Trade, Capital Flows, and Migration As Channels for International Transmission of Stabilization Policies

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In this paper, a model of the economic transmission process is dissected to reveal the separate importance of trade, capital flows, and migration. Our experiments make use of the Canadian quarterly model RDX2 linked to the MPS model of the United States.[1] The simulations extend for eight years, tracing the effects of stabilization policies (mainly changes in Federal Government expenditures) originating in the United States or Canada. Two alternative systems are used to determine the exchange rate linking the Canadian and U. S. dollars; the managed peg exchange system adhered to by Canada between mid-1962 and mid-1970, and a flexible exchange system modelled using data from Canada's experience before 1962 and after 1970.

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[1]References to the two models are given in the Appendix. The project has been the work of many hands over several years. Among the authors of papers noted in the next footnote, Ian Stewart, Fred Gorbet, and Tom Maxwell were especially large contributors. The main participants in the current simulations are J. L. Bolduc, John Lester, and Robert McRae. Financial support from the Canada Council has made the project possible, and the continued cooperation of the special studies group at the Bank of Canada has been vitally important. Albert Ando and Robert Rasche have assisted us greatly by providing various versions of the MPS model, along with advice and early drafts of model documents. Helpful comments by discussants Lawrence Klein and Stephen Goldfeld, and by other participants at the conference, led to substantial post-conference revisions. The most important alterations include a more strict monetary rule for RDX2, (which dampens employment and output multipliers considerably), the treatment of the Eurodollar interest rate as an endogenous variable, the addition of an equation for U.S. exports of goods and services to countries other than Canada, re-estimation of the main equation for exports of goods from Canada to the United States, and the use of a more flexible exchange rate in the simulations reported in Tables 4 and 5. Details are described in the appendix.

In section 1, we describe the elements of modelled linkages between Canada and the United States, and present results showing the full transmission process in action. In sections 2, 3, and 4, we examine the effects of suppressing migration, long-term capital flows, and both long- and short-term capital flows. In section 5, we present results with migration and all capital flows suppressed, for easier comparison with the parallel results from the Project LINK system (as described in the papers in this volume by Keith Johnson and Lawrence Klein, and by Bert Hickman) and from the set of Common Market models described in the paper by Waelbroeck and Dramais. Section 6 and the accompanying Table 6 show the hypothetical closed economy results of fiscal policy, obtained by making all international influences exogenous to both models. We conclude, in section 7, with a discussion of some of the more promising avenues for future research.

1. *Features of the Full Transmission Process*

RDX2 and MPS are linked by many equations for trade flows and trade prices, short- and long-term capital flows, and migration. Earlier papers[2] describe the structure of the linkage and contain results from previous linked simulations.

In the present paper, we use revised versions of both models, including improvements in the determination of trade prices, parallel definitions of monetary policy in the two models, and an improved determination of equity prices in MPS. The revised models are described in section 1 of the appendix, while section 2 of the appendix describes the mechanics of the linked simulations.

The chief purpose of the paper is to unravel the contributions of trade capital flows, and migration in the international transmission of the effects of stabilization policies. For this purpose, our main example policy is a sustained reduction of constant-dollar Federal Government expenditure. For each country, the accommodating monetary policy is assumed to be an unchanged supply of currency and demand deposits (M1). In MPS this is accomplished by setting M1$ exogenous in shock and control solutions alike. In RDX2, a rule is imposed in the shock solutions that forces the short-term interest rate to move so that M1 is the same in shock and control solutions. These monetary policy assumptions are used

[2]Chapters 4, 5, 10 and 11 of Helliwell et al, 1971 describe the trade, migration, capital flows and exchange market in some detail. Chapter 12 of Ball, ed., 1973 contains a broad description of these equations, and a comparison of the structures of RDX2 and MPS. Two other papers (Helliwell, 1972 and Helliwell and Maxwell, 1974a) provide earlier results of linked simulations; the first of these shows the transmission of monetary and fiscal policies, while the second is concerned with monetary interdependence under five alternative exchange rate systems.

for the country initiating the fiscal policy as well as for the reacting country; in both cases the implication is that induced changes in the Federal Government's borrowing requirements lead to corresponding changes in interest-bearing Federal debt. Over the 1963-1970 simulation period, these monetary policy assumptions are not very realistic for either country. Our purpose in using them is to achieve more comparability between the two models, not to show how the monetary authorities in either country responded in fact to domestic or foreign fiscal policies. The nature and effects of alternative monetary policy strategies are important enough to be a subject of a separate paper (Helliwell and McRae, 1974).

In our earlier linkage experiments, we used an estimated monetary policy reaction function for RDX2 and an exogenous supply of unborrowed reserves (ZMS) for MPS. This made our fiscal policy results for the two countries somewhat difficult to compare. To avoid this problem, we have settled, for now, on M1 as a monetary policy instrument (or "intermediate target") that has a roughly similar meaning and role within the two economies.

Table 1-A shows the effects on selected variables of a sustained cut in constant-dollar U. S. Federal Government expenditure. The cut is equal to 1 percent of U. S. constant-dollar gross national expenditure (GNE) in 1963. For all domestic variables but the GNE multipliers, unemployment rates, and short-term interest rates, the consequences are shown as percentages of the control solution values. The multipliers are pure numbers, being the change in the initiating country's real GNE (usually negative) divided by the sustained change in constant-dollar Government expenditure (always negative). For the country not initiating a cut in Government expenditure, the induced changes in real GNE (usually negative) are shown as a percentage of that country's 1963 real GNE. For the unemployment rate, the shock minus control results are the differences between the two percentage unemployment rates. The interest rate differences are also shown in percentage points.

Among the international variables, the change in the Canadian annual balance of trade with all countries (XBAL$) is shown in millions of Canadian dollars, the change in Canadian foreign exchange reserves is shown (only for the fixed exchange rate system) in millions of U. S. dollars, and the Canadian price of U. S. dollars is shown (only for the flexible system) as the percentage difference between the shock and control solutions. The changes in northbound and southbound trade flows are shown both as percentages of the control solution and in millions of Canadian dollars, at annual rates of flow.

Now for some results. The traditional theory of transmission of economic fluctuations under fixed exchange rates, with mobile goods and capital, indicates that a fiscal cut in one country will cause downward movements of income and employment in the home and foreign economies (see, e.g., Kenen, 1972). Our results demonstrate that proposition, but show that induced effects at home and abroad follow cyclical patterns including sign changes.

The dynamic multipliers for real GNE are smaller and less cyclical for RDX2 than for MPS, as befits a more open economy.[3] Although the U.S. economy is more than 11 times as large as the Canadian, U. S. trade is only three times as large as Canadian trade.

One cause of the greater cyclicity in MPS is the much greater effect of fiscal policy on prices in MPS, which in turn is related to the effect of the unemployment rate on the wage rate. In RDX2, the increase in the unemployment rate causes, after some lags, substantial increases in emigration and decreases in immigration. After six years of expenditure cut, the Canadian population is lower by 90 thousand persons, more than .4 percent of the 1968 population. Thus the reductions in real output per capita in the RDX2 are not as great as indicated by the aggregate figures at the top of Table 1-B.

Another interesting feature of the results is that Canadian fiscal policy with a fixed money supply leaves external balance affected only slightly. Reserves are down slightly for the first six years and then up. For the United States, this conclusion cannot be established, because MPS does not have equations for movements of long- and short-term capital to countries other than Canada.

Given our result that neither Canadian nor U. S. fiscal policy with M1 constant quickly affects the level of reserves under a fixed exchange system, it is not surprising that the exchange rate does not move quickly under a flexible system. This result does not follow of necessity, however, as the determination of short-term capital flows is different under the two exchange systems. Without substantial exchange rate movement, it follows directly that the effects of fiscal policy are fairly similar under fixed and flexible exchange systems.

The Canadian price of U. S. dollars gradually decreases under U. S. fiscal cut. Under Canadian fiscal shock it increases for the first six years and then decreases. Thus for both countries the apparent effect of domestic expenditure reduction is to decrease the value of the domestic currency. This result arises because the induced capital outflow (due to decreased expenditure and interest rates) exceeds the induced surplus on trade account (caused by lower domestic prices and demand). For the United States, the conclusion can apply only to the bilateral flows between the United States and Canada, as reflected by the exchange rate linking the two currencies. For Canada, the result relates to the links between Canada and all countries. The net effect is not very strong for either country, and is subject to reversal with different assumptions about the accommodating monetary policy, or with alternative specifications for the trade and capital flow equations.

[3]The RDX2 multipliers reported in the first version of the paper were significantly higher than those reported here, because the money supply rule used in the first version was loose enough to permit some contraction in the money supply. In Helliwell and McRae (1974) it is shown that real expenditure multipliers are three to four times greater if the nominal interest rate rather than M1 is pegged at its control value.

Table 1-C records the last of our simulations with the full transmission mechanisms in operation. The U. S. monetary policy depicted involves a reduction of 1 percent in the annual rate of growth of the U. S. money supply (M1$). As expected, monetary contraction has a substantial balance-of-payments impact, because the direct trade and capital account effects are in the same direction. Taken together, Tables 1-A and 1-C raise the presumption that, for the United States, monetary policy has a strong comparative advantage in dealing with the balance of payments. This advantage extends over the whole eight-year simulation period, despite the fact that all of the major capital movements fulfill portfolio adjustment conditions, and that the bilateral flows of interest and dividends are endogenously determined from the simulated interest rates applied to the relevant portfolio totals. Numerous experiments with RDX2 indicate that a similar comparative advantage exists for Canadian monetary policy with respect to external balance.

The substantial bilateral balance-of-payments impacts of U. S. monetary policy imply that the flexible exchange rate will move, thus permitting the effects on Canada to be different under the two exchange rate systems. The results in the two right hand columns of Table 1-C show that the transmitted expenditure, price, and employment effects are generally one-half to three-quarters as large under flexible as under fixed exchange rates. The fact that output and prices move in the same direction in Canada as in the United States overturns a theoretical presumption (e.g. Mundell, 1968, p. 269) that monetary contraction lowers income at home and raises it abroad, if capital is interest-sensitive and the exchange rate flexible. The basic reason for our result is that private short-term capital moves to offset exchange rate changes, thus restoring the possibility that expenditure and employment should move in the same direction in both countries.[4]

Finally, the results in the three parts of Table 1 may be compared with results based on earlier versions of MPS and RDX2. The expenditure, employment, and price effects of monetary and fiscal policies in MPS are now about one-half as large as in the version we used previously, and the cyclical response, although marked, is less explosive. The chief cause of the unsatisfactory performance of the earlier version lay in our use of a particular version of the dividend-price equation used to determine the market value of equities in MPS. The new version of RDX2 has a much longer cyclical response than the original version, and shows somewhat more sustained effects for fiscal policy. The flexible exchange rate equation has been re-estimated using more data from the 1970s, and shows less response to payments imbalance, and hence diminishes the short-run differences between the fixed and flexible exchange rate versions of the model. The linkage between the models especially the determination of trade flows and prices, has been improved, so that our present linkage results have slightly more claim to reliability.

