No. 108 (81-9)

AN ECONOMETRIC ANALYSIS OF MULTI-COUNTRY MULTIPLIERS UNDER FIXED AND FLOATING EXCHANGE RATE REGIMES*

by

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March 1981

* An earlier draft of this paper was presented at the Annual Meeting of the Japanese Association of Theoretical Economics in October, 1978. We wish to acknowledge useful comments received there. The authors are grateful to Kiyo Harada for computer programming and research assistance.

Abstract

The present paper attempts to analyze the dynamic multiplier effects of fiscal monetary policies for the developed countries in a consistent framework of a global econometric model under both fixed and flexible exchange rate regimes. The paper first discusses the estimation of exchange rate functions for eight developed countries with special reference to "fundamentals" in economic performance such as international gaps in inflation, productivity, expected real rate of return, etc. The results are then incorporated into the global model to derive and compare dynamic multipliers under both fixed and flexible exchange rate regimes. "Insuration effects" are observed in most cases in terms of both output and inflation, though this differs according to the country. Policy implications are discussed at the end.

1. Introduction

Empirical studies on flexible exchange rates in recent years have been confined to the macro-economic model of a single country or to a comparative analysis of exchange rate functions for several countries without explicit linkage to their international relationships. The present paper discusses the empirical implications of flexible exchange rate mechanisms, as compared with fixed exchange rate mechanisms, in the consistent framework of a multicountry econometric model so as to evaluate the impacts of fiscal and monetary policies. A world econometric model created by the University of Tsukuba and the Foundation for Advancement of International Sciences (T-FAIS IV) was used for this purpose in which the exchange rates for eight developed countries (Japan, United States, Canada, United Kingdom, France, Federal Republic of Germany (FRG), Italy and Australia) are endogenized.[1/] The effectiveness of fiscal and monetary policies is evaluated with special reference to their degree of independence from the rest of the world through multiplier analysis of various policy instruments.

1/ See S. Shishido (1980) for the detailed structure of the model and do. (1975) for the original version of the model and the parameters.

2. Exchange Rate Functions

The basic framework of our model for exchange rate determination is the interaction between real and financial transactions including asset substitutions. Unlike the present, conventional types of flow or stock approaches, we put more emphasis on longer term changes in exchange rates of different currencies in the context of the "fundamentals" such as productivity differentials, inflationary gaps, etc. The current account surplus (or deficit) thus plays an important role in formulating the present model, since it represents net output surplus (or deficit) of the economy in the form of absorption as well as a net increase in supply of foreign assets (either in foreign exchange or in other types of foreign assets). The inflation gaps between different currencies are introduced and indicated as relative differences of GNP deflators which represent "purchasing power parity" (PPP) conditions. On the asset side, we introduce relative differences in expected rate of return on assets, which represent arbitrage conditions for real interest rates.

In greater detail, our model can be shown by the following formulation of flow approach. In the small country case the equillibrium condition for foreign exchange market can be defined as

$$B_c + B_k = 0 \qquad (1)$$

when B_c and B_k are current and capital account balances in U.S. dollars, respectively. They are specified:

$$B_c = B_c(\varepsilon/\varepsilon',\ p/p',\ \tau/\tau',\ y/y',\ y^c/y^{c\prime}) \qquad (2)$$
$$\quad\ (-)\quad (-)\quad (-)\quad (-)\quad (+)$$

$$B_k = B_k[1+\gamma)/(1+\gamma'),\ y/y'] \qquad (3)$$
$$\quad\ (+)\quad\ (+)$$

$$1 + \gamma = (1 + i + \dot{\varepsilon})/\varepsilon \qquad (4)$$

$$1 + \gamma' = (1 + i' + \dot{\varepsilon}')/\varepsilon' \qquad (5)$$

where ε is the exchange rate in terms of U.S. dollars per unit of national currency, p is the GNP deflator (as an indicator of the rate of inflation), τ is the terms of trade (export price index / import price index), y is real output, y^c is capacity output, γ is the real rate of return on assets, i is the interest rate and $\dot{\varepsilon}$ is the expected rate of change of exchange rate. Variables with a prime mark denote those of foreign countries. Plus or minus signs between brackets denote the sign condition of the structural parameter.

Equation 2 represents an ordinary balance of trade surplus (or deficit) except that, for price effects, a distinction is made between the general price level (p) and terms of trade (τ) and the supply effect caused by capacity increase is explicitly introduced.[2/] It should be noted that the conventional flow approaches

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2/ For the introduction of supply factors into export functions, see K. Sato (1977). For similar view which emphasizes the importance of non-price factors in export functions, see S. Shishido et al. (1980).

that rely merely on demand side and relative price are substantially revised.

Capital account in equation 3 also differs from the conventional approach, as it explicitly introduces real demand effect for foreign capital beside the expected rate of return of assets deflated by the value of domestic currency.

Thus our reduced form from the above equations for exchange rate determination is formulated as:

$$\varepsilon/\varepsilon' = f[p/p', \tau/\tau', y/y', y^c/y^{c'}, (i+\dot{\varepsilon}) - (i'+\dot{\varepsilon}')]. \quad (6)$$
$$(-) \quad (-) \quad (+,-) \quad (+) \quad (+)$$

Since the variable ε/ε' represents "effective exchange rate" which deals with a more generalized value of national currency, the equation implies that the relative values of currencies depend not only on inflation gaps, as shown by p/p', but also on the countries' competitive positions such as terms of trade, capacity limits (which are closely related to productivity differentials), and expectations on the rate of return on real and financial assets.

