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SOURCES OF MACROECONOMIC IMBALANCES IN THE WORLD ECONOMY: A SIMULATION APPROACH

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ABSTRACT

This paper uses a global macroeconomic simulation model to identify the factors that have contributed to global trade and financial imbalances in the 1980s. After investigating the properties of monetary and fiscal policies in the model, we examine whether the budgetary shifts in the OECD economies in the 1980s can account for the bulk of trade and exchange rate movements. Our conclusions are mixed. The combination of sharply higher fiscal deficits in the United States and sharply reduced deficits in Japan goes far to explain the movements of the trade balances and exchange rates of the two economies. However, the drop in the dollar vis-a-vis the Yen since late 1985 is not well explained by the model. We also investigate the prospects for a reduction of the U.S. trade deficits if U.S. budget deficits are in fact reduced, as well as the possible role for Japanese monetary and fiscal policies in reducing the trade imbalances of the two countries.

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Sources of Macroeconomic Imbalances in the World Economy: A Simulation Approach

During the 1980s, there have been several striking developments in world trade and financial patterns. As shown in Table 1, the United States shifted from a trade deficit of about 1 percent of GNP at the end of the 1970s to a trade deficit of over 3 percent of GNP in 1985. Japan, on the other hand, shifted from a small surplus to a surplus in excess of 4 percent of GNP in the same period. The non-oil developing countries also experienced a dramatic change, with their large trade deficits at the end of the 1970s being virtually eliminated by 1985.

The financial counterparts of these trade changes are well known and equally dramatic. The U.S., which in 1980 was the world's large net creditor country, is now the largest net debtor country, while Japan has replaced the U.S. as the world's preeminent creditor country. At the same time, most non-oil developing countries virtually lost their access to market borrowing in the early 1980s, and many of the largest borrowers in the late 1970s became net repayers of debt in the mid-1980s.

The trade and financial imbalances in recent years have generated enormous political pressures in the United States for measures to "restore balance". Different interpretations of the reasons for the imbalances have led to differing emphases in the policy proposals. Many U.S. politicians, for example, ascribe the Japanese trade surpluses to unfair Japanese trading practices. The policy proposal

Table 1. Changes in Trade Balances.

	Average Trade Balance (% of GNP), 1978-80	Trade Balance (% of GNP),1985	Change
United States	-1.2	-3.1	-1.9
Japan	1.0	4.2	3.2
Canada	2.3	3.8	3.2
Rest of OECD,[a]	-0.6	0.4	1.0
of which:			
Germany	2.4	4.6	1.8
France	-0.9	-0.9	0.0
United Kingdom	-0.7	-0.5	0.2
10 Smaller Countries[b]	-2.2	-0.3	1.9
Non-Oil LDC's[c]	-2.2	-0.3	1.9

a 1982 Weights

b Australia, Austria, Belgium, Denmark, Finland, Greece, Netherlands, Norway, Spain, Sweeden.

c Percent of U.S. GNP

Source: International Financial Statistics, IMF.

most closely identified with this interpretation is the Gephardt Amendment, which calls for U.S. tariff increases against foreign countries that have large bilateral trade surpluses vis-a-vis the U.S., and are certified by the U.S. International Trade Commission to be engaging in unfair trade practices against U.S. goods. [1]

Many business analysts and some economists see the U.S. trade deficits as resulting from a long-term decline in U.S. "competitiveness", resulting from poor management practices, old-fashioned labor-relations procedures, a lack of entrepreneurship, or other factors that have contributed to slow productivity growth. Advocates of this point of view have urged a new industrial policy in the United States, usually with some variant of labor-management-government cooperation to overcome structural problems in the U.S. economy.

Most economists, however, regard the trade imbalances as deriving from macroeconomic causes, and therefore look to macroeconomic solutions. [2] The most common interpretations of the U.S. and Japanese imbalances stress the role of expansionary U.S. fiscal policies and contractionary Japanese fiscal policies. The differing movements in

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1. At the time of this writing, the Gephardt Amendment has been included in the Omnibus Trade Bill passed by the U.S. House of Representatives. The trade legislation is now under consideration by the U.S. Senate. The President has stated that he will veto a trade bill that includes the Gephardt Amendment in its current form.

2. It is possible, of course, to agree with the diagnosis that there has been an important productivity slowdown in the U.S. economy, while at the same time interpreting the trade balance developments as resulting from other macroeconomic factors rather the productivity slowdown itself.

the budgets of the two countries, as measured by changes in the structural inflation-adjusted (full-employment) budget deficit, can be seen in Table 2. Between 1979 and 1985, the U.S. structural budget deficit widened by 4.4 percent of potential GNP in the U.S., while the Japanese deficit was reduced by 3.7 percent. In the rest of the OECD, Germany also reduced its structural deficit, by 3.3 percent of GNP, while the smaller economies generally had a small increase in their deficits. In the most common interpretation of the trade imbalances (and one that is largely supported in this paper), the U.S. fiscal expansion cum Japanese fiscal contraction raised U.S. interest rates relative to Japanese rates, induced a capital inflow from Japan, and caused a dollar appreciation and a worsening of the U.S. trade imbalance.

Other economists put less weight on fiscal policy, and argue that the dollar exchange rate had a "life of its own" in the 1980s, with much of the appreciation of the dollar between 1980 and 1985 resulting from speculative movements that pushed the dollar well above "fundamental" levels, and thereby inducing a U.S. trade deficit. Movements in the real exchange rate of the U.S. vis-a-vis other countries are shown in Table 3 (real exchange rates are measured there as the nominal exchange rate adjusted for relative consumer price level changes). Whether the 24 percent real appreciation of the dollar vis-a-vis the Yen between 1978-80 and 1985, and the 39 percent appreciation vis-a-vis the rest of the OECD, are explained by budget deficits or by a speculative bubble, there is little doubt that the exchange rate movements played an important role in generating the

Table 2. Changes in General Government Financial Balances, percent of GNP

	Actual Balance	Inflation-Adjusted Structural Balance
United States	-4.3	-4.4
Japan	3.6	3.7
Canada	-3.6	-2.2
Rest of OECD,[a]	-1.3	0.5
of which:		
Germany	1.3	3.3
France	-3.1	0.5
United Kingdom	0.5	1.9
10 Smaller Countries[b]	-2.0	-0.8

a 1982 GDP weights

b Australia, Austria, Belgium, Denmark, Finland, Greece, Netherlands, Norway, Spain, Sweeden.

Source: Atkinson, P. and Chauraqui, J-C.,"The Origins of High Real Interest Rates," OECD Economic Studies, Autumn 1985, Table 3, p. 16.

Table 3. Real Bilateral Exchange Rate vis-a-vis $ U.S..

Real Exchange Rate vis-a-vis $ U.S.

(1978-1980 = 100)

	1985	1986	Change 1978-80/ 1985	Change 1985/ 1986
Japan	76	106	-24	30
Canada	91	91	-9	0
Rest of OECD,	61	77	-39	16
of which:				
Germany	55	73	-45	18
France	58	76	-42	18
United Kingdom	68	78	-32	10

Source: The real exchange rate is defined as $P/E\,P^{u}$, where P is the CPI of the country or region, E is in units of currency per dollar, and P^{u} is the CPI of the United States. A rise in the index signifies a real depreciation of the dollar.

trade imbalances of the early 1980's. Note that the model ideally should explain both the appreciation of the dollar up to 1985, and the sharp depreciation afterwards.

Other economists suggest that the U.S. experienced an investment boom in the 1980s due to a favorable economic climate and high business confidence. They argue that the trade deficits in the U.S. are a sign of investment strength and economic vigor rather than economic weakness. Some go so far as to aver that apparent relationship of the budget deficit and trade deficit is purely coincidental, and that the real story of the U.S. trade imbalance is not a fall in national savings (coming from larger public sector deficits), but rather a rise in national investment.

Each of these differing macroeconomic interpretations leads to a distinct policy recommendation. Those who stress the fiscal sources of the trade imbalances usually stress the need for fiscal actions in the major industrial countries as the way to reduce the trade imbalances. A standard view is that the U.S. should have a fiscal contraction, while Japan and Europe should engineer an offsetting fiscal expansion. Economists emphasizing the independent role of the exchange rate stress the need for coordinated management of the exchange rate, in addition to any fiscal actions which may be warranted. The dollar should be "talked down", or pushed down if necessary by foreign exchange intervention policies or relatively expansionary U.S. monetary policies. Finally, those who see evidence of an investment boom in the data argue that nothing particular needs

to be done. International capital is simply flowing to the economy with the most exceptional investment opportunities.

The goal of this paper is to present a simulation model of the world economy to examine the fiscal policy interpretation of the trade imbalance. The argument for such an approach is that the issues at hand require quantitative evidence that can best be adduced in the context of a structural macroeconomic model. We can be confident, for example, that the fiscal actions in the U.S., Europe, and Japan, have contributed to the trade imbalances in recent years. But is it reasonable to attribute most or all of the observed imbalances to this factor? Do we have to invoke additional factors, such as speculative exchange rate movements, or declining U.S. productivity, to account for the large shifts that have occurred in recent years? The simulation model presented in this paper can provide a quantitative assessment of such issues.

The simulation results in the paper suggest that the combination of fiscal policies in the OECD and the cutoff in lending to the LDCs in the early 1980s can account for most of the trade balance movements of the U.S. and Japan, and some though not all of the exchange rate movements since 1980. However, there remain major areas of uncertainty, especially in explaining the extraordinary drop in the dollar in the past year. The model also suggests several interesting points regarding the international transmission of policy changes. Most importantly, the international linkages among the major economies are probably not strong enough to justify the recent intense pressures from the U.S. for "international policy coordination." U.S. economic

growth and trade imbalances, for example, will be little affected by the fiscal policy choices made by Japan and Europe. Even the direction of effect of one country's monetary and fiscal policies on other countries is often contrary to the conventional view. Perhaps most important, the use of monetary policies in the U.S. and abroad to induce a further depreciation the dollar would, by itself, do little to reduce the U.S. trade deficits.

The model is described briefly in Section II (the model equations are listed in Appendix A to the paper). A more detailed description of the model will soon be available in McKibbin and Sachs (1987). The basic policy simulation results are described in Section III, where a comparison is made with the standard Mundell-Fleming two country model. In Section IV, the model is used to track several of the developments in the period since 1980, and is used to make some forecasts of the next few years. In Section V, we underscore several limitations of the model and descibe some extensions that are now underway.

II. The MSG2 Model of the World Economy

The model in this paper, which we term the MSG2 model, is a further development of the McKibbin-Sachs Global (MSG) model, which has been decribed elsewhere (see especially McKibbin and Sachs (1986) and Ishii, McKibbin, and Sachs (1986) for discussion of the earlier version). The new model extends the earlier version by including a more satisfactory treatment of aggregate supply and investment

behavior. The new model, however, is still very much in a developmental stage, and we are indeed dissatisfied with the specification of some of the key relations in the present version.

A. An Overview of the Model

The MSG2 is a dynamic general equilibrium model of a six-region world economy, divided into the United States, Japan, Canada, the rest of the OECD economies (denoted ROECD, and constituted mainly by OECD Europe), and non-oil developing countries (LDCs), and OPEC. The model is of moderate size (about three dozen behavioral equations per industrial region). It is distinctive relative to most other global models in that it solves for a full intertemporal equilibrium in which agents have rational expectations of future variables. In theoretical conception, therefore, the model is close in design to intertemporal dynamic models of fiscal policy in Lipton and Sachs (1983) and Frenkel and Razin (1986). Those studies, like the present simulation model, examine fiscal policy in an intertemporal perfect-foresight environment, with considerable attention given to intertemporal optimization and intertemporal budget constraints. Frenkel and Razin are noteworthy in being able to derive analytical results from their model, rather than relying on simulations, as in the current study.

The model has a mix of Keynesian and classical properties by virtue of a maintained assumption of slow adjustment of nominal wages in the labor markets of the U.S., Canada, and the ROECD (Japan is treated somewhat differently, as described below).

The model is solved in a linearized form, to facilitate policy optimization exercises with the model, and especially to use linear-quadratic dynamic game theory and dynamic programming solution techniques. [3] The global stability of the linearized model can be readily confirmed by an analysis of the model's eigenvalues. At this point, the model is parametrized by choosing parameters based on existing econometric research in the literature, rather than by undertaking our own econometric estimation of the model parameters. The procedure of relying on other research estimates for key parameters represents, in our opinion, a healthy division of labor between those who focus on general equilibrium modelling and those who focus on the econometric study of particular aspects of the macroeconomy.

Speaking broadly, the model has several attractive features. First, all stock-flow relationships are carefully observed. Budget deficits cumulate into stocks of public debt; current account deficits cumulate into net foreign investment positions; and physical investment cumulates into the capital stock. Underlying growth of Harrod-nuetral productivity plus labor force growth is assumed to be 4 percent per region. Given the long-run properties of the model, the world economy settles down to the 4 percent steady-state growth path following any set of initial disturbances.

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3. In general, quantity variables are linearized around their levels relative to potential GDP, while price variables are linearized in log form.

A second attractive feature is that the asset markets are efficient in the sense that asset prices are determined by a combination of intertemporal arbitrage conditions and rational expectations. By virtue of the rational expectations assumption and the forward-looking behavior of households and firms, the model can be used to examine the effects of anticipated future policy changes, such as the sequence of future budget deficit cuts called for by the Gramm-Rudman legislation in the U.S. Indeed, one of the difficulties of using the MSG2 model is that every simulation requires that the "entire" future sequence of anticipated policies be specified. In practice, forty year paths of policy variables, or endogenous policy rules, must be specified.

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

Another point of interest regarding the supply side is the specification of the wage-price dynamics in each of the industrial regions. Extensive macroeconomic research has demonstrated important differences in the wage-price processes in the U.S., Europe, and

Japan, and these differences are incorporated in the model. In particular, the U.S. and Canada are characterized by nominal wage rigidities arising from long-term nominal wage contracts. In Japan, on the contrary, nominal wages are assumed to be renegotiated on an annual, synchronized cycle, with nominal wages selected for the following year to clear the labor market on average. In the ROECD, nominal wages are assumed to be more forward looking than in the U.S. and Canada, though real wages adjust slowly to clear the labour market.

A third feature of the supply side of some interest is the assumption regarding trade prices. Many observers have recently pointed out the fairly significant lag in the passthrough of exchange rate changes into import price changes in the U.S. economy (and probably in the other economies as well, which have been less extensively examined). The appreciation of the dollar during 1981-85 did not bring about an instantaneous and equivalent fall in U.S. import prices, and the recent depreciation of the dollar has not brought about an equivalent rise in prices. To capture part of this effect, we assume that exporters into the U.S. market set their prices in dollars one period in advance, in order to equate the export price with the <u>expected</u> home market price in the following period. If the dollar then unexpectedly appreciates, the importers into the U.S. reap an unanticipated windfall, in that the price that they receive in the U.S. market, expressed in local currency at the spot market exchange rate, exceeds the domestic price of output. This divergence will be eliminated, on average, in the following period, when the trade prices are reset. There are of course other reasons for the failure of

exchange rate movements to pass through into prices, most of which involve imperfect competition in trade (see Dornbusch(1986) or Krugman (1986) for details). We plan to incorporate such imperfect competition features into a later version of the model.

