Introduction, Summary, and Conclusions from

The International Transmission of Inflation

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THE INTERNATIONAL TRANSMISSION OF INFLATION

CONTENTS

CHAPTER 1

INTRODUCTION AND SUMMARY

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Inflation became the dominant economic, social, and political problem
of the industrialized West during the 1970s. This book is about how the in-
flation came to pass and what can be done about it. To answer these ques-
tions, we must first discover the nature of the economic linkages which
apparently transmitted inflation from country to country like a contagious
disease. To accomplish all this is a very tall order, but the interrelated
and mutually supporting empirical studies reported in this volume go a long
way toward filling it. This brave boast can be redeemed only by the studies
themselves, but first in this chapter we provide an overview of our results
and how we obtained them.

Our major conclusions can be summarized briefly. As to channels of
transmission, both goods and assets are substitutable internationally but
neither perfectly so. The balance of payments has had no discernable effect
on the American money supply and at least partial sterilization has been a
universal practice among nonreserve central banks although lagged adjust-
ments of their money supplies to the balance of payments are noted. Cur-
rency substitution and the traditional absorption channel provide at most
weak linkages, and the main transmission occurs via the balance of payments
effects of goods and assets substitutability. Our empirical results thus
offer support for the assumptions characterizing the portfolio-balance ap-
proach.

The major cause of the world inflation in the early 1970s was an upward trend in American monetary growth goals. As illustrated in Table 1-1, the American inflation rate increased in the latter half of the 1960s but sterilization policies delayed the impact on the nonreserve countries until the beginning of the 1970s.[1] While the upward trend in American money growth cannot be definitely attributed to any particular factor, it does not appear to be responsive in any significant way to international variables. The major increases in oil prices occurring during 1973 II-1974 I play a supporting role to money growth in explaining the more rapid inflation in the second half of 1971-1975, but coincidental removal of general price controls in the United States and abroad may be even more important. In the latter half of the 1970s, domestic inflation has been determined by the monetary policy of each central bank and cannot be attributed directly to the United States except as the foreign central banks are reluctant to bear the costs of reducing the previously established inflation rate.

This evidence points to two policy conclusions. One has to do with the international monetary system; the other, which partially embraces the first, with the control of inflation. As we see it, a necessary and sufficient condition for a country to reduce its rate of inflation is a reduction in the rate of growth of its nominal stock of money. Our evidence indicates that the myriad of other palliatives that have been proposed in recent years and continue to be advocated in the popular press as well as in scholarly circles are beside the point.

The problem with the Bretton-Woods System was that over time increases in monetary growth in the United States tended to spill over to other countries. Those countries that were more averse to inflation than the United

States, therefore, abandoned pegged rates for floating. Those that wanted to inflate at an even faster pace did the same. Floating exchange rates are thus an integral part of an anti-inflation program in a nonreserve country confronted by inflationary policies abroad. And in our view they are the only viable longer-term alternative in a world in which domestic policy goals differ.

We see no effective means for any country to eliminate inflation absent the political concensus to enforce a monetary constitution which limits the ability of the central bank to print money. Our preference is for a fiat monetary standard with fixed money supply growth, but a gold standard would also serve to provide long-run (if not short-run) stability. A third monetary constitution open to countries other than the United States would be to rigidly fix their exchange rate with a country constrained by an effective monetary constitution.

The strong empirical results summarized at the beginning of this chapter could be achieved only because of the creation of a major new data bank providing consistent quarterly series from 1955 through 1976 for the United States, the United Kingdom, Canada, France, Germany, Italy, Japan, and the Netherlands. James Lothian, who was responsible for its creation, describes this data bank in Chapter 3. Complete documentation and listing is provided in the Data Appendix to this volume together with discussion of access to the data and their extensions on tape and on line. The major advantages of the data bank are longer coverage and somewhat higher quality than the International Monetary Fund data which are the best alternative.

Two other chapters complete the preliminary part of this volume. In the earlier of these Anna Schwartz describes the historical evolution of --

and revolutions in -- the international monetary system. Even the expert practitioner will benefit from this review, particularly as it reminds us of events which appeared trivial as they happened but ultimately proved to have major consequences. The second chapter by Anthony Cassese and James Lothian concludes the preliminaries by beginning the empirical analysis.

Cassesse and Lothian apply Granger-causality tests to a number of pairs of variables. This provides a direct method for eliminating a number of popular hypotheses from consideration and thus serves as a basis for the more structural approaches which follow it. Their tests of domestic money and prices, for example, effectively reject the hypothesis that prices adjust instantaneously via goods arbitrage and then money supplies adjust with a lag; in general the timing relationship is just the reverse. The general lack of support for prices causing money is also contrary to the hypothesis that independent movements in wages or other costs have been accomodated by passive central banks. Comparison of nonreserve country prices with either American prices or an index of foreign prices provide little evidence of causality running in either direction. The strongest evidence for international transmission occurs in the asset markets, but even here nonreserve interest rates generally adjust over time rather than instantaneously to changes in American interest rates. There is some suggestive evidence of sterilization of reserve flows by offsetting changes in domestic credit, but the mostly contemporaneous nature of this issue is ill-suited to the Granger tests.

The second part of the book reports the results of a major effort to build a medium-scale structural model which would permit the data to choose between the monetary, portfolio-balance, and Keynesian approaches.[2] Michael

Darby and Alan Stockman in Chapters 5 and 6 report on the specification

and estimation of the Mark III International Transmission Model. In

Chapter 7, Darby uses a simplified simulation version of this model to draw

out its implications for monetary and fiscal policy in the United States

and the nonreserve countries. He uses the same model in Chapter 8 to

simulate the effect of the 1973-1974 increase in the real price of oil.

Chapter 9 is an extended digression on the Lucas-Barro real income equation

used in the model with mixed success.

The Mark III International Transmission Model is specified and estimated

in two versions corresponding to pegged and floating exchange rates. There

are 67 behavioral equations in the former and 74 in the latter with a

nearly equal number of identities used to close each model. Each country

is described by a domestic macroeconomic subsector and an international

subsector. The domestic sector uses a rational-expectations/natural-rate

approach to determine real income, the price level, and interest rates given

exogenous real government spending and endogenous nominal money and exports.

Nominal money is determined within the subsector by central bank reaction

functions which are responsive to inflation, unemployment or transitory

income, unexpected government spending, and (for the nonreserve countries

only) the scaled balance of payments. The international subsector determines

exports, imports, import prices, capital flows, the balance of payments,

and (for the nonreserve countries in the floating version) the exchange

rate. The model is specified so that goods or capital flows may overwhelm

any attempt at independent nonreserve monetary policy, but whether this is

so depends on the estimated values of various parameters. Other potential

international linkages include a currency-substitution channel in the

money-demand functions, the traditional Keynesian absorption channel, and direct effects of the real price of oil.

