

EXCHANGE RATE SYSTEMS AND TRENDS IN INFLATION

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Two very different views of what caused the inflation of the second half of the 1960s and the 1970s have been widely propounded. On the one hand, there are those who stress the role of special factors: the monopoly power of the business sector and of trade unions, the substantial rise in commodity prices in 1973, and, most importantly, the OPEC-induced increases in the price of petroleum in 1973-74.¹ On the other hand are those observers who regard inflation in general as a monetary phenomenon and this particular episode as just another member of the species. According to most proponents of this view, the United States played a key role in the process, its excessive monetary growth being exported abroad via the fixed-exchange rate system formally in existence until 1973.²

To students of economic history and the history of economic thought, this recent debate about the causes of inflation provides just another illustration of Ecclesiastes' dictum "There is no new thing under the sun." In Britain during the bullionist controversy at the start of the nineteenth century and then again several decades later during the currency-school banking-school debate almost the exact same arguments were being voiced as today. The same is true for the widespread discussions of inflation in America at the start of this century.

So similar, in fact, have the views of the various participants in each side of this recurrent debate been that proponents of one position at one time almost appear to be responding directly to proponents of the other position during earlier and later periods. Consider Irving Fisher (1920, pp. 14, 16), "Obviously no explanation of a general rise of prices is sufficient which merely explains one price in terms of another . . . Nor will special causes working on selected commodities prove to be general enough to explain the concerted behavior of commodities."

Although writing in 1920, Fisher could easily have been responding to Thomas Tooke and William Newmarch who more than sixty years before had concluded that "in every instance of a variation of Prices, a full explanation of the change in apparently afforded by circumstances affecting the Supply or Demand" (1857, reprinted in 1928, p. 233), or indeed to the modern day advocates of that position.

Together with several colleagues at the National Bureau of Economic Research and a number of (now former) graduate students, we have recently completed a study of this question and the related question of how inflation was transmitted among countries during the Bretton-Woods era.³ In this paper we review that evidence, provide some additional observations of our own on the inflation of very recent years and present our conclusions for policy.

I. What Caused the Inflation?

The National Bureau study begins with the first quarter of 1955 and ends with the fourth quarter of 1976. The evidence we and our colleagues present there lends very little support to the most recent reincarnation of the special-factor explanation of inflation. We find that at most it can account for only a minor fraction of the inflation during that period. Monetary factors explain the bulk.

Both the trade-union and monopoly-power versions of the cost-push or special-factor hypothesis would suggest that nominal-money growth either lags behind price changes as central banks react to the unemployment resulting from wage and price increases or is unrelated to price changes. Anthony Cassese and James Lothian, who conducted Granger-causality tests between various pairs of domestic and foreign variables for each of the eight countries reported just the opposite. They found that, in general, lagged money growth significantly affects prices but not vice versa.

Darby in another part of the study reviews the theoretical underpinnings of the special-factor hypothesis as applied to oil. He then goes on to test and otherwise evaluate its validity. The gist of his conclusions in the theoretical analysis is that for the special-factor hypothesis to make sense either real income would have had to have fallen or monetary growth to have been increased in response to oil-price shocks.

To assess the importance of the first of these two avenues of influence, Darby incorporated oil-price terms into the real-income equations of the simultaneous Mark III Model that he and Alan Stockman constructed. Since these equations did not perform even tolerably well for three of the

eight countries in the sample at the outset, he focused upon the remaining five. In only three of these five cases were the oil-price terms taken as a group significant. These three countries -- the Netherlands, the United Kingdom and the United States -- all had general price controls, however, that were removed more or less coincidentally with the increase in oil prices. Canada and Germany, the other two countries that Darby considered and for which he could uncover no significant effect, did not have controls during the relevant period. Given the tendency for price controls to affect the time pattern of changes in the real and price components of nominal income as well as the time pattern of movements in velocity, the estimated reductions in real income may well have been spurious.

So that he could also allow for the indirect effects of the oil-price increase on nominal money supplies and on real exports while assessing its direct influence on real incomes and hence price levels, Darby performed a simulation experiment with a pared down version of the model. Unfortunately, these results were not very conclusive. The influence of oil prices on the price level, according to these results, might have been anywhere from 0 to 5 percent. However, if we translate this into the effect on the 1971-1975 inflation rate, this amounts to only a 0 to 1 percent per annum oil component as compared to the 3.5 percent per annum average increase in inflation over the previous quinquennium. Thus, while it is possible that the oil-price increase had a significant role in increasing inflation, it certainly was not a dominant one.