In view of the difficulty in estimating all the structural parameters with expected sign conditions, however, the second, third and fourth explanatory variables are combined into a single variable, B_c^* (balance of current account in real terms), and its relative position can be shown as:

$$B_c^* - B_c^{*\prime} = f[\tau/\tau',\ y/y',\ y^c/y^{c\prime}]. \qquad (7)$$
$$(-)\quad (+,-)\quad (+)$$

Since this equation represents the nation's real surplus in current account, and it also implies net additional supply of foreign assets in real terms, the exchange rate function in equation 6 can be further adjusted as:

$$\varepsilon/\varepsilon' = f[p/p',\ B_c^* - B_c^{*\prime},\ (i+\dot{\varepsilon}) - (i'+\dot{\varepsilon}')]. \qquad (8)$$
$$(-)\qquad (+)\qquad (+)$$

The equation implies that the effective exchange rates are dependent upon both commodity as well as asset markets, and that the conventional PPP principle needs to be substantially modified especially in the real world where there are growing gaps in productivity and in long-term expectations for real rates of return. Equation 8 also has an advantage in that it explains the "polarization tendency" between strong and weak currency groups in industrial countries. This advantage can be compared with the recent stock approach emphasizing more short-run fluctuations with little attention to long-run movement of different types of currencies.[3/]

[3/] For a survey article on recent development of foreign exchange rate theories, see J. F. Helliwell (1979).

3. Empirical Implementation of the Model

An empirical implementation of our theoretical model was undertaken for the eight developed countries mentioned earlier. Although our world model is based on annual data, we based our estimate of the exchange rate equations on quarterly data, thus making 14 samples for the period 1974/2nd through 1977/3rd quarter, when the floating exchange rate regime, whether managed or non-managed, was prevailing for all these countries.

As in the case with most empirical studies, our theoretical formula needed to be slightly adjusted in the face of the data availability. B_c^*, real current account balances, were replaced by nominal current account balances B_c, because of difficulty in obtaining uniform estimates for the eight countries. For interest rate, i, the discount rates of central banks were used because of their high comparability and the heterogeneities in various term-structures of the conventional interest rate data.

The third adjustment is an explicit introduction of the central bank's intervention in the foreign exchange market. It was regarded as essential in obtaining realistic estimates, because the "cleanliness" of floating rates varies substantially according to the country. Therefore, net changes in official foreign exchange reserves are used as crude proxies.

Our final version of exchange rate function thus can be formulated as:

$$\varepsilon/\varepsilon' = a_0 + a_1(p/p') + a_2(B_c - B_c') + a_3(i + \dot{\varepsilon} - i' - \dot{\varepsilon}') + a_4(\Delta R - \Delta R')$$

where ΔR is net change in official foreign exchange reserves.

As noted earlier, all the variables with primes denote weighed averages of the eight industrial countries in terms of foreign trade. They are used as denominators in deriving the effective exchange rate (ε/ε').

The results of our estimation are shown in Table 1. For convenience, all the parameters, originally estimated on a quarterly basis, are indicated as annual ones in a summary form. (See Appendix for quarterly parameters.) In terms of coefficient of determination ($\bar{R}^2$), most of the equations explain fairly the movements of effective exchange rates except for France whose value is 0.6. Most of the parameters are also significant and satisfy our theoretical hypothesis. For instance, the PPP condition for a_0 and a_1 is almost met, as the sum of the two parameters is roughly unity, implying that an effective exchange rate tends to follow a relative inflation gap in the absence of other gaps such as those in current account surplus, expected rate of return and central bank interventions in the foreign exchange market.

Trade gap parameters, a_2, range widely from 0.156 to 0.011, but their differences narrow considerably when adjustments are made for the size of foreign trade.[4/] The results are 0.0041 for Japan, 0.0016 for Canada, 0.0028 for U.K., 0.0020 for France, 0.0018 for Germany, 0.0028 for Italy, 0.0039 for Australia and 0.0028 for the U.S. Except for Japan and Australia, the adjusted parameters tend to range between 0.0020 to 0.0030.

As for the parameter of the expected rate of return, a_3, the estimates are significant in six out of eight countries. The Canadian parameter is significant, but on a slightly different specification. The average impact of a one percent relative difference in the expected rate of return on exchange rate is about 0.3 percent for six countries with significant parameters.

Our last parameter, a_4, implying interventions of monetary authorities, is also significant with expected signs for most of the countries. It should be noted that the values are fairly close to those of a_2, though with opposite signs, i.e. $a_4 \fallingdotseq -a_2$, imlying that the net available increase in foreign assets $(B_c - B_c' - \Delta R + \Delta R')$ tends to raise the effective exchange rate. This, together with a_3, provides for a link between the conventional flow and asset approaches to exchange rate determination.

[4/] The weights for foreign trade in 1975 are as follows: Japan = 0.123, U.S. = 0.260, Canada = 0.076, U.K. = 0.121, France = 0.123, FRG = 0.189, Italy = 0.083, Australia = 0.025

Lastly, the equations were applied to follow the actual movement of exchange rates during the observation period from 1974 to 1977 on an annual basis, which are shown in Figure 1. The general patterns of the fluctuations are in most cases well followed by these equations, such as rising trends in the yen and the German mark and falling trends in the pound, the lira and the Australian dollar, etc. In Table 3 we take up the four typical currencies, and their patterns are analyzed according to the types of the explanatory variables. The rising tendency of the yen is mostly accounted for by its trade surpluses, the German mark by its low rate of inflation, and the British pound by its high rate of inflation. The U.S. dollar indicates a mixed pattern due partly to its trade deficits and partly to its lower rate of inflation during this period.

