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ISSUES CONCERNING NOMINAL ANCHORS FOR MONETARY POLICY

Robert Flood
Michael Mussa

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ABSTRACT

This paper presents a selective survey of issues relevant to the choice of nominal anchors for monetary policy. Section I reviews long price-level histories for the United Kingdom and United States, which reveal that the price level behaved very differently following WWII in these countries than it had done in previous post-war experiences. In particular following WWII the responsibilities of monetary policy expanded to encompass a business-cycle stabilization role and the nominal anchor shifted from the fixed anchor or price-level stability to the moving anchor of inflation-rate stability. The remaining sections of the paper review, in the context of a variety of models, some of the considerations that are relevant to setting the average inflation rate in countries without a fixed nominal anchor.

Robert Flood
Research Department
International Monetary Fund
700 19th Street, NW
Washington, DC 20431
and NBER

Michael Mussa
Research Department
International Monetary Fund
700 19th Street, NW
Washington, DC 20431
and NBER

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Summary

A nominal anchor is a nominal variable that is the target for monetary policy. In this paper we distinguish three types of such anchors. First, when monetary policy fixes the currency price of a commodity or a group of commodities we refer to such an anchor as a fixed nominal anchor, with the gold standard as a famous example. Second, and more generally, when monetary policy targets the growth of a nominal magnitude such as the price level, a monetary aggregate or nominal income for example, building on an inherited past, we refer to such an anchor as a moving nominal anchor. The third arrangement, which is not completely distinct from the previous two, aims at fixing or managing the price of one or more countries' currencies in terms of another country's currency. Countries entering into such a system are agreeing to share a more basic nominal anchor such as one of the countries' inflation target and the nominal systems in those countries inherit properties of the underlying nominal anchor.

Before WWII and the great depression many countries adhered to a commodity standard, on and off, with the gold/silver standard the best-known example. During this period countries following such a standard experienced long-run price stability; inflations, which accompanied wars, were followed by equivalently-sized deflations after the wars. In the period following the great depression and WWII monetary policy was often placed into a more activist role and was expected to make an effort to help stabilize the real economy as well as to deliver politically-tolerable inflation performance.

Much attention in recent years has been directed toward: (1) the appropriate design of monetary policy using theoretical arguments and data-based simulations; (2) the role of monetary policy rules; and (3) the ability of the private sector to exploit certain monetary policy rules as in, for example, a speculative attack on a fixed exchange rate rule. We review selected aspects of this literature drawing out features that we think may be robust across industrial countries and possibly important for their average inflation-rate choice.

Finally, it should be emphasized that in the actual conduct of monetary policy, governments and central banks do not generally behave in a manner that can be summarized easily in a mathematical equation. Almost always, some degree of judgement is exercised by a country's monetary authority. Nevertheless, the conduct of monetary policy is not random and undisciplined; it is governed by reasonably well-defined objectives, in the context of a broad understanding of how monetary policy affects the real economy, the financial system, and the price level. In the end, it is the fact that there is something systematic about the conduct of monetary policy, and about its effects, that allows economic analysis to shed some light, at least potentially, on the effects of alternative monetary policies in supplying a nominal anchor for the economic system. The practical importance and implications of any such analytical exercise, of course, need to be interpreted with an appropriate degree of caution.

I. Introduction

Episodes of various monetary standards, guidelines and sometimes excesses present themselves in every country's history. Monetary arrangements and their price-level results have varied from the long-term average price-level stability of metallic standards adopted by many countries for long periods before World War II, to the hyperinflations in some countries after World War I, during which prices rose at the rate of 50 percent or more per month never to return to the far-distant pre-hyperinflation level. In the gold-standard era the fixed currency price of gold provided an anchor to which prices returned after periods of inflation. Post-WWII economies have not shown a tendency or a desire to return to historical price levels, instead in many post-WWII economies the inflation rate plays the part played previously by a fixed nominal gold price. In this set of economies the inflation rate rather than the price level tends to return to normal levels after bouts of moderately high inflation. In another set of economies low inflation has not been monetary policy's target. In these economies monetary policy is not directed at a nominal target. Instead, the monetary authority has a substantial revenue-producing role, which results in periods of very high inflation alternating with attempts at reform.

These experiences illustrate different *nominal anchors* for monetary policy, where a *nominal anchor is a nominal variable that is the target for monetary policy*. 1/ Three nominal anchor types were common during the last two centuries. The first type of nominal anchor fixes the currency price of one or more commodities. The metallic standards in which many countries linked their monies to gold or silver or a combination of the two for long periods before World War II are the prime examples of such a nominal anchor. In this instance the nominal anchor is the fixed currency price of a standardized metallic unit and such standards are known as *commodity standards*. We refer to this type of anchor as a *fixed nominal anchor* because under such standards there was a general tendency for the level of nominal prices to return to some fixed normal level over long periods.

The second type of nominal anchor comes from a monetary authority's attempting to hit a moving nominal target. Examples of this sort of anchor are monetary targeting strategies, inflation targets or nominal income targets all of which aim at nominal targets that are based on desired growth of a nominal variable building on the inherited past. Such arrangements are best thought of as *inflation standards* since the resulting time path for prices and other nominal magnitudes shows inflation and rates-of-change of other nominal variables returning to baselines over the medium-to longer-term, but with no tendency for the general level of prices to return to some long-term normal level. We refer to this type of system as having a *moving nominal anchor*.

1/ See Adams and Gros (1986), Bruno (1986), and Patinkin (1993).

The third type of arrangement, which is not really completely distinct from the previous two, aims at fixing, or managing the price of a country's currency in terms of another country's currency. These exchange rate arrangements, of which there are many varieties, sometimes involve, for example, almost fixed parities, fixed devaluation schedules, fairly wide *exchange rate target zones* or complicated rules for different kinds of transactions. The nature of all of these exchange rate arrangements is that the countries joining in a fixed or controlled parity arrangement are agreeing to *share a nominal anchor*, with one or more of the participating countries targeting that anchor and others targeting an exchange rate. The countries in Bretton Woods Agreement shared the post-WWII U.S. inflation experience and countries in the Exchange Rate Mechanism portion of the European Monetary System also share a common inflation experience. A shared nominal anchor system can allow a combination of different inflation standards across countries when one of the countries adopts a fixed exchange rate adjustment schedule relative to the partner currency. Because a shared nominal anchor inherits the main features of the underlying nominal anchor with which it is associated, this paper will not devote separate attention to this derivative form of nominal anchor until we study specific policy rules in Section 3.

