NBER WORKING PAPER SERIES

THE OPEN ECONOMY: IMPLICATIONS FOR MONETARY AND FISCAL POLICY

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Working Paper No. 1422

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 1984

The research reported here is part of the NBER's research program in Economic Fluctuations and project in Productivity (World Economy). Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

The exchange rate has by 1984 become as central to United States economic policy discussions as it has long been in the rest of the world. In this paper we show how the standard closed-economy macroeconomic model--the Phillips curve augmented IS-LM analysis--has to be modified for the United States to take account of the economy's international interactions. The only key structural equation that goes unamended is the money demand equation. Foreign prices, foreign activity, and foreign asset yields in the goods and asset markets appear as important determinants of domestic activity, prices, and interest rates.

We show that international interactions exert an important effect on the manner in which monetary and fiscal policies operate. The Phillips curve is much steeper under flexible than fixed interest rates. A tight money policy leads to appreciation under flexible rates, and thus to more rapid disinflation. Fiscal expansion, because it induces currency appreciation, is less inflationary under flexible than fixed exchange rates, but it also involves more crowding out. We show that these effects are in practice significantly large for the United States economy.

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THE OPEN ECONOMY: IMPLICATIONS FOR MONETARY AND FISCAL POLICY.

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The exchange rate has by 1984 become as central in United States economic policy discussions as it has long been in the rest of the world. The rapid dollar appreciation in the current disinflation is argued to have contributed powerfully to the speed of the disinflation. The 1984 Economic Report of the President fears that the "overvalued" dollar creates an unbalanced recovery by curtailing export growth, and fears also that large current account deficits will lead to a depreciation of the exchange rate which will contribute to a resurgence of inflation.

As the Bretton Woods system came under increasing pressure in the 1960's, economic policymaking became more constrained by balance of payments and exchange rate considerations. Supporters of a shift to flexible exchange rates--and by the end this was most economists--believed that a shift to floating rates would enable countries to insulate themselves from foreign disturbances. That did not happen. One reason is that the dominance of supply shocks in the 1970's was certainly not foreseen: real shocks will be transmitted between countries under both fixed and felxible rates. A second reason is that with different speeds of adjustment of assets and goods markets, shifts in monetary policy produce real rather than merely nominal exchange rate changes.

We start by describing trends and cycles in United States' international linkages, in goods, factor, and asset markets. We then develop the analysis of the operation of fiscal and monetary policy in the current flexible rate environment.

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*Department of Economics, MIT, and Research Associates, NBER. We thank Stanley Black, Alan Meltzer and Anna Schwartz for comments, David Wilcox for research assistance and the National Science Foundation for financial support.

I. The External Linkages: Trends and Cycles

The U.S. economy is linked to the rest of the world through goods, factor, and assets markets. The linkages are reflected in the flows of goods and services in international trade; in the relationships between goods and factor prices at home and abroad; and in the asset pricing and capital flow relationships between domestic and foreign asset markets. This section documents trends and cycles in these linkages.

We start with summary measures of the degree of coordination of business cycles in different periods. Morgenstern calculated the percentage of months that business cycles in the United States, France, Germany, and the United Kigdom were in the same phase in the periods 1879-1914 and 1919-1932.[1] In the pre-World War I period business cycles in the four countries were in the same phase 54% of the time; in the inter-War period the phases coincided only 36% of the time. Working with the same four countries, over the period 1953 to 1980 we find business cycle phases coinciding 35% of the time.[2] There is no substantial difference in the measure of co-incidence between the fixed and flexible exchange rate periods after World War II.[3] Thus business cycles seem to have been more co-ordinated internationally during the vintage gold standard period than subsequently. But the data are too crude and the differences too small to provide strong support for the view that the truly fixed exchange rates provided by the gold standard linked countries together more closely than the less reliable exchange rate arrangements of subsequent periods.

1. Trade in goods and services

Table 1 presents summary data on trade in goods and services for a period of over a century. Data are expressed as a percentage of GNP. The Table shows exports and imports of goods, and net exports of services: net exports of goods

TABLE 1: UNITED STATES TRADE AND TARIFFS, 1869-1983.

Period	IMG/GNP	EXG/GNP	NSER/GNP	NX/GNP	TAR/IMG
1869-76	7.7	6.6	-0.8	-2.0	35.1
1877-86	5.9	7.4	-0.9	0.7	29.8
1887-96	6.0	6.5	-1.3	-0.8	25.5
1897-06	4.4	6.8	-0.8	1.7	26.3
1907-14	4.5	5.9	-0.8	0.7	19.7
1915-19	4.7	9.6	0.2	5.1	8.1
1920-29	4.4	5.6	0.4	1.6	13.0
1930-39	2.9	3.5	0.2	0.8	17.0
1940-49	2.3	3.8	0.0	1.5	9.7
1950-69	3.1	3.8	0.3	1.0	6.6
1970-73	4.6	4.5	0.7	0.5	5.9
1974-77	7.1	6.7	1.3	0.8	3.8
1978-83	8.4	7.2	1.7	0.4	3.5

Notes: 1. Data are expressed as a percent of GNP for imports of goods (IMG), exports of goods (EXG), net exports of services (NSER), and net exports (NX). Last column shows tariff proceeds as a percentage of total imports of goods.

2. Sources for the years to 1929 are Historical Statistics of the United States, Part II, Series U201, U202, U211, U1, U2, U8, U9.

plus net services exports constitute net exports in the national income accounts, shown as the fourth column in Table 1. The current account is not shown in the table. The main difference between net exports (NIPA) and the current account is the inclusion in the latter of unilateral transfers and of government interest payments to the rest of the world.

The most striking point is the extent to which the U.S. economy has, from the viewpoint of trade in goods and services, been closed. Even back into the nineteenth centrury, neither exports nor imports exceeded ten percent of GNP for any substantial period. Merchandise exports peaked as a percentage of GNP during World War I, falling in the 1920's to lower levels than ever before, and then in the thirties and well into the sixties remaining even below 4% of GNP. The merchandise trade balance was for long in surplus, but has in the last decade moved into a large and growing deficit. Despite the doubling in the shares of both imports and exports in GNP since the fifties, the United States remains the most closed of all industrialized countries.

The average rate of tariffs has fallen substantially over the past century. But the decline was not monotonic: tariff acts punctuated the generally declining trend, notably in this century the Fordney-McCumber tariff of 1922, and the Smoot-Hawley tariff of 1930.[4] The effect of the Smoot-Hawley tariff on the domestic economy will be discussed below.

The cyclical behavior of imports and exports (goods and services) is summarized in Table 2, which presents correlations among: the growth rate of real GNP, the growth rates of (real) exports and imports, and the change in the share of net exports in GNP, over different periods. The consistent result is that imports are, as would be expected from the effects of aggregate demand on imports, pro-cyclical. The cyclical behavior of exports varies over the different periods shown in Table 2. There is no expectation of a consistent

TABLE 2: CYCLICAL BEHAVIOR OF IMPORTS AND EXPORTS

	1930-1983		1946-1973		1954-1983	
	GNP72GR	M72GR	GNP72GR	M72GR	GNP72GR	M72GR
M72GR	.586		.611		.492	
EX72GR	.063	-.093	-.215	-.696	.359	.164
DNXSH	-.162		-.276		.052	

Notes: 1. Data are correlation coefficients. Variables are year over year growth rates of real GNP (GNP72GR), real imports (M72GR) and exports (EX72GR), and the change in the share of net exports in GNP (DNXSH).

cyclical pattern in the case of exports: the correlation depends on the co-ordination of domestic and foreign business cycles, and on whether a particular expansion is domestically or export led. Net exports tend to move in an anti-cyclical direction, driven by the positive relationship between imports and the cycle. However, in periods in which export growth is positively correlated with GNP growth as for 1954-1983, net exports can on balance move pro-cyclically.

The correlation results of Table 2 agree with the findings of Mintz, who examined the cyclical behavior of exports, imports, and the trade balance over periods extending back to 1879. Mintz shows imports peaking at business cycles peaks and at their lowest at the trough.[5] Exports, by contrast are shown by Mintz not to have a consistent cyclical pattern, being strongly pro-cyclical in the inter-World War period but peaking well after the business cycle peak in the pre-World War I era. The trade balance was on average countercyclical.

Figure 1 shows the trade balance and the current account as a percent of GNP over the period since 1946. The eye may see a generally deteriorating current account in Figure 1, but more careful examination suggests that the enormous surpluses of the World War II era had been worked off by the end of the Korean War, and that the current account then fluctuated around a basic surplus of about 1% of GNP until a marked deterioration took place at the end of the period. The absence of any strong cyclical behavior of net exports in Table 2 is reflected in the differing behavior of the trade balance (and the current account) from cycle to cycle. The trade balance improved during the recessions in 1954, 1960, 1970, and 1980, and worsened during the recessions of 1957, 1973-75, and 1982.

Although the United States is, by the criterion of the shares of exports and imports in GNP, the most closed of the Western economies, it is not closed at the margin. Tariffs have declined to very low levels and leave only a few areas in

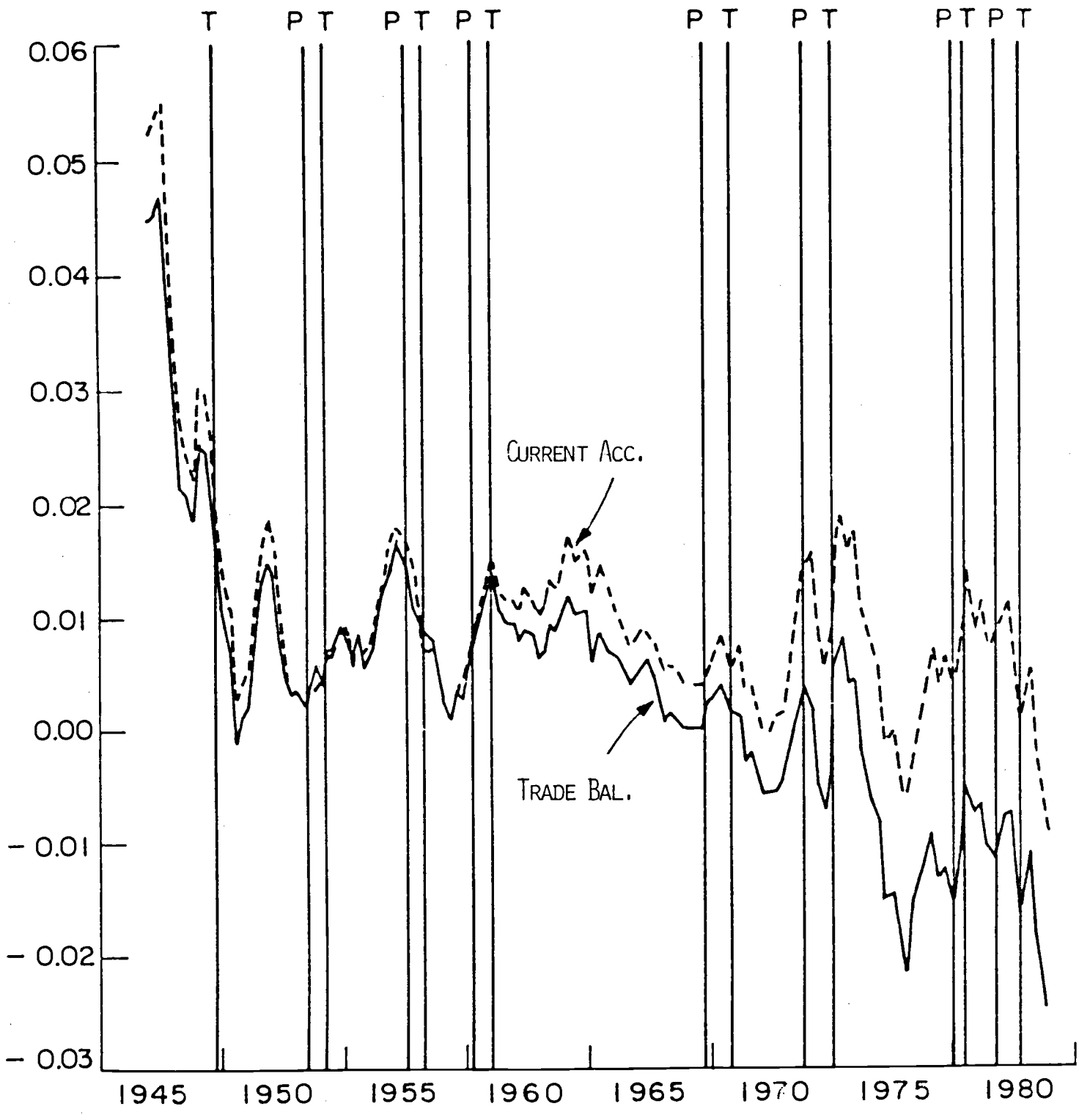

Figure 1: The Trade Balance and the Current Account (Relative to GNP)

which domestic industries are sheltered from foreign competition, except where quotas or their equivalent in the form of voluntary export restraints (automobiles, steel, textiles, etc.) have been imposed. Estimates of the income elasticity of aggregate imports are typically in the range of 1.5 to 2. Export shares in GNP have also fluctuated substantially.

Table 3 presents a measure of the variability of components of GNP over the period 1954 to 1983. The underlying data are year to year changes in the ratio of each category of spending to GNP, expressed in percent.[6] The data in Table 3 are the variances of those changes. Exports and imports each vary less than the other components of GNP in absolute terms, but despite the low average ratios of imports and exports to GNP, their year to year variability is of the same order of magnitude as that of the remaining expenditure categories.