B. A more detailed look at MSG2

The complete MSG2 model is presented in Appendix A, and a complete technical description will be found in McKibbin and Sachs (1987). Here we will merely sketch out some of the key structural features of the model.

Each of the regions in the model produces a good which is an imperfect substitute in the production and spending decisions of the other regions. Each industrialized region produces one final good which is used for investment and consumption purposes in that region and in all of the other regions. LDC and OPEC each produce one good which is a primary input in the production processes of the industrial regions. Demands for the outputs of LDC and OPEC are therefore derived demands for the production inputs. The U.S., Europe, and Canada are also each assumed to produce an exogenous amount of domestic oil, which is a perfect substitute for imports from OPEC.

In the model version in this paper, only the four industrial country regions are fully modelled with an internal macroeconomic structure. In LDC and OPEC, only the foreign trade and external financial aspects are modelled (we are now upgrading the model to include an internal macroeconomic structure for LDC). Note that in

referring to variables of the various regions, we will use the following notation: U.S. (U); ROECD (R); Japan (J); OPEC (O); and LDC (L). The currency of the ROECD will be termed "ECU", though in fact the countries included in the ROECD and in the actual ECU are not exactly the same.

To understand the model, it is best to consider one bloc of the model, that of the U.S., and to indicate where necessary any differences in the modelling of the other OECD regions. The cornerstone of aggregate supply in the model is a representative firm which maximizes income by producing a single output Q at price P, subject to a two-input production function (for simplicity, potential growth is ignored in the equations that follow, even though a constant underlying potential growth rate of 4 percent is included in the model). Thus, aggregate production is given as:

$$(1) \qquad Q = Q (V , N)$$

Gross output Q is a produced with value added V, and primary inputs N. In turn, V is produced with capital K and labor L, while N is produced with the imports from OPEC (net of domestic oil production) N_O and the LDCs N_L :

$$(2) \qquad V = V (K, L)$$

$$(3) \qquad N = N (N_O, N_L)$$

The capital stock changes according to the rate of fixed capital formation J and the rate of geometric depreciation δ:

$$(4) \qquad K_{t+1} = J_t + (1-\delta)\, K_t$$

J is itself a composite good, produced with a Cobb-Douglas tecnology that has as inputs the domestic goods and the final goods of Canada, Europe, and Japan. The price of J is simply a weighted sum of the prices of the home goods P (P^U for the U.S.) and the dollar import prices (P_W^i, i = R, J, C) of goods from the other OECD regions :

$$(5) \qquad J = (Q^U)^{\theta}1\ (Q^R)^{\theta}2\ (Q^J)^{\theta}3\ (Q^C)^{\theta}4$$

$$(6) \qquad p^J = \theta_1\, p^U + \theta_2\, p_W^R + \theta_3\, p_W^J + \theta_4\, p_W^C$$

As is customary in modern models of investment, it is assumed that the investment process is subject to rising marginal costs of installation, with total nominal investment expenditures I equal to the value of direct purchases of investment P^J*J, plus the per unit costs of instalation. These per unit costs, in turn, are assumed to be a linear function of the rate of investment J/K, so that adjustment costs are $P^J*J\ [(\phi_o/2)(J/K)]$. Total investment expenditure is therefore:

$$(7) \qquad I = [\, P^J + P^J \, (\phi_o/2) \, (J/K)\,]\, J$$

The goal of the firm is to choose inputs of L, N, and J to maximize intertemporal net-of-tax profits. In fact, the firm faces a stochastic problem, a point which is ignored in the derivation of the firm's behavior (in other word's, the firm is assumed to hold its estimates of future variables with subjective certainty). The firm's deterministic problem, formally stated, is:

$$(8) \qquad \max \sum_{\tau=t}^{\infty} (1+R_\tau)^{-1} \, [\, Q - (W/P)\, L - (P_N/P)\, N - P^J\, I]$$

where $(1+R_\tau)^{-1}$ is a discount factor equal to:

$$\prod_{i=t}^{\tau} (1+ r_i)^{-1}$$

and r_i is the period i short-term real interest rate.

The solution to this problem is now well known (see Bruno and Sachs, 1985, as an example). There are three key points. First, inputs of L and N are hired to the point where marginal productivities of these factors equal their factor prices. This leads to equations for the derived demand for L and N of the form:

$$(9) \qquad L = L\,(\, W/P,\, P_N/P)\, K$$

$$(10) \qquad N = N\,(W/P,\ P_N/P)\ K$$

Gross fixed capital formation can be written in terms of Tobin's "marginal" q, in the following manner:

$$(11) \qquad J = [(q-1)/\phi_o]\ K$$

Third, q (the shadow value of new investment) equals the discounted value of future profits, with q given by:

$$(12) \qquad q\ /\ P^J = \sum_{\tau=t}^{\infty} (1 + R_\tau)^{-1}\ (F_K + \Phi_K)$$

Here F_k is the marginal product of capital in the production function, and Φ_K is the marginal product of capital in reducing adjustment costs in investment.

In the specific application in the model, the gross output production function is taken to be a two-level CES function in V and N, with V a Cobb-Douglas function of L and K, and N a CES function of oil and non-oil primary inputs. The investment function derived in (11) is also modified, for empirical realism, by writing J as a function not only of q, but also of the level of flow capital income at time t, and the change in the level of gross output, along standard investment accelerator lines. The modified investment equation is of the form:

$$(11') \quad J_t = \theta \left[(q-1)/\phi_o\right] K + (1-\theta)\left[Q - (W/P)\,L - (P_N/P)\,N\right] +$$

$$+ \epsilon\,(Q_t - Q_{t-1})$$

Total private consumption spending is written as a function of labor income net of labor taxes (τ_L is the labor income tax rate), and total nominal financial wealth P*F, as in:

$$(13) \quad P^C\,C = C_L\left[W\,L\,(1-\tau_L)\right] + C_K\,(P * F)$$

This equation is certainly the most problematic of the model. The equation is an ad hoc compromise between alternative conceptions of aggregate consumption, in line with the empirical evidence that consumption is partly determined along life-cycle lines, with considerable intertemporal consumption smoothing, and partly along simpler Keynesian lines (perhaps because of liquidity constrained households). Thus, we specify that spending is a fixed proportion of current net-of-tax labor income (with no consumption smoothing of the labor income flow), as in standard Keynesian models, and a fixed proportion of wealth, as in standard life-cycle models with infinite-lived individuals. We are now experimenting with other variants of the consumption function, that include at least some degree of consumption smoothing of post-tax labor income.

Once P^C*C is determined, it is divided into purchases of the domestic good, and imported final goods from Canada, ROECD, and Japan.

The division of P^C*C is made to maximize an instantaneous utility function of CES form. The result is demands for home goods and imported goods of the form:

$$(14) \quad C^i = C^i (P_W^J/P^U, P_W^C/P^U, P_W^R/P^U) * (P_C * C)$$

$$\text{with} \quad P^C * C = P_W^J * C^J + P_W^C * C^C + P^U * C^U + P_W^R * C^R$$

where $i = J, C, R, U$

Note that P_W^i signifies the import price paid by U.S. consumers for imports from country i.

We assume that the government divides spending G among the final goods in the same proportion as does the private sector (this assumption is for convenience only), so that:

$$(15) \quad G^i / G^U = C^i / C^U \qquad \text{for } i = C, R, J$$

The price of imports is derived as follows. U.S. imports from ROECD, Canada, and Japan are invoiced in dollars, according to an equation which makes the invoice price in period t+1 equal to the (rationally) expected dollar price of the output of country i in period t+1:

$$(16) \qquad {}_t(p_W^i)_{t+1} = {}_tp^i_{t+1} + {}_te^i_{t+1}$$

where ${}_tX_{t+1}$ signifies the period t rational expectations of variable X at time t+1. (16) holds that the (log) price in period t+1 of a U.S. import from country i is determined in period t, as the sum of the (log) expected exchange rate and the (log) price of output in country i in period t+1. On average, the import price will equal the U.S. dollar price of output in country i. However, if the actual exchange rate of the dollar in period t+1 turns out to be stronger (weaker) than expected, the import price in the U.S. market will be higher (lower) than the price of country i output converted at the actual exchange rate.

The U.S. is in fact the only major market in which import prices are invoiced in the importers currency. In most other markets, the imports are invoiced in the exporter's currency, so that exchange rate changes of the importing country are quickly passed through into import prices. Thus for all exports of final goods by country i to country k other than the U.S., (k = R, J, C), the price of imports in country k is given by the contemporaneous P^i multiplied by E^i_k, the contemporaneous exchange rate between currency i and k.

For the primary goods of OPEC and the LDCs, there is a single uniform world price of goods which applies in all markets at all times (i.e. the law of one price holds). Letting P^O be the dollar price of OPEC goods, we assume that P^O is a variable markup over a basket of OECD goods, so that:

$$(16) \quad P^O = P^O (P^U, E_U^J * P^J, E_U^R * P^R, E_U^C * P^C) * h (X^O)$$

with $h' > 0$.

Note that E^i_U is in units of dollars per unit of currency i. The function P^O (.,.,.,.,.) is linear homogenous and increasing in the prices of the OECD goods. The function $h(X^O)$ makes the OPEC markup an increasing function of the total demand for OPEC exports X^O to the other regions. A similar equation governs the price of LDC commodities. The local currency price of OPEC goods in a non-U.S. region j is then given by $P^O_J = E^U_J * P^O$, according to the law of one price. A similar equation applies for the LDC commodity export.

The supply side of the U.S. block of the model is completed with the wage equation, which makes the nominal wage change a function of past consumer price (p^c) changes, rationally expected future price changes, and the level of unemployment in the economy, according to a standard Phillips curve mechanism:

$$(17) \quad (w_{t+1} - w_t) = \alpha (p^c_t - p^c_{t-1}) + (1-\alpha) ({}_tp^c_{t+1} - p^c_t) + \beta (L_t/L^f)$$

where L^f represents the inelastically supplied full-employment stock of labor. The parameter α in (17) determines how much weight is given to backward-looking versus forward-looking price expectations.

As already noted, we allow for differences in the wage dynamics of the different regions. In Japan, we specify that wages are set one

period ahead at their expected market clearing levels. Thus, let $({}_tw_{t+1})^f$ be the wage expected to clear the labor market at time t+1, in the sense that ${}_tL_{t+1} = L^f$. Then:

$$(18) \qquad w^J_{t+1} = ({}_tw^J_{t+1})^f$$

The rest of the model can be quickly stated. Prices in the U.S. (and the other OECD regions) are fully flexible within each period, so that demand for U.S. output (domestic demand plus export demand) equals output supply. Money demand equations are specified for each OECD region in a standard Goldfeld-type transactions demand equation. Asset markets are assumed to be perfectly integrated across the OECD regions. Expected returns of loans denominated in the currencies of the various regions are equalized period to period, according to the following interest arbitrage relations:

$$(21) \qquad i^i_t = i^j_t + {}_t(e^i_j)_{t+1} - e^i_{jt}$$

Thus, we do not allow for risk premia on the assets of alternative currencies. We choose the assumption of perfect capital mobility and zero risk premia in light of the failure of the empirical exchange rate literature to demonstrate the existence of stable risk premia across international currencies.

For the U.S., Canada, Japan, ROECD, and OPEC, the current account is determined under the assumption that domestic agents have free unrationed access to international borrowing and lending at the

international interest rate. It is assumed for simplicity that all international borrowing and lending takes place in dollar denominated assets. For the LDCs, in distinction, the scale of borrowing is set exogenously, under the assumption that the amount of loans available to the LDCs is rationed by country risk considerations. One of the experiments that we study later is an exogenous shift in the amount of lending made available to the LDCs.

The model is parametrized using estimates of behavioral and technological parameters from the econometrics literature. Thus, elasticities of demand for home and foreign goods, the elasticities of demand for money balances, the factor shares in the production function, etc., are taken from other studies. The only real calibration that takes place using actual data is in the trade bloc, where the free parameters of the utility function are selected to reproduce the patterns of trade among the various industrial regions as of 1986. Thus, by choice of utility function parameters, the baseline of the model exactly reproduces the direction of trade among the various regions in the first half of 1986. Choosing 1986 as the basis for linearization is of course a bit problematic for simulations of the 1981-86 period, but we chose to use the 1986 base to give a better picture here of the current policy multipliers.

III. Simulation results for monetary and fiscal policies

We now employ the model to try to understand the reasons for the shifts in global trade and financial imbalances in recent years, and

to understand better the nature of the international transmission of macroeconomic policies. We begin with standard simulations of the effects of monetary and fiscal policy, and then turn to the policy changes of the period 1980-85.

A. Fiscal policy in the U.S. and Japan

Various simulation results for fiscal policies are shown in the next few tables. Before discussing these results, however, it is important to understand the precise experiment that is being undertaken. In line with rational expectations modelling, policy experiments must define an entire future path of policies, and not just a change in during the simulation period. In the case of fiscal policy, it is important that tax and spending policies be consistent with the intertemporal budget constraint of the public sector. In particular, starting from any initial stock of public debt, the discounted value of current and future taxes must equal the discounted value of government spending plus the initial value of outstanding public debt.

