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A CRITICAL APPRAISAL OF MCKINNON'S WORLD MONEY SUPPLY HYPOTHESIS

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In a lecture given in 1978, Arnold C. Harberger pointed to the similarity of inflation rates across 16 industrial countries during each of the three periods 1952-67, 1967-72, and 1972-78. Noting the relatively narrow range of average inflation rates for the middle 12 countries in each period, Harberger conjectured that the driving force behind this shared inflationary experience was the common impact of the world money supply under a regime of relatively fixed exchange rates. Although the major currencies have been nominally floating against one another since early 1973, he nonetheless contended that the concept of a world money supply remained a fruitful notion:

> Even though we have had nearly five years of floating rates, it is my impression that the monetary authorities of the major countries have behaved with far less independence than the theorists of floating rates are prone to assume. Consequently, in terms of the way the international monetary system has worked since 1973, I would characterize it as a hybrid, functioning if anything more like a fixed-exchange rate system than like a textbook case of floating rates.

Much the same evaluation has recently been made by Ronald McKinnon (1982). According to McKinnon, a combination of intense intermittent speculative pressure, heavy official intervention, and a "perfect" world capital market has meant that, even under floating exchange rates, the world money supply has had a significant impact on inflation and output in the United States. McKinnon concludes that the Federal Reserve should adjust its money-growth policies in the light of money supply behavior in other leading countries. This behavior, he argues, moves in close correspondence with the exchange rate between their currencies and the dollar. Thus, he writes:

> The doctrine of domestic monetarism, where the Federal Reserve System keys on some purely American monetary aggregate such as M1 and M2 and ignores the foreign exchanges, is increasingly inefficient for preventing global inflation or deflation--and for stabilizing American income and prices.

This paper disputes McKinnon's interpretation of the behavior of exchange rates and national money supplies since the early 1970s. Its five sections include (I) a brief graphical restatement of McKinnon's central point; (II) some criticisms of his analysis; (III) an alternative interpretation of events under managed floating; (IV) some evidence suggesting that quarterly money supply growth in other industrial countries has been largely independent of official intervention activities and has had only a small impact on U.S. prices and activity levels; and (V) conclusions.

I. A graphical illustration of McKinnon's model

McKinnon's model has two countries, the U.S. and ROW (rest of the world), with the dollar and the rowa as national currencies. The spot and forward dollar prices of the rowa are denoted by S and F, and interest rates on dollar-denominated and row-denominated assets by i and i*. Now, consider an initial equilibrium where, for simplicity, s, the expected near-term change in the spot price of the rowa [$s = E(dS/dt) = (F - S)/S$] is zero, the latter equality holding because F is assumed equal to the expected value of S at the relevant future date. Satisfaction of McKinnon's equation (6)

$$i - i^* = s \quad \text{(Fisher open condition)}$$

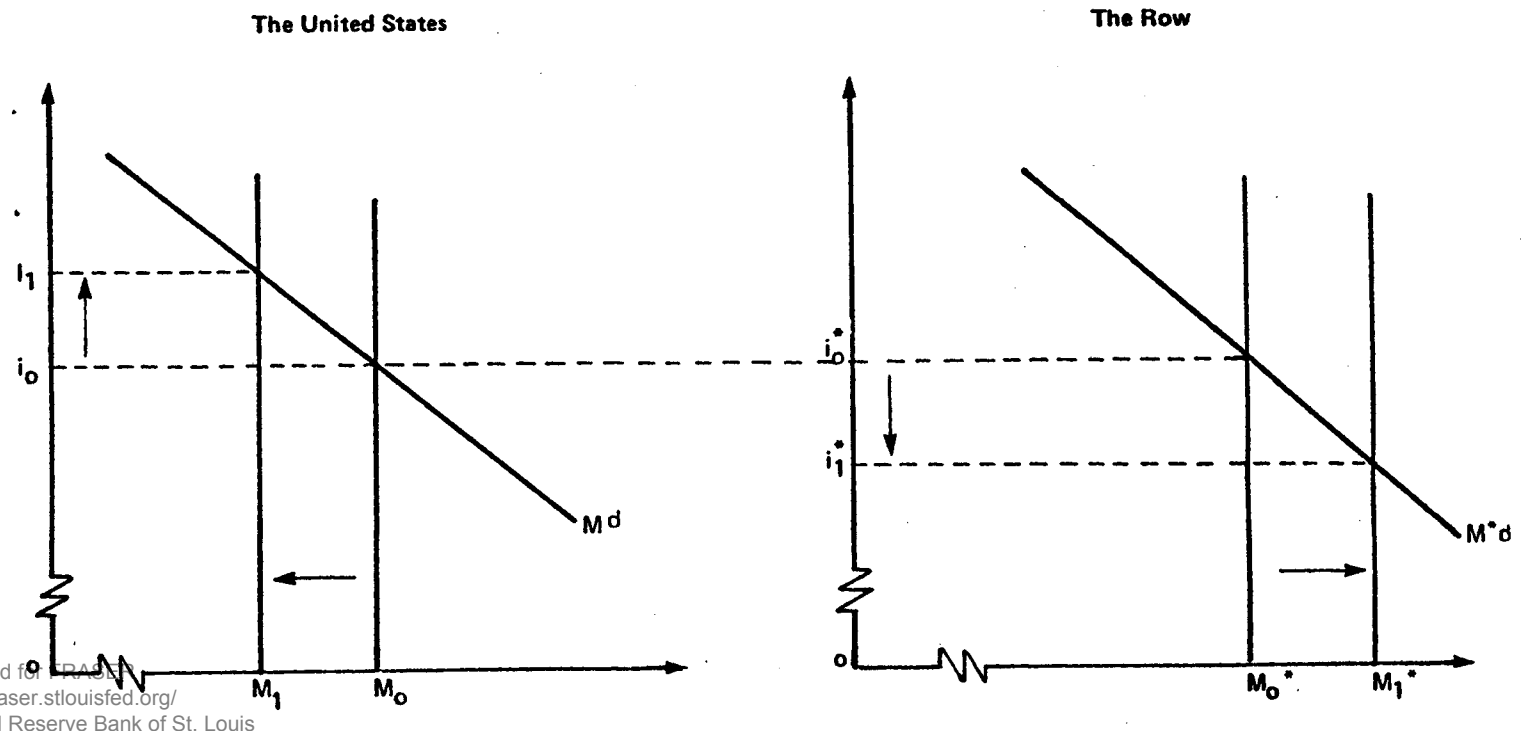
then implies that $i_o = i^*_o$, where the subscript denotes time zero. Now let there be a sharp exogenous rise in s. According to McKinnon, this development triggers currency substitution through two channels. Channel One comprises direct shifts of working balances from dollars into rowa by large commercial banks and nonfinancial multinationals. Channel Two involves indirect currency substitution which, McKinnon argues, is likely to be much more important than direct substitution. It is the discovery and elucidation of this Channel Two process that represents the key contribution of the McKinnon article.

