

## Some Lessons from the Great Inflations

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From the mid-1960s through the 1980s, the world experienced the most prolonged and widespread peacetime inflation in recorded history. For the years 1965-88, not a single country had a zero or negative average rate of inflation (World Bank, 1990). The lowest reported average rate is 2% (Rwanda). Two countries, Bolivia and Argentina, have average rates of more than 150% for the 23 year period, and 44 countries have average rates in double digits or above. In the seven major developed countries compound annual rates of inflation ranged from 5% to more than 15% in the years of peak inflation, 1970-82 (Federal Reserve Bank of St. Louis, 1990).

Inflation and the development of monetary theory are closely linked. Some of the most durable propositions of monetary economics were developed by classical writers in the early 19th century based on observations of the great inflation of that period. By comparison, the inflation rates of the 18th and 19th century, are much lower — an average of 3.1% in Britain from 1792 to 1813, 2.6% in France from 1798 to 1812, and 3.6% in Germany from 1792 to 1808.<sup>1</sup> One reason that average inflation rates are lower is that prices fell during part of the period in each of these countries.

Sparse data suggest that the earlier inflation was not only lower, but it appears to have been less persistent and less widespread. Although prices rose in Britain and Germany from 1792 to 1801 and 1808 respectively, prices fell in France from 1798 to 1804. Further, even the sparse data suggest that inflation was less highly correlated; Britain and France experienced inflation during the Napoleonic war years, but prices in

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<sup>1</sup>Rates are computed to the peak in the first two decades of the 19th century using wholesale price indexes from Mitchell (1975).

Germany fell from 1808 to 1815. The highest sustained average annual rate of inflation from trough to peak in prices during these years is 6-1/4% for Britain from 1792 to 1801 and France from 1804 to 1812. The latter is, of course, not peacetime inflation.

In both the 19th and 20th century, the presence of persistent inflation encouraged economists to learn more about its causes and consequences. The distinction between nominal and real values, central to all of economics, had been noted earlier, but was reaffirmed notably in the work of David Ricardo and Henry Thornton. Other propositions were discovered, supported or confirmed by the evidence from the inflationary experience. Some of these propositions were lost, forgotten, or dismissed subsequently, so they had to be rediscovered or reaffirmed during the past quarter century. Some new knowledge particularly about expectations, the dynamics of inflation and policy rules was added. But part of what was learned about the dynamics of inflation and the costs of inflation proved to be either incomplete or misdirected. And some useful earlier learning about monetary economics continues to be neglected.

## I. Thornton

Henry Thornton stands out not only among his contemporaries but among writers on monetary theory for the next century or more.<sup>2</sup> His contributions at the start of the nineteenth century show a remarkable understanding of events and the ability to develop theoretical principles based on his analyses of these events. Eight propositions summarize his main contributions.

First, Thornton saw that monetary velocity was variable, not constant. Velocity depends on confidence or anticipations and on the rate of interest or the opportunity cost of holding money. When the public is optimistic about the future, they "provide less amply against contingencies" (Thornton, 1965, p.96). "When, on the contrary, a season of distrust arises... the loss of interest arising from a detention of notes for a few additional days should not be regarded" (*ibid.*, p. 97).<sup>3</sup>

Second, the rate of interest rises and falls in direct proportion to the rate of inflation. In his "Speeches on the Bullion Report" (*ibid.*, pp. 327-61), Thornton argued that with inflation at 2 to 3 percent per annum, a borrower gained from inflation, so the interest rate relevant for his computation of cost is the nominal rate paid minus the rate of inflation (*ibid.*, pp. 335-6). He concluded that "in countries in which the currency was in a rapid course of depreciation, supposing there were no usury laws, the current rate of interest was often... proportionably augmented" (*ibid.*, p. 336). The increase in interest rates was compensation for the expected depreciation of money.

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<sup>2</sup>Viner (1965, p. 122) writes that "Ricardo made but few additions to the analysis of his predecessors and... on some important points he committed errors" from which they had been free. Thornton is one of the best of Ricardo's predecessors. A succinct summary of Thornton's contribution is in Schwartz (1989).

<sup>3</sup>See also *ibid.*, p. 234.

Third, just as market interest rates move directly with inflation, currency values move inversely. Thornton expressed the principle that was later called purchasing power parity; the external value of a currency rises or falls with the relative rates of inflation in the two countries. But, he pointed out, the value of paper money and gold move in opposite directions; inflation lowers the exchange value of paper money but, since gold is a commodity, its price increases (*ibid.*, pp. 198-200). Further, Thornton distinguished these long-run effects from short-run adjustment. The latter depended *inter alia* on the price elasticity of imports. Britain, as an importer of food and raw materials should expect an excess of imports over exports as the short-run response to a reduction in the quantity of money (*ibid.*, p. 121).

Fourth, Thornton distinguished between the general equilibrium, monetary approach to the balance of payments and the mercantile view that the balance of payments depends on the trade account. He criticized Locke's statement that gold flows depend on the balance of trade. Gold movements depend "on the quantity of circulating medium issued" (*ibid.*, p. 248). If paper money is issued to excess, domestic prices rise relative to foreign prices, producing an excess of imports over exports and a loss of gold. A similar process operates domestically; gold is demanded in exchange for paper at the central bank. Thornton drew the correct policy implication from his analysis. The policy of a central bank should be to avoid both inflation and deflation, to protect the gold reserve, and to serve as lender of last resort.<sup>4</sup>

"To limit the total amount of paper issued, and to resort for this purpose, whenever the temptation to borrow is strong, to some effectual principle of restriction; in no case, however, materially to diminish the sum in circulation, but to let it vibrate only within certain limits; to allow a slow and cautious extension of it, as the general trade of the kingdom enlarges itself; to allow of some special, though temporary, increase in the event of an extraordinary alarm or difficulty, as the best means of preventing a great demand at home for guineas; and to lean on the side of diminution, in the case of gold going abroad, and of the general exchanges continuing long unfavorable; this seems to be the true policy of the directors of an institution circumstanced like that of the Bank of England. To suffer the solicitations of the merchants, or the wishes of government, to determine the measure of the bank issues, is unquestionably to adopt a very false principle of conduct (*ibid.*, p. 259)."