In our case, a permanent fiscal expansion, as shown in Table 4, is treated in the following way. The basic experiment is a sustained rise in government spending (later we consider a cut in taxes). Government final expenditure rises permanently by 1 percent of potential GDP. Initially, the tax schedule remains unchanged, with taxes increasing only to the extent that the fiscal expansion raises output and thereby induces an endogenous tax increase (in other words,

Table 4.
Permanent US Fiscal Expansion (1% GNP)

Year		1	2	3	4	5
U.S. Economy						
Output	%	0.37	0.23	0.37	0.34	0.27
Priv Consumption	%GNP	-0.22	-0.07	-0.04	-0.05	-0.10
Priv Investment	%GNP	0.00	-0.16	-0.07	-0.12	-0.15
Govt Consumption	%GNP	1.00	1.00	1.00	1.00	1.00
Exports	%GNP	-0.18	-0.16	-0.15	-0.15	-0.15
Imports	%GNP	0.16	0.13	0.14	0.13	0.12
Imports (quant.)	%GNP	0.23	0.37	0.36	0.34	0.33
Trade Balance	%GNP	-0.34	-0.29	-0.29	-0.28	-0.28
Labour Demand	%	0.52	0.32	0.57	0.54	0.48
Inflation	D	-0.04	-0.26	-0.06	0.03	0.09
Int Rate (sh)	D	0.86	0.44	0.54	0.50	0.52
Int Rate (lg)	D	0.59	0.53	0.50	0.46	0.44
Tobin's Q	%	-3.15	-2.61	-2.62	-2.68	-2.86
Real Exchange Rate						
$/ecu	%	-3.85	-3.15	-2.80	-2.54	-2.42
$/yen	%	-4.20	-3.58	-3.36	-3.27	-3.32
$/can	%	-2.66	-2.23	-2.02	-1.80	-1.67
ROECD Economies						
Output	%	0.07	-0.07	-0.20	-0.33	-0.44
Priv Consumption	%GNP	-0.16	-0.23	-0.30	-0.36	-0.42
Priv Investment	%GNP	-0.13	-0.23	-0.23	-0.26	-0.28
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.14	0.19	0.15	0.12	0.09
Imports	%GNP	-0.04	-0.06	-0.07	-0.08	-0.09
Imports (quant.)	%GNP	-0.23	-0.20	-0.19	-0.18	-0.17
Trade Balance	%GNP	0.27	0.24	0.22	0.19	0.18
Labour Demand	%	0.25	-0.04	-0.14	-0.25	-0.33
Inflation	D	0.29	0.14	0.15	0.13	0.13
Int Rate (sh)	D	0.41	0.33	0.40	0.42	0.48
Japanese Economy						
Output	%	0.03	-0.04	-0.10	-0.15	-0.20
Priv Consumption	%GNP	-0.20	-0.31	-0.38	-0.41	-0.46
Priv Investment	%GNP	-0.14	-0.27	-0.24	-0.25	-0.27
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.17	0.34	0.32	0.31	0.30
Imports	%GNP	-0.02	-0.04	-0.05	-0.05	-0.06
Imports (quant.)	%GNP	-0.20	-0.20	-0.20	-0.21	-0.22
Trade Balance	%GNP	0.39	0.38	0.37	0.36	0.36
Labour Demand	%	0.31	-0.00	-0.00	-0.00	-0.00
Inflation	D	0.28	0.18	0.12	0.07	0.08
Int Rate (sh)	D	0.51	0.41	0.51	0.53	0.58

the cyclically adjusted budget deficit rises by one percent of GDP, the full amount of the spending increase). The actual fiscal deficit rises by about 0.85 of 1 percent of GDP following the 1 percent of GDP rise in government spending, because of the induced increase in taxes of 0.15 percent of GDP. The deficit is financed entirely by the issuance of public debt, with the money stock held constant.

If the tax schedule were not subsequently altered, the stock of public debt would eventually rise without bound, at an explosive geometric rate. To prevent this, we assume that labor income taxes are increased each year by enough to cover the increasing interest costs on the rising stock of public debt. Letting B_0 be the pre expansion stock of debt, the tax rule is therefore:

$$(22) \quad T_t = T_o + \tau_L (W/P\ L) + \tau_K [Q - (W/P)\ L - (P_N/P)\ N] + T_s$$

Here, τ_L is the average tax rate on labor income, and τ_K is the average tax rate (corporate and personal) on capital income. T_s is a shift term in the tax shedule that rises along with the increase in interest payments on the public debt, $r_t B_t - r_0 B_0$. It is assumed that T_s falls entirely on labor income (this assumption is made for convenience only, and will be modified in a later version of the model). T_o is an exogenous tax shift parameter.

In this way, the overall deficit remains fairly constant at about 1 percent of GNP following a rise in government spending (it fluctuates slightly due to fluctuations in real economic activity). The primary deficit (government spending net of interest payments,

minus total taxes), given as $(G_t - T_t)$, eventually turns to a surplus, as is necessary to prevent an explosive growth in debt. Since the level of debt eventually stabilizes given the way that we have conducted this experiment, while the real economy grows at its potential rate of 4 percent in the long run, the debt to GNP ratio in fact eventually falls to zero after an initial increase following the rise in government spending.

Consider now the effects of a permanent rise in U.S. government spending shown in Table 4. All variables are expressed as deviations from an initial baseline. Output is recorded as a percentage deviation from the initial baseline, while consumption, investment, exports, imports, and the trade balance are all reported as deviations from the baseline in percent of potential GDP. Thus, in 1986, private consumption falls relative to the baseline by 0.22 of one percent of U.S. GDP. Labor input (total manhours in the economy), is measured as a percentage deviation from the baseline. Inflation and interest rates are measured as percentage point deviations from the baseline. Thus, inflation in the first year of the fiscal expansion falls by 0.04 percentage points, while short term interest rates increase by 0.86 percentage points. The three bilateral real exchange rates are reported as percent changes from baseline values. Note that a negative value for the exchange rate indicates an appreciation of the dollar, since the exchange rates are measured as dollars per unit of foreign exchange.

How do the simulation results compare with our expectations from the simple Mundell-Fleming model of policy transmission under flexible

exchange rates? According to the standard model, we should expect a bond-financed fiscal expansion, in the presence of perfect substitutability of home and foreign financial assets, to result in a rise in domestic income, an appreciation of the exchange rate, a rise in short and long term interest rates, and a worsening of the trade balance. Tobin's q might rise or fall. On the one hand higher interest rates will tend to depress q, while on the other hand, higher output (and greater profits) will tend to raise q, with the overall effect being ambiguous. We see from Table 4 that the model behaves in line with these expectations. Output rises, though with a multiplier considerably less than 1. The dollar appreciates in real terms by 3.85 percent vis-a-vis the ECU, 4.20 percent vis-a-vis the yen, and 2.66 percent vis-a-vis the Canadian dollar. Short-term interest rates rise by 0.86 percentage points, and long-term rates rise by 0.59 percentage points. The trade balance deteriorates by 0.34 percent of potential GDP in the first year, and that deterioration persists for the next several years. Note that Tobin's q in fact falls, by 3.15 percent. Investment nonetheless does not fall in the first year of the fiscal expansion because of the accelerator effect (which operates in addition to q) while investment is depressed relative to baseline in the later years.

Let us next turn to the international transmission effects. Importantly, the Mundell-Fleming model, when extended to allow for endogenous wages and prices, teaches that the international transmission effect of a fiscal expansion on foreign output is <u>ambiguous</u>. On the one hand, the U.S. expansion raises world interest

rates, which tends to depress investment abroad. On the other hand, the expansion causes an appreciation of the dollar, which tends to raise net exports abroad. Europe, Japan, and Canada benefit from a trade boom, but suffer a drop in domestic investment. The net effect on output is therefore ambiguous, despite a tendency of many commentators to assume that foreign fiscal expansions are necessary stimulative of the domestic economy.

As described in Bruno and Sachs (1985, Chapter 5), and in Oudiz and Sachs (1984), the transmission is more likely to be negative if foreign wages and prices rise rapidly in response to the depreciation of the foreign currencies vis-a-vis the dollar. If foreign nominal wages are perfectly fixed, as in the original Mundell-Fleming model, then the U.S. fiscal expansion must raise output abroad. The simple version of the Mundell-Fleming model is probably the source of the misconception that fiscal expansions are always transmitted positively.

As can be seen in Table 4, for Japan and the rest of the OECD, the transmission is positive in the first year, but then negative in later years [4]. Note that net exports indeed expand everywhere abroad as expected, but that both foreign consumption and investment tend to get crowded out by the U.S. expansion. The negative effect on foreign consumption derives from the adverse effect of the fiscal expansion on the value of foreign Tobin's q. As q falls abroad, not only does investment decline, but so too does consumption, due to a negative

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4. Only for Canada, whose results are not shown in the tables,is there an uninterrupted positive transmission from the U.S..

wealth effect. Since Canada is so dependent on U.S. trade, the expansionary trade effects dominate the contractionary effects on C and I. In the ROECD and Japan, however, the negative effects on domestic spending dominate the export stimulus.

Table 5 records the dynamic adjustments to a permanent fiscal expansion in Japan. Note that by the assumption of wage setting in Japan, the rise in Japanese employment following the fiscal expansion can last just one period. By the second period, Japanese wages exactly enough to restore exact full employment in the labor market. As in the U.S., the Japanese fiscal expansion raises output, depresses Tobin's q at home and abroad, appreciates the Yen vis-a-vis the other currencies, and worsens the Japanese trade balance. Indeed, the adverse effect on the trade balance is even larger than in the U.S. as a percent of own GDP, with the trade balance falling by 0.63 percent of GDP.

The Japanese fiscal expansion has a contractionary effect on the U.S. economy after the first year. Inflation rises, and output goes down. It is true that the trade balance improves, but by a miniscule $3-4 billion (in 1987 $ US) for each 1 percent of GNP Japanese fiscal expansion. This improvement in the trade balance is more than crowded out by a drop in investment and consumption. Many observers have stressed the need for a Japanese fiscal expansion to help stabilize growth in the U.S. Table 5 should give them pause.

The result that a Japanese fiscal expansion appreciates the Yen and causes a very large trade deficit may be surprising to Japanese observers whose assessments of policy were formed during the pre-1980

Table 5.
Permanent Japanese Fiscal Expansion (1% GNP).

Year		1	2	3	4	5
U.S. Economy						
Output	%	0.01	-0.02	-0.13	-0.22	-0.29
Priv Consumption	%GNP	-0.02	-0.09	-0.16	-0.22	-0.27
Priv Investment	%GNP	-0.06	-0.08	-0.12	-0.14	-0.15
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.04	0.03	0.02	0.02	0.01
Imports	%GNP	-0.03	-0.03	-0.04	-0.05	-0.05
Imports (quant.)	%GNP	-0.05	-0.12	-0.13	-0.13	-0.13
Trade Balance	%GNP	0.07	0.06	0.06	0.06	0.06
Labour Demand	%	0.01	-0.01	-0.14	-0.22	-0.28
Inflation	D	0.05	0.15	0.12	0.11	0.09
Int Rate (sh)	D	0.01	0.11	0.13	0.19	0.23
Int Rate (lg)	D	0.21	0.21	0.21	0.20	0.19
Tobin's Q	%	-0.76	-1.03	-1.22	-1.39	-1.53
Real Exchange Rate						
$/ecu	%	0.08	0.03	0.02	-0.02	-0.04
$/yen	%	3.93	3.56	3.43	3.22	3.03
$/can	%	0.07	0.06	0.07	0.05	0.03
ROECD Economies						
Output	%	0.04	-0.06	-0.13	-0.19	-0.26
Priv Consumption	%GNP	-0.07	-0.12	-0.17	-0.22	-0.26
Priv Investment	%GNP	-0.06	-0.10	-0.11	-0.13	-0.14
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.05	0.04	0.03	0.03	0.02
Imports	%GNP	-0.02	-0.03	-0.04	-0.04	-0.05
Imports (quant.)	%GNP	-0.12	-0.12	-0.12	-0.13	-0.13
Trade Balance	%GNP	0.07	0.07	0.07	0.07	0.07
Labour Demand	%	0.05	-0.06	-0.12	-0.18	-0.23
Inflation	D	0.13	0.09	0.09	0.09	0.08
Int Rate (sh)	D	0.08	0.09	0.15	0.19	0.23
Japanese Economy						
Output	%	0.38	0.02	-0.00	-0.02	-0.05
Priv Consumption	%GNP	0.08	0.03	-0.04	-0.08	-0.13
Priv Investment	%GNP	0.06	-0.11	-0.09	-0.09	-0.10
Govt Consumption	%GNP	1.00	1.00	1.00	1.00	1.00
Exports	%GNP	-0.35	-0.53	-0.52	-0.51	-0.49
Imports	%GNP	0.09	0.07	0.07	0.06	0.06
Imports (quant.)	%GNP	0.42	0.37	0.36	0.34	0.32
Trade Balance	%GNP	-0.63	-0.60	-0.59	-0.57	-0.55
Labour Demand	%	0.24	0.00	0.00	0.00	0.00
Inflation	D	-0.33	0.09	0.09	0.06	0.05
Int Rate (sh)	D	0.38	0.20	0.28	0.32	0.35

period of low international capital mobility and strong capital controls. As a counterfactual experiment it is useful to consider a permanent Japanese fiscal expansion under the assumption of complete immobility of capital, as an approximation to the Japanese policy environment before the liberalization of portfolio investment flows in 1980. The results are shown in Table 6. The importance of capital mobility to the earlier results is immediately evident. With capital immobility, the fiscal expansion crowds out a much large share of investment and consumption, rather than net exports. Japanese short term interest rates rise by 1.28 percentage points, much more that the rise of 0.38 percentage points observed in Table 5. The Yen now depreciates after the first year, as it required to maintain current account balance in the face of a fiscal expansion. The results of Table 6 will be noted again when we consider the sources of the trade imbalances in the 1980s. The large Japanese trade surpluses of recent years would have been virtually impossible without the liberalization of Japanese capital outflows in the 1980.

B. Monetary Policy in the U.S. and Japan

As with fiscal policy, the international transmission of monetary policy to foreign output has a theoretically ambiguous sign. A domestic monetary expansion almost surely raises home output temporarily, but it may raise or lower output abroad, depending on the strength of two competing channels. On the one hand, the monetary expansion tends to depreciate the domestic currency, thus shifting

Table 6.
Permanent Japanese Fiscal Expansion (1% GNP)
with no Capital Mobility in Japan.

