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PART

I Preliminaries

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1 Introduction and Summary

Michael R. Darby and James R. Lothian

Inflation became the dominant economic, social, and political problem of the industrialized West during the 1970s. This book is about how the inflation came to pass and what can be done about it. To answer these questions, we must first discover the nature of the economic linkages which apparently transmitted inflation from country to country like a contagious disease. To accomplish 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 substantiated only by the studies themselves, but first we provide in this chapter 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 is perfectly so. The balance of payments has had no discernible effect on the American money supply, and at least partial sterilization has been a universal practice among nonreserve central banks although lagged adjustments of their money supplies to the balance of payments are noted. Currency 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 approach.

The major cause of the world inflation of 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

1. The initial resistance to the increased U.S. inflation may explain the larger increase in nonreserve inflation during 1971–75. On a decade-average basis, U.S. inflation increased by

Table 1.1 Average Continuously Compounded Inflation Rates 1956–75

Period[1]	United States[2]	Nonreserve Countries[3]	All Eight Countries[4]	Adjusted for Exchange-Rate Changes[5]	
				Nonreserve Countries	All Eight Countries
Quinquennia					
1956–60	2.28%	3.25%	2.74%	2.26%	2.27%
1961–65	1.66%	3.96%	2.74%	3.96%	2.74%
1966–70	4.32%	4.25%	4.29%	4.01%	4.18%
1971–75	6.74%	9.22%	7.90%	11.84%	9.13%
Decades					
1956–65	1.97%	3.60%	2.74%	3.11%	2.50%
1966–75	5.53%	6.74%	6.10%	7.92%	6.66%
Others					
1956–70	2.75%	3.82%	3.26%	3.41%	3.06%
1971–73I	4.50%	6.46%	5.41%	13.50%	8.71%
1973II–75	8.57%	11.48%	9.94%	10.48%	9.47%
1956–75	3.75%	5.17%	4.42%	5.52%	4.58%

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 the geometrically weighted average was computed.

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 1973II–74I played a supporting role to money growth in explaining the more rapid inflation in the second half of 1971–75, but coincidental removal of general price controls in the United States and abroad may have been even more important. In the latter half of the 1970s, domestic inflation was determined by the monetary policy of each central bank and cannot be attributed directly to the United States except as the foreign central banks

3.56 percentage points from 1.97% for 1956–65 to 5.53% for 1966–75 while nonreserve inflation increased by 3.14 percentage points from 3.60% to 6.74%, respectively. Thus, the 1971–75 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 overshooting. The last two columns of table 1.1 demonstrate that these patterns are despite—not due to—changes in exchange rates.

were 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 trend rate of inflation is a reduction in the trend 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 without the political consensus to enforce a monetary constitution, be it de jure or de facto, that 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 rates 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 are provided in the Data Appendix to this volume. 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 at the time they happened but ultimately proved to have major consequences. The second remaining chap-

ter of part I, by Anthony Cassese and James Lothian, concludes the preliminaries by beginning the empirical analysis.

Cassese 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 relation 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 accommodated by passive central banks. Comparison of nonreserve country prices with either American prices or an index of foreign prices provides 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 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 among 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 1973–74 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, one corresponding to pegged and the other to floating exchange rates. There are sixty-seven behavioral equations in the former and seventy-four in the latter, with a nearly equal number of identities used to close each model. Each country is described by a

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.

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 the actual values of the variables well 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 reported 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 *de*preciated in response to an unexpected increase in the American money supply.

The experiments involving shocks to government spending 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 because of 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%; in terms of inflationary trends over say four years, this implies only a range of 0 to 1¼% 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 1971–75 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. On the whole, those countries which removed price controls during 1973–74 are also those for which we obtain a significant decrease in real income (and so real money demand) as a result of the 1973–74 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

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 an increase in the reported price level.

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 international-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% 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% level and for Canada at the 10% 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.

Because of dynamic instabilities, the floating version of the Mark IV International Simulation Model is relatively uninformative on 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 feasible 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, as a consequence of the absence of a satisfactory correlation between the risk variables and the instrument variables. When Melvin uses an alternative data set covering 1973–78, 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 IV addresses the question of what were the causes of the inflation of the late 1960s and the 1970s 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 1970s.

Specifically, in chapter 14 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 aggregate 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 all of the cases examined. The estimated fraction of total inflation attrib-

utable to oil price increases had a median value of only 15% for 1973–74, or 9% over the longer period of 1973–76.[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 1973–74.

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 trend inflation despite the presence of significant random-walk 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 growth and its 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 a 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%) of the variance of inflation cannot be explained by nominal money growth using quarterly, annual, or biennial observations, this fraction drops to only 3% 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

4. These numbers are for the estimates made with a second-order autoregressive correction.

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 1970s 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 to be done, and we close by outlining a program of promising areas for future research.

Acknowledgments

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References

Barro, R. J. 1978. Unanticipated money, output, and the price level in the United States. *Journal of Political Economy* 86 (August): 549–80.

Darby, M. R. 1979. *Intermediate macroeconomics*. New York: McGraw-Hill.