[4]This result is discussed more fully in Helliwell and Maxwell (1974a), and is placed in the context of a survey of other studies of the Canadian experience in Helliwell (1974).

2. *Transmission with Migration Suppressed*

The simulations reported in Tables 2-A and 2-B use the same control solutions and fiscal policies used for Tables 1-A and 1-B. Migration is suppressed in the fiscal simulations by setting Canadian migration flows equal to their control solution values. These flows are not split between the United States and the rest of the world, because the existing data do not permit the separation to be made. Migration is not endogenous to MPS.

Canadian immigration is influenced strongly by the Canadian unemployment rate, the U. S. unemployment rate, and the ratio of the real wage rate in Canada to a corresponding weighted average for the main countries (including the United States) supplying migrants to Canada. Canadian emigration, which is primarily to the United States, is explained by the unemployment rates in Canada and in the United States. Based on a 1970 labor-force population of 15 million persons, an increase of the Canadian unemployment rate from 4 percent to 5 percent would lead eventually to an annual decrease in immigration of about 50 thousand persons. Subject to slightly shorter lags, there would be an increase of 20 thousand in the annual flow of emigrants. An increase of 10 percent in the Canadian real wage relative to the foreign real wage increases annual immigration by about 35 thousand.

These are dramatically large effects. An attempt to reduce Canadian unemployment by 100 thousand, given the 1970 labor force of about 8.4 million, would lead, after about two years, to an increase in annual net immigration about four-fifths as large, were not the migration raising the unemployment rate again so as to choke off the induced flow. These calculations suggest that without a substantial change in migration policy there is little chance of long-term success for fiscal policies intended to reduce the Canadian unemployment rate, which is traditionally very high by international standards.

The calculations above are based solely on the unemployment effects in the migration equations, and neglect the influence of real wage rates on migration, the effects of changes in population on aggregate demand, and so on. To get a more comprehensive view of the relation between migration and the effects of fiscal policies, we must compare the simulation results in Table 2-B with those in Table 1-B. For the first two years, induced migration has little impact on the results of fiscal policy. Thereafter, the differences become marked. Without migration the aggregate expenditure effects are smaller and more short-lived, while the effects on the unemployment rate, wages, and prices are substantially larger and more sustained. If the output changes in Table 1-B are expressed in per capita terms they become, in the fixed exchange rate system, -1.24 percent, -.60 percent, -.40 percent, and -.59 percent in the 2nd, 4th, 6th, and 8th years, much closer to the path followed in Table 2-B. Even in per capita terms, the aggregate output effects are initially larger with than without induced

migration, chiefly because aggregate supply (UGPPD) drops faster if induced migration takes place, thus reducing the extent to which price and wage changes serve to limit the real multiplier process.

The effect of migration on the supply of labor is the primary reason that fiscal policy in Table 1-B has substantially smaller effects on the unemployment rate, and hence on wage rates and price levels. From the comparison of Tables 1-B and 2-B, it appears that migration policy would have a comparative advantage in the attainment of employment and real wage objectives.

The substantial importance of migration in RDX2 suggests that further work be done to attempt a separation between the possible effects of past changes in migration policies and the corresponding macroeconomic influences. There may also be some gain from attempting to build migration explicitly into MPS for linkage purposes; this is even more likely to be true for migration among European countries. At present, the only effects of migration in MPS are rather second-hand; if a U.S. policy affects Canada differently with the migration equations in play, then the reflected repercussions on the United States will be different. A comparison of Tables 1-A and 2-A shows that these secondary effects are small enough to be ignored.

3. *Transmission with Long-Term Capital Flows Suppressed*

The two parts of Table 3 show the consequences of U.S. and Canadian fiscal policies with all Canadian and U.S. long-term capital flows treated as exogenous. The structure of RDX2 is further altered to remove the U.S. supply price of capital from its direct role in the definition of the implicit rental price of capital goods used by Canadian business.[5]

Comparing Table 3-A with Table 1-A, it can be seen that the suppression of capital flows does not materially alter the domestic impact of U.S. fiscal policy under either fixed or flexible exchange rates. Capital flows have no direct impact on any of the variables of the MPS model. Thus the differences in U.S. effects reflect the consequences for the U.S. trade account of the substantial influence that U.S. fiscal policy has on the Canadian economy. The trade account effects differ in principle under fixed and flexible exchange rates. The exchange rate does move further when long-term capital is not available to flow north to offset the net reduction in southbound flows of goods, but the difference is slight. Under either exchange rate system, the effects of suppressing long-term capital flows are larger for the more open Canadian economy.

[5]This direct role is related to the proportion of Canadian capital expenditures financed by U.S. direct investment, for which the relevant supply price of capital is that applying in U.S. financial markets. To undertake simulations assuming no long-term capital flows, we use the Canadian supply price of capital in place of the usual weighted average of Canadian and U.S. values.

The effects of U.S. fiscal policy on Canadian real output, under fixed exchange rates, are initially smaller but eventually larger if long-term capital flows are suppressed. The initial effect is smaller because the link is cut that usually joins U.S. final demand to Canadian business capital expenditures through changes in U.S. direct investment in Canada. The larger long-term effect arises because the lower U.S. interest rates no longer have their usual direct but lagged expansionary effect on Canadian business investment. Under flexible exchange rates, the pattern is fairly similar; the price of the U.S. dollar (PFX) is slightly higher when long-term capital flows are exogenous, but not enough to make much difference.

The effects of Canadian fiscal policy on Canadian expenditures and employment are for at least four years slightly smaller if there are no induced long-term capital flows. Under full transmission, the Canadian expenditure cut leads at first to reductions in several forms of capital inflow, some of which reductions lead directly to further cuts in Canadian investment expenditure. With these capital flows, Canadian financial markets become tighter, or less easy, than they would have been with capital flows suppressed. Thus the monetary offset to the fiscal policy has more effect without long-term capital flows, and plays a larger role in moderating the decline in investment expenditure.

The broad conclusion from the results in parts A and B of Tables 1 and 3 is that long-term capital flows have a fairly modest role in the transmission of the effects of fiscal policy. It is perhaps surprising that the Table 1 similarity between fixed and flexible exchange rates does not disappear when long-term capital flows are suppressed. The suspicion immediately arises that short-term rather than long-term capital is flowing to make the fixed and flexible rate systems operate in such a similar fashion; which leads us into the next section.

4. *Transmission with All Capital Flows Suppressed*

The suppression of short-term capital flows is tied up closely with the specification of the foreign exchange market. The fixed rate model in RDX2 includes separate private and official demand equations for foreign exchange, which are solved jointly to determine the exchange rate and the change in foreign exchange reserves. To conduct the experiments underlying Table 4, we replaced the usual private demand equation by an expression equal to the negative of the U.S. dollar equivalent of current quarter's Canadian balance on trade and long-term capital accounts, thus eliminating private short-term capital flows. The official demand equation was left untouched, thus permitting the price of foreign exchange to move between its support margins.

For the flexible exchange rate system, the complete suppression of short-term capital flows is not consistent with short-term stability in a quarterly model. A devaluation leads immediately to an increase in the demand for foreign exchange by the devaluing country in order to pay its

larger import bill. After some lags, export prices and quantities increase, and import volumes drop, but in the current quarter the exchange market is unstable if capital flows are eliminated entirely. We altered the structure of the estimated spot foreign exchange rate equation by removing all interest rate effects, and by shortening the lags and increasing the current responses of the rate to any imbalance of trade. Part 2 of the appendix describes these adjustments, the corresponding adjustments to the forward rate equation, and the changes to both spot and forward exchange rates under the fixed rate system. The figures for the Canadian current-dollar trade balance (XBAL$) in the flexible exchange rate part of Table 4 indicate the extent to which our revised model of the flexible exchange rate still permits short-term capital flows (the "leads and lags") to remain in the model.

The simulation results show much greater movement of the foreign exchange rate, especially under the influence of Canadian fiscal policy. In the 4th year of Canadian fiscal cut the price of U.S. dollars (PFX) is down by 2.4 percent, compared to increases of 1.27 percent with full transmission and 1.04 percent with long-term capital flows suppressed. There are correspondingly larger differences between the fiscal policy effects under fixed and flexible exchange rates. Under flexible rates, the effects of Canadian fiscal policy on domestic real output, employment, and prices are much larger without capital flows, especially after four years or more, and are substantially larger than the effects under fixed exchange rates.

With fixed exchange rates, the removal of capital flows gives fiscal policy a substantial impact on foreign exchange reserves. After eight years of Canadian fiscal policy, Canadian reserves are up by $1200 million, more than 20 times as much as with full transmission. The real expenditure and employment effects are slightly greater at first and then smaller than with full transmission. Except for the change in reserves, the fixed exchange rate results with all capital flows suppressed are very similar to those with just long-term flows suppressed. In part this reflects the fact that short-term capital flows, which must be treated on a net basis, cannot be integrated fully into the private sector asset and liability accounting of RDX2. The additions to foreign exchange reserves influence monetary conditions by increasing the supply of Government interest-bearing debt, which alters the relative supplies of Government debt and private real capital, thus reducing the supply price of capital to business relative to interest rates on government securities.

The movements in the exchange rate are large enough to make the choice of exchange system alter the effects on the United States of either country's fiscal policy. Under flexible exchange rates, the United States is slightly more influenced by its own fiscal policy and less affected by Canadian fiscal policy. The suppression of all capital flows makes the Canadian economy more responsive to U.S. fiscal policy (but not at first) under fixed exchange rates and less responsive under flexible rates.

Table 4-C shows the impact of U.S. monetary policy with no capital flows. The effects in the United States do not differ markedly from those in Table 1-C except for the stock of short-term claims held by foreign governments, including Canada. With no capital flows, the effects on Canada of U.S. monetary policy differ from the effects of U.S. fiscal policy chiefly because of the different expenditure composition and price effects of the two policies.

5. *Transmission with Migration and Capital Flows Suppressed*

The two parts of Table 5 contain results from simulations combining the assumptions of Tables 2 and 4. The only remaining linkages are through trade flows and prices, as in the experiments described in the papers by Waelbroeck and Dramais, Johnson and Klein, and Hickman.

This section contains a comparison of the results of Tables 5-A and 5-B with the corresponding Project LINK results reported in this volume by Bert Hickman. The LINK system used by Johnson and Klein is slightly more up to date than that used by Hickman, but Hickman's simulation assumptions and methods of tabular presentation correspond more closely with those used for the current experiments with the RDX2-MPS system. Detailed comparison of our results with the Common Market simulations undertaken by Waelbroeck and Dramais will be deferred until more comparable material is available.