4. Multicountry Multipliers under Fixed and Floating Exchange Rate Regimes

Our next step is to simulate our world econometric model (T-FAIS IV)[5/] under alternative assumptions to evaluate the impacts of policy variables with special reference to fixed vs. floating exchange rate regimes. The exchange rate equations discussed in the previous section are incorporated in the case of the floating exchange rate regime.

Since the details of the model are discussed in another paper by Shishido,[1/] we mention here only the major points necessary to exchange rate analysis.

First, each national model is of Keynsian type demand-oriented model for the eight developed countries, but production functions are included on the supply side to derive the capacity output, the rate of capacity utilization and changes in various price deflators for demand-supply adjustment.

Secondly, government purchases of goods and services are treated as exogenous in real terms. The treatment tends to increase its multiplier effects as against nominal purchases since the negative impact of the price increase on real purchases are disregarded.

[5/] See S. Shishido et al., op. cit.

Thirdly, the money supply is endogenized in the model, as it is linked to the government deficits and bank credits which are accounted for by fiscal and monetary conditions. This treatment of the money supply also causes an increase in the multiplier effects of real government purchases, though to a limited extent.

Fourthly, international capital flows are temporarily made exogenous, implying imperfect international capital markets. Although these assumptions are being relaxed in a revised version of the present model, it is noted that the interest rates in the present model tend to move rather independently from the external impacts.

The model was run to derive three types of dynamic multipliers for the period between 1976 and 1979: a) a rise in real government investment by one percent of real GNP, b) a rise in bank loans by one percent of nominal GNP, and c) a fall in the discount rate by one percent. All of these simulations were made under both fixed and flexible exchange rate assumptions for the eight developed countries. For the other developing countries, however, fixed exchange rates are assumed:

1. Fiscal Policy Effects

The results of our first simulation on real government investment are indicated in percentage in Table 3-A. For each country a distinction is made in the dynamic multipliers between

fixed or pegged rates (P) and floating rates (F). All the figures are obtained as percentage deviations from the standard simulations for the period 1976 to 1979.

In terms of real GNP the dynamic multipliers tend to indicate higher values in the floating exchange rate regime than in the fixed rate regime in most cases, implying the significance of what is called "insuration effects" in the former case.[6/] Since the money supply is endogenized, pessimistic views on fiscal impacts on total output under a flexible exchange rate regime, as pointed out by Fleming and Mundel,[7/] are not supported by these results, except for U.K. and Italy where the price increases caused by the declines in the exchange rates tend to cancel the expansionay impacts of government investment.

Country-wise analysis of these results indicates that the highest dynamic responses in output are observed for Japan and the U.S. under both regimes. The Japanese responses are featured by its active, induced business investment and the U.S. responses by its relatively lower dependence on imports. Canada and most of the European countries indicate relatively lower dynamic multipliers especially in the case of the fixed exchange rate chiefly because of their higher dependence on imports. In the latter half of the period, however, especially under the flexible exchange

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6/ See Laursen and Metzler (1950).
7/ See M. Fleming (1962) and R. A. Mundel (1968).

rate regime, the multipliers in Canada, France and W.Germany become significantly higher because of their higher price sensitivities in export and import function.

These insuration effects become more noticeable when cross multipliers are compared as in Table 4-A. Due to space limitations, we will take up the cases of only three countries: Japan, U.S. and W.Germany. A distinction is again made between "P" and "F" in their multiplier effects on real output. As in the previous case, the cross multipliers of Japan and W.Germany on other countries are significantly lower throughout the period in the case of "F" than in the case of "P". Because of its higher share in the world economy, U.S. impacts on other countries are much greater than those of Japan and W.Germany, but the differences between the two regimes are rather small and "F" is not necessarily lower than "P". This probably implies that the greater impacts by the U.S. on output of other countries tend to offset contractionery impacts caused by the rises in their exchange rates.

With regard to the effects on price levels, Table 3-B indicates significantly higher values of "own multipliers", as against "cross multiplier", in the case of "F" than in the case of "P" for most of the countries, implying similar insuration effects to those in output.

The insuration effects in this respect are caused by two

factors: (a) the changes in both output levels and (b) those in import prices which are affected by the depreciations in the exchange-rates. It is noted that higher "own multipliers" of output roughly correspond to those of the rate of inflation as in the U.S., Canada and W.Germany.

In order to evaluate relative significance of the rate of inflation as against the rate of growth, Table 5 shows the performance of each country in terms of what we call "price sensitivity" which implies relative stability of price responses. Average price sensitivities during the past four years were generally low for Japan, U.S., W.Germany and Australia in both fixed and flexible exchange rate regimes, while relatively higher values are observed for Canada, France and U.K. in the fixed exchange rate case and for Canada, U.K. and Italy in the flexible exchange rate case. The extremely high sensitivity in Italy is mostly due to the price sensitivity in its exchange rate function as shown in Table 1 and the high dependence of its domestic price levels on import prices. As noted earlier, these features of the Italian economy tend to reduce the expansionary impacts of its investment multiplier in the flexible exchange rate case as compared with the fixed exchange rate case.