Year		1	2	3	4	5
U.S. Economy						
Output	%	-0.01	-0.00	-0.01	-0.03	-0.04
Priv Consumption	%GNP	-0.00	-0.01	-0.01	-0.03	-0.04
Priv Investment	%GNP	-0.01	-0.01	-0.01	-0.02	-0.02
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.00	-0.00	-0.00	-0.00	-0.00
Imports	%GNP	-0.00	-0.00	-0.00	-0.01	-0.01
Imports (quant.)	%GNP	-0.00	-0.01	-0.02	-0.02	-0.02
Trade Balance	%GNP	0.00	0.00	0.00	0.00	0.00
Labour Demand	%	-0.01	-0.00	-0.01	-0.03	-0.04
Inflation	D	-0.00	0.01	0.02	0.02	0.02
Int Rate (sh)	D	-0.01	-0.00	0.00	0.01	0.02
Int Rate (lg)	D	0.03	0.03	0.03	0.03	0.03
Tobin's Q	%	-0.06	-0.09	-0.13	-0.17	-0.21
Real Exchange Rate						
$/ecu	%	-0.02	-0.02	-0.01	-0.01	-0.01
$/yen	%	-0.15	0.32	0.58	0.67	0.75
$/can	%	0.01	0.01	0.01	0.02	0.02
ROECD Economies						
Output	%	-0.01	-0.01	-0.03	-0.04	-0.06
Priv Consumption	%GNP	0.00	-0.01	-0.02	-0.04	-0.05
Priv Investment	%GNP	-0.01	-0.01	-0.02	-0.02	-0.03
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.00	-0.00	-0.01	-0.01	-0.01
Imports	%GNP	-0.00	-0.00	-0.01	-0.01	-0.01
Imports (quant.)	%GNP	-0.00	-0.01	-0.02	-0.02	-0.03
Trade Balance	%GNP	0.00	0.00	0.00	-0.00	-0.00
Labour Demand	%	-0.01	-0.01	-0.03	-0.05	-0.06
Inflation	D	-0.00	0.02	0.03	0.02	0.02
Int Rate (sh)	D	-0.01	0.00	0.01	0.02	0.02
Japanese Economy						
Output	%	0.57	-0.03	-0.16	-0.24	-0.33
Priv Consumption	%GNP	-0.24	-0.44	-0.60	-0.66	-0.72
Priv Investment	%GNP	-0.14	-0.50	-0.41	-0.42	-0.43
Govt Consumption	%GNP	1.00	1.00	1.00	1.00	1.00
Exports	%GNP	0.01	-0.06	-0.10	-0.11	-0.13
Imports	%GNP	0.06	0.00	-0.00	-0.01	-0.02
Imports (quant.)	%GNP	0.05	0.03	0.05	0.05	0.05
Trade Balance	%GNP	-0.05	-0.06	-0.09	-0.10	-0.11
Labour Demand	%	0.78	-0.00	-0.00	-0.00	-0.00
Inflation	D	0.19	0.35	0.23	0.11	0.10
Int Rate (sh)	D	1.28	0.90	1.12	1.17	1.22

demand away from foreign goods and towards home goods. On the other hand, the monetary expansion lowers real interest rates and raises Tobin's q abroad as well as at home, and thereby spurs investment and consumption spending. In the simple Mundell-Fleming model with nominal wage rigidity, the (adverse) exchange rate effect dominates, so that foreign output falls when the home country expands the money supply. In more general models, with more flexible wages, the direction of effect can readily be reversed.

Monetary policy also has an ambiguous effect on the domestic trade and current account balances. Higher domestic money improves international competitiveness by depreciating the exchange rate. Assuming that the usual Marshall-Lerner conditions hold (as is true in MSG2), the exchange rate effect tends to raise output, national savings, and the trade and current account balances. On the other hand, the fall in real interest rates and the rise in Tobin's q tend to spur investment demand, thereby worsening the current account and trade balances. Since both savings and investment tend to rise, the effect on the balance of savings minus investment (i.e., the external balance) is ambiguous theoretically.

Let us now examine these issues in the model. Table 7 reports the results of a permanent increase in the U.S. nominal money stock of 1 percent. The monetary expansion in the U.S. causes output to rise by 0.73 percent in the first year, and causes the nominal exchange rate vis-a-vis the Yen to depreciate by 1.33 percent on impact while the real exchange rate depreciates by 1.06 percent. U.S. inflation increases by 0.28 percentage points in the first year, and 0.20

Table 7.
Permanent US Monetary Expansion (1%)

Years		1	2	3	4	5
U.S. Economy						
Output	%	0.73	0.45	0.34	0.24	0.17
Priv Consumption	%GNP	0.41	0.33	0.23	0.17	0.12
Priv Investment	%GNP	0.31	0.03	0.04	0.02	0.01
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.06	0.05	0.04	0.03	0.02
Imports	%GNP	0.06	0.03	0.02	0.02	0.01
Imports (quant.)	%GNP	0.05	-0.05	-0.03	-0.02	-0.01
Trade Balance	%GNP	-0.00	0.02	0.01	0.01	0.01
Labour Demand	%	1.00	0.52	0.36	0.22	0.12
Inflation	D	0.28	0.20	0.15	0.10	0.08
Int Rate (sh)	D	-0.00	-0.25	-0.15	-0.12	-0.08
Int Rate (lg)	D	-0.04	-0.04	-0.03	-0.02	-0.01
Tobin's Q	%	0.95	0.78	0.47	0.28	0.15
Real Exchange Rate						
$/ecu	%	1.01	0.89	0.57	0.37	0.24
$/yen	%	1.06	0.94	0.64	0.45	0.31
$/can	%	1.00	0.83	0.55	0.35	0.21
ROECD Economies						
Output	%	0.00	-0.00	0.03	0.04	0.03
Priv Consumption	%GNP	0.02	0.04	0.04	0.04	0.02
Priv Investment	%GNP	0.01	0.02	0.02	0.01	0.01
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.02	-0.03	-0.01	0.00	0.01
Imports	%GNP	0.00	0.01	0.01	0.01	0.00
Imports (quant.)	%GNP	0.04	0.04	0.03	0.02	0.01
Trade Balance	%GNP	-0.01	-0.03	-0.01	-0.00	0.01
Labour Demand	%	-0.04	-0.01	0.03	0.03	0.02
Inflation	D	-0.05	-0.04	0.00	0.01	0.02
Int Rate (sh)	D	-0.06	-0.10	-0.07	-0.05	-0.04
Japanese Economy						
Output	%	0.03	0.00	0.01	0.01	0.01
Priv Consumption	%GNP	0.02	0.05	0.04	0.03	0.03
Priv Investment	%GNP	0.01	0.02	0.01	0.01	0.00
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.04	-0.04	-0.02	-0.01	-0.00
Imports	%GNP	0.00	0.01	0.00	0.00	0.00
Imports (quant.)	%GNP	0.03	0.04	0.02	0.02	0.01
Trade Balance	%GNP	-0.02	-0.05	-0.03	-0.02	-0.01
Labour Demand	%	-0.04	0.00	0.00	0.00	0.00
Inflation	D	-0.04	-0.05	0.02	0.02	0.01
Int Rate (sh)	D	-0.07	-0.09	-0.07	-0.05	-0.03

Table 8.
Permanent Japanese Monetary Expansion (1%).

Year		1	2	3	4	5
U.S. Economy						
Output	%	0.00	-0.00	0.01	0.01	0.01
Priv Consumption	%GNP	-0.00	0.01	0.01	0.01	0.01
Priv Investment	%GNP	0.00	0.00	0.01	0.00	0.00
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.00	-0.00	0.00	0.00	0.00
Imports	%GNP	0.00	0.00	0.00	0.00	0.00
Imports (quant.)	%GNP	0.00	0.01	0.00	0.00	0.00
Trade Balance	%GNP	0.00	-0.00	-0.00	0.00	0.00
Labour Demand	%	0.00	-0.00	0.02	0.01	0.01
Inflation	D	-0.00	-0.02	0.00	0.00	0.00
Int Rate (sh)	D	0.00	-0.02	-0.00	-0.01	-0.00
Int Rate (lg)	D	-0.00	-0.00	-0.00	-0.00	-0.00
Tobin's Q	%	0.02	0.04	0.02	0.02	0.01
Real Exchange Rate						
$/ecu	%	0.01	0.01	0.01	0.02	0.02
$/yen	%	-0.71	-0.45	-0.07	-0.05	-0.05
$/can	%	-0.01	-0.00	-0.00	0.01	0.01
ROECD Economies						
Output	%	-0.00	0.00	0.01	0.00	-0.00
Priv Consumption	%GNP	0.01	0.01	0.01	0.01	0.00
Priv Investment	%GNP	0.00	0.01	0.00	-0.00	-0.00
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.01	-0.00	0.00	-0.00	-0.00
Imports	%GNP	0.00	0.00	0.00	0.00	0.00
Imports (quant.)	%GNP	0.02	0.01	0.00	0.00	0.00
Trade Balance	%GNP	0.01	-0.00	-0.00	-0.00	-0.00
Labour Demand	%	-0.00	0.00	0.01	-0.00	-0.01
Inflation	D	-0.02	-0.01	0.01	0.01	0.00
Int Rate (sh)	D	-0.00	-0.01	-0.01	-0.01	-0.00
Japanese Economy						
Output	%	0.83	0.08	0.03	0.03	0.03
Priv Consumption	%GNP	0.44	0.14	0.02	0.02	0.01
Priv Investment	%GNP	0.33	-0.17	-0.00	0.00	0.00
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.07	0.07	0.01	0.01	0.01
Imports	%GNP	0.08	0.00	0.00	0.00	0.00
Imports (quant.)	%GNP	0.02	-0.04	-0.00	-0.00	-0.00
Trade Balance	%GNP	0.02	0.07	0.01	0.01	0.01
Labour Demand	%	1.16	0.00	0.00	0.00	0.00
Inflation	D	0.34	0.48	0.14	0.01	0.00
Int Rate (sh)	D	0.23	-0.24	-0.01	-0.01	-0.01

percentage points in the second. Note that there is far more inflation per unit of output increase than was found with the fiscal expansion in Table 4. A 2.7 percent of GDP increase in G raises U.S. GDP by 1.0 percent in the first year, and lowers inflation by 0.11 percentage points. A 1.37 percent monetary expansion also raises first period output by 1 percent, but raises inflation by 0.38 percent. The differential effects on inflation of monetary and fiscal policy of course result from their opposite effects on the dollar exchange rate: fiscal policy induces a currency appreciation, which reduces import prices, while monetary policy induces a depreciation, which raises import prices.

Remarkably, there is almost no effect of the dollar expansion on the U.S. trade balance, or on output and the trade balances in the other regions. This is a striking, and seemingly robust result of this model: monetary policy can be pursued by each region independently, without spillovers on the trade balance or level of economic activity in other regions. The reason for the absence of spillovers has already been noted. Monetary expansion in the U.S. depreciates the dollar, which tends to reduce aggregate demand abroad, but it also lowers real interest rates abroad (and raises Tobin's q), thereby spurring aggregate demand abroad. Morover, while the dollar depreciation spurs U.S. exports, the fall in U.S. real interest rates spurs U.S. spending and U.S. imports, keeping the trade balance almost exactly unchanged.

As can be seen from Table 8, the results on U.S. monetary policy also apply to a Japanese monetary expansion. Once again, the monetary

expansion raises output, depreciates the currency, lowers real interest rates, and has little effect on the trade balance or the rest of the world. Because of the rapid labor market clearing in the case of Japan, the domestic effects of the monetary expansion on the real economy are dissipated by the second period. According to these results, the U.S. stands to benefit little or lose little from an easier monetary policy in Japan (or in the ROECD).

C. Policy mix effects and miscellaneous simulations

The simulation experiments in parts A and B of this section are often not the most useful way to consider fiscal or monetary policy changes. In present discussions in the United States, for example, it is widely recognized that cuts in the deficit will make it possible (and desirable) for the Fed to easy monetary policy. A plausible policy goal might be to tighten fiscal policy and ease monetary policies in tandem in order to hold employment constant. Tables 9 and 10 in this section report the results of such a policy mix in the United States and Japan.

Since the model is linear, the effects of a policy mix are simply the sum of the effects of the underlying component policies. However, modelling an employment-neutral fiscal expansion cum monetary contraction is not quite as easy as combining the results of Tables 4 and 7, or Tables 5 and 8. The reason is that with a permanent change in government spending, the whole path of monetary policy must be altered in order to stabilize employment. Of course, the maintained

assumption is that from the beginning of the policy shift, the economic agents take into account the change in the entire path of the future money supply in making their production, spending, and portfolio decisions.

Comparing Tables 4 and 9, and Tables 5 and 10, we have the intuitive result that a fiscal expansion with monetary offset leads to a larger appreciation of the currency, a greater rise in long term interest rates and a greater crowding out of consumption and investment, than does a fiscal expansion alone. The trade balance effect of the fiscal expansion is basically the same whether or not the monetary authorities lean against the expansion. This is a reflection of the earlier finding that monetary policy changes have little effect on the trade balance.

Before proceeding to the analysis of the policy shifts in the early 1980s, it is useful to study two more cases. First, we consider in Table 11 the implications of an exogenous decline in the availability of financing for the non-oil LDCs. When country risk considerations lead to a drying up of new capital for the LDCs, as occurred in 1982, the current account position of the LDCs must <u>per force</u> improve. Table 11 shows the effects of a sustained 10-year drop in new financing equal to 1 percent of U.S. potential GDP. For each OECD region, the effect of this shock is like a contraction of bond-financed fiscal spending in the rest of the world.

Thus, the effect on the U.S. of the cut in financing for the LDCs is akin to a reduction in government spending in Japan (the effects of a fiscal <u>reduction</u> in Japan can be read from Table 5, simply by

Table 9.
Permanent US Fiscal Expansion (1% GNP) with Money Stabilizing Employment.

Year		1	2	3	4	5
U.S. Economy						
Output	%	0.00	-0.04	-0.08	-0.13	-0.17
Priv Consumption	%GNP	-0.41	-0.22	-0.28	-0.34	-0.40
Priv Investment	%GNP	-0.16	-0.21	-0.22	-0.23	-0.24
Govt Consumption	%GNP	1.00	1.00	1.00	1.00	1.00
Exports	%GNP	-0.22	-0.19	-0.19	-0.19	-0.19
Imports	%GNP	0.13	0.12	0.11	0.10	0.09
Imports (quant.)	%GNP	0.21	0.41	0.39	0.37	0.34
Trade Balance	%GNP	-0.35	-0.31	-0.30	-0.29	-0.28
Labour Demand	%	0.01	0.00	0.00	0.00	0.00
Inflation	D	-0.18	-0.40	-0.31	-0.22	-0.14
Int Rate (sh)	D	0.73	0.22	0.36	0.48	0.59
Int Rate (lg)	D	0.70	0.65	0.63	0.61	0.58
Tobin's Q	%	-3.80	-3.32	-3.42	-3.51	-3.60
Real Exchange Rate						
$/ecu	%	-4.45	-3.79	-3.47	-3.20	-2.96
$/yen	%	-4.80	-4.23	-4.06	-3.99	-3.93
$/can	%	-3.24	-2.82	-2.68	-2.46	-2.20
ROECD Economies						
Output	%	0.07	-0.07	-0.22	-0.37	-0.49
Priv Consumption	%GNP	-0.17	-0.26	-0.34	-0.42	-0.48
Priv Investment	%GNP	-0.14	-0.25	-0.26	-0.28	-0.30
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.13	0.21	0.16	0.12	0.09
Imports	%GNP	-0.04	-0.06	-0.07	-0.09	-0.09
Imports (quant.)	%GNP	-0.25	-0.23	-0.22	-0.21	-0.20
Trade Balance	%GNP	0.29	0.27	0.23	0.21	0.18
Labour Demand	%	0.27	-0.03	-0.16	-0.29	-0.38
Inflation	D	0.32	0.19	0.17	0.15	0.13
Int Rate (sh)	D	0.45	0.41	0.48	0.53	0.57
Japanese Economy						
Output	%	0.02	-0.04	-0.11	-0.16	-0.21
Priv Consumption	%GNP	-0.21	-0.35	-0.42	-0.46	-0.49
Priv Investment	%GNP	-0.15	-0.29	-0.25	-0.26	-0.27
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.15	0.38	0.34	0.33	0.31
Imports	%GNP	-0.02	-0.05	-0.05	-0.06	-0.06
Imports (quant.)	%GNP	-0.22	-0.22	-0.22	-0.23	-0.24
Trade Balance	%GNP	0.41	0.42	0.39	0.38	0.37
Labour Demand	%	0.34	-0.00	-0.00	-0.00	-0.00
Inflation	D	0.30	0.23	0.12	0.08	0.07
Int Rate (sh)	D	0.56	0.50	0.60	0.63	0.66

Table 10.
Permanent Japanese Fiscal Expansion (1% GNP) with Money Stabilizing Employment.