Shifts in the competitiveness of the United States relative to its trading partners are one of major determinants of merchandise trade. Competitiveness is shown in Figure 2 by an index of the U.S. value added deflator in manufacturing compared to the exchange rate-adjusted, trade-weighted deflators of partner countries in international trade.[7] Note in Figure 2 the large adjustment in the measure of competitiveness in the 1971-73 period, in the transition to flexible exchange rates. The magnitude of the adjustment and its persistence demonstrate that the Bretton Woods system had led to a cumulative overvaluation of the dollar. Even after the rapid appreciation of the dollar in the early 1980's the real exchange rate is still well above its 1970 level.

Tables 4 and 5 show long-term shifts in the composition and direction of U.S. merchandise trade. The long-term shifts are, on the side of exports, entirely as expected. The United States shifted from exporting primarily food and crude materials in the last century to manufactures in the twentieth century. Even so, there is some tendency for the share of manufactures to fall in the post

TABLE 3: VARIABILITY OF COMPONENTS OF GNP.

DCSH	DISH	DINVSH	DGSH	DEXSH	DIMSH
.589	.640	.642	.750	.540	.319

Note: Data are variances of the change in the shares (expressed as a percentage) of GNP of consumption (DCSH), fixed investment (DISH), inventory investment (DINVSH), government spending (DGSH), exports (DEXSH) and imports (DIMSH), for annual data, 1954-1983.

TABLE 4: THE COMPOSITION OF U.S. TRADE

	Exports			Imports		
	Crude materials	Food	Manufactures	Crude materials	Food	Manufactures
1869-76	47	33	20	15	35	49
1877-86	33	47	20	20	36	44
1887-1906	32	40	28	28	31	41
1907-14	33	23	44	35	24	42
1915-19	17	29	54	41	27	32
1920-29	26	21	53	37	25	39
1930-39	28	12	62	30	28	41
1940-49	10	15	75	33	27	39
1950-69	13	15	72	21	23	58
1970-73	14	14	72	16	14	70
1974-77	16	15	69	35	10	55
1978-82	16	15	69	35	8	57

Source: Historical Statistics of the United States, Part 2, Series U-214 through U-224, and Economic Report of the President, 1983.

TABLE 5: THE DIRECTION OF U.S. TRADE, 1869-1982. (%)

	Imports					Exports				
	Canada	Other America	U.K.	Other Europe	Rest of World	Canada	Other America	U.K.	Other Europe	Rest of World
1869-76	6	28	35	20	11	6	12	53	27	3
1877-86	6	28	26	27	13	5	9	53	29	4
1887-1906	5	27	20	32	16	7	10	45	32	7
1907-14	5	25	16	34	18	13	14	28	37	9
1915-19	12	36	10	12	30	12	11	32	34	10
1920-29	11	27	9	20	32	15	18	20	31	17
1930-39	14	25	7	22	33	15	17	18	28	23
1940-49	23	37	4	8	28	15	18	21	25	21
1950-69	23	27	6	20	25	20	20	6	28	26
1970-73	27	14	5	23	31	23	15	5	28	30
1974-77	22	16	4	18	41	21	15	5	26	33
1978-82	18	15	4	17	46	17	17	5	26	35

Source: Historical Statistics of the United States, Part 2, pp.903-906, and Survey of Current Business, various issues.

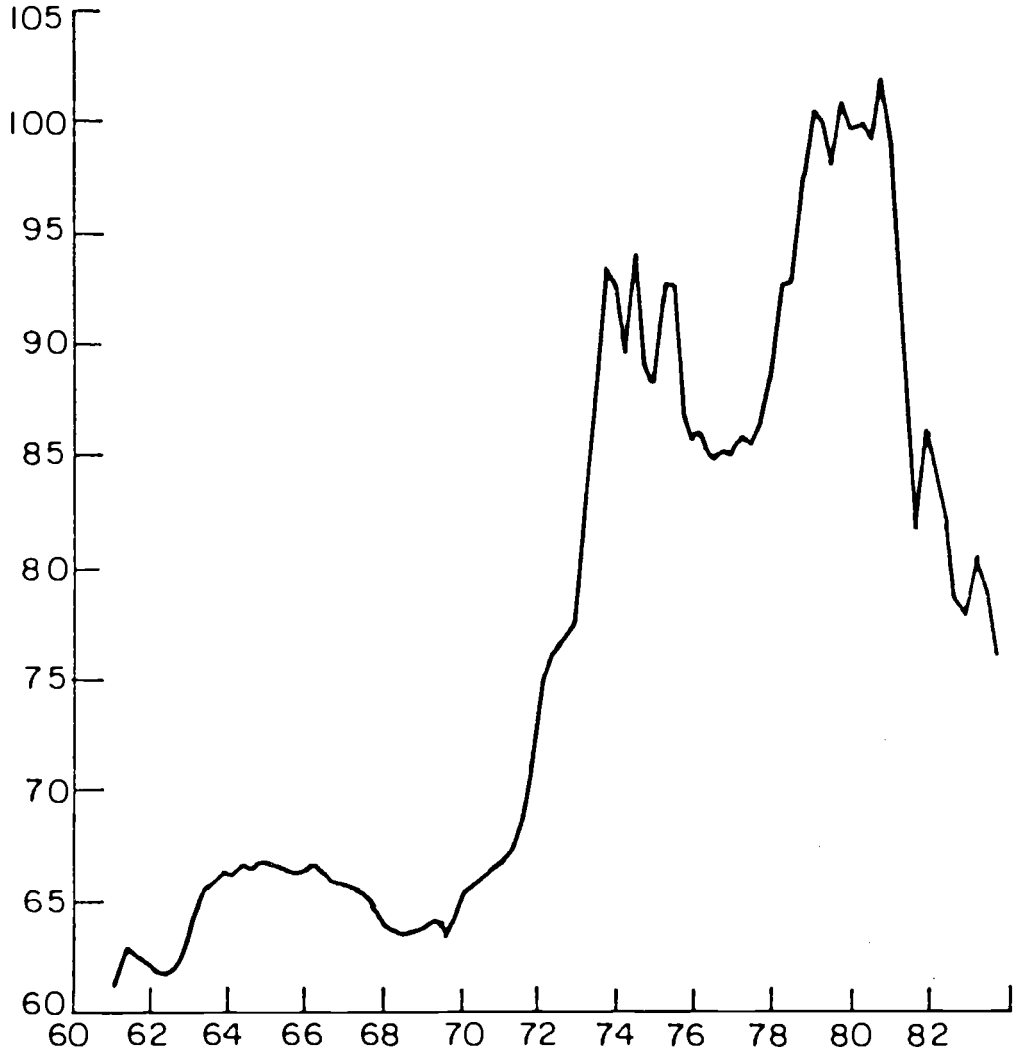

Figure 2: The Real Exchange Rate (Index, 1980=100)

Source: See text.

World War II period. On the import side, crude materials are as significant a share of imports now as they were in the World Wars; food imports are currently extremely low. The reorientation in the direction of trade is also simple: away from Europe, especially the United Kingdom, and towards Asia.

We conclude the review of trade patterns with a comment on the importance of the U.S. in world trade. The share of the U.S. in world trade has steadily declined over the post-World War II period. In 1951-53 the U.S. share of world exports was 21%, in the early 1960's and 1970's respectively 17.2% and 13.5%. By 1981-82 the U.S. share of world exports had declined to 12.5%, despite the increase in the share of exports in U.S. GNP. Germany and Japan are becoming near equals of the U.S. in world trade as their share of exports approaches 10% in the early 1980's.

Digression: The Smoot-Hawley Tariff and the Great Depression.

The tariff changes shown in Table 1 have been receiving increasing attention as a macroeconomic phenomenon. In particular, the Smoot-Hawley tariff of 1930 is argued to have played an important role in the Great Depression. This view is certainly not found in the classic Friedman-Schwartz account of the Depression:[8] the Hawley-Smoot Tariff Act does not appear in the index; when it does appear, in a footnote on p.342, it is only as a contributor to the gold inflow of late 1930; and it is not featured in the discussion (pp.359-363) of the international character of the Depression. Kindleberger gives the Tariff Act a substantial role, but on symbolic grounds: its signing represented United States abdication of its responsibility to take charge of the world economy.[9]

The modern interest in the Smoot-Hawley tariff traces mainly to Meltzer's brief analysis.[10] The argument "assigns a large role to the Hawley-Smoot tariff and subsequent tariff retaliation in explaining why the 1929 recession did not follow the path of previous monetary contractions but became the Great

Depression", (p.460). The detailed explanation gives considerable weight to the reductions in imports of semi-finished goods and exports of agricultural goods following the tariff, suggesting that the fact that bank failures in 1930 and 1931 were concentrated in agricultural regions was in part a consequence of the tariff. But it is important to note that Meltzer is mainly discussing the question of the onset and rapid worsening of the recession, rather than the responsibility of macroeconomic policy for the Depression becoming Great. There is no implication that intelligent macroeconomic, and particularly monetary, policy could not have prevented the disasters of 1932-33.

In Table 6 we present summary data on trade and GNP in the periods 1918-1923 and 1928-1923. Each of these periods saw a major recession and a major increase in tariffs. Indeed, the 1922 Fordney-McCumber tariff increased tariff rates (calculated as the ratio of duties to either total imports, or dutiable imports) as much as the Smoot-Hawley tariff.[11] In light of the increases in tariffs shown in Table 5, it is difficult to accept Haberler's "skyscraper" description of Smoot-Hawley (op.cit., p.8 and p.33). Fordney-McCumber would on the same scale qualify as a "rocket" tariff. Further, as a matter of arithmetic, part of the blame for the increase in tariffs between 1929 and 1933 goes to the drop in price levels, since many tariffs were specific, i.e. specified in dollar terms, rather than ad valorem.[12]

Fordney-McCumber was imposed in 1921-22 and was followed by an increase in imports and decrease in exports. The economic expansion was responsible for the import increase; the decrease in exports was a deflationary impulse, outweighed by the start of the expansion of the 1920's. A recession did begin in May 1923 but it was brief; 1924 real GNP was unchanged from that of 1923, and imports fell very little. Smoot-Hawley was also followed by a reduction in exports, but this time by a reduction in imports. These were primarily the result of the

TABLE 6: TARIFFS AND THE MACROECONOMY, 1918-23 AND 1928-33.

Years		Real GNP (1918=100)		Ratio of to duties total imports (%)		Ratio of duties to dutiable imports (%)		Quantity of imports (index)		Export index		Exports of crude food (quantity index)	
		(F3)		(U211)		(U212)		(U237)		(U225)		(U229)	
1918	1928	100	126	5.8	13.3	23.7	38.8	71	115	98	128	148	98
1919	1929	97	134	6.2	13.5	21.3	40.1	81	131	120	132	174	94
1920	1930	92	121	6.4	14.8	16.4	44.7	88	111	116	109	213	69
1921	1931	84	112	11.4	17.8	29.5	53.2	74	98	97	89	269	71
1922	1932	98	95	14.7	19.6	38.1	59.1	95	79	90	69	218	59
1923	1933	109	93	15.2	19.8	36.2	53.6	99	86	91	69	122	32

Sources: Data are from Historical Statistics of the United States, 1970, series numbers indicated in column leading.

recession. The declines in agricultural exports following Smoot-Hawley was large, but so was the decline following Fordney-McCumber.

From either a Keynesian or monetarist perspective, the tariff by itself would have been an expansionary impulse in the absence of retaliation. In the Keynesian view, the reduction in imports diverts demand to domestic goods; in the monetarist view the gold inflow increases the domestic money stock if bit sterilized. In the event, the balance on goods and services fell after the imposition of the tariff. The behavior of net exports suggests the emphasis on recession abroad and retaliation, rather than the direct effect of the tariff, as a force contributing to recession. Exports were 7% of GNP in 1929. Between 1929 and 1931, they fell by 1.5% of 1929 GNP. Attributing the entire fall to the tariff retaliation, and assuming a multiplier of two real GNP would have fallen 3% on this account. The fall in real GNP between 1929 and 1931 was over 15%, thus indicating that the tariff could not have played the major role in creating the recession by affecting the demand for goods. Further, the 3% of GNP estimate is surely a high estimate of the effects of the tariff on exports.

In addition to the tariff US net exports were, of course, affected by the extensive competitive depreciation on the part of foreign countries. This consideration further reduces the significance to be attached to the tariff as a cause precipitating the Great Depression.

On the monetary side, gold inflows increased at the end of 1930, but 1931 saw a reduction back to close the 1929 proportion to NNP.[13] These inflows were an inflationary force. To the extent that the tariffs, via foreign retaliation, worked by creating distress in agricultural areas, and thereby setting off early bank collapses, they had an adverse monetary effect. But this only emphasizes the perversity of the Fed's bank closing policy. Further, it is not clear that a U.S. tariff on agricultural imports that sheltered domestic producers from the

collapse of world commodity prices would adversely affect those producers. Rather it was likely to have raised their incomes (given inelastic supply) above the free trade level.

We can summarize our argument briefly: Fordney-McCumber increased tariffs substantially when the United States economy was in a deep recession that was followed by a rapid recovery. Smoot-Hawley increased tariffs at the start of a deep recession that was followed by the Great Depression. Neither should receive prime credit or blame for what followed: macroeconomic policies are far more significant.[14]

2. Goods and Factor Price Links.

The strict purchasing parity (PPP) theory of the exchange rate holds that exchange rates move proportionately with national price levels.[15] PPP thus implies a one-for-one link between domestic and foreign prices. Figure 3 and much other evidence shows that PPP does not hold in any relevant sense. Relative national price levels, adjusted through exchange rates, can and do move for lengthy periods.[16]

Despite the absence of any strong relationship between national price levels, exchange rate and foreign price level changes do affect domestic prices. Changes in the dollar prices of imports directly affect goods and raw material input prices in the United States, and thus affect the prices of final goods. The pressure of international competition on the prices of traded goods also affects domestic prices and the wage settlements reached in the affected industries. Links of these types, to be reviewed in the next section, change the dynamics of inflation between fixed and flexible exchange rate systems.

