to a 28 per cent increase in the second year of the 1978-79 simulation. In the earlier simulation, despite the larger shock, eight of 13 countries had relative GDP drops that were smaller than that for the 13 LINK countries in the second year of the later simulation. If we make a linearity assumption to standardize the shocks, the second-

year GDP response for the 13 countries in the later simulation is 1.75 times as big as in the earlier one, and the response of the consumption price deflator is 1.30 times as big. To better understand the reasons for these disparities, it would be useful to run comparable oil price shocks with successive versions of the LINK system, as well as with alternative linkage systems.

In the linkage results reported in Table 5.1, the stagflationary effects of higher oil prices tend to lead to higher nominal and lower real interest rates in most countries. Marion and Svensson (1982) emphasize that the lower real interest rates are a natural counterpart of the higher OPEC saving, and they act to partially offset the income effects of the terms-of-trade loss for countries that are net debtors as well as net oil importers.

6. Summary and Implications for Further Research

In this section we summarize our preliminary conclusions and suggest promising directions for further empirical research.

Our review of the effects of fiscal shocks shows that it is very important to consider jointly the exchange-rate and monetary linkages. The amount of evidence available on this score is still fairly limited, as only the Japanese and RDX2-MPS results compare the international effects of fiscal shocks under fixed and flexible exchange rates, and only the latter do so under alternative monetary policy assumptions. The experiments suggest that if policy-set interest rates are held at their control values and exchange rates are fixed, uncoordinated increases in government spending will usually lead to current

account deficits for the initiating country. Under flexible exchange rates, the induced current account deficits are smaller, and hence the fiscal policy's effects on GNP in other countries are likewise less. However, with exchange rates to some extent policy-determined, as in the EPA model, the fixed and flexible exchange rate results are not very different. The RDX2-MPS results with fixed money supplies show even less difference between fixed and flexible exchange rates; in the Canadian case, the fiscal policy does not induce much change in the balance of payments under fixed exchange rates, and hence little change in the exchange rate under flexible exchange rates. Other countries will differ to some extent, but in general it would not be surprising if the short-term international effects of fiscal policy turn out to be fairly similar under fixed and flexible exchange rates. Much depends, of course, on how exchange rates are modelled. The pervasiveness of J-curve effects among the linkage models, and the modest size of estimated long-term elasticities of substitution among exports from different countries, mean that either official intervention or exchange-rate-stabilizing private capital movements are a necessary condition for exchange market stability.

Exchange rate flexibility becomes more important when one considers the international effects of monetary policy. Even with substantial amounts of exchange-rate smoothing by official intervention or private sector capital flows, the reported international effects of monetary policy are markedly different under fixed and flexible exchange rates. This difference does

not show up, of course, in the models that concentrate on trade linkage, but it does appear wherever there are capital account and exchange rate linkages. The flexible exchange rate does serve to increase the domestic income and price effects of domestic monetary policy, and it reduces the foreign effects, but only sometimes does it produce the Mundell (1963) result in which real income moves in opposite directions at home and abroad.

The available evidence on the multinational effects of changes in world oil prices is still fairly limited, and still somewhat preliminary in nature. This is in part because the induced OPEC spending and saving behavior are not well and easily modelled, and in part because the supply sides of many of the national models, especially the role of energy in the production process, are still rather rudimentary. As the models develop, they continue to show substantial stagflationary effects from higher world oil prices. Conversely, substantial drops in world oil prices can be expected to produce less inflation and more growth, although relatively few tests have been run of the symmetry of the responses of world trade, output, and inflation with respect to fluctuations in the world price of oil.

Our judgment is that many of the past and current empirical studies of macroeconomic interdependence have produced useful results. These studies have served to put likely signs on some of the uncertain theoretical propositions, and to reduce somewhat the range of uncertainty about the strength of key linkages. However, despite the sometimes heroic efforts of the

researchers, and despite the assistance of a few interpretive surveys, many linkage models still have too much the reputation of black boxes. This reputation is largely unjustified for the linkage models reported here, because they are models for which the equation structures and parameter estimates are generally available. To some extent, the reputation reflects the unwillingness of those only peripherally interested in quantitative results to make the required investment in knowledge about macroeconomic facts and models. However, it is also the case that the models themselves are seldom presented in a way that makes it feasible, even for their operators, to assess the relative quantitative importance of the various channels of international linkage. Such information is in short supply, even for national models, so it is not surprising that still less is available for the linkage projects, most of which are of fairly recent origin.

Empirical studies of macroeconomic interdependence have been producing useful results for over a decade. The earliest studies were mainly of two types: large multilateral projects based mainly on linkage through trade flows and trade prices, and bilateral or few-country models with a more complete and consistent modelling of trade, capital, exchange rate, and, occasionally, migration linkages. More recently, the availability of better multi-country data sets has made possible the construction of many-country models based on consistent aggregate theoretical structures and emphasizing monetary and exchange rate linkages. At the same time, forecasting models such as Project LINK, the OECD INTERLINK, and the EEC Eurolink

models have moved some way towards a complete specification of monetary and capital account linkages, and modellers have been examining and ironing out unnecessary differences among the structures of the individual country models.

The use of structural econometric models for policy analysis has been criticized for not taking explicit account of the possible effects of such policy actions on private sector expectations. To the extent that this criticism is valid, it applies as much to the international linkage models assessed here as to national econometric models. The ability of the linkage models to depict accurately the international repercussions of national policy changes depends on the policies being not much more or less predictable or exploitable than previous ones. The sensitivity of model results to changes in the formation of expectations is especially great under flexible exchange rates. Increasing attention is likely to be paid to these issues as flexible exchange rates become a more general feature of linkage models.

There has arisen a distinction, emphasized in the linkage context by Fair (1979), between small and large national models as building blocks for empirical studies of macroeconomic interdependence. From our survey of model structures and results, we conclude that the actual size of the models in question is much less important, from the point of view of the user of results, than the ease with which the properties of the models can be fully understood and described. Thus we have found it easier to interpret and assess the reliability of results from some of the larger models (e.g. those of the Japanese EPA

project) than from the constellation of smaller models in our group IV projects. Of course, this is partly because some of the latter projects are at a very early stage of development and hence not very well tested, corrected, and understood.

What is needed, in our view, for all of the models, are clearer explanations of the comparative properties of the component national models, as well as a clearer analytical and empirical decomposition of the strength and nature of the links between countries. Hickman and Filatov (1982), in their decomposition of international trade multipliers, provide a useful move in this direction, but there is much more in the way of comparative macroeconomics that can usefully be done within the context of linked econometric models. (7) Indeed, this comparative analysis is probably a necessary element in understanding the reasons for many of the particular linkage results and an important aid to the design of better empirical models.

Footnotes

1. Hickman (1982) surveys a broad range of model types that were presented at a 1980 conference, with an emphasis on models with global coverage. Courbis (1981) surveys some of the multinational econometric models and general equilibrium trade models presented at a 1976 conference. Whalley and Shoven are in the process of surveying the general equilibrium world trade models.
2. The main strategy and results of Project LINK are recorded in three North-Holland volumes, respectively edited by R.J. Ball (1973), J.L. Waelbroeck (1976) and J.A. Sawyer (1979). The main simulation results we shall refer to in this chapter are from Hickman (1974), Johnson and Klein (1974), Hickman and Schleicher (1978), Klein (1978), Filatov, Hickman and Klein (1982), and Klein, Simes and Voisin (1981).