		1986	1987	1988	1989	1990
U.S. Economy						
Output	%	0.01	-0.02	-0.14	-0.22	-0.29
Priv Consumption	%GNP	-0.02	-0.10	-0.16	-0.22	-0.28
Priv Investment	%GNP	-0.06	-0.08	-0.13	-0.14	-0.15
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.04	0.03	0.02	0.02	0.01
Imports	%GNP	-0.03	-0.03	-0.04	-0.05	-0.05
Imports (quant.)	%GNP	-0.05	-0.12	-0.13	-0.13	-0.13
Trade Balance	%GNP	0.07	0.06	0.06	0.06	0.06
Labour Demand	%	0.01	-0.01	-0.14	-0.22	-0.28
Inflation	D	0.05	0.15	0.12	0.11	0.09
Int Rate (sh)	D	0.01	0.11	0.13	0.19	0.23
Int Rate (lg)	D	0.21	0.21	0.21	0.20	0.19
Tobin's Q	%	-0.77	-1.04	-1.22	-1.40	-1.53
Real Exchange Rate						
$/ecu	%	0.08	0.03	0.02	-0.02	-0.04
$/yen	%	4.08	3.65	3.44	3.23	3.04
$/can	%	0.07	0.06	0.07	0.05	0.03
ROECD Economies						
Output	%	0.04	-0.06	-0.13	-0.20	-0.26
Priv Consumption	%GNP	-0.07	-0.12	-0.17	-0.22	-0.26
Priv Investment	%GNP	-0.06	-0.10	-0.11	-0.13	-0.14
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.05	0.04	0.03	0.03	0.02
Imports	%GNP	-0.02	-0.03	-0.04	-0.04	-0.05
Imports (quant.)	%GNP	-0.12	-0.12	-0.13	-0.13	-0.13
Trade Balance	%GNP	0.07	0.07	0.07	0.07	0.07
Labour Demand	%	0.05	-0.06	-0.12	-0.18	-0.23
Inflation	D	0.13	0.10	0.09	0.09	0.08
Int Rate (sh)	D	0.08	0.10	0.15	0.19	0.23
Japanese Economy						
Output	%	0.21	0.01	-0.01	-0.03	-0.05
Priv Consumption	%GNP	-0.00	0.01	-0.04	-0.09	-0.13
Priv Investment	%GNP	-0.01	-0.08	-0.08	-0.09	-0.10
Govt Consumption	%GNP	1.00	1.00	1.00	1.00	1.00
Exports	%GNP	-0.36	-0.54	-0.53	-0.51	-0.49
Imports	%GNP	0.08	0.07	0.07	0.06	0.06
Imports (quant.)	%GNP	0.42	0.38	0.36	0.34	0.32
Trade Balance	%GNP	-0.63	-0.62	-0.59	-0.57	-0.55
Labour Demand	%	0.01	0.00	0.00	0.00	0.00
Inflation	D	-0.40	-0.03	-0.03	-0.02	-0.02
Int Rate (sh)	D	0.32	0.16	0.20	0.24	0.28

reversing the signs of all variables). U.S. interest rates go down, the trade balance deteriorates, and U.S. investment and consumption are "crowded in", while net exports are "crowded out". Indeed the cutoff in lending to the LDCs is even more contractionary to the U.S. than an equal-sized reduction in Japanese government spending, since the LDCs have a higher marginal propensity to spend on U.S. goods than does the Japanese government.

One argument sometimes made concerning the rise of the dollar in the early 1980s is that the cutoff in finance to the LDCs induced a net capital inflow into the U.S. that caused a large dollar appreciation. This argument is fallacious, as shown by the results of the simulation. The cuttoff in lending induced a reversal of capital outflows from the OECD as a whole to the LDCs, but there is no reason why such a cutoff should be of first-order importance for exchange rates within the OECD. Nor is it important that most of the LDC lending was coming from U.S. banks, if in fact the OECD capital markets are indeed highly integrated. As we see from the Table, a cuttoff of lending of 1 percent of U.S. GDP induces a dollar appreciation of a mere 1 to 2 percent. The cuttoff that actually occurred was on the order of 1.4 percent of U.S. GDP, so that the resulting dollar appreciation from this effect was probably under 3 percent.

IV. A simulation analysis of the trade and financial imbalances of the 1980s

Table 11.
Cut in LDC's Current Account Financing (1% US GNP) lasting 10 years.

Year		1	2	3	4	5
U.S. Economy						
Output	%	-0.14	-0.00	0.16	0.32	0.48
Priv Consumption	%GNP	0.06	0.16	0.27	0.38	0.50
Priv Investment	%GNP	0.15	0.22	0.27	0.30	0.33
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.23	-0.20	-0.19	-0.18	-0.16
Imports	%GNP	0.07	0.08	0.10	0.11	0.13
Imports (quant.)	%GNP	0.12	0.17	0.18	0.19	0.19
Trade Balance	%GNP	-0.30	-0.28	-0.29	-0.29	-0.28
Labour Demand	%	-0.15	-0.01	0.14	0.28	0.41
Inflation	D	-0.15	-0.22	-0.22	-0.23	-0.22
Int Rate (sh)	D	-0.25	-0.32	-0.43	-0.55	-0.68
Int Rate (lg)	D	-0.50	-0.48	-0.46	-0.43	-0.40
Tobin's Q	%	2.33	2.70	3.07	3.39	3.65
Real Exchange Rate						
$/ecu	%	-1.34	-1.15	-1.09	-1.04	-1.01
$/yen	%	-0.84	-0.68	-0.54	-0.31	-0.08
$/can	%	-0.18	-0.19	-0.24	-0.23	-0.22
ROECD Economies						
Output	%	-0.22	-0.06	0.03	0.17	0.33
Priv Consumption	%GNP	0.10	0.12	0.20	0.29	0.39
Priv Investment	%GNP	0.13	0.21	0.24	0.29	0.33
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.45	-0.38	-0.38	-0.37	-0.35
Imports	%GNP	0.02	0.03	0.04	0.06	0.08
Imports (quant.)	%GNP	-0.00	0.01	0.02	0.03	0.04
Trade Balance	%GNP	-0.43	-0.42	-0.43	-0.43	-0.42
Labour Demand	%	-0.22	-0.11	-0.05	0.07	0.21
Inflation	D	-0.05	-0.10	-0.18	-0.21	-0.24
Int Rate (sh)	D	-0.37	-0.32	-0.46	-0.60	-0.74
Japanese Economy						
Output	%	-0.25	0.04	0.11	0.17	0.22
Priv Consumption	%GNP	0.15	0.24	0.33	0.39	0.45
Priv Investment	%GNP	0.15	0.28	0.27	0.29	0.31
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.46	-0.38	-0.37	-0.38	-0.37
Imports	%GNP	0.02	0.04	0.05	0.06	0.06
Imports (quant.)	%GNP	0.08	0.11	0.12	0.14	0.16
Trade Balance	%GNP	-0.43	-0.42	-0.42	-0.43	-0.44
Labour Demand	%	-0.28	0.00	0.00	0.00	0.00
Inflation	D	-0.15	-0.21	-0.18	-0.15	-0.15
Int Rate (sh)	D	-0.46	-0.40	-0.57	-0.70	-0.83

We are now ready to ask whether the model can help us to understand the sources of the trade and international financial patterns noted at the beginning of the paper: the large U.S. trade deficits and Japanese trade surpluses, the sharp appreciation of the dollar during 1981-85, the rise in real interest rates, and the subsequent sharp fall in the dollar beginning in 1985 and accelerating in 1986. We divide the analysis in two stages, 1980-85, and 1986 onward (with forecasts until 1992). This division marks off two policy phases in both the U.S. and Japan. During the first period, the U.S. fiscal deficit widened significantly, while in Japan there was a steady reduction in the structural deficit. In the second period, the U.S. deficit is projected to decline, while the Japanese deficit is expected to stabilize, or even increase slightly.

In approaching the simulation exercise, we are more ambitious in some ways and less ambitious in others than other simulation studies that have been made. On the one hand, we go far beyond the common partial equilibrium approach of tracking trade balance developments for exogenously given paths of growth, exchange rates, etc. (for approaches along these lines, see for example Richardson (1987) of the OECD, and the Brookings Project summarized by Bryant and Holtham (1987)). We seek to explain the movements in growth, exchange rates, and so on, according to more fundamental shifts in policies.

On the less ambitious side, we do not propose at this point to track the year-to-year historical experience during 1981 to 1985, but rather to examine the overall changes between 1980 and 1985. Our reason for this more modest approach relates in part to the nature of

rational expectations modelling. In order to understand year-to-year changes, it is necessary to model the expectations of future policies as of each year. This is a worthwhile exercise, but is beyond the scope of the present paper. Also, in modelling year-to-year changes, the timing of particular policy actions also become extremely important: when does a tax cut go into effect?; what is "old" versus "new" capital investment from the point of a corporate tax change?; what are the short-run lags on monetary policy? A third reason for avoiding a year-to-year analysis is the added difficulty of modelling the recession of 1981-82, which came in the wake of the anti-inflation policies of the OECD monetary authorities. By comparing 1980 and 1985, we can abstract from cyclical movements in economic activity. It is a separate, and interesting question as to whether the model could in fact track the recession period, but one that we leave for a later date.

A. The period 1980-85

Our strategy is to consider the shifts in the trade balance, exchange rates, etc., as resulting from five distinct factors, and to see whether the combined effect of these changes can explain the observed phenomena. The five shifts are as follows (see Table 2):

- A rise in the U.S. structural deficit of approximately 4.4 percent of U.S. GNP;

- A reduction in the Japanese structural budget deficit of approximately 3.4 percent of GNP;

- An increase in the structural deficit in Canada of approximately 2.2 percent of GNP, and an increase in the structural budget surplus in the ROECD of approximately 0.5 percent of GNP;

- An exogenous reduction in the net flow of new borrowing (i.e. the current account deficit) of the LDCs in the magnitude of 1.4 percent of U.S. GNP; [5]

- An assumed offset of monetary policy in Canada, Japan, the United States and the rest of the OECD to maintain an unchanged level of employment.

The combined effect of these changes (as a deviation from a baseline) is shown in Table 12, where we see that the effect of the package is that the dollar appreciates sharply and the U.S. trade balance worsens significantly as a percent of GNP. In Table 13, we compare the predicted effects on the trade balance, dollar exchange rate, and the short-term real interest rate with the actual effects observed in comparing the 1978- 80 with the year 1985. As noted earlier, the model does quite well in explaining the shifts in the U.S. and Japanese trade balances and the Yen-dollar exchange rate. It does much more poorly with the ROECD. In Table 14, we apportion the overall predicted shift in the U.S. trade balance and real bilateral exchange

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5. The current account balance of the non-oil LDCs was as follows (as percent of U.S. GNP in parentheses): 1978, $33.2b (1.5); 1979, $49.7b (2.0); 1980, 74.4b (2.8); and 1985 28.7b (0.7). The average deficit during 1978-80 was 2.1 percent of U.S. GNP, so that the shift from 1978-80 to 1985 was on the order of 1.4 percent of U.S. GNP.

Table 12.
1981-1985 Global Scenario with Money Stabilizing Employment.

		1981	1982	1983	1984	1985
U.S. Economy						
Output	%	-0.00	0.07	0.08	0.05	0.01
Priv Consumption	%GNP	1.50	2.89	3.38	3.66	3.59
Priv Investment	%GNP	0.27	0.08	-0.04	-0.14	-0.17
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.91	-0.96	-1.08	-1.15	-1.13
Imports	%GNP	0.55	0.61	0.69	0.73	0.71
Imports (quant.)	%GNP	0.86	1.93	2.19	2.33	2.27
Trade Balance	%GNP	-1.46	-1.57	-1.77	-1.88	-1.84
Labour Demand	%	0.05	0.05	0.05	0.04	0.03
Inflation	D	-0.75	-2.19	-2.52	-2.68	-2.56
Int Rate (sh)	D	-2.45	-3.98	-3.09	-1.50	-1.50
Int Rate (lg)	D	-0.83	-0.64	-0.37	-0.17	-0.09
Tobin's Q	%	-0.49	-1.10	-3.16	-4.49	-4.49
Real Exchange Rate						
$/ecu	%	-14.52	-15.65	-17.60	-18.63	-18.11
$/yen	%	-20.98	-23.74	-27.40	-29.63	-28.96
$/can	%	-5.94	-5.75	-6.44	-6.60	-6.40
ROECD Economies						
Output	%	-0.42	-0.11	-0.17	-0.22	-0.26
Priv Consumption	%GNP	-0.45	-0.69	-0.85	-0.94	-0.89
Priv Investment	%GNP	-0.24	-0.24	-0.25	-0.24	-0.23
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.32	0.18	0.22	0.23	0.16
Imports	%GNP	-0.10	-0.12	-0.15	-0.16	-0.15
Imports (quant.)	%GNP	-0.59	-0.63	-0.70	-0.73	-0.70
Trade Balance	%GNP	0.14	0.30	0.37	0.39	0.31
Labour Demand	%	-0.01	-0.01	-0.01	-0.00	-0.00
Inflation	D	0.56	0.73	0.96	1.10	1.13
Int Rate (sh)	D	0.64	1.30	1.63	1.71	1.63
Japanese Economy						
Output	%	-1.09	-0.16	-0.28	-0.37	-0.43
Priv Consumption	%GNP	-1.58	-2.15	-2.47	-2.34	-2.30
Priv Investment	%GNP	-0.62	-0.49	-0.44	-0.36	-0.33
Govt Consumption	%GNP	-0.50	-1.00	-1.50	-2.20	-2.20
Exports	%GNP	0.38	2.00	2.38	2.61	2.52
Imports	%GNP	-0.20	-0.27	-0.33	-0.36	-0.36
Imports (quant.)	%GNP	-1.22	-1.48	-1.75	-1.92	-1.89
Trade Balance	%GNP	1.62	2.27	2.71	2.97	2.88
Labour Demand	%	-0.07	-0.00	-0.00	-0.00	-0.00
Inflation	D	1.13	0.01	0.03	0.05	0.04
Int Rate (sh)	D	1.47	2.01	1.72	0.48	0.44

Table 13.