Incorporating oil-price terms directly into a reduced-form price equation, Arthur Gandolfi and Lothian took a more direct approach than Darby but reached conclusions qualitatively similar to his. In almost all

of the eight countries they were able to uncover a significant effect in at least one formulation of their equation. However, the significance of such effects in a given country was not at all consistent among equations and the estimated magnitudes in most instances were quite small. In another set of tests, Gandolfi and Lothian incorporated the relative price of basic commodities as an additional variable in their price equations. The results of this exercise were unambiguous: little or no effect in almost all cases.

The other question that is highly relevant to the debate over monetary versus special factors, and which is logically antecedant to our discussion of channels of transmission is the role of the United States as the reserve-currency country. Darby deals with this issue explicitly in one chapter of the NBER volume from both the theoretical and empirical perspectives. In his model, the reserve-currency country's money supply (rather than the world money supply which some others have stressed) is the ultimate determinant of the price level in the rest of the world as well as in the reserve-currency country. This exogeneity of the United States as a source of world inflation rests on two assumptions: that growth in its nominal money supply is independent of changes in its and other countries' reserves and that growth in its real money demand is similarly independent of foreign influences.

Darby evaluated this second assumption by estimating a simple distributed lag relationship between inflation in the United States and growth in M1 over the previous 16 quarters. He found that as the data are averaged over progressively longer periods the explainability of the relationship progressively increased to the point where, when he used four-year

averages, he could account for 97% of the variation in inflation. Hence, if foreign influences were important they only operated in the shorter term, affecting the transition to a new equilibrium rate of inflation, but not the equilibrium itself.

To examine the validity of the first assumption, Darby reestimated the Federal Reserve's reaction function, and included various measures of the balance of payments. He was unable to reject the hypothesis that these variables had no influence, either over the full sample period or the several subperiods that he examines. In contrast, he and Stockman showed elsewhere that balance of payments variables do enter significantly in the money-supply reaction functions of the other seven countries' monetary authorities.

These findings, moreover, square with evidence presented by Cassese and Lothian, by Gandolfi and Lothian, and by Anna Schwartz: Using bivariate causality tests, Cassese and Lothian found no significant effect -- positive or negative -- of the lagged balance of payments on growth in American high-powered money. They did, however, find a significant negative effect running in the opposite direction.

Gandolfi and Lothian's expected money functions that underlie their price equations tell a similar story: In each of the seven foreign countries, monetary growth in the United States or the domestic balance of payments -- sometimes both -- had a significant effect on monetary growth; in the United States, the balance of payments is not significant.

Schwartz presents an historical overview of the period in which she describes the principal events in the international monetary arena and the part the United States played both during the Bretton-Woods years and

afterwards. Her historical account supports the results of the various econometric analyses. Securities denominated in U.S. dollars were the dominant source of increase in international reserves under Bretton-Woods and these outflows had no direct effect on the American money supply. The Federal Reserve System's response to continuing balance-of-payments deficits appeared to go little beyond public statements of concern and cosmetic operations.

II. How Inflation Was Transmitted

The international linkages among national macroeconomies follow four main channels: goods substitution, bonds substitution, currency substitution, and absorption effects. We found evidence that all of these channels were operative, but not so strongly as argued by respective proponents.

Goods Substitution

There are two distinct traditions in the literature as to the nature of the linkages operating through tradeable goods. The first, which we associate with David Hume, views internationally traded goods as substitutes, but not perfect substitutes. Thus, their relative prices may change temporarily as part of the adjustment process initiated by a monetary disturbance.⁴ The second view, which Whitman (1975) associates with the "global monetarists" like Laffer (1975) and which is usually termed price arbitrage, assumes that internationally traded goods indeed are perfect substitutes with prices continuously and rigidly linked. Further consideration of factor competition between tradeable and nontradeable goods results in the "law of one price level" which states that purchasing power parity holds continuously, and not just in long-run equilibrium as in Humean analyses.⁵ Thus the empirical question to be answered is to what extent are goods substitutable internationally, or as Isard (1977) wryly put it: "How far can we push the 'Law of One Price'?"

We and our colleagues have amassed a variety of evidence to support the conclusion of such authors as Isard (1977), Kravis and Lipsey (1977, 1978), and Richardson (1978) that goods are substitutable internationally, but far from perfectly so. The most direct evidence is found in the

relatively weak price effects in the export and import-price equations estimated by Darby and Stockman as part of their simultaneous model. Generally, the relative-price effect on the balance of trade is not large although it does increase over time. Experiments with the simulation version of that model tell the same story: monetary shocks whether originating in the United States or abroad result in Humean movements in relative price levels.⁶

An only slightly less direct sort of evidence is provided by Cassese and Lothian. They use bivariate Granger tests to analyze the relationship between domestic and foreign inflation as well as the relationship between domestic money growth and domestic inflation which we have already discussed. In the inflation comparisons, they use two different measures of foreign inflation. For the United States as well as the seven nonreserve countries they use the percentage change in a nominal-income weighted index of the remaining seven countries' GNP (or GDP) deflators; for the seven nonreserve countries alone, they use the percentage change in the United States deflator. In both instances, the lagged foreign inflation rate was significant in fewer than half the countries.