The comparison of our results with those based on the U.S. Wharton model and the Canadian TRACE model used in Project LINK will be in two parts. First, the fixed exchange rate results in Tables 5-A and 5-B. will be compared to the U.S. and Canada own-country and cross effects reported by Hickman. Then the fixed and flexible exchange results from the RDX2-MPS system will be compared to corresponding results from the TRACE model recently reported by Carr, Jump, and Sawyer (1974).

First, the own-country results of fiscal policy. In MPS, the real GNE multipliers for the first three years are 1.53, 2.02, and 1.64, compared to 1.18, 1.87, and 2.58 for the LINK simulations of the Wharton Model.[6] The Wharton Model apparently does not have as strong cyclical responses as does MPS. M1$ (currency plus demand deposits) is exogenous in MPS, and the monetary base is exogenous in the Wharton Model, so that the financial concomitants of fiscal policy are roughly the same in the two models.

[6]The LINK results are "elasticity multipliers," which become increasingly smaller than true multipliers if the simulation proceeds in a context of growth. Offsetting this effect is the definition of the expenditure change in nominal terms in the LINK simulations of U.S. and Canadian fiscal policy, which implies a smaller real change as time progresses. If prices and real GNE are growing at about the same rate, then Hickman's calculations will be close in nature to the multipliers reported in Table 5. Another non-comparability arises from the use of an expenditure increase in the simulations reported by Hickman, and by Carr et al, while RDX2 and MPS are simulated with an expenditure cut.

In the Table 5-B simulations of RDX2, the real GNE multipliers for the first three years are .86, .94, and .53, compared to 1.15, 1.15, and .79 for the LINK simulations of the TRACE model. However, Hickman's simulations were apparently run with a slightly out-of-date version of the TRACE model. If the latest version of TRACE is simulated with a rigidly fixed exchange rate and M1 held constant, as reported by Carr et al (1974, Table 3), the real GNE multipliers are .79, .48, and .25 for the first three years.[7] Thus the TRACE multipliers are less than one-third as large, in the third year of simulation, if the latest version of TRACE is used instead of that employed by Hickman. These differences are disturbingly large. If periodic revisions to model structure can lead to substantial changes in multipliers, we must be cautious when interpreting the resulting calculations in the magnitude of international transmissions.

In the second year of Hickman's LINK simulations of U.S. fiscal shock, Canadian real GNE has changed by .56 percent, compared to .08 percent in the Table 5-A results and .19 percent in Table 1-A.[8] If the LINK results are restated to roughly correspond to the TRACE multipliers reported by Carr et al, they become .23 percent, not strikingly different from the results from the fully linked RDX2-MPS system. The dynamics remain noticeably different, however.

Dealing with the effects of Canadian fiscal policy on the United States, Hickman reports second year effects of .12 percent of U.S. GNE compared with .04 percent to .05 percent from the RDX2-MPS system, depending on the degree on linkage. The figures come into close correspondence when we note that the effects of fiscal policy in TRACE become .48 percent rather than 1.15 percent of GNE if the Carr et al multipliers are used.

[7]The simulations by Carr et al make use of version IIIR of TRACE, while Hickman uses version II. There are several differences in structure between the two versions. Among others, the consumption, investment, and interest rate equations are specified differently. Detailed study of comparable simulations would be required to find which are the more important causes of the large discrepancies between the Hickman and the Carr et al results, especially in the second and third years. Version II is described in Choudry et al, 1972. The TRACE econometric model of the Canadian economy, (University of Toronto Press, Toronto), while version IIIR is described in Jack Sawyer's Februrary 1974 Report referred to by Carr et al. The simulations by Carr et al use a constant-dollar expenditure increase, so that true multipliers can be calculated by multiplying the total GNE effects by 2.0, because the size of shock is .5 billion 1961 dollars.

[8]The Table 5 results for the Canadian effects of U.S. fiscal policy reflect an understatement, as the weighted average of U.S. final demands (where the weights depend on import coefficients from the U.S. input-output table) used in explaining Canadian exports to the United States does not include Federal Government expenditure. If the export equation is re-specified to include a weighted average of all major U.S. final demands in the current period, including Federal expenditure and inventory accumulation, the second-year Canadian effect of U.S. fiscal policy rises from .08 percent to .20 percent, and subsequently reverses much faster than in the present system. The revised system described also includes a re-specified export price equation, removing energy exports and the influence of U.S. capacity utilization.

Turning finally to the comparison of fixed and flexible exchange rates, the Table 5 results can be related to those reported by Carr et al. They report that in the second year of expenditure increase under flexible exchange rates the multiplier is .85, compared to .48 under fixed exchange rates with constant M1. For RDX2, the second year GNE multipliers are smaller under flexible exchange rates than under pegged rates if capital flows are endogenous (as in Tables 1-B and 2-B) and about equal if capital flows and migration are suppressed. Capital flows are apparently substantially more responsive to interest and income in RDX2 than in TRACE, and trade flows less quickly responsive to changes in the exchange rate. A further difference is posed by the different specification of short-term capital flows in the two models. In TRACE, short-term capital flows are influenced only by short-term interest rates. In RDX2, however, short-term capital flows play a crucial buffer-stock role in smoothing the clearance of trade and long-term capital flows through the foreign exchange market. Indeed, without such a role for short-term capital flows (which exists in all the quarterly Canadian models surveyed in Helliwell (1974)), the foreign exchange market would be unstable in a quarterly model because of the lags in the effects of prices on trade flows.[9] Even in Table 5-B, in which the role of short-term capital flows is minimized, there is still some buffer-stock role for short-term capital, thus deferring the time when differences between fixed and flexible exchange rate systems become large.

6. *Fiscal Policies in Closed Economies*

The natural terminus for our series of experiments is a pair of fiscal policy simulations in which there are no international linkages in play. The links are cut by performing separate single-model simulations for RDX2 and for MPS, with the trade sector exogenous in MPS and all trade, capital flows, capital balances, and migration exogenous in RDX2. Other adjustments were made consistent with the ones underlying Tables 2 through 5, but there are still some respects in which the simulations do not represent the operation of fully closed economies. Despite these problems, the results of the closed economy simulations are strikingly different from the results in any of the other tables. Naturally, the differences are greater for RDX2 than for MPS, because trade flows are four times larger, relative to GNE, in Canada than in the United States.

Table 6 is more abbreviated than the other tables, as there remain no distinctions between fixed and flexible exchange rates, no effects of one

[9]In a footnote, Carr et al criticize RDX2 for using a "reduced form" equation for the foreign exchange rate and ignoring the restrictions imposed by the structure of the model. In fact, the RDX2 exchange rate equation is just a re-normalization of the equation for the private demand for foreign exchange, and contains all of the determinants of that demand. Presumably, Carr et al would like to see the restriction imposed that the exchange rate move far enough to clear all trade and long-term capital flows through the foreign exchange market in the current period. As noted in the text and the appendix, this apparently is inconsistent with exchange market stability in a quarterly model.

country's policies on domestic variables in the other country, and there are no international variables to report. The extra space has been put to use in reporting some of the domestic consequences for the average of the quarterly values in each year of the simulation.

7. *Prospects for Future Research*

Within the historical simulation context used for this paper, we are interested in performing a range of experiments designed to unravel past policy choices to assess their consequences within the linked system. Studies have already been undertaken using RDX2 alone to assess the Canadian effects of the U.S. DISC program (Helliwell and Lester, 1972), the U.S. Interest Equalization Tax (Grady, 1974), changes in the exchange rate linking Canada and the United States (Helliwell, 1972), and the Canadian Conversion Loan of 1958 (Christofides, 1973). These and other studies of economic policies with international ramifications can be enriched by using the linked RDX2-MPS system, especially where the policies have substantial direct effects within the United States.

To get a clearer idea of the dynamics of the transmission process, we have been developing simulation environments in which all of the exogenous variables follow mutually consistent but steady growth paths. We plan to do this in a general enough way that any or all of the basic causes of economic growth can be set to arbitrary values. It is naturally more of a job to obtain model specifications that are consistent with no-growth as well as steady growth conditions. So far, we have made the no-growth adjustments separately from the steady growth adjustments, but eventually we would like to be able to study the pure dynamics of the system for any pattern of assumptions about birth rates, monetary growth, and disembodied technical progress.

We would like to be able to study the implications of large and sharp changes in the price of oil and other widely traded raw materials. Short of building natural resource inputs more securely into national models, there is still much that can be done to trace the balance of trade and payments implications of big shifts in raw material prices. The data problems here are well-known, so that we do not expect to make much progress soon. Our first step has been to isolate Canadian exports of oil and natural gas from other exports of goods to the United States.

A separate paper (Helliwell and McRae, 1974) assesses the domestic and foreign consequences of alternative monetary policy strategies in the two countries. Two polar strategies are tested within the context of a flexible exchange rate system. The first involves keeping M1 equal to control, as in this paper, while the second involves a policy directed to holding a short-term nominal interest rate at its control solution values. In general, the M1 rule provides the best protection against domestic expenditure consequences of foreign fiscal policies, regardless of the monetary rule used by the initiating country. The exchange rate effects are minimized by using the opposite monetary strategy to that employed by the initiating country.

In the future, we hope to assess alternative monetary strategies under exchange systems involving official support of the exchange rate, where the monetary strategies must be broadened to encompass links between foreign exchange reserves and the national money supply.

We have not lost sight of the possibilities for more comprehensive linkage on a balanced multilateral basis, but that must be a very long-term goal, and will probably best be accomplished by adding new features to the various national models in the Project LINK system, or by starting from scratch with symmetric systems of the sort described by Waelbroeck and Dramais. Within the RDX2-MPS framework, however, there are nevertheless some obvious possibilities for establishing links with a balanced set of European models, a Japanese model, and various commodity models being developed within Project LINK.

There is substantial scope for assessing policy strategies with international repercussions in a game-theoretic context, as suggested by Hamada (1974).

For most of the experiments described above, a long and relatively noise-free simulation environment is required. Therefore we are placing high priority to efforts to tie our historical and forecasting contexts together, so that we can run experiments from the early 1960s to 1985 and beyond. RDX2 is safely simulating to 1985 in its current version, but we have not yet been able to develop sound control solutions for MPS that far into the future. For this we hope to draw more heavily on the skills of the U.S. users of the model, who no doubt have other reasons for wishing to use MPS to depict some of the possibilities beyond 1980.

Appendix

This appendix has two sections. In the first, we describe the versions of RDX2 and MPS used in our simulations, and indicate the changes that have been made to the most recently published versions. In the second section, we describe the mechanics of the linkage simulations, including the methods that we have used to implement policies and suppress transmission mechanisms.