The Eurolink model, which is run by the Commission of the European Communities in Brussels, joins quarterly models of the United Kingdom, France, Italy, and Germany, with the system being closed by a "Rest of the World" model. The trade linkages are described in Ranuzzi (1981) and some alternative exchange rate and capital market linkages by Ranuzzi and Anthemus (1981). It is intended to add models for the other E.E.C. countries, for Canada, and for the United States.
3. Hickman (1981) describes the current and planned treatment of exchange rates within Project LINK.
4. Amano et al, 1981. In other work, Gana, Hickman, Lau and Jacobson (1979) report a comparison of results from application of the Klein-Van Peeterssen and the Hickman-Lau methods to a four-commodity-class disaggregation of world trade. They find the Hickman-Lau method better for imports of commodity group SITC 5-9, and the Klein-Van Peeterssen method better for total world trade, GDP, and total exports and trade balances of individual countries. They also found that both methods generally dominated the assumptions of constant export shares in terms of either value or volume, although the latter provided the best estimates of SITC 5-9 exports.
5. Table 5.1 also shows the exchange rate changes for the MCM and Fair models. However, there are no comparable results run under fixed exchange rates. McGuirk (1982) uses the International Monetary Fund's multilateral exchange rate model (MERM, Artus and McGuirk 1981) to estimate the real exchange rate changes required to eliminate the trade imbalances caused by the OPEC price increases. The summary discussion in that volume contains an attempt to compare and reconcile the MCM and MERM results.
6. Amano et al., eds. (1982), p. 376. While 21 per cent of oil export revenues are spend on current imports, only 56 per cent ultimately goes into foreign exchange reserves. This implies that the remaining 23 per cent is invested abroad in some form other than official foreign exchange reserves.
7. De Bever et al (1979) provide an example of the quantitative decomposition and comparison of model properties that we think could usefully be applied to whole sets of country models.

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Table 2.1
Classification of linkage models.

Model and reference	Trade Linkage'	Monetary Linkage	Exchange rates	Country coverage
Group I:				
Linkage of available national models.				
1. Project LINK (Ball 1973, Waelbroeck 1976, Sawyer, 1979)	Klein/Van Peeterssen	Capital flows among developed countries, but only in short term simulations.	Fixed in long term simulations. Floating according to reaction functions or PPP.	18 OECD countries, seven Comecon countries, and four developing regions.
2. Eurolink (Ranuzzi 1981)	Bilateral imports determined by total imports and competing export prices	Total inflows set by portfolio balance	Fixed or managed float with structural balance of payments approach.	Germany, Italy, France U.K and ROW.
Group II:				
Linkage of structural models built with monetary and exchange rate linkages in mind.				
1. EPA World Econometric Model (Amano et al 1982)	Hickman/Lau	Incomes, assets, and interest rates.	Fixed or managed float with exchange-rate bands and reserve flow target.	Major seven OECD countries plus Australia, S. Korea, and six trading regions.
2. MCM (Howe et al 1981)	Bilateral imports determined by income, and importer, exporter and competitor prices	Multilateral service account and direct investment flows.	Fixed or flexible with inverted capital-account portfolio-balance equation.	U.S., Canada, Japan U.K., Germany and ROW
3. RDX2-MPS (Helliwell 1974)	Bilateral	Interest rates and portfolio balance	Fixed, Bretton Woods, flexible and crawling peg.	Canada and U.S.
Group III:				
Models with a common structure, main focus on trade linkages and no monetary linkages.				
1. INTERLINK (OECD 1982)	Modified Samuelson/Kurihara	None	Fixed	23 OECD countries plus eight regions.
2. COMET (Barten et al 1976)	d'Alcantara/Barten/ Italianer	None	Fixed	11 European countries, U.S., Japan and 5 regions

3. DESMOS (Waelbroeck and Dramais, 1976, and Dramais, 1981)	Hickman/Lau with income and capacity utilization adjustments	None	Fixed	8 EEC countries and U.S. with trade links to Japan and three regions
4. METEOR (Kooyman, 1982)	Modified Samuelson/Kurihara	None	Fixed	6 EEC countries plus U.S., Japan, Canada and 5 regions
Group IV:				
Groupings of small national models with common structure focussed on monetary and exchange-rate linkages.				
1. Fair (1981a)	Export share equations	Capital flow equations interest rate reaction functions	Exchange rate reaction functions	64 countries plus RDW
2. Darby et al (1982)	Indirect	Interest rates and reserve flows	Fixed and flexible rates from inverted import demand equation	Seven major DECD countries plus Netherlands.
3. Minford et al(1981)	Indirect	Interest rates and reserve flows	Real interest parity condition on real exchange rate.	Seven major DECD plus Netherlands, Belgium and three regions (with trade links only).

[1] See appendix for a detailed discussion of trade linkages.

Table 3.1

Impacts of fiscal shocks with the LINK, OECD INTERLINK, EPA World Econometric Model, mini-METEOR, DESMOS, Fair, COMET, RDX2-MPS, Deardorff-Stern Naive, and MCM models.[1] Impacts are presented as percentage change in income for a shock of one per cent of income in the initiating country.

Income shock in	Model	Simulation year[2]	Impact on income in US	JA	GE	FR	UK	IT	CA
US	LINK(a)	1	1.18	0.13	0.04	0.02	0.08	0.08	0.31
US	LINK(a)	2	1.87	0.27	0.08	0.04	0.21	0.17	0.56
US	LINK(a)	3	2.58	0.40	0.14	0.06	0.35	0.31	0.86
US	LINK(b)	1	1.60	0.13	0.13	0.05	0.08	0.14	0.53
US	LINK(b)	2	2.39	0.20	0.21	0.06	0.12	0.21	0.63
US	LINK(b)	3	2.73	0.22	0.33	0.07	0.13	0.26	0.63
US	INTERLINK	2	1.52	0.18	0.20	0.16	0.21	0.19	0.59
US	INTERLINK	3	2.06	0.34	0.43	0.34	0.39	0.39	0.93
US	EPA	1	1.59	0.11	0.09	0.07	0.22	0.06	0.46
US	EPA	2	2.60	0.33	0.25	0.27	0.56	0.20	0.83
US	EPA	3	3.29	0.53	0.37	0.44	0.70	0.34	1.41
US	METEOR	1	2.46	0.22	0.19	0.12	0.19	0.15	0.65
US	METEOR	2	2.86	0.45	0.43	0.30	0.45	0.34	1.29
US	RDX2-MPS	2	2.03						-0.15
US	RDX2-MPS	4	0.93						0.28
US	Naive	Any	2.24	1.12	0.07	0.03	0.10	0.07	0.65
US	MCM	1	1.98	0.14	0.16		0.10		0.34
US	MCM	2	1.90	0.21	0.32		0.16		0.54
US	MCM	3	1.43	0.20	0.38		0.08		0.61
US	Fair	1	1.43	0.06	0.05	0.03	0.07	0.04	0.18
US	Fair	2	1.39	0.18	0.19	0.01	0.21	0.19	0.55
JA	LINK(a)	1	0.02	1.18	0.01	0.00	0.02	0.01	0.02
JA	LINK(a)	2	0.04	1.50	0.01	0.01	0.04	0.02	0.04
JA	LINK(a)	3	0.06	1.50	0.02	0.01	0.06	0.03	0.04
JA	LINK(b)	1	0.01	1.08	0.03	0.01	0.01	0.02	0.02
JA	LINK(b)	2	0.03	1.15	0.04	0.01	0.02	0.04	0.03
JA	LINK(b)	3	0.04	1.22	0.06	0.02	0.03	0.05	0.04
JA	INTERLINK	2	0.04	1.41	0.05	0.04	0.06	0.04	0.06
JA	INTERLINK	3	0.08	1.97	0.13	0.10	0.13	0.13	0.12
JA	EPA	1	0.02	1.45	0.04	0.02	0.05	0.02	0.05
JA	EPA	2	0.02	2.17	0.11	0.11	0.15	0.08	0.12