For their tests of the domestic money-price relationships they used three measures of money -- M1, M2, and high-powered money -- and the consumer price index as well as the deflator. As we have already stated, they found much more consistent effects running from lagged values of money to current inflation than the other way around. Furthermore, these relationships exhibited no tendency to reverse themselves during the shorter fixed rate sample period ending in the third quarter of 1971. Cassese and Lothian's results, thus, stand at odds with the assumption of continuous

price arbitrage with money supplies adjusting with a lag to changes in nominal money demand induced by foreign price shocks.

Gandolfi and Lothian used their reduced-form price equation to conduct tests of the price arbitrage mechanism similar to those discussed above for oil and commodity prices. In the bulk of the comparisons the foreign inflation term was not statistically significant. Moreover, in their regressions with a second-order correction, the United States price variable was only significant in both the CPI and GNP relationships in Japan and the rest-of-world price index only significant in both the relationships in France.

Asset Flows and Monetary Linkages

Recent presentations of the monetary approach to the balance of payments have come to stress "interest arbitrage" rather than price arbitrage on Dornbusch's (1976b, p. 1,162) "assumption that exchange rates and asset markets adjust fast relative to goods markets." The essential idea is that assets are perfect substitutes internationally so that the interest rate in any nonreserve country must equal the interest rate in the reserve country plus the expected depreciation in the exchange rate. So long as the expected depreciation is independent of domestic monetary policy and the balance of payments, this interest parity relationship fixes the domestic interest rate and hence the domestic nominal money supply, price level, and so forth as effectively as did the law of one price level in the early versions of the monetary approach.

This airtight conclusion breaks down if assets (bonds in the macro-economic paradigm) are not perfect substitutes internationally because of

nondiversifiable risk.⁷ In this case capital flows will change the equilibrium domestic interest rate for a given foreign interest rate plus expected depreciation. This is the essence of the portfolio-balance approach pioneered by Branson (1968, 1970) and advanced by Dan Lee and Michael Melvin in separate studies in the NBER volume.⁸ With imperfect asset substitutability there may be movements in relative interest rates analogous to the movements in relative price levels during the adjustment period. Again, the balance of payments effects of the induced capital flows may induce the gradual changes in money supply which ultimately reestablish equilibrium. In this way, the portfolio-balance approach is the asset market analogue to the Humean relative-price adjustment mechanism.

Our evidence is generally consistent with the view that reserve flows induced by a portfolio-balance mechanism were an important channel of international transmission under the Bretton-Woods System. However, the strength of this channel is not overwhelming, and, if we use the simulations as a guide, the actual transmission of effects through this mechanism appears to have been both fairly weak and rather drawn out over time. Besides the evidence of exercise of monetary control examined immediately below, our evidence is of several types: the tests and other assessments of the interest arbitrage mechanism by Cassese and Lothian and by Darby and Stockman, and simulation results with the Mark IV Model.

Cassese and Lothian find that for all seven nonreserve countries lagged American interest rates were a significant determinant of domestic interest rates during the pegged rate period. With the exception of Canada, where the effect was largely in the current quarter, these effects were typically distributed over a number of quarters. Arbitrage, therefore,

appears to have been rather limited in the short-run in most countries, contrary to the implications of perfect asset substitutability, but more powerful in the long run.

Darby and Stockman's estimates of capital-flows equations accord with these findings. With the exception of Japan and the United Kingdom, for which the estimated equations were exceedingly poor, they found a negative but weak relationship between capital flows and either the level or first difference of the domestic versus foreign interest-rate differential adjusted for expected changes in the exchange rate. Simulation experiments, moreover, confirm this impression.

Other Channels of Transmission

The two remaining channels of transmission to be discussed are currency substitution and Keynesian absorption effects. Evidence on both channels comes from the simultaneous model.

The theoretical rationale for currency substitution is that monetary assets denominated in the domestic currency are substitutes in demand with those denominated in the foreign currency. In the extreme case in which both are near-perfect substitutes, German money holders, for example, will be indifferent between deposits in dollars and in DM, so that any contraction in the supply of DM deposits will induce German money holders to increase their deposits denominated in dollars by an equivalent amount in terms of DM. As the supply of money in DM declines, therefore, its velocity rises to offset these decreases with the end result that income flows in Germany are left unaltered. This Radcliffesque view is contradicted by the existence of stable money-demand functions, but it may well be that foreign moneys are substitutes in demand for domestic money.