Figure 1 illustrates this Channel Two process. As s increases exogenously, incipient pressure by international bond arbitragers forces

interest rates to adjust immediately, so that the spread between i_1 and i_1^* equals the new value of s. Simultaneously, the forward discount on the dollar takes a value equal to s. At the new interest rates imposed by these powerful expectational forces, transactors in each country find themselves off their respective money demand curves. U.S. transactors now want to hold M_1 of dollar balances but the U.S. money supply remains at M_o; similarly, ROW transactors want to hold M_1^* of rowa balances but only M_o^* currently exists. U.S. transactors respond by trying to switch out of cash balances and into dollar-denominated bonds; and ROW transactors by trying to switch out of rowa denominated bonds and into rowa cash balances. The result is to push $(i - i^*)$ just barely below s, which induces international bond arbitragers--sensitive to even the slightest expected uncovered yield differential --to switch out of dollar bonds and into rowa bonds . Thus, McKinnon concludes:

> Massive capital flow can be easily induced even when the interest differential remains 'correctly' aligned to reflect accurately the change in expected exchange depreciation.

Figure 1
Equilibrium and disequilibrium in the two national markets for money balances



What is the response of the central banks to these capital flows? McKinnon assumes that the ROW central bank intervenes to peg the spot exchange rate in the immediate short run. As a result it creates new high-powered balances in rowa on a scale sufficient to increase M* to the amount demanded at the lower interest rate, i_1^*. Moreover, the ROW central bank does not try to check this externally induced money-supply expansion through open-market sales or reserve requirement increases. Indeed, any attempt to sterilize the domestic monetary base effects of these speculatively induced capital inflows would be foiled by perfect capital mobility--a key assumption of McKinnon's model. In the United States, however, the monetary authorities, according to McKinnon, do sterilize. Indeed, such sterilization occurs automatically insofar as the ROW bank uses its dollar accruals to buy U.S. government securities rather than increase its dollar deposits at the Federal Reserve. With respect to Figure 1, this sterilization means that dollar-denominated transactions balances actually held amount to M_o whereas balances demanded amount to M_1^*. This disequilibrium is presumably resolved by persisting attempts by U.S. transactors to acquire both bonds and goods, with resultant lagged expansionary pressures on the world economy. As nominal world income responds, the M^d and M^{*d} curves eventually shift to the right by amounts sufficient to restore equilibrium in the combined "markets" for the two national money supplies.

Sterilization by the Federal Reserve represents a key policy mistake, according to McKinnon. For it implies that an exogenous shift in exchange rate expectations, as indicated by an increase in the value of the parameter s, leads to the creation of an excess supply of world money. In a dynamic context, what the Fed authorities have failed to perceive is that the more rapid growth of foreign money balances (stemming from speculatively

induced capital flows out of the dollar) needs to be balanced by a slower growth of U.S. money balances. By focusing only on the growth rate of U.S. money the Fed has aimed at the wrong target.

For two reasons, McKinnon argues, targeting on U.S. money alone was not such a serious problem under the fixed exchange rates of the 1950s and 1960s. First, the dollar then dominated the supply of "international money," as most leading foreign currencies were nonconvertible on capital account. Second, most exchange rates were convincingly fixed so that expected exchange-rate fluctuations leading to international money substitution were minimal. During the last 12 years, however, circumstances have differed. Managed floating, more volatile exchange rate expectations, and a secular decline in the share of dollars in world money have all increased international currency substitution.

McKinnon uses his model to explain "the two explosions in world money supply in 1971-72 and again in 1977-78" when, he argues, $\underline{s}$ took on large positive values. In addition, he uses it to explain "the Great Deflation of 1981-82." He claims that there was an exogenous fall in $\underline{s}$, in 1980, in response to expectations of Reagan's election and a new deflationary U.S. policy, as well as to events in Poland and the election of a socialist government in France. As the dollar surged in response to these events, central banks in Switzerland, Germany and Japan became large net sellers of dollars, "thus contracting that part of world money (M1) denominated in Swiss francs, marks, and yen." With no offsetting U.S. monetary expansion, a sharp deflation was imposed on the world economy.