These monetary anchor regimes differ markedly from monetary regimes in which the monetary authority provides a substantial portion of government revenue. In such systems monetary expansion is directed primarily toward government command of resources instead of being directed at nominal targets. These systems effectively have no nominal anchor and often experience high and variable inflation rates.

In this paper, we discuss nominal anchors and monetary policy in the following three sections. Section I presents and interprets long price-level histories in the United States and the United Kingdom. In this section, it is seen that price levels under the gold standard had a tendency to return to a fixed level--inflations were followed by equivalently-sized deflations. 1/ With the end of the gold standards, following the Great Depression and WWII, industrial countries moved to an inflation standard in which the nominal anchor for most industrial countries became inherited

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1/ Great Britain was on an effectively gold standard after Isaac Newton, as director of the Mint, applied Gresham's law and undervalued gold relative to silver and thereby drove silver coinage out of circulation. The United States was formally on a bi-metallic standard (which was suspended during the Civil War and until 1879). Gold replaced silver as the circulating medium in the United States after the world price of gold relative to silver fell below the U.S. mint ratio in the pre-Civil War period. In 1873, Congress eliminated the bi-metallic standard and provided for the resumption of a gold standard on January 1, 1879. For simplicity, however, we shall refer to the "gold standard" as describing the metallic standard of both the United States and Great Britain in the era before World War II.

nominal magnitudes coupled with a fairly low political tolerance for inflation. Section II presents data on the simple correlation, over a wide cross section of countries in the period since 1960 of average inflation rates and average seignorage revenue collected by the monetary authorities. In this section, it is argued that the setting of the average inflation rate is a problem in political economy that has been reasonably well solved in industrial countries through investment in noninflationary revenue-collecting machinery.

Section III pursues some aspects of monetary policy that go beyond the setting of the average inflation rate and involve the relationship between inflation, monetary policy and economic stabilization. Out of the many contributions in this area, this section reviews two concerning inflation expectations and policy rules that set the stage for many later developments. As applications of these ideas we then examine the performance of some specific monetary policy rules, each adopting a different moving nominal anchor, in a variety of econometric simulation models. Finally we then study the idea that policy rules in general and some nominal anchor policies in particular are temporary. Some concluding remarks and a Technical Appendix follow Section III.

II. Long Price-Level Histories

This section reviews long price-level histories for the United Kingdom and the United States. 1/ Figure 1, Panel A, depicts the U.K. price level. 2/ The Panel begins in 1800, which followed a period of great turmoil in the British financial system. Effectively the British were off the gold standard during the Napoleonic Era and did not return to specie until 1819. From 1820 through the early days of WWI, the United Kingdom stuck firmly to the gold standard and experienced nearly 100 years of comparative *price-level* stability. Note, however, that while the U.K. price level in 1820 nearly matches that in 1920, the time path was a volatile one--adopting a gold standard did not produce year-to-year price stability. The United Kingdom left the gold standard during WWI and the price level more than doubled between 1914 and 1920. Following the war, the United Kingdom painfully deflated until 1925 and was able to resume a form of the gold standard with gold priced at its prewar parity level.

The British experience with the gold standard ended during the Great Depression with the Gold Standard (Amendment) Act of 1931, which ended the Bank of England's commitment to sell gold at a fixed price in exchange sterling bank notes. Once the British left the gold standard, the fixed

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1/ Also presented, in the appendix for comparison, are long price-level histories for France, Italy and Spain, see Figure A1.

2/ The data used in this section are Wholesale Price Indices taken from Mitchell (1992) for the period prior to 1989 and are spliced to comparable data taken from IFS for 1989-92.

nominal anchor was removed from their monetary system and the tendency for goods prices to return to a baseline level was ended. After 1940, in the British experience, it was typical for the inflation rate rather than the price level to return to a normal level.

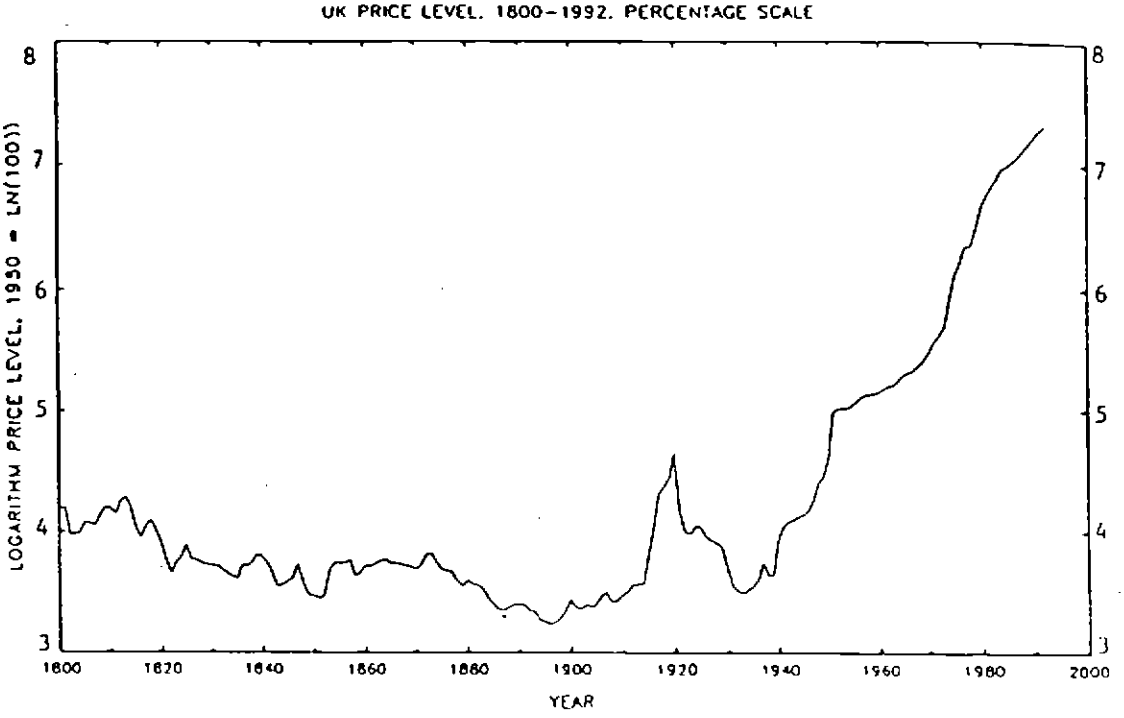
Panel B of Figure 1 plots the United States price level, beginning in 1800 and ending in 1992. This panel reveals the same remarkable difference between pre-WWII and post-WWII price-level behavior that is seen in panel A. Following the observations of Klein (1975) and Friedman and Schwartz (1982), it is apparent from the figure that prices in the prewar period had a tendency to return to a baseline level, with periods of deflation following periods of inflation. This phenomenon also encompasses the departure and subsequent return to the gold standard during and after the U.S. Civil War. On December 30, 1861, all banks suspended specie payments (i.e., stopped converting bank deposits into gold) and the U.S. Treasury soon followed suit, thus effectively removing the US from the gold standard. A massive increase in the supply of paper money (greenbacks) issued to help finance the federal government's wartime expenditures then led to the large rise in the price level during the Civil War years. Following the Civil War, the US experienced a substantial deflation in preparation for the return to specie in 1879. Such price-level reversion is a key characteristic of a specie standard, including a specie standard that is temporarily suspended and later reinstated at the same parity.