JA	EPA	3	0.03	2.38	0.16	0.18	0.17	0.11	0.18
JA	Naive	Any	0.03	1.69	0.01	0.01	0.01	0.01	0.05
JA	MCM	1	0.08	1.21	0.02		0.02		0.02
JA	MCM	2	0.10	1.50	0.03		0.04		0.04
JA	MCM	3	0.03	1.63	0.02		0.07		0.03
GE	LINK(a)	1	0.04	0.04	0.98	0.08	0.10	0.19	0.05
GE	LINK(a)	2	0.11	0.09	1.38	0.16	0.25	0.42	0.10
GE	LINK(a)	3	0.26	0.18	1.20	0.21	0.53	0.81	0.35
GE	LINK(b)	1	0.04	0.06	1.83	0.11	0.09	0.28	0.06
GE	LINK(b)	2	0.10	0.11	1.87	0.12	0.12	0.35	0.09
GE	LINK(b)	3	0.16	0.17	2.91	0.17	0.19	0.52	0.13
GE	INTERLINK	2	0.11	0.13	1.96	0.40	0.34	0.46	0.07
GE	INTERLINK	3	0.11	0.13	1.96	0.40	0.34	0.46	0.14
GE	EPA	1	0.01	0.04	1.44	0.19	0.12	0.14	0.04
GE	EPA	2	0.02	0.14	1.98	0.66	0.34	0.42	0.12
GE	EPA	3	-0.00	0.24	1.77	0.84	0.33	0.56	0.18
GE	METEOR	1	0.05	0.04	1.75	0.16	0.09	0.17	0.04
GE	METEOR	2	0.13	0.09	1.06	0.29	0.20	0.27	0.13
GE	DESMOS	1			1.25	0.08	0.04	0.08	
GE	DESMOS	3			1.56	0.14	0.08	0.16	
GE	COMET	1			1.29	0.16	0.08	0.24	
GE	COMET	8			0.87	0.44	0.24	0.40	
GE	Naive	Any	0.02	0.01	1.50	0.10	0.03	0.13	0.02
GE	MCM	1	0.06	0.02	1.45		0.04		0.01
GE	MCM	2	0.07	0.05	1.95		0.10		0.02
GE	MCM	3	-0.03	0.10	2.20		0.16		0.01
GE	Fair	1	0.02	0.02	2.36	0.25	0.12	0.20	0.01
GE	Fair	2	0.02	0.06	2.36	0.46	0.17	0.48	0.03
FR	LINK(a)	1	0.01	0.01	0.04	1.21	0.04	0.07	0.02
FR	LINK(a)	2	0.02	0.01	0.05	1.19	0.05	0.08	0.01
FR	LINK(a)	3	0.01	0.00	0.06	1.22	0.04	0.11	0.00
FR	LINK(b)	1	0.02	0.03	0.09	1.07	0.03	0.09	0.03
FR	LINK(b)	2	0.03	0.04	0.12	1.07	0.04	0.11	0.04
FR	LINK(b)	3	0.04	0.05	0.19	1.07	0.06	0.14	0.05
FR	INTERLINK	2	0.04	0.04	0.19	1.31	0.13	0.18	0.05
FR	INTERLINK	3	0.08	0.09	0.40	1.82	0.25	0.35	0.10

FR	EPA	1	0.01	0.01	0.07	1.85	0.06	0.06	0.01
FR	EPA	2	0.01	0.05	0.24	3.02	0.21	0.19	0.05
FR	EPA	3	0.03	0.11	0.32	2.63	0.23	0.30	0.09
FR	METEOR	1	0.04	0.03	0.14	1.78	0.07	0.11	0.03
FR	METEOR	2	0.09	0.06	0.23	1.16	0.15	0.18	0.08
FR	DESMOS	1			0.07	1.46	0.03	0.05	
FR	DESMOS	3			0.09	1.61	0.04	0.08	
FR	Naive	Any	0.01	0.01	0.08	1.72	0.03	0.09	0.01
UK	LINK(a)	1	0.01	0.01	0.02	0.01	1.24	0.03	0.03
UK	LINK(a)	2	0.04	0.03	0.03	0.02	1.69	0.06	0.06
UK	LINK(a)	3	0.05	0.03	0.04	0.02	1.51	0.08	0.05
UK	LINK(b)	1	0.02	0.03	0.08	0.03	1.07	0.08	0.05
UK	LINK(b)	2	0.04	0.05	0.11	0.04	1.14	0.11	0.07
UK	LINK(b)	3	0.06	0.05	0.17	0.05	1.16	0.13	0.08
UK	INTERLINK	2	0.03	0.04	0.11	0.09	1.16	0.09	0.07
UK	INTERLINK	3	0.06	0.08	0.23	0.19	1.43	0.19	0.12
UK	EPA	1	0.01	0.03	0.08	0.10	1.31	0.05	0.04
UK	EPA	2	0.02	0.09	0.23	0.30	0.78	0.15	0.11
UK	EPA	3	0.01	0.14	0.26	0.38	0.65	0.22	0.15
UK	METEOR	1	0.04	0.03	0.07	0.06	1.55	0.05	0.08
UK	METEOR	2	0.11	0.07	0.15	0.12	1.23	0.11	0.16
UK	DESMOS	1			0.02	0.02	1.19	0.02	
UK	DESMOS	3			0.04	0.03	1.29	0.04	
UK	Naive	Any	0.01	0.01	0.03	0.03	1.57	0.03	0.04
UK	MCM	1	0.05	0.01	0.02		1.15		0.02
UK	MCM	2	0.07	0.03	0.03		1.20		0.03
UK	MCM	3	0.03	0.03	0.03		1.15		0.02
IT	LINK(a)	1	0.01	0.01	0.02	0.02	0.03	1.30	0.02
IT	LINK(a)	2	0.03	0.02	0.03	0.03	0.06	1.51	0.02
IT	LINK(a)	3	0.05	0.03	0.05	0.04	0.08	1.80	0.03
IT	LINK(b)	1	0.01	0.02	0.07	0.03	0.02	1.61	0.02
IT	LINK(b)	2	0.04	0.05	0.16	0.06	0.06	1.83	0.05
IT	LINK(b)	3	0.06	0.05	0.20	0.06	0.06	1.94	0.05
IT	INTERLINK	2	0.02	0.02	0.08	0.08	0.05	1.16	0.02
IT	INTERLINK	3	0.04	0.04	0.18	0.16	0.11	1.54	0.05
IT	EPA	1	0.02	0.02	0.14	0.19	0.09	1.18	0.03
IT	EPA	2	-0.02	0.08	0.30	0.43	0.15	1.39	0.08

IT	EPA	3	0.00	0.12	0.34	0.53	0.17	1.68	0.12
IT	DESMOS	1			0.05	0.04	0.03	1.69	
IT	DESMOS	3			0.09	0.08	0.05	2.37	
IT	Naive	Any	0.01	0.00	0.05	0.06	0.02	1.70	0.01
CA	LINK(a)	1	0.08	0.02	0.02	0.01	0.05	0.03	1.15
CA	LINK(a)	2	0.12	0.05	0.03	0.01	0.09	0.05	1.15
CA	LINK(a)	3	0.13	0.04	0.03	0.01	0.08	0.06	0.79
CA	LINK(b)	1	0.02	0.01	0.01	0.00	0.01	0.01	1.38
CA	LINK(b)	2	0.04	0.01	0.02	0.00	0.01	0.02	1.36
CA	LINK(b)	3	0.05	0.01	0.02	0.01	0.01	0.02	1.37
CA	INTERLINK	2	0.05	0.01	0.02	0.01	0.03	0.02	1.27
CA	INTERLINK	3	0.07	0.03	0.04	0.03	0.05	0.03	1.49
CA	EPA	1	0.02	0.01	0.01	0.01	0.02	0.01	1.52
CA	EPA	2	0.06	0.06	0.06	0.06	0.07	0.05	1.97
CA	EPA	3	0.09	0.11	0.11	0.12	0.09	0.07	1.84
CA	RDX2-MPS	2	-0.04						0.89
CA	RDX2-MPS	4	-0.09						0.80
CA	Naive	Any	0.05	0.01	0.01	0.00	0.02	0.01	1.50
CA	MCM	1	0.12	0.02	0.02		0.00		1.04
CA	MCM	2	0.17	0.03	0.03		-0.01		1.00
CA	MCM	3	0.12	0.01	0.03		-0.02		1.00

[1] Sources for the results are as follows: for METEOR and Naive, Deardorff and Stern (1979); for LINK(a), Hickman(1974); for LINK(b), Filatov, Hickman and Klein(1982) ; for RDX2-MPS, Helliwell(1974); for DESMOS, Waelbroeck and Dramais(1974); for Fair, Fair(1982); for COMET, Barten et al(1976) ; for INTERLINK, OECD(1980); for EPA , Amano, et al(1982). The MCM results were produced for this survey.