II. Questions about the McKinnon Model

1. McKinnon assumes that huge amounts of uncovered funds move in response to very small differentials in expected yields. Such sensitivity

seems implausible for uncovered capital movements. Though international borrowers and lenders may well "take a view" regarding the probable level of the spot rate in the near future, it seems unlikely that they would expose themselves to large adverse swings in the exchange rate merely to obtain a 10 or 20 basis-point incremental expected return. In brief, for risk-adverse transactors, the uncertainty of this expected incremental return seems likely to outweigh the appeal of its small expected value.[1]

2. To illustrate his model, McKinnon provides the following numerical example:

> [S]uppose s increases from zero to 6 percent because the American Secretary of the Treasury opines that the dollar is overvalued. The "perfect" international bond market quickly adjusts to these new exchange-rate expectations; the incipient arbitrage pressure to move out of dollar bonds into rowa bonds causes interest rates to adjust immediately; i rises by three percentage points, and i^* falls by three percentage points.

But with s defined as "the expected change in S, averaged into the near future of 'several weeks,'" a six percent rise in the spot dollar price of rowa over the next four weeks (taking "several" as four) implies a forward premium and an interest-rate spread of 72 percent per annum. As no such premia or interest-rate spreads have been observed among the OECD currencies since the advent of managed floating. We surmise either that the exchange-risk considerations just noted prevent the existence of perfect capital markets (in the sense of McKinnon) or that an expected rate change approaching 6 percent over the next "several weeks" never in fact materializes for these currencies (perhaps because management of the float is flexible enough to avoid such strong one-way expectations).

To make the Fisher Open Position consistent with observed interest differentials of two to 10 per cent per annum would require assigning s a monthly value of 0.16 to 0.83 percent. Such values seem implausibly small

given the state of the markets during periods of particularly strong one-way pressure.

3. A more serious empirical question is associated with the recent period of strong dollar appreciation. From mid-1980 to mid-1982, the dollar appreciated substantially against almost all other leading currencies. The DM was a leading example. As the Bundesbank leaned against the wind during this period, its external reserves, exclusive of gold, fell from $52.5 billion at end-1979 to $41.0 billion at end-July 1982. If the market expected the DM to depreciate during this period, as McKinnon assumes, his model requires that short-term DM yields exceed short-term dollar yields. But in fact, except for a brief period in mid-1980, rates on dollar assets remained well above rates on comparable DM assets. Indeed, German interest rates have been substantially and consistently below U.S. interest rates both when the DM was strong against the dollar (1977-1979) and when it was weak against the dollar (1980 to mid-1982). One does not have to search hard for an explanation: the greater expected inflation in the United States than in Germany. Similar bilateral comparisons, contrary to McKinnon's model, could be made between the U.S. and Switzerland, the U.S. and Japan, and the U.S. and the Netherlands. In other words, consistent with empirical evidence in Solnik (1982), satisfaction of "the Fisher closed condition" may well have prevented satisfaction of the "Fisher open condition" in a world where exchange rates were not expected to move in strict accordance with relative changes in national price levels.

III. An alternative view

An alternative assessment of the managed floating rate experience since 1973--presented in somewhat dogmatic fashion as a foil to the McKinnon view--runs as follows:

(1) By and large, ROW central banks do "take a view" regarding the appropriate level and rate of change of the dollar price for their currencies. If the rate begins to diverge from the level they think appropriate, they will usually intervene. But they will only lean against the wind--they will not prevent market pressure from moving the rate.[2] Accordingly, we disagree with Harberger's perception that since 1973 the hybrid international monetary system has functioned "more like a fixed-exchange rate system than a textbook case of floating rates."

(2) The central banks also have short-run interest rate and money-supply targets, which they vary in response to changes in domestic demand conditions and exogenous inflationary shocks. By and large, the central banks try to neutralize the effects of their dollar accruals or sales on their domestic monetary base, but if the exchange market pressure is intense they may choose to alter their earlier domestic money-growth and interest-rate targets at the same time that they back away from (yet resist) that pressure. Such a response makes good economic sense because the exchange-rate trend influences prices and real demand in a way that offsets the effects of the faster or slower monetary growth induced by their intervention. During 1977-78, for example, Germany experienced low inflation relative to her major trading partners together with considerable slack capacity. As the DM strengthened, the Bundesbank absorbed substantial amounts of dollars from the exchange market. Its policy of only partially sterilizing, hence allowing the domestic money supply to grow well above the earlier target range, seems sensible given that faster money growth was accompanied by a sharply rising DM in the foreign exchange market. For as the Bundesbank noted in its 1978 Report:

> Both at the beginning of the year [1978] and in the autumn new monetary unrest

> associated with the temporary weakness of the U.S. dollar and to some extend also with tensions in the European narrower margins arrangement (the "snake"), resulted in a rapid appreciation of the Deutsche Mark in international foreign exchange markets. In order to slow down this upward movement, which far exceeded the price and costs differential between Germany and other countries, and at the same time to mitigate the dampening effect of an excessive appreciation on domestic activity, the Bundesbank took considerable amounts of foreign currency out of the market....In these circumstances the Bundesbank was forced to adhere to a relatively easy domestic monetary policy. Both factors--the massive inflows of funds from abroad and the stance of domestic monetary policy--led to an expansion of the money growth target for 1978. As long as the trend of business activity remained fairly flat (as in the early part of last year) and as the sharp appreciation of the Deutsche Mark automatically restrained the increase in domestic costs and prices, it was possible to tolerate the faster expansion of liquid funds in Germany; in fact, any application of the monetary brakes during that period would probably have had an adverse effect on the economy as a whole. [our italics] (p. 1)

(3) Slower monetary growth in the non-U.S. industrial countries during 1980-82 represented a response to cost-push pressures caused by the second oil shock and a strengthening dollar; it was not caused by an inability to offset the domestic-base effects of dollar sales in the exchange market.[3] Indeed, these effects were more than fully offset in that money growth remained positive even though the central banks were net sellers of dollars in the exchange markets.