Fifth, although Thornton and several of his contemporaries and predecessors understood that money is neutral in the long-run, Thornton denied short-run neutrality. He traced out the dynamic process by which changes in money affect first demand and output and later are fully reflected in price levels. The reasons for the distinction between short- and long-run adjustment is that some prices, and particularly wages, are fixed in the

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<sup>4</sup>Thornton (*ibid.*, pp. 98-9) observes that although the demand during periods of panics is for gold, the panic is removed by the "expectation of a supply of Exchequer bills."

short-run. In full adjustment, prices increase in the same proportion as the stock of money (*ibid.*, pp. 236-41).

Sixth, Thornton distinguished between anticipated and unanticipated changes and between real and nominal changes. Although he relied on sluggish adjustment of money wages rather than the distinction between actual and anticipated changes in prices to explain fluctuations in output, he recognized that anticipations changed with events. The short-term effect of unanticipated changes on output was consistent with his analysis of velocity and, of course, would supplement his argument about the lag of wages behind prices.

Seventh, the real bills doctrine claiming that bank loans and money could be limited by controlling the quality of credit had been advanced by several of Thornton's contemporaries and had been used unsuccessfully to limit the note issue of the Bank of England prior to 1797. Thornton rejected the real bills doctrine (See Chapter X, esp. p. 244). The value of money internally and externally does not depend on the security that lies behind the issue. Nor does the nature of the security provide any effective limitation on the quantity. Effective limitation can be achieved, Thornton said, by a policy or rule that restricts the quantity of money to rise with aggregate demand or, in the phrase he used in the quotation above, the general trade of the kingdom.

Eighth, Thornton distinguished between money — the medium of exchange — and credit — the stock of loans outstanding at banks (and other lenders). At the start of an (unanticipated) inflation, Thornton said, the public's demand for bank credit and the demand for money move in opposite directions. These movements reflect a common cause, changed anticipations of the return to real assets and the rate of change of prices. Increases in the stock of money resulting from an issue of paper or a gold inflow increase the demand for goods, raising the prices of the goods demanded and encouraging borrowing by businessmen whose sales and prospective profits rise. Velocity increases — the demand for money falls — not only because (some) businessmen are, for a time, more optimistic and velocity depends on "confidence," (*ibid.*, p.96) thus on anticipations of the future, but also because inventories decline (*ibid.*, p. 237). These are short-term cyclical movements, but for a time they persist and generate additional increases in the demand for credit and in velocity. One reason that the process continues is that all prices do not adjust at the same rate. Some are fixed by contracts in nominal terms and rise or fall more slowly than others. Thornton used money wages as an example of a price that was fixed in nominal value and argued that, as a result, real profits rise and real wages fall in periods of (unanticipated) inflation. Once real balances are adjusted to their desired level, total wealth is "nearly the same" (pp. 189-90) but there has been a once-and-for-all redistribution from creditors to debtors.

This summary of Thornton's remarkable achievements can not substitute adequately for reading his work. But it may convey the extent to which monetary analysis had developed by the end of the first decade of the nineteenth century. An economist of the

late twentieth century would note that Thornton's propositions are based almost entirely on observations and reasoning from those observations. There is no model of a utility maximizing individual or a wealth maximizing firm. There is no formal model in the sense in which that term is now used. Yet, the analysis is first rate, and the prescriptions for domestic and international monetary policy are superior to the policies followed more than one hundred years later, during the deflation from 1929 to 1933 and the great inflation of the postwar years. Thornton failed to supply a satisfactory explanation of the short-term effects of inflation or disinflation on real wages and other relative prices. For this, his analysis can be faulted. Nearly two centuries later, however, an economic theory of sticky prices remains beyond our grasp.

## II. Relearning about Inflation

The inflationary experience of the past twenty-five years produced many more rigorous analyses but also many fewer additions to economists' understanding of monetary theory and appropriate monetary policy. In the first twenty years of the postwar era, much of the progress in monetary analysis consisted of a rediscovery and more formal development of many of the propositions stated by Thornton more than a century before. The rediscoveries produced an improved understanding of the effects of money on prices, output, international payments, exchange rates and interest rates and a change in the consensus view.

One source on the professional consensus in the early postwar years is the *Survey of Contemporary Economics* published by the American Economic Association. The principal essay on monetary theory in that volume describes monetary policy as "broadly ineffective" (Villard, 1948, p. 314). A decade later, similar views were put forward by the Radcliffe Committee in Great Britain. Given these supposedly weak effects of money, many countries, including Britain and the United States, introduced credit controls, down payment requirements, and direct restrictions on the amount or types of loans. Reliance on these policies and their justification by economists was a retreat from the understanding reached by Thornton. Many econometric models built in the 1950s and 1960s had no role for money, reflecting the then widely held view that money was largely irrelevant for output. As late as the mid-1970s Sir John Hicks (1976) speculated that the multiplier-accelerator model could explain most of the fluctuations in real output; money had a modest role or no role at all. This view — that money is irrelevant for fluctuations in output — survives in some of the real business cycle models with which leading journals are currently filled.