[2] Simulation period for LINK(a) was 1973-75; for LINK(b) 1979-82; for DESMOS, 1970-74; for COMET, 1973-80; for RDX2-MPS, 1963-70; for MCM, 1975-78;for Fair, 1976I-77IV; for INTERLINK, 1978-80; for EPA, 1974-77.

Table 3.2
Ratio of linked to unlinked government spending multipliers.[1]

Country	OECD		EPA	
	1st year	2nd year	1st year	2nd year
US	1.05	1.08	1.02	1.08
JA	1.01	1.04	1.12	1.13
GE	1.11	1.20	1.05	1.10
FR	1.07	1.12	1.01	1.03
UK	1.06	1.12	1.03	1.40
IT	1.05	1.08	1.26	1.70
CA	1.01	1.01	1.00	1.00

[1] Calculated from data in OECD (1980), and Amano et al(1982).

Table 3.3

Effect of endogenizing exchange rates in the EPA World Econometric Model.[1] Displayed are the ratios of the fiscal multiplier with exchange rates endogenous to the multiplier when the exchange rate is exogenous. Actual values of the multipliers with endogenous exchange rates are given in Table 3.1. Impacts on prices and exchange rates are given in Table 3.4.

Increase in Expenditure in	Year	Multiplier ratio for US	JA	GE	FR	UK	IT	CA
US	1974	1.016	1.000	4.000	1.000	1.225	1.197	0.842
US	1975	1.042	0.964	4.102	0.952	1.195	1.689	0.882
US	1976	1.063	0.879	5.444	2.030	1.111	1.346	0.807
US	1977	1.135	0.902	6.361	3.165	1.364	1.374	1.019
JA	1974	0.474	0.987	0.757	1.000	1.000	1.474	1.000
JA	1975	0.474	1.013	0.504	0.920	0.874	1.000	0.919
JA	1976	-0.333	1.084	0.312	0.944	0.882	1.000	0.722
JA	1977	Small	1.198	0.216	0.721	1.050	0.847	0.469
GE	1974	Small	1.000	0.923	0.927	0.937	1.106	1.216
GE	1975	-1.467	0.789	1.139	0.762	0.781	0.964	0.874
GE	1976	Large	0.613	1.584	0.773	0.952	1.150	0.707
GE	1977	-2.500	0.513	2.485	0.778	1.968	1.405	0.682
FR	1974	1.000	1.000	0.373	1.014	1.000	0.712	1.000
FR	1975	2.941	0.680	0.357	1.083	0.919	0.953	0.680
FR	1976	1.692	0.667	0.378	1.083	0.771	0.882	0.805
FR	1977	2.056	0.458	0.315	1.157	0.626	0.667	0.696
UK	1974	1.100	1.032	0.631	0.884	1.024	1.189	1.000
UK	1975	0.476	0.667	0.319	0.725	1.381	0.935	0.726
UK	1976	2.000	0.462	0.292	0.587	1.475	0.900	0.214
UK	1977	3.095	0.436	0.502	0.421	0.926	1.089	0.212
IT	1974	1.000	1.000	0.496	0.729	0.800	1.130	1.000
IT	1975	1.000	0.602	0.332	0.614	0.779	1.215	0.795
IT	1976	Large	0.575	0.350	0.581	0.702	1.173	0.575
IT	1977	Large	0.449	0.295	0.507	0.817	1.257	0.504
CA	1974	1.000	1.000	1.000	1.000	0.500	1.000	1.030
CA	1975	1.386	0.596	0.596	0.596	0.838	0.756	1.109
CA	1976	1.000	0.443	0.670	0.602	0.711	0.831	1.321
CA	1977	1.134	0.276	1.000	0.545	0.381	0.505	1.740

[1] From Amano et al (1982). See footnote to Table 3.4.

Table 3.4
Impact of increased autonomous expenditure in the Japanese EPA World Economic Model.[1] Impacts are presented[2] as per cent difference from control for a one per cent increase in expenditure

(Endogenous exchange rates.)

Increase in Expenditure in	Year	Impact on PA in US	JA	GE	FR	UK	IT	CA
US	1974	0.024	0.061	0.024	0.024	0.085	0.085	0.024
US	1975	-0.098	0.245	0.257	-0.000	0.527	0.747	0.208
US	1976	-0.116	0.541	0.812	0.606	0.877	1.676	0.593
US	1977	0.121	1.172	1.751	1.131	0.391	3.341	0.943
JA	1974	0.019	-0.065	0.000	-0.000	0.019	0.019	0.009
JA	1975	0.057	0.085	0.009	-0.019	0.132	0.066	0.057
JA	1976	0.070	0.609	0.010	-0.030	0.220	0.040	0.110
JA	1977	0.032	1.710	0.011	-0.053	0.095	0.021	0.116
GE	1974	0.037	0.007	0.060	-0.060	0.060	0.037	0.022
GE	1975	0.067	-0.097	0.425	-0.231	0.209	0.052	0.060
GE	1976	0.084	-0.353	1.089	-0.261	0.115	0.353	0.092
GE	1977	0.080	-0.689	1.868	-0.240	-0.248	0.890	0.088
FR	1974	-0.008	-0.008	-0.000	-0.134	0.008	-0.034	-0.008
FR	1975	-0.008	-0.034	-0.017	-0.252	0.017	-0.008	-0.008
FR	1976	0.026	-0.052	-0.026	-0.428	0.035	0.122	0.026
FR	1977	0.037	-0.147	-0.028	-0.111	-0.000	0.046	0.046
UK	1974	0.021	-0.000	0.000	-0.032	0.368	0.032	0.011
UK	1975	0.021	-0.072	-0.000	-0.113	1.471	0.021	0.021
UK	1976	-0.022	-0.209	-0.022	-0.110	3.824	0.044	0.022
UK	1977	0.000	-0.258	-0.032	-0.043	6.794	0.333	0.022
IT	1974	0.017	-0.000	-0.000	-0.085	0.017	0.734	0.000
IT	1975	0.016	-0.050	-0.016	-0.149	0.066	2.116	0.017
IT	1976	0.034	-0.154	-0.034	-0.120	0.051	3.498	0.034
IT	1977	0.035	-0.278	-0.052	-0.122	0.000	4.814	0.035
CA	1974	-0.011	-0.000	0.000	-0.000	0.000	0.000	0.528
CA	1975	0.000	-0.011	0.000	-0.011	0.023	0.045	1.662
CA	1976	0.023	-0.035	0.024	0.000	0.083	0.106	2.842
CA	1977	0.012	-0.085	0.049	0.012	0.085	0.146	3.994

(Exogenous exchange rates.)