Actual and Predicted Changes in Trade Balances and Real Exchange Rates (1985 compared with average of 1978-1980).

	Actual	Predicted
Trade Balance Change (percent of GDP)		
U.S.	1.9	1.8
Japan	3.2	2.8
Rest of OECD	1.0	0.3
Real Exchange Rate Change of the U.S. relative to:		
Japan	24	28
Rest of the OECD	41	18

Source: "Actual" from tables 1,3; "Predicted" from 1985 data in table 12.

Table 14.

Decomposition of Changes in Trade and Exchange Rates.

	Total Predicted Effect	Sum of Effects of: Fiscal Policies in U	J	R+C	Cutoff in LDC Lending	Offsetting Monetary Policy
Effect on:						
U.S. Trade Balance	-1.84	-1.01	-0.23	-0.03	-0.40	-0.17
Japan Trade Balance	2.88	1.36	1.91	-0.06	-0.61	0.28
U.S.-Japan Real Exchange Rate	28.9	11.8	10.6	-0.03	-0.11	6.64

rates to the various underlying disturbances. Not surprisingly, the largest factor in explaining the U.S. and Japanese trade balance changes is the fiscal policy in the own country. Cross-country effects play a small role for the U.S., though a fairly important role for Japan. In both cases, the cutoff in lending to LDC's accounts for about 20 percent of the trade balance shift in the evolution each country's trade imbalances.

There are several puzzles not explained by the simulation model. Most importantly, while the model tracks the appreciation of the dollar vis-a-vis the Yen during the period, it fails to track the larger appreciation of the dollar vis-of-vis the ROECD. We fear that part of the problem here is one of aggregation. The ROECD is a varied mix of countries with a quite varied mix of policies during this period. At the center of the ROECD we have West Germany, which pursued highly contractionary fiscal policies (see Table 2), and thus should be expected to have a large real depreciation vis-a-vis the dollar, as in fact occurred. On the other hand, most of the little OECD countries included in ROECD pursued mildly expansionary fiscal policies, and thus should not have experienced as large a real depreciation vis-a-vis the dollar as in fact occurred. The dollar rate vis-a-vis the overall ROECD however, seems to behave more in line with what would be predicted from German fiscal policy, rather than overall ROECD policy. This might be explained by the fact that many non-German ROECD countries peg their currencies to the Deutsche mark, and by the fact that much of the non-German ROECD has relatively

closed capital markets (in which case a fiscal expansion leads to a depreciation).

One of the ironies in the 1980-85 period is that Japan liberalized its capital account in 1980 just as it started to tighten fiscal policy, and just as the United States started to run large budget deficits. Without the capital market liberalization, Japan would not have generated such enormous trade surpluses in response to the fiscal shifts in the United States and Japan, because the Yen would have appreciated in response to the trade surpluses. Presumably, the political pressures now being felt by Japan would thereby have been largely avoided.

To examine this conclusion, the package of fiscal and financial changes just discussed can be simulated under the counterfactual assumption of zero international capital mobility in Japan, as is done in Table 15. With zero capital mobility and freely floating exchange rates in Japan, the Japanese economy must be in current account equilibrium at all times. We see from Table 15 that if Japan had not liberalized its capital account, the result would have been a smaller Yen depreciation in the period, and a much smaller trade surplus. The surplus would have risen by 1.26 percent of GDP, instead of the 2.88 percent reported in Table 12, and the 3.2 percent that actually occurred.

Note, also, the effects on the U.S. Without the benefit of Japanese savings, the U.S. interest rates (both short and long term) would naturally have been higher, and investment would have been reduced, but the effect found by the simulation is smaller than is

Table 15.
1981-1985 Global Scenario with Stabilizing Money. No Capital Mobility in Japan.

		1981	1982	1983	1984	1985
U.S. Economy						
Output	%	0.00	0.04	0.01	-0.06	-0.14
Priv Consumption	%GNP	1.49	2.64	3.05	3.28	3.19
Priv Investment	%GNP	0.15	-0.10	-0.24	-0.35	-0.39
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.85	-0.88	-0.98	-1.04	-1.02
Imports	%GNP	0.50	0.53	0.59	0.62	0.61
Imports (quant.)	%GNP	0.78	1.62	1.82	1.95	1.91
Trade Balance	%GNP	-1.35	-1.41	-1.57	-1.66	-1.63
Labour Demand	%	0.05	0.06	0.06	0.05	0.04
Inflation	D	-0.68	-1.78	-2.00	-2.08	-1.93
Int Rate (sh)	D	-2.50	-3.37	-2.22	-0.48	-0.43
Int Rate (lg)	D	0.17	0.35	0.58	0.72	0.75
Tobin's Q	%	-2.07	-3.42	-5.76	-7.23	-7.29
Real Exchange Rate						
$/ecu	%	-14.13	-15.29	-17.17	-18.15	-17.61
$/yen	%	-15.27	-15.06	-17.47	-19.55	-19.60
$/can	%	-5.75	-5.64	-6.33	-6.49	-6.30
ROECD Economies						
Output	%	-0.41	-0.15	-0.24	-0.34	-0.42
Priv Consumption	%GNP	-0.52	-0.91	-1.16	-1.31	-1.27
Priv Investment	%GNP	-0.36	-0.40	-0.44	-0.44	-0.43
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.27	0.27	0.35	0.37	0.29
Imports	%GNP	-0.13	-0.18	-0.21	-0.23	-0.23
Imports (quant.)	%GNP	-0.74	-0.89	-1.01	-1.04	-0.99
Trade Balance	%GNP	0.21	0.45	0.56	0.60	0.52
Labour Demand	%	-0.01	-0.01	-0.01	-0.01	-0.01
Inflation	D	0.70	1.13	1.50	1.73	1.79
Int Rate (sh)	D	0.74	1.87	2.50	2.74	2.71
Japanese Economy						
Output	%	-0.78	0.06	0.18	0.34	0.52
Priv Consumption	%GNP	-1.01	-0.79	-0.66	-0.27	-0.18
Priv Investment	%GNP	0.19	0.53	0.69	0.82	0.87
Govt Consumption	%GNP	-0.50	-1.00	-1.50	-2.20	-2.20
Exports	%GNP	-0.11	0.74	0.95	1.16	1.18
Imports	%GNP	-0.09	-0.08	-0.09	-0.10	-0.09
Imports (quant.)	%GNP	-0.65	-0.57	-0.70	-0.83	-0.85
Trade Balance	%GNP	0.75	0.82	1.04	1.26	1.26
Labour Demand	%	-0.04	-0.00	-0.00	-0.00	0.00
Inflation	D	0.59	0.00	0.00	-0.00	-0.00
Int Rate (sh)	D	2.44	1.02	-0.36	-2.17	-2.18

often supposed. The reason is that Japan provides only a modest share of OECD savings, despite the fact that Japan's current account surplus is by far the largest in the OECD. Under the maintained assumption of this model that all OECD savings are potentially available for international capital flows, the contribution from Japan is simply not overwhelming. To the extent that the bilateral trade surplus of Japan is reduced, the trade surpluses of Canada and the ROECD are increased. As the financial counterpart, of course, the U.S. gets more of its net international investment flows from the other two areas. It is possible that this simulation result understates the consequences of eliminating Japan's capital outflows, if on average Japan allows more international capital outflow than do the other countries in the OECD. To the extent that much of the ROECD is cut off from world capital markets (as is true of France, Italy, and much of Scandinavia), then Japanese savings would represent a larger fraction of the pool of total savings available to finance U.S. current account deficits, even though Japanese savings represent a modest fraction of total OECD savings.

There is other direct evidence in support of the proposition that fiscal policies, rather than an investment boom, lie behind the U.S. trade deficits in recent years. Table 16 shows the evolution of the private savings and investment rates in the United States during 1980-85. As predicted by the model, the rise in the U.S. current account deficit is accounted for by the deterioration in the budget deficit, rather than a rise in the investment rate. There is no evidence in the data for the proposition that households in the U.S.

have raised their private savings in anticipation of higher future taxes resulting from the large current U.S. budget deficits. [6]

B. The period 1986-1992

Since 1985, there have been some significant changes in the economic outlook, as well as large swings in exchange rates. Most importantly, there are increased prospects for a significant improvement in the U.S. fiscal situation. Those prospects are reflected in the legislative commitment in the Gramm-Rudman-Hollings (hereafter, GRH) law to a balanced budget by 1992. The questions in this section are twofold. First, can the shift in the fiscal outlook account for the dramatic decline in the dollar since mid-1985? Second, would implementation of the GRH targets be sufficient to restore trade balance in the United States?

The real depreciation of the dollar between 1985 and 1986 was shown in Table 3. For the cases of the European currencies, the dollar decline began in early 1985, and has continued apace since then. For the Yen, most of the dollar decline has occurred since the Plaza meeting of finance ministers of the G-5 in September 1985. There are at least three interpretations of the recent exchange rate

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6. Recently Robert Barro has suggested that the decline in U.S. national savings may be overstated since household purchases of consumer durables, which have risen as a share of GNP in the U.S., should be classified as investment spending rather than consumption spending. Even when that correction is made, however, the decline in the overall U.S. national savings rate and slight change in the U.S. investment rate is still found in the data. See Poterba and Summers (1986) for evidence on this point.

Table 16. U.S. Savings and Investment Rates. 1980-1985 (percent of GNP) .

	Gross Private Savings	Gross Private Investment	Total Government Deficit	Current Account
1980	17.5	16.0	-1.3	0.5
1981	18.0	16.9	-1.0	0.3
1982	18.3	14.7	-3.6	0.0
1983	17.4	14.7	-3.8	-1.0
1984	17.9	17.6	-2.7	-2.4
1985	17.2	16.5	-3.4	-2.9
Change: 1985-1980	-0.3	0.5	-2.1	-2.4

Source: Economic Report of The President, January 1987, table B-27.

movements. The first is that the decline has come from a shift in macroeconomic policies, both current and anticipated. The second is that decline reflected a bursting of a speculative bubble that had been building since 1981. The third is that private portfolio holders have begun to demand a larger risk premium for holding dollar assets, following a saturation of private portfolios with dollar claims in recent years. If the third interpretation is correct, the shift in required risk premium must have been unanticipated to explain the fact that the dollar first rose sharply then fell.

Unfortunately, the simplest interpretation, of a pure policy shift, is hard to reconcile with the magnitude of the recent dollar decline. In Table 17, we simulate the effects of a 1986 shift in public expectations about the future course of U.S. budget deficits. Specifically, we assume that the time path of deficit reductions called for in GRH is taken as the public's new expectation of U.S. fiscal policies. [7] It is further assumed that the Federal Reserve Board will accomodate the fiscal contraction with easier monetary policy, as necessary, in order to stabilize employment.

The results are interesting for several reasons. First, the dollar depreciates, as expected, but only by about 10 percent in real terms on impact. The long-term interest rate falls by more than 2 percentage points, though the short-term nominal interest rate rises. Inflation increases because of the dollar depreciation. The U.S. is

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7. Actually, since the fiscal year 1986 target was already missed by 1986, we look at a modified GRH schedule, which catches up with the legislative schedule by fiscal year 1988.

Table 17.
1986-1990 Scenario: Gramm-Rudman and Oil Price Fall with Money Stabilizing Employment.

		1986	1987	1988	1989	1990
U.S. Economy						
Output	%	-0.71	-0.62	-0.49	-0.33	-0.12
Priv Consumption	%GNP	-1.27	-1.56	-1.52	-1.47	-1.31
Priv Investment	%GNP	0.36	0.50	0.74	0.95	1.13
Govt Consumption	%GNP	0.00	-0.65	-1.35	-1.80	-2.25
Exports	%GNP	0.50	0.67	0.87	1.02	1.15
Imports	%GNP	0.15	0.07	-0.03	-0.08	-0.12
Imports (quant.)	%GNP	0.30	-0.42	-0.76	-0.98	-1.16
Trade Balance	%GNP	0.35	0.60	0.90	1.10	1.27
Labour Demand	%	-0.05	-0.05	-0.05	-0.05	-0.05
Inflation	D	-0.37	0.43	0.70	0.77	0.74
Int Rate (sh)	D	3.47	2.95	1.25	0.35	-1.03
Int Rate (lg)	D	-2.06	-2.31	-2.52	-2.60	-2.62
Tobin's Q	%	3.71	7.65	11.56	14.36	16.84
Real Exchange Rate						
$/ecu	%	9.05	11.76	14.87	16.92	18.62
$/yen	%	8.47	11.12	14.34	16.51	18.38
$/can	%	4.58	6.38	8.54	9.95	11.20
ROECD Economies						
Output	%	-0.11	-0.00	0.26	0.53	0.81
Priv Consumption	%GNP	0.38	1.11	1.53	1.85	2.13
Priv Investment	%GNP	1.21	1.15	1.27	1.36	1.44
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.11	-0.24	-0.33	-0.33	-0.32
Imports	%GNP	0.59	0.67	0.73	0.78	0.83
Imports (quant.)	%GNP	1.81	2.01	2.21	2.34	2.45
Trade Balance	%GNP	-0.69	-0.91	-1.06	-1.12	-1.15
Labour Demand	%	0.02	0.02	0.02	0.02	0.02
Inflation	D	-1.74	-2.64	-3.48	-4.20	-4.89
Int Rate (sh)	D	-1.66	-4.08	-5.60	-6.83	-8.00
Japanese Economy						
Output	%	0.43	0.29	0.56	0.84	1.12
Priv Consumption	%GNP	0.90	1.65	2.11	2.48	2.84
Priv Investment	%GNP	1.32	1.18	1.32	1.42	1.51
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.05	-0.56	-0.74	-0.83	-0.89
Imports	%GNP	0.40	0.44	0.49	0.53	0.57
Imports (quant.)	%GNP	1.85	1.98	2.13	2.25	2.34
Trade Balance	%GNP	-0.73	-1.01	-1.23	-1.36	-1.46
Labour Demand	%	0.11	0.00	0.00	0.00	0.00
Inflation	D	-1.76	-0.02	-0.04	-0.05	-0.06
Int Rate (sh)	D	0.97	-0.78	-1.58	-2.19	-2.81

forced to give up some of the low-inflation dividend that it enjoyed during the period of dollar appreciation though the inflation effect is modest.

The problem with the second interpretation of the exchange rate, i.e. a bursting of a speculative bubble, is that the dollar appreciation during 1981-85 seems to be well explained, at least vis-a-vis the Yen, by the fiscal policy shifts studied earlier. There was some evidence of a speculative excess in the appreciation of the dollar vis-a-vis the ROECD currencies, but not against the Yen.