Progress in monetary economics through the 1960s often consisted of relearning, at times in new and more rigorous ways, what had been forgotten. As learning occurred, monetary policy was no longer regarded as impotent. In many countries, and most assuredly in the United States, domestic monetary actions were now seen as one instru-

ment that could be used in concert with other instruments to achieve multiple objectives. Domestic objectives included employment, avoidance of effects of higher interest rates on housing and other durable assets, the distribution of income and inflation. International objectives added one or more measures of the balance of trade or payments and the exchange rate. There were never enough instruments to achieve all of these objectives simultaneously, so there was some shifting about. In the United States, however, monetary policy was generally assigned responsibility for management of the short-term market interest rate. To control inflation, while improving the Phillips curve tradeoff between inflation and unemployment (or making full employment and price stability compatible), policymakers relied on wage and price guideposts and later on price and wage controls. See Tobin (1987) or several of the annual reports of the Council of Economic Advisers in the 1960s for statements of these views.

Discussions of international economic policy in the 1960s typically offered two related themes. One enumerated the three problems of Bretton Woods — liquidity, adjustment and confidence. The other emphasized the policy mix — an early effort at policy coordination by the principal countries.

Despite repeated references to liquidity, adjustment, and confidence, official policy efforts were directed mainly at avoiding periodic crises and supplying additional liquidity in the form of Special Drawing Rights (SDRs). The discussion of SDRs continued into the late sixties, when it was agreed that SDRs would be issued. The initial issue in 1970 added \$3.1 billion to world reserves. In the same year, as a result of U.S. past and current monetary expansion, foreign exchange reserves increased by \$14 billion to reach \$91 billion, a 50 percent increase for the decade and a 22 percent increase for 1970 (IMF, 1971, p. 19).

The introduction of SDRs in 1970 with consumer price inflation in the United States, Germany and Japan at 6, 4 and 8 percent respectively suggests how little emphasis was given in official discussion to monetary control and inflation. The IMF described reserves as “less than adequate” (1969, p. 27), made references to inflation but avoided criticism of both U.S. monetary policy and the unwillingness of surplus countries to revalue. The United States sought to avoid dollar devaluation and disinflation but remained unwilling to adjust domestic policy to maintain the Bretton Woods System.

Official discussions leading up to the introduction of SDRs reveal central features of the then current analysis of money. Absent from most of these discussions is recognition of the role of money as a medium of exchange that provides real transaction services, the social cost of excessive variability in the value of money, and the role of purchasing power parity in the adjustment toward the long-run domestic and international value of money. The proponents of the SDR believed they could create an international money to substitute for gold in country balances and for dollars as a medium of exchange between countries. The SDR did not pay a competitive rate of interest, did not provide transaction service for the public, and was dominated in central bank portfolios by many alternatives.

Moreover, this new reserve asset was introduced without putting any restrictions on U.S. monetary policy.

Some governments outside the United States, particularly creditors, expressed concern about inflation, preached the virtues of monetary discipline and the need for deficit countries to adjust. Official U.S. policy advice to the governments that expressed these concerns varied between suggestions that creditor countries revalue and recommendations that they change their own policy mix by introducing more restrictive fiscal policy to offset the expansive monetary policy required to finance U.S. current account deficits under the fixed exchange rate system.

These attempts to vary the mix of fiscal and monetary actions and to coordinate actions by principal countries failed. There was neither any basis in experience nor any evidence to suggest that creditor countries could control inflation by running budget surpluses large enough to offset the expansive effects emanating from the United States. Increasingly countries relied on exchange controls, some to inhibit inflows, others to reduce outflows. Inflation continued and spread until the fixed exchange rate system ended. Thereafter experiences differed. Some countries adopted policies to lower their rate of inflation. Others continued to inflate for a decade or more.

Some lessons were learned. In the 1970s and 1980s, Germany resisted proposals to coordinate policy actions with the United States. Proposals to coordinate policy actions internationally continue to reappear either as proposals for currency market intervention or as schemes to vary the mix of fiscal and monetary actions to achieve global balance. The latter, like the proposals in the Bretton Woods era, are generally resisted by principal governments outside the United States. These governments have learned that coordination of policy actions is a poor substitute for a system of monetary rules and the supporting fiscal policies. Also, after Europe introduced its own system of fixed but adjustable exchange rates, both surplus and deficit countries adjusted exchange rates to correct imbalances. Surplus countries learned from experience that nominal revaluation was less costly than inflation and did not hurt exporters.

Other learning, or relearning, included the distinctions between nominal and real interest rates and nominal and real exchange rates and the response of real variables to unanticipated changes in money. As interest rates rose during the 1960s, academic researchers, central banks and governments rediscovered that the inflation premium rises directly with the rate of inflation, as Thornton had noted early in the 19th century. As inflation rose, they rediscovered also the impossibility of maintaining fixed exchange rates when countries inflate at different rates. Again, this was a lesson relearned from the earlier inflation.

Alas for the supposed positive association of higher employment and output with higher inflation. The Phillips curve proved to be shifting and unreliable in the short-run and inconsistent with rational behavior in the long-run. The relearning in this case reminded policymakers and economists that the initial effects of unanticipated monetary

changes are on real variables, but these effects vanish while the lasting effects on nominal values persist. While Thornton had stated this proposition for price levels, the Phillips curve literature substituted inflation. But this difference may reflect the difference between the average rate of change of prices in the postwar years compared to the average that Thornton experienced under the gold standard in the late 18th century.