The propagation process of world inflation can be analyzed more closely in cross international multipliers of the rates of inflation. Again we take up only three countries and

the results are shown in Table 4-B. As compared with "P", the multipliers in the rate of inflation in the case of "F", are significantly lower, sometimes even negative, in most of the countries except for those of "own multipliers" which are much higher as discussed earlier. In other words, under the floating rate regime, the expansionary impacts of investment by one country are not only insurated to a certain extent through reduced demend, but also lowered through falls in import prices as a result of appreciation in exchanges rates. Such negative tendencies are especially noticeable for Japan's impacts on the U.S. and Australia, and W.Germany's impacts on Japan.

The results on the changes in exchange rates are indicated in Table 6-A, which also provide an interesting pattern under the flexible exchange rate regime. The rates of change of "own multipliers" in response to the autonomous changes of one percent are one to two percent for the second year and two to four percent for the fourth year in most of the countries, except Canada, U.K. and Italy where the changes are much higher due to the higher rates of import dependencies, price sensitivities in trade balances and domestic price responsiveness to total demand and import price changes.

The cross multipliers of the exchange rates in Table 6-B also provide an interesting pattern in the context of the rates of international inflation. First, the U.S. impacts on other countries

are all positive, and higher than Japan's and W.Germany's impacts, ranging from one to two percent for the second year and two to five percent for the fourth year. For Japan and W.Germany the impacts on the exchange rates of the other countries are relatively small and some of them show even negative values, though to a limited extent. In terms of effective exchange rate, however, it is clear that most of those negative values turn out to be positive, except in the case where the negative effect of the price increase exceeds the positive impacts of trade surpluses.

2. Monetary Policy Effects

In our next analysis the dynamic multipliers of monetary policies are derived in a similar way to the fiscal policy analysis shown above. Two types of policy variables: a) an increase in money supply through expansion of bank loans and b) a reduction of the discount rate of the monetary authorities. In the former case, as the money supply is endogenized in our model, the parameters in the equations for extending loans by private financial institutions are raised by one percent of the nominal GNP. This is almost comparable with the treatment of real government investment. In the second simulation the discount rates are reduced by one percent, say to six from seven percent. The results are shown in Tables 6 and 7, respectively, distinguished again between fixed and floating exchange rate regimes.

The dynamic multipliers of financial impacts in Table 7

indicate a highly similar pattern to that of real government investment, although the former values are a little lower than the latter ones. The insuration effects of the floating exchange rate regime are again noticeable especially for Japan, Canada, France, W.Germany and Italy. The price responses also indicate similar patterns to those of GNP. As compared with Table 3, the French multipliers are much higher in both "P" and "F", which is probably accounted for by its high dependence on financial institutions for private investment.

The discount rate multipliers in Table 8 also show similar tendencies, but they are not exactly comparable with the above two cases because of the difference in units of measure and an explicit inclusion of international interest rate arbitrage as discussed earlier. As compared with the case of real government investment, the one percent reductions of discount rates tend to indicate about one third or half the values of the government investment multipliers for the second year and about half or two third the values for the last year. Canada and W.Germany are rather exceptions which show higher values than in the investment multipliers for the last year especially in the case of the floating exchange rate regime. The Canadian multipliers in "F" are much affected by a sharp decline in her own exchange rate.[8/]

[8/] The effects on exchange rates are especially high for Canada, U.K., and Italy. They are 4.9, 2.1 and 4.7 percent respectively for the second year.

The price responses to the changes in discount rate also follow similar patterns to the above two cases. The higher price responses in Canada and Italy are affected by the falls in their exchange rates, while those in W.Germany are mostly due to its higher responsiveness of total demand.

5. Concluding Remarks and Some Policy Implications

Although it includes tentative factors, the above analysis seems to suggest the following points as its conclusion.

First, real GNP multipliers, whether their impacts are induced by government investment, bank loans, or discount rates, certainly indicate "insuration effects" under the flexible exchange rate regime as compared with the fixed exchange rate regime. The effects are significantly higher in Canada, Japan and Australia, especially in their "own multipliers". For most of the other countries these effects are also observed, though to a limited extent.

Secondly, inflation rates are also partly insurated, especially for Japan, Canada, Italy and Australia in both "own" and "cross multipliers", due to changes in trade balances and import prices through exchange rate adjustments.

Thirdly, as far as "own multipliers" are concerned, the management of total demand in real terms tends to be accompanied by greater changes in price levels under the flexible exchange rate regime. This by no means implies that the flexible exchange rate system is more inflationary in nature, since the international propagation of inflation tends to be insurated to a certain extent through exchange rate adjustments, as shown in

the case of cross multipliers.

Lastly, from the point of view of international coordination of macro-economic policy, the U.S. shows the largest impacts on the world economy in output and price levels, but the differences in multipliers are not highly significant between fixed and flexible exchange rate regimes. The impacts on other countries of Japan and West Germany do not differ in terms of output, but the former's impacts are much lower in terms of price levels. This would probably imply the more active role by the Japanese economy as a "locomotive" second to the U.S. in bringing about recovery in the world's business conditions.