Increase in Expenditure in	Year	Impact on PA in US	JA	GE	FR	UK	IT	CA
US	1974	0.073	0.012	0.000	-0.000	0.049	0.024	0.109
US	1975	0.000	0.037	0.037	-0.025	0.319	0.061	0.417
US	1976	0.206	0.103	0.116	-0.064	0.748	0.103	0.864
US	1977	0.795	0.148	0.216	-0.054	1.266	0.175	1.320
JA	1974	0.009	0.084	0.000	0.000	0.009	0.009	0.009
JA	1975	0.047	0.236	0.019	-0.000	0.094	0.047	0.076
JA	1976	0.070	0.120	0.060	-0.010	0.240	0.070	0.160
JA	1977	0.084	-0.275	0.095	-0.021	0.370	0.063	0.211
GE	1974	0.015	0.015	0.082	-0.015	0.037	0.030	0.015
GE	1975	0.052	0.045	0.462	-0.082	0.223	0.097	0.074
GE	1976	0.100	0.084	0.889	-0.130	0.491	0.138	0.169
GE	1977	0.120	0.112	1.138	-0.088	0.705	0.153	0.248
FR	1974	0.000	0.000	0.000	-0.243	0.008	-0.000	0.000
FR	1975	0.017	0.008	0.025	-0.562	0.092	0.000	0.017
FR	1976	0.035	0.026	0.079	-0.586	0.245	0.017	0.061
FR	1977	0.046	0.034	0.138	-0.332	0.359	0.018	0.101
UK	1974	0.011	0.011	0.000	-0.011	0.378	0.011	0.011
UK	1975	0.031	0.021	0.031	-0.041	1.029	0.041	0.062
UK	1976	0.055	0.055	0.088	-0.066	1.278	0.055	0.132
UK	1977	0.075	0.065	0.129	-0.043	1.688	0.065	0.172
IT	1974	0.017	0.017	0.000	-0.017	0.017	0.085	0.017
IT	1975	0.033	0.033	0.050	-0.066	0.116	0.182	0.050
IT	1976	0.051	0.051	0.120	-0.086	0.240	0.326	0.103
IT	1977	0.070	0.070	0.174	-0.070	0.365	0.556	0.156
CA	1974	0.011	0.000	0.000	0.000	0.011	0.000	0.404
CA	1975	0.045	0.023	0.011	0.000	0.057	0.034	1.243
CA	1976	0.094	0.047	0.035	-0.000	0.142	0.059	1.757
CA	1977	0.122	0.061	0.061	-0.000	0.244	0.073	1.863

(Endogenous exchange rates.)

Increase in Expenditure in	Year	Impact on FXS in US	JA	GE	FR	UK	IT	CA
US	1974	-0.776	0.412	2.596	0.898	0.946	0.995	-0.340
US	1975	-1.997	1.176	6.960	1.703	1.715	4.607	-0.417
US	1976	-5.620	2.655	15.636	12.684	0.825	10.389	1.353
US	1977	-8.998	6.021	29.755	17.390	-0.687	18.993	0.674
JA	1974	0.205	-0.626	-0.168	-0.093	0.065	0.000	-0.075
JA	1975	0.274	-0.245	-0.557	-0.330	-0.057	-0.085	-0.142
JA	1976	-0.359	2.805	-0.399	-0.190	-0.699	-0.190	-0.120
JA	1977	-1.710	8.573	0.348	-0.021	-0.940	0.053	-0.148
GE	1974	0.328	-0.112	-0.887	-0.813	0.007	-0.224	-0.052
GE	1975	-0.037	-0.700	2.287	-1.281	-0.655	-0.074	-0.142
GE	1976	-0.598	-1.633	6.387	-0.337	-2.063	1.809	-0.153
GE	1977	-1.339	-2.389	10.525	0.128	-1.683	4.361	-0.200
FR	1974	-0.126	-0.017	-0.160	1.528	-0.000	0.025	-0.025
FR	1975	-0.151	-0.084	-0.386	2.717	-0.361	0.403	-0.034
FR	1976	0.262	-0.280	-0.787	0.723	-0.691	0.411	-0.026
FR	1977	0.046	-0.617	-0.166	1.814	-0.507	0.322	-0.018
UK	1974	0.147	-0.074	-0.347	-0.378	0.126	-0.032	-0.074
UK	1975	-0.422	-0.391	-0.689	-0.535	5.567	0.021	-0.123
UK	1976	-1.752	-0.771	-0.154	0.231	15.186	0.683	-0.066
UK	1977	-1.290	-0.774	-0.172	0.151	11.105	1.398	-0.043
IT	1974	0.222	-0.051	-0.495	-0.632	-0.051	2.835	-0.051
IT	1975	0.397	-0.281	-0.942	-0.512	-0.248	7.620	-0.083
IT	1976	0.429	-0.669	-0.840	0.000	-0.583	10.718	-0.069
IT	1977	0.556	-1.043	-0.904	-0.348	-0.382	13.364	-0.104
CA	1974	-0.326	-0.011	0.011	-0.011	0.000	0.011	0.943
CA	1975	-0.746	-0.079	0.023	-0.045	0.000	0.147	2.238
CA	1976	-1.415	-0.259	0.142	0.130	-0.047	0.318	4.328
CA	1977	-2.484	-0.390	0.560	0.280	-0.134	0.499	7.330

[1] Calculated from data in Amano et al, (1982).
[2] Actual shocks were a sustained increase in real government non-wage expenditure in the U.S. of $10 billion, a sustained increase in real government expenditure in West Germany of 10 billion DM, a sustained increase in real government gross fixed investment in Japan of 1 trillion yen, an increase in the U.K. of general gross fixed capital formation by 1 billion pounds, increases in Italy of government expenditure and the constant term of the fixed investment equation by 700 billion lire, and an increase in Canada of government fixed investment by $1 billion.

Table 3.5

Impact of fiscal policy in linked RDX2 - MPS system.[1] Sustained cut equal to 1% of 1963 GNP. Impacts given as per cent difference from control.

Shock starts in 1963.

(Flexible exchange rate, fixed money supplies.)

Decreased expenditure in	Year	Impact on GNP[2] in US		Impact on PGNP in US		Impact on RS[3] in US		Impact on FXS
			CA		CA		CA	
US	1964	1.97	-0.16	-0.21	0.01	-0.29	-0.02	-0.37
US	1966	0.88	0.22	-1.08	-0.20	-0.32	-0.03	-0.35
CA	1964	-0.06	0.83	-0.00	-0.61	-0.01	-0.55	1.23
CA	1966	-0.10	0.58	-0.04	-1.06	-0.02	-0.60	1.27

(Fixed exchange rate, fixed money supplies.)

Decreased expenditure in	Year	Impact on GNP in US		Impact on PGNP in US		Impact on RS in US		
			CA		CA		CA	
US	1964	2.03	-0.15	-0.21	0.02	-0.29	-0.02	
US	1966	0.93	0.28	-1.08	-0.11	-0.32	-0.01	
CA	1964	-0.04	0.89	0.00	-0.66	-0.01	-0.52	
CA	1966	-0.09	0.80	-0.02	-1.37	-0.02	-0.69	

(Flexible exchange rate, fixed short-term interest rates.)

Decreased expenditure in	Year	Impact on GNP in US		Impact on PGNP in US		Impact on M1 in US		Impact on FXS
			CA		CA		CA	
US	1964	2.47	-0.27	-0.21	-0.00	-1.62	-0.18	0.05
US	1966	2.43	-0.11	-1.28	-0.19	-2.70	-0.31	0.20
CA	1964	-0.13	2.02	-0.00	-0.99	-0.07	-2.99	-0.31
CA	1966	-0.16	2.69	-0.07	-2.00	-0.16	-4.47	-0.88

[1] From Helliwell (1974), 259-261, and Helliwell and McRae (1977), 174-175.

[2] Percent of 1963 GNP

[3] Percentage points.

Table 4.1
Impact of a one percentage point increase in discount rate in the Japanese EPA World Economic Model.[1]
Impacts are presented as per cent difference from control solution.

(Endogenous exchange rates.)