(4) We have argued that large Channel Two capital flows are implausible. We suspect that Channel One capital flows are also unimportant. Aside from compensating balances, sophisticated multinational concerns are unlikely to hold significant amounts of transactions balances in any currency if these

balances yield either zero or small explicit interest returns. Such transactors might well choose to go long or short in a given currency for speculative reasons, but in so doing they would prefer to acquire an interest-earning asset.

IV. Some Evidence

In this section we present three sets of evidence which seem consistent with our assessment of the post-1973 international monetary system and inconsistent with that of McKinnon and Harberger.

(1) Cumulative money growth and price-level changes in 10 countries

Harberger's perception of a common worldwide inflationary process persisting well after the breakdown of the Bretton Woods arrangements rested on the proposition that exchange rates among the leading currencies were really more fixed than floating. McKinnon's analysis of the importance of the world money supply under floating rates would seem to rest on much the same proposition. This proposition implies that prices rise over time by roughly the same margin in all "participating countries" as the common world money supply percolates through a relatively fixed exchange rate structure. The proposition would, however, seem to be contradicted if marked divergences in rates of growth in national monetary supplies were associated with corresponding divergences in price-level behavior. For then one would have to infer (given an absence of ever-intensifying trade restrictions) that exchange-rate adjustments were such as to bottle up the price-level effects of above-average or below-average money growth within national boundaries. Some evidence on this issue is provide by Figure 2. The horizontal axis measures the percentage increase in M1 from end-1975 to end-1981; the vertical axis, the percentage change in the CPI from 1975 (average for the year) to June

1982. The scatter seems to support the bottling up thesis over the spillover thesis inherent in essentially fixed exchange rates.

Figure 3 plots the percentage change in the CPI against the percentage change in the narrow money supply for the same ten countries for a period of comparable length in the 1960s, when exchange rates were pegged. In this earlier period, it seems clear that significant differences in money supply growth were not accompanied by corresponding differences in cumulative price-level movements. To a first approximation, "the law of one price" coupled with fixed exchange rates appears to have prevented national inflation rates from diverging substantially from one another.