One test of this proposition has been to include a foreign -- usually United States -- (uncovered) interest rate variable in the domestic money demand function (e.g., Hamburger, 1977; Mills, 1978; and Brittain, 1981). The problem with such tests, however, is that they do not discriminate between currency substitution and more general asset substitution. Indeed our view is that foreign bonds (and domestic bonds also) are generally more important substitutes for domestic money than are foreign moneys. The return to a domestic holder of a foreign bond is the foreign interest rate plus the expected depreciation in the exchange rate.⁹ This more general concept is the one examined in the NBER study.

To do so, Darby and Stockman included a foreign interest rate plus expected depreciation term in each country's money demand function in the Mark III Model. Only for Japan and the United Kingdom was the foreign interest rate statistically significant. In both instances, moreover, the magnitude of the estimated coefficients was exceedingly small. One possible explanation for the disparity between these results and those reported in some other studies may be simultaneous equations bias since our results are obtained in the context of a simultaneous model and the others using single equation approaches.

The traditional Keynesian absorption channel links one country's increase in real income to increased demand for imports and hence increased exports and real income in other countries. On the one hand, regressions of an extended Barro real-income equation find that the distributed lag coefficients on real export shocks are insignificant as a group for all countries at the 5 percent level and for all countries except the United States and Germany at the 10 percent level. On the other hand, absorption

effects were the dominant channel of transmission in simulation experiments for two countries, Canada and the United Kingdom. Their domestic money stocks, as already mentioned, were unaffected by the increase in the money stock in the United States. Increases in their exports, though, affected real income and, in the case of the United Kingdom, interest rates.¹⁰

Whether or not the importance of the absorption channel and unimportance of monetary channels for these countries will survive further study remains to be seen.

III. The Role of Nonreserve Central Banks

Monetary control by nonreserve central banks under pegged exchange rates implies an ability to move domestic interest rates and prices relative to their international parity values. So evidence of monetary control reinforces the direct evidence of imperfectly substitutable assets and goods. The exercise of monetary control is complete or partial according to whether induced reserve flows are completely or partially sterilized. If sterilization is complete, then the central bank chooses the money supply without regard to the induced variations in its reserve assets. Where only partial (or no) sterilization is practiced, the induced reserve flows move the money supply to a point intermediate between that otherwise desired by the central bank and that consistent with the international parity values.

We and our colleagues have accumulated evidence on three aspects of this larger issue: the prevalence and magnitude of sterilization among our sample of nonreserve countries, the degree of short-run monetary control exercised by these countries under pegged exchange rates, and the implications for dynamic stability of this exercise of short-run monetary control.

Traditional presentations of the monetary approach such as Johnson (1976, pp. 152-153) have made the extreme assumption that nonreserve central banks do not sterilize the balance of payments at all. This assumption appears to be made primarily for analytical convenience, since it permits analysis to proceed conditioned upon an exogenously determined domestic credit.¹¹ Some monetary approachers, however, have gone further, taking the no-sterilization assumption as an empirical datum. The reasoning

is that complete sterilization is impossible and partial sterilization, because of the exaggerated movements in the balance of payments it engenders, undesirable to and, hence, not practiced by nonreserve central banks (e.g. Genberg, 1976).

Our study reports the results of three separate investigations of sterilization. Although the approaches are diverse, the conclusions are identical: Partial or complete sterilization appears to have been a universal practice at least for this set of developed nonreserve countries. Our results thus accord well with those reported by both Herring and Marston (1977) and Obstfeld (1980a) for Germany, Hilliard (1979) for Britain, Connolly and Taylor (1979) for a group of ten developed countries¹² and John Price (1978) in earlier work with a preliminary version of our data base for five of the nonreserve countries in our sample.

The first body of evidence in the NBER volume comes from Cassese and Lothian's bivariate causality tests of the relationship between changes in foreign reserves and in domestic credit. They find that generally the balance of payments Granger causes changes in domestic credit, but only for U.K. and Canada is their evidence of a relationship going the other way. Since these tests are limited to the two variables and do not speak directly to the contemporaneous relationship, they are, however, only suggestive.

Darby and Stockman estimate a uniformly specified nominal-money reaction function for all nonreserve countries in the simultaneous-equation environment of the quarterly Mark III International Transmission Model. Their reaction function for Italy had little explanatory value, but for the other six countries, only for Germany and perhaps Japan could the hypothesis of complete contemporaneous sterilization be rejected.¹³ They found that

between 87 percent and all of the contemporaneous effect of the balance of payments on money growth was eliminated by sterilization policies of the nonreserve central banks. However, lagged responses to the balance of payments ultimately induced a positive relationship in all six countries.¹⁴ Thus while quarterly data indicates either complete or partial sterilization, only partial sterilization would be observed in annual data.