The estimation of the Mark III International Transmission Model yielded some surprising results which can be summarized by the statement that linkages among countries joined by pegged exchange rates appear to be much looser or more elusive than has been assumed in many previous studies. In particular, substantial or complete sterilization of the contemporaneous balance of payments appears to be a universal practice among central banks so that domestic credit is properly treated as an endogenous variable. Sterilization policies increase these central banks' control of their domestic money supplies which is made possible by the relatively weak substitutability of goods and assets as estimated in the trade and capital flows equations, respectively. Currency substitution does not appear to provide much of a link either: Foreign interest rates are statistically significant only in the British and Japanese money-demand functions and the coefficients are very small in absolute magnitude.

The slow and weak international transmission estimated in the Mark III Model was explored further in a series of simulation experiments reported in Chapter 7. First a simplified simulation version, the Mark IV International Simulation Model, was created by dropping insignificant variables and combining terms where a priori hypotheses on equality of coefficients were not rejected by the data. The pegged version of the Mark IV Model is dynamically stable and appears to track well the actual values of the variables throughout the eight-year feasible simulation period. Unfortunately dynamic instabilities become important in the floating version after only seven quarters; this apparently reflects the impossibility of adequately

eliminating simultaneous equation bias with the short sample available for some of the floating equations.

Two types of simulation experiments were designed to illustrate the model's implications for monetary and fiscal policy. Care was taken that the experiments were consistent with the actual evolution of nominal money and real government spending in the sample period: The money experiments involved a one-quarter increase in the disturbance of a given country's money-supply reaction function, and the government spending experiments considered a one-quarter increase in unexpected real government spending. The less reliable data for France, Italy, and Japan yielded mutually inconsistent results here as in a number of other instances in this volume. Accordingly, the discussion centers on the other five countries.

Under pegged exchange rates, only the German simulations indicated an immediate if partial movement in the money supply in response to the American money supply shock. The Netherlands money supply also adjusted, but with a lag, while the British and Canadian money supplies seemed unaffected by American monetary policy. These results reflect the weakness of both the estimated international linkages among countries and the liquidity-effect on domestic interest rates. British and German money-supply-shock experiments both indicated considerable control of their respective domestic money supplies at least for the first several years.

The instability of the floating version model precluded much substantive discussion, but the American money-shock experiment was reported to illustrate a possibly perverse effect of the estimated J-curves in import demand equations. Because short-run price elasticity of import demand is much smaller than in the long run, the immediate effect of a depreciation is to

increase the value of imports and so worsen the balance of trade. In the simulations reported, this J-curve phenomenon in a general-equilibrium setting implied that some other currencies initially depreciated in response to an unexpected increase in the American money supply.

The government-spending-shock experiments indicated the largest temporary effects for the American case where the shock implied a permanent increase in the level of real government spending and an induced increase in the money supply. The total multiplier amounted to about 1.5 in the quarter of maximum impact. In the British case, government spending was permanently increased by only about half of the initial shock and even using this small base the peak multiplier is only about 0.75 due to perverse effects of induced money supply changes. No significant effects were estimated in the German case. Only the American fiscal shock had significant international repercussions, and those seemed to be due as much to the increased American money supply as to the induced increases in foreign exports.

In Chapter 8 Darby attempts to assess the role of oil-price increases in the 1970s world inflation. A formal analysis focuses on the two channels by which an effect on the price level might occur: induced decreases in the real quantity of money demanded and induced increases in the nominal quantity of money supplied. The major result is that the theoretical, estimated, and simulated results are not at all robust to changes in specification: The effect on the price level could be as little as 0 or as much as 5 percent; in terms of inflationary trends over say 4 years, this implies only a range of 0 to 1 1/4 percent effect on the average inflation rate. Reference to Table 1-1 will illustrate the sense in which this range implies

that the oil-price shock played at most a supporting role in explaining the 1971-1975 increase in the world inflation rate.

The main reason for the ambiguity in the estimated and simulated price-level effect of the oil-price shock is the coincidental removal of general price controls in a number of countries. Generally speaking, those countries which removed price controls during 1973-1974 are also those for which we obtain a significant decrease in real income (and so real money demand) as a result of the 1973-1974 oil price increase. Only future research can unravel whether these estimated oil-price effects are real or a statistical illusion due to overstatement of measured real income and understatement of the increased price level due to price controls.[3]

A disturbing feature of the Mark III model was the relatively poor explanatory power of the real-income equation for nonreserve countries. This equation explains the growth rate of real income by lagged logarithmic transitory income and current and lagged values of the shocks (innovations) in nominal money, real government spending, and real exports. It is thus an extended version of Barro's approach to solving a standard aggregate demand curve in conjunction with the Lucas aggregate supply function. Experiments reported in this chapter show that distributed lags on the actual rather than unexpected value of the aggregate demand variables do no better for the nonreserve countries and worse for the United States. While the relatively poor nonreserve country results may be due to greater measurement problems, these results do suggest a cautious approach toward application of the Barro-Lucas equation.

The third part of this volume continues examination of the degree to which national economies are linked in statistical environments other than

the Mark III and IV Models. The authors of these four chapters either apply a relatively model-free approach or else use smaller scale models so that the results are more simply interpreted. Darby and Laskar in Chapters 10 and 11, respectively, both test for the exercise of monetary control by nonreserve central banks under pegged exchange rates. They show that previous tests were biased by failure to control for sterilization and that monetary control was in fact exercised by these central banks. The implied ability of sterilized intervention to affect floating exchange rates is developed by Dan Lee in a dynamic portfolio-balance model. In Chapter 13, Michael Melvin provides further empirical evidence for the portfolio-balance approach by introducing exchange-rate-risk covariance measures implied by the internation-asset-pricing model.

In Chapter 10, Darby develops a convenient expositional model which includes as special cases variants of the monetary approach both with and without sterilization. This framework makes domestic credit, which is endogenous with sterilization, a superfluous concept. The analysis illustrates two points: (1) Factors (other than the current balance of payments) appearing in the nominal-money reaction function will be uncorrelated with actual growth in nominal money if either variant of the monetary approach holds. (2) Expectational instability may imply a limited feasible range within which monetary control can be exercised.

The first of these two conclusions underlies Darby's empirical test of the null hypothesis that the nonreserve countries did not exercise control over their domestic money supplies. This hypothesis could be rejected at the 5 percent level or better for six of the seven countries, the exception being the Netherlands.

Laskar specifies a set of small-scale models to test whether offsetting capital flows defeat attempts by partially sterilizing central banks to exercise monetary control. The "offset coefficient" is significantly less than the no-control value for six countries at the 5 percent level and for Canada at the 10 percent level. Laskar goes further to measure the fraction of a shift in the money-supply reaction function which will actually be reflected in money growth when account is taken of the extent (always significant) to which the central bank sterilizes the induced capital flows. He finds that this fraction is always significantly greater than 0 and in no case significantly less than 1.

Due to dynamic instabilities, the floating version of the Mark IV International Simulation Model is relatively uninformative as to the effects of nonreserve monetary and exchange policy. Dan Lee provides a theoretical analysis of the effects of foreign exchange and open market operations consistent with imperfect substitutability of assets and strong expectational effects on interest rates. He reconciles long-run neutrality with differential short-run effects on exchange rates and interest rates of the two means of creating money. Of particular interest is his analysis of the lack of overshooting in the exchange-rate if rational inflation expectations cause the nominal interest rate to rise during the adjustment to an unexpected increase in the money supply.