The third interpretation, of a shifting risk premium, is the most problematic, and is difficult either to refute or accept. A portfolio balance effect is surely plausible, but should have been enough to limit the appreciation of the dollar in the first place, since portfolio holders could have foreseen the enormous buildup of U.S. dollar liabilities that would result from the projected U.S. current account deficits. It is possible that part of the story of the exchange rate is that the liberalization of the Japanese capital market led to a one-time stock shift in demand for dollars during 1981-86, which is now over because Japanese portfolio holders are saturated with U.S. assets. However, this story does not explain very well the movements of the dollar-DM rate, since the German capital market has been open during the past fifteen years.

Supposing that the recent depreciation of the dollar in fact reflects a portfolio shift against the dollar, we can introduce that into the simulation model by assuming that portfolio holders now demand a positive risk premium to hold dollar assets. In Table 18, we

Table 18.
1986-1990 Scenario: Permanent Rise in the Risk Premium on Dollar Assets (of 3%) and Money Stabilizing Employment.

		1986	1987	1988	1989	1990
U.S. Economy						
Output	%	-0.01	-0.14	-0.26	-0.36	-0.46
Priv Consumption	%GNP	-0.41	-0.91	-0.94	-0.97	-0.99
Priv Investment	%GNP	-0.54	-0.52	-0.53	-0.53	-0.53
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	0.47	0.40	0.37	0.35	0.32
Imports	%GNP	-0.30	-0.28	-0.27	-0.27	-0.26
Imports (quant.)	%GNP	-0.47	-0.89	-0.84	-0.78	-0.73
Trade Balance	%GNP	0.77	0.67	0.65	0.62	0.59
Labour Demand	%	-0.01	-0.01	-0.01	-0.00	-0.00
Inflation	D	0.42	1.12	1.20	1.26	1.32
Int Rate (sh)	D	1.12	2.40	2.51	2.62	2.71
Int Rate (lg)	D	2.06	1.98	1.81	1.65	1.50
Tobin's Q	%	-6.11	-7.07	-6.95	-6.84	-6.72
Real Exchange Rate						
$/ecu	%	9.96	8.41	7.73	7.07	6.44
$/yen	%	9.70	8.16	7.53	6.91	6.32
$/can	%	6.70	5.23	4.64	4.08	3.56
ROECD Economies						
Output	%	0.27	0.14	0.23	0.31	0.39
Priv Consumption	%GNP	0.70	0.74	0.74	0.74	0.74
Priv Investment	%GNP	0.49	0.43	0.43	0.42	0.41
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.27	-0.47	-0.41	-0.35	-0.30
Imports	%GNP	0.16	0.15	0.15	0.15	0.15
Imports (quant.)	%GNP	0.65	0.57	0.53	0.50	0.46
Trade Balance	%GNP	-0.67	-0.62	-0.55	-0.50	-0.45
Labour Demand	%	0.00	0.00	0.00	-0.00	-0.00
Inflation	D	-0.59	-0.66	-0.77	-0.87	-0.95
Int Rate (sh)	D	-1.70	-1.95	-2.02	-2.08	-2.14
Japanese Economy						
Output	%	0.49	0.11	0.21	0.29	0.37
Priv Consumption	%GNP	0.71	0.77	0.78	0.79	0.81
Priv Investment	%GNP	0.47	0.42	0.42	0.41	0.41
Govt Consumption	%GNP	0.00	0.00	0.00	0.00	0.00
Exports	%GNP	-0.23	-0.69	-0.62	-0.56	-0.51
Imports	%GNP	0.08	0.09	0.09	0.09	0.10
Imports (quant.)	%GNP	0.45	0.39	0.37	0.35	0.33
Trade Balance	%GNP	-0.80	-0.77	-0.71	-0.65	-0.60
Labour Demand	%	0.02	0.00	0.00	0.00	0.00
Inflation	D	-0.39	-0.02	-0.02	-0.02	-0.02
Int Rate (sh)	D	-1.05	-1.23	-1.19	-1.17	-1.16

assume that the risk premium required to hold dollars rises permanently from zero in 1985 to 3 percentuage points in 1986 and after. The result is a dollar depreciation of 7 to 10 percent, and a rise in the U.S. long-term interest rate of 2 percentage points. Somewhat surprisingly, even a large shift in the risk premium (too large, no doubt!) seems to produce a modest movement of the dollar, that does not well explain the 30-40 percent depreciation in 1986.

Using these results, let us now turn to the second question, the prospective evolution of the trade deficit of the United States. Would Gramm-Rudman-Hollings, by itself or together with the portfolio balance shift, be enough to restore trade balance in the United States by the early 1990s? The answer is that by itself GRH is unlikely to restore trade balance, at least not along a full-employment path for the U.S. economy. According to the results underlying Table 17, even if there is a complete elimination of the budget deficit by 1992, the improvement in the trade balance (at full employment) reaches 1.27 percent of GDP, leaving a trade deficit on the order of 1.8 percent of potential GDP (the equivalent of $ 70 b in 1987). Thus, GRH would have to be combined with a significant rise in the risk premium on the dollar, a further shift to budget surpluses, or some other unaccounted for shifts in savings and investment in the United States to restore trade balance. A recession might be another way to restore the trade balance.

Why is it that a complete elimination of the U.S. budget deficit would be insufficient by itself to restore trade balance at full employment? There are three main reasons. First, even before the

buildup of the U.S. fiscal deficit after 1980, the U.S. was running a trade deficit on the order of 1 - 1.5 percent of GDP. Second, part of the worsening in the U.S. trade balance resulted from the cutoff in LDC financing, an event which is not likely to be reversed in the near term. And third, about percent of GDP of the trade deficit resulted from the contraction of Japanese fiscal policies, which is also not likely to be reversed entirely (if at all).

Note finally that the simulation model is emphatic on two major points. First, monetary policies alone can do little, if anything, to rectify trade imbalances. Remembering the results in Tables 7 and 8, monetary policy shifts may depreciate or appreciate currencies, but will not by themselves contribute to major changes in the external balance. Second, fiscal or monetary expansions in Japan and the ROECD will do little or nothing for U.S. economic growth rates. A major Japanese fiscal expansion would raise world interest rates at the same time that it spurred U.S. export growth. The net effect on U.S. aggregate demand would be small and of uncertain sign.

VI. Conclusions and some possible extensions

The simulation model reported in this paper was able to account for most of the observed movements in the trade balances of the U.S. and Japan during 1980-85 according to shifts in fiscal policies, and the decline in lending to the developing countries. The model did well in tracking the trade balance movements of the U.S. and Japan, as well as the Yen- dollar rate through 1985. The model does much less

well in accounting for the recent decline in the dollar vis-a-vis the Yen and European currencies. The shift in expectations regarding U.S. budget deficits seems to be insufficient to account for the decline in the dollar of more than 30 percent since 1985. Other possible explanations for the dollar depreciation, such as a rise in the required risk premium on the dollar, can be examined in the model, but cannot be explained by the model, especially in view of the maintained assumption of perfect asset substitutability among the OECD financial assets.

The model is deficient in several important ways, so that the conclusions must allow for a considerable margin of error. Let us mention some of the key areas where the model needs strengthening. First, the private-sector consumption function should be respecified, to allow for some partial smoothing of labor income and labor-income taxes. Second, the ROECD should be dissagregated, most usefully between areas with and without capital controls. Third, imperfect competition in international trade should be introduced explicitly, to allow for the slow and incomplete passthrough of exchange rate changes into import and export prices.

Fourth, and perhaps most important, the assumption of perfect capital mobility should be reassessed. It will probably be wise to allow for some degree of imperfect asset substitutability, even though the empirical evidence on stable risk premia is virtually non-existent. Surely portfolio holders these days must care about the buildup of dollar denominated claims in their portfolios, even if the expected returns on dollars and other currencies are equalized.

Fifth, we should pay closer attention to the long-term trend decline in U.S. productivity growth. As Krugman and Baldwin (1987) have stressed, this long-term decline probably helps to explain the secular decline in the U.S. real exchange rate that is consistent with U.S. external balance. In our model, there is an implicit assumption that long-term U.S. balance is consistent with a stable, not depreciating, real exchange rate.

Sixth, we should give more attention to the apparent secular decline in the private Japanese savings rate, which should have important implications for the Japanese current account deficit in the next decades. If in fact the Japanese private savings rate is in steady decline, as Horika (1986) among others has argued, then the appearance of unrelenting Japanese external surpluses may be exaggerated.

Seventh, and finally, it will be useful to provide some disaggregation of the supply side in the U.S. and Japan, particularly since both economies will soon have to undergo important structural changes to adapt to the large swing in the exchange rate. The Maeyakawa Commission recommendations in Japan, for example, note that domestic led growth in Japan can best be facilitated through the deregulation of land, and the liberalization of agricultural trade. A multisectoral model of the Japanese economy will be necessary to give adequate attention to such issues.

APPENDIX A: Six-Region World Model

U.S. Equations

Households

i. Utility Function

$$U^U = \log C^U$$

$$C^U = \left[\beta_2 (C^{dU})^{\beta_3} + (1-\beta_2)(C^{mU})^{\beta_3} \right]^{(1/\beta_3)}$$

$$C^{mU} = \left[\beta_4 (C_R^U)^{\beta_5} + \beta_1 (C_J^U)^{\beta_5} + (1-\beta_1-\beta_4)(C_C^U)^{\beta_5} \right]^{(1/\beta_5)}$$

$$\sigma_1^U = \frac{1}{1-\beta_3} \quad ; \quad \sigma_2^U = \frac{1}{1-\beta_5}$$

ii. Demand Functions

$$P^{cU} C^U = \beta_{28} P^U F^U + \beta_{31} [W^U L^U (1-\tau_1) - TAX^U + P^O OIL^U]$$

$$C^{dU} = C^U \frac{P^{cU}}{P^U} \left[\frac{1}{1+ \Omega_1 \beta_6} \right] \qquad \beta_6 = \left[\frac{1-\beta_2}{\beta_2} \right]^{\sigma_1^U}$$

$$C^{mU} = C^U \frac{P^{cU}}{P^{mU}} \left[\frac{\Omega_1 \beta_6}{1+ \Omega_1 \beta_6} \right]$$

$$\Omega_1 = \left[\frac{P^{mU}}{P^U} \right]^{(1-\sigma_1^U)}$$

$$I^U = P^{JU} \; J^U \; [\, 1 + (\beta_{15}/2)\, J^U / K^U \,]$$

$$q^U_{t+1} = (1+r^U_t+\beta_{14})q^U_t - \frac{\partial Q^U}{\partial K^U}(1-\tau_2) - \frac{P^{JU}}{P^U}(0.5\beta_{15})(J^U_t/K^U_t)^2$$

$$\frac{\partial Q^U}{\partial K^U} = \beta_9 \left[\frac{Q^U}{K^U} \right]$$

$$P^{JU} = P^{U\beta_{16}} (E^J P^J)^{\beta_{17}} (E^R P^R)^{\beta_{18}} (E^C P^C)^{(1-\beta_{16}-\beta_{17}-\beta_{18})}$$

$$J^U_R = \beta_{18} J^U / \wedge^R$$

$$J^U_J = \beta_{17} J^U / \wedge^J$$

$$J^U_C = (1-\beta_{16}-\beta_{17}-\beta_{18}) \; J^U / \wedge^C$$

$$P^{nU} = \left[\beta_{12}^{\sigma^U_4} (P^O)^{(1-\sigma^U_4)} + (1-\beta_{12})^{\sigma^U_4} (P^L)^{(1-\sigma^U_4)} \right]^{1/(1-\sigma^U_4)}$$

or $\quad P^{nU} = (P^O)^{\beta_{12}} (P^L)^{(1-\beta_{12})} \quad$ if $\sigma^U_4 = 1$

Asset Markets

$$\frac{M^U}{P^U} = \sigma_6 \; Q^U - \sigma_7 \; i^U$$

$$\wedge^R = P^R E^R / P^U$$

$$\wedge^J = P^J E^J / P^U$$

$$\wedge^C = P^C E^C / P^U$$

$$\wedge^L = P^L / P^U$$

$$\wedge^O = P^O / P^U$$

$$i_t^U = r_t^U + \Pi_t^U$$

$$r_t^U = R_t^U - ({}_tR_{t+1}^U - R_t^U)/R_t^U$$

$$\Pi_t^U = (P_{t+1}^U - P_t^U)/P_t^U$$

$$\Pi_t^{cU} = (P_{t+1}^{cU} - P_t^{cU})/P_t^{cU}$$

Balance of Payments

$$TB^U = C_U^R + C_U^J + C_U^L + C_U^O + C_U^C + I_U^R + I_U^J + I_U^C$$

$$- \wedge^R(C_R^U + I_R^U) - \wedge^J(C_J^U + I_J^U) - \wedge^C(C_C^U + I_C^U) - \wedge^O N_O^U - \wedge^L N_L^U$$

$$CA^U = TB^U + r^U(A_L^U - A_U^P - A_U^R - A_U^J - A_U^C)$$

Government Sector

$$DEF^U = G^U + r^U B^U - T^U$$

$$T^U = TAX^U + \tau_1 \frac{W^U L^U}{P^U} + \tau_2 \left(Q^U - W\frac{L^U}{P^U} - P\frac{n^U N^U}{P^U}\right)$$

$$TAX^U = r^U B^U + TAXE^U$$

$$B^U_{t+1} = B^U_t (1-\alpha) + DEF^U_t$$

Wage Contracts

$$w^U_{t+1} = w^U_t + \beta_{25}({}_tp^{cU}_{t+1} - p^{cU}_t) + (1-\beta_{25})(p^{cU}_t - p^{cU}_{t-1}) + .1(L^U_t - \bar{L})$$

where $w = \log W$; $p^c = \log P^c$;