Laskar investigated a number of variants of the Mark III reaction functions using different estimation techniques from those of Darby and Stockman and including the lagged scaled reserves stock as an additional argument. This variable enters positively and eliminates most of the explanatory power of the lagged balance of payments terms, but the results are qualitatively the same as Darby and Stockman's except that the Netherlands replaces Japan as one of the two countries for which complete contemporaneous sterilization can be rejected.¹⁵ In other variants of the reaction functions, Laskar found indications that in Japan payments surpluses were completely sterilized but deficits only partially so and that in the United Kingdom, Canada, and France speculative capital flows were partially sterilized while other components of the balance of payments were completely sterilized.

Short-Run Monetary Control

The most striking conclusion of the monetary approach to the balance of payments was that nonreserve central banks are impotent with respect to their domestic money supplies and interest rates but can attain any desired balance of payments via their actions. Either or both of two assumptions have traditionally been offered to justify this conclusion: goods are perfect

substitutes internationally and assets are perfect substitutes internationally.¹⁶ Darby in our volume adds as a third condition **expectations** of depreciation which are too responsive to variations in the **balance** of payments.¹⁷ In recent papers, Stockman (1979) and Obstfeld (1980b, 1980c, 1980d) have emphasized that even if assets are not perfect substitutes, it is sufficient that consumers completely discount future taxes for them to act as if government holdings of foreign bonds were their own. In this case a government exchange of foreign for domestic bonds will induce an exactly offsetting shift in private demands so that monetary control is again lost.

Since any one of these four conditions -- and there are doubtless others -- preclude monetary control, it is difficult to conclusively reject the impotence of nonreserve central banks with respect to their money supplies. Nonetheless, two types of tests have led us to the conclusion that nonreserve central banks did indeed exercise monetary control under pegged exchange rates: First we have the direct evidence on the two major conditions for monetary control which indicates that neither goods nor assets were perfect substitutes internationally. Second we have evidence that the actual growth in the money supply was indeed determined, at least in part, by domestic policy goals.

Four nonreserve countries (United Kingdom, Canada, Germany, and the Netherlands) were examined in some detail in the simulation experiment referred to above. Only Germany displayed any evidence of the balance of payments limiting short-run monetary control. For Germany an immediate, albeit partial, response of domestic nominal money to increased U.S. money was observed, but the balance of payments only slightly offset an upward

shift in the domestic money-supply reaction function. Thus the model estimates do indeed imply substantial short-run monetary control.

Daniel Laskar provides additional evidence on the subject. He deals with a set of smaller single-country models in the tradition of Kouri and Porter (1974), Argy and Kouri (1974), and Herring and Marston (1977). Although his estimation techniques allow for possible endogeneity of the balance of trade, Laskar's analysis of monetary control assumes that the only significant loss of control would occur via offsetting capital flows. The offset coefficient (the fraction of an increase in domestic credit offset by contemporaneous capital flows) is significantly less than one at the five percent level for all countries except Canada, for which the difference is significant at the ten percent level. While some of the offset coefficients are nonetheless quite high,¹⁸ Laskar measures the independence of monetary policy by a scalar that takes account of the extent to which induced capital flows are themselves sterilized. This scalar indicates the fraction of a shift in the money-supply reaction function which will actually be reflected in money growth given the central bank's reaction to the induced balance of payments. Laskar's estimates of it were all significantly different from 0 and none are significantly different from 1, implying a high degree of monetary independence for all seven nonreserve countries.

Since the results of the Mark III International Transmission Model and Laskar's smaller models could conceivably be due to some omitted channels,¹⁹ a set of relatively model-free tests were also performed. These confirmed the results obtained from the structural models. They rely on the fact that absent short-run monetary control, movements in money-supply-reaction-

function variables other than the current balance of payments will be uncorrelated with actual movements in the money supply. Darby, who performed these tests, finds the opposite: the growth of the money supply is indeed dependent on these domestic policy variables in all the countries, except perhaps the Netherlands.

The Dynamic Stability of the Bretton-Woods System

The adjustment process under the Bretton-Woods System, therefore, had the following salient features: (1) The evolution of American monetary and inflationary trends was determined by domestic factors with international forces playing only a transient role. (2) The proximate determinant of inflation in the nonreserve countries is to be found in their own past money supply growth. (3) Changes in American money growth do not cause overwhelming capital flows abroad; trade-flow effects build up only as the resulting inflation shifts relative price levels. (4) These balance-of-payments flows have little or no contemporaneous effects on nonreserve money growth, although the cumulative lagged effect may be substantial.