Michael Melvin demonstrates that it is possible to specify proxies for exchange-rate risk which are consistent with standard finance theory and also contribute significantly to the explanatory power of net-capital-flow equations in the partial adjustment formulation. His attempts to replace the capital-flows equations in the Mark III Model with his own

formulation proved unsuccessful, however, due to the absence of a satisfactory correlation between the risk variables and the instrument variables. When Melvin uses an alternative data set covering 1973-1978 the empirical dominance of his formulation improves over standard formulations. His results thus provide single-equation estimation results supportive of the empirical value of the portfolio approach.

Part 4 addresses the question of what were the causes of the late 1960's and 1970's inflation in the United States and our other seven industrialized countries. In Chapter 14, Gandolfi and Lothian use a reduced-form price equation derived along the lines of Barro (1978) to assess the relative roles of domestic money, international price and monetary developments, and oil-price changes. Next Darby shows that purchasing-power parity can be a useful paradigm for understanding the harmonization of inflationary trends even though the predictability of the purchasing-power ratio deteriorates over time. The same analysis explains why monetary growth variations may explain nearly all variations in trend inflation rates despite random permanent shifts in the money-demand function such as reported by Gandolfi and Lothian. In Chapter 16, Darby confirms their findings that American money-supply growth has evolved independently of foreign influences and goes further to show that variations in American money growth explain practically all variations in American inflation trends. Thus an exogenous rise in American inflationary trends operating primarily via monetary channels to maintain purchasing-power-parity growth trends is found to be the dominant source of the inflation which infected the industrialized West in the early 1970's.

Specifically, Gandolfi and Lothian combine a Lucas-aggregate-
supply function and a conventional money-demand function to obtain a
reduced-form price equation in nominal money, permanent income, the
long-term interest rate, and a distributed lag on money supply shocks.
International factors enter these basic equations only indirectly through
expected money supply as lagged scaled balances of payments or American
money growth are found significant as predictors of current money growth.
The authors tried adding foreign variables which might shift the aggre-
gate supply function directly into their basic price equations: the
real price of oil, a world commodity price index, the American price
deflator, and a rest-of-world price index. These variables were generally
insignificant although the oil-price was significant in nearly half of
the cases examined. When the estimated fraction of total inflation attri-
butable to oil prices increases was computed, this had a median value of
only 15 percent for 1973-1974 or 9 percent over the longer period of 1973-
1976.[4] In summary, Gandolfi and Lothian's results indicate that domestic
monetary developments rather than foreign price movements were the dominant
proximate determinant of price behavior with at most a supporting role for
the oil price increase even during 1973-1974.

In Chapter 15, Darby focuses on the statistical paradox that the
variance of average growth rate of the purchasing-power ratio goes to 0
as the prediction interval increases while the variance of the level
of the same ratio goes to infinity. He uses data from 1971 through 1978
to illustrate that substantial variations in the level of the purchasing-
power ratio may occur even though the (exchange-rate converted) reserve-
country inflation rate adequately explains the domestic inflation rates

in the nonreserve countries. The point is to illustrate the dominance of systematic factors in explaining trend inflation despite the presence of significant random-walk-type elements moving other price levels relative to that of the United States.

Darby elaborates this theme further in Chapter 16. First he shows that world inflation trends are determined exogenously under pegged exchange rates within the reserve-currency country if both its nominal-money-supply and real-money-demand growth are unresponsive to foreign influences. The American money-supply reaction function is explored at length in search of a response to either gold flows or the balance of payments on official reserves settlement basis. Since only insignificant and generally perverse effects of these variables are estimated, the conclusion is that American nominal money growth is indeed exogenous with respect to foreign influences. Finally, Darby turns to the question of whether or not the foreign influences on American real money demand detected with quarterly data have any significant influence on its trend growth rate. While a substantial fraction (40 to 20 percent) of the variance of inflation cannot be explained by nominal money growth using quarterly, annual or biennial observations, this drops to only 3 percent for quadrennial observations. Thus factors -- domestic or foreign -- other than nominal money growth variations play no appreciable role in explaining variations in either the growth rate of the real quantity of money demanded or the American inflation rate.

We conclude that American inflation caused by the Federal Reserve System was an exogenous source of world inflationary trends. Because of the unwillingness of their central banks to appreciate or float their currencies until in extremis, the nonreserve countries too caught the American disease.

The lag of the nonreserve countries behind the American lead noted previously in Table 1-1 reflects the operation of a slower specie-flow mechanism rather than the smooth contemporaneous adjustment posited by the monetary approach. This mechanism may have accentuated the variability of the nonreserve inflation rates during the catch-up period of the early 1970's as increasing balance of payments surpluses finally induced very rapid money supply growth.

We opened this chapter with a summary of the conclusions that we have drawn from the research reported both in this volume and by others. Those conclusions and the reasons for them are presented in detail in the final chapter. If the research reported here has gone a long way toward answering basic questions about linkages among countries and the causes and cures of the recent inflation, it is only because there was so much to do. More remains and we close by outlining a program of promising areas for future research.

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Darby, Michael R., <u>Intermediate Macroeconomics</u>,New York: McGraw-Hill Book Co., 1979.

FOOTNOTES TO CHAPTER 1

[1] The initial resistance to the increased U.S. inflation may explain the larger increase in nonreserve inflation during 1971-1975. Using decade averages, U.S. inflation increased by 3.56 percentage points from 1.97% for 1956-1965 to 5.53% for 1966-1975 while nonreserve inflation increased by 3.14 percentage points from 3.60% to 6.74%, respectively. Thus the 1971-1975 burst of nonreserve inflation may be a partial "catch-up" of the sort emphasized in Darby (1979): a lagged initial movement in the growth rate compensated for by subsequent over-shooting. The last two columns of Table 1-1 demonstrate that these patterns are despite -- not due -- to changes in exchange rates.

[2] We use the term monetary approach to refer to the class of models in which goods, assets, or both are perfectly substitutable internationally so that the money supply adjusts under pegged exchange rates to equal the quantity demanded at the international parity values. The Keynesian approach refers to those that assume price and interest-rate linkages are negligible and concentrate instead on the absorption channel (increased foreign income implying increased domestic exports and vice versa). In between these extremes lies the portfolio-balance approach which incorporates substantial but not perfect price and interest rate linkages so that both foreign and domestic influences simultaneously determine a nonreserve country's money supply, prices, and interest rates.

[3] As price controls are removed and hidden price increases measured, removal of understatement in the deflators would cause a decrease in reported real output and increase in the reported price level.

[4]These numbers are for the estimates made with a second order auto-regressive correction.