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Table 1

Parameters of Exchange Rate Functions(*)

for Eight Developed Countries

$$\varepsilon/\varepsilon' = a_0 + a_1(p/p') + a_2(B_c - B_c') + a_3(i + \dot{e} - i' - \dot{e}') + a_4(\Delta R - \Delta R')$$

	a_0	a_1	a_2	a_3	a_4	$\bar{R}^2$	S.E.	D.W.
Japan	2.00515	-0.97142 (-6.9)	0.03375 (7.3)	0.00085 (0.7)	-0.0370 (-3.6)	0.96	0.0091	2.23
U. S.	1.75865	-0.76707 (-3.9)	0.01062 (3.7)	0.00265 (2.5)	-0.01364 (-1.6)	0.88	0.0075	1.81
Canada	4.72979	-3.74260 (-4.8)	0.02211 (3.8)	0.04271(**) (6.8)	-0.0395 (-1.6)	0.88	0.0123	1.91
U. K.	1.99284	-1.03561 (-7.1)	0.02293 (1.4)	0.00549 (2.4)	-0.0140 (-1.0)	0.96	0.0233	1.80
France	1.49200	-0.55617 (-1.2)	0.01638 (0.7)	0.00400 (3.3)	-0.0072 (-0.6)	0.61	0.0319	1.39
W. Germany	1.93892	-0.93291 (-7.9)	0.00959 (2.0)	0.00372 (5.6)	-0.01026 (-1.4)	0.93	0.0120	2.36
Italy	2.63128	-1.69644 (-9.5)	0.03402 (2.3)	0.00510 (3.7)	-0.01458 (-1.0)	0.94	0.0279	1.68
Australia	2.20938	-1.18005 (-6.4)	0.15583 (2.1)	0.00480 (2.9)	-0.07561 (-2.3)	0.89	0.0281	2.50

* The original quarterly parameters with different time lags are here aggregated into annual parameters for convenience of presentation. (See Appendix)

** For Canada, i-i' was used, instead of i+ė-i'-ė'.

Figure 1

Results of Effective Exchange Rate Functions

on Annual Basis

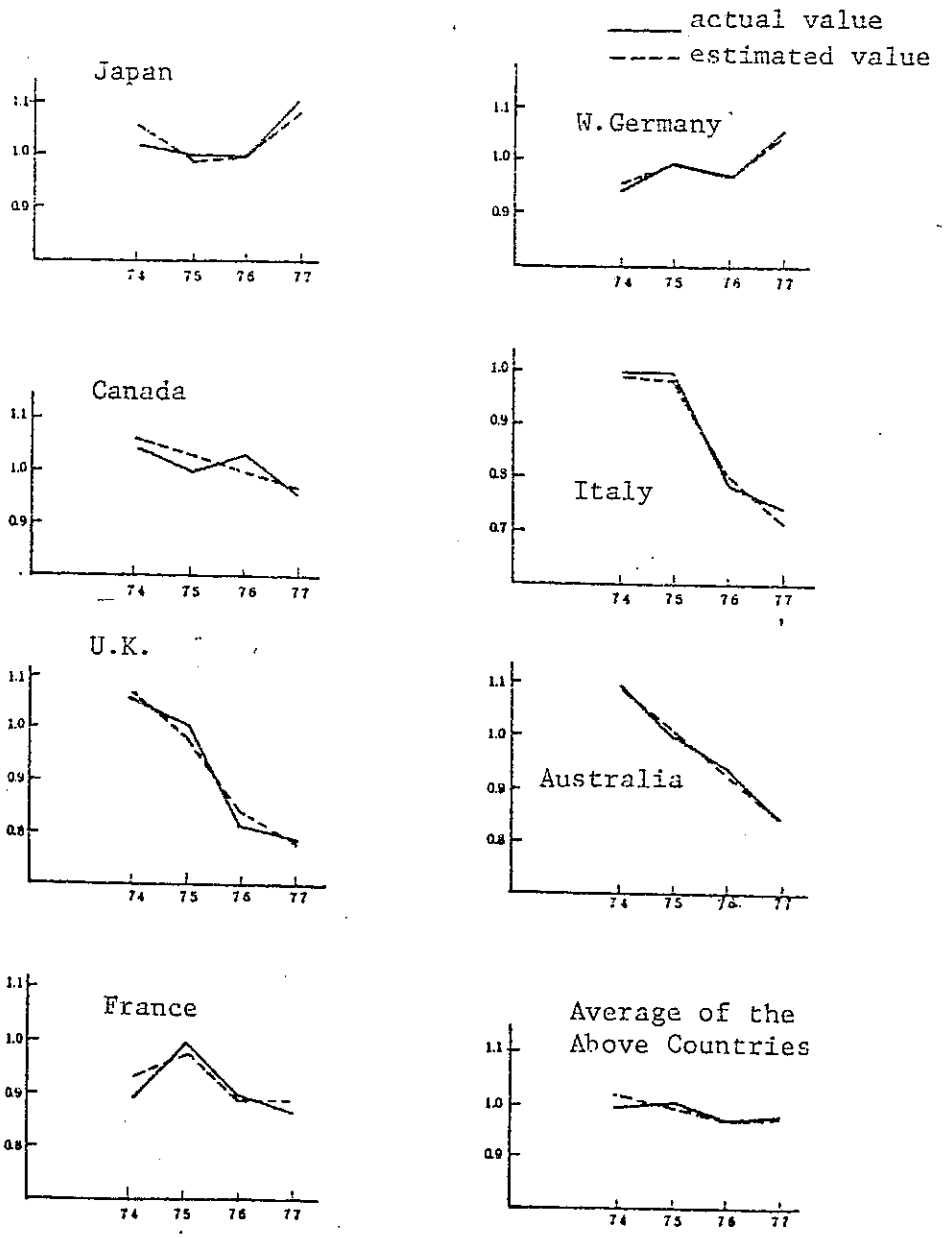

Table 2

Factors Affecting Effective Exchange Rates

of Major Currencies, 1974 - 1977

(%)