1. *RDX2 and MPS*

The model is basically that described in Helliwell et al (1971), as revised and estimated to 4Q70 and presented in Helliwell and Maxwell (1974). The main change we have made for our linked simulations is to build in a new equation for Canadian exports of goods to the United States, excluding motor vehicles and energy products. Energy exports to the United States increased rapidly after 1970, and we wish to be able to simulate easily within the linked system the consequences of alternative policies relating to energy trade between the two countries. By treating energy exports as a separate exogenous series, we are able to facilitate these simulations and to obtain a more satisfactory equation for the main southbound flow of goods. The price elasticity of the new equation is -1.09 with respect to a 16-quarter moving average of the ratio of the Canadian export price to the Canadian dollar equivalent of the price of U.S. non-farm business product. Interestingly enough, this same long lag on relative prices also worked best in explaining exports of goods from the United States to countries other than Canada.

We are using version "S" of the MPS Model, with a mimeographed equation list dated January 1973. The equation for the dividend/price ratio dates from mid-1973. Our earlier experiments used a version for which the equation list was dated January 1971. There is no published version of the current model, but Albert Ando (1974) has recently described the theoretical features of the model, and Ando and Modigliani (1975) are working on a monograph describing the structure and properties of version S. MPS has four equations for imports, split between goods and services and between Canada and other countries. For our current simulations, the model was run with M1$ exogenous and the residuals added back to the RTB equation. Structural alterations made especially for our simulations include:

1. The equations for imports from Canada are replaced by the RDX2 equations for the same flows, with an exogenous series used to adjust for data discrepancies.

2. All U.S. exports of goods and services are now endogenous to the linked system. The constant-dollar total of Canadian imports from the United States, as determined from the nine RDX2 equations for these items, is adjusted by fixed proportionate seasonal adjustment factors and

divided by 258.05 to convert the flow into U.S. exports to Canada, measured as a quarterly flow at annual rates. This series is subtracted from EEX, the series for total U.S. exports, to obtain X23, a new series for exports to countries other than Canada. This series is explained by a log-linear equation showing an elasticity with respect to total world imports (excluding North America) of .77, and a price elasticity of -.90 with respect to a 16-quarter moving average of PEEX/PWXG. This lag length gave better fit and higher price elasticity than did longer or shorter lags, whether based on moving averages or Almon variables. The dock strike variable JDOCK also contributes significantly to the equation, which has an RB2 of .969 in its log form.

3. The MPS export price index is made endogenous by an estimated equation that explains PEEX in terms of the main U.S. price PXBNF and the U.N. index for the price of world exports of goods. That index (PWXG in RDX2) is defined in terms of U.S. dollars, so that no exchange rates are used in the equation for PEEX. The MPS export price index is not used in explaining trade flows to Canada, because RDX2 makes use of more disaggregated import prices, but is needed to obtain an appropriate distinction between changes in the value and volume of trade in the U.S. national income and expenditure accounts.

4. The MPS import price is left exogenous for imports from countries other than Canada. To deflate imports from Canada for national accounts purposes, PEIM is replaced by EPEIM*PXNMV12/PFX, where EPEIM is a new exogenous series defined so as to make the substitution exact in terms of historical data.

5. The 90-day London Eurodollar rate (REUR in RDX2) is made endogenous for our linked simulations by means of an identity: REUR = .72*RTB2 + EREUR where EREUR is a new exogenous series defined to make the equation fit exactly over the historical period. The coefficient on the U.S. Treasury bill rate is based on recent work by Herring and Marston. We selected a coefficient that excludes periods of extreme credit tightness in the United States and abstracts from the effects of U.S. interest rates on European central bank discount rates.

In the course of further research we intend to make the structure of MPS more compatible than that of RDX2, and to complete the linkage between MPS and the non-Canadian world. Some notable prospects for change include:

1. The wage/price dynamics and theory differ too much between the models. The main MPS price equation is constrained to have an elasticity of 1.0 with respect to normal unit labor costs, while the wage rate has an elasticity much less than 1.0 with respect to consumer prices, even after all lags are worked out. In RDX2, by contrast, the long-term elasticity of the wage rate with respect to consumer prices is constrained to be 1.0, while the average elasticity of the aggregate output price with respect to normal unit labor costs is about equal to labor's share in value-added. John Lester has been experimenting with a number of alternatives for MPS that are more consistent with RDX2.

2. Possible explanation of migration, or at least an attempt to allocate some of Canadian migration to U.S. sources or destinations.

3. Modelling U.S. capital flows, and integrating them with a more fully specified portfolio model of U.S. wealth allocation among domestic and foreign assets.

4. Development of measures of capacity output more closely related to aggregate factor supplies. The present variable (XBC) is a slowly moving weighted average of past levels of actual output.

5. Perhaps an application of the RDX2 factor demand and disequilibrium adjustment framework to MPS.

We hope to encourage some of the U.S. proprietors or users of MPS to direct some of their efforts to certain of the areas outlined above.

2. *Mechanics of Linkage and Policy Simulations*

Thanks to efforts over the years by Ian Stewart, Al Coombs, Tom Maxwell, and Robert McRae, our simulation program has the ability to simulate RDX2 and MPS together or separately, and to accept new versions of either model quickly into the linkage framework. In each quarter, MPS is solved first; then subroutines are called to define the U.S. variables used in RDX2 in terms of the solution values from MPS. RDX2 is then solved, and subroutines called to translate the RDX2 output to the form required for MPS. MPS is then solved again, and the process continues until the linked system converges The procedure is repeated for each quarter.

The suppression of certain elements of the linkage is fairly straightforward. Migration is suppressed by altering SOLV26 and using POLICY to get NIMS and NEMS equal to their control solution values. Long-term capital flows are suppressed by declaring exogenous the sectors CAPACT and CAPBAL, and by substituting .668*RHO for RHO2 in the equations for RCME and RCNR. Short-term capital flows are suppressed in the fixed rate model by using FXP = -UBAL/PFX instead of the usual equation, and by setting at zero the coefficient on the interest rate term in the PFXF equation. In the flexible rate model, a similar change was made to the PFXF equation, and the following equation was used for the spot exchange rate:

$$PFX = .25 + .75*J1L(PFX) - .2(UBAL/PFX) + .03*J1L(ULS)$$

the equation used for the simulation reported in the first version of the paper had coefficients only one-quarter as large for UBAL/PFX and half as large for ULS. In the course of revision, we experimented further by doubling the speed of response of the exchange rate until the exchange market in the control solution became unstable. We adopted the fastest successful rule for the simulations reported in Tables 4 and 5. The exchange rate now moves faster and reverses its movement sooner than in the results reported earlier.

The closed economy simulations involved single-model solutions of MPS with the FORGN subroutine exogenous. For RDX2, the above adjustments for RCME, RCNR, NIMS, and NEMS were supplemented by making four sectors exogenous — CAPACT, CAPBAL, FOREXC, TRADE.

Canadian monetary policy was modelled in the control solutions by replacing the estimated reaction function for RS by the following equation based on a target rate of growth for the sum of currency held by the non-bank public and demand deposits at the chartered banks.

```
RS = J1L(RS) — .001*(1.065*J4L(ANFCUR+DDB) —
     (.963*Q1 + 1.048*Q2 + 1.009*Q3
     + 1.046*Q4) *J1L(ANCFUR + DDB))
```

In the first version of this paper, the above monetary policy rule was also used for the shock simulations, as a reasonably operational counterpart of the MPS monetary assumption that M1$ is held constant when fiscal policy is changed. In this final version of the paper, the Canadian money supply M1$C is forced to be identical in shock and control solutions. Although this type of accommodating monetary policy may be harder to put into practice, given the lags between monetary changes and the final adjustments to M1, it makes the RDX2 results more closely comparable to the MPS results.

The U.S. monetary policy was modelled by removing the historical series for M1$ and substituting a series with the same value in the fourth quarter of 1962, growing thereafter at an annual rate 1 percent slower than the actual rate of growth.

The U.S. fiscal shock was accomplished by subtracting 5.51 from the exogenous series for constant-dollar Federal Government expenditure.

The Canadian fiscal policy was modelled by subtracting 111.*J1L*PGCNWF from the equation for GCNWF. For both models, the changes had the effect of subtracting, on a continuing basis, a constant-dollar amount equal to 1 percent of the country's 1963 constant-dollar GNE.

Table 1-A

U.S. Fiscal Policy with Full Transmission

Reduction of U.S. Federal Government Expenditure, 1963-1970
Sustained Cut Equal to 1% of 1963 U.S. GNE

Change in Variables	Effects in U.S. Fixed	Effects in U.S. Flexible	Effects in Canada Fixed	Effects in Canada Flexible
Real Private Business Output (% of Control)				
2nd Year	-2.12	-2.11	-0.19	-0.21
4th Year	-0.84	-0.84	+0.27	+0.19
6th Year	-1.66	-1.99	-0.01	-0.09
8th Year	+0.85	+0.92	+0.83	+0.80
Real GNE Multiplier (US), or Induced Effects As % of 1963 GNE (Canada)				
2nd Year	+2.03	+1.97	-0.15	-0.16
4th Year	+0.93	+0.88	+0.28	+0.22
6th Year	+1.95	+2.31	+0.10	+0.05
8th Year	-1.07	-1.09	+1.19	+1.25
Price of GNE (% of Control)				
2nd Year	-0.21	-0.21	+0.02	+0.01
4th Year	-1.08	-1.08	-0.11	-.20
6th Year	-2.78	-2.88	-0.44	-0.54
8th Year	-5.11	-5.55	-1.14	-1.14
Unemployment Rate (Percentage Points)				
2nd Year	+0.49	+0.48	+0.10	+0.11
4th Year	+0.37	+0.36	-0.06	-0.02
6th Year	+0.46	+0.53	+0.17	+0.19
8th Year	+0.10	+0.11	-0.01	+0.02
Short-term Interest Rate (Percentage Points)				
2nd Year	-0.29	-0.29	-0.02	-0.02
4th Year	-0.32	-0.32	-0.01	-0.03
6th Year	-0.87	-0.99	-0.06	-0.09
8th Year	-1.61	-1.79	—	-0.06

International Effects	Fixed Rate Reserves	Fixed Rate X BAL $	Flexible Rate PFX % ch	Flexible Rate X BAL $
Can. Reserves in Mill $ U.S. X BAL $ Is Change In Can. Total Trade Balance in Mill $ Can. PFX Is $ Can./$ U.S.				
2nd Year	+4.	+9.	-0.37	-1.
4th Year	—	-170.	-0.35	-178.
6th Year	+5.	-155.	-0.79	-191.
8th Year	+11.	-277.	-1.86	-480.

Southbound Trade Flows (Canadian Current-Dollar Exports to U.S.)	% Change	Mill$	% Change	Mill$
2nd Year	-0.48	-30.	-0.63	-39.
4th Year	-1.43	-118.	-1.71	-135.
6th Year	-2.43	-270.	-2.90	-314.
8th Year	-2.31	-342.	-3.35	-501.

Northbound Trade Flows (Canadian Current-Dollar Imports from U.S.)	% Change	Mill$	% Change	Mill$
2nd Year	-0.36	-27.	-0.42	-31.
4th Year	+0.32	+32.	+0.18	+17.
6th Year	-0.79	-95.	-0.93	-112.
8th Year	-0.37	-59.	-0.53	-85.