TABLE 1-1

Average Continuously Compounded Inflation Rates

1956 - 1975

Period[1]	United States[2]	Nonreserve Countries[3]	All 8 Countries[4]	Adjusted for Exchange Rate Changes[5]	
				Nonreserve Countries	All 8 Countries
Quinquenia:					
1956-1960	2.28%	3.25%	2.74%	2.26%	2.27%
1961-1965	1.66%	3.96%	2.74%	3.96%	2.74%
1966-1970	4.32%	4.25%	4.29%	4.01%	4.18%
1971-1975	6.74%	9.22%	7.90%	11.84%	9.13%
Decades:					
1956-1965	1.97%	3.60%	2.74%	3.11%	2.50%
1966-1975	5.53%	6.74%	6.10%	7.92%	6.66%
Others:					
1956-1970	2.75%	3.82%	3.26%	3.41%	3.06%
1971-1973I	4.50%	6.46%	5.41%	13.50%	8.71%
1973II-1975	8.57%	11.48%	9.94%	10.48%	9.47%
1956-1975	3.75%	5.17%	4.42%	5.52%	4.58%

Notes:

1. All inflation rates are computed from the quarter preceding the indicated period to the quarter which ends the period (e.g., average logarithmic change from fourth quarter 1955 to fourth quarter 1960).

2. The basic price index is the GNP deflator.

3. The seven nonreserve countries are Canada, France, Germany, Italy, Japan, the Netherlands, and the United Kingdom. The deflators used are detailed in Table 6-20 below. The seven-country price index is geometrically weighted by nominal income weights (see Table 5-7 below).

4. The eight-country price index is geometrically weighted by nominal income weights (see Table 5-7 below).

5. In these indexes, all nonreserve deflators were divided by the exchange rate (domestic currency/U.S. dollar) before computing the geometrically weighted average.

CHAPTER 17

Conclusions on the International Transmission of Inflation

Michael R. Darby and James R. Lothian*

Science is organized knowledge.
          - Herbert Spencer

It is better to know nothing than to
know what ain't so.
          - Josh Billings

The goal of empirical research in any science is to maximize the number
of assumptions which can be securely included in the body of theory. While
empirical research can never establish the truth of any statement about the
world, conformity of the world to a particular hypothesis in repeated and
varied trials does give us confidence to incorporate the hypothesis into the
set of assumptions which we use to make scientific predictions. In cases in
which data or measurement tools are lacking, a hypothesis may gain wide cur-
rency based not on solid empirical successus but on logical, aesthetic, or
even political grounds. One example in economics would be the Phillips
curve, another much of the Keynesian revolution. Because of awesome data
problems, international finance has been particularly prone to intellectual
fads in which particular assumptions achieve dominance based more on the
intellectual force of their proponents than the strength of supporting em-
pirical evidence.

With many contending and inconsistent hypotheses in the field, once
the data are available it merely takes hard work to find that some of them
are very unlikely to be true given the observations. Thus the greatest
contribution of this project must be the creation of the consistent set of

data on which the rest of our research is based. We have explored the conformity of this data set to the implications of certain popular hypotheses relevant to the international transmission of inflation. These tests, besides their intrinsic interest, served as a quality check on the data by highlighting any questionable observations.

Our conclusions from the tests reported in this volume can be organized around four related issues: monetary versus other explanations of inflation, the channels of international transmission of inflation, sterilization and monetary control, and alternative monetary arrangements. These are presented in Sections 17.1 to 17.4, respectively. We write finis by proposing a number of topics for future research suggested by our analyses of the data.

17.1. Money Versus Special Factors

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 1974-75.[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]

In broad outline, both explanations are consistent enough with the facts that neither can be ruled out. The relative prices of agricultural commodities did increase markedly immediately prior to and during the peak inflation years. So also did the relative price of oil. Increases in monopoly power might have accounted for inflation up until that point. At least there was general concern in government and among a relatively large segment of economists that they did. Moreover, inflation abated for a time once commodity prices fell in relative terms and oil prices ceased rising so rapidly.

By the same token, monetary growth in the United States accelerated substantially after 1965. Fixed exchange rates via a variety of channels would normally have been expected to spread that inflationary American monetary impulse to other countries. Moreover, monetary growth in most

other industrial countries followed the same general pattern as monetary growth in the United States.

To students of economic history and the history of economic thought, the current 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's (1920) discussion of explanations of inflation that rely purely on movements in relative prices as an example: "Obviously no explanation of a general rise of prices is sufficient which merely explains one price in terms of another" (p. 14). He soon added, "[n]or will special causes working on selected commodities prove to be general enough to explain the concerted behavior of commodities" (p. 16). Fisher concluded instead that the available empirical evidence indicated that ". . . the chief disturber of the peace, so far as the purchasing power of money is concerned, has invariably, or at any rate almost invariably, been money itself, not the goods which money purchases" (p. 35).

Though Fisher was writing in 1920, his argument could easily have been a response 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 is 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.

Our own evidence on the subject lends very little support to the most recent reincarnation of the special-factor explanation of inflation. In spite of this hypothesis' broad popular appear and rather widespread support in economic policy circles, we find that at best it can account for only a minor fraction of the inflation in the first half of the 1970s. Monetary factors, we find, 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. Cassese and Lothian in Chapter 4 report just the opposite with lagged money growth significantly affecting prices but not vice versa. We conclude -- as have others -- that a viable special-factors hypothesis must rely on increases in the price of oil and other commodities.

Darby in Chapter 8 reviews the theoretical underpinnings of the special-factor hypothesis as applied to oil before going on to test and otherwise evaluate its validity. The gist of the conclusions he reaches in the theoretical analysis is that for the special-factor hypothesis to make sense either of two things would have had to have happened: real income would have to have fallen or monetary growth have been increased in response to oil-price shocks.

To assess the importance of the first of these two avenues of influence, Darby incorporates oil-price terms into the real-income equations of the Mark III Model. Since these equations did not perform even tolerably well for three of the eight countries in the sample at the outset, he focuses upon the remaining five. In only three of these five cases are 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 considers 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, Darby concludes that the estimated reductions in real income may well be spurious.

So that he can 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 performs a simulation experiment with the Mark IV Simulation Model. Unfortunately, these results are not at all conclusive. For several countries, the simulations are distorted by theoretically perverse effects. In the remaining instances, the problem of price controls coupled with the differences in behavior among countries, makes it impossible to say anything definitive about "the" influence of oil prices on the price level: The price level might be increased by 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 quinquenium. 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 their price equation in Chapter 14, Gandolfi and Lothian take a more direct approach than Darby but reach conclusions qualitatively similar to his. In almost all of the eight countries they are able to uncover a significant effect in at least one formulation of their equation. However, the significance of such effects in a given country is not at all consistent among equations. It varies both by the model of the error structure and by the measure of the price level that they use. Even if one ignores these differences and focuses upon the equation most favorable to the oil-price hypothesis, the estimated effects in most countries are still not terribly large.

In another set of tests, Gandolfi and Lothian incorporate the relative price of basic commodities as an additional variable in their price equations. The results of this exercise are unambiguous. In their regressions with a correction for second order serial correlation, the commodity price variable enters significantly only two times: for Canada with the GNP deflator but not the CPI used as the measure of the price level and Italy with the CPI, but not the GNP deflator.