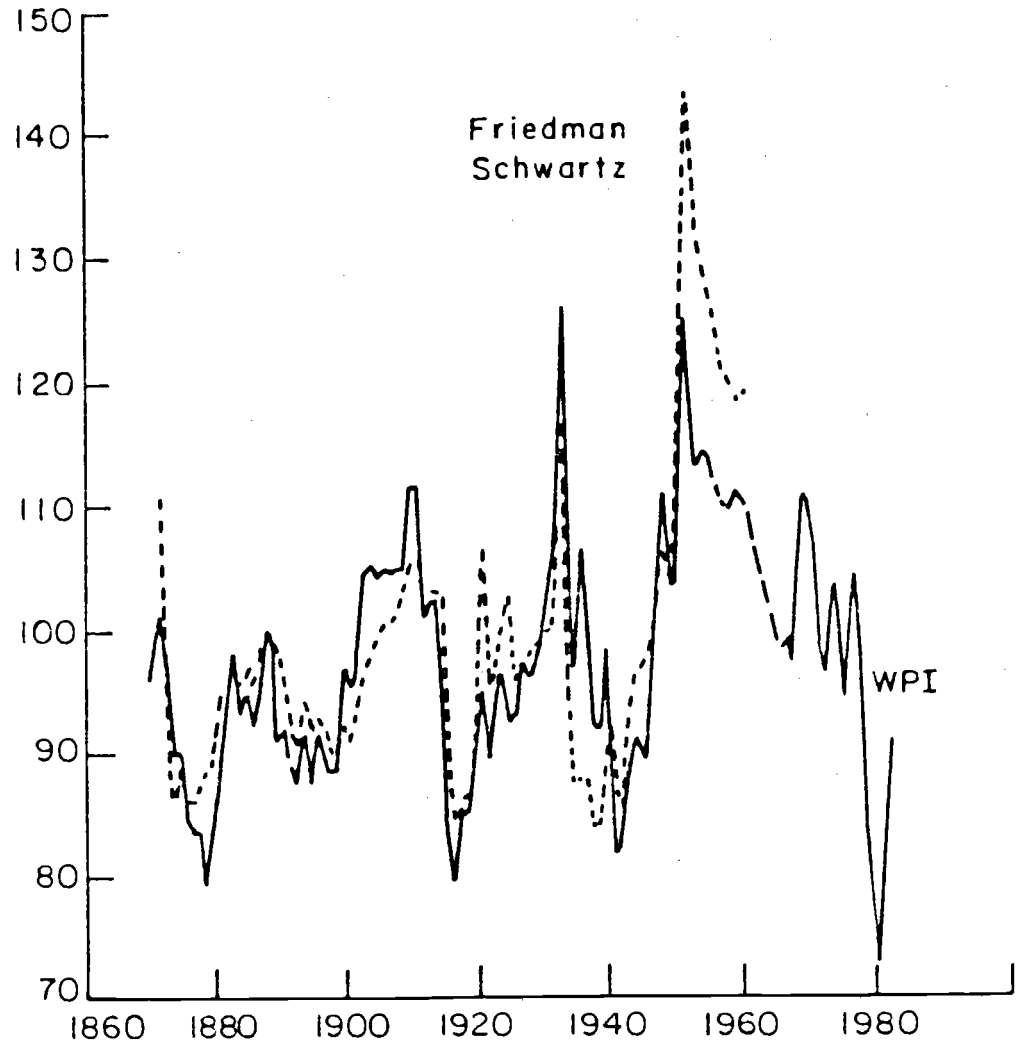

Figure 3: International Purchasing Power Comparisons: United States / United Kingdom.

Sources: Friedman / Schwartz, from Appendix A, pp 769 - 771, in A Monetary History of the United States 1867 - 1960, wholesale prices.

3. Asset market linkages and capital flows.

The international integration of assets markets is in the 1980's an accepted fact. Interest rates are linked internationally (adjusted for anticipated depreciation) and capital flows are highly, and perhaps excessively, responsive to anticipated return differentials.

Asset market integration was of course a well-known feature of the pre-World War I and inter-War world economies. The thrust of careful empirical work is however to suggest that the linkages were less tight than simple accounts of the gold standard imply. Morgenstern calculated correlation coefficients among short term interest rates in London, New York, Paris and Berlin. For the period 1876-1914 the correlation between the New York commercial paper rate and the London private discount rate is only 0.45; for the period 1925-1938 the correlation is 0.93.[17] The correlation between monthly U.K. and U.S. treasury bill rates for the flexible rate period, January 1974 to November 1983 is 0.583,[18] above the correlation for short-term rates for the earlier gold standard period calculated by Morgenstern. During the adjustable peg period, January 1964 to July 1971, the correlation between monthly British and U.S. treasury bill rates was 0.794, below the correlation for the inter-War period calculated by Morgenstern. While the Morgenstern data give the impression that short-term interest rates had considerable latitude to move independently in the pre-World War I period, the economic significance of the low correlation depends on the absolute variability of the rates as well as their correlation.

Interest rate differentials during the gold standard period were substantial. Morgenstern (p. 335) calculates that the degree of flexibility of the exchange rate implied by the gold points allowed an interest differential on 90-day bills of 3.73% between London and New York.[19] In the period 1876-1914 the commercial paper rate in New York was on average 2.17% higher than the

private discount rate in London. Risk and transaction costs of course permit differences in mean rates of return on apparently similar short-term assets.[20] But there was also considerable variability in the interest rate differential: the standard deviation of the difference between the London and New York rates was 1.21%. The differential exceeded 4% in more than 7% of the months in the pre-World War I period, and in July 1893, during a United States banking panic in which convertibility was suspended, was 9.63%. In the flexible exchange rate period, 1974 to 1983, the standard deviation of the difference between treasury bill rates in the United States and United Kingdom, 2.66%, was substantially larger than in the early gold standard period.

The asset market linkages were closer in the inter-War period and in the fixed exchange rate period 1964-1971. In the period 1925-1938 the mean London - New York differential was only 0.24% with a standard deviation of 0.71%. The mean differential in the 1964-1971 period was 1.33%, with the standard deviation of the difference, 0.72%, almost identical to that for the inter-War period.

There appear to be no reliable data on the size of short-term capital flows during the gold standard periods, but the presumption is that they were both large and an essential part of the mechanism that tied capital markets together. The extent to which disturbances to United States financial markets originated abroad rather than domestically has not to our knowledge been documented, although there are discussions of the national origins of international financial crises.[21] Morgenstern (pp 548-549) shows the United States as more frequently the originator than the recipient of (stock market) panics. Of the eleven first and second order United States panics recorded for the period 1873-1932, the United States transmits panic abroad in nine episodes and is the recipient of foreign shocks in only two (1890 and 1907). On other occasions, including 1914, foreign disturbances are transmitted to the United States without causing a

panic.

There are estimates of aggregate capital flows, long- plus short-term, which are consistent with the net export data presented in Table 1 above.[22] These show the United States as primarily an importer of capital (averaging 0.8% of NNP) over the period until 1896; an exporter of capital (average equal to 1.1% of NNP) over the next nine years; once more an importer on a small scale until 1914; exporting capital on a large scale during World War I (average of 4.8% per year of NNP for the years 1914-1919) and continuing to do so until 1933; reverting to the role of importer until 1941; and thereafter exporting capital until the most recent period.

4. Adjustment under the Gold Standard

We now briefly pull together the strands in the above discussion of the mechanisms linking the United States and foreign economies under the gold standard, as background for our analysis in the next section of the operation of the current flexible exchange rate system.

The earliest analysis of the operation of the gold standard, the Hume price-specie flow mechanism, focussed on the goods markets and on movements in relative national price levels. These mechanisms should be expected to produce slow adjustment to disturbances. Consider for example the response of the economy to an upward shift in the domestic demand for money. Under the price-specie flow mechanism, the reduced demand for goods tends to reduce domestic prices and the demand for imports. The current account goes into surplus and gold flows in to satisfy the increase in money demand. The mechanism can operate successfully through real balance effects on the demand for imports even if PPP holds exactly. In the event the disturbance to money demand is temporary, the process will have to be reversed when the disturbance disappears.

Subsequent analysis described a system with more rapid adjustment in which asset market linkages allowed capital flows in response to incipient interest rate movements, perhaps caused by active central bank (or in the case of the United States, Treasury) intervention, to help equilibrate the system.[23] We continue with the example of an upward shift in the demand for money. The impact of such a shift, which might be associated with a financial panic, is to increase domestic interest rates. There is a capital inflow that equilibrates interest rates at home and abroad, and helps meet the increased demand for money. If the demand shift is temporary, there need be no major disruptions to the goods markets. Thus in this case the capital markets facilitate more rapid adjustment to a domestic disturbance. If the demand shift is permanent, goods market adjustments are needed to pay the interest on the capital inflow.

This example is chosen as a case in which capital flows ease domestic adjustment. But of course from the viewpoint of the foreign country the asset market linkages permit transmission of a disturbance that would otherwise have been much slower in appearing. Further, as we know from the downfall of the Bretton Woods system, international capital flows in fixed exchange rate systems are not always regarded as an unmitigated blessing. There are thus two questions: first, how did the gold standard system survive during the period 1879-1914 when capital flows were not restricted; and second, did capital flows on average ease the adjustment processes of the system to disturbances?

Bloomfield argues that because there was no serious belief, even during the silver agitation in the United States, that exchange rates would change, capital flows under the pre-World War I gold standard while substantial and sensitive to interest rate movements, were not destabilizing. He argues also that over the period, the discount rate actions needed for external balance typically coincided with those needed for internal stabilization, so that capital flows were on

balance stabilizing. The latter argument is vitiated by the well-known fact that central banks did not even during the heyday of the gold standard conform to the rules of the game, and frequently sterilized gold flows.[24]

The issues of the stabilizing or destabilizing roles and relative importance of the goods market, price-specie flow, and asset market linkages, and of intervention, under the gold standard have not been settled, despite the extensive literature. Friedman and Schwartz emphasize the importance of relative national price level adjustments in response to money flows.[25] Nurkse (op.cit.) argues that adjustment was typically more rapid than the price-specie flow mechanism implies, and credits multiplier effects of the trade balance for part of the speed-up. The capital account tended to move procyclically, apparently offsetting the stabilizing effects on the system of the money stock movements implied by the anti-cyclical current account. Such capital flows might appear to have been destabilizing from the viewpoint of the cycle, but that would not be the case if they were accommodating temporary disturbances.[26] And the issue of whether central bank sterilization had and can have any real effects, and if so whether the effects are stabilizing, is still alive.

II. Open Economy Macroeconomic Linkages.

In this section we study the ties between U.S. macroeconomic variables and the world economy, and discuss how the openness of the economy affects stabilization policy. The analysis relies on the theoretical model sketched in the appendix, which embodies the main channels and effects that are given emphasis in open economy macroeconomics.[27] As in the previous section, we start with goods market linkages between the United States and other economies.

1. Goods Markets.

The channels of transmission in the goods market are described by equations (1) and (2) below. (For notation, and other arguments of the demand function, see the appendix; time subscripts are omitted when there is no risk of confusion).

(1) $Y = D(eP^*/P, Yd, q, V, \ldots) + NX(eP^*/P, Yd, Y^*d, V, V^*, \ldots)$

Equation (1), the goods market equilibrium condition, describes the contribution of net exports to aggregate demand. The demand for domestic goods is determined by real disposable income, the profitability of investment, the real exchange rate eP^*/P, and real wealth. Exports depend on the real exchange rate, and on domestic and foreign income and wealth.

Equation (2) is the price equation:

(2) $P = C(W, Pm, eP^*, Y/K)$

In (2) the materials price term, Pm, changes as the prices of imported inputs change. The term in foreign prices, eP^*, represents the effects of foreign competitiveness on domestic prices. Equation (2) can be thought of either as a mark-up equation, or as the description of equilibrium price determination in a competitive economy.

Several channels of transmission, which can be described in aggregate supply and demand terms, emerge from equations (1) and (2).[28] We confine ourselves for the moment to impact effects, thus taking into account only shortrun cyclical flexibility of prices and wages. The channels are:

(i) Most familiar, a rise in foreign income and spending raises the demand for

our goods, shifts the aggregate demand curve up, and thus leads to an increase in output and home goods. An example is an increase in foreign import demand as a result of expansion abroad. This channel is of course present under both fixed and flexible exchange rates. Such multipliers should be close in size to government spending multipliers.[29]

(ii) A rise in import prices, induced by exchange depreciation or increased foreign prices, shifts both aggregate demand and supply curves. On the demand side, assuming a sufficiently large price elasticity, there is a shift toward domestic goods, and therefore a tendency for output and prices to rise. On the supply side, the increase in competitors' prices leads to an increase in home prices as domestic firms increase their mark-up.[30] Domestic prices certainly rise; we would expect output to increase.

The effects of an import price increase in practice depend on the extent to which other endogenous and policy variables react to the disturbance. In particular, it is important to know whether wages rise in response to higher import prices, and whether the monetary authorities accommodate the disturbance. The more wages rise with import prices, and the more accommodating is money, the smaller the real effects and the larger the impact of the import price change on prices. Results of simulations of econometric models, such as the OECD Interlink model, the Japanese EPA model, or the Federal Reserve's MCM model will differ in their assumptions about the nominal feedbacks resulting from an import price increase, and conclusions about the effects of disturbances are likely to differ.

Even leaving aside feedbacks from wages and money, there are effects of import price changes on aggregate demand. To the extent that higher import prices raise the price level, without there being offsetting reductions in domestic prices, the real money stock falls and the equilibrium interest rate that clears the assets markets will rise. Higher interest rates in turn imply a

reduction in income and spending, and reduced aggregate demand and employment.