Table 1-B

Canadian Fiscal Policy with Full Transmission

Reduction of Canadian Federal Government Nonwage Expenditure, 1963-1970
Sustained Cut Equal to 1% of 1963 Canadian GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.04	-0.06	-1.35	-1.28
4th Year	-0.08	-0.09	-1.19	-0.89
6th Year	-0.07	-0.40	-0.95	-0.83
8th Year	+0.06	+0.11	-0.66	-0.94
Real GNE Multiplier (Canada), or Induced Effects As % of 1963 GNE (US)				
2nd Year	-0.04	-0.06	+0.89	+0.83
4th Year	-0.09	-0.10	+0.80	+0.58
6th Year	-0.08	-0.48	+0.65	+0.63
8th Year	+0.08	+0.14	+0.52	+0.84
Price of GNE (% of Control)				
2nd Year	—	—	-0.66	-0.61
4th Year	-0.02	-0.03	-1.37	-1.06
6th Year	-0.09	-0.21	-1.12	-0.73
8th Year	-0.19	-0.64	-0.58	-0.67
Unemployment Rate (Percentage Points)				
2nd Year	+0.01	+0.02	+0.65	+0.63
4th Year	+0.02	+0.03	+0.25	+0.12
6th Year	+0.01	+0.08	-0.23	-0.19
8th Year	—	+0.01	-0.15	+0.19

Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.01	-0.01	-0.52	-0.55
4th Year	-0.02	-0.02	-0.69	-0.59
6th Year	-0.04	-0.15	-0.39	-0.33
8th Year	-0.05	-0.23	-0.11	-0.12

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X BAL $	PFX % ch	X BAL $
Can. Reserves in Mill $ U.S. X BAL $ Is Change In Can. Total Trade Balance in Mill $ Can. PFX Is $ Can./$ U.S.				
2nd Year	-11.	+153.	+1.23	+199.
4th Year	-9.	+298.	+1.27	+327.
6th Year	-1.	+312.	+0.32	+318.
8th Year	+57.	+246.	-1.00	+184.

Southbound Trade Flows (Canadian Current-Dollar Exports To U.S.)	% Change	Mill$	% Change	Mill$
2nd Year	-0.42	-26.	+0.18	+11.
4th Year	-0.17	-13.	+0.81	+65.
6th Year	+0.27	+30.	+0.66	+70.
8th Year	+0.29	+42.	-0.39	-60.

Northbound Trade Flows (Canadian Current-Dollar Imports From U.S.)	% Change	Mill$	% Change	Mill$
2nd Year	-1.45	-111.	-1.30	-98.
4th Year	-1.92	-196.	-1.37	-136.
6th Year	-1.53	-183.	-1.26	-149.
8th Year	-0.93	-145.	-1.24	-195.

Table 1-C

U.S. Monetary Policy With Full Transmission

Reduction in Rate of Growth of M1$, 1963-1970
New Exogenous M1$ Grows 1% Less Fast Than Historical Series

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.64	-0.65	-0.17	-0.14
4th Year	-1.79	-1.81	-0.47	-0.30
6th Year	-3.36	-3.70	-0.96	-0.69
8th Year	-3.91	-3.88	-0.83	-0.60

Induced Effects As % of 1963 GNE				
2nd Year	-0.62	-0.62	-0.13	-0.11
4th Year	-1.96	-1.99	-0.40	-0.27
6th Year	-4.05	-4.47	-0.80	-0.63
8th Year	-4.84	-4.81	-0.62	-0.47
Price of GNE (% of Control)				
2nd Year	-0.03	-0.03	—	+0.02
4th Year	-0.37	-0.37	-0.07	+0.09
6th Year	-2.02	-2.12	-0.25	+0.08
8th Year	-5.36	-5.82	-0.87	-0.57
Unemployment Rate (Percentage Points)				
2nd Year	+0.13	+0.13	+0.06	+0.05
4th Year	+0.40	+0.41	+0.22	+0.14
6th Year	+0.75	+0.82	+0.37	+0.32
8th Year	+0.93	+0.95	+0.46	+0.52
Short-Term Interest Rate (Percentage Points)				
2nd Year	+0.34	+0.34	—	—
4th Year	+0.63	+0.63	-0.08	-0.02
6th Year	+0.43	+0.32	-0.14	-0.09
8th Year	-0.13	-0.33	-0.26	-0.18

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X BAL $	PFX % ch	X BAL $
Can. Reserves in Mill $ U.S.				
X BAL $ Is Change In Can. Total				
Trade Balance in Mill $ Can.				
PFX Is $ Can./$ U.S.				
2nd Year	-8.	+12.	+0.57	+29.
4th Year	-19.	-19.	+1.14	+10.
6th Year	-32.	-203.	+1.55	-155.
8th Year	-149.	-524.	+1.16	-548.
Southbound Trade Flows				
(Canadian Current-Dollar Exports to U.S.)				
	% Change	Mill$	% Change	Mill$
2nd Year	-0.18	-12.	+0.06	+4.
4th Year	-1.16	-96.	-0.56	-45.
6th Year	-3.53	-393.	-2.88	-312.
8th Year	-5.76	-855.	-5.45	-819.
Northbound Trade Flows				
(Canadian Current-Dollar Imports fromU.S.)				
	% Change	Mill$	% Change	Mill$
2nd Year	-0.21	-16.	-0.13	-9.
4th Year	-0.47	-48.	-0.14	-14.
6th Year	-1.01	-122.	-0.58	-69.
8th Year	-1.36	-213.	-0.88	-139.

Table 2-A

U.S. Fiscal Policy with Migration Suppressed

Reduction of U.S. Federal Government Expenditure, 1963-1970
Sustained Cut Equal to 1% of 1963 U.S. GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-2.12	-2.11	-0.20	-0.22
4th Year	-0.84	-0.84	+0.25	+0.18
6th Year	-1.66	-1.99	-0.14	-0.19
8th Year	+0.85	+0.91	+0.71	+0.70
Real GNE Multiplier (US), or				
Induced Effects As % of 1963 GNE (Canada)				
2nd Year	+2.03	+2.03	-0.16	-0.17
4th Year	+0.93	+0.93	+0.26	+0.21
6th Year	+1.96	+2.36	-0.03	-0.05
8th Year	-1.07	-1.14	+1.04	+1.12
Price of GNE (% of Control)				
2nd Year	-0.21	-0.21	+0.02	+0.01
4th Year	-1.08	-1.08	-0.11	-0.20
6th Year	-2.78	-2.88	-0.43	-0.53
8th Year	-5.11	-5.55	-1.11	-1.37
Unemployment Rate (Percentage Points)				
2nd Year	+0.49	+0.49	+0.09	+0.10
4th Year	+0.37	+0.37	-0.08	-0.03
6th Year	+0.46	+0.53	+0.08	-0.11
8th Year	+0.10	+0.12	-0.11	-0.08
Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.29	-0.29	-0.02	-0.03
4th Year	-0.32	-0.32	-0.02	-0.04
6th Year	-0.88	-0.99	-0.09	-0.12
8th Year	-1.61	-1.79	-0.01	-0.07

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX %ch	X Bal $
Can. Reserves in Mill $ U.S.				
X Bal $ Is Change in Can. Total				
Trade Balance in Mill $ Can.				
PFX is $ Can./$U.S.				
2nd Year	+4.	+9.	-0.37	—
4th Year	—	-169.	-0.35	-177.
6th Year	+5.	-141.	-0.74	-178.
8th Year	+13.	-264.	-1.85	-464.

Southbound Trade Flows
(Canadian Current-Dollar Exports to U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-0.48	-30.	-0.63	-39.
4th Year	-1.43	-117.	-1.71	-135.
6th Year	-2.43	-270.	-2.89	-312.
8th Year	-2.29	-339.	-3.31	-497.

Northbound Trade Flows
(Canadian Current-Dollar Imports from U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-0.37	-28.	-0.43	-32.
4th Year	+0.31	+31.	+0.17	+17.
6th Year	-0.88	-107.	-1.00	-120.
8th Yeear	-0.44	-70.	-0.60	-95.

Table 2-B

Canadian Fiscal Policy With Migration Suppressed

Reduction of Canadian Federal Government Nonwage Expenditure, 1963-1970
Sustained Cut Equal to 1% of 1963 Canadian GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.04	-0.06	-1.26	-1.19
4th Year	-0.07	-0.08	-0.73	-0.49
6th Year	-0.06	-0.40	-0.46	-0.48
8th Year	+0.05	+0.08	-0.38	-0.68
Real GNE Multiplier (Canada), or Induced Effects as % of 1963 GNE (U.S.)				
2nd Year	-0.04	-0.06	+0.81	+0.76
4th Year	-0.08	-0.09	+0.37	+0.21
6th Year	-0.07	-0.47	+0.10	+0.22
8th Year	+0.06	+0.10	+0.13	+0.48
Price of GNE (% of Control)				
2nd Year	—	—	-0.66	-0.60
4th Year	-0.02	-0.03	-1.40	-1.11
6th Year	-0.08	-0.20	-1.28	-0.94
8th Year	-0.17	-0.65	-0.82	-0.88
Unemployment Rate (Percentage Points)				
2nd Year	+0.01	+0.01	+0.73	+0.71
4th Year	+0.01	+0.02	+0.63	+0.48
6th Year	+0.01	+0.08	+0.22	+0.20
8th Year	—	+0.02	+0.10	+0.34

Short-Term Interest Rate (Percentage Points)

2nd Year	-0.01	-0.01	-0.46	-0.50
4th Year	-0.02	-0.02	-0.54	-0.47
6th Year	-0.03	-0.15	-0.35	-0.32
8th Year	-0.05	-0.25	-0.14	-0.15

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX %ch	X Bal $
Can. Reserves in Mill $ U.S. X Bal $ Is Change in Can. Total Trade Balance in Mill $ Can. PFX is $ Can./$U.S.				
2nd Year	-10.	+148.	+1.17	+194.
4th Year	-7.	+259.	+1.02	+283.
6th Year	-3.	+267.	+0.29	+279.
8th Year	+51.	+261.	-0.84	+209.

Southbound Trade Flows
(Canadian Current-Dollar Exports to U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-0.42	-26.	+0.16	+11.
4th Year	-0.20	-16.	+0.66	+53.
6th Year	+0.19	+21.	+0.48	+51.
8th Year	+0.25	+38.	-0.37	-56.

Northbound Trade Flows
(Canadian Current-Dollar Imports from U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-1.40	-107.	-1.26	-95.
4th Year	-1.63	-166.	-1.15	-114.
6th Year	-1.22	-146.	-1.09	-129.
8th Year	-0.90	-141.	-1.21	-191.