Market Equilibrium

$$Q^U = P^{cU}(C^U + G^U)/P^U + I^U / P^U + TB^U + (P^U N^U - P^O OIL^U) / P^U$$

$$M^U = \bar{M}^U$$

LDC Equations

$$P^L = (P^U)^{\mu_1}(P^R E^R)^{\mu_2}(P^J E^J)^{\mu_3}(P^C E^C)^{\mu_4}(P^O)^{(1-\mu_1-\mu_2-\mu_3-\mu_4)}(C_L^U+C_L^R+C_L^O+C_L^J+C_L^C)^{\mu_5}$$

$$C_U^L = \mu_1(C_U^L+\wedge^R C_R^L+\wedge^O C_O^L+\wedge^J C_J^L+\wedge^C C_C^L)$$

$$C_R^L = \mu_2(C_U^L+\wedge^R C_R^L+\wedge^O C_O^L+\wedge^J C_J^L+\wedge^C C_C^L)/\wedge^R$$

$$C_J^L = \mu_3(C_U^L+\wedge^R C_R^L+\wedge^O C_O^L+\wedge^J C_J^L+\wedge^C C_C^L)/\wedge^J$$

$$C_C^L = \mu_4(C_U^L+\wedge^R C_R^L+\wedge^O C_O^L+\wedge^J C_J^L+\wedge^C C_C^L)/\wedge^C$$

$$C_O^L = (1-\mu_1-\mu_2-\mu_3-\mu_4)\ (C_U^L+\wedge^R C_R^L+\wedge^O C_O^L+\wedge^J C_J^L+\wedge^C C_C^L)/\wedge^O$$

$$TB^L = \wedge^L(C_L^U+C_L^R+C_L^O+C_L^J+C_L^C) - C_U^L - \wedge^R C_R^L - \wedge^O C_O^L - \wedge^J C_J^L - \wedge^C C_C^L$$

$$CA_t^L = \bar{C}\bar{A}$$

$$DEBT = A_L^U + A_L^R\wedge^R + A_L^O + A_L^J\wedge^J + A_L^C\wedge^C$$

$$A_{Lt+1}^R\wedge_t^R = \mu_8[(A_{Lt+1}^U+A_{Lt+1}^R\wedge_t^R+A_{Lt+1}^O+A_{Lt+1}^J\wedge_t^J+A_{Lt+1}^C\wedge_t^C)$$

$$-(A_{Lt}^U+A_{Lt}^R\wedge_t^R+A_{Lt}^O+A_{Jt}^J\wedge_t^J+A_{Lt}^C\wedge_t^C)(1-\alpha)] + A_{Lt}^R\wedge_t^R(1-\alpha)$$

$$A^{O}_{Lt+1} = \mu_9[(A^{U}_{Lt+1}+A^{R}_{Lt+1}\wedge^{R}_{t}+A^{O}_{Lt+1}+A^{J}_{Lt+1}\wedge^{J}_{t}+A^{C}_{Lt+1}\wedge^{C}_{t})$$

$$-(A^{U}_{Lt}+A^{R}_{Lt}\wedge^{R}_{t}+A^{O}_{Lt}+A^{J}_{Lt}\wedge^{J}_{t}+A^{C}_{Lt}\wedge^{C}_{t})(1-\alpha)] + A^{O}_{Lt}(1-\alpha)$$

$$A^{J}_{Lt+1}\wedge^{J}_{t} = \mu_{10}[(A^{U}_{Lt+1}+A^{R}_{Lt+1}\wedge^{R}_{t}+A^{O}_{Lt+1}+A^{J}_{Lt+1}\wedge^{J}_{t}+A^{C}_{Lt+1}\wedge^{C}_{t})$$

$$-(A^{U}_{Lt}+A^{R}_{Lt}\wedge^{R}_{t}+A^{O}_{Lt}+A^{J}_{Lt}\wedge^{J}_{t}+A^{C}_{Lt}\wedge^{C}_{t})(1-\alpha)] + A^{J}_{Lt}\wedge^{J}_{t}(1-\alpha)$$

$$A^{C}_{Lt+1}\wedge^{C}_{t} = \mu_{11}[(A^{U}_{Lt+1}+A^{R}_{Lt+1}\wedge^{R}_{t}+A^{O}_{Lt+1}+A^{J}_{Lt+1}\wedge^{J}_{t}+A^{C}_{Lt+1}\wedge^{C}_{t})$$

$$-(A^{U}_{Lt}+A^{R}_{Lt}\wedge^{R}_{t}+A^{O}_{Lt}+A^{J}_{Lt}\wedge^{J}_{t}+A^{C}_{Lt}\wedge^{C}_{t})(1-\alpha)] + A^{C}_{Lt}\wedge^{C}_{t}(1-\alpha)$$

$$A^{U}_{Lt+1} = -CA^{L}_{t} - [(A^{J}_{Lt+1}\wedge^{J}_{t}+A^{C}_{Lt+1}\wedge^{C}_{t}+A^{R}_{Lt+1}\wedge^{R}_{t}+A^{O}_{Lt+1}]$$

$$+(A^{U}_{Lt}+A^{J}_{Jt}\wedge^{J}_{t}+A^{C}_{Lt}\wedge^{C}_{t}+A^{R}_{Lt}\wedge^{R}_{t}+A^{O}_{Lt})(1-\alpha)$$

OPEC Equations

$$P^{O} = (P^{U})^{\gamma_1}(P^{R}E^{R})^{\gamma_2}(P^{J}E^{J})^{\gamma_3}(P^{C}E^{C})^{\gamma_4}(P^{L})^{(1-\gamma_1-\gamma_2-\gamma_3-\gamma_4)}(C^{U}_{O}+C^{R}_{O}+C^{O}_{O}+C^{J}_{O}+C^{C}_{O})^{\gamma_5}$$

$$C^{O}_{U} = \gamma_1(C^{O}_{U}+\wedge^{R}C^{O}_{R}+\wedge^{L}C^{O}_{L}+\wedge^{J}C^{O}_{J}+\wedge^{C}C^{O}_{C})$$

$$C^{O}_{R} = \gamma_2(C^{O}_{U}+\wedge^{R}C^{O}_{R}+\wedge^{L}C^{O}_{L}+\wedge^{J}C^{O}_{J}+\wedge^{C}C^{O}_{C})/\wedge^{R}$$

$$C_J^O = \gamma_3(C_U^O+\wedge^R C_R^O+\wedge^L C_L^O+\wedge^J C_J^O+\wedge^C C_C^O)/\wedge^J$$

$$C_C^O = \gamma_4(C_U^O+\wedge^R C_R^O+\wedge^L C_L^O+\wedge^J C_J^O+\wedge^C C_C^O)/\wedge^C$$

$$C_L^O = (1-\gamma_1-\gamma_2-\gamma_3-\gamma_4)\ (C_U^O+\wedge^R C_R^O+\wedge^L C_L^O+\wedge^J C_J^O+\wedge^C C_C^O)/\wedge^L$$

$$TB^O = \wedge^O(C_O^U+C_O^R+C_O^L+C_O^J+C_O^C) - C_U^O - \wedge^R C_R^O - \wedge^L C_L^O - \wedge^J C_J^O - \wedge^C C_C^O$$

$$H^O = A_U^O + A_R^O + A_L^O + A_J^O\wedge^J$$

$$CA_t^O = \gamma_5[\gamma_6(C_{Ot}^U + C_{Ot}^R + C_{Ot}^L + C_{Ot}^J + C_{Ot}^C)\ (P_t^O/P_t^U) - H_{t-1}^O] + \alpha H_{t-1}^O$$

$$A_{Ut+1}^O = CA_t^O - (A_{Rt+1}^O\wedge_t^R + A_{Lt+1}^O + A_{Jt+1}^O\wedge_t^J + A_{Ct+1}^O\wedge_t^C) +$$

$$(A_U^O + A_{Rt}^O\wedge_t^R + A_{Lt}^O + A_{Jt}^O\wedge_t^J + A_{Ct}^O\wedge_t^C)$$

$$A_{Rt+1}^O\wedge_t^R = \gamma_7[A_{Ut+1}^O + A_{Rt+1}^O\wedge_t^R + A_{Lt+1}^O + A_{Jt+1}^O\wedge_t^J + A_{Ct+1}^O\wedge_t^C)$$

$$- (A_{Ut}^O + A_{Rt}^O\wedge_t^R + A_{Lt}^O + A_{Jt}^O\wedge_t^O + A_{Ct}^O\wedge_t^C)(1-\alpha)] + A_{Rt}^O\wedge_t^R(1-\alpha)$$

$$A_{Jt+1}^O\wedge_t^J = \gamma_8[A_{Ut+1}^O + A_{Rt+1}^O\wedge_t^R + A_{Lt+1}^O + A_{Jt+1}^O\wedge_t^J + A_{Ct+1}^O\wedge_t^C)$$

$$- (A_{Ut}^O + A_{Rt}^O\wedge_t^R + A_{Lt}^O + A_{Jt}^O\wedge_t^O + A_{Ct}^O\wedge_t^C)(1-\alpha)] + A_{Jt}^O\wedge_t^J(1-\alpha)$$

$$A^{O}_{Ct+1}\hat{}^{C}_{t} = \gamma_9[A^{O}_{Ut+1} + A^{O}_{Rt+1}\hat{}^{R}_{t} + A^{O}_{Lt+1} + A^{O}_{Jt+1}\hat{}^{J}_{t} + A^{O}_{Ct+1}\hat{}^{C}_{t})$$

$$- (A^{O}_{Ut} + A^{O}_{Rt}\hat{}^{R}_{t} + A^{O}_{Lt} + A^{O}_{Jt}\hat{}^{O}_{t} + A^{O}_{Ct}\hat{}^{C}_{t})(1-\alpha)] \quad + A^{O}_{Ct}\hat{}^{C}_{t}(1-\alpha)$$

Variable Definitions - World Model

A_i^j real claims by country j against country i

B real government debt

B_i^j real concessional claims by country j against country i

C real consumption of goods

C^d real consumption of domestic goods

C^m real consumption of imported goods

C_j^i consumption by country i of country j good

CA current account balance

DEBT LDC debt

DEF real budget deficit

E nominal exchange rate ($/ecu)

F real financial wealth

G real government expenditure on goods

H real human wealth

HOPEC net asset position of OPEC

i short nominal interest rate

I nominal investment expenditure inclusive of adjustment costs

I_j^i demand for country j good for investment in country j

J gross fixed capital formation

K capital stock

L demand for labor

M nominal money supply

N basket of intermediate inputs used in production

N_j^i import of country j good used as intermediate input in i

P price of domestic goods

P^m price of imported goods

P^c price of a basket of imported and domestic goods

P^I price of investment goods

P^n price of intermediate goods

Π product price inflation

Π^c consumer price inflation

Q real gross output

q Tobin's q

R long real interest rate

r short real interest rate

T total nominal tax receipts

TAX lump sum tax on households

TAXE exogenous tax

TB trade balance

v short real concessional interest rate on LDC debt

W nominal wage

α growth rate of population plus labor-augmenting technical change

τ_1 tax rate on household income

τ_2 tax rate on corporate profits

σ_1 elasticity of substitution between domestic and imported goods

σ_3 elasticity of substitution betweem capital and labor

Λ^R real exchange rate (relative price of ROECD goods)

Λ^J real exchange rate (relative price of Japanese goods)

Λ^{L} real exchange rate (relative price of LDC goods)

Λ^{O} real exchange rate (relative price of OPEC goods)

Parameters

α =0.040

U.S.

β1 =0.332	β11 =-9.000	β21 = 0
β2 =0.931	β12 =0.202	β22 = 1.000
β3 =0.000	β13 =0.000	β23 = 0.089
β4 =0.355	β14 =0.083	β24 = 0.000
β5 =0.471	β15 =8.000	β25 = 0.250
β6 =0.074	β16 =0.933	β26 = 0
β7 =0.881	β17 =0.022	β27 = 0.785
β8 =0.706	β18 =0.025	β28 = 0.050
β9 =0.263	β19 =1.429	β29 = 0.200
β10=0.031	β20 =1.000	β30 = 0
	β31 =0.85	β32 = 0.25
τ1 =0.350	τ2 =0.000	τ3 = 0.000
σ1 =1.000	σ2 =1.891	σ3 = 0.100
σ4 =1.000	σ5 =1.000	θ = 0.080
σ6 =1.000	σ7 =0.60	

ROECD

β1 =0.354	β11 =-9.000	β21 = 0
β2 =0.936	β12 =0.318	β22 = 1.000
β3 =0.000	β13 =0.000	β23 = 0.070
β4 =0.463	β14 =0.077	β24 = 0.000
β5 =0.285	β15 =8.000	β25 = 0.500
β6 =0.069	β16 =0.934	β26 = 0
β7 =0.688	β17 =0.023	β27 = 0.274
β8 =0.697	β18 =0.034	β28 = 0.050
β9 =0.251	β19 =1.506	β29 = 0.200
β10=0.052	β20 =1.000	β30 = 0
	β31 =0.85	β32 = 0.25
τ1 =0.350	τ2 =0.000	τ3 = 0.000
σ1 =1.000	σ2 =1.399	σ3 = 0.100
σ4 =1.000	σ5 =1.000	θ = 0.080
σ6 =1.000	σ7 =0.60	

Japan

$\beta 1$ =0.473	$\beta 11$ =-9.000	$\beta 21$ = 0
$\beta 2$ =0.950	$\beta 12$ =0.546	$\beta 22$ = 1.000
$\beta 3$ =0.000	$\beta 13$ =0.000	$\beta 23$ = 0.031
$\beta 4$ =0.423	$\beta 14$ =0.095	$\beta 24$ = 0.000
$\beta 5$ =0.146	$\beta 15$ =8.000	$\beta 25$ = 0.500
$\beta 6$ =0.052	$\beta 16$ =0.950	$\beta 26$ = 0
$\beta 7$ =1.139	$\beta 17$ =0.023	$\beta 27$ = 0.195
$\beta 8$ =0.652	$\beta 18$ =0.027	$\beta 28$ = 0.050
$\beta 9$ =0.292	$\beta 19$ =1.558	$\beta 29$ = 0.200
$\beta 10$=0.055	$\beta 20$ =1.000	$\beta 30$ = 0
	$\beta 31$ =0.85	$\beta 32$ = 0.25
$\tau 1$ =0.350	$\tau 2$ =0.000	$\tau 3$ = 0.000
$\sigma 1$ =1.000	$\sigma 2$ =1.171	$\sigma 3$ = 0.100
$\sigma 4$ =1.000	$\sigma 5$ =1.000	θ = 0.080
$\sigma 6$ =1.000	$\sigma 7$ =0.60	

Canada

$\beta 1$ =0.303	$\beta 11$ =-9.000	$\beta 21$ = 0
$\beta 2$ =0.760	$\beta 12$ =0.229	$\beta 22$ = 1.000
$\beta 3$ = 0	$\beta 13$ =0.000	$\beta 23$ = 0.008
$\beta 4$ =0.324	$\beta 14$ =0.055	$\beta 24$ = 0.000
$\beta 5$ =0.912	$\beta 15$ =8.000	$\beta 25$ = 0.500
$\beta 6$ =0.316	$\beta 16$ =0.644	$\beta 26$ = 0
$\beta 7$ =0.461	$\beta 17$ =0.273	$\beta 27$ = 4.800
$\beta 8$ =0.776	$\beta 18$ =0.057	$\beta 28$ = 0.050
$\beta 9$ =0.203	$\beta 19$ =1.329	$\beta 29$ = 0.200
$\beta 10$=0.022	$\beta 20$ =1.000	$\beta 30$ = 0
	$\beta 31$ =0.85	$\beta 32$ = 0.25
$\tau 1$ =0.350	$\tau 2$ =0.000	$\tau 3$ = 0.000
$\sigma 1$ =1.000	$\sigma 2$ =11.410	$\sigma 3$ = 0.100
$\sigma 4$ =1.000	$\sigma 5$ =1.000	θ = 0.080
$\sigma 6$ =1.000	$\sigma 7$ =0.60	

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