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 Chapter 16 from both the theoretical and empirical perspectives. Schwartz

in her historical overview of the period in Chapter 2 describes the principal events in the international monetary arena and the part the United States played both during the Bretton-Woods years and afterwards. Also of interest are Cassese and Lothian's analysis of movements in American and foreign money and Gandolfi and Lothian's estimates of expected money functions.

Darby's theoretical model in Chapter 16 illustrates the importance of the reserve currency country in a world of fixed exchange rates. In the 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 evaluates 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 finds that as the data are averaged over progressively longer periods the explainability of the relationship progressively increases to the point where, when he uses four-year averages, he can account for 97% of the variation in inflation. From this exercise, he concludes that 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 reestimates the Federal Reserve's reaction function, and includes various measures of the

balance of payments. He finds that he cannot reject the hypothesis that these variables had no influence, either over the full sample period or the several subperiods that he examines. In contrast, in Chapter 6 he and Stockman show 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 that Cassese and Lothian present in Chapter 4 and that Gandolfi and Lothian give in Chapter 14. Using bivariate causality tests, Cassese and Lothian find no significant effect -- positive or negative -- of the lagged balance of payments on growth in American high-powered money. They do, however, find a significant negative effect running in the opposite direction.

Gandolfi and Lothian's estimates of the 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 -- has a significant effect on monetary growth; in the United States, the balance of payments is not significant.

Schwartz's review in Chapter 2 of the institutional framework of the Bretton-Woods system supports the results of the econometric analysis. 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.

We turn next to a detailed examination of the channels of international transmission which explicates how a homegrown American inflation was exported to the industrialized West.

17.2. Channels of Transmission

The international linkages among national macroeconomies follow four main channels: goods substitution, bonds substitution, currency substitution, and absorption effects. The previous chapters have disclosed evidence that all of these channels have been operative, but not so strongly as argued by respective proponents. In this section we examine these arguments and the empirical evidence. Section 17.3 then presents evidence on the extent to which central bank sterilization policies frustrated or delayed the international transmission of inflation under the Bretton-Woods System.

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.[3] The second view, associated by Whitman (1975) with the "global monetarists" like Laffer (1975) and 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 tradable and nontradable 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.[4] 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'?"

In this volume we have reported 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. This evidence can be arranged on a spectrum from direct to most roundabout. The latter, which infers that goods (and assets) are imperfect substitutes from the ability of nonreserve countries to exercise independent monetary policies under pegged exchange rates, is presented at length in Section 17.3. The remainder of the evidence is considered here.

The most direct evidence is found in the relatively weak price effects found in the export and import-price equations estimated by Darby and Stockman in Chapter 6.[5] Generally, the relative-price effect on the balance of trade is not large although it does increase over time. Experiments with the Mark IV International Simulation Model confirm that Humean movements in relative price levels are implied by monetary shocks whether originating in the United States or abroad.[6]

An only slightly less direct sort of evidence is provided by Cassese and Lothian in Chapter 4. They use bivariate Granger tests to analyze two relationships: domestic versus foreign inflation and domestic money growth versus domestic inflation. 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. For all eight countries, they find a much more consistent effect running from lagged values of money to current inflation than the other way around. Furthermore, these relationships exhibit 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.

In Chapter 14, Gandolfi and Lothian use their reduced-form price equation to conduct tests of the price arbitrage mechanism similar to those discussed in Section 17.1 for oil and commodity prices. Like Cassese and Lothian, they use both the price level in the United States and a weighted average of the price levels in the seven countries other than the one being analyzed as alternative measures of foreign prices. In the great bulk of the comparisons these measures are not statistically significant. Moreover, in their regressions with the second-order correction, the United States price variable is 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. They conclude: "Some evidence of price arbitrage, therefore, exists but even on the most favorable interpretation of the evidence it is weak and hardly universal." Similarly weak results with a preliminary version of the Mark III Model were reported in Darby (1979).

Darby examined the predictive power of purchasing power parity under floating exchange rates in Chapter 15. His results do not speak to the

This airtight conclusion breaks down if assets (bonds in the macro-economic paradigm) are not perfect substitutes internationally because of nondiversifiable risk.[10] 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 Chapters 12 and 13 of this volume.[11] 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.

The evidence in this volume 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 in Section 17.3 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 Darby's simulation results with the Mark IV Model.

Cassese and Lothian report in Chapter 4 that for all seven nonreserve countries lagged American interest rates were a significant determinant of the domestic interest rates during the pegged rate period. With the exception

issue of whether goods are perfect substitutes since changes in the parity value may occur due to permanent changes of relative prices.[7] The major implication for examining historical data is that as the period of observation is increased, the level of the purchasing power ratio becomes less predictable while its growth rate becomes more predictable.[8]

Asset Flows and Monetary Linkages

We have already suggested that the substitutability of goods may transmit inflation from country to country not only by direct price arbitrage but also by inducing changes in the money supply. The money supply changes are supposed to result from the effect of the trade balance on the balance of payments. Asset flows may provide important balance of payments effects even if the trade balance responds only weakly to a monetary disturbance. The extent to which the balance of payments affects the nominal supply of money is discussed at length in Section 17.3.[9]

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. 1162) "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.

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 on the basis of their estimates of capital-flows equations concur in Chapter 6. With the exception of Japan and the United Kingdom, for which the estimated equations were exceedingly poor, they find 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. The Chapter 7 simulation experiments confirm this impression. For Germany substantial capital flows result in _partial_ contemporaneous harmonization of domestic money growth to an American monetary shock, but a domestic money shock does not induce large offsetting reserve flows. For the Netherlands, balance-of-trade effects seem quite as important as capital flows. However, in neither Canada nor the United Kingdom are the simulated effects of the increase in the nominal stock of money in the United States at all substantial. An important reason that the simulated capital flows are so weak and easily sterilized is the small estimated liquidity effect of money shocks on domestic interest rates.[12]

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 estimates of the model presented in

Chapter 6 and the results of the simulation experiments described in Chapter 7.

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 German DM declines, therefore, its velocity rises to offset 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. Miles (1978) follows this procedure for Canada, justifying the inclusion of the variable within the context of a model similar to that used by Chetty (1969) in his investigation of the substitutability of monetary assets within the United States. Other studies of this type are Hamburger (1977) and Brittain (1981). An alternative procedure, which Brittain also follows, is to examine the cross-correlations of the residuals from simple regressions of velocity on time. The authors of all of these studies find support, to varying degrees, for the currency-substitution hypothesis. Bordo and Choudhri (1982) note that the differential cost of holding foreign instead of domestic money is the expected change in the

exchange rate, but this variable does not enter the Canadian demand for money. Further, their reexamination of Miles's work shows that his finding of currency substitution was spurious.

These tests are generally ill-suited to differentiate between currency substitution and the more general concept of asset substitution. Indeed we would argue that foreign bonds (and domestic bonds!) 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.[13] This more general concept has been examined in this volume.