Table 3-A

U.S. Fiscal Policy with Long-Term Capital Flows Suppressed

Reduction of U.S. Federal Government Expenditure, 1963-1970
Sustained Cut Equal to 1% of 1963 U.S. GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-2.11	-2.11	-0.11	-0.13
4th Year	-0.86	-0.87	-0.13	-0.20
6th Year	-1.65	-1.99	-0.09	-0.15
8th Year	+0.83	+0.92	+0.47	+0.23
Real GNE Multiplier (U.S.), or Induced Effects as % of 1963 GNE (Canada)				
2nd Year	+2.02	+2.02	-0.09	-0.11
4th Year	+0.95	+0.96	-0.06	-0.10
6th Year	+1.94	+2.36	+0.03	-0.01
8th Year	-1.05	-1.15	+0.76	+0.59
Price of GNE (% of Control)				
2nd Year	-0.21	-0.21	+0.05	+0.04
4th Year	-1.07	-1.08	-0.22	-0.32
6th Year	-2.77	-2.89	-0.45	-0.55
8th Year	-5.08	-5.57	-0.92	-1.24
Unemployment Rate (Percentage Points)				
2nd Year	+0.49	+0.48	+0.07	+0.08
4th Year	+0.37	+0.37	+0.14	+0.17
6th Year	+0.46	+0.53	+0.08	+0.09
8th Year	+0.10	+0.12	-0.05	+0.08
Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.29	-0.29	-0.01	-0.02
4th Year	-0.32	-0.33	-0.06	-0.08
6th Year	-0.87	-0.99	-0.11	-0.15
8th Year	-1.61	-1.81	-0.07	-0.19

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X BAL $	PFX % ch	X BAL $
Can. Reserves in Mill $ U.S. X BAL $ Is Change In Can. Total Trade Balance in Mill $ Can. PFX Is $ Can./$ U.S.				
2nd Year	+4.	-16.	-0.43	-28.
4th Year	—	-64.	-0.31	-77.
6th Year	+2.	-147.	-0.76	-183.
8th Year	-2.	-202.	-1.80	-331.

Southbound Trade Flows (Canadian Current-Dollar Exports to U.S.)	% Change	Mill $	% Change	Mill $
2nd Year	-0.46	-29.	-0.64	-39.
4th Year	-1.54	-126.	-1.82	-143.
6th Year	-2.32	-258.	-2.79	-301.
8th Year	-2.20	-327.	-3.28	-492.
Northbound Trade Flows (Canadian Current-Dollar Imports from U.S.)	% Change	Mill $	% Change	Mill $
2nd Year	-0.13	-10.	-0.20	-15.
4th Year	-0.47	-48.	-0.56	-57.
6th Year	-0.73	-88.	-0.87	-104.
8th Year	-0.74	-120.	-1.23	-202.

Table 3-B

Canadian Fiscal Policy with Long-Term Capital Flows Suppressed

Reduction of Canadian Federal Government Nonwage Expenditure, 1963-1970
Sustained Cut Equal to 1% of 1963 Canadian GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.04	-0.06	-1.31	-1.22
4th Year	-0.04	-0.06	-0.81	-0.56
6th Year	-0.06	-0.41	-1.00	-0.98
8th Year	—	+0.06	-0.81	-1.23
Real GNE Multiplier (Canada), or Induced Effects as % of 1963 GNE (U.S.)				
2nd Year	-0.04	-0.06	+0.85	+0.78
4th Year	-0.04	-0.07	+0.44	+0.28
6th Year	-0.07	-0.49	+0.63	+0.71
8th Year	—	+0.07	+0.56	+1.04
Price of GNE (% of Control)				
2nd Year	—	—	-0.69	-0.63
4th Year	-0.02	-0.03	-1.35	-1.05
6th Year	-0.05	-0.19	-1.46	-1.10
8th Year	-0.10	-0.64	-1.30	-1.37
Unemployment Rate (Percentage Points)				
2nd Year	+0.01	+0.01	+0.65	+0.62
4th Year	+0.01	+0.02	+0.11	-0.01
6th Year	+0.01	+0.08	-0.01	+0.06
8th Year	+0.01	+0.02	+0.08	+0.43

Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.01	-0.01	-0.58	-0.56
4th Year	-0.01	-0.02	-0.70	-0.60
6th Year	-0.03	-0.15	-0.46	-0.39
8th Year	-0.04	-0.25	-0.29	-0.29

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X BAL $	PFX % ch	X BAL $
Can. Reserves in Mill $ U.S.				
X BAL $ Is Change In Can. Total				
Trade Balance in Mill $ Can.				
PFX Is $ Can./$ U.S.				
2nd Year	-6.	+138.	+1.20	+186.
4th Year	-1.	+149.	+1.04	+197.
6th Year	+14.	+276.	-0.12	+297.
8th Year	+85.	+320.	-1.35	+271.

Southbound Trade Flows (Canadian Current-Dollar Exports to U.S.)				
	% Change	Mill $	% Change	Mill $
2nd Year	-0.45	-28.	+0.17	+11.
4th Year	-0.17	-14.	+0.73	+58.
6th Year	-0.01	-1.	+0.19	+19.
8th Year	+0.07	+10.	-0.80	-122.

Northbound Trade Flows (Canadian Current-Dollar Imports from U.S.)				
	% Change	Mill $	% Change	Mill $
2nd Year	-1.32	-99.	-1.16	-86.
4th Year	-0.93	-94.	-0.58	-57.
6th Year	-1.50	-180.	-1.51	-180.
8th Year	-1.22	-199.	-1.80	-295.

Table 4-A

U.S. Fiscal Policy with all Capital Flows Suppressed

Reduction of U.S. Federal Government Expenditure, 1963 — 1970
Sustained Cut Equal to 1% of 1963 U.S. GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-2.11	-2.11	-0.08	-0.08
4th Year	-0.86	-0.88	-0.07	—
6th Year	-1.65	-2.02	-0.10	+0.29
8th Year	+0.83	+0.95	+0.37	+1.39
Real GNE Multiplier (U.S.), or Induced Effects as % of 1963 GNE (Canada)				
2nd Year	+2.02	+2.02	-0.06	-0.06
4th Year	+0.94	+0.97	-0.02	+0.03
6th Year	+1.95	+2.40	—	+0.32
8th Year	-1.05	-1.18	+0.65	+1.38
Price of GNE (% of Control)				
2nd Year	-0.21	-0.21	+0.06	+0.05
4th Year	-1.08	-1.08	-0.21	-0.14
6th Year	-2.77	-2.90	-0.46	-0.23
8th Year	-5.09	-5.64	-1.02	+0.03
Unemployment Rate (Percentage Points)				
2nd Year	+0.49	+0.49	+0.05	+0.05
4th Year	+0.37	+0.37	+0.12	+0.08
6th Year	+0.46	+0.54	+0.10	-0.03
8th Year	+0.10	+0.11	+0.02	-0.35
Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.29	-0.29	-0.03	-0.01
4th Year	-0.32	-0.33	-0.10	-0.01
6th Year	-0.87	-1.01	-0.14	-0.05
8th Year	-1.61	-1.85	-0.12	+0.23

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX % ch	X Bal $
Can. Reserves in Mill $ U.S.				
X Bal $ is Change in Can. Total				
Trade Balance in Mill $ Can.				
PFX is $ Can./ $ U.S.				
2nd Year	-20.	-19.	+0.21	-17.
4th Year	-124.	-66.	+0.88	-26.
6th Year	-348.	-129.	+3.23	-43.
8th Year	-668.	-162.	+2.31	+25.

Southbound Trade Flows (Canadian Current-Dollar Exports to U.S.)	% Change	Mill $	% Change	Mill $
2nd Year	-0.43	-28.	-0.38	-23.
4th Year	-1.48	-121.	-1.08	-83.
6th Year	-2.29	-255.	-1.24	-127.
8th Year	-2.20	-326.	-0.48	-63.

Northbound Trade Flows (Canadian Current-Dollar Imports from U.S.)	% Change	Mill $	% Change	Mill $
2nd Year	-0.08	-6.	-0.05	-4.
4th Year	-0.40	-40.	-0.29	-28.
6th Year	-0.83	-100.	-0.16	-18.
8th Year	-0.88	-143.	-0.04	-7.

Table 4-B

Canadian Fiscal Policy with all Capital Flows Suppressed

Reduction of Canadian Federal Government Nonwage Expenditure, 1963 — 1970
Sustained Cut Equal to 1% of 1963 Canadian GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.05	-0.02	-1.55	-1.56
4th Year	-0.03	-0.01	-0.86	-1.20
6th Year	-0.04	-0.02	-0.73	-1.21
8th Year	+0.01	-0.02	-0.56	-1.32
Real GNE Multiplier (Canada), or Induced Effects as % of 1963 GNE (U.S.)				
2nd Year	-0.05	+0.02	+1.02	+1.03
4th Year	-0.03	+0.01	+0.46	+0.62
6th Year	-0.05	+0.02	+0.41	+0.65
8th Year	+0.01	+0.02	+0.31	+0.56
Price of GNE (% of Control)				
2nd Year	—	—	-0.75	-0.78
4th Year	-0.02	-0.01	-1.39	-1.95
6th Year	-0.05	-0.02	-1.22	-2.08
8th Year	-0.10	-0.05	-1.00	-2.47
Unemployment Rate (Percentage Points)				
2nd Year	+0.01	—	+0.76	+0.78
4th Year	+0.01	+0.01	+0.08	+0.28
6th Year	+0.01	—	-0.21	-0.07
8th Year	—	—	+0.03	+0.22

Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.01	—	-0.44	-0.65
4th Year	-0.01	—	-0.78	-0.87
6th Year	-0.02	-0.01	-0.53	-0.70
8th Year	-0.04	-0.02	-0.22	-0.56

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX % ch	X Bal $
Can. Reserves in Mill $ U.S. X Bal $ is Change in Can. Total Trade Balance in Mill $ Can. PFX is $ Can./ $ U.S.				
2nd Year	+231.	+163.	-2.44	+92.
4th Year	+482.	+131.	-2.37	+17.
6th Year	+779.	+195.	-4.43	+27.
8th Year	+1183.	+251.	-3.00	+46.
Southbound Trade Flows (Canadian Current-Dollar Exports to U.S.)	% Change	Mill $	% Change	Mill $
2nd Year	-0.62	-38.	-1.54	-93.
4th Year	-0.29	-23.	-2.04	-157.
6th Year	+0.05	+6.	-2.09	-216.
8th Year	+0.10	+15.	-2.04	-270.
Northbound Trade Flows (Canadian Current-Dollar Imports from U.S.)	% Change	Mill $	% Change	Mill $
2nd Year	-1.68	-127.	-1.91	-143.
4th Year	-0.86	-86.	-1.47	-145.
6th Year	-1.02	+123.	-1.95	-227.
8th Year	-0.94	+153.	-1.81	-277.