It is well known from the literature on trade equations[31] that higher import prices can in the short run lead to increased import spending and a decline in net exports. The fall in net demand may imply a reduction in demand for domestic goods, or possibly a reduction in saving.[32] If increased import spending is financed by a reduction in domestic saving, output will expand. If it has as its counterpart reduced spending on domestic goods, output will fall. Theoretical analyses show that in this context it matters whether the disturbance is permanent or transitory, and whether consumers strongly prefer smooth consumption streams and do not react to changes in the intertemporal terms of trade. The case most favorable to expansion of employment occurs if a disturbance is believed to be temporary and consumption smoothing dominates real interest rate-induced effects.

(iii) Increased materials prices imply increased costs and therefore cause the aggregate supply curve to shift up. But there are also demand side effects. Increased prices of imported materials imply a reduction in real disposable income since there is a reduction in value added at a given level of output. Domestic real disposable income falls because with real output unchanged, the higher real price of imported intermediate products implies that real income available for domestic factors of production is reduced. Aggregate demand therefore declines. Bruno and Sachs (1983) have discussed the relative importance of the supply and demand shifts and the resulting ambiguity for the net effects.[33] There is no question that output will decline, but the price level may rise or fall. We assume the net effect is an increase in prices.

Materials prices are determined by supply and demand conditions in the world market. Equation (3) describes the price of materials:

(3) $Pm = v(Y, Y^*, \ldots, P, eP^*)$

We assume v( ) is degree one homogeneous in the domestic and foreign price levels. Accordingly, we can rewrite (3) as

(3a) $Pm/P = v(Y, Y^*, \ldots, eP^*/P)$

Equations (3) and (3a) make the important point that exchange rate disturbances unrelated to price level movements directly change commodity prices, both in dollars and in real (U.S. goods) terms. In addition, of course, the real price of commodities is affected by short and longrun supply conditions, such as OPEC shocks.

(iv) The wealth and disposable income terms in (1) point to a further channel of international linkage. Changes in the world real interest rate redistribute wealth and income internationally between net creditors and net debtors. A rise in the real interest rate is an intertemporal terms of trade change that benefits lenders whose real income rises, and hurts borrowers. At the same time, higher real interest rates affect the valuation of existing assets. The values of real capital and longterm debt decline, thereby reducing world wealth. The net impact of these changes on aggregate demand for United States goods is not obvious.

(v) Wealth effects are important also in the context of persistent international capital movements, for instance arising from persistent public sector deficits. With marginal spending patterns differing internationally, international redistributions of wealth associated with capital account imbalances shift the pattern of world demand toward the goods demanded by persistent lenders and away from those demanded by persistent borrowers.[34]

TABLE 7: EXCHANGE RATES AND THE GNP DEFLATOR, 1962:4 to 1983:3

egression #	Dependent Variable	C	Exchange Rate Change	DWAGE	DPROD	DPOG	ρ	$\bar{R}^2$	D.W.	S.E.R.
			DWAX							
1	INFDEF	.419	.062	0.722	-.107	.089	.371	.81	2.04	1.18
		(0.61)	(2.12)	(6.96)	(-1.53)	(4.64)	(2.71)			
			[2.15]	[3.08]						
			DEX							
2	INFDEF	.211	0.089	0.745	-.122	.089	.328	.83	2.01	1.14
		(0.33)	(3.04)	(7.85)	(-1.87)	(4.94)	(2.42)			
			[2.14]	[3.12]						
			IMP* IMPL							
3	INFDEF	.133	.055 .074	0.713	-.108	.011	.278	.83	1.99	1.13
		(0.25)	(1.74)(1.72)	(8.65)	(-1.89)	(0.51)	(2.56)			
			[2.72]	[3.57]						

otes: 1. All variables are quarter over quarter changes, at an annual rate.

2. Variables are defined as follows:

INFDEF Inflation rate, GNP deflator

C Constant

DWAX Rate of change of weighted average U.S. exchange rate

DEX Rate of change of real exchange rate, defined as relative prices of

Table 7 continued

manufactured goods.

IMP Inflation rate of import price defator.

IMPL Lagged values of IMP.

DWAGE Rate of change of hourly wage rate, manufacturing.

DPROD Rate of change of output per hour, manufacturing.

DPOG Rate of change of price of oil and gas.

3. All variables except wage enters with four lags. DWAGE has 6 lags. Coefficients and t statistics are for sums of coefficients on variables. No contemporaneous variables are included except for IMP in regression 3.

4. Equation 3 is estimated using instrumental variables for IMP; instruments are current and lagged values of the monetary base, full employment deficit, and military spending.
(*indicates use of instrumental variables).

5. Entries in [ ] are mean lags, e.g. in regression 1, mean lag of distribution of coefficients on DWAX is 2.15 quarters.

TABLE 8: EXCHANGE RATES AND THE CONSUMPTION DEFLATOR, 1962:4 to 1983:3

egression #	Dependent Variable	C	Exchange Rate Change	DWAGE	DPROD	DPOG	ρ	$\bar{R}^2$	D.W.	S.E.R.
			DWAX							
4	INFPCD	1.024	.083	.601	-.102	.085	.588	.82	1.94	1.15
		(1.10)	(2.39)	(4.36)	(-1.29)	(3.60)	(4.87)			
			[3.38]	[3.97]						
			DEX							
5	INFPCD	0.443	.125	.666	-.099	.089	.509	.84	1.96	1.09
		(0.57)	(3.72)	(5.83)	(-1.38)	(4.34)	(4.13)			
			[2.87]	[3.96]						
			IMP* IMPL							
6	INFPCD	0.198	.086 .054	0.658	-.095	.012	.405	.85	1.93	1.06
		(0.34)	(2.85)(1.23)	(7.26)	(-1.59)	(0.50)	(3.99)			
			[1.61]	[3.75]						

otes: 1. INFPCD is inflation rate of personal consumption deflator.

2. Other details are as for Table 7.

TABLE 9: EXCHANGE RATES AND THE PHILLIPS CURVE

Regression #	Dependent Variable	C	DWAX	DEX	IMPL	LOGUMM*	EXPINF	ρ	$\bar{R}^2$	D.W.	S.E.R.
7	DAHM	3.757	.141			-1.821	0.966	.059	.50	1.98	1.93
		(5.31)	(3.34)			(-2.01)	(6.94)	(0.53)			
			[4.02]								
8	DAHM	3.922		.126		-2.393	1.033	.083	.49	2.00	1.96
		(5.46)		(3.08)		(-2.76)	(7.27)	(0.76)			
				[4.03]							
9	DAHM	4.340			.108	-2.096	0.745	.044	.50	1.99	1.94
		(6.68)			(3.07)	(-2.54)	(4.54)	(0.40)			
					[4.47]						

Notes: 1. Variable definitions as in Table 7. EXPINF is the expected inflation rate, calculated as a weighted average (with decay coefficient of .15 per quarter) of past PCE quarter over same quarter a year before inflation rate. LOGUMM is logarithm of unemployment rate for married men.

2. Exchange rate variables are entered with six lags.

3. *Indicates treated as endogenous, using same instruments as in Table 6.

2. Goods and Factor Price Linkages.

Equations (2) and (3) show the external sector affecting domestic prices directly, both through the effects of competitive import prices on domestic mark-ups, and because import prices affect costs and thus prices. Equation (2) also points to two indirect routes through which the foreign sector affects domestic prices. Exposure to foreign competition may affect wage settlements in industries substantially involved in the international economy. Further, demand pressures from abroad affect domestic prices through their impact on aggregate demand.

Tables 7-9 report evidence on the impact of the external sector on domestic inflation.[35] For simplicity, and to avoid "overfitting", we did not allow ourselves the use of dummy variables, nor did we experiment much with lag lengths. The basic approach was to enter four lagged values of each of the right hand side variables, but not to restrict the shape of the lag distribution. The coefficients on the wage change variable were still increasing up to the fourth lag, so we extended that lag length to six quarters. Contemporaneous values of the right hand side variables are generally excluded; ordinary least squares regressions suggested that the omission was serious only in regressions 3 (and 6), where a contemporaneous value of the rate of change of the import price deflator is accordingly entered.[36]

The exchange rate variables in each case affect the inflation rate in the expected direction, and for the most part significantly. Further, the mean lag by which the exchange rate affects the inflation rate is always shorter than that by which wage changes affect inflation.[37] Equation (1) gives the most direct relationship between the rate of change of the exchange rate and the inflation rate of the GNP deflator. According to (1), a 10% change in the exchange rate directly changes the GNP deflator by only 0.6%. Even the largest effect, in

regression (3), would change the GNP deflator by only 1.3% in response to a 10% change in import prices.[38] The direct effects are not, however, the end of the story, because we shall see in discussing Table 8 that changes in the exchange rate affect wages.

Comparing Tables 7 and 8 we find a generally more powerful effect of the exchange rate variables on consumer prices than on the GNP deflator. The feedthrough to consumer price inflation is particularly rapid in the case of changes of import prices. Even in this case, though, the sum of the lag coefficients is only 0.14: a 10% change in import prices changes the personal consumption deflator by 1.4%, with most of the effect taking place contemporaneously.

Table 9 examines the impact of the exchange rate on the rate of change of wages.[39] The results across the three equations show a consistent effect of exchange rate movements on the rate of change of manufacturing wages: a 10% rate of change of the exchange rate reduces the rate of wage change by between 1% and 1.5%. The mean lags are however longer than in the price equations.

Taking the price and wage equations together, and at a given unemployment rate, an appreciation of the currency affects the domestic price level first through direct price effects and then through indirect effects on wages. The direct effects are relatively quick, and imply that a 10% change in the exchange rate affects the price level within a year by about 1%. There is then a second, more slow-working, effect on prices, working through wages, amounting to somewhat under 1% for each 10% change in the exchange rate. We take the latter effect to represent the impact of foreign competition on domestic wages.

The results of Table 7-9 thus support the argument that exchange rate changes affect the domestic price level, and during the adjustment period, the inflation rate.[40] To the extent that monetary and fiscal policy affect exchange

rates, a flexible exchange rate regime provides an extra channel of influence of policy on prices.

Table 10 summarizes the channels and lags with which a 10% real depreciation translates into an increased consumption deflator. The Table highlights the fact that for given unemployment and expected inflation rates, real depreciation exerts a significant impact on prices and does so quite rapidly The exchange rate must play a part in explaining U.S. inflation, and in assessing the impact of policy changes on the price level.

Figure 4 shows the actual inflation rate and also an estimate of the inflation rate purged of exchange rate effects. The latter series is constructed using the estimated coefficients of the real depreciation variable in equations 5 and 8 in Table 8 and 9 respectively. The adjusted series is an estimate of what inflation would have been had there been no effect of real depreciation on prices, either directly or indirectly via wages. Figure 4 brings out the role of exchange rate changes in the major episodes of inflation acceleration and deceleration: 1973-74, 1978-80 and 1981-83. In the acceleration periods exchange depreciation increases inflation substantially while in 1981-83 exchange appreciation strongly reinforces the deceleration of inflation. This role of exchange rates in the wage-price sector of the economy is accepted as obvious in small countries. In the U.S. it is already part of macroeconometric models, but is not yet accpeted by mainline macroeconomics.[41].

We now turn to the asset markets to explore further the effects of monetary and fiscal policy on the exchange rate.

3. Asset Markets.

International capital mobility is a fact, but the appropriate specification of asset markets remains an open issue.[42] There are three chief questions.

TABLE 10: EFFECT OF A 10% REAL DEPRECIATION ON WAGES AND THE CONSUMPTION DEFLATOR

	Wages	Direct Effect on Prices	Total Effect on Prices
Magnitude	1.26	1.25	2.09
(% Change) Mean Lag (Quarters)	4.03	2.87	n.a.

Source: Tables 8 and 9, eqs. 5 and 8.