To retest the neutrality proposition, I ran a regression of the average rate of inflation on average growth of per capita real GDP for the years of inflation and disinflation, 1965-88. The data include a cross section of 100 countries (World Bank, 1990, Table 1). The regression shows no evidence that higher inflation is associated with higher growth of per capita output. In fact, the association is very weak but slightly negative; one percent higher inflation is associated with approximately 0.02% lower real growth on average. Disaggregating these data by size of per capita GDP in 1988 suggests that the negative association is found mainly in relatively poor countries. One explanation is that often data for these countries are less accurate.<sup>5</sup> A second alternative consistent with the negative coefficient found in all samples, is that the variability of inflation is positively related to the average. Variable inflation may lower investment. Or, institutions may not fully adjust to inflation. A third alternative explanation is that countries that have policies that produce negative economic growth also have relatively high inflation. Many of the

Table 1 Dependent Variable: per capita real GDP growth\*  
1965-88

|                                    | Constant       | Average Rate<br>of Inflation | Adjusted<br>R <sup>2</sup> |
|------------------------------------|----------------|------------------------------|----------------------------|
| 100 countries                      | 2.00<br>(7.38) | -0.02<br>(1.94)              | 0.03                       |
| 30 low income                      | 1.69<br>(2.84) | -0.08<br>(2.32)              | 0.13                       |
| 32 middle income                   | 2.34<br>(5.36) | -0.02<br>(1.63)              | 0.05                       |
| 38 upper middle<br>and high income | 2.63<br>(6.07) | -0.02<br>(1.08)              | 0.004                      |

\*t-statistics in parentheses

<sup>5</sup>The estimates are in Table 1.



countries with negative average growth for more than twenty years are found in the low income group in 1988. To check further on this explanation, I compared countries with high and low growth rates. The eight countries with the most negative average growth have rates of inflation that are about twice the average for the eight countries with the highest average growth. No doubt there are other alternatives.

The absence of a positive relation between inflation and growth implies that during the great inflation, countries on average did not increase real growth by inflating. And the relatively small negative association may be consistent with neutrality at low rates of inflation. The evidence for the developed countries supports neutrality (at low rates of inflation). Evidence of neutrality and heightened interest in micro foundations during the current inflation led to a rejection of the classical argument for short-run non-neutrality of money — the lag of wages or anticipations behind actual, reported changes in the general price level. The classical, neo-classical and monetarist sequence was replaced, first, by the rational expectations natural rate hypothesis, that seemed to permit only a brief period of non-neutrality, and later by the real business cycle hypothesis that denied non-neutrality. In the first of these, the short-term effect of money on output was evanescent; in the second, it was non-existent.

### III. New Ideas

It is common in science to revisit old problems with new techniques. Often the basis for the old conclusions is strengthened, and the limits of established propositions become clearer. Much less common is to find earlier conclusions rejected and later restored. The great inflation from the middle 1960s to the 1980s, both supplied new data and generated new research that restored former conclusions and strengthened their analytic and empirical foundations.

Learning from the great inflation was not limited to rediscovery of old truths. Two important hypotheses — rational expectations and time consistency — were added to the core propositions of economics.<sup>6</sup>

The principle illuminated by the time consistency proposition is not restricted to the theory of inflation or policy toward inflation. It applies to policies at the micro and macro level whenever the public's current anticipations or actions depend on the government's future policy actions. In the dynamic context in which policies are analyzed, policymakers follow decision rules; the choice between policies is a choice between rules. Discretion now has a more restricted meaning: the policymaker chooses a decision rule, but the choice of weights in his objective function is unrestricted. He can surprise the public by

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<sup>6</sup>Few ideas in economics do not have traces in earlier work that can be discovered once the idea is explicated. As I have noted elsewhere, there are clear statements of the idea of rational expectations in Keynes's *General Theory*. This fact notwithstanding, the use of rational expectations in economic models is new.

shifting weights on specific objectives such as inflation and employment. These shifts introduce unanticipated changes, and frequent shifts in objectives reduce credibility, thereby raising the cost of achieving the policymaker's objectives (which may be the voters' objectives as well). In general, discretionary changes are suboptimal.

Time consistency is an example of a new technique strengthening and refining old conclusions. Classical and neo-classical economists discussed policy as a choice among alternative rules. Economists of that era who criticized the gold standard as introducing avoidable variability and uncertainty did not oppose policy rules. The critics offered several alternatives — bimetallism, symmetallism, a tabular standard, or Fisher's compensated dollar. None of the alternatives gave total discretion to the central bank or government. The proposed rules restricted actions by governments or monetary authorities but, like the gold standard, did not fix the quantity of money or its rate of change. To achieve price stability, they relied on individual incentives to protect personal wealth and to gain from exchange by taking advantage of actual or expected differences between the market and mint prices of gold or other commodities. In current jargon, private incentives for profit provided a punishment strategy, if policy actions differed from the policy rule. But the classical literature did not have a developed understanding of the relation of time consistency to optimality, so they did not recognize that a credible rule can reduce the average rate of inflation and the cost of restoring price stability. Those implications were brought out in the Kydland-Prescott (1977) analysis.