It is readily apparent from Figure 1 that there has been an important change in the longer-term behavior of the price level in both the United Kingdom and the United States (and also in other countries not illustrated in this figure) during the past half-century. The run up in the price level during WWII was not unusual by past experience; but the failure of the price level to fall substantially after the war was a key departure from the experience after WWI (for both countries), after the U.S. Civil War (for the United States), and after the Napoleonic Wars (for the United Kingdom). Moreover, since the depression of the 1930s, the cumulative rise of the price level has been far greater than in any previous episode of temporary inflation; and, very strikingly, there has been no period during which the price level has registered any significant decline in either country. In particular, the last time the U.S. CPI registered a year-over-year decline was in 1954, following the Korean War, and this price-level decline amounted to only one percentage point. Clearly, something fundamental has changed in the longer-term behavior of the price level--the inflation rate is persistently positive and there is no longer any tendency for the price level to return to a normal level over the long term. Surely now there is no one who believes that the general price level will ever fall back to where it was in the 1920s or 1930s, or even to where it was in the 1960s or 1970s. Instead, the general price level appears to be headed indefinitely on an upward course, and the only open question for the longer term is how rapid will be the average rate of price inflation.

As illustrated in Figure 2, while the inflation rate has remained positive during the postwar era in both the United Kingdom and the United