Table 4-C

U.S. Monetary Policy with all Capital Flows Suppressed

Reduction in Rate of Growth of M1$, 1963 — 1970
New Exogenous M1$ Grows 1% Less Fast Than Historical Series

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.64	-0.64	-0.16	-0.16
4th Year	-1.77	-1.80	-0.45	-0.46
6th Year	-3.35	-3.74	-0.95	-0.61
8th Year	-3.94	-3.91	+1.18	+0.74

Induced Effects as % of 1963 GNE				
2nd Year	-0.62	-0.62	-0.12	-0.12
4th Year	-1.94	-1.98	-0.37	-0.37
6th Year	-4.04	-4.52	-0.77	-0.44
8th Year	-4.88	-4.85	-0.97	+0.67
Price of GNE (% of Control)				
2nd Year	-0.02	-0.03	-0.01	-0.01
4th Year	-0.37	-0.37	-0.07	-0.09
6th Year	-1.99	-2.13	-0.31	-0.30
8th Year	-5.32	-5.89	-1.05	+0.31
Unemployment Rate (Percentage Points)				
2nd Year	+0.13	+0.13	+0.06	+0.06
4th Year	+0.40	+0.41	+0.20	+0.21
6th Year	+0.75	+0.83	+0.38	+0.27
8th Year	+0.93	+0.95	+0.62	-0.22
Short-Term Interest Rate (Percentage Points)				
2nd Year	+0.34	+0.34	+0.01	—
4th Year	+0.64	+0.63	-0.09	-0.07
6th Year	+0.44	+0.32	-0.33	-0.20
8th Year	-0.12	-0.38	-0.63	+0.07

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX % ch	X Bal $
Can. Reserves in Mill $ U.S.				
X Bal $ is Change in Can. Total				
Trade Balance in Mill $ Can.				
PFX is $ Can./ $ U.S.				
2nd Year	+7.	+6.	-0.08	+5.
4th Year	-33.	-39.	+0.35	-32.
6th Year	-350.	-229.	+4.44	-122.
8th Year	-1136.	-480.	+6.13	-97.

Southbound Trade Flows (Canadian Current-Dollar Exports to U.S.)				
	% Change	Mill $	% Change	Mill $
2nd Year	-0.21	-13.	-0.24	-14.
4th Year	-1.22	-101.	-1.17	-91.
6th Year	-3.61	-403.	-2.59	-266.
8th Year	-5.96	-886.	-2.75	-364.

Northbound Trade Flows (Canadian Current-Dollar Imports from U.S.)				
	% Change	Mill $	% Change	Mill $
2nd Year	-0.17	-13.	-0.18	-13.
4th Year	-0.38	-39.	-0.33	-33.
6th Year	-0.92	-112.	-0.28	-32.
8th Year	-1.65	-268.	+0.30	+44.

Table 5-A

U.S. Fiscal Policy with Migration and All Capital Flows Suppressed

Reduction of U.S. Federal Government Expenditure, 1963 — 1970
Sustained Cut Equal to 1% of 1963 U.S. GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-2.11	-2.11	-0.10	-0.10
4th Year	-0.86	-0.88	-0.10	-0.03
6th Year	-1.65	-2.02	-0.14	+0.21
8th Year	+0.83	+0.95	+0.29	+1.06
Real GNE Multiplier (U.S.), or Induced Effects as % of 1963 GNE (Canada)				
2nd Year	+2.02	+2.02	-0.08	-0.08
4th Year	+0.94	+0.97	-0.04	—
6th Year	+1.95	+2,40	-0.03	+0.24
8th Year	-1.05	-1.18	+0.56	+1.03
Price of GNE (% of Control)				
2nd Year	-0.21	-0.21	+0.06	+0.05
4th Year	-1.08	-1.08	-0.21	-0.14
6th Year	-2.77	-2.91	-0.45	-0.22
8th Year	-5.09	-5.64	-1.00	-0.06
Unemployment Rate (Percentage Points)				
2nd Year	+0.49	+0.49	+0.04	+0.04
4th Year	+0.37	+0.37	+0.10	+0.06
6th Year	+0.46	+0.54	+0.07	-0.10
8th Year	+0.10	+0.11	-0.03	-0.51
Short-Term Interest Rate (Percentage Points)				
2nd Year	-0.29	-0.29	-0.04	-0.02
4th Year	-0.32	-0.33	-0.10	-0.02
6th Year	-0.87	-1.01	-0.15	-0.08
8th Year	-1.61	-1.85	-0.13	+0.15

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX % ch	X Bal $
Can. Reserves in Mill $ U.S.				
X Bal $ is Change in Can. Total				
Trade Balance in Mill $ Can.				
PFX is $ Can./ $ U.S.				
2nd Year	-18.	-18.	+0.20	-16.
4th Year	-118.	-64.	+0.84	-26.
6th Year	-340.	-129.	+3.15	-39.
8th Year	-637.	-151.	+1.88	+37.

Southbound Trade Flows
(Canadian Current-Dollar Exports to U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-0.43	-28.	-0.38	-24.
4th Year	-1.48	-121.	-1.10	-84.
6th Year	-2.29	-255.	-1.27	-130.
8th Year	-2.20	-326.	-0.66	-86.

Northbound Trade Flows
(Canadian Current-Dollar Imports from U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-0.10	-8.	-0.07	-5.
4th Year	-0.42	-42.	-0.31	-31.
6th Year	-0.83	-101.	-0.22	-25.
8th Year	-0.94	-153.	-0.33	-51.

Table 5-B

Canadian Fiscal Policy with Migration and All Capital Flows Suppressed

Reduction of Canadian Federal Government Nonwage Expenditure, 1963 — 1970
Sustained Cut Equal to 1% of Canadian Constant-Dollar 1963 GNE

Change in Variables	Effects in U.S.		Effects in Canada	
	Fixed	Flexible	Fixed	Flexible
Real Private Business Output (% of Control)				
2nd Year	-0.05	-0.02	-1.44	-1.45
4th Year	-0.02	-0.01	-0.33	-0.62
6th Year	-0.04	-0.02	-0.44	-0.61
8th Year	-0.01	-0.02	-0.35	-0.97
Real GNE Multiplier (Canada), or Induced Effects as % of 1963 GNE (U.S.)				
2nd Year	-0.04	-0.02	+0.94	+0.95
4th Year	-0.02	-0.01	-0.03	+0.10
6th Year	-0.05	-0.03	+0.03	+0.05
8th Year	-0.01	-0.02	—	+0.14
Price of GNE (% of Control)				
2nd Year	—	—	-0.74	-0.78
4th Year	-0.02	-0.01	-1.40	-1.93
6th Year	-0.05	-0.02	-1.41	-2.09
8th Year	-0.08	-0.05	-1.25	-2.53

Unemployment Rate (Percentage Points)

2nd Year	+0.01	—	+0.85	+0.86
4th Year	+0.01	+0.01	+0.47	+0.67
6th Year	+0.01	+0.01	+0.22	+0.40
8th Year	—	—	+0.23	+0.61

Short-Term Interest Rate (Percentage Points)

2nd Year	-0.01	—	-0.40	-0.59
4th Year	-0.01	—	-0.64	-0.69
6th Year	-0.02	-0.01	-0.52	-0.59
8th Year	-0.04	-0.03	-0.24	-0.52

International Effects	Fixed Rate		Flexible Rate	
	Reserves	X Bal $	PFX % ch	X Bal $
Can. Reserves in Mill $ U.S. X Bal $ is Change in Can. Total Trade Balance in Mill $ Can. PFX is $ Can./ $ U.S.				
2nd Year	+226.	+157.	-2.38	+87.
4th Year	+408.	+87.	-1.76	-5.
6th Year	+672.	+194.	-3.81	+46.
8th Year	+1082.	+279.	-3.02	+54.

Southbound Trade Flows
(Canadian Current-Dollar Exports to U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-0.61	-38.	-1.51	-92.
4th Year	-0.30	-24.	-1.78	-136.
6th Year	-0.05	-5.	-1.74	-180.
8th Year	+0.10	+14.	-1.90	-252.

Northbound Trade Flows
(Canadian Current-Dollar Imports from U.S.)

	% Change	Mill $	% Change	Mill $
2nd Year	-1.61	-122.	-1.84	-137.
4th Year	-0.52	-52.	-1.03	-101.
6th Year	-1.00	-120.	-1.63	-189.
8th Year	-0.96	-155.	-1.67	-256.

Table 6

U.S. and Canadian Fiscal Policies with Closed Economies

Reduction of Federal Government Expenditure, 1963-1970

Sustained Cut Equal to 1% of Each Country's Real 1963 GNE

Change in Variables	Effects in U.S.	Effects in Canada
Real Private Business Output (% of control)		
1st Year	-1.87	-1.53
2nd Year	-2.53	-1.80
3rd Year	-2.13	-1.62
4th Year	-1.31	-1.31
5th Year	-1.61	-0.87
6th Year	-3.03	-0.58
7th Year	-3.45	-0.64
8th Year	-0.89	-0.76
Real GNE Multipliers (both Countries)		
1st Year	+1.69	+1.00
2nd Year	+2.42	+1.16
3rd Year	+2.17	+0.88
4th Year	+1.43	+0.58
5th Year	+1.85	+0.20
6th Year	+3.64	-0.09
7th Year	+4.22	-0.06
8th Year	+1.06	+0.07
Price of GNE (% of Control)		
1st Year	+0.03	-0.25
2nd Year	-0.20	-0.83
3rd Year	-0.57	-1.60
4th Year	-1.14	-2.09
5th Year	-1.94	-2.29
6th Year	-3.18	-2.28
7th Year	-4.92	-2.18
8th Year	-6.74	-1.98
Unemployment Rate (Percentage Points)		
1st Year	+0.36	+0.53
2nd Year	+0.55	+1.06
3rd Year	+0.59	+1.18
4th Year	+0.49	+1.01
5th Year	+0.52	+0.82
6th Year	+0.73	+0.52
7th Year	+0.78	+0.38
8th Year	+0.47	+0.38

Short-Term Interest Rate (Percentage Points)		
1st Year	-0.22	-0.67
2nd Year	-0.34	-0.63
3rd Year	-0.34	-0.72
4th Year	-0.39	-0.81
5th Year	-0.58	-0.71
6th Year	-1.26	-0.65
7th Year	-2.57	-0.62
8th Year	-2.63	-0.54

References

Ando, A. 1974. "Some Aspects of Stabilization Policies, the Monetarist Controversy, and the MPS Model." *International Economic Review.* October, 1974.

Ando, A. and Modigliani, F. 1974. "Some Reflections on Describing Structure of Financial Models." In *The Brookings Model: Perspective and Recent Developments.* Amsterdam: North Holland.

_____. 1975. *The MPS Econometric Model: Its Theoretical Foundation and Empirical Findings.* Forthcoming.

Ball, R., ed. 1973. *International Linkage of National Economic Models.* Amsterdam: North Holland.

Carr, J., Jump, G., and Sawyer, J. 1974. "The Operations of the Canadian Economy under Fixed and Flexible Exchange Rates: Simulation-Results from the TRACE Model." Working Paper 7405, Institute for Policy Analysis, University of Toronto.