The other major new development from research on recent inflation is rational expectations — the application of rational behavior to the use of information and the formation of expectations. In adjusting anticipations and beliefs to new information, individuals are assumed to use information efficiently. This weak form of rational expectations is accepted by most economists. The strong form of rational expectations, however, makes the subjective probabilities used to form expectations the same as the true probability distribution of the events to be forecast. The strong form of rational expectations typically neglects costs of acquiring information, incomplete knowledge about the structure of the economy, and uncertainty about the past and present. In policy discussions, officials frequently spend much of their time considering alternative interpretations of what has happened and speculating on what current data portend. Economists have little precise knowledge about the quantitative structure of any economy. Years of intense econometric investigation of the macro structure has produced few invariant quantitative estimates. Moreover, it has proved difficult to draw definite conclusions about the nature of past shocks from the analysis of past history. Both the degree of persistence and the distribution of shocks between real and nominal disturbances have been difficult to identify reliably.

A problem with the strong form of rational expectations is that it endows everyone with information that he cannot have at zero cost. Neglecting costs of information would be more acceptable if the distributions of outcomes were fixed; this would imply that the

mean of the distribution was constant. In such case shocks or surprises could be treated as deviations from the mean, and the rationally expected path would be a return to the mean. This convenient property vanishes, however, if shocks or surprises are a mix of persistent and transitory changes.

I have noted that economists have not been able to pin down the distribution of changes, so it is counterfactual to assume that people know the distribution. Moreover, knowledge of the distribution for some past period, even if it were available, would not remove uncertainty about current or future shocks. There is no valid reason for assuming that the distribution of shocks between persistent and transitory changes drawn from the past will remain invariant in the future. And the distribution of shocks between real and nominal disturbances depends on institutional arrangements, for example the type of monetary rule. Neo-classical economists understood that the choice of a monetary rule influenced the variability to which the economy was subjected. They regarded the reduction of variance to the minimum inherent in nature and trading arrangements as a principal objective of economic policy and institutional design. The choice between policy rules was based on analysis of this kind — showing that proper policy rules reduce variability. This proposition has not been learned to a degree that would make it part of the current consensus.

The assumption of zero cost of acquiring information removes an important difference between individuals, for example professional traders or dealers and the general public. For the dealer or professional trader, acquiring knowledge about the price of the objects he buys or sells is mostly fixed cost. But the prices he knows well are the nominal prices of a small number of goods, not the price level of the entire market basket. The price he sets, or fixes for a time if you wish, is the nominal price. In this way, he conveys his specialized information to his customers.

Why does he fix or set a price? In a world of costless information there is no reason. With costly information, he improves his competitive position by offering to share the available information with potential customers. The dealer, merchant or trader may even pay to advertise his nominal prices as a way of getting information to potential customers and attracting them as buyers.

Reflect on the difference between a bazaar and a modern supermarket. A bazaar is inefficient in the use of information. Costs of acquiring information about reservation prices are relatively high. Every trade is a separate transaction that conveys no information to other buyers. A bidder does not know whether his successful bid is above the seller's reservation price or whether he has minimized his purchase cost. Other buyers cannot discover the prices paid in previous transactions, and there is no incentive under these arrangements for the seller to reveal the price. Each buyer must pay the cost of acquiring information and bear the uncertainty about the reservation price. A modern supermarket imposes relatively low costs of acquiring information and reduces uncertainty. Nominal prices are posted. There is no doubt about the seller's reservation price.

Everyone pays the same price.

In markets where buyers and sellers have about the same information, prices are set at auction. Securities markets are examples. So, too, is the wholesale diamond market. In contrast, the retail diamond market typically has preset prices. The seller tries to establish a reputation for dependability and honesty to reassure the buyer about quality and price. Buyers rely on the seller's information about current market conditions. Wholesale markets for used cars are typically auction markets but, unlike the diamond markets, retail market prices are negotiated. The merchandise is difficult to grade and classify reliably.

These brief remarks sketch some reasons why sellers in some markets are price setters, while in others they are price takers.<sup>7</sup> Differences in costs of acquiring information give rise to nominal price setting as an efficient arrangement for providing information. But, these costs do not yet explain why some prices (or wages) may adjust so slowly that changes in the nominal money stock alter output, employment and other real variables, as many economists have observed during the past two centuries.

As many have noted, there are contracts and costs of changing prices. A main reason was discussed above. Information can be available, widely distributed, but difficult to interpret reliably. Often changes cannot be classified promptly as permanent, transitory, real, or nominal. The proper response of prices depends on interpreting information correctly. As is well-known, slow, partial adjustment can be the rational response under conditions of imperfect information.

By ignoring these issues, the strong form of rational expectations increases analytical power and removes complexity. But it dismisses costs that are essential for understanding the role of money as a medium of exchange, for distinguishing between money and non-money assets, and for analyzing the effects of unanticipated changes in money on output and prices (Brunner and Meltzer, 1971).

Recent experience in Eastern Europe and Latin America gives useful information on the reasons the public chooses a particular asset as money — the medium of exchange. During times of high inflation, Russians, Poles, Argentines, Israelis and others did not choose the currency with the lowest rate of inflation. They did not choose their money because the government imposed some arbitrary restriction. They appear to have chosen from among currencies with low inflation, and used with high frequency, a unit with comparatively low costs of information — a well-known brand — the U.S. dollar. The widespread choice of the dollar supports the argument that costs of acquiring information are essential for understanding the services of money and the difference between money and other assets.

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<sup>7</sup>A more extensive discussion of this argument and others is in Brunner and Meltzer (1992).

#### IV. Optimal Inflation and the Okun Gap

I have drifted from a discussion of learning from the recent inflation into a critique of what has been learned and the consideration of some gaps in our formal analysis. It may be fruitful to continue in this way a bit longer. Several problems have been actively discussed and, in some cases, researched in formal models that miss important parts of the inflation problem. I have chosen two examples: (1) the discussion of Harberger triangles and Okun gaps and (2) the optimality of an inflation tax on cash balances.