Darby and Stockman include a foreign interest rate plus expected depreciation term in each country's money demand function in the Mark III Model. For the nonreserve countries they use the three-month U.S. Treasury bill rate; for the United States they use the three-month U.K. treasury bill rate.[14] Only for Japan and the United Kingdom is the foreign interest rate statistically significant. In both instances, moreover, the magnitude of the estimated coefficients is exceedingly small. One possible explanation for the disparity between our 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. We conclude that foreign asset substitution for domestic money is not an important channel of economic transmission among countries.

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 (reported in Chapters 6 and 9)

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. These results suggest that the absorption channel is empirically irrelevant. On the other hand, absorption effects are the dominant channel of transmission in the 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, however, affected real income and, in the case of the United Kingdom, interest rates.[15] Whether or not the importance of the absorption channel and unimportance of monetary channels for these countries will survive further study is an interesting question.

Summary

Neither goods nor assets appear to be perfect substitutes, but both the trade balance and capital flows are responsive to movements in foreign prices and (expected-exchange-rate-change-adjusted) interest rates relative to their domestic counterparts, with the response increasing over time. Only weak evidence was found in support of either asset-substitution effects on money demand or absorption effects on real income.

17.3. Sterilization and Monetary Control

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.

In this section, we will assess our evidence on three aspects of this larger issue: the prevalence and magnitude of sterilization among our sample of nonreserve countries, whether short-run monetary control was in fact exercised by these countries under pegged exchange rates, and the implications for dynamic stability of their exercise of short-run monetary control. Finally, we draw out the implications of this evidence for the effects of central-bank intervention in the foreign exchange markets under floating exchange rates.

The Prevalence and Magnitude of Sterilization

Complete sterilization occurs if the contemporaneous scaled balance of payments (B/H) does not enter into the nonreserve central bank's money supply function.[16] No sterilization occurs if the contemporaneous scaled balance of payment enters that reaction function with a coefficient of 1 so that the money growth rate is (B + ΔD)/H where the scaled-domestic-credit

change $\Delta D/H$ is determined independently of the balance of payments. Partial sterilization occurs if central bank behavior falls between these extremes.

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. Mussa (1976, p. 192) makes it clear, for example, that a (partial) sterilization policy will merely result in exaggerated movements in the balance of payments under the other assumptions of the monetary approach. To the extent that proponents of the monetary approach have not taken this assumption seriously, it is hoped that the generalized monetary approach model presented in Chapter 10 will demonstrate by example that sterilization presents no real analytical or expositional inconvenience.

In the past, at least, some monetary approachers have taken the no-sterilization assumption to be a true statement of how the world operates. The reasoning of Genberg (1976, p. 322) is typical: The nominal money supply is determined by the international parity values of prices and interest rates; so complete sterilization is impossible. Further, partial sterilization results in exaggerated movements in the balance of payments with no effect on the money supply; this is not attractive to a central bank and so the policy will not be attempted. There are two empirical statements here: (1) Nonreserve central banks have no monetary control. (2) They are aware of that lack of control and averse to exaggerated movements in the balance of payments. Thus sterilization is an empirical, not a theoretical question.

Nonreserve central bank behavior is quite strictly limited if they are to eschew sterilization. They must formulate their policy in terms of

their holdings of assets denominated in domestic currency and forswear any goals as to domestic interest rates or money supply. Herring and Marston (1977) and Hilliard (1979) conducted exemplary studies indicating that the German and British central banks, respectively, indeed did follow active policies of sterilization. Obstfeld (1980a) confirmed Herring and Marston's results for Germany. Connolly and Taylor (1979) used a very simple monetary model, but still found significant evidence of sterilization for the ten developed countries they examined, even over periods as long as two years.[17] In work using preliminary versions of our data bank and single equation methods, John Price (1978) also found evidence of substantial sterilization for five nonreserve countries.

Three separate investigations of the existence of sterilization policies have been reported above in Chapters 4, 6 and 11. 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.

Cassesse and Lothian use bivariate causality tests in Chapter 4 to examine the relationship between changes in foreign reserves and changes 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, we do not view them as more than 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

results for the pegged exchange rate period are summarized in Tables 6-7 and 6-8 above. The 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.[18] Stated differently, 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.[19] Thus while quarterly data indicates either complete or partial sterilization, only partial sterilization would be observed in annual data.

Laskar investigates a number of variants of the Mark III reaction functions in Section 11.3 above. Aside from differences in estimation technique, the major innovation in Laskar's specification is the inclusion of the lagged scaled reserves <u>stock</u>. 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 those in Chapter 6 except that the Netherlands replaces Japan as one of the two countries for which complete contemporaneous sterilization can be rejected.[20] 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 are partially sterilized while other components of the balance of payments are completely sterilized.

It is clear that money-supply reaction functions are a fertile area for future research, but the work reported here in conjunction with earlier

work strongly indicates that partial or complete sterilization is standard operating procedure among nonreserve developed countries maintaining pegged exchange rates. Besides the implications for monetary control to be discussed immediately below, this implies that changes in domestic credit are simultaneously determined with the balance of payments. Therefore the standard single-equation estimates explaining the balance of payments by changes in domestic credit and money demand variables tell us little about the validity of the monetary approach to the balance of payments.[21]

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.[22] Darby in Chapter 10 adds a third condition which would imply a lack of monetary control: expectations of depreciation which are too responsive to variations in the balance of payments.[23] 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 sup-
plies. Nonetheless, the hypothesis is a scientific one and so tests can be
derived. 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 direct evidence on the two major conditions which in-
dicates that neither goods nor assets are perfect substitutes internation-
ally; this evidence was discussed in Section 17.2 above. Second we have
evidence that the actual growth in the money supply is indeed determined, at
least in part, by domestic policy goals.

One way to see whether nonreserve central banks in fact exercised mone-
tary control is to specify and estimate a structural model and then deter-
mine the implications of the estimates. The Mark III International Trans-
mission Model described in Chapters 5 and 6 is our major effort of this
sort. A simplified version (the Mark IV Simulation Model) was used in
Chapter 7 to determine how the significant channels of international trans-
mission interact, particularly with respect to monetary control. Four non-
reserve countries (United Kingdom, Canada, Germany, and the Netherlands)
were examined in some detail, and only Germany displayed any evidence of the
balance of payments limiting short-run monetary control. For Germany an im-
mediate, 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 in Chapter 11 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 <u>trade</u>, 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,[24] Laskar measures the independence of monetary policy by a scalar A which takes account of the extent to which induced capital flows are themselves sterilized. This A 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 A are all significantly different from 0 and none are significantly different from 1. Thus a high degree of monetary independence is estimated for all seven nonreserve countries.

Both the results of the Mark III International Transmission Model and Laskar's smaller models may be criticized as being due to some omitted channels such as that suggested by Stockman (1979) and Obstfeld (1980b, 1980c, 1980d) as described above.[25] A set of relatively model-free tests were performed, however, that confirm the results obtained from the structural models. These tests 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. If unemployment increases, the central bank might want to increase money growth but the induced balance-of-payments deficit will dissuade it from doing so. As reported in Chapter 10, the growth of the

money supply is indeed dependent on these domestic policy variables in all
the countries, except perhaps the Netherlands.