Figure 1. Long Price Level Histories: United Kingdom and United States

Panel A



Panel B

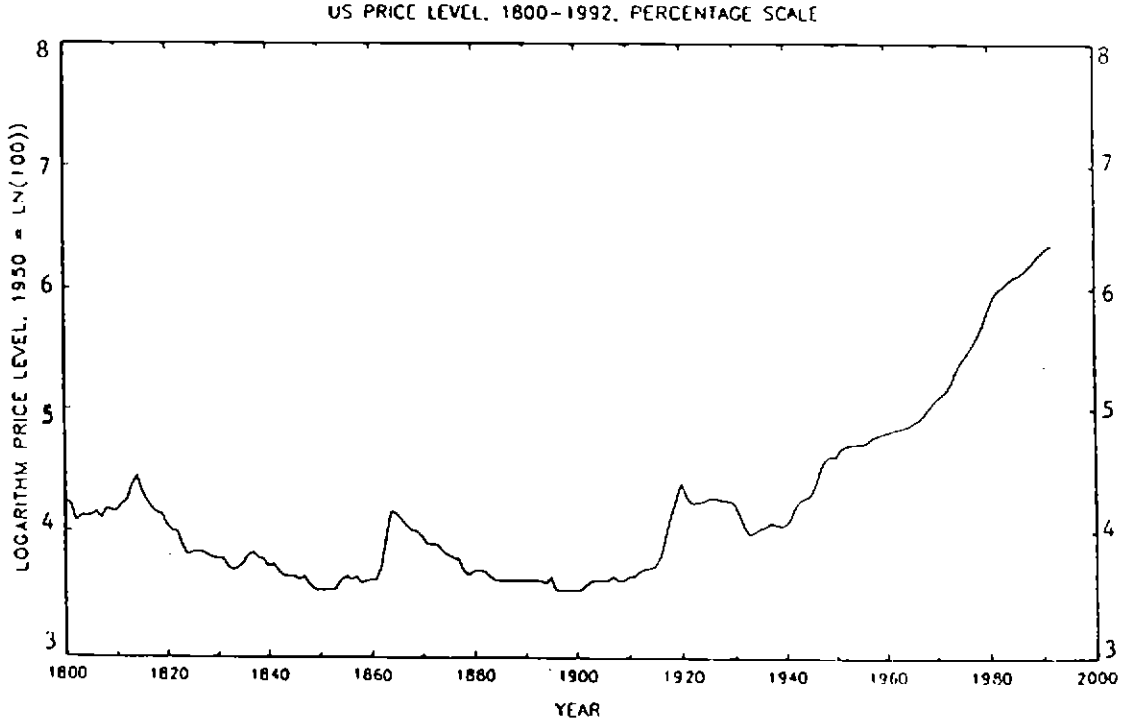
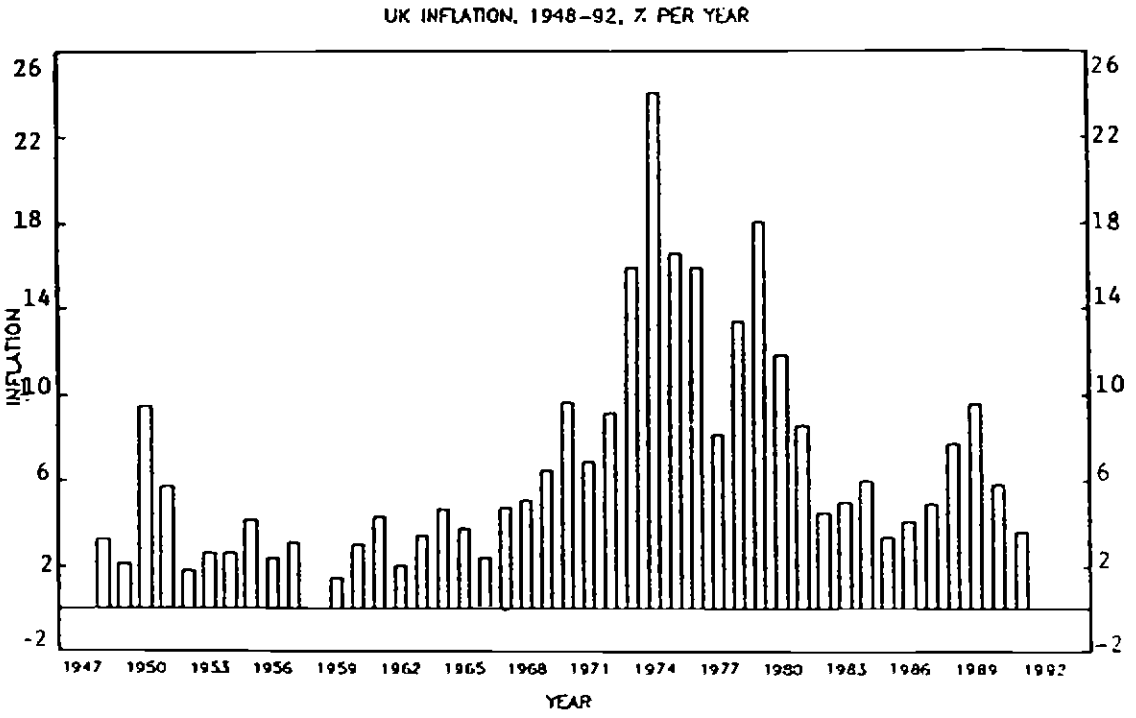
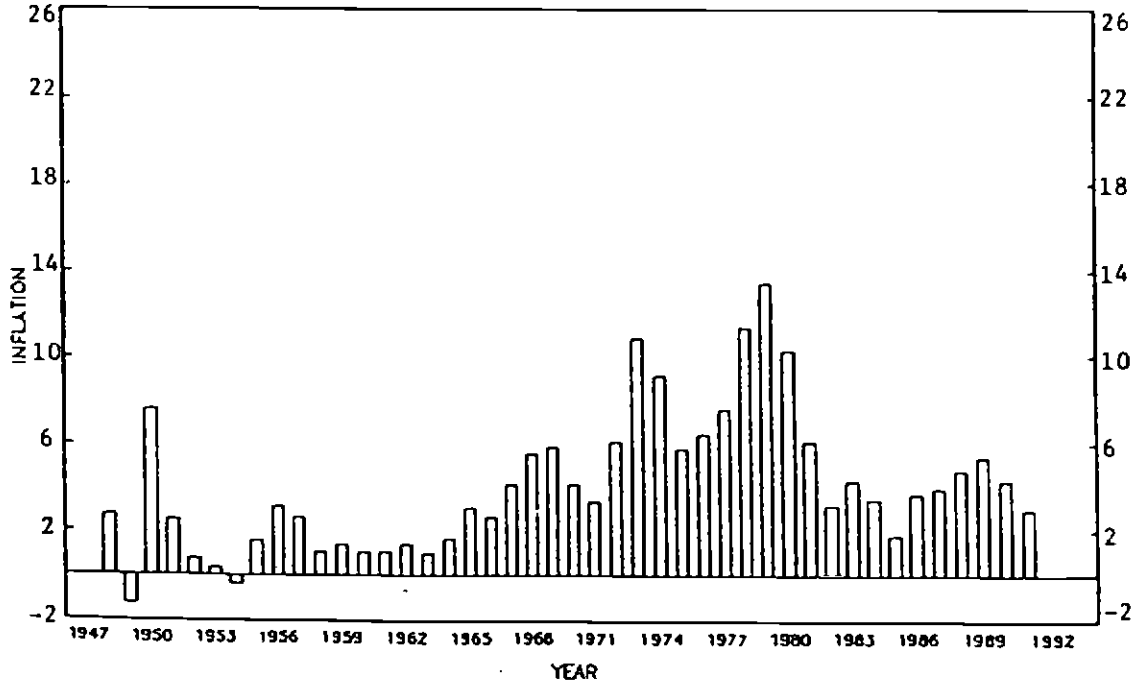


Figure 2. Annual Inflation: United Kingdom and United States

Panel A



Panel B



States, it has surely not been constant in either country. Specifically, for both countries, there is a clear upsurge of inflation beginning in the late 1960s and extending through the 1970s, followed by a noticeable downturn of inflation during the 1980s. In broad terms, this is also the pattern of inflation in most other industrial countries.

It is important that the downward shift of inflation rates during the 1980s and the early 1990s does not appear to be merely a random fluctuation. Governments of most industrial countries have deliberately adjusted their economic policies, especially their monetary policies, to reduce annual percentage rates of inflation generally to the low single digits; and they have been prepared to adopt and persist in such policies even when their economies have turned toward recession. The reason for this apparent shift of policy, in comparison with the 1970s, reflects something more than the absence of supply shocks (especially oil price increases) that contributed to the earlier upsurge of inflation. As indicated in Figure 3 for the United Kingdom and the United States, experience has revealed that higher rates of inflation are not typically associated with stronger economic growth (or with lower unemployment)--certainly not in any medium-term sense. As the public generally became aware that higher inflation was associated with generally poorer, rather than generally better, economic performance, the popular demand to pursue policies consistent with relatively low inflation has clearly grown. Government policy has responded to this popular demand; and the result is apparent in the general reduction of inflation rates during the past decade. This popular demand for low inflation, however, has not induced a return to price-level stability. One does not hear a popular clamor for aggressive price deflation to restore the general level of prices to that prevailing in the 1950s or 1960s; and there is absolutely no evidence that any government is prepared even to contemplate policies that might produce such a result.