		Changes in effective exchange rate (A)	Purchasing power parity (B)	Trade balance (C)	Expected rate of return (D)	Central bank intervention (E)	Residuals (F)
Japan	1975	-2.4	-5.3	-0.3	0.1	-1.9	4.9
	1976	3.5	2.6	3.4	0.4	-1.3	-1.6
	1977	9.1	0.7	6.1	0.4	-0.9	2.8
U. S.	1975	-0.6	1.3	1.0	0	0	-3.0
	1976	3.4	1.1	0.6	0.5	0.2	1.0
	1977	-1.4	1.3	-3.2	-0.8	2.3	-1.0
U. K.	1975	-5.9	-9.4	0.4	-0.9	0.3	3.6
	1976	-15.3	-9.9	1.8	-3.9	0.4	-3.7
	1977	-4.1	-6.7	1.2	1.3	-3.2	3.3
West Germany	1975	4.5	4.4	-1.5	-0.6	0.9	1.3
	1976	-1.1	3.3	-0.2	-1.6	-0.5	0.1
	1977	6.9	3.4	0.3	2.1	0.3	0.8

Note: (A) = (B)+(C)+(D)+(E)+(F)

Table 3

International Multipliers of Real Government Investment Increased by 1 % of Real GNP under Fixed (P) and Flexible (F) Exchange Rate Regimes

		A. Real GNP (%)				B. GNP Deflators (%)			
		1976	1977	1978	1979	1976	1977	1978	1979
Japan	P	2.89	3.65	4.53	3.12	-0.04	0.36	0.73	0.95
	F	3.30	5.08	6.98	6.25	0.07	0.67	1.39	1.91
U. S.	P	2.14	3.71	5.28	5.92	0	0.24	1.04	2.50
	F	2.16	3.77	5.44	6.23	0.02	0.30	1.16	2.71
Canada	P	0.97	1.03	0.76	0.24	0.23	0.53	0.90	1.20
	F	1.02	1.79	3.15	5.78	0.23	0.75	2.11	4.44
U. K.	P	1.41	1.47	0.91	0.77	0.01	0.83	0.87	0.54
	F	1.39	1.13	0.31	0.58	0.17	1.07	0.74	0.12
France	P	1.03	1.27	1.31	1.43	0.59	0.71	0.69	0.71
	F	1.07	1.43	1.66	1.97	0.69	0.88	0.93	1.07
W. Germany	P	1.33	2.41	3.27	3.69	0.18	0.86	1.36	1.68
	F	1.39	2.54	3.41	3.90	0.19	0.91	1.45	1.80
Italy	P	1.24	0.92	0.68	0.85	-0.05	0.50	0.39	0.47
	F	1.20	0.91	0.70	0.51	0.33	3.39	8.40	17.85
Australia	P	1.29	3.09	3.63	2.74	0.17	0.46	0.57	0.35
	F	1.28	3.55	4.61	3.69	0.27	1.03	1.82	1.84

Note: Percentage increase over standard simulation.

Table 4

Cross International Multipliers of

Real Government Investment under

Fixed (P) and Flexible (F) Exchange Rate Regimes

I. Impacts of Japan

		A. Real GNP (%)				B. GNP Deflator (%)			
		1976	1977	1978	1979	1976	1977	1978	1979
Japan	P	2.89	3.65	4.53	3.12	-0.04	0.36	0.73	0.95
	F	3.30	5.08	6.98	6.25	0.07	0.67	1.39	1.91
U. S.	P	0.02	0.11	0.28	0.51	0	0.02	0.10	0.21
	F	0.01	0.09	0.22	0.39	-0.01	-0.01	0.02	0.09
Canada	P	0.04	0.25	0.47	0.59	0.01	0.07	0.23	0.51
	F	0.02	0.17	0.38	0.87	0	0.04	0.17	0.49
U. K.	P	0.10	0.24	0.32	0.30	0	0.17	0.34	0.45
	F	0.09	0.30	0.27	0.06	-0.06	0.04	0.38	0.07
France	P	0.05	0.16	0.28	0.39	0.03	0.11	0.20	0.29
	F	0.05	0.13	0.19	0.31	0.02	0.08	0.13	0.26
W. Germany	P	0.01	0.19	0.43	0.74	0	0.04	0.15	0.31
	F	0	0.13	0.24	0.58	0	0.02	0.10	0.21
Italy	P	0.09	0.12	0.20	0.20	-0.01	0.11	0.29	0.46
	F	0.09	0.13	0.16	0.19	-0.15	-0.30	-0.65	-1.42
Australia	P	0.19	0.42	0.69	0.62	0.01	0.21	0.43	0.59
	F	0.23	0.29	0.55	0.65	-0.24	-0.20	-0.11	0.40

Note: See note on Table 3.