Taken as a whole, the evidence from this volume and the work of
others can be summarized as follows: The central banks of developed non-
reserve countries can exercise independent monetary control in the short run
under pegged exchange rates. Induced changes in the balance of payments will
deter them somewhat from deviating from the reserve country's policy, but
domestic goals appear to be generally dominant in determining actual money
growth.

The Dynamic Stability of the Bretton-Woods System

The idealized Bretton-Woods System survived only some fifteen years
from the general restoration of dollar convertibility to the breakdown of
1971. We can now assess the weaknesses in the adjustment process which led
to this dynamic instability and then consider briefly alternative means of
achieving equilibrium.

The adjustment process can be described by the following salient fea-
tures: (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 nonre-
serve 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 17-1 illustrates 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 off-set about half of the 8 percent change in relative price levels in 1966-1970.[26] 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.

What lessons can be drawn? First, the asset-flows channel was too weak to induce large immediate balance of payments effects. This may reflect more the weakness of the liquidity effect on interest rates than the unresponsiveness of asset flows to movements in interest rates.[27] Second, Humean relative-price movements do characterize the adjustment process. Third, sterilization policies did result in exaggerated balance of payment flows -- some speculative -- which ultimately caused a very rapid increase in nonreserve money growth.

Besides this adjustment process, three other means were available to reconcile short-run monetary independence with long-run equilibrium:

harmonization of inflation targets, progressive changes in trade and capital barriers, and revaluations. The first of these may be viewed as an alternative means of harmonizing foreign and American inflation rates while the latter two are means of avoiding that harmonization.

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.[28] Indeed, the average nonreserve inflation rates were 3.25%, 3.96%, and 4.25% in the three quinquennia ending with 1966-1970, and the final increase can be attributed to the incipient effects of increased U.S. inflation. 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 may be thought of as a covert and costly version of the latter. As recounted in Chapter 2, these methods were used, usually sequentially, only in extremis.[29] The relaxation of controls at the time of revaluations is the apparent explanation for the

generally much larger coefficients on foreign prices than exchange rates in both export and import-supply equations in the Mark III Model.[30]

In summary, the balance-of-payments adjustment mechanism was too slow and too weak to reconcile money growth in the face of inconsistent central bank inflation goals. Repeated revaluations and fluctuations in controls were a politically unacceptable alternative, and thus was born the floating regime which has evolved since 1971.

Intervention under Floating Exchange Rates

The short sample period permits little by the way of direct evidence on the operation of the floating exchange rate system. But our evidence on monetary control under pegged exchange rates does permit us to draw inferences about the efficacy of the widespread practice of central bank intervention. Monetary control is possible only if shifts in the central bank's portfolio between foreign and domestic assets can affect the exchange rate consistent with a given domestic money supply and foreign variables. Otherwise, the balance of payments would increase without limit if the nonreserve central bank chose a money supply inconsistent with the parity values of interest rates and prices. Thus, our evidence on short-run monetary control directly implies that (sterilized) foreign exchange intervention can affect the exchange rate for a given money supply. This analysis is pursued by Dan Lee in Chapter 12 along lines initiated by Branson, Halttunen, and Masson (1977), Girton and Henderson (1976), and Henderson (1977, 1979). Conversely, Taylor (1981) has found that central banks have been consistent money losers under floating exchange rates. While Taylor stresses the destabilizing nature of central bank intervention, they must have had an

effect in order to have destabilized. So Taylor's evidence supports the
feasibility of monetary control under pegged exchange rates.

17.4. Monetary Policy and the International Monetary System

The results summarized above have important implications for two related issues: the control of inflation and the relative economic merits of various international monetary arrangements. Discussion of either question, however, is to a large extent conditional upon the answer to the other. Accordingly, we first focus very briefly on the inflation issue and then go on to consider it further within the context of our discussion of monetary standards and exchange rate regimes.

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. Therefore, the fact 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.[31] 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 instruc-
tive in both regards. From the start of 1977 to the end of 1980, rates of
inflation have diverged fairly markedly among the countries is our sample.
Japan, and to a somewhat lesser but still noticeable extent, Germany and the
Netherlands have consistently had much lower rates of inflation than the
United States. Two countries, Canada and France, have had approximately the
same pattern of inflation as the United States while two others, Italy and
the United Kingdom, have experienced considerably higher inflation. These
figures are presented in Table 17-2.

The experience suggests that in at least three of the seven nonreserve
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 infla-
tion to a much greater extent than did the United States. 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.[32] 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 cases. 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-a-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.[33]

Comparison of the experience under floating rates with the experience under Bretton Woods and in its immediate aftermath suggests, therefore, that fixed exchange rates are only viable if the domestic economic policy goals of the various countries involved are in harmony over the longer run. Conversely, floating rates provide those countries with the degree of freedom necessary to pursue different goals.

In this respect, the breakdown of Bretton-Woods is almost a mirror image of the collapse of the gold standard in the early 1930s. In the thirties, many countries abandoned the fixed-rate gold standard because they did not want to import a further contraction in output from the United States. In the seventies, many countries abandoned the fixed-rate dollar standard because they did not want to import American inflation.[34] In both instances, the moves away from fixed and towards flexible rates successfully provided the countries making these changes with insulation from foreign disturbances. That fact, in and of itself, provides an additional bit of evidence corroborating our findings.[35]

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.[36]

For the United States, we believe that the only real hope for controlling inflation is the birth of a political concensus 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 would also serve. 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. As Leijonhufvud (1980) has persuasively argued, an appropriate monetary reform or transitional procedure could minimize or eliminate the transitional unemployment costs of ending the inflation within the context

of a believable political concensus enforcing the new monetary constitu-
tion.[37]

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.[38] 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.

17.5. Areas for Future Research

At the end of a project such as described in this volume, researchers find it hard to be satisfied with what has been accomplished rather than troubled by all the questions which would have been studied were there but time, money, and energy enough. The knowledge that any science develops in small increments and no one person or group can make more than a marginal contribution rings hollow against the wish to have done more. By way of exorcism for these futile wishes, we like our predecessors list the issues that we think particularly deserve further study.

The most obvious next step would be to extend our data bank and link it directly with currently available national data sources. Lothian is currently making efforts along these lines. When the extended data set comes available, it will be possible to reestimate both the Mark III and Mark IV Models and a number of other relations applicable to the floating-rate period. In particular, data for 1979-1980 may permit much sharper estimates of the effects of changes in the real price of oil.

Daniel Laskar's work introduced a number of sophisticated approaches to the formulation of money-supply reaction functions. Those are well worth developing and applying to other data sets.

Stockman (1979) and Obstfeld (1980b, 1980c, 1980d) have shown that monetary control under pegged exchange rates need not obtain even if bonds are imperfect substitutes internationally. Although some of our tests apparently reject their ultrarationality postulate, it would be interesting to see whether private-capital-flow functions do indeed shift in a partial if not complete manner in response to sterilized foreign exchange operations.

Substitution in demand for domestic money by foreign money and foreign assets did not appear to be important in the tests which we conducted. Some other economists have reported conflicting results. Further work is required to reconcile these differences.