Increase in Interest rate in	Year	Impact on GNP in US	JA	GE	FR	UK	IT	CA
US	1974	-0.36	-0.03	0.24	-0.02	-0.01	-0.01	-0.13
US	1975	-0.68	-0.10	0.22	-0.11	-0.15	-0.00	-0.38
US	1976	-0.51	-0.14	0.06	-0.04	-0.17	-0.14	-0.43
US	1977	-0.14	-0.13	-0.15	-0.12	-0.06	-0.21	-0.40
JA	1974	0.01	-0.08	0.01	0.00	-0.01	0.01	0.01
JA	1975	0.01	-0.20	0.02	0.02	-0.01	0.01	0.02
JA	1976	0.01	-0.31	0.03	0.03	-0.01	0.02	0.03
JA	1977	0.02	-0.39	0.04	0.06	-0.01	0.03	0.05
GE	1974	-0.00	0.00	-0.54	-0.11	-0.03	-0.02	0.01
GE	1975	-0.03	-0.04	-1.29	-0.42	-0.22	-0.22	-0.03
GE	1976	-0.04	-0.09	-2.01	-0.77	-0.30	-0.42	-0.07
GE	1977	-0.05	-0.11	-2.31	-0.72	-0.40	-0.61	-0.08
FR	1974	-0.00	0.00	0.01	-0.21	-0.01	0.01	0.01
FR	1975	-0.01	-0.00	-0.01	-0.48	-0.03	-0.02	0.00
FR	1976	-0.01	0.01	0.01	-0.69	-0.03	-0.01	0.01
FR	1977	0.00	-0.01	-0.01	-0.52	-0.03	-0.03	0.01
UK	1974	0.01	0.01	0.02	0.01	-0.14	0.03	0.01
UK	1975	0.00	0.01	0.01	0.02	-0.08	0.01	0.02
UK	1976	0.01	0.02	0.02	0.05	0.08	0.00	0.04
UK	1977	0.03	0.01	0.02	0.05	-0.07	0.03	0.04
IT	1974	-0.01	0.00	0.01	0.01	-0.00	-0.16	0.00
IT	1975	-0.03	0.01	-0.00	0.03	-0.02	-0.41	0.01
IT	1976	-0.05	0.01	-0.02	0.04	-0.03	-0.40	0.01
IT	1977	-0.05	-0.01	-0.02	0.03	-0.02	-0.24	0.02
CA	1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA	1975	0.01	0.00	0.01	0.00	0.00	0.01	-0.05
CA	1976	-0.00	0.01	0.02	0.01	0.01	0.02	-0.49
CA	1977	0.01	0.01	0.02	0.01	-0.01	0.01	-0.87

(Exogenous exchange rates.)

Increase in Interest rate in	Year	Impact on GNP in US	JA	GE	FR	UK	IT	CA
US	1974	-0.39	-0.03	-0.02	-0.02	-0.06	-0.02	-0.09
US	1975	-0.75	-0.11	-0.07	-0.09	-0.19	-0.06	-0.40
US	1976	-0.60	-0.16	-0.11	-0.13	-0.17	-0.09	-0.37
US	1977	-0.20	-0.17	-0.10	-0.11	-0.09	-0.10	-0.33
JA	1974	0.01	-0.04	-0.00	-0.00	-0.00	-0.00	0.00
JA	1975	0.02	-0.12	-0.01	-0.01	-0.01	-0.00	-0.00
JA	1976	0.02	-0.19	-0.01	-0.01	-0.01	-0.01	-0.00
JA	1977	0.02	-0.24	-0.01	-0.01	-0.02	-0.01	-0.01
GE	1974	0.01	-0.01	-0.27	-0.11	-0.03	-0.03	-0.01
GE	1975	0.02	-0.05	-0.81	-0.47	-0.16	-0.19	-0.04
GE	1976	0.04	-0.12	-1.14	-0.78	-0.25	-0.36	-0.09
GE	1977	0.05	-0.18	-1.14	-0.76	-0.26	-0.46	-0.12
FR	1974	0.01	-0.00	-0.01	-0.16	-0.01	-0.01	0.00
FR	1975	0.01	-0.01	-0.03	-0.41	-0.02	-0.02	-0.00
FR	1976	0.02	-0.01	-0.05	-0.52	-0.04	-0.04	-0.01
FR	1977	0.02	-0.02	-0.05	-0.44	-0.04	-0.05	-0.01
UK	1974	0.01	0.00	-0.00	-0.00	-0.06	-0.00	0.00
UK	1975	0.02	-0.00	-0.01	-0.02	-0.04	-0.01	0.00
UK	1976	0.03	-0.00	-0.01	-0.01	0.03	-0.01	0.01
UK	1977	0.03	0.00	0.00	-0.00	-0.03	-0.00	0.02
IT	1974	-0.00	-0.00	-0.01	-0.01	-0.01	-0.06	-0.00
IT	1975	-0.00	-0.01	-0.04	-0.05	-0.02	-0.18	-0.01
IT	1976	-0.00	-0.02	-0.06	-0.08	-0.03	-0.24	-0.02
IT	1977	-0.00	-0.02	-0.06	-0.08	-0.03	-0.14	-0.02
CA	1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA	1975	0.00	0.00	-0.00	-0.00	-0.00	0.00	-0.01
CA	1976	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.45
CA	1977	0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.35

(Endogenous exchange rates.)

Increase in Interest rate in	Year	Impact on PA in US	JA	GE	FR	UK	IT	CA
US	1974	-0.08	0.13	0.04	0.05	0.01	0.12	-0.02
US	1975	-0.12	0.38	0.18	0.04	0.06	0.55	-0.16
US	1976	-0.31	0.61	0.28	0.18	-0.09	0.54	-0.37
US	1977	-0.47	0.84	0.26	0.01	-0.29	0.39	-0.48
JA	1974	0.01	-0.28	0.00	0.01	0.01	0.01	0.01
JA	1975	0.02	-0.76	0.00	0.01	0.03	0.02	0.01
JA	1976	0.03	-1.27	-0.00	0.01	0.08	0.01	0.02
JA	1977	0.04	-1.74	-0.01	0.02	0.12	0.00	0.02
GE	1974	0.03	0.02	-0.05	0.01	0.03	0.02	0.02
GE	1975	0.02	0.02	-0.39	0.12	0.05	-0.13	0.02
GE	1976	0.03	0.08	-0.79	0.18	0.08	-0.25	0.01
GE	1977	0.06	0.23	-1.31	0.31	0.25	-0.57	0.00
FR	1974	0.01	0.01	0.00	-0.09	0.01	0.03	0.01
FR	1975	0.01	-0.01	0.01	-0.04	0.03	-0.03	0.01
FR	1976	0.03	-0.01	0.01	-0.11	0.04	0.00	0.02
FR	1977	0.04	-0.02	0.01	-0.01	0.07	-0.07	0.03
UK	1974	0.02	0.01	0.00	0.01	-0.13	0.08	0.01
UK	1975	0.03	-0.00	0.01	0.02	-0.70	0.12	0.03
UK	1976	0.04	-0.05	0.01	0.01	-1.21	0.06	0.03
UK	1977	0.03	-0.10	0.01	-0.01	-1.33	0.05	0.04
IT	1974	0.01	0.01	0.00	0.01	0.01	-0.36	0.01
IT	1975	0.02	0.02	0.01	0.03	0.04	-1.26	0.02
IT	1976	0.05	-0.01	0.01	0.02	0.08	-1.89	0.04
IT	1977	0.06	-0.07	0.01	0.02	0.08	-1.91	0.04
CA	1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA	1975	0.01	0.00	0.00	0.00	0.00	0.01	-0.06
CA	1976	0.04	-0.01	0.00	-0.00	0.02	0.06	-0.41
CA	1977	0.03	-0.03	0.01	0.00	0.05	0.06	-0.96

(Exogenous exchange rates.)