Figure 2
Money and Inflation in 10 countries under floating exchange rates

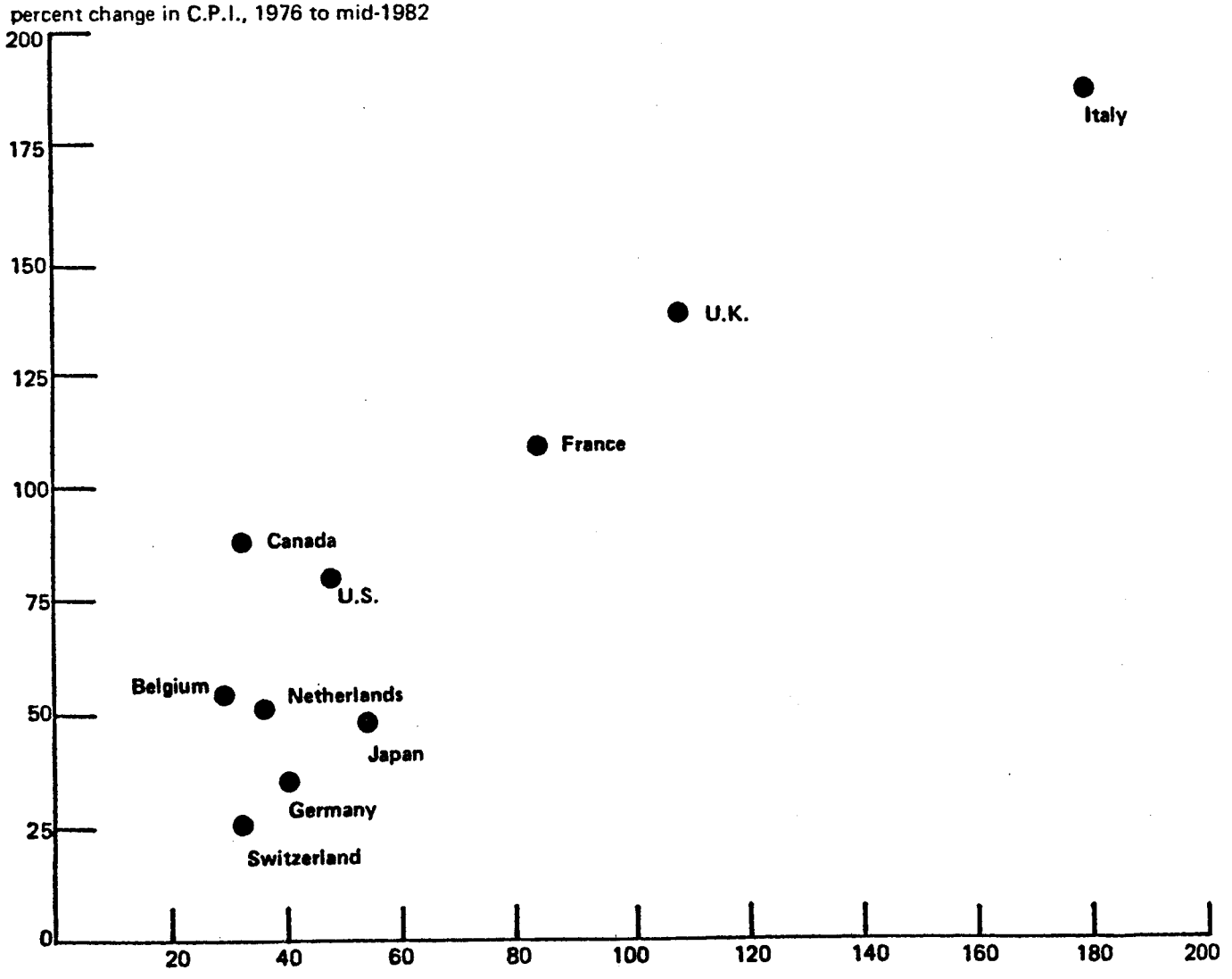
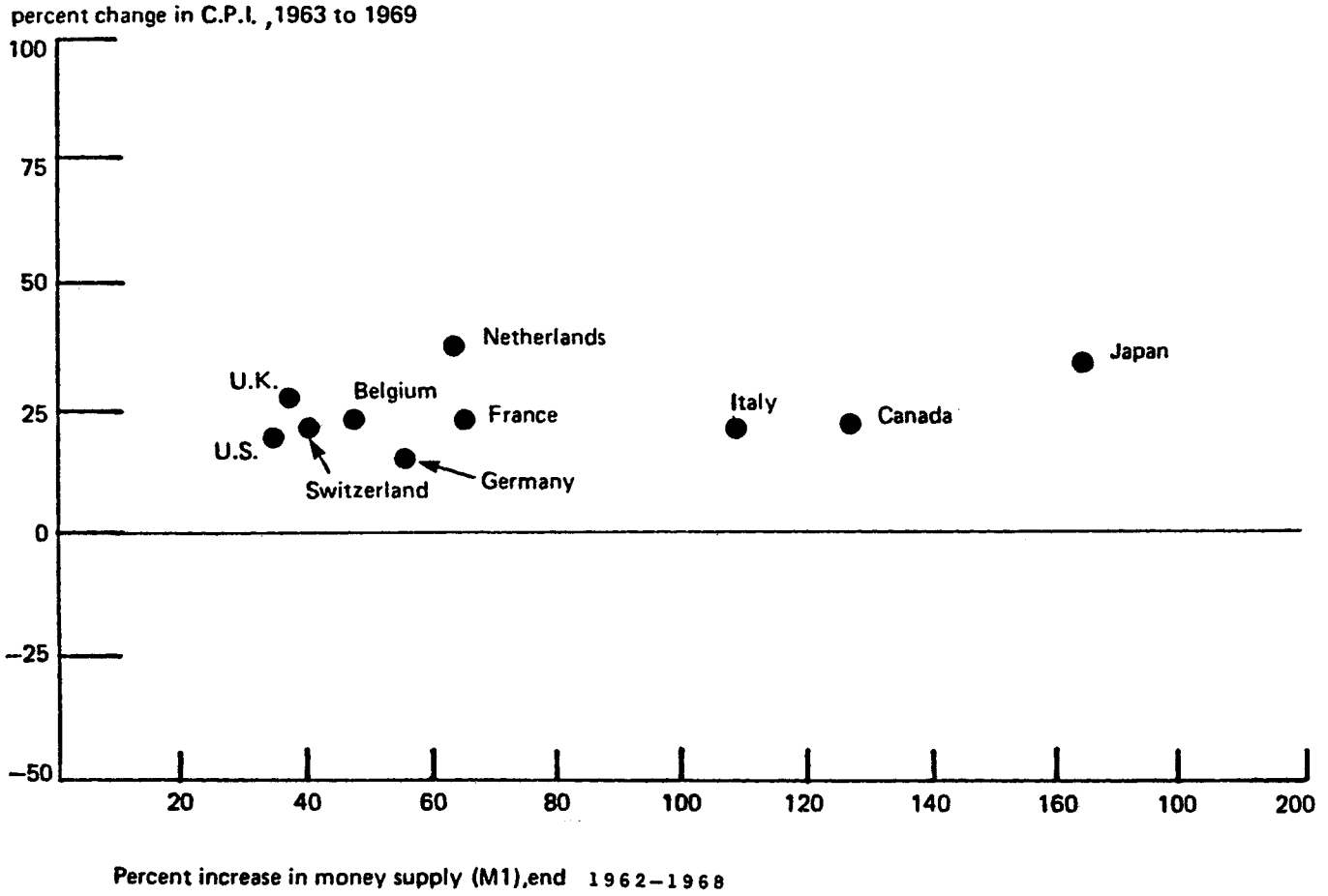


Figure 3

Money and Inflation in 10 countries in the 1960s



Figures 2 and 3 compared cumulative changes in national price levels for periods of equal length under fixed and floating rates. Table 1 shows two measures of dispersion in annual inflation rates for the same 10 countries for the two different policy regimes, giving mean values of the annual range and annual standard deviation of their inflation rates. Both measures show a marked increase in the dispersion of annual inflation rates after the adoption of floating rates, again suggesting an increase in policy independence under that regime.[4]

Table 1: Alternative Measures of Dispersion in Annual Inflation Rates across Ten Industrial Countries: Fixed Rate Period vs. Floating Rate Period

	Fixed Rate Period (1960-70, inclusive)	Floating Rate Period (1974-81 inclusive)
Mean of the Annual Range	4.64 % p.a.	14.89 % p.a.
Mean of Annual Standard Deviations	1.42 % p.a.	4.48 % p.a.
Mean of the Annual Means	3.20 % p.a.	9.66 % p.a.