The behavior of exchange rates in the floating period remains largely unexplained. However, Dan Lee's integration of the information set used in forming inflationary and exchange rate expectations seems to be a valuable starting point. This approach is pursued to some extent in the expectational functions of the Mark III and Mark IV Models, but much remains to be done. Such an approach suggests that with consistent expectations in the bond and foreign exchange markets, a money shock will initially affect the exchange rate by an amount equal to the integral of the induced deviations between the domestic and foreign real interest rates.

Except for the United States, the Barro-esque real income equation did relatively poorly and added little if anything to the explanatory power of short distributed lags on the actual changes in aggregate-demand variables. An errors-in-the-variables argument is capable of explaining the results numerically, but the weak evidence suggests the value of further research.

Finally, we propose an examination of the political economy of alternative monetary systems. This work has already begun, but is only at the earliest stage of development at present.[39] Given the probability that action to change the existing system will be taken in the near future whether in ignorance or not, the potential value of research here is great indeed.

Besides these major areas for further research, a number of additional topics have been suggested in the individual chapters. Furthermore, it is

all too likely that the most important leads eluded our notice. We only hope that if that be the case, our readers will correct our oversight as well as our other errors.

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FOOTNOTES TO CHAPTER 17

*The authors have benefitted in drafting this chapter from conversations with the other contributors to this volume but are solely responsible for the opinions expressed here.

[1] The 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.

[2] Laidler and Parkin (1975), Meiselman (1975), and Johnson (1976) provide clear statements of the monetary approach to worldwide inflation, but as we demonstrate in this chapter 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.

[3] Dietrich 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).

[4]The relevant concept of purchasing power parity here is a _ceteris paribus_ one: The purchasing power ratio (real exchange rate) is unaffected in short-run and long-run equilibrium by a monetary disturbance. As discussed in note 1 to Chapter 15 above, this equilibrium value may shift randomly due to such factors as _permanent_ shifts in relative prices.

[5]See Tables 6-10 and 6-13.

[6]We 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.

[7]See Stockman (1980). However, Kravis, Heston, and Summers (1978) attempt to make international purchasing power comparisons based on standardized baskets and find these to differ from exchange-rate converted nominal income ratios.

[8]Thus Darby shows that convergence of exchange-rate-adjusted inflation rates over longer periods of observation -- such as noted by Gailliot (1970) and Lawrence (1979) -- are consistent with the equilibrium value of the purchasing power ratio following a random walk. However, it is very difficult to distinguish statistically a random walk from a very slow adjustment process such as argued by Frenkel (1980b, 1980c).

[9]To anticipate Section 17.3 a bit, we find that the balance of payments generally does affect nominal money growth in nonreserve countries, but only very weakly at first.

[10]This 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.

[11]Even 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." See Chapter 15 above and Section 17.3 below for details.

[12]Recall from Chapter 10 that the capital flows induced by a difference between domestic nominal money and its international "parity" value depends upon the _product_ of the interest rate coefficient in the capital flows equation and the derivative of the interest rate with respect to money. Thus, if the liquidity effect is small or nil, so will be the capital flows. Large liquidity effects are not consistent with a shock-absorber money demand function which distinguishes between unexpected and expected money growth; see Carr and Darby (1981).

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

[14]The expected changes in the exchange rates are proxied by the predictions of behavioral equations described in Section 5.3.

[15]Although 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.

[16]To put it another way, the scaled balance of payments B/H enters the scaled-change-in-domestic-credit ($\Delta D/H$) reaction function with a coefficient of -1.

[17]The 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.

[18]The 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.

[19]In Italy, even the lagged response was negative.

[20]The inclusion of scaled lagged reserves is preferrable 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 (1980a) 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.

[21]See Section 10.2 above and Darby (1980) on this.

[22]As noted in Chapter 10, these assumptions must be coupled with supporting assumptions that the contemporaneous effect of money on prices is positive and on the interest rate negative, respectively.

[23]This 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.

[24]For 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.

[25]A residual-cross-correlation check for such omitted channels for the Mark III Model is reported in Section 6.2. No pattern of significant correlations was found.

[26]All of the inflation rates in Table 17-1 are measured relative to the corresponding 1956-1965 average inflation rates. This implicitly assumes that the 1.1 to 1.6 percent per annum higher nonreserve inflation rates in the earlier period reflect stable trends in purchasing power parity. If we were to insist that purchasing power parity has no trend, the 42 percent change in exchange-rate-adjusted relative price levels from 1955 to 1975 is difficult to explain.

McKinnon (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.

[27]See note 12 above.

[28]The strong upward trend in American money growth is discussed in Sections 6.2 and 16.2. It 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 reported in Table 6-7 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).

[29]In 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.

[30]See Tables 6-10 and 6-13.

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

[32]In 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.

[33]The 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 de-
cline beginning 6 quarters later in mid-1971.

[34] An additional inflation-related factor, as Klein (1978) points out,
may have been the decrease in the predictability of the longer-term United
States inflation rate during these years that accompanied the increase in
the average rate of inflation.

[35] Writing shortly after the fact, Irving Fisher (1935) used the dif-
ferences in the behavior of output abroad relative to that in the United
States under the two different international monetary standards as a test
of the hypothesis that the Depression was in the main engendered by money.
In the seventies, the differences in the patterns of inflation under fixed
and floating rate regimes provides an additional test in favor of the
hypotheses we have advanced to explain inflation during our sample period.

Interestingly, Fisher's analysis is based, in modern terms, on a
"Lucas" (price-level innovation) aggregate-supply curve and either "a law
of one price level" or a Humean specie-flow mechanism for countries linked
by fixed exchange rates. (It is unclear in this presentation whether
Fisher contemplates a price arbitrage or monetary transmission, but the
latter is used in Fisher (1920) cited here.) It appears from his charts
that somewhat better explanatory power would have been obtained by concen-
trating on money flows and a "Barro" (money-supply innovation) real-income
equation, but the movements are large enough that either chain works.

A more recent statement of this hypothesis together with supporting
empirical evidence virtually identical to Fisher's is Choudhri and Kochin
(1980). Lothian (1981) contains a similar discussion of the interwar U.K.
evidence.

[36]We 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.

[37]Feldstein (1979) has recently observed that these unemployment costs must be weighed against the very large present value of the benefits. Since the costs of inflation tend to grow with real income, their present value is much larger than might appear from previous estimates of relatively small annual cost. Since he analyzes a permanent reduction in inflation, Feldstein too must implicitly anticipate a monetary constitution which would prevent repetition of our past mistakes.

[38]Understanding, of course, that choosing a monetary constitution is simultaneously choosing an exchange-rate regime.

[39]Willett and Mullen (1981) contribute not only new insights but a careful review of this literature.

TABLE 17-1

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.

TABLE 17-2

Average Continuously Compounded
Growth Rates of Consumer Prices
1977 through 1980

Countries	Periods[1]				
	1977-80	1977	1978	1979	1980
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 imme-
diately preceding to the quarter ending the designated
period. The price index used is the CPI or other index of
retail prices.