II. Impacts of U. S.

		A. Real GNP (%)				B. GNP Deflator (%)			
		1976	1977	1978	1979	1976	1977	1978	1979
Japan	P	0.81	2.08	3.80	5.49	0	0.13	0.45	0.87
	F	0.59	1.24	2.20	3.62	-0.08	-0.12	0	0.06
U. S.	P	2.14	3.71	5.28	5.92	0	0.24	1.04	2.50
	F	2.16	3.77	5.44	6.23	0.02	0.30	1.16	2.71
Canada	P	0.62	1.53	2.66	3.61	0.15	0.58	1.61	3.14
	F	0.67	1.34	2.75	5.18	0.15	0.52	1.52	3.47
U. K.	P	0.36	0.80	1.18	1.35	0.05	0.46	1.09	1.76
	F	0.44	1.14	1.50	1.44	0.08	0.64	1.48	1.61
France	P	0.27	0.70	1.22	1.72	0.16	0.46	0.83	1.23
	F	0.30	0.71	1.13	1.64	0.16	0.41	0.72	1.19
W. Germany	P	0.17	0.66	1.57	2.82	0.03	0.18	0.54	1.15
	F	0.20	0.71	1.65	3.23	0.03	0.20	0.57	1.23
Italy	P	0.43	0.59	0.74	0.95	0.04	0.40	0.94	1.70
	F	0.50	0.72	0.92	1.43	-0.24	0.05	0.66	0.15
Australia	P	0.42	1.20	2.26	2.95	0.11	0.45	1.10	2.02
	F	0.50	0.98	1.81	2.77	-0.20	-0.29	-0.08	0.83

III. Impacts of W. Germany

		A. Real GNP (%)				B. GNP Deflator (%)			
		1976	1977	1978	1979	1976	1977	1978	1979
Japan	P	0.14	0.51	1.14	1.93	0	0.04	0.13	0.29
	F	0.10	0.37	0.74	1.54	-0.01	0.01	0.09	0.19
U. S.	P	0.01	0.07	0.22	0.50	0.01	0.03	0.09	0.23
	F	0.01	0.07	0.18	0.39	0.01	0.03	0.08	0.19
Canada	P	0.05	0.21	0.52	0.87	0.01	0.07	0.26	0.60
	F	0.05	0.18	0.35	0.91	0.01	0.06	0.20	0.51
U. K.	P	0.09	0.23	0.38	0.42	0.04	0.21	0.50	0.79
	F	0.09	0.26	0.24	0.09	0.02	0.19	0.60	0.32
France	P	0.09	0.23	0.40	0.57	0.06	0.18	0.34	0.51
	F	0.09	0.19	0.29	0.48	0.06	0.16	0.26	0.47
W. Germany	P	1.33	2.41	3.27	3.69	0.18	0.86	1.36	1.68
	F	1.39	2.54	3.41	3.90	0.19	0.91	1.45	1.80
Italy	P	0.13	0.14	0.14	0.23	0.06	0.30	0.70	1.14
	F	0.13	0.13	0.12	0.33	-0.02	0.38	1.38	4.02
Australia	P	0.04	0.17	0.45	0.78	0.04	0.16	0.44	0.84
	F	0.04	0.13	0.37	0.77	0.01	0.13	0.30	1.00

Table 5

Average Price Sensitivities Derived from Multipliers for 1976 to 1979 under Fixed (P) and Flexible (F) Exchange Rate Regimes[1/ 2/]

(%)

		A. GNP Growth Rate	B. Rate of Inflation	Price Sensitivity[3/] (=B/A)
Japan	P	3.55	0.50	0.14
	F	5.40	1.01	0.19
U. S.	P	4.26	0.95	0.22
	F	4.40	1.05	0.24
Canada	P	0.75	0.72	0.96
	F	2.94	1.88	0.64
U. K.	P	1.14	0.56	0.49
	F	0.85	0.53	0.62
France	P	1.26	0.68	0.54
	F	1.53	0.89	0.58
W. Germany	P	2.68	1.02	0.38
	F	2.81	1.09	0.39
Italy	P	0.92	0.33	0.36
	F	0.83	7.49	9.02
Australia	P	2.69	0.39	0.14
	F	3.28	1.24	0.38

Note: 1/ Figures are shown as an average percentage increase over standard simulation for 1976 to 1979.

2/ See note on Table 3.

3/ Defined as a ratio of the rate of inflation to GNP growth rate.

Table 6

Impacts of Real Government Investment on

Exchange Rates under

Flexible Exchange Rate Regime

A. Own Multipliers

(%)

	1976	1977	1978	1979
Japan	-0.91	-2.31	-3.91	-4.66
U. S.	(-0.29)	(-0.87)	(-1.27)	(-1.77)
Canada	-0.53	-2.03	-4.52	-10.61
U. K.	-1.28	-3.55	-1.57	1.07
France	-0.97	-1.20	-1.34	-1.69
W. Germany	-0.23	-0.56	-1.19	-1.39
Italy	-0.78	-7.07	-14.92	-33.87
Australia	-0.23	-1.09	-2.06	-2.34

Note: See note on Table 3.

B. Cross Multipliers

(%)

	1976	1977	1978	1979
Japan's Impacts				
Japan	-0.91	-2.31	-3.91	-4.66
U. S.	(0.06)	(0.27)	(0.60)	(0.83)
Canada	0	-0.17	-0.28	-0.78
U. K.	0.32	0.55	-2.12	2.01
France	0.06	-0.08	-0.27	-0.70
W. Germany	0.01	-0.14	-0.24	-0.52
Italy	0.28	0.60	1.29	2.88
Australia	0.57	0.38	0.30	-0.37
U. S.' Impacts				
Japan	0.74	2.10	3.18	5.16
U. S.	(-0.29)	(-0.87)	(-1.27)	(-1.77)
Canada	0.39	0.39	0.15	-1.46
U. K.	0.52	0.54	0.40	6.93
France	0.42	1.18	1.64	2.04
W. Germany	0.35	0.87	1.34	1.95
Italy	0.79	0.84	1.05	3.68
Australia	1.01	1.93	2.78	3.38
W. Germany's Impacts				
Japan	0.07	0.13	0.09	0.18
U. S.	(0.02)	(0.13)	(0.33)	(0.58)
Canada	0.01	0	0.04	-0.24
U. K.	0.13	-0.05	-2.33	3.03
France	0.04	-0.09	-0.29	-0.74
W. Germany	-0.23	-0.56	-1.19	-1.39
Italy	0.16	-0.45	-1.74	-6.37
Australia	0.06	-0.03	-0.13	-0.58

Note: Exchange rates are defined as U. S. dollars per unit of national currency. For the U. S., however, the figures in brackets refer to effective exchange rates.