The essence of the process is lagged adjustment to lagged adjustment to lagged adjustment. The long cumulative lag from an increase in American money growth to an increase in nonreserve inflation can explain the failure of the System. Table 1 shows that the initial increase in American inflation in 1966-1970 occasioned very little concurrent rise in inflation in the nonreserve countries. The cumulative effect was to shift relative price levels by some 8 percent since even as nonreserve money growth rates finally began to rise in response to growing balance of payments surpluses, their inflation rates would respond only with a lag. The large surpluses

of the late 1960s and early 1970s ultimately produced sufficient money growth to surpass American inflation in 1971-1975 and offset about half of the 8 percent change in relative price levels in 1966-1970.²⁰ However, the surpluses ultimately became sufficiently large to induce speculative capital flows which destroyed the System. Furthermore, a full adjustment would have required an even sharper increase in the average nonreserve inflation rate during the catch-up period.

If the inflation targets of the Federal Reserve System and the non-reserve central banks were in harmony, the lagged adjustment process just described might be equal to the relatively small stress implied by random, once-and-for-all shifts in purchasing power parities. Unfortunately the strong upward trend captured in the American money supply reaction function was not reflected in any of the nonreserve reaction functions except the Netherlands.²¹ So while the trend in American money growth brought it closer to those countries (Britain and, later, Italy) which would prefer faster money growth, it simultaneously moved it away from countries such as Germany which would prefer a lower rate of inflation. Thus, the incompatible money-supply rules pursued by the reserve and nonreserve central banks put the lagged balance-of-payments adjustment system to a test beyond its powers.

Given inconsistent money-supply rules and a weak balance-of-payments adjustment mechanism, only two means were available for reconciling the cumulating inconsistencies in price levels: changes in trade and capital controls or revaluation. Of course the former is often a covert and costly version of the latter. As Schwartz recounts in her historical overview, these methods were used, usually sequentially, only in extremis.²²

IV. Policy Conclusions

To us, the results reported in this volume establish beyond a shadow of a doubt the essential monetary nature of the inflation experienced both in the United States and in the seven foreign countries that we and our colleagues have investigated. Special factors -- oil prices, in particular -- may have had some impact on the price levels in these countries but that impact was neither continual nor substantial. Controlling inflation, therefore, reduces to the problem of controlling the nominal stock of money in each of these countries. By extension, that inflation was not controlled is attributable to the failure of policymakers in these countries to exercise control over the nominal stocks of money. In the United States, the reserve-country, that failure was largely a domestic matter, the Federal Reserve either because of ineptness or, as we consider more likely, political pressure, steadily increasing the longer-term rate of monetary growth over this period. In the nonreserve countries, the inability to control monetary growth over the longer term was an inherent feature of the Bretton-Woods System of pegged exchange rates.²³ As we point out below, however, policymakers in some countries seemed to view that constraint differently from those in others, some apparently being content to see their domestic money stock increase with that of the United States.

Experience in the four years after our sample period ended is instructive in both regards. It suggests that in at least three of the seven non-reserve countries -- Germany, Japan and the Netherlands -- policy in the United States was of paramount importance during our sample period. When they severed the fixed exchange rate link, all three were able to contain

inflation to a much greater extent than did the United States. We present these figures in Table 2. Presumably, therefore, had they begun to float their exchange rates earlier, they would have avoided much of the increases in their inflation rates in 1971-1975. The domestic political impetus to higher monetary growth would not have been strong.

In Italy and the United Kingdom that most likely would not have been the case.²⁴ The subsequent behavior of inflation in both suggests that the high rates of monetary expansion and ensuing inflation would have occurred even in the absence of American monetary stimulus.

Canada and France are less clearcut. The fact that both -- Canada particularly so -- have had broadly similar patterns of inflation to that of the United States since the early 1960s regardless of the exchange rate system deprives us of a meaningful counterfactual experiment. But given the attempts of both to revalue their exchange rates vis-à-vis the United States dollar even before the formal break with Bretton-Woods, we are inclined to view them also as heavily influenced by policy in the United States during our sample period.²⁵

Why monetary growth in the United States increased and why some other countries were apparently content to accept, if not add to the inflationary consequences of that monetary growth, are the ultimate questions. Attempting to answer them would draw us far afield from this study. The burgeoning literature in the field of public choice and the related studies of regulation point to directions in which to search. Both suggest that political considerations that make inflation desirable to government policymakers and other officials are the root cause. How to quantify those returns from inflationary monetary policies, how to juxtapose them in a

quantifiable way against the costs, not to mention what role ideas play in the process, are all crucial questions that, at this juncture, appear to us unanswerable.