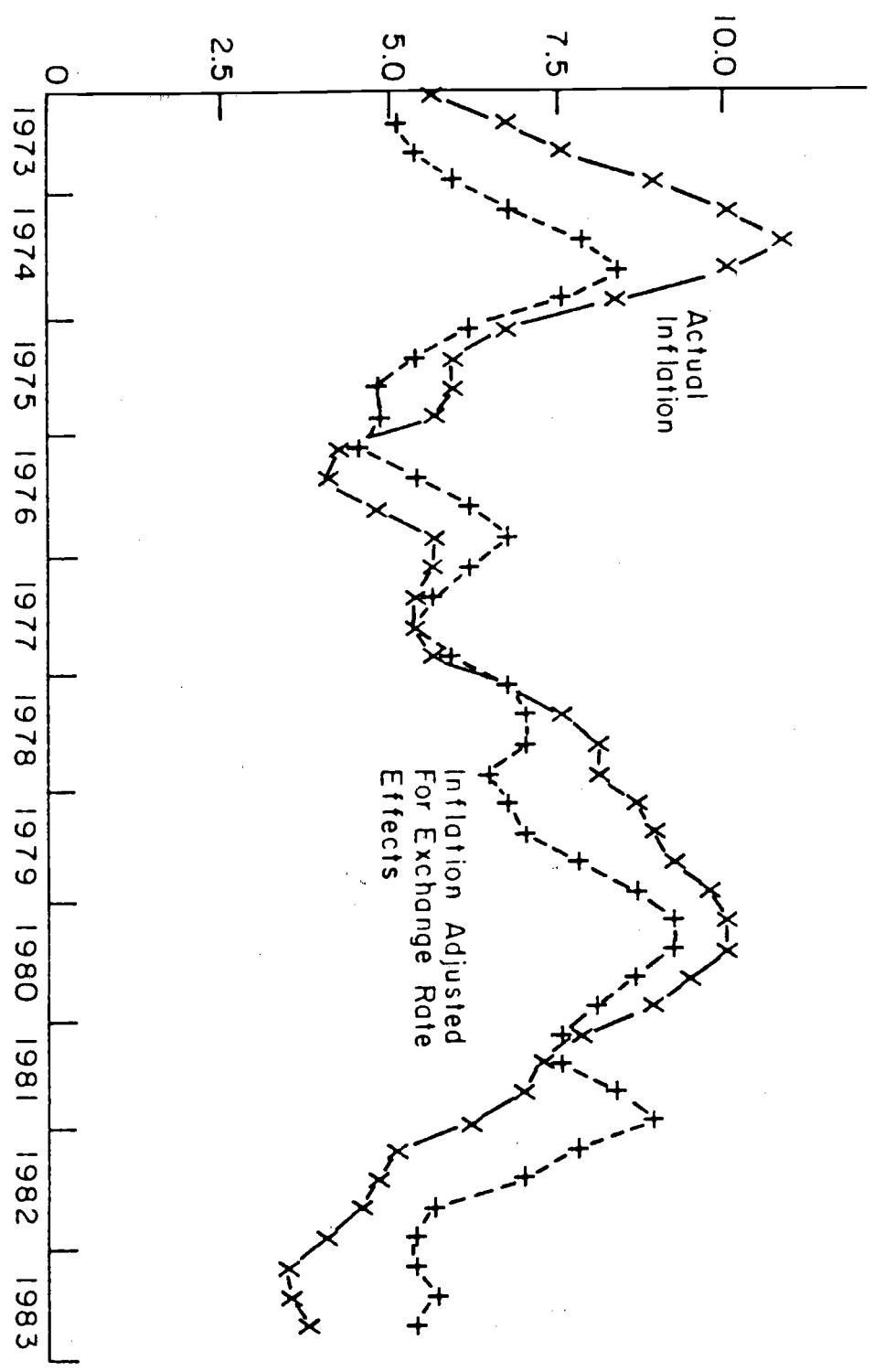

Figure 4: Exchange Rate Effects on Inflation

First, are domestic and foreign bonds perfect or imperfect substitutes? Second, should stock markets be given a prominent role in modelling interntional asset markets, or is the traditional money-bonds model adequate for understanding the linkages? Third, does the international redistribution of wealth through the current account play a significant role in the determination of the exchange rate and macroeconomic equilibrium? The answers to these questions help analyze the implications of sustained fiscal deficits and of longterm current account deficits--for instance, whether sustained deficits build up a "dollar overhang" that will force exchange depreciation.

We have to preface this section by noting that empirical exchange rate models perform poorly. Meese and Rogoff (1983) show that a random walk model typically predicts exchange rates as well as standard structural models, even when the forecasts of the latter are based on realized values of future explanatory variables.[43] The exchange rate is like the stock market in that price movements are dominated by unforecastable changes; accordingly the extraction of the systematic components of price movements is difficult in samples of the length currently available. The absence of decisive empirical evidence forces a greater reliance on theorizing, and on snippets of evidence rather than a complete empirical model, in discussing exchange rate and international economics.[44]

We start with the basic model in which foreign and domestic bonds are perfect substitutes. The domestic nominal interest rate is therefore equal to the foreign nominal rate plus the anticipated rate of depreciation:

$$(4)\quad i = i^* + \dot{e}$$

(A over a variable denotes its proportional rate of change.) Subtracting

national inflation rates from both sides gives the equivalent equation in real interest rate form:

$$(5)\quad r = r^* + (e + p - p^*)$$

Real interest rates can diverge internationally so long as the real exchange rate is changing, but in longrun equilibrium real interest rates are equalized. The assumptions of perfect asset substitutability, in combination with a specification of goods markets in which output determines demand and prices adjust slowly to excess demands and supplies, leads to the following results:[45]

1. An increase in the money stock leads under flexible rates to an immediate depreciation of the exchange rate. The exchange rate initially overshoots its long run equilibrium because prices are sticky, real balances increase, and output expands while the real and nominal interest rate fall. In the adjustment process following the initial overshooting, inflation is accompanied by currency appreciation as the real exchange rate returns to its long run equilibrium value.[46]

Monetary and fiscal policy thus work in good part through the real exchange rate as well as the real interest rate channel. This was of course the fundamental insight of the Mundell-Fleming model. In 1964 Mundell[47] noted

> It is important to notice too that budgetary policy, like monetary policy, has a different role in a flexible exchange rate system. ....An increased budget deficit without monetary expansion would raise interest rates, attract capital, appreciate the exchange rate, and worsen the trade balance with little benefit to employment. With sufficient monetary expansion a budget deficit would be unnecessary.

4. Monetary Policy.

The results of any policy change are quite sensitive to policies followed in the rest of the world. Specifically it matters whether the authorities in

the rest of the world stabilize interest rates, output, or monetary aggregates. For instance, if they attempt to stabilize interest rates in the context of a foreign budget deficit, they create a monetary expansion in attempting to fight rising domestic rates.[48]

The combination of rapidly clearing assets markets and prices that adjust sluggishly implies a relation between real interest differentials and real exchange rates. In the course of adjustment to a monetary disturbance, the real exchange rate will adjust gradually to its longrun equilibrium value, $\bar{R}$. Let $R = \log(eP^*/P)$ denote the logarithm of the real exchange rate. Then the model implies that:[49]

$$(6) \quad R_t = (1-a)R_{t-1} + a\bar{R}$$

Combining the equation with the relation between real interest rates in (5), $r = r^* + R$, we obtain:

$$(7) \quad R_t = \bar{R} - b(r-r^*), \qquad b=(1-a)/a$$

Equation (7) states that if our interest rates exceed those abroad, then the real exchange rate will be below its long run euqilibrium value. In other words, a positive real interest differential implies real appreciation. The extent of such appreciation depends on the speed of adjustment in the economy. The term b is the mean lag, which under rational expectations is a compound of the structural coefficients in the model. If the mean lag is three years, then a 3 percentage point real interest differential implies that the exchange rate deviates from its longrun equilibrium by 9%. The asymmetry in adjustment speeds

between goods and assets markets thus establishes a link between tight money and significant, transitory, exchange rate overvaluation.[50]

The implications of flexible exchange rates for disinflation in a sticky price world (the real world) are quite apparent: because tight monetary policy works rapidly and strongly on the exchange rate, disinflation can take place more rapidly. The Phillips curve becomes steeper under flexible exchange rates.[51]

5. Fiscal Policy The analysis of fiscal policy under assumptions of perfect asset substitutability is straightforward: a sustained fiscal expansion raises longrun aggregate demand and therefore must bring about crowding out. The crowding out occurs through two channels. The first is a real appreciation in the expanding country due to the relative increase in demand for that country's goods. The other is an increase in the world real interest rate. In a small country, crowding out will work entirely through the real exchange rate, implying that the current account deteriorates by the full amount of the fiscal expansion.

What are the implications for the exchange rate? Given the nominal money stock and full employment, higher real interest rates imply reduced real money demand and hence a higher price level in each country. For the real exchange rate to appreciate, we, therefore, require a nominal appreciation of the expanding country.

This analysis of the effects of a fiscal expansion is incomplete in that it does not take into account complications arising from the debt-financing of the deficit in the short term and the ultimate need to raise taxes to service the larger debt. Nor have we taken into consideration the implications of sustained current account imbalances that redistribute wealth away from the expanding

country. What are the implications of these additional channels?

As noted above, the redistribution of wealth via current account imbalances will affect the goods markets because marginal spending patterns differ. Therefore, demand for the expanding country's goods would decline over time, due to redistribution; the need for real appreciation is therefore dampened. But, this effect is offset, to some extent, by the stimulus due to deficit finance.[52]

The portfolio effects associated with debt finance remain an unsettled area of research. Once we depart from the assumption of perfect asset substitutability, we must reckon with the asset market implications of debt finance. These effects occur through two channels. First, there is a direct effect of debt finance on the relative supplies of assets. Debt finance implies that the relative supply of the expanding country's debt rises. Asset holders have to be compensated to hold an increasing fraction of their wealth in the form of the expanding country's debt either through an increased nominal interest differential or through anticipated appreciation. But, it is also possible that a once and for all depreciation of the expanding country reduces the value of her debts in terms of foreign exchange, thus reducing the portfolio share and eliminating the need for higher interest rates or appreciation.[53]

The discussion is clarified in equation (8) where we present the interational interest rate relation taking into account the risk premium that results from imperfect asset substitution.[54] The equation states that the nominal interest differential equals the expected rate of depreciation plus a risk premium, K, which depends on the relative supply of domestic debt relative to world wealth and on the domestic share in world wealth.

$$(8) \quad i = i^* + e + K(B/e\bar{V}^*, V/e\bar{V}^*), \; K_1 > 0, K_2 < 0$$

where $\overline{V}^*$ is world wealth measured in terms of foreign exchange. Equation (8) shows that the exchange rate or the rate of depreciation must adjust to maintain portfolio balance in the face of a rise in the domestic bond supply, given interest rates. The possibility of exchange depreciation to clear asset markets runs counter to the analysis for the goods markets, where crowding out leads to expect an appreciation. What then will happen? As the discussion here already makes clear, this is not an area where we expect unambiguous results.

Research on the implications of debt finance has used simulation to attempt to assess the relative importance of portfolio effects--relative asset supplies and risk premia--and aggregate demand effects.[55] The quantitative finding that emerges is that in the longrun a fiscal expansion will lead to depreciation, rather than appreciation, if the portfolio effects are relatively important. Specifically, if debt issue forces a large increase in our interest rates to maintain portfolio balance, and if demand reacts to the interest rate increase by more than full crowding out, then a real depreciation is required to restore goods market equilibrium. If, by contrast, assets are very highly substitutable, then risk premia do not play a significant role, and as a result, the longrun crowding out must take place via real appreciation.

In concluding the discussion of the portfolio effects of fiscal policy, we note that these effects are entirely due to the assumption that budget deficits are financed by issuing bonds denominated in terms of the expanding country's currency. The risk premium effects can be avoided by financing deficits in a way that keeps the currency composition of world outside assets unchanged. For instance, in the present circumstances, the U.S. would finance part of the deficit in Yen and DM bonds. We also note that our analysis has not taken into account effects of fiscal policy on the stock market. These effects have not

been addressed in the literature, but, may well turn out to be more important than the questions associated with the currency denomination of bonds.

6. Interdependence.

Our discussion so far has taken as given the key foreign variables--interest rates, income, prices--that influence domestic macroeconomic equilibrium via trade in goods and assets. But of cours these variables are determined jointly with those at home and, to complicate matters, policy interdependence comest to play a role. Foreign monetary and fiscal policies respond to disturbances at home as foreign policy makers attempt to influence the movements of exchange rates, interest rates, prices and output in a manner that optimizes their macroeconomic policy objectives. This interdependence influences, of course, our conclusions about the effects of monetary and fiscal policies. Tight money, for example, may not lead to appreciation if foreign governments are inflation-sensitive and therefore contract their own money stocks in tandem with our contraction to avoid currency depreciation. In other instances "synchronized expansion" agreed upon by the governments of the major countries provides the "locomotive" for world recovery.

In view of this interdependence it is interesting to ask how closely monetary growth and discretionary fiscal policy are correlated between countries. Table 11 provides information on this question for the growth rates of M1 and for the discretionary fiscal policy changes.

It is interesting to note that there is no definite change in the money growth correlations between the fixed and flexible exchange rate periods. The qualification to that statement is the interesting shift to a negative correlation for Japan under flexible rates. For fiscal policy, taking the whole period for which data are available, the correlation is relatively low. Moreover

TABLE 11: CORRELATION OF MONEY GROWTH AND FISCAL POLICY OF MAJOR COUNTRIES WITH THE U.S.

	Germany	Japan	U.K.
Annual M1 Growth:			
1959-72	0.16	0.07	0.50
1974-82	0.27	-0.27	0.20
Fiscal Policy Change:			
1971-82	0.11	0.29	-0.14

Source: IMF and OECD Occasional Studies, June 1978, p.19 and Economic Outlook December 1983, p.34.

Note: For definition of discretionary fiscal policy change see the sources.

the correlation between fiscal policy changes in the U.S. and a simple average of other countries in Table 11 is only .08.

Econometric modelling of the world macroeconomy remains at an experimental stage, but such models do exist at the Federal Reserve Board, the OECD, and the Japanese Economic Planning Agency. Comparisons of the policy multipliers from these models is rendered difficult by differing assumptions about monetary and fiscal accommodation to shocks and by differences in the simulation periods. But even so it is worthwhile to see a comparison of some results. Table 12 shows the multipliers of the Federal Reserve's MCM model and the EPA's World Economic Model for a U.S. fiscal expansion under flexible exchange rates.

In looking at the effects of U.S. policies on the foreign countries we note that there are spill-over effects under flexible exchange rates both on output and on prices. But Table 12 also reveals that these impacts are not very sizeable as long as the disturbance remains small.

III. Summary.

The standard macroeconomic paradigm remains the IS-LM model augmented with a Phillips curve. In this paper we have shown how the model must, for the case of the U.S. economy, be amended, to take account of international effects and interactions. What conclusions emerge?

The only key structural equation that goes unamended is the money demand equation. Even here foreign variables are often proposed although not persuasively.[57] In the goods and assets markets foreign prices, foreign activity and foreign asset yields appear as important determinants of domestic activity, prices and interest rates. The quantitative magnitude and the stability of these relations remains a topic of research, but their existence and importance to an understanding of the U.S. macroeconomy is beyond question.