Source: International Monetary Fund, International Financial Statistics, Yearbook, 1982. The inflation rates used are year-to-year percentage changes in the consumer price index for the United States, Canada, Japan, Belgium, France, Germany, Italy, the Netherlands, Switzerland, and the United Kingdom.

2. Co-variation in international reserves and domestic money growth

Various accounts of official intervention in the foreign exchange markets during the 1970s and early 1980s would seem to suggest that above average official purchases of dollars in the t-th quarter ought to be associated with above average rates of growth in the M1 money supply in that quarter or the next, and vice-versa.

On this point, McKinnon observes:

> Central banks often take offsetting actions--through open-market operations, changed reserve requirements, or rediscounting--to sterilize the domestic monetary impact of...official interventions.
>
> ...[But] clearly, sterilization would make it much more difficult for ROW bank to meet its exchange-

> rate target. Morever, Hans Genberg and Swoboda (1981) provide evidence that when sterilization occurs in Europe and elsewhere, it is only partial. Hence, let us assume for analytical purposes that ROW bank does not sterilize: A* is constant as foreign exchange intervention takes place. (p. 328)

To what extent does this analytically convenient assumption by McKinnon match reality? To test this sterilization assumption, we ran a regression for each of the nine leading OECD industrial countries (other than the United States) of the following form:

$$\Delta \ln M_t = a_o + a_1 \Delta \ln R_t + a_2 \Delta \ln R_{t-1}$$

where $\Delta \ln M_t$ = percentage change in domestic money growth during the t-th quarter

$\Delta \ln R_t$ = percentage change in international reserves (less gold)[5] in the t-th quarter

$\Delta \ln R_{t-1}$ = percentage change in international reserves (less gold) in quarter (t-1).

For the 50 quarters ending in mid-1982 the results are summarized in Table 2.

Table 2: Regression Results for $\Delta \ln M_t = a_o + a_1 \Delta \ln R_t + a_2 \Delta \ln R_{t-1}$ for I/1970-II/1982

		Size of significant coefficient on:	
Country	R^2	$\Delta \ln R_t$*	$\Delta \ln R_{t-1}$
Canada	.01	--	--
Switzerland	.17	.09 (2.73)	--
Belgium	.04	--	--
Netherlands	.18	.03 (3.03)	--
Italy	.01	--	--
France	.00	--	--
Germany	.01	--	--
Japan	.13	.02 (2.37)	--
U.K.	.04	--	--

*t-value in parentheses.

It would appear that large quarterly percentage changes in national money supplies are not tightly linked to large quarterly percentage changes in

international reserves since almost all the R^2 values for these equations are extremely low and the coefficients on $\Delta \ln R_t$, even when statistically significant, are so small numerically[6]. By one means or another, the central banks of these nine countries appear to have been able to neutralize the effects of large changes in international reserves on their M1 money supplies.[7] This evidence is consistent with Laney and Willett (1982), who conclude that increases in international reserves were not the dominant explanation for the global monetary expansion during the 1970s.

3. Some St. Louis regressions

In this section, we report various regressions that seek to test whether the weighted average growth rate of money supplies in industrial countries outside the United States (ROW money) has had a significant influence on either the U.S. rate of inflation or U.S. real output.

We follow McKinnon in measuring the growth rate of world money. For this purpose, he assumes that the world consists of ten industrial countries--the United States, Canada, Japan, the U.K., Germany, France, Italy, the Netherlands, Belgium, and Switzerland. For any given quarter, growth rates in these countries' respective narrowly defined seasonally adjusted money supplies--as given on line 34b of International Financial Statistics--were computed, weighted by their relative GNP Levels as of a particular year, and then summed. McKinnon used GNP weights for 1970, the mid-year of the two decades of data presented in his article; we have used 1976 weights, as 1976 is the mid-year for most of our regressions.[8] We constructed a corresponding series for the growth rate of Rest-of-World money (ROW money) by simply omitting the U.S. component from the world money index and rescaling the remaining weights to make them again sum to one.[9]

World money growth and U.S. inflation

A number of reduced form regressions published by economists at the Federal Reserve Bank of St. Louis show that quarterly U.S. inflation during the 1970s can be well explained statistically by a regression of the GNP deflator on (i) lagged U.S. money growth over the past three years; (ii) changes in relative energy prices; (iii) changes in relative food prices; and (iv) dummy variables to capture the effects of wage and price controls.[10] McKinnon's contention that monetary developments in the ROW have had powerful effects on the U.S. economy can be tested by using the St. Louis approach. Specifically, suppose that we run regressions for the floating-rate period, II/1973-II/1982, using moving averages of past U.S. money growth and world money growth as alternative variables--would world money growth prove to be the better explanatory variable, as McKinnon's argument clearly implies? And suppose that we run a regression that includes moving averages of both U.S. money growth and ROW money growth as explanatory variables--would ROW money growth prove to be statistically significant and would its inclusion appreciably improve the explanatory value of the equation? Tables 3 and 4 below show the results of alternative regressions with these specifications. The equations in Table 3 cover the floating-rate period, per se, II/1973-II/1982; those in Table 4, the slightly longer period, I/1970-II/1982.