Christofides, L.N. 1973. "The Canadian Conversion Loan of 1958: A Study of Debt Management." Ph.D. dissertation, University of British Columbia.

Grady, P. 1974. "The Canadian Exemption from the Interest-Equalization Tax: An Alternative Scenario." *Canadian Journal of Economics.* 5: 100-111.

Hamada, K. 1974. "Alternative Exchange Rate Systems and the Interdependence of Monetary Policies." In *National Monetary Policies and the International Financial System*, edited by R. Aliber. Chicago: University of Chicago.

Helliwell, J. 1972. "North American Interdependence under Alternative Foreign Exchange Systems." Paper presented to the European meetings of the Econometric Society. Budapest.

_____. 1972. "The Effects of Revaluation on Trade and Capital Flows Between Canada and the United States." In *Canadian-United States Financial Relationships.* Conf. Proceedings, no. 6, Boston: Federal Reserve Bank of Boston.

_____. 1974. "Adjustment under Fixed and Flexible Exchange Rates." In *International Trade and Finance: Frontiers for Research,* edited by P. Kenen. London: Cambridge University Press.

Helliwell, J., and Lester, J. 1972. "Reviewing the Latest DISC Simulations of Its Aggregate Impacts on Canada." *Canadian Tax Journal.* 20:291-298.

Helliwell, J., Shapiro, H., Sparks, G., Stewart, I., Gorbet, F., and Stephenson, D. 1971. *The Structure of RDX2.* Ottawa: Bank of Canada.

Helliwell, J., and Maxwell, T. 1974. *The Equations of RDX2 Revised and Estimated to 4Q 1970.* Ottawa: Bank of Canada.

_____. 1974a. "Monetary Interdependence of Canada and the United States under Alternative Exchange Rate Systems." In *National Monetary Policies and the International Financial System,* edited by R. Aliber. Chicago: University of Chicago.

Helliwell, J., and McRae, R. 1974. "The Interdependence of Monetary, Debt, and Fiscal Policies in an International Setting." Paper prepared for the Wingspread Conference on the Political Economy of Monetary Reform, July 24-27, 1974. (also available as U.B.C. Department of Economics Discussion Paper 74-16.)

Herring, R., and Marston, R. 1974. "The Simultaneous Determination of the Eurodollar Rate and European National Interest Rates." (Mimeograph) Philadelphia: University of Pennsylvania.

Hickman, B.G. 1974. "International Transmission of Economic Fluctuations and Inflation," in this volume. (My references are to the revised version available as Research Memorandum 174 of the Stanford University Centre for Research in Economic Growth, August).

Johnson, K., and Klein, L. R. 1974. "Stability in the International Economy: the LINK Experience," in this volume.

Kenen, P. 1972. "The Analytics of External Balance: an Extended Taxonomy." Working papers in international economics. Princeton: International Finance Section.

Mundell, R. 1968. *International Economics.* New York: Macmillan Co.

Waelbroeck, J., and Dramais, A. 1974. "Desmos: a Model of Policy Coordination for the EEC Countries," in this volume.

Discussion

Stephen M. Goldfeld

The paper by Helliwell is an extremely impressive and carefully done piece of work. It is similar in spirit to a number of studies which have emerged from Project Link, but it differs in a number of important respects as well. For one, it is restricted to two countries, making it somewhat easier to homogenize the models, to carry out the simulations, and to interpret the results. Offset against this is the fact that the two models utilized are considerably more complex than the models found in Project Link, or among econometric models more generally. Indeed, I understand that the computer coding for RDX itself is larger than the coding for all the Link models put together. It is thus all the more impressive that Helliwell was able to carry out a set of well-conceived experiments designed to shed light on a number of important issues. Before turning to the experiments themselves, two general comments are in order.

First, one may ask what one can hope to learn from the experiments. Ideally, of course, one would hope to be able to say something useful about the real world and the structure of the economies involved. In view of the richness of the foreign sector of the RDX model, there would seem to be most hope on this score for Canada. Indeed, the results would seem to bear this out. Policy variations produce appropriately varying results and Helliwell is able to weave quite plausible stories as to why the differences emerge. The results differ to a lesser extent for the United States but these are colored by the fairly rudimentary state of the foreign sector in the MPS model. In other words, for the United States at least, one has to remember that some of the results may be telling us more about the econometric model than the economy per se.

A second general point concerning the experiments is that conceptual problems are often involved in the mechanics of translating verbal intentions into actual procedures. In particular, there is often more than one way in which a change can be introduced and the results may be sensitive to the precise manner in which this is done (e.g., how a given equation or sector is "suspended"). This is probably best illustrated in the present

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paper by the extensive modifications needed to suppress short-term capital flows. The complexity of RDX and my relative unfamilarity with the model make it difficult to discuss these technical aspects but this is probably just as well. The interested reader will find ample details on the procedures in the Appendix and in the various sources cited in the text. From a somewhat casual perusal of this material, my overall impression is that the technical details of the experiments have been handled with a great deal of care. Indeed, in this respect the paper could well serve as a model for other studies.

We turn now briefly to the results. The first thing that is obvious about the results is their sheer quantity. In an admirable attempt to disentangle the causal mechanisms, Helliwell has presented us with an almost overwhelming set of numbers. Despite this, a rather clear picture does emerge. Let us consider the United States first. Domestic fiscal policy generally has the same effect regardless of the underlying assumptions of the simulations. For example, the four-year effects on real private business output all fall in the narrow range 0.84 — 0.88 percent whatever assumptions one makes about capital flows, exchange rates, and the like. The effects of domestic fiscal policy on short-term interest rates are somewhat curious. In particular, following a policy change interest rates steadily decrease over time and at the end of eight years the short rate is about 1 3/4 percentage points below where it would have been. This seems a rather large effect. Canadian fiscal policy, at least of the size envisaged, has rather small effects on the United States although the relative sizes of the two economies must be borne in mind. Finally, the U. S. monetary policy examined differs rather substantially from the fiscal policies considered. For example, after eight years monetary policy leads to a 4 percent reduction in private output in the United States while the basic fiscal experiment leads to a 1 percent increase in private output. This must be borne in mind in interpreting the effects on Canada since these two policies are obviously not substitutes from the U.S. point of view.

Turning to Canada we find that U.S. fiscal policy does have substantial effects on Canadian variables and there are significant variations as the assumptions are altered. The same is true for the effects of domestic fiscal policy in Canada. The roles of short-term capital flows and immigration have particularly important consequences in altering the size of the various multipliers. Both of these factors would seem to warrant some further investigation.

In fact, Helliwell clearly has a sizable amount of additional work in mind. In his concluding section (and in the Appendix) he lays out an impressive agenda for future work. To this list I would add two things. First, it would seem that some increased attention should be devoted to the dynamics of the results. There are a number of mildly puzzling features of the results which seem only to emerge in the eighth year of the simulation and it would be interesting to track these down. Secondly, the simulations have been carried out for a particular historical period, 1963

— 1970. It would be nice to know how sensitive the results are to this choice. I raise this point because I have recently had occasion to compute one-, four-, and eight-quarter multipliers for all monetary and fiscal instruments in the MPS model for each quarter in the period 1958 — 72. As one might suspect with a nonlinear model, there were dramatic variations in the multipliers over time. The consequences of this for the robustness of Helliwell's results need to be examined.

In summary, Helliwell is to be congratulated for the careful job of marrying two monster-sized econometric models and for the reasonable set of experiments he has chosen. This sort of work needs to be encouraged and only when substantial further improvements along the lines he suggests are made, can we be confident that the experiments will move from the realm of telling us about the models to telling us about the real world.

*Discussion**

L. R. Klein

This is an excellent and interesting paper. I am pleased to have the opportunity of studying it critically for commentary. Such bilateral studies, as John Helliwell has prepared, are important methodologically and substantively in the case of U.S.-Canadian relations.

It is noteworthy that the United States turns out in this study to have a competitive advantage in using monetary policy for balance-of-payments problems. This seems to me to be unexpected because I was not aware that our monetary policy had been especially effective for stabilizing movements in the balance of payments.

In the paper, John Helliwell remarks that simulated movements of output and prices in the same directions in both countries overturns a theoretical presumption ". . . that monetary contraction lowers income at home and raises it abroad . . ." Historical experience has been that U.S. and Canadian cycles are largely the same except that amplitudes are smaller in Canada.

The results dealing with migration are unusual and extremely interesting. Migration effects play important roles in European models and in the form of bracero earnings in Mexican models. A question that comes to mind is how are guest workers treated, i.e., Canadian or U.S. citizens who do not register formally as immigrants? Guest worker effects ought to be built explicitly into both U.S. and Canadian models. It would be interesting to see if they have any influence on wage equations, as in some European countries.

Some suggestions for further research are:

1. Intermediate goods imports should be entered as factor inputs in the respective production functions. Much of the bilateral trade in

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*Editor's Note: Professor Klein's discussion originally contained some comments on three additional points: comparison of Helliwell's results with those from the TRACE model; a question of the length of lags associated with fiscal policy actions; and a possibility of insulation of the Canadian economy under the flexible exchange rate system. These points have been taken into account by Helliwell in his revision, and Klein has agreed to eliminate the portion dealing with these points from his discussion.

newsprint, timber, oil, coal, and other goods is undertaken with the expectation of being used in further production.

2. Long-run simulation of the MPS model is possible; it has been done. These simulations can be used together with long-run simulations that are apparently feasible with RDX2.

3. U.S. export price equations should be entered explicitly in the MPS model. In some recent research of this subject, I have found that U.S. export prices depend on unit domestic costs, capacity utilization, and U.S. dollar exchange rates (weighted average). In many countries, export prices are set at levels that are competitive with those of other trading nations. It is doubtful whether this price policy prevails in the United States but it may turn out to be the case that the United States intervenes in the wheat market so as to be competitive with Canada.

4. The fiscal shocks that are introduced ought to have a more rounded structure. The models should be examined to see whether output originating in government, government wages, government employment, defense orders or other related exogenous variables change when public expenditures change. Also the basic fiscal changes ought to be nominal instead of real. That is the way political decisions are made.

5. It is stated that an accommodating monetary policy means that M_1 is unchanged on the supply side. This seems to me to be a strange form of accommodation. I would prefer to see M_1 changed in such a way as to leave the degree of tightness in financial markets unchanged.

6. In the sample period, a number of special factors influenced the bilateral trade and payments of the two countries. These were the Interest Equalization Tax, EXPO, U.S. dock strikes (especially on the West Coast), the oil crisis, the U.S. draft provisions during Viet Nam, the automobile trade agreements, and restraints on timber trade. I would like to know if special adjustments were introduced for these in both models because they could have large effects on estimated coefficients and on some simulation results. Also it would be worth while to design simulation experiments to estimate the effects of some of these events on the economies.