Thus, even from a very crude examination of the facts, it may be stated with great confidence that there has been a fundamental change in the nature of the nominal anchor in industrial countries in the post-WWII era. There has been a shift away from a commodity-standard anchor that fixes the longer-term average behavior of the price level, with alternating periods of offsetting inflation and deflation. There has been a shift to a nominal anchor that appears to place some limit on the longer-term average behavior of the rate of price inflation.

This shift in the fundamental nature of the nominal anchor of the monetary system corresponds to the widespread acceptance of paper money standards under which national governments (or national central banks) take responsibility for managing the conduct of monetary policy with some objective other than the maintenance of a fixed price of some specific commodity in terms of paper money. As these paper money standards have been managed during the past half-century, it is clear that the general price level has lost its tendency (under the previously prevailing metallic standards) to return to some average level over the long term. Instead, the objectives that have effectively governed the conduct of national monetary

policies have delivered consistently positive, but not persistently accelerating, rates of general price inflation. The absence of any widespread popular demand for a return to commodity-based money, and the corresponding general acceptance of "well-managed" paper money standards, suggest that, for the foreseeable future, the longer-term movement of general price level is likely to be characterized a positive (and hopefully quite low) rate of inflation. A key question with respect to this new form of moving nominal anchor is--what determines the longer-term average rate of price inflation?

III. Inflation, Public Finance and Political Economy

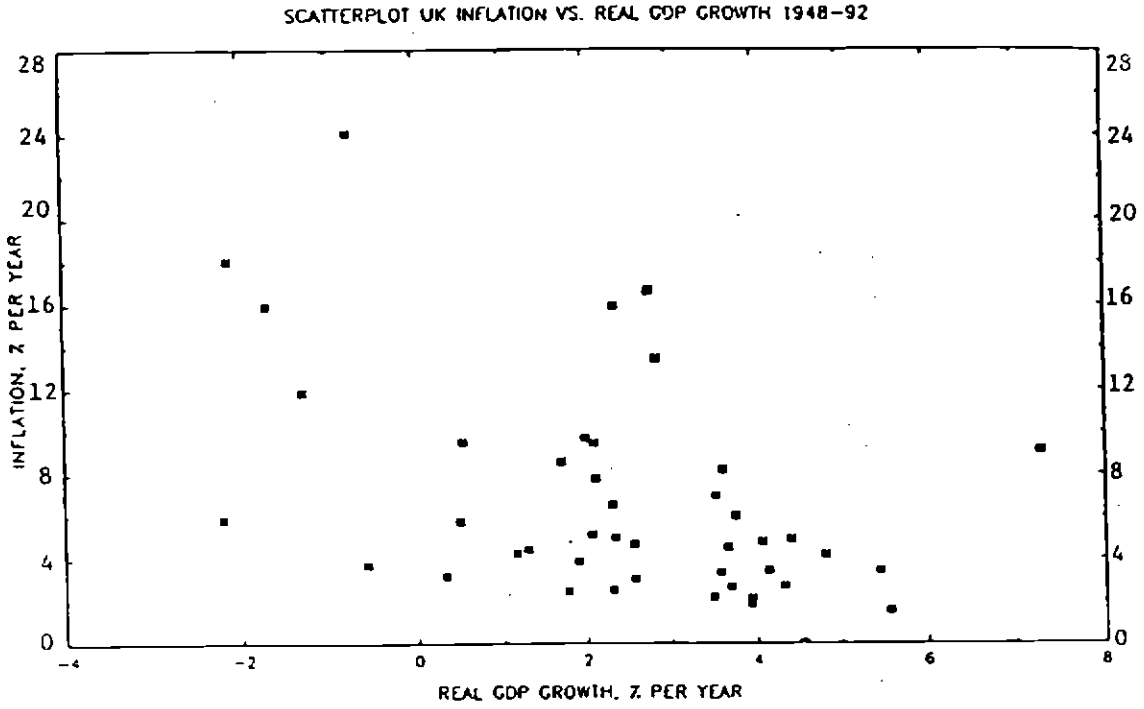
The use of a commodity standard in establishing a nominal anchor for monetary policy might be said to focus primarily on money's traditional function as a unit of account. A quite different perspective on the nominal anchor, and one more consistent with a situation of persistently positive inflation, comes from the treatment of money within the theory of public finance. From the perspective of public finance, money is like any other taxable commodity except that taxes on existing money balances are collected very directly and without much fanfare by the government's issuing more nominal money balances instead of through a more indirect government-revenue agency. The real revenue raised by a government from monetary expansion, real seignorage, is equal to $\Delta M/P = \mu*(M/P)$ where ΔM is the change in government-issued base money, P is the price level and μ is the rate of base-money expansion.

To clarify the connection between μ and inflation note that the income-velocity identity, $M*V = P*y$, where V is income velocity and y is real income, implies, for small changes, $\pi = \mu + (\Delta V/V) - (\Delta y/y)$, where π is inflation. The velocity growth rate, $\Delta V/V$, and the real income growth rate, $\Delta y/y$, modify the one-to-one relation between money growth and inflation. For fixed money growth rates, however, whose levels are unlikely to influence the rate of change of velocity or output, changes in money growth translate directly into equivalent changes in inflation.