The results for both periods are quite similar. Comparing equations (1) and (2), we see that U.S. money growth is highly significant in both periods, whereas world money growth is only significant for the longer period. For each period, the explanatory power of the equations using world money is markedly lower than the equation using U.S. money. Morever, the estimated coefficients for world money growth are well below unity in both cases, whereas the coefficients on U.S. money growth--1.09 for the shorter period and 1.12 for the longer period--are not significantly different from unity.

Table 3: Estimate of Alternative Money Price Relationships for the Unites States, II/1973-II/1982

Equation	Constant	MUS3	MW3	MROW3	ENER	DUMC	DUMA	DW	R^2	$SE \cdot 10^2$
(1)	-.003	1.091			.035	--	.042	2.15	.519	.397
	(-.039)	(3.56)			(1.43)		(2.28)			
(2)	.024		.479		.069	--	.018	1.37	.326	.470
	(.751)		(1.26)		(2.57)		(.892)			
(3)	-.019	1.155		.145	.037	--	.040	2.17	.531	.400
	(.636)	(3.61)		(.782)	(1.49)		(2.12)			

NOTE: The dependent variable is the annualized percentage change in the GNP deflator for the quarter. MUS3 is the average annual rate of change in the U.S. money supply (M1) over the previous 12 quarters. MW3 is the average annual rate of change in the world money supply, as defined in the text, over the previous 12 quarters. MROW3 is the average annual rate of change in the ROW money supply as defined in the text over the previous 12 quarters. ENER is the average annual rate of change in an index of energy prices divided by the GNP deflator over the current and previous five quarters. DUMC is the price control dummy (equal to one over II/1971-1/1974, zero elsewhere). DUMA is the post-price-control dummy (equal to equal to one over II/1974-IV/1974).

Table 4: Estimates of Alternative Money Price Relationships for the United States, I/1970-II/1982

Equation	Constant	MUS3	MW3	MROW3	ENER	DUMC	DUMA	DW	R^2	$SE \cdot 10^2$
(1)	-.003	1.120			.041	-.010	.032	2.03	.624	.375
	(-0.212)	(4.25)			(1.85)	(-1.80)	(2.87)			
(2)	.005		.699		.077	-.023	.006	1.39	.527	.420
	(.205)		(2.57)		(3.28)	(-2.98)	(.530)			
(3)	-.026	1.136		.208	.046	-0.164	.025	2.10	.644	.369
	(-1.158)	(4.37)		(1.44)	(2.08)	(-2.32)	(2.14)			

Equation (3) is also quite similar for both periods. The growth rate in ROW money is statistically insignificant whereas the growth rate for U.S. money is highly significant and its coefficient is little changed in numerical size from that estimated in equation (1). Overall, the addition of ROW money adds virtually nothing to the ability of this simplified version of the St. Louis equation to explain U.S. inflation.

U.S. real economic activity and ROW money

As Milton Friedman and Anna J. Schwartz (1963), William Poole (1975), and Leonall C. Anderson and Keith M. Carlson (1970) have shown, fluctuations in real U.S. economic activity are linked to significant changes in U.S. M1 growth from its recent trend. More recently, Batten and Hafer (1982) have argued that the same sort of relationship holds for Britain, West Germany, and Italy. Is it possible that deviations from trend in world money growth have an even stronger link to the growth rate of real U.S. GNP? And if we were to put the U.S. monetary deviation variable and the ROW monetary deviation variable into the same regression equation, would both prove to be significant, and would the regression equation have significantly greater explanatory power than the equation without the ROW money-growth variable? McKinnon's analysis suggests positive answers to these questions.

To test this implication of his analysis, we ran the regressions shown in Table 5. Equations (1) and (2) show virtually no difference in their ability to account for fluctuations in U.S. real GNP. On the other hand, when the variables MUS-dev and MROW-dev are both included in a regression equation aimed at explaining U.S. real output deviations, as in equation (3), the U.S. monetary variable remains significant and with a much larger coefficient than the ROW monetary variable; and, indeed, MROW-dev is not statistically significant. As with the earlier regressions seeking to explain U.S.

Table 5: Money-growth deviations and U.S. real GNP: alternative specifications I/1970-II/1982

Equation	Constant	MUS-dev	MW-dev	MROW-dev	ENER	DW	R^2	$SE \cdot 10^2$
(1)	.012	.130			-.038	1.97	.370	.985
	(4.48)	(2.19)			(-2.72)			
(2)	.012		.144		-.032	2.02	.365	.992
	(4.41)		(2.11)		(-2.13)			
(3)	.012	.124		.049	-.033	2.08	.389	.987
	(4.35)	(2.09)		(1.06)	(-2.20)			

NOTE: The dependent variable is the annualized percentage growth rate in U.S. real GNP, seasonally adjusted. MUS-dev is the two quarter growth rate for M1 over the current and past quarter less the 12-quarter moving average of M1; MW-dev is a similar variable for world money; MROW-dev is a similar variable for Rest-of-World money; ENER is the average annual rate of change in the index of energy prices divided by the GNP deflator over the current and previous five quarters. (The variables DUMC and DUMA, as defined in Table 3 above, were also included in the regressions, but their coefficients were had very small t-values and are not reported.)

inflation, the inclusion of ROW money does not significantly improve the explanatory power of the regression.