Table 7

International Multipliers of Private Bank Loans

Increased by 1 % of Nominal GNP under

Fixed (P) and Flexible (F) Exchange Rate Regimes

		A. Real GNP (%)				B. GNP Deflator (%)			
		1976	1977	1978	1979	1976	1977	1978	1979
Japan	P	0	1.20	1.77	2.30	0	0.14	0.39	0.63
	F	0	1.49	2.40	3.34	0	0.20	0.58	1.04
U. S.	P	0	1.37	2.33	3.35	0	0	0.15	0.63
	F	0	1.38	2.39	3.52	0	0.02	0.20	0.73
Canada	P	0.04	0.20	0.29	0.28	0.01	0.06	0.14	0.24
	F	0.04	0.28	0.78	1.58	0.01	0.08	0.33	0.93
U. K.	P	0.12	0.30	0.47	0.55	0	0.07	0.17	0.24
	F	0.12	0.25	0.32	0.46	0.01	0.11	0.21	0.02
France	P	2.19	2.78	2.89	3.05	1.24	1.63	1.64	1.67
	F	2.28	3.10	3.60	4.13	1.46	1.99	2.18	2.51
W. Germany	P	-0.02	0.16	0.57	1.17	0.15	0.43	0.76	1.20
	F	-0.01	0.22	0.68	1.39	0.15	0.44	0.81	1.29
Italy	P	0.13	0.31	0.39	0.39	0	0.05	0.14	0.18
	F	0.13	0.33	0.51	0.40	0.04	0.43	1.60	4.27
Australia	P	0.42	1.17	1.90	1.91	0.06	0.18	0.29	0.29
	F	0.41	1.48	3.07	3.53	0.13	0.44	0.92	1.26

Note: See note on Table 3.

Table 8

International Multipliers of Discount Rate

Reduced by 1 % under Fixed (P) and

Flexible (F) Exchange Rate Regimes

		A. Real GNP (%)				B. GNP Deflator (%)			
		1976	1977	1978	1979	1976	1977	1978	1979
Japan	p	0.27	1.24	1.87	2.24	0	0.09	0.27	0.46
	F	0.33	1.65	2.59	3.44	0.01	0.17	0.50	0.88
U. S.	P	0	1.14	1.91	2.54	0	0	0.12	0.51
	F	0.02	1.15	2.01	2.74	0.02	0.08	0.30	0.89
Canada	P	0.01	0.20	0.22	0.18	0	0.05	0.11	0.20
	F	0.21	2.53	5.06	8.17	0.05	0.95	3.15	7.08
U. K.	P	0.01	0.18	0.26	0.23	0	0.01	0.10	0.13
	F	0.01	0.05	0.09	0.43	0.09	0.16	0.01	0.68
France	P	0.04	0.25	0.51	0.75	0.02	0.15	0.30	0.43
	F	0.05	0.30	0.67	1.04	0.04	0.23	0.44	0.67
W. Germany	P	0.53	2.15	4.32	6.57	0.20	0.89	2.13	3.73
	F	0.56	2.32	4.56	7.17	0.20	0.93	2.25	3.99
Italy	P	0.40	0.53	0.44	0.44	-0.08	0.05	0.14	0.13
	F	0.34	0.50	0.51	0.42	0.45	2.14	4.96	8.59
Australia	P	0.80	2.31	3.15	2.60	0.11	0.34	0.47	0.36
	F	0.83	2.62	4.29	3.89	-0.01	0.28	0.69	0.72

Note: See note on Table 3.

APPENDIX

Quarterly Basis on Exchange Rate Functions

Quarterly lag structures of the exchange rate functions in Table 1 for the eight developed countries are indicated as follows. (The figures below refer to time lags on a quarterly basis. For instance, 2 ~ 5 for a_1 in Japan means $a_1 \frac{1}{4} \sum_{i=2}^{5} (p/p')_{t-i}$. (i = 2 ··· 5))

	a_1	a_2	a_3	a_4
Japan	2 ~ 5	0 ~ 3	0	0 ~ 3
U. S.	2 ~ 3	2 ~ 3	1 ~ 4	0 ~ 1
Canada	2 ~ 5	0 ~ 1	1 ~ 3	0 ~ 1
U. K.	0 ~ 3	0	1 ~ 3	0 ~ 3
France	2 ~ 5	0	1 ~ 4	0
W. Germany	2 ~ 5	0 ~ 2	1 ~ 4	0 ~ 3
Italy	2 ~ 5	0 ~ 1	1 ~ 3	0 ~ 1
Australia	2 ~ 4	0 ~ 1	1 ~ 3	0

For a_3, time lags refer only to i_N, discount rate, with $\dot{e}$ having no time lag.