For the United States, we believe that the only real hope for controlling inflation is the birth of a political consensus in support of an effective monetary constitution. While our preference would be for establishing a prespecified growth path for money and requiring the Federal Reserve System to continuously maintain money within one percent of that path, adoption of a fixed gold or other commodity standard might also serve.²⁶ In any case, it is important that the standard -- whether fiat or commodity -- be understandable and proof against well-meaning tinkering. Otherwise this monetary constitution -- like other constitutional provisions and monetary standards in the past -- may fail with no explicit repeal until long after the fact.

Had the Federal Reserve System been constrained by such a rule in the postwar period, we believe that the United States -- and many other countries -- would have been spared much of the economic loss that high and variable inflation and the periodic half-hearted attempts to check it have brought.

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FOOTNOTES

*This paper summarizes research reported in the forthcoming volume on The International Transmission of Inflation by Michael R. Darby, James R. Lothian, Arthur E. Gandolfi, Anna J. Schwartz, and Alan C. Stockman. Our debts to our coauthors are obvious although we are solely responsible for the opinions expressed here. This work has been funded by grants from the National Science Foundation (grants number APR76-12334, APR78-13072, and DAR-7922874), Scaife Family Trusts, Alex C. Walker Educational and Charitable Foundation, and Relm Foundation. This paper has not undergone the review accorded official NBER publications; in particular, it has not been submitted for approval by the Board of Directors and therefore is not a publication of the National Bureau.

¹The clearest statement of the special-factors view was made by Kaldor (1976). See also, Bruno and Sachs (1979), Fried and Schultze (1975) on oil and Perry (1975, 1980) on wage-push. Laidler and Parkin (1975) and Gordon (1977) have provided particularly useful critical assessments of this view.

²Laidler and Parkin (1975), Meiselman (1975), and Johnson (1976) provide clear statements of the monetary approach to worldwide inflation, but as we shall demonstrate there is considerable room for disagreement among economists who agree that inflation is an essentially monetary phenomenon. Further many economists who stress "special factors" assume that the central bank accomodates those factors by money growth.

³Besides the general authors of the volume, Daniel M. Laskar, Dan Lee, and Michael T. Melvin each contributed individual chapters and Anthony Cassese jointly authored a chapter with Lothian.

⁴Dietrich Fausten (1979) has persuasively distinguished the Humean tradition from the law of one price level discussed below. Either the law of one price level or interest arbitrage (discussed in the next subsection) together with ancillary assumptions can be used to establish the result that the nominal quantity of money demanded in a small economy maintaining pegged exchange rates is determined by foreign factors. Hence the conclusion, if money supply equals money demand, that reserve changes must supply the money not supplied via domestic credit and "the balance of payments is essentially a monetary phenomenon" (Frenkel and Johnson, 1976, p. 21).

⁵The relevant concept of purchasing power parity here is a ceteris paribus one: The purchasing power ratio (real exchange rate) is unaffected in the short-run and long-run equilibrium by a monetary disturbance. This equilibrium value may shift randomly due to such factors as permanent shifts in relative prices.

⁶We refer here only to the Humean effect on relative price levels, since for neither the United Kingdom nor Canada does Darby simulate the working of a specie-flow mechanism. For those countries sterilization prevented any substantial impact on domestic nominal money of an American money shock.

⁷This risk may be with regard to exchange rate changes or to capital controls since exchange-rate crises were international events which would affect many countries simultaneously.

⁸Even if assets were imperfect substitutes internationally, induced changes in the expected exchange-rate depreciation may limit the ability of a nonreserve central bank to choose nominal money growth rates much different from those consistent with interest-rate "parity."

⁹Including this variable and the domestic interest rate in the money demand function is equivalent to Bordo and Choudhri's (1982) approach to currency substitution under their assumption that bonds (but not moneys) are perfect substitutes internationally.

¹⁰Although the distributed lag coefficients on export shocks were insignificant as a group, individual coefficients passed the t-statistic criterion for inclusion in the simulation model.

¹¹Mussa (1976, p. 192) makes it clear that a (partial) sterilization policy will merely induce larger reserve flows under the other monetary approach assumptions.

¹²The large standard errors for their 17 developing countries precluded any definite conclusion for them, but all the point estimates indicated only slightly less active sterilization.

¹³The contemporaneous balance of payments effect on money growth was significantly negative (!) for Italy, but little can be made of this given the poor fit of the regression.

¹⁴In Italy, even the lagged response was negative.