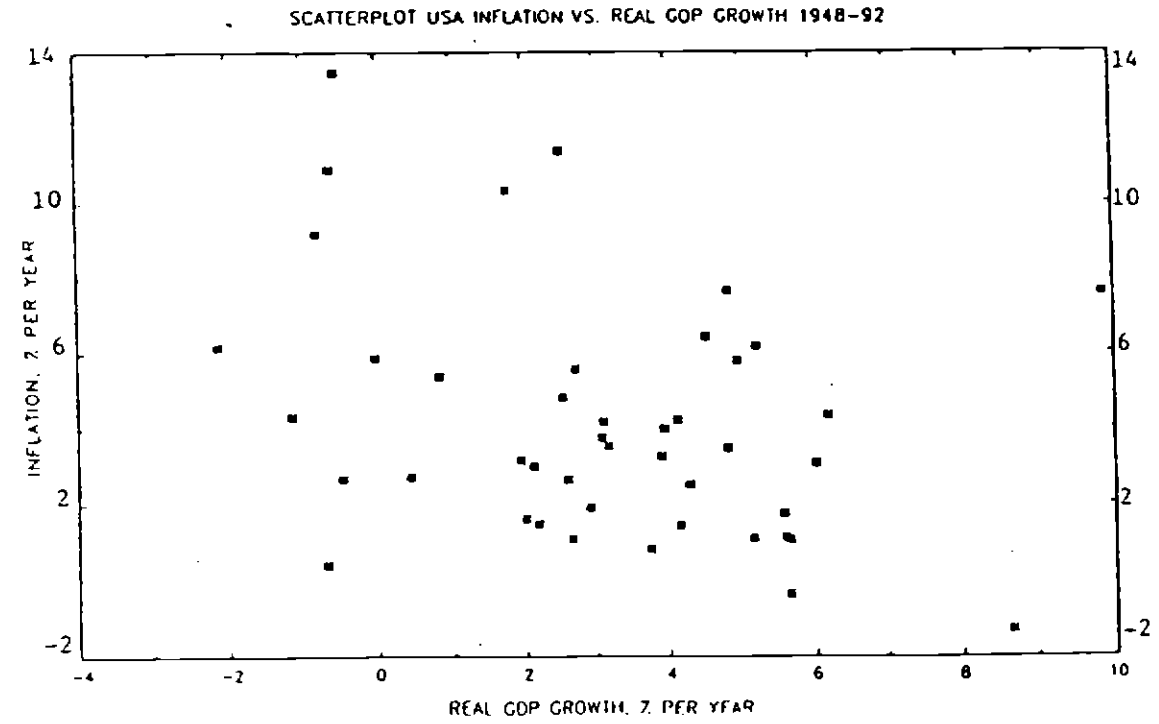
Changes in money growth, however, do not translate proportionately into changes in seignorage because an increase in steady inflation raises the cost of holding real money balances, M/P, and accordingly tends to reduce the demand to hold such balances. In other words, a higher rate of monetary expansion tends to increase velocity and therefore tends to lead to a less than proportional increase in seignorage. Indeed, at sufficiently high rates of monetary expansion and of inflation, further increases in the rate of monetary expansion can actually reduce seignorage. In practice, this effect is often reinforced, to a considerable extent, by the "Tanzi effect," that is, by the tendency for other sources of government revenue to erode as the rate of inflation rise.

Leaving aside the Tanzi effect, the theory of public finance typically divides the burden imposed on society by the inflation (or money

Figure 3. Inflation and Output Growth Scatterpoints:
United Kingdom and United States
Panel A



Panel B



creation) tax into two elements: the *primary burden* of the tax, which is the amount of seignorage raised by this tax; and the *excess burden* of the tax, which measures the distortionary effects of inflation in reducing the efficiency of economic activity by artificially inducing people to economize on the use of money balances. 1/ The traditional measure of the excess burden of inflation taxation is identified with the area under the money demand curve beyond the current level of money holding. 2/ In principle, if a government could raise adequate revenue by imposing distortionless taxes, there would be no need to impose an inflation tax and thereby incur the excess burden of this tax. In practice, however, with only distortionary taxes available to raise necessary revenue, the optimal tax structure requires that the total excess burden of raising government revenue be minimized. This, in turn, implies that the marginal excess burdens of a government's raising revenue from its various sources be equated. If not, rearranging tax burdens would provide an efficiency gain. 3/

Estimating efficient tax levels across markets requires a knowledge of appropriately-constructed demand and supply for all commodities and services for which taxes are being considered. A full solution of this problem in an applied situation requires a detailed knowledge of the economy being studied. As a practical matter, however, it may not be these concerns highlighted by the theory of public finance, but rather more down-to-earth concerns of political economy that determine different countries choices of an average inflation rate and of how this average inflation rate may evolve with other economic circumstances.

Industrial countries typically have invested in large and efficient mechanisms for collecting property, income and value-added or other consumption taxes. After an upsurge of inflation during the 1970s, most of the industrial countries have more recently pursued inflation rates in the low to medium single-digits, even sometimes at what has appeared to be the cost of recessions of considerable depth and duration. The explanation of these developments in terms of the theory of public finance is somewhat

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1/ It is in this sense that a tax that cannot be avoided is an efficient one. It has no excess burden and does not distort private behavior.

2/ This measure is due to Bailey (1956). Friedman (1969) pointed out that this traditional measure yields an optimal quantity of money equal to the level of real money balances at which the money demand curve depicting the demand for real money balances against the nominal interest rate hits the real money balances axis. In other words the optimum requires a zero nominal rate of interest or a rate of *expected deflation* that exactly equals the real rate of interest.

3/ Phelps (1973) noted that Friedman's (1969) result, which places the marginal excess burden on money holding at zero, requires that taxes other than those on money be raised by a nondistorting lump-sum manner. Since lump-sum taxes are not available, Phelps argued, the appropriate tax on money should equate marginal excess burdens that are positive.

problematical. 1/ The objections of the electorate to higher rates of inflation, and the association of higher inflation rates with lower growth and higher unemployment, may perhaps provide a better explanation of this shift back toward lower average inflation rates.

In a number of developing countries, with less of an investment in tax-collecting capital, there has often been much greater reliance on the inflation tax, as a means of government finance. This is indicated in Figure 4 which, in its two panels, provides scatter-plots across a sample of different countries of average inflation rates (on the vertical axis) against a seignorage measure (on the horizontal axis). 2/

Panel A plots that country-average data over the period 1960-92. Each data point shows a particular country's average annual inflation rate over the period and its average annual ratio of seignorage to GDP. 3/ The first point to notice about Panel A is the distinctly positive relation between the variables. Second, as a broad generalization, when seignorage/GDP rises above about 2 percent, it appears that a country risks high inflation, and this risk grows more serious as the ratio continues to rise. Indeed, this phenomenon is generally most pronounced for countries with the highest inflation rates, all of which have seignorage/GDP ratios above 2 percent. These observations have been excluded from the Figure in order to avoid their appearance dominating the diagram.