Increase in Interest rate in	Year	Impact on PA in US	JA	GE	FR	UK	IT	CA
US	1974	-0.02	-0.01	-0.00	0.00	-0.02	-0.01	-0.02
US	1975	-0.05	-0.01	-0.01	0.01	-0.10	-0.02	-0.14
US	1976	-0.22	-0.04	-0.03	0.01	-0.23	-0.05	-0.31
US	1977	-0.37	-0.06	-0.06	-0.00	-0.33	-0.08	-0.39
JA	1974	-0.00	-0.01	-0.00	-0.00	-0.00	-0.00	0.00
JA	1975	-0.00	-0.02	-0.00	-0.00	-0.00	-0.00	-0.00
JA	1976	0.00	-0.03	-0.00	0.00	-0.01	-0.01	-0.01
JA	1977	0.01	-0.04	-0.01	0.00	-0.02	-0.01	-0.01
GE	1974	-0.00	-0.00	-0.02	0.01	-0.01	-0.01	-0.00
GE	1975	-0.02	-0.02	-0.15	0.05	-0.07	-0.04	-0.02
GE	1976	-0.05	-0.04	-0.36	0.12	-0.23	-0.07	-0.07
GE	1977	-0.06	-0.06	-0.55	0.13	-0.40	-0.09	-0.12
FR	1974	0.00	-0.00	-0.00	0.01	-0.00	-0.00	0.00
FR	1975	-0.00	-0.00	-0.00	0.05	-0.01	-0.00	-0.00
FR	1976	-0.00	-0.01	-0.01	0.08	-0.03	-0.01	-0.01
FR	1977	-0.00	-0.01	-0.02	0.07	-0.05	-0.01	-0.01
UK	1974	0.00	0.00	-0.00	0.00	-0.01	-0.00	0.00
UK	1975	0.00	-0.00	-0.00	0.00	-0.05	-0.00	0.00
UK	1976	0.01	-0.00	-0.01	0.01	-0.04	-0.00	0.00
UK	1977	0.01	-0.00	-0.01	0.00	-0.04	0.00	0.01
IT	1974	-0.00	-0.00	-0.00	0.00	-0.00	-0.01	-0.00
IT	1975	-0.01	-0.00	-0.01	0.01	-0.01	-0.02	-0.01
IT	1976	-0.01	-0.01	-0.01	0.02	-0.03	-0.03	-0.01
IT	1977	-0.01	-0.01	-0.03	0.02	-0.05	-0.04	-0.02
CA	1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA	1975	0.00	0.00	0.00	0.00	-0.00	0.00	0.01
CA	1976	-0.01	-0.00	-0.00	-0.00	-0.01	-0.00	-0.10
CA	1977	-0.01	-0.01	-0.01	-0.00	-0.02	-0.01	-0.27

(Endogenous exchange rates.)

Increase in Interest rate in	Year	Impact on FXS in US	JA	GE	FR	UK	IT	CA
US	1974	-1.03	0.75	2.63	1.10	0.85	1.25	0.19
US	1975	-1.08	1.63	2.49	0.63	0.82	2.80	0.03
US	1976	-1.23	2.38	2.19	2.34	0.05	2.25	-0.06
US	1977	-0.74	2.90	0.94	0.69	0.23	0.84	-0.10
JA	1974	0.28	-1.18	-0.10	0.03	0.03	0.01	-0.01
JA	1975	0.66	-2.71	-0.22	-0.06	0 13	-0.05	-0.02
JA	1976	0.97	-4.00	-0.30	-0.03	0.20	-0.10	-0.02
JA	1977	1.31	-5.09	-0.47	-0.03	0.12	-0.15	-0.03
GE	1974	0.51	-0.02	-2.08	-0.36	0.08	-0.29	-0.00
GE	1975	0.60	0.01	-3.17	0.39	0.38	-0.80	0.06
GE	1976	1.01	0.33	-5.34	-0.33	1.28	-1.49	0.09
GE	1977	1.45	0.83	-7.79	0.56	1.19	-2.93	0.09
FR	1974	0.15	-0.01	-0.10	-1.08	0.02	-0.09	-0.00
FR	1975	0.08	-0.06	-0.04	-0.46	0.01	-0.22	-0.01
FR	1976	0.26	-0.12	-0.16	-1.79	0.11	-0.29	0.01
FR	1977	0.03	-0.20	0.02	-0.02	0.08	-0.34	0.02
UK	1974	0.27	-0.01	-0.11	-0.01	-1.63	0.20	-0.01
UK	1975	0.55	-0.11	-0.22	-0.06	-3.12	0.12	-0.02
UK	1976	0.54	-0.27	-0.18	-0.12	-2.76	-0.13	-0.04
UK	1977	0.30	-0.41	-0.04	0.04	-1.28	0.06	-0.05
IT	1974	0.01	0.02	-0.04	0.02	0.01	-1.64	0.00
IT	1975	0.05	-0.03	-0.19	-0.06	0.03	-5.00	-0.00
IT	1976	0.14	-0.19	-0.30	-0.23	-0.01	-5.94	-0.01
IT	1977	0.18	-0.41	-0.26	-0.10	-0.05	-4.90	-0.04
CA	1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA	1975	0.18	-0.00	0.01	-0.01	-0.01	0.05	-0.50
CA	1976	0.75	-0.06	-0.01	-0.03	0.08	0.20	-2.08
CA	1977	0.86	-0.12	0.08	0.04	0.03	0.18	-2.38

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' For the U.S., U.K., Germany and Japan, the discount rates w
increased; in France, the call money rate, in Italy, the trea
rate. In Canada, M1 was reduced appropriately.

Table 4.2

Impacts of a co-ordinated 1 per cent cut in interest rates as simulated by LINK[1] and the Multi-Country Model.[2] Impacts are presented as per cent difference from control solution.

Model	Year	Impact on income in US	JA	GE	UK	CA
LINK	1980	0.3	0.4	0.5	0.1	0.2
	1981	0.6	0.4	1.0	0.3	0.4
	1982	0.7	0.6	1.2	0.2	0.8
	1983	0.7	0.6	1.5	0.1	0.7
MCM	1975	0.2	0.2	0.2	0.1	0.1
	1976	0.7	0.5	0.5	0.2	0.5
	1977	0.6	0.6	0.7	0.2	0.7
	1978	0.4	0.6	0.6	0.1	0.7

Model	Year	Impact on price level in US	JA	GE	UK	CA
LINK	1980	0.0	0.0	0.0	0.0	0.0
	1981	-0.3	0.1	0.0	0.0	0.0
	1982	-0.3	0.3	0.1	0.1	0.2
	1983	-0.6	0.3	0.1	0.2	0.4
MCM	1975	0.0	0.0	0.0	0.0	0.0
	1976	0.0	0.1	0.1	0.0	0.1
	1977	0.0	0.1	0.2	0.1	0.4
	1978	0.1	0.2	0.4	0.2	0.6

[1] From data in Klein, Simes and Voisin (1981). Simulated shock was a 2 per cent cut, so we have scaled the impacts by .5. Exchange rates are exogenous, and in the case of Japan and some other countries not shown, investment was shocked directly by 1 per cent in the first year, 2 per cent in the second and 3 per cent in the last two years.

[2] From a simulation provided for this study. Exchange rates are endogenous. The shock was a monetary contraction, so we have reversed the signs of the impacts. The shock was administered through the central bank discount rate and standardized across countries to yield approximately one per centage point change in short term interest rates at the outset.

Table 4.3

Comparison of the effects of isolated and coordinated monetary policy as simulated by LINK[1] and MCM[2]. The tabulated figures are ratios of the percent change in price level to the percent change in income in the fourth year of the shock, a measure of the inflation cost of the induced output. (In no case did output decrease.)

	Price/output ratio in				
	US	JA	GE	UK	CA
LINK (isolated)	-0.9	0.4	-0.0	0.1	0.5
LINK (coordinated)	-0.9	0.5	0.0	0.4	0.5
MCM (isolated)	1.0	0.3	0.9	LARGE	1.1
MCM (coordinated)	0.3	0.3	0.7	2.0	0.9

[1] Calculated from data in Klein, Simes and Voisin (1981). See notes to Table 4.2.

[2] Calculated from data in a simulation provided for this study. See notes to Table 4.2.

Table 5.1
Impact of an oil price shock according to four models.
Impacts are presented as per cent difference from control,
in the second year of the shock.