¹⁵The inclusion of scaled lagged reserves is preferable to four quarters of lagged balances of payments if a slow partial adjustment process is operative. Heller and Knight (1978), Heller and Kahn (1978), Bilson and Frenkel (1979), and Frenkel (1980) have made recent contributions to the literature on the demand for reserves by central banks. Bilson and Frenkel have presented evidence supporting the slow partial adjustment mechanism for reserves. Note, however, that a slow partial adjustment of actual toward desired reserves could be accomplished entirely via changes in domestic

credit with no effects on the money-supply; this would correspond to the workings of the monetary approach to the balance of payments. So it is difficult to go directly from the reserves literature to the proper form for the money-supply reaction function.

¹⁶These assumptions must be coupled with supporting assumptions that the contemporaneous effect of money on prices is positive and on the interest rate negative, respectively.

¹⁷This latter is a stability condition explaining perhaps how a central bank might induce overwhelming speculative capital flows; it is not applicable to explaining loss of control absent such a speculative crisis.

¹⁸For example the German offset coefficient of about 0.9 is as high as any of the estimates listed in Obstfeld's (1980a, p. 3) summary of the German evidence and higher than any of the simultaneous equation estimates, including Obstfeld's own.

¹⁹A residual-cross-correlation check for such omitted channels for the Mark III revealed no pattern of significant correlations.

²⁰McKinnon (1980) argues that the comparatively rapid nonreserve money growth and inflation rates in 1970-1976 contradict the view that American monetary policy caused the world inflation. He obviously overlooks that lagged adjustment in the late 1960's requires overshooting of the corresponding American rates in the catch-up period. Such catch-up periods are characteristic of dynamic models in which variables lag behind changes in the growth rates of their long-run equilibrium values.

²¹The strong upward trend in American money growth accounts for an increase of about 5.7 percentage points in the annualized American money

growth rate between 1956 and 1976. For five of the nonreserve countries the coefficient of the time trend was either insignificant or negative. Taking account of implied changes in inflation (but not the balance of payments), the Italian trend would increase money growth by far more (some 19 percentage points) while the Netherlands effect is similar in magnitude (about 7 percentage points).

²²In the simple monetary approach models -- e.g., Dornbusch (1976a) -- devaluations (appreciations) are means to induce domestic inflations (deflations) since international parities hold continuously. On the present Humean view, such revaluations are means of short-circuiting the adjustment process so that appreciations are used to avoid faster money growth and increased inflation.

²³We interpret the Bretton-Woods System here as prohibiting regular changes in valuations for these countries.

²⁴In Britain, in particular, the impetus to inflate appears to have been strong during our sample period: Darby and Stockman find that unemployment entered the Bank of England's reaction function while inflation did not.

²⁵The Canadian versus U.S. dollar exchange rate declined with only minor interruption in 12 quarters prior to the formal demise of fixed rates in February 1973. The franc-dollar rate underwent a similar quarterly decline beginning 6 quarters later in mid-1971.

²⁶We do not wish to suggest that a commodity standard would serve equally well in the short run. Shifts in gold's relative price might be a potent source of short-run instability and occur due to both monetary and

nonmonetary factors. Nonetheless, over long periods of time the average inflation rate converges to 0 under a gold standard with a constant mint ratio.

For the United States fixing an exchange rate with another country is not a viable basis for a monetary constitution. Other countries do have this option as well as the options open to the United States. As the Bretton-Woods System indicated, this option fails as a control on inflation if the reserve country itself lacks an effective monetary constitution or if there is insufficient feedback of reserve flows on the domestic money supply.

TABLE 1
 Increase in Average Continuously Compounded
 Inflation Rates over 1956-1965 Average

Period	United States	Nonreserve Countries	
		Unadjusted	Adj. for Exchange Rate Changes
1966-1970	2.4%	0.6%	0.9%
1971-1975	4.8%	5.6%	8.7%
1966-1975	3.6%	3.1%	4.8%

Source: Table 1-1 of The International Transmission of Inflation.

TABLE 2

Average Continuously Compounded
Growth Rates of Consumer Prices
1977 through 1980

Countries	Periods ¹				
	<u>1977-80</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
United States	9.85%	6.53%	8.71%	12.48%	11.68%
Japan	5.11%	4.70%	3.45%	5.49%	6.79%
Germany	4.12%	3.29%	2.63%	5.24%	5.31%
Netherlands	5.02%	5.09%	3.76%	4.71%	6.53%
Canada	9.28%	9.07%	8.10%	9.32%	10.62%
France	10.45%	8.60%	9.27%	11.16%	12.77%
Italy	15.15%	13.10%	10.96%	17.19%	19.36%
United Kingdom	12.37%	11.46%	8.05%	15.90%	14.08%

Source: Economics Department, Citibank, N.A.

Note: 1. All inflation rates are computed from the quarter immediately preceding to the quarter ending the designated period. The price index used is the CPI or other index of retail prices.