Panel B of the Figure repeats the first panel, but for the shorter period from 1980-92; and the Appendix presents similar diagrams for 1960-69 and for 1970-79. All of these diagrams illustrate strongly the importance of some sort of nominal anchor that limits the longer-term average inflation rate. Specifically, when there is an effort to push seignorage as a percent of GDP above about 1-2 percent on average on the longer term, the *risks* of very high inflation escalate dramatically. As many studies have shown, there appears to be no reliable way to stabilize inflation at moderately high rates of, say, 50 percent per year. Either there must be an effort to

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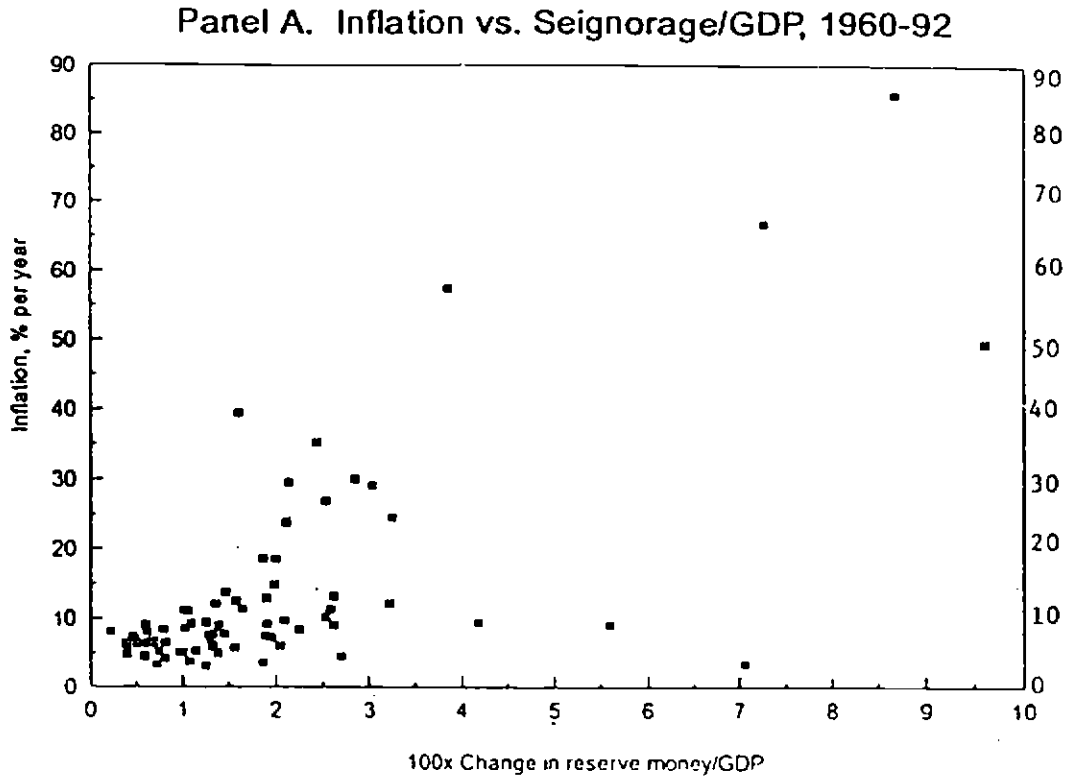
1/ See Fischer and Modigliani (1978) and Fischer (1981).

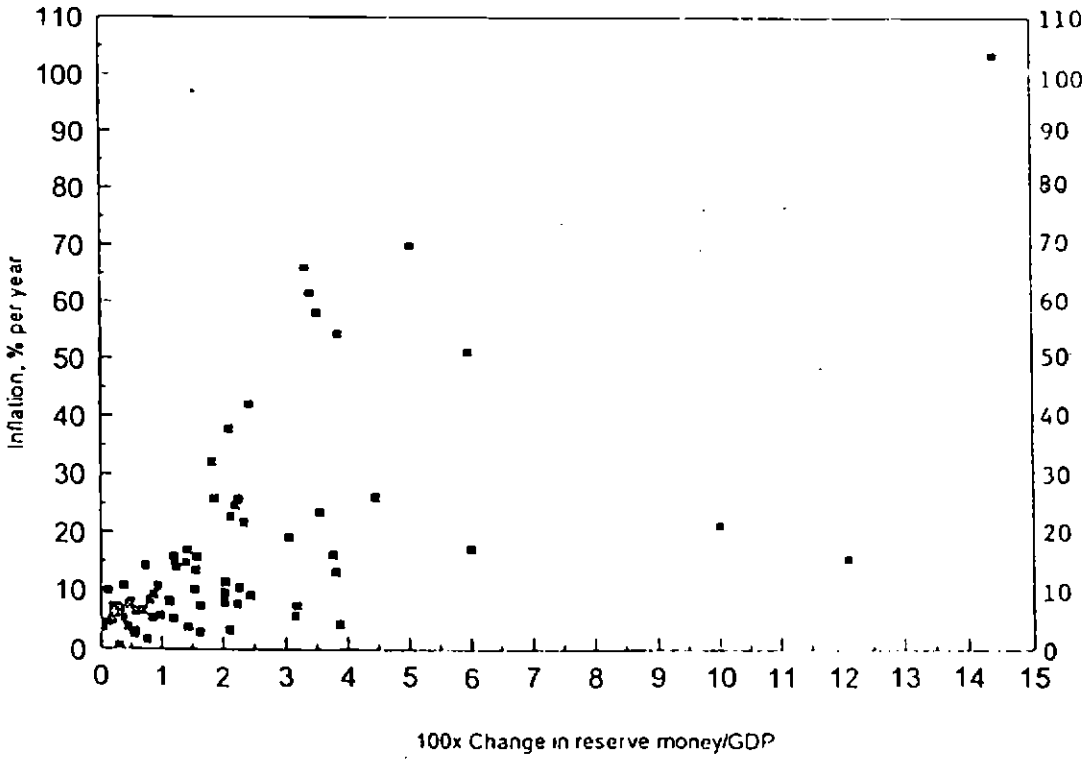
2/ Our seignorage measure, which follows Fischer (1982), is change in reserve money, line 14 in IFS. This measure somewhat overstates true seignorage since we are neglecting the real costs of maintaining the monetary system, the cost of coinage, and the cost printing and replacing paper money. A better seignorage estimate would adjust for such costs to find the real revenue created by the monetary authority for use in other government activities.