TABLE 12 FISCAL MULTIPLIERS FROM TWO WORLD MACRO MODELS

(Percent Increase in Real GDP in the first two years)

	U.S.		Japan		Germany	
Effect on Real GDP:						
FRB MCM	1.5	0.9	0.2	0.2	0.2	0.5
EPA WEM	2.02	2.01	0.17	0.56	0.17	0.59
Effect on Prices						
FRB MCM	-0.0	0.3	0.0	0.1	0.0	0.2
EPA WEM	0.57	1.38	0.11	0.36	0.04	0.20

Note: The table shows the percentage increase in real GDP and in consumer prices due to a sustained increase in U.S. real government spending equal to 1% of GDP for the first two years.

Source: See footnote 57.

International interactions exert an important effect on the manner in whcih monetary and fiscal policies operate. The exchange rate system determines the extent to which asynchronized policies are possible and the channels through which they exert their effects on the economy. The Mundell-Fleming model of twenty years ago introduced these ideas and they remain valid today. For the U.S economy policy limitations becase apparent in the late 1960s when capital outflows on a large scale signalled that even a large country could not set the tone for the world economy. But under flexible exchange rates these interdependence effects have become much more dramatic. They immediately affect the key trade-off--the Phillips curve. Theory suggests and empirical evidence supports the notion that under flexible rates the Phillips curve is much steeper. A tight money policy leads to appreciation and thus allows rapid disinflation. The traditional idea, appropriate to fixed rates, is that crowding out takes place chiefly via higher interest rates depressing interest sensitive components of spending, particularly housing. Under flexible rates the crowding out takes place also at another margin, reduced net exports due to appreciation.

Thinking on fiscal policy, too, must be modified. Fiscal expansion via its impact on interest rates induces currency appreciation, at least in the short run. Therefore fiscal expansion is less inflationary than the closed economy Phillips curve would suggest, but it also involves more crowding out. This is because net exports decline under the impact of appreciation.

Several unsettled areas of research require attention. One is to determine the importance of relative aset supplies for risk premia and hence for longrun interest differentials and/or equilibrium real exchange rates. The literature, as yet, gives no quidance to these issues. To make the point concretely, we do not have in domestic macroeconomics any empirical evidence that suggests that the maturity of the debt affects the term structure of interest rates. Long term and

short term debt, for macroeconomics, is much the same. Is this also true when we ask whether it makes a difference whether our U.S. deficits are financed in DM or $US bonds? If the answer is affirmative an entire popular range of ideas about budget and exchange rates becomes irrelevant.

The second issue on which we know very little, indeed even less, is the open economy role of the stock market. If asset markets are important via their impact on exchange rates and hence on aggregate demand and prices, then surely the stock market must take a particularly important place. The stock market would play an important role because it is forward looking and because of its size relative to other asset markets.

The third issue, closely linked to the previous point, concerns the open economy linkages to investment. What is the impact of real exchange rates on investment spending and how important are long swings in real exchange rates in affecting investment and hence productivity growth and employment. This question connects, of course, with the crowding out issue raised above. The current view expressed in policy discussions is that there is less crowding out under flexible than under fixed exchange rates. But perhaps, taking into account the open economy channels, we get as much crowding out of investment, but with real appreciation rather than increased real interest rates as the channels and with manufacturing rather than housing as the affected sector. Such effects, if they do exist, would have significant longer run implications for the performance of the economy.

Appendix

In this appendix we set out and briefly analyze a simple model that includes the three chief links between the domestic and international economies: the demand for goods, corresponding to Keynesian multiplier analysis; asset market linkages, emphasis on which at one time led to the claim that exchange rates are determined in the assets markets; and the supply side, which has received emphasis in the recent disinflation. The model guides our discussions in the text of the effects of exchange rate changes and foreign shocks.

I. The Model

A. The Assets Markets: There are four assets: domestic money, domestic bonds, foreign bonds, and capital. Domestic money is held entirely by domestic residents. Domestic bonds and capital may be held by foreigners as well; foreign bonds may be held by domestic residents.

Equilibrium conditions in the markets for domestic assets are:

$$(A1)\quad \frac{M_t}{P_t} = L(Y_t,\ R_t^B) \qquad L_1 > 0,\ L_2 < 0$$

$$(A2)\quad \frac{B_t}{P_t} = H(Y_t,\ \gamma_t^B,\ \Pi_t,\ \gamma_t^K,\ \gamma_t^F,\ V_t,\ V_t^*) \qquad H_1 < 0,\ H_2 > 0,\ H_3 > 0$$

$$H_4 < 0,\ H_5 < 0,\ H_6 > 0,\ H_7 > 0$$

$$(A3)\quad q_t K_t = J(Y_t,\ \gamma_t^B,\ \Pi_t,\ \gamma_t^K,\ V_t,\ V_t^*) \qquad J_1 < 0,\ J_2 < 0,\ J_3 > 0,$$

$$J_4 > 0,\ J_5 < 0,\ J_6 > 0,\ J_7 > 0$$

Symbols are defined in Table A1. The expected real returns on domestic bonds, capital (equity) and foreign bonds are given by:

$$(A4) \quad (1+\gamma^B_t) = (1+R^B_t)_t\left(\frac{P_t}{P_{t+1}}\right)$$

$$(A5) \quad (1+\gamma^K_t) = \frac{F_K(K_t, Y_t) + {}_tq_{t+1}}{q_t}$$

$$(A6) \quad (1+\gamma^F_t) = (1+R^F_t)_t\left(\frac{e_t P_t}{e_{t+1} P_{t+1}}\right)$$

The pre-subscript t, indicates the expectation formed on the basis of information available at time t. In writing (A2) and (A3) as functions not only of expected real returns, but also of Π_t, the expected inflation rate, we use the first order approximation:

$$(A4)' \quad (1+R^B_t) = (1+\gamma^B_t)\frac{1}{{}_t\left(\frac{P_t}{P_{t+1}}\right)}$$

$$\simeq (1+\gamma^B_t)\frac{{}_tP_{t+1}}{P_t}$$

$$= (1+\gamma^B_t)(1+\Pi_t)$$

A similar approximation applies for the return on foreign bonds.

Real domestic wealth, V_t, consists of holdings of the four assets by

Table A1 = Symbols

M_t	Money stock
P_t	Price level
Y_t	Real output
R_t^B	Nominal return on domestic bonds
B_t	Stock of domestic bonds
γ_t^B	Expected real return on domestic bonds
Π_t	Expected inflation rate
γ_t^K	Expected real return on domestic equity
V_t	Wealth of domestic residents
V_t^*	Foreign wealth
q_t	Relative price of an equity claim on capital
e_t	Exchange rate
B_t^{d*}	Holdings of foreign bonds by domestic residents
B_t^d, K_t^d	Holdings of corresponding assets by domestic residents
P_t^*	Foreign price level
Y_t^d	Disposable income
G_t	Government expenditure
Y_t^*	Foreign output
P_t^m	Domestic price of material inputs
W_t	Nominal wage
δ	Rate of depreciation of capital
T_t	Real taxes minus transfers, exclusive of interest payments on government debt.

domestic residents:

$$(A7)\quad V_t = \frac{M_t}{P_t} + \frac{B_t^d}{P_t} + q_t K_t^d + \frac{e_t B_t^{d*}}{P_t}$$

Because foreign residents may hold both domestic bonds and domestic equity, the amounts of these assets held by domestic residents are not usually equal to the outstanding stocks.

The assumption in (A1) is that money is held for transactions purposes, at an opportunity cost equal to the return on bonds.[1]

The assets are assumed to be gross substitutes. Demand functions by domestic residents have the same general forms as LC( ), H( ), and J( ), but are not dependent on foreign wealth, V_t^*. In addition, the demand by domestic residents for foreign bonds is:

$$(A8)\quad \frac{e_t B_t^{d*}}{P_t} = G(Y_t,\ \gamma_t^B,\ \Pi_t,\ \gamma_t^K,\ \gamma_t^F,\ V_t) \qquad G_1 < 0,\ G_2 < 0,\ G_3 > 0,$$
$$G_4 < 0,\ G_5 > 0,\ G_6 > 0$$

B. <u>The Goods Market</u>: We start by specifying the demand for domestic output.

$$(A9)\quad Y_t = D(\frac{e_t P_t^*}{P_t},\ Y_t^d,\ G_t,\ V_t,\ q_t) + NX(\frac{e_t P_t^*}{P_t},\ Y_t^d,\ Y_t^*,\ V_t(q, q^*, P_m/P))$$

$$D_i > 0,\ i = 1,?\qquad NX_1 > 0,\ NX_2 < 0,\ NX_3 > 0,\ NX_4 < 0$$

Prices are based on costs and the level of output relative to capacity:

$$(A10)\quad P_t = C(W_t,\ P_t^m,\ e_t P_t^*,\ Y_t/K_t) \qquad C_1 > 0,\ C_2 > 0,\ C_3 > 0,\ C_4 > 0$$

The function (A10) permits an interpretation as a supply function with output on increasing function of the price level and a decreasing function of the wage, materials prices, and the prices of imported inputs.[2]

C. Wages: Wages are predetermined, based on the level of output (and thus employment) and expected price level:

$$(A11)\quad W_t = \phi((Y/K)_{t-1},\ {}_{t-1}(Y/K)_t,\ \frac{{}_{t-1}P_t}{P_t},\ W_{t-1}); \qquad \phi_1 > 0,\ \phi_2 > 0,\ \phi_3 > 0,\ \phi_4 > 0$$

D. Accumulation Equations: The wage equation provides the first explicit dynamic equation. Asset accumulation equations add further essential dynamics.

$$(A12)\quad K_t = (1-\delta)K_{t-1} + I(q_{t-1}, K_{t-1})$$

$$(A13)\quad (M_{t+1}+B_{t+1}-M_t-B_t) = P_t(G_t-T_t) + (1+R^B_{t-1})B_t$$

$$(A14)\quad (1+R^f_{t-1})e_t B^{*f}_t - (1+R^b_{t-1})(B_t-B^d_t) - (1+F_K(\ ))q_t(K_t-K^d_t) + P_t NX_t$$

$$= e_t B^{*f}_{t+1} - (B_{t+1} - B^d_{t+1}) - q_t(K_{t+1} - K^d_{t+1})$$

(A12) is the capital accumulation equation, (A13) the government budget constraint, where it is implicitly assumed that all debt is one-period, and (A14) is the balance of payments constraint.

The openess of the economy is reflected in the asset market equilibrium conditions, the goods market, and in the asset accumulation equations. In the assets markets, movements in foreign interest rates, or in foreign wealth, affect U.S. rates of return and asset prices: Foreign influences appear on both the demand and supply sides in the goods market; on the supply side, external disturbances may affect both the prices of material inputs and, directly, the costs of imported inputs. Equation (A14) describes the link between the current account and net ownership of foreign assets.

We now analyze the short and long-run equilibria of the model, emphasizing open-economy aspects, before turning to the dynamics of adjustment.

II. Short Run Equilibrium

To start we examine short-run asset market equilibrium. We wish to obtain functions:

$$\text{(A15)} \quad \begin{aligned} R^B_t &= R(X_t) \\ q_t &= q(X_t) \\ e_t/P_t &= e(X_t) \end{aligned}$$

where $X_t = [M_t, B_t, K_t, P_t, Y_t, \frac{{}_tP_{t+1}}{P_t}, \frac{{}_te_{t+1}}{e_t}, \frac{{}_tq_{t+1}}{q_t}, Y^f_t, B^d_t, K^d_t, B^{*d}_t]$

Several of the variables in X_t will themselves be determined in the full

equilibrium of the model. The asset holdings, B_t^d, K_t^d, B_t^{*d} are to be understood as beginning of period stocks.

The properties of the functions in (A15) are implied by the equilibrium conditions (A1) - (A3). (A1) directly implies

$$(A16) \quad R_t^B = R\left(\frac{M_t}{P_t}, Y_t\right) \qquad R_1 < 0, \; R_2 > 0$$

We are thus making the strong assumption that money market conditions alone determine the short term interest rate. Inclusion of wealth in the demand function for money would modify this latter conclusion without affecting the signs of the derivatives indicated in (A16).

The properties of the q( ) and e( ) functions are obtained using (A2) and (A3). Suppose there is an increase in the expected real return on foreign bonds, γ_t^f, with other variables in X_t held fixed. (Thus both the nominal and real returns on foreign bonds increase.) Figure A1 shows asset market equilibrium loci, JJ representing capital market equilibrium and HH bond market equilibrium. The JJ curve is positively sloped because an increase in q creates an excess supply fo capital that is offset by the wealth effect arising from an increase in the real exchange rate (depreciation). The HH curve slopes down because an increase in q creates excess demand for bonds through both rate of return and wealth effects, which is offset by the wealth effect of an appreciation.