The two can be discussed together. Both depend on a fully anticipated rate of inflation. This rate provides the revenue from inflation in the optimal tax literature and is the measure of the cost of inflation (the Harberger triangle) used for comparison to the loss of output and employment in periods of disinflation. This loss is called the Okun gap and is measured by the difference between actual and full employment output. When Tobin (1980) compared the costs of inflation and disinflation, he criticized policy to disinflate on grounds that many Harberger triangles can fit inside an Okun gap. Apparently any moderate rate of inflation should be preferred as less costly than disinflation.

The inflation tax is a small part of the cost of inflation. Models of the inflation tax neglect the costs arising from non-indexed depreciation and distortion of relative prices. Fischer (1981) showed that these costs are typically much larger than the inflation tax, and Cukierman (1984) showed that the variability of relative prices was positively related to the mean rate of inflation during the recent inflation. Variable inflation may impose additional costs affecting saving and investment decisions by increasing uncertainty. It becomes more difficult to distinguish relative and absolute price changes or to estimate how long inflation will persist and at what rate.

Many of the costs of inflation arising from non-indexation, or more generally, from institutional non-adaptation, cannot be avoided. Full indexation of the economy is easy to conceptualize but difficult to implement when there are both real and nominal shocks that cannot be identified precisely. Some means must be found to separate reliably the effects of these two types of shocks. Economists have not proposed a solution, as far as I know. Brazil, Israel and Italy have tried different formulas for indexing, but neither they nor others have found a way to index against nominal shocks while letting real shocks affect individual prices and the price level.

Comparisons of the inflation tax to the Okun gap understate the costs of inflation and overstate the cost of disinflation (or the Okun gap). In this comparison, the costs of disinflation are treated as permanent, not temporary, reductions of employment and output. This is an error. Average growth is not much affected by inflation as my earlier data show. Lifetime earnings, permanent income and normal output are not much affected by recessions. The Okun gap overstates the permanent loss. Moreover, the

social cost of inflation includes more than the triangle under the demand for money. Costs of inflation include not only the costs related to institutional non-adaptation but also the excess burden of uncertainty about the future path of individual prices and the price level. Rising inflation generates demands on the political system to reduce inflation. Intermittent periods of disinflation, unanticipated as to timing and duration, produce a series of Okun gaps. The present value of these Okun gaps is the cost of variable inflation and disinflation. These costs exceed both the single Okun gap and the inflation tax used in Tobin's comparison.<sup>8</sup>

## V. Money and Credit

Thornton's analysis distinguished between money and credit, so he was able to analyze the different responses of the public's demands for money and credit during cyclical fluctuations. He noted that the demand for money declines relative to output during an expansion while the demand for credit increases. Banks or intermediaries have a role in the inflation process as lenders who provide financial resources that permit producers to anticipate future income and future inflation.

Most contemporary analysis makes no provision for banks or intermediaries. There is a single nominal interest rate and, after adjusting for anticipated inflation, a single real interest rate. However, when the balance sheets of households, businesses, banks and intermediaries are consolidated on one side, and the government and central bank balance sheets are consolidated on the other, there are three assets held by the public — base money, government debt, and real capital. To reconcile this asset structure with the single interest rate used in conventional analysis, two of the assets must be perfect substitutes. Typically government debt is assumed to be a perfect substitute for real capital in private portfolios, and in an open economy, real capital must be a perfect substitute for foreign government debt as well.

The assumption of perfect substitution treats a debt financed fiscal expansion as equivalent to an increase in the expected return to real capital that raises the demand for real capital. The price of a unit of capital is the value of a dollar of earnings capitalized at the single interest rate used in the analysis. Differences in duration of shocks that change the term structure of interest rates during business cycles are neglected.

During the Japanese inflation of the late 1980s, asset prices rose and fell substantially more than the output price or market interest rates. The Bank of Japan expressed concern about the rise in asset prices and interpreted the rise as evidence of future inflation. The Bank undertook to raise interest rates so as to lower asset prices and prevent future inflation. The policy succeeded in lowering the prices of common stocks and other assets.

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<sup>8</sup>As noted above, the data in Table 1 show a weak negative relation between average inflation and average growth during 1965-88.

A model that includes money, credit or debt, and capital provides a foundation for the Bank's interpretation.<sup>9</sup> This model implies that the increase in money growth following the Plaza agreement raised the anticipated future rate of inflation. Investors purchased land, raising land prices. Many corporations have large land holdings, so the prices of their shares rose. Also, the public borrowed against the rise in land prices to purchase additional assets including shares of stock.<sup>10</sup> The rise in prices of existing assets relative to the prices of new production encouraged production, raising income, output, and the price level of current output.

To test the model with money, credit and capital on data for Japanese inflation, I used two vector auto regressions. The first relates changes in the logarithms of money, prices, interest rates and stock prices. The second includes changes in log output as an additional variable. Data are quarterly observation from first quarter 1963 to first quarter 1990 on  $M_2$ +CDs, the consumer price index, real GNP, the Nikkei stock index, and the call money rate. A dummy variable is used for the oil shocks in the first 3 quarters of 1974 and 1980. There are eleven lagged values of each variable.

The test equations compare the effects of changes in asset prices and interest rates on the rate of inflation, holding constant the growth rate of money and any information in past rates of inflation or prior changes in real income, as suggested by a modified Phillips curve relation. Including changes in output holds constant the effect of past real growth on asset prices. Summary results for the tests are in Table 2.