The samples used in constructing Figure 4 and the corresponding figure in the appendix, Figure A2, are presented in appendix Tables A1-A4. Countries for which IFS data is not available since 1960 or for which there are other data problems in IFS are not included in our report.

3/ The relationship between inflation and seignorage will be different, even over longer periods, between countries depending in the country's degree of use of base money and output growth rate.

Figure 4. Inflation v.s. Seignorage/GDP





drive inflation back down at least to the lower double digits on an annual basis, or there appears to be a tendency for inflation to escalate well into the double digits on a monthly basis. Economies that fall into this latter category really have no meaningful nominal anchor. The remainder of this paper shall not be concerned with such economies, but only with economies that have achieved at least some reasonable nominal stability as measured by the longer-term average inflation rate.

For countries that do maintain a meaningful nominal anchor in the form of a relatively low longer-term inflation rate, seignorage revenue from money creation is in general a quite small fraction of GDP and of total government revenue. Even for such countries, seignorage is not necessarily a trivial concern. However, it is difficult to see that the generation of seignorage, within a scheme of minimizing the distortionary effects of the government's entire scheme for revenue generation, as the dominant concern in determining the longer-term inflation rate. In particular, it strains credulity to attempt to argue that the general increase of inflation rates in industrial countries during the 1970s was motivated primarily by a calculated effort to counterbalance increases in the marginal distortionary effects of other forms of raising government revenue through taxation by increasing the rate of the inflation tax. Correspondingly, it is difficult to see the general reduction of inflation during the past decade in a reverse manner from the perspective of the determination of the inflation rate within the theory of public finance. Rather, it seems necessary to look elsewhere, to broader concerns about the conduct of monetary policy, to seek a plausible explanation for the determination of the longer-term average inflation rate.

IV. Stabilization Policy and Inflation

From our earlier examination of Figure 1 it is evident that U.S. and U.K. price levels behaved differently before and after the period surrounding WWII. According to Klein (1975) and Friedman and Schwartz (1982) the role of monetary policy changed fundamentally during the period just following the War. Before the War monetary policy was primarily responsible for maintaining the fixed nominal anchor, but after the War monetary policy assumed part of the responsibility for economic stabilization. The relationship between monetary policy, inflation and economic activity has been the subject of a truly enormous literature. Instead of trying to cover the whole field we will first review briefly the case for using monetary policy to stabilize the real economy and then concentrate on the two developments that helped shape recent work in this area, the appreciation of importance of expectations and the appreciation of the role of policy rules. As applications of these two developments we then examine briefly the performance of a selection of monetary policy rules directed toward various nominal anchors in multi-country models. Finally we discuss temporary versus more-permanent policy rules including an exposition of how well-informed and very well-financed private speculators can force a policy crisis.

1. The case for monetary stabilization of the real economy

At least since the work of Keynes (1936), macroeconomists have tended to be divided into two broad groups: those who favor active policy intervention to attempt to stabilize the real economy on a more or less continuous basis; and those who generally oppose such intervention except perhaps in limited instances. In general, the more interventionist group may be a little more tolerant of a higher average rate of inflation or, put slightly differently, may be a little more anxious to avoid the short-term costs of reducing inflation. The noninterventionist group, on the other hand, may generally be somewhat more concerned about the economic costs of a higher average inflation rate. The main difference between the two groups concerns, however, the role and usefulness of monetary policy as counter-cyclical policy tool.

In the most recent phase of this debate the groups have also tended to be separated by technical issues of economic modeling. The noninterventionists have focused to a considerable extent on "real business cycles," that is on viewing business cycles as the natural result of real disturbances to tastes and technology affecting a competitive economic system with flexible prices and wages. From the perspective of equilibrium-business-cycle models, there is little that monetary policy can do to affect the behavior of the real economy; and, accordingly, there is little or no useful role for interventionist monetary policy to attempt to stabilize the real economy. 1/ In contrast, the more interventionist group has focused more on "neo-Keynesian" models of business cycles that feature various market imperfections and frictions, especially sticky wages and prices, assorted liquidity phenomena or missing markets for product or

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1/ The equilibrium business-cycle group, which is based on Kydland and Prescott (1982), and King and Plosser (1984) argues that the observed correlation between the business cycle and various monetary measures is due to monetary accommodation of real shocks in order to stabilize interest rates. A simple way to think about this view is in terms of a money market equilibrium that depends on real money balances, the nominal interest rate and real output. A real output shock, say positive, increases the demand for money and would require a price level movement combined with an interest rate movement unless the monetary authority accommodates the real shock by increasing the money supply to preserve monetary equilibrium at an unchanged interest rate and unchanged price level.

labor market information. 1/ The essential idea is that these imperfections and frictions give monetary policy some significant bite in influencing the real economy. Accordingly, many who adopt the neo-Keynesian perspective argue that there is a good deal that monetary policy can and should do to stabilize the real economy in the face of both nominal and real shocks that would otherwise cause significant and undesirable departures from medium-term macroeconomic equilibrium.

Because our purpose is to study a variety of important issues concerning the use of monetary policy for stabilization purposes that have been developed in the macroeconomics literature, in this discussion we adopt important elements of the neo-Keynesian perspective--at least to the extent that we assume that there are mechanisms through which monetary policy might have a meaningful influence on the behavior of the real economy. At the outset, however, we emphasize that the assumption of a capacity for such influence does not automatically imply that monetary policy can be used successfully for economic stabilization. Indeed, many of the more traditional monetary economists who have opposed activist monetary policies have done so not because of any doubt of the real influence of monetary policy, but rather because of considerable doubt about the ability to use this influence systematically in a constructive manner.

This critically important point can be illustrated with a variety of models that allow a meaningful role for monetary policy in influencing the real economy. Most of these models share essential common elements and end up providing broadly similar rationales for stabilization policy. The key ingredient is usually some form of (temporary) nominal price or wage rigidity that allows quantities to adjust to purely nominal disturbances. These quantity adjustments may be the best responses available for individual decision makers, but are distinctly inappropriate from the economy-wide perspective. The idea is that the best response to a nominal disturbance would be a price response, but with prices harder to move than quantities, individuals make socially-undesirable quantity responses. In

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1/ Models with sticky wages and prices form the underpinnings of many large-scale macro models such as those discussed below. Rational expectations were introduced to this part of the literature by