V. Conclusion

McKinnon has advanced an imaginative interpretation of macroeconomic events during the past decade of managed floating. In a number of important respects, however, his interpretation seems strikingly at odds with the empirical evidence. We conclude that a combination of sterilization techniques and exchange-rate adjustments have provided central banks in the leading industrial countries with far more independence from monetary developments elsewhere than McKinnon's analysis suggests. Whether or not this judgment is correct, money supply developments in other leading industrial countries do not appear to have had a significant impact on U.S. inflation or on fluctuations in U.S. output since the advent of managed floating. Contrary to McKinnon, the evidence does not suggest that the Federal Reserve should alter its monetary stance in the light of monetary policies in the other leading industrial countries.

Acceptance of this proposition does not mean that the U.S. monetary authorities should ignore the behavior of the dollar in the exchange markets. An exceptionally strong DM led the Bundesbank to permit faster German monetary growth in 1978; for the same reasons, one can argue that an exceptionally strong dollar should have persuaded the Federal Reserve to expand U.S. money by more than it did during 1981-82. But such a judgement--whether valid or not--does not rest on the proposition that external money growth is an important determinant of U.S. economic activity under managed floating.

Footnotes

[1]Solnik (1982) has recently tested whether international interest-rate spreads for the period 1971-1980 can be better explained by expected exchange rate changes or by differences in domestic economic policies. He finds "much more support for a domestic model of interest rate determination." "This result," he notes, "could be explained by international market inefficiencies but more probably [is explained] by the fact that exchange rate variations are so unpredictable that their expectations play a little role in setting differences between national interest rates."

[2]For a confirming view citing a number of empirical studies, see Wonnacott (1982, p. 3).

[3]On this issue, see the comments by H. Lehment (1982) and K. Shigehara (1982).

[4]The mean annual coefficient of variation is 0.43 for the fixed rate period and 0.48 for the floating rate period. This particular measure of dispersion, however, seems irrelevant. As between any two countries, adjustments in the exchange rate to maintain competitiveness, and in nominal interest rates to maintain a real interest-rate differential, depend on the absolute difference between their inflation rates and not on whether average inflation in the two countries is high or low. The same consideration would apply across 10 countries as well.

[5]Reserves, less gold, are in U.S. dollars, as taken from line 11.d in the relevant country pages of International Financial Statistics. To the extent that these countries held their official reserves in dollars, quarterly changes in this variable are free from exchange-rate valuation effects. Such quarterly changes will fail to correspond to official-intervention efforts, however, insofar as they reflect (a) the issuance or retirement of non-dollar denominated securities abroad by the United States; (b) the issuance or retirement of foreign-currency denominated securities by foreign government agencies, where the proceeds (or repayments) were not funnelled through the foreign exchange market; (c) certain swap transactions between the U.S. and other monetary authorities; (d) SDR allocations.

[6]Many studies have regressed changes in the central bank domestic assets on changes in reserves in an attempt to estimate the "sterilization coefficient." Such an approach ignores the fact that monetary authorities outside the U.S. typically sterilize through direct controls and changes in reserve requirements rather than through open market operations.

[7]These regressions in Table 2 are of course subject to simultaneous equations bias insofar as attempted changes in the domestic money supply through domestic policy actions are offset by reserve flows (see, for example, Laney and Willett (1982, pp. 143-46)). However, McKinnon explicitly argues that a large share of money supply changes stem from exogenous changes in reserves which are incompletely sterilized. If one accepts the exogeneity of reserve flows, the estimates in Table 2 are not biased for this reason.

[8]Selecting a particular year for weighting purposes imposes the danger that an atypical pattern of exchange rates in that year might significantly bias computations of the world money supply growth rate for other years. The following computations indicate, however, that the choice of year does not change the weights markedly:

Country	1970 weights	1976 weights	1981 weights
U.S.	.517	.440	.432
Canada	.043	.050	.040
Japan	.104	.143	.166
U.K.	.065	.058	.075
Germany	.099	.114	.101
France	.080	.090	.085
Italy	.049	.048	.051
Netherlands	.017	.023	.020
Belgium	.014	.017	.014
Switzerland	.011	.017	.014

[9]An important preliminary question is whether there is any statistical evidence of a "causal relationship" between U.S. money growth and ROW money growth. To answer this question, we tested the joint time series properties of these two variables using cross correlation functions and Box-Tiao schematic representations. Neither variable appeared to cause the other in a statistical sense. The Box-Tiao schematics for partial autocorrelation are shown below:

Lag	1	2	3	4	5	6	7	8	9	10
MUS3	+	.	.	.	.	.	.	.	-	.	.	.	.	.
MROW3	.	+	.	.	.	.	.	.	.	.	.	.	.	.

[10]In particular, a study by Carlson (1980) for the period I/1970-IV-79, which used distribution lags on U.S. money growth (M1) and relative energy prices, exhibits an R^2 of .728, significant t-values for almost all the explanatory variables, and a Durbin Watson statistic of 2.18. (The sum of Carlson's coefficients on money growth for the current and past 12 quarters--the elasticity of current inflation with respect to recent cumulative money growth--totals 1.16 and has a t-value of 3.3.) A similar study by Bordo and Choudhri (1982), explaining U.S. inflation from I/1971-IV/1980, uses a simple average of money growth rates for the previous 12 quarters in place of a distributed lag specification; it yields a money growth elasticity of 1.55, an R^2 of .71, and a DW statistic of 1.88.

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