The tests suggest that, holding constant the effect of past inflation, money growth and the rate of change of stock prices have a significant effect on current inflation. In fact, the effects of stock prices and money are more significant than lagged prices. Changes in the interest and real output add no significant additional information.

The tests also provide evidence on some alternative hypotheses. There is no evidence of reverse causation from lagged inflation to money growth and only weak effects of output on money or money on output. The data show evidence that stock prices affect output as well as prices, but the significance level of the response is lower for output. Interest rates show no significant effect on other variables, and other variables show no significant effect on interest rates. Even the autoregressive effect of all lagged interest rates on current rates is not highly significant.

The data support the argument that rising stock prices in Japan signalled rising consumer prices in the absence of monetary restraint. There is not much evidence of an effect of money on stock prices or interest rates and no evidence of the effect of inflation on interest rates.

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<sup>9</sup>The analysis is developed more fully in several papers written jointly with Karl Brunner. See Brunner and Meltzer (1989).

<sup>10</sup>According to one estimate, between 1986 and 1988, the price of a condominium in Tokyo rose from 6 to more than 10 times the average income of a city worker. A 165 square meter plot of land in a popular Tokyo district (Setagaya) rose to the equivalent of a salaried employee's lifetime income (Sanwa Bank, 1990).

Table 2 VARs for Japanese Inflation  
1963/1 – 1990/1

|                    | Significance Levels  |                      |          |          |          |
|--------------------|----------------------|----------------------|----------|----------|----------|
|                    | p                    | M <sub>2</sub> +CD   | SP       | i        | y        |
| p                  | .88×10 <sup>-2</sup> | .48                  | .84      | .99      |          |
| M <sub>2</sub> +CD | .63×10 <sup>-5</sup> | .40×10 <sup>-7</sup> | .28      | .13      |          |
| SP                 | .79×10 <sup>-4</sup> | .95                  | .02      | .60      |          |
| i                  | .34                  | .16                  | .18      | .01      |          |
| R <sup>2</sup> /DW | .68/1.93             | .88/1.99             | .31/1.97 | .25/1.94 |          |
| p                  | .03                  | .17                  | .85      | .95      | .81      |
| M <sub>2</sub> +CD | .002                 | .10×10 <sup>-9</sup> | .23      | .17      | .28      |
| SP                 | .006                 | .33                  | .03      | .78      | .08      |
| i                  | .39                  | .42                  | .11      | .09      | .21      |
| y                  | .91                  | .06                  | .24      | .62      | .88      |
| R <sup>2</sup> /DW | .65/1.99             | .89/2.06             | .34/2.00 | .23/1.96 | .50/1.74 |

Definition of variables (all variables are relative rates of change):

p = consumer price index

M<sub>2</sub>+CD = money stock

SP = Nikkei index

i = call money rate

y = real GNP

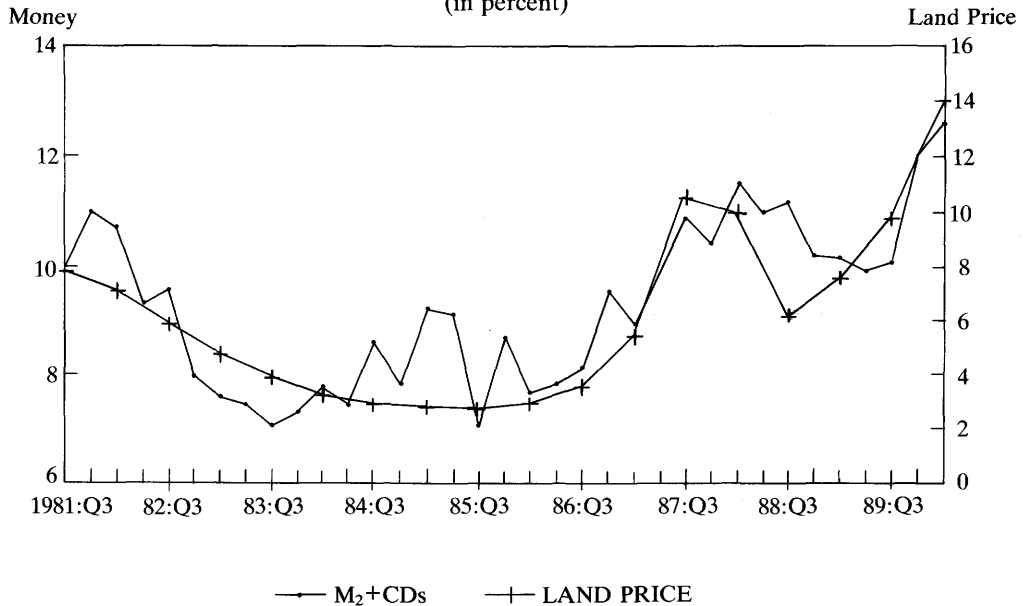
As is well-known, evidence from VARs is often sensitive to specification. While the effect of stock prices and money on consumer prices in Japan may be sufficiently strong to be robust in alternative specifications, other findings are more tentative. Also, lagged interest rates and money may be highly correlated or correlated with other lagged variables. A positive finding is suggestive; a negative finding provides little information.

To gain additional evidence of the effect of asset prices on the CPI, I substituted land prices for interest rates in the VAR. A series on land prices in Japan is available semi-annually, so the number of degrees of freedom is reduced by one-half. Land prices appear to have had a highly significant effect on inflation, given past money growth, inflation, and the growth of stock prices.

Figure 1 shows the relation between money growth and the rate of change of land prices in Japan during the 1980s. There is some question about the degree to which the prices are transaction prices. If the series is an accurate reflection of land prices, the



Figure 1 Money Stock and Land Price  
(in percent)



correlation between the two series during this period is striking. Allowing for differences in scale, it appears that the rate of change of this index of land prices was twice the average rate of change of  $M_2+CDs$  during that decade.