10% oil price increase modelled by	Year	Impact on GNP in US	JA	GE	FR	UK	IT	CA	Impact on PGNP in US	JA	GE	FR	UK	IT	CA
Fair[1]	1977	-0.23	0.08	-0.10	0.19	-0.14	0.10	-0.22	0.59	0.58	0.02	0.38	0.26	1.01	0.22
EPA[2]	1975	-0.64	-0.62	-0.19	-0.29	-0.47	-0.44	-0.06	0.32	2.59	.10	0.36	0.84	1.56	0.31
EPA[3]	1975	-0.66	-0.78	-0.07	-0.21	-0.49	-0.44	-0.02	0.37	1.35	0.13	0.39	0.60	0.99	0.34
MCM[4]	1980	-0.21	-0.56	-0.09		-0.18		-0.05	0.39	1.32	0.43		0.24		0.15
Eurolink[5]	1981I			-1.46	-0.17	-0.46	-0.33				0.20	0.03	1.00	-0.38	

10% oil price increase modelled by	Year	Impact on FXS in US	JA	GE	FR	UK	IT	CA
EPA	1975	-1.20	5.08	-0.07	-0.43	1.33	1.89	0.00
MCM	1980	-0.91	2.62	0.41		-0.20		0.04

[1] Calculated from data in Fair (1982), Table 10. A 50 per cent price shock was simulated, so we have scaled down Fair's impacts by 5.
[2] From Amano et al (1982), with endogenous exchange rate.
[3] From Amano et al (1982), with exogenous exchange rate.
[4] Calculated from data in Hooper and Tryon (1982), Tables 7 to 11. Estimated historical patterns for OPEC absorption and investment. Their price shock was 100 per cent of the base, so we have scaled their impacts down by 10.
[5] Simulation provided for this survey. The shock was a 25 per cent price increase, so impacts have been scaled down by 2.5.

Table 5.2
Impact of a 10 per cent oil price increase with the Japanese EPA model.
The impacts are presented as per cent difference from control solution.

(Endogenous exchange rates)

Year	Impact on GNP in US	JA	GE	FR	UK	IT	CA
1974	-0.22	-0.23	0.01	-0.09	-0.17	0.03	0.05
1975	-0.64	-0.62	-0.19	-0.29	-0.47	-0.44	-0.06
1976	-0.85	-0.69	-0.39	-0.53	-0.50	-0.85	-0.27
1977	-0.85	-0.60	-0.55	-0.54	-0.39	-1.03	-0.42

(Exogenous exchange rates)

Year	Impact on GNP in US	JA	GE	FR	UK	IT	CA
1974	-0.23	-0.27	0.05	-0.10	-0.23	-0.03	0.07
1975	-0.66	-0.78	-0.07	-0.21	-0.49	-0.44	-0.02
1976	-0.81	-1.03	-0.22	-0.25	-0.46	-0.70	-0.16
1977	-0.79	-1.08	-0.23	-0.22	-0.43	-0.82	-0.24

(Endogenous exchange rates)

Year	Impact on PA in US	JA	GE	FR	UK	IT	CA
1974	0.26	1.36	0.03	0.31	0.26	1.06	0.19
1975	0.32	2.59	0.10	0.36	0.84	1.56	0.31
1976	0.33	3.95	0.12	0.33	1.04	1.45	0.30
1977	0.32	5.42	0.07	0.37	1.06	1.17	0.21

(Exogenous exchange rates)

Year	Impact on PA in US	JA	GE	FR	UK	IT	CA
1974	0.29	1.08	0.03	0.27	0.25	0.77	0.20
1975	0.37	1.35	0.13	0.34	0.60	0.99	0.34
1976	0.38	1.30	0.18	0.41	0.63	1.09	0.37
1977	0.45	1.31	0.17	0.41	0.55	1.18	0.36

(Endogenous exchange rates)

Year	Impact on FXS in US	JA	GE	FR	UK	IT	CA
1974	-0.53	1.41	0.21	0.54	0.81	1.51	0.01
1975	-1.20	5.08	-0.07	-0.43	1.33	1.89	0.00
1976	-1.95	9.65	-0.07	-1.20	1.10	0.32	-0.15
1977	-2.58	13.67	-0.86	-0.80	1.18	-1.11	-0.30

From Amano et al. (1982).

Table 5.3
Impacts of oil price shocks calculated by LINK.[1]
Impacts[2],[3] are presented as per cent shock minus control over control, or, where indicated, in billions of $US.

	Impact on GDP in								Impact on PGDP in						
Year	US	JA	GE	FR	UK	IT	CA	OECD	US	JA	GE	FR	UK	IT	CA
1978	-0.4	-2.3	-0.8	-0.6	-0.4	-0.6	0.0	$-10b	0.0	1.0	-0.3	1.6	0.4	-0.1	0.5
1979	-0.5	-4.0	-1.1	-0.9	-0.5	-0.8	-0.1	$-32b	0.0	1.1	-0.7	1.9	1.2	-0.1	0.9
1979								-0.5							
1980								-0.9							
1981								-1.4							
1982								-1.9							

Table 5.3 (continued)

	Impact on PC in								Impact on Trade Balance in							Impact on World Price
Year	US	JA	GE	FR	UK	IT	CA	OECD	US	JA	GE	FR	UK	IT	CA	
1978	0.2	6.6	---	1.9	0.6	0.4	0.3	1.1	-6.7	-6.0	-1 6	-1.9	-0.2	-1.2	0.2	4.4
1979	0.2	6.0	---	2.3	1.2	0.6	0.7	1.1	-15.5	-13.0	-4.2	-4.3	0.1	-2.3	0.1	2.1
1979								0.3								1.8
1980								0.6								2.7
1981								1.1								4.4
1982								1.5								4.4

[1] The 1978-79 simulation is from Klein (1978), Table 2, and the 1979-82 simulation is from Filatov, Hickman and Klein (1982), Table 6.
[2] In the 1978-1979 simulation, the shock is an oil price increase of $2 per barrel over control in the first year and $4 per barrel over control in the second year.
[3] In the 1979-82 simulation, the shock is an oil price increase over control of 8.5 per cent in the first year, an additional 3.2 per cent in the second years, an additional 6.5 per cent in the third, and an additional 5.2 per cent in the fourth.

Table 5.4
Impact of an oil price shock in the Fair model.[1]
Impacts are presented as percent difference from control.

	Impact on GNP in							Impact on PGNP in						
Year	US	JA	GE	FR	UK	IT	CA	US	JA	GE	FR	UK	IT	CA
1976II	-0.30	0.03	-0.40	0.47	-0.30	-0.24	-0.19	1.22	0.81	0.10	0.46	0.32	1.33	0.33
1977II	-1.16	0.41	-0.51	0.94	-0.71	0.51	-1.12	2.96	2.91	0.08	1.89	1.30	5.06	1.10

Table 5.4 (continued)

	Impact on RS in							Impact on FXS in						
Year	US	JA	GE	FR	UK	IT	CA	US	JA	GE	FR	UK	IT	CA
1976II	0.25	1.91	-0.02	0.91	-0.01	2.44	0.44	---	1.47	-1.47	-1.69	-0.94	-0.40	-0.16
1977II	0.02	2.39	-0.21	0.79	-0.12	2.31	0.80	---	5.05	-6.30	-5.26	-5.51	-1.60	-0.71

[1] From Fair (1982), Table 10. The shock is a sustained 50% increase in the price of exports from the oil exporting countries, beginning in 1976I.

Table 5.5
Impact of an oil price shock in the Eurolink model.[1]
Impacts are presented as percent difference from control.

	Impact on GNP in				Impact on PGNP in			
Year	GE	FR	UK	IT	GE	FR	UK	IT
1980	-2.03	0.07	-0.19	0.33	0.18	-0.83	0.73	-1.34
1981	-3.66	-0.43	-1.14	-0.83	0.49	0.08	2.50	-0.95
1982	-3.41	-0.99	-1.36	-1.13	0.27	1.21	3.72	-0.01
1983	-1.75	-0.85	-1.20	-1.14	0.18	2.04	4.41	0.12

	Impact on PC in				Impact on RS in			
Year	GE	FR	UK	IT	GE	FR	UK	IT
1980	0.63	0.54	0.61	-0.50	.....	3.07	.....	0.78
1981	1.35	1.64	1.80	-0.13	.....	6.13	.....	0.84
1982	1.52	2.49	2.45	0.73	.....	6.92	.....	2.76
1983	1.66	3.18	2.83	0.86	.....	8.78	.....	1.84

[1] Simulation provided for this survey. In the simulation, Rest of World is exogenous, and in the shock mode, the Rest of World oil price (SITC 3) is increased by 25 per cent throughout the period of the simulation.