An increase in the foreign interest rate creates an excess supply of both bonds and capital in the U.S. The curves shift as shown in Figure A1 to maintain asset market equilibrium. The real exchange rate unambiguously rises--the currency depreciates. The effects on q depend on the relative substitutability

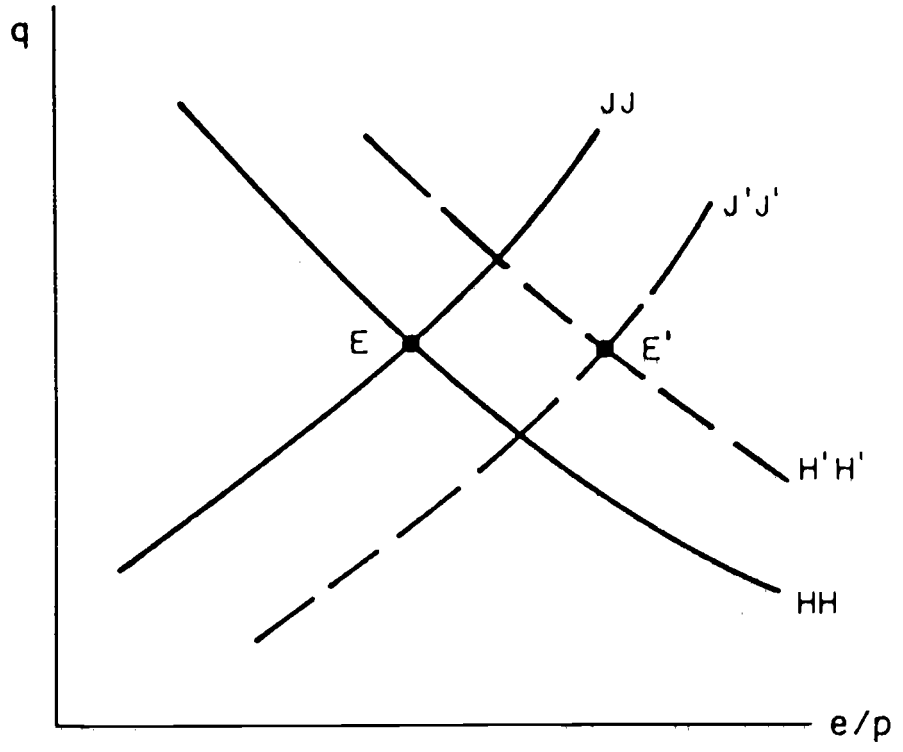

Figure A1 Effects of an Increase in the Fireign Interest Rate

of domestic bonds and capital for foreign bonds. If the substitution is mainly between domestic and foreign bonds, then q will rise. This occurs because with the domestic interest rate given, the increase in e/P that equilibrates the bond market is large and creates excess demand in the capital market. If substitution between foreign bonds and domestic real assets is high, a rise in interest rates abroad will reduce U.S. stock values. An increase in the expected rate of depreciation of the dollar (i.e. a rise in ${}_te_{t+1}/e_t$) will have the same effects on the exchange rate and q as a change in the foreign interest rate.

An open market purchase, in Figure A2, reduces the domestic interest rate, creating an excess demand for capital and--it can be shown--an excess supply of bonds. Equity prices rise while the effects on the exchange rate are ambiguous. The more substitutable are bonds and capital the more likely is it that the open market purchase causes the currency to depreciate.

The properties of the functions q( ) and e( ) in (A15), which can be derived using similar analysis, are:

$$(A17)\quad \frac{\partial q}{\partial M} > 0; \frac{\partial q}{\partial B} > 0; \frac{\partial q}{\partial K} < 0; \frac{\partial q}{\partial P} < 0; \frac{\partial q}{\partial Y} ?; \frac{\partial q}{\partial \frac{{}_tP_{t+1}}{P_t}}, \frac{\partial q}{\partial \frac{{}_te_{t+1}}{e_t}} \gtrless 0; \frac{\partial q}{\partial \frac{{}_tq_{t+1}}{q_t}} > 0 \quad \frac{\partial q}{\partial \gamma_t^f} \gtrless 0$$

$$\frac{\partial e}{\partial M} > 0, \frac{\partial e}{\partial B} > 0, \frac{\partial e}{\partial K} > 0, \frac{\partial e}{\partial P} < 0, \frac{\partial e}{\partial Y} ?, \frac{\partial e}{\partial \frac{{}_tP_{t+1}}{P_t}}, \frac{\partial e}{\partial \frac{{}_te_{t+1}}{e_t}} > 0; \frac{\partial e}{\partial \frac{{}_tq_{t+1}}{q_t}} > 0 \quad \frac{\partial e}{\partial \gamma_t^f} > 0$$

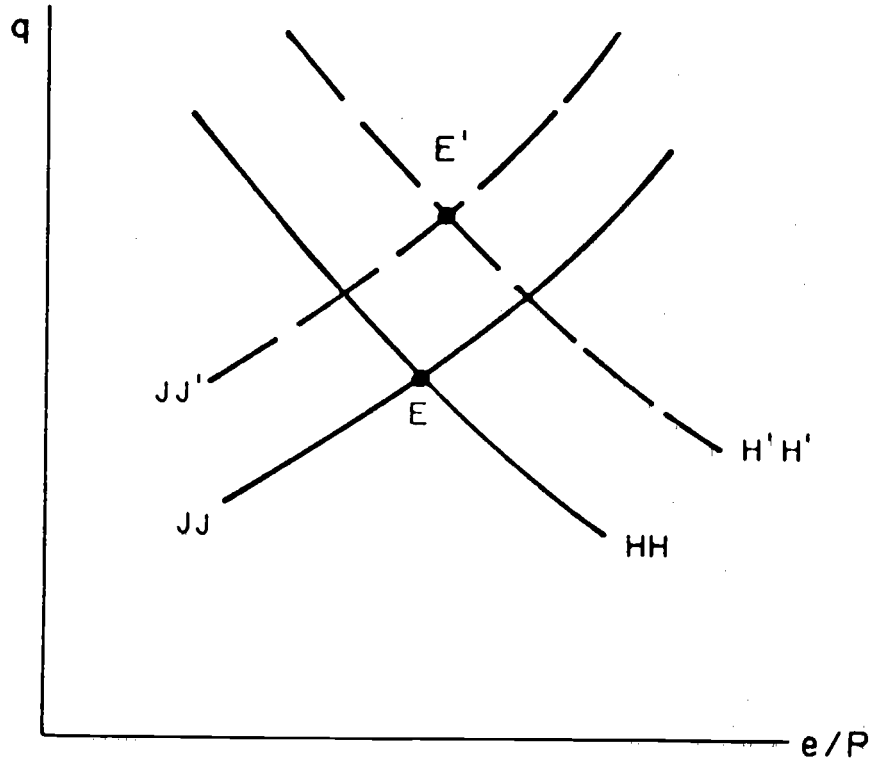

Figure A2 Effects of an Open Market Purchase

Appendix: Data and Definitions

1. The Wage equations in Table 5 use the following data:

W: hourly earnings of produciton workers, total private non-farm

Wman: hourly earnings of produciton workers in manufacturing

Wser: hourly earnings of production workers, services

Wage inflation is measured by the quarter to quarter change at an annual rate in each equation. The unmeployment variables in the three equations are respectively the unemployment rate of wage and salary workers in manufacturing, the unemployment rate of wage and salary workers in finance and services, and the economy-wide unemployment rate of married men.

Expinf: Expected inflation is measured by a geometrically distributed lag on the four quarter inflation rate of the consumption expenditure deflator with a .15 decay factor so that expinf = .15log(P(-1)/P(-5)) + .85*expinf(-1).

Delex denotes the 12 quarter change in the real exchagne rate. The real exchange rate variable is the relative value added deflator in manufacturing reported in the IMF International Financial Statistics. With R the real exchange rate Delex = 100*log(R/R(-12)).

2. The inflation equation in Table 4 shows as independent variable the quarter to quarter change, at an annual rate, of the fixed weight GNP deflator. The unemployment rate is that of married men. Real exchange depreciation is defined as above. The wage inflation variable is the four quarter change in hourly compensation in the private non-farm economy, Winf = 100*log(Wage/Wage(-4)). The dummy variable in the regression assumes a value of 0 for 1965-1972 and 1 for 1973:1 to 1983:2.

3. The inflation equation for manufacturing uses as wage inflation the quarter to quarter change, at annual rates, of hourly compensation in manufacturing. The unemployment rate is that of wage and salary workers in manufacturing. The real depreciation variable is defined as above.

Notes

1. Oskar Morgenstern, International Financial Transactions and Business Cycles, Princeton University Press, 1959, p. 45.

2. Calculations are based on growth cycle chronologies reported in Philip A. Klein and Geoffrey H. Moore, "The Leading Indicator Approach to Economic Forecasting --Retrospect and Prospect", Journal of Forecasting, 2,2 (1983), 119-135, p. 125.

3. However inclusion of the years 1981-1983 might tilt the balance to the conclusion that business cycles have been more co-ordinated in the flexible rate than in the fixed rate period.

4. Column 5 gives the ratio of tariff revenues to imports of goods, dutiable and non-dutiable. Such measures are imperfect indicators of the level of tariffs, as exemplified by the fact that a prohibitive tariff would have no weight in an index of this type.

5. See Ilse Mintz, Trade Balances During Business Cycles: U.S. and Britain since 1880 Occasional Paper 67, National Bureau of Economic Research, 1959; and Ilse Mintz, Cyclical Fluctuations in the Exports of the United States since 1879, Columbia University Press for National Bureau of Economic Research, 1967. Chart 5, p.15 in Mintz (1959) presents the cyclical pattern of imports.

6. We work with changes to remove possible trends in the shares of the different categories of spending in GNP.

7. The index is of manufacturing prices because the assumption is that agricultural goods prices, subsidies and tariffs aside, are equal across countries. See International Finance Statistics for other indexes and a discussion of the series. Exchange rates and measures of competitiveness frequently leave the reader not knowing which way is up. In this paper we adopt the convention that a depreciation of the dollar appears as an increase in the

exchange rate and increase in competitiveness.

8. Milton Friedman and Anna J. Schwartz, A Monetary History of the United States, 1867-1960, Princeton University Press, 1963. Schwartz discusses the Smott-Hawley tariff at greater length in "Understanding 1929-1933," in Karl Brunner (ed.), The Great Depression Revisited, Martinus Nijhoff Publishing, 1981. While she regrets the tariff, she does not give it any greater role in the proprogation of the Depression than do Friedman-Schwartz.

9. The World in Depression, 1929-1939, University of California Press, 1973, p.134. See, too, League of Nations Commercial Policy in the Interwar Period: International Proposals and National Policies, Geneva 1942. In the World Economic Survey, Geneva 1932, p.281, the impact of the Hawley-Smoot tariff is described in terms of its effects on protection: "From the middle of 1929, the steady deepening of depression, particularly in the raw material producing countries, greatly reinforced the pressure for higher tariffs...The whole movement was undoubtedly accentuated both by the alarm and resentment felt in many countries as the discussions of the new Hawley-Smoot tariff dragged on in the United States Congress from May 1929 to June 1930, and by the real effects of that tariff when it went into operation." There is no suggestion that the tariff is the or even a chief cause of the depression.

10. Allan H. Meltzer, "Monetary and Other Explanations of the Start of the Great Depression," Journal of Monetary Economics, 2, 4 (Nov. 1976), pp.455-471, expecially pp.459-461. Meltzer refers also to Gottfried Haberler, The World Economy, Money, and the Great Depression 1919-1939, American Enterprise Institute, 1976.

11. Tariffs rose in 1921 as a result of "emergency" measures to aid agriculture and, because tariffs were partly specific, as a result of the fall in prices.

12. F.W. Taussig, The Tariff History of the United States, Capricorn Books

Edition, 1964, pp.518-519 presents the results of a Tariff Commission calculation of what tariff revenues would have been in 1922 and 1930 for imports at the level of 1928. This index thus holds the composition of imports and their prices constant: tariffs increase for all categories, but the increases are small. The largest increase is from 19.9% to 33.6% for agricultural products and provisions. Other examples are chemicals, oils, and paints, from 29.22% to 31.4%, metals and manufactures from 33.7% to 35.0%, manufactures of cotton from 40.3% to 46.4%.

13. Data in Friedman and Schwartz, op.cit., p.770.

14. It should be unnecessary to add that we are not advocating raising tariffs as a way either into or out of recessions. Exchange rate changes that can be made to stick achieve most of the same purposes.

15. For a careful review and analysis of the alternative versions of PPP, see Louka T. Katseli-Papaefstratiou, The Reemergence of the Purchasing Power Parity Doctrine in the 1970's, Princeton Special Papers in International Economics, no. 13, Dec. 1979.

16. For discussion of the failure of PPP, see Irving Kravis and Robert Lipsey, Toward a Theory of National Price Levels, Princeton Studies in International Finance, November 1983, and Jacob Frenkel, "The Collapse of Purchasing Power Parity During the 1970's", European Economic Review, February 1981. This is one of the key points at which the monetary theories of the exchange rate of the early 1970's, which linked the domestic price level to the domestic money stock and then set the exchange rate as the ratio of price levels, broke down.

17. Op. cit. p. 105. The data and sources are described on pp 119-123. The meaning of these correlations is obscured by the fact that there are consistent and non-coincident seasonals in the rates in different countries.

18. Calculations use International Financial Statistics data.

19. The gold points are given as $4.845 - $4.890, a range of 0.92%. Incidentally, one of Morgenstern's findings is that the gold points were on many occasions violated by actual exchange rates.

20. In this connection it would be useful to calculate differentials between similar assets in the same national market, as a benchmark for the international comparisons.

21. Charles P. Kindleberger, Manias, Panics, and Crashes, Basic Books, 1978, Chapter 7, and Morgenstern, op. cit, pp 541-555. Milton Friedman and Anna J. Schwartz, A Monetary History of the United States, 1867 - 1960, Princeton University Press, 1963 typically regard American banking panics as of domestic origin. An exception is the 1890 crisis in which the Baring failure receives mention (p 104).

22. For the period 1869-1960, see Friedman and Schwartz, op cit, pp 769-771.

23. R.S. Sayers in Central Banking After Bagehot, Oxford University Press, 1958, Chapter 2, describes the use of Bank Rate in maintaining the international financial system, and includes references to earlier literature, including Clapham, Hawtrey and Viner. See also Arthur I. Bloomfield, Monetary Policy under the International Gold Standard: 1880-1914, Federal Reserve Bank of New York, 1959, particularly pp 41-46. J.M. Keynes, A Treatise on Money, Vol. II, Macmillan, 1930, Chapters 35-38 describes the operation of the international gold standard and the role of central banks. R. Nurkse in International Currency Experience, 1944 (reprinted by Arno Press, New York, 1978) pp98-105 also describes the adjustment mechanism.

24. Bloomfield, op,cit., p.69, for the inter-War period. It was suggested during discussion that behavior or central banks was different in the heyday of the gold standard. Bloomfield, loc.cit., pp.48-51, compares central bank behavior pre 1914 with post World War I behavior studied by Nurkse. His

conclusion on the propensity to sterilize is noteworthy (p.50). "By an amazing coincidence, these overall percentages [frequency of offsetting] are virtually identical to those reached in the League study for the interwar period...One might even conclude, on the basis of this formula, that central banks in general played the rules of the game just as badly before 1914 as they did thereafter!"

25. Milton Friedman and Anna J. Schwartz, op.cit. Friedman and Schwartz calculate the PPP data presented in Figure 3 in examining the role of capital flows in moving relative goods price levels.

26. Bijan B. Aghevli, "The Balance of Payments and Money Supply Under the Gold Standard Regime: U.S. 1879-1914," American Economic Review, 65, 1, (March 1975), 40-58, estimates an econometric model that includes both capital flows and the influence of the current account on the money stock. He concludes that while capital flows moved in a procyclical direction, thus offsetting the effects on money supply of the anti-cyclical current account, the current account effects dominate.

27. For recent discussions of open economy macroeconomics, see William Branson, "Trends in United States International Trade and Investment," in Martin Feldstein (ed), The American Economy in Transition, University of Chicago Press, 1980; William Branson and Willem Buiter, "Monetary and Fiscal Policy with Flexible Exchange Rates," in Jagdeep S. Bhandari and Bluford H. Putnam (eds) Economic Interdependence and Flexible Exchange Rates, MIT Press, 1983; Rudiger Dornbusch, "Equili brium and Disequilibrium Exchange Rates," Zeitschrift fur Wirtschafts- und-Sozialwissenschaften, 102, 6 (1982), pp573-599, and "Flexible Exchange Rates and Interdependence," IMF Staff Papers, 30, 1 (March 1983, 3-30); Jacob A. Frenkel (ed), Exchange Rates and International Macroeconomics, National Bureau of Economic Research, 1983; Dale W. Henderson, "Exchange Rate Intervention," forthcoming in John Bilson and Richard Marston, (eds) Exchange Rate Economics,

National Bureau of Economic Research, 1984; Michael Mussa, "Exchange Rate Determination: Established Principles and Unresolved Issues," also forthcoming in Bilson and Marston, op cit; Maurice Obstfeld and Alan Stockman, "Exchange-Rate Dynamics," manuscript, Columbia University, September 1983.

28. To derive the aggregate demand schedule we assume away complications in the model presented in the appendix that result from the multiplicity of assets and direct links between exchange rates and asset markets.

29. Multiplier assumptions or estimates in large scale trade models range between one and two. For instance, the OECD International Linkage Model assumes a first year government spending multiplier for the United States of 1.5. See "International Economic Linkages," in OECD Economic Studies, No. 1, (Autumn 1983), pp43-92. The EPA model has an implied first year multiplier closer to one. See Akihiro Amano, Akira Sadahiro, and Takahiro Sasaki, "Structure and Application of the EPA World Econometric Model," Economic Planning Agency, Tokyo, August 1981, p. 50. (Calculation based on the elasticity of U.S. GNP with respect to world imports in the EPA model.) However, Michael Darby and Alan C. Stockman find very weak multiplier effects in their international model. See Chapters 5-7 in Michael Darby et.al., The International Transmission of Inflation, National Bureau of Economic Research, 1983.

30. Here obviously we interpret (2) as a mark-up equation.

31. See, for example, Robert Stern et.al., Price Elasticities in International Trade: An Annotated Bibliography, Butterworth, London, 1976.

32. See S. Laursen and L. Metzler, "Flexible Exchange Rates and the Theory of Employment," Review of Economics and Statistics, Feb. 1950, and Assaf Razin and Lars Svensson, "The Terms of Trade and the Current Account: The Harberger-Laursen-Metzler Effect," Journal of Political Economy, Feb. 1983.

33. Michael Bruno and Jeffrey Sachs, Wages, Profits and Commodity Prices:

Macroeconomics of Stagflation, Harvard University Press, forthcoming.

34. Ideally we would want to quantify each of the five channels isolated in the above discussion. However since in practice they all operate at the same time, it is not easy to separate them. Nor are we aware of attempts to do so. Large scale econometric models typically explicitly embody some but not all of these channels; for instance the EPA model (op.cit.) includes the multiplier, relative price, oil (equivalent to raw materials in our discussion) and some wealth redistribution effects.

35. Inclusion of external variables in the Phillips curve, particularly import prices, has a long tradition in open economies such as the United Kingdom. Without serious loss of generality, we confined our search of the United States literature to the Brookings Papers on Economic Activity, (BPEA). Foreign variables first appeared in a United States Phillips curve in BPEA in William Nordhaus, "The Worldwide Wage Explosion," BPEA, 2, 1972, pp.431-464. Robert J. Gordon reported on a re-estimate of his basic Phillips curve to include import prices in "The Response of Wages and Prices to the First Two Years of Controls," BPEA, 3, 1973, pp 765-778. Interestingly, at that time import prices fed through only slowly into domestic prices. James L. Pierce and Jared J. Enzler used the MPS model to examine the effects of foreign disturbances in "The Effects of External Inflationary Shocks," BPEA, 1, 1974, pp.13-54. More recent empirical work that emphasizes external effects includes Robert J. Gordon, "Inflation, Flexible Exchange Rates, and the Natural Rate of Unemployment," pp.89-153 in Martin N. Baily (ed.), Workers, Jobs, and Inflation, Brookings Institution, 1982.

36. Here are futher details of and comments on our estimation or search procedure. (i) We also experimented with the addition of the rate of change of the food price deflator, omitting that variable because of collinearity with

included variables. (ii) The theoretical specification of the mark-up equation in equation (2) includes the level of output, but we did not find output measures or the unemployment rate entering the regressions of Table 6 significantly. (iii) Given the serial correlation, the endogeneity problem remains even when the right hand side contains only lagged variables. However, the problem is limited because the serial correlation coefficient in most of the equations is low, and because the lag coefficients in the most problematic case--that of wages--typically peak only at the third lag and are small at the first lag. Instrumental variable techniques are used in equations (3), (6) and (7)-(9). We did not use the technique more extensively because we were unable to persuade ourselves that the instruments we used--the monetary base, full employment budget surplus, and military spending--were indeed exogenous, except perhaps the last. In the cases where we used instrumental variable estimation, the ordinary least squares and two stage least square estimates were quite similar.

37. This is not a reflection of the fact that we allow six lags for the wage variable and only four for the exchange rate variables; when we allowed only four lags for wages, the mean lag for this variable was still longer than that for exchange rates. The mean lag is easy to interpret when all lag coefficients are of the same sign. In all but one case, the coefficients on wage change are all positive. In the case of exchange rate changes, though, either the first or the last lag coefficient is usually of a different sign (though statistically insignificant) than the remaining coefficients. To avoid prejudicing the comparison of mean lags in favor of the exchange rate, we define the mean lag as $\sum \frac{i|a_i|}{(\Sigma a_i)}$, where the a_i are the estimated coefficients.

38. It is noticeable in both Tables 7 and 8 that the coefficient on DEX is larger than that on DWAX. The reason is probably that DEX, the rate of change of the real exchange rate, is approximately equal to DWAX plus the foreign inflation

rate minus the domestic inflation rate. Since DEX enters negatively, it essentially includes positive lagged values of the dependent variable. Its coefficient is therefore increased as a result of serial correlation of the dependent variable. This interpretation is strengthened by the fact that the coefficient of serial correlation in regression (2) is lower than that in (1), and similarly comparing regressions (5) and (4).

39. In Table 9 we use a simple adaptive expectations formulation to generate expected inflation. We have also re-estimated equation (7) using a three period distributed lag on the predicted inflation rates from equation (4) as the expectations variable. This change reduces the coefficient on the unemployment rate, and also reduces the coefficient on the exchange rate to -.11 with a t-statistic of 2.43. The sum of the coefficients on the expected inflation rate is 0.93.

40. Our direct coefficients are typically smaller than those of Gordon (1982, op.cit.) This may be a result of our choosing not to use dummy variables to account for episodes such as wage-price controls. Nonetheless, the sum of the direct and indirect effects is quite smaller to the coefficients obtained by Gordon, whose sample period was 1952 to 1980.

41. See for example Alan Blinder "The Anatomy of Double Digit Inflation in the 1970s," in Robert Hall (ed.) Inflation: Causes and Effects, National Bureau of Economic Research, 1982.

42. See Robert E. Cumby and Maurice Obstfeld, "International Interest-Rate and Price-Level Linkages Under Flexible Exchange Rates: A Review of Recent Evidence," National Bureau of Economic Research Working Paper No. 921, June 1982; Jeffrey A. Frankel, "In Search of the Exchange Risk Premium: A Six-Currency Test Assuming Mean Variance Optimization," Journal of International Money and Finance, 1, (1982), pp.255-274; Michael Melvin, "An Alternative Approach to

International Capital Flows," Chap. 13 in Derby, et.al., op.cit.; Maurice Obstfeld, "Can We Sterilize? Theory and Evidence," American Economic Review, Papers and Proceedings, May 1982, pp.45-50; Kenneth Rogoff, "Time Series Studies of the Relationship Between Exchange Rates and Intervention: A Review of the Techniques and Literature," Federal Reserve Board Staff Study No. 132, 1983.

43. Richard A. Meese and Kenneth Rogoff, "Empirical Exchange Rate Models of the Seventies," Journal of International Economics, 14, (1983), pp.3-24.

44. We are not certain that the situation in open economy macroeconomics is significantly different from that for the closed economy. However, discussion of that issue and its implications would take us too far afield.

45. See Eliana Cardoso, "Exchange Rates and the Stock Market," unpublished manuscript, Boston University, 1983; Rudiger Dornbusch, "Expectations and Exchange Rate Dynamics," Journal of Political Economy, 84, (Dec. 1976), pp.1161-1176, Maurice Obstfeld and Alan C. Stockman, "Exchange Rate Dynamics," op.cit.

46. Overshooting is not inevitable: if dynamics are such that output initially expands sufficiently to raise the nominal interest rate when the money stock is raised, the exchange rate will not overshoot. The presumption is though that the nominal interest rate absorbs most of the initial impact of the money shock.

47. Robert A. Mundell, "Problems of Monetary and Exchange Rate Management in Canada," The National Banking Review, 2 (September 1964), p.85.

48. A growing theoretical literature discusses the effects of alternative policy reaction functions and coordination mechanisms. See for example Matthew Canzoneri and Jo Anna Gray, "Monetary Policy Games and the Consequences of Non-cooperative Behavior," International Finance Discussion Paper No. 219, Federal Reserve Board, February 1983, and Kenneth Rogoff, "Productive and Counterproductive Cooperative Monetary Policies," manuscript, International Finance Division, Federal Reserve Board, February 1984. Empirical models too may

include reaction functions, e.g. Chaps. 5-7 in Darby et.al., op.cit.

49. See Rudiger Dornbusch, op.cit.

50. For an empirical implementation of this approach, see Robert Driskill, "Exchange Rate Dynamics: An Empirical Investigation," Journal of Political Economy, 89, 2 (April 1981), pp.357-371. For further review of the empirical evidence, see Graham Hacche, "The Determinants of Exchange Rate Movements," unpublished working paper, OECD, June 1983.

51. See Rudiger Dornbusch and Paul Krugman, "Flexible Exchange Rates in the Short Run," Brookings Papers on Economic Activity, 3, 1976, pp 537-576; Willem Buiter and Marcus Miller, "Real Exchange Rate Overshooting and the Output Cost of Bringing Down Inflation," European Economic Review, 18, 1 (1982), pp.85-123; and the discussion of the Phillips curve above.

52. Olivier Blanchard, "Debt, Deficits, and Finite Horizons," unpublished manuscript, M.I.T., 1983, has shown that fiscal expansion will have additional expansionary effects associated with debt issue, when future taxes are discounted at more than market rates. This effect continues, though dampened, in the open economy. Unless the entire debt finance translates into current account deficits, so that the rest of the world acquires all the debt, there will be some net expansion of demand from debt creation.

53. Empirical work has not clearly established that foreign and domestic bonds are imperfect substitutes. See Jeffrey Frankel "In Search of the Exchange Rate Risk Premium," Journal of International Money and Finance, 1, (1982), pp.255-274; and "Intervention in Foreign Exchange Markets," Federal Reserve Bulletin, Nov. 1983, pp.830-836.

54. See R. Dornbusch "Exchange Rate Risk and the Macroeconomics of Exchange Rate Determination" in R. Hawkins et al (ed.) The Internationalisation of Financial Markets and National Economic Policy, JAI Press, 1982 for a derivation and

references to the extensive literature.

55. See Charles Wyplosz and Jeffrey Sachs, "Real Exchange Rate Effects of Fiscal Policy," forthcoming NBER Working Paper, 1984 and Alberto Giovannini Essays on Flexible Exchange Rates, Unpublished Ph.D. dissertation, M.I.T., 1982.

56. See Board of Governors of the Federal Reserve FRB Multicountry Model: Version August 1983, A. Amano et al, "Structure and Application of the World Economic Model," Economic Research Institute, Economic Planning Agency, Tokyo abd M. Yoshitomi, "The Insulating and Transmission Mechanism of Floating Exchange Rates Analyzed by teh EPA World Econometric Model," Economic Planning Agency, Tokyo, March 1984. For further references see, too, F. Larsen et al, "International Economic Linkages," in OECD Economic Studies, No. 1 Autumn 1983.

57. See, for example, Ronald McKinnon "Currency Substitution and the World Dollar Standard," American Economic Review, June 1982.

58. The return R_t^B should therefore be thought of as applying to a short-term asset; it would be desirable to include term-structure relations in an extended version of the model.

59. We have not included cost of capital measures in (A10) though the rental rate on capital and inventory holding costs do provide a supply side channel for interest rates to affect prices.