The evidence presented here suggests the importance of asset prices in the transmission of inflation but does not fully support the model with money, debt and capital. That model includes both asset prices and interest rates as determinants of prices and output. The data here give no evidence that changes in interest rates have a significant effect on the rates of change of prices and output, given asset prices.

## VI. Conclusion

Inflation has stimulated research and speculation that added to our understanding of money and monetary policy. This paper discussed the very high level of understanding about money, inflation, interest rates and exchange rates reached by Henry Thornton and others by the end of the first decade of the 19th century. Much of this analysis had to be relearned during the inflation of the past quarter century.

Much new learning occurred also. The development of rational expectations and the analysis of time consistency and credibility have enriched our understanding of theory and policy. Like our predecessors in the 19th century, however, we have not incorporated costs of variability or costs of acquiring information. And we do not have an

accepted explanation of the short-run non-neutrality of money. The paper suggests that costs of acquiring information are central to analyzing the role of money, nominal price setting and some of the costs of variability.

Thornton proposed a rule for monetary policy that, in modern form, called on the central bank to:

1. limit the growth rate of money to the growth rate of output;
2. never reduce the money stock;
3. serve as lender of last resort; and
4. prevent either government spending or the issuance of real bills from influencing the rate of money growth.

Thornton's rule precludes efforts to coordinate policy actions internationally or to adjust the rate of monetary expansion to the stance of domestic fiscal policy. These efforts contributed to the recent inflation in the United States, Japan, and elsewhere. The rule removes the Phillips curve as an influence on policy action by holding money growth close to the long-term growth of output.

If policymakers had followed Thornton's rule, both the rise in inflation at the end of the 1980s and the inflation of the 1960s and 1970s would have been avoided. If policymakers had followed Thornton's rule for money growth and had served as lender of last resort, the severe deflation of the 1930s would have been avoided also.

Classical and neo-classical economists saw the policy problem as a choice of rules and institutions that reduce risk or uncertainty to the minimum inherent in nature and a market economy. This vision was discarded by most of the economics profession after the 1930s. In its place was the view of policy as action taken independent of any rule. Recent work on credibility, rational expectations and time inconsistency restores much of the earlier vision of the policy problem and brings a firmer foundation.

This work, the high cost of variable inflation, and the impossibility of adjusting institutions and norms so as to make inflation fully anticipated probably encouraged the search for changes in policy procedures. Several central banks and governments replaced discretionary action with so-called medium-term strategies, a type of adaptive rule. Some moved toward a fixed exchange rate system with countries in their trading bloc and, to maintain exchange rates, coordinated policies rather than actions. Relearning the benefits of policy rules and humility about our ability to improve on rules that reduce variability are probably the main policy lessons from both great inflations.

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## References

- Brunner, K., and Meltzer, A.H., "The Uses of Money: Money in the Theory of an Exchange Economy," *American Economic Review*, Vol. 61, No. 5, 1971, pp. 784-805.
- , and ———, *Monetary Economics*, Oxford: Basil Blackwell, 1989.
- , and ———, *Money and Economic Activity: Issues in Monetary Analysis*, The 1987 Raffaele Mattioli Lectures, Cambridge, MA: Cambridge University Press, 1992.
- Cukierman, A., *Inflation, Stagflation, Relative Prices and Imperfect Information*, Cambridge, MA: Cambridge University Press, 1984.
- Federal Reserve Bank of St. Louis, *International Economic Conditions*, 1990.
- Fischer, S., "Towards an Understanding of the Costs of Inflation: II," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 15, 1981, pp. 5-42.
- Hicks, J.R., "Real and Monetary Factors in Economic Fluctuations," in M. Monti, ed., *The "New Inflation" and Monetary Policy*, London: Macmillan, 1976, pp. 3-13.
- International Monetary Fund (IMF), *Annual Report*, Washington, various years.
- Kydland, F.E., and Prescott, E.C., "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy*, Vol. 74, December 1977, pp. 545-55.
- Mitchell, B.R., *European Historical Statistics, 1750-1970*, New York: Columbia, 1975.
- Robinson, J., "Ideology and Logic," (with F. Wilkinson), in F. Vicarelli, ed., *Keynes's Relevance Today*, Philadelphia: University of Pennsylvania Press, 1985, pp. 73-98.
- Sanwa Bank, *Economic Letter*, Tokyo: Sanwa Bank, March 1990.
- Schwartz, Anna J., "A Century of British Market Interest Rates," in F. Capie and G.E. Wood, eds., *Monetary Economics in the 1980s*, London: Macmillan, 1989, pp. 41-55.
- Thornton, H., *An Enquiry into the Nature and Effects of the Paper Credit of Great Britain*, New York: Kelley, 1802, repr., 1965.
- Tobin, J., "The Monetarist Counter - Revolution Today — An Appraisal," *Economic Journal*, Vol. 91, March 1980, pp. 29-42.
- , *Policies for Prosperity: Essays in a Keynesian Mode*, P.M. Jackson, ed., Cambridge, MA: MIT Press, 1987.
- Villard, H., "Monetary Theory," in H.S. Ellis, ed., *A Survey of Contemporary Economics*, Philadelphia: Blakiston for the American Economic Association, 1948, pp. 314-51.
- Viner, J., *Studies in the Theory of International Trade*, New York: Kelley, 1937, repr., 1965.
- World Bank, *World Development Report 1990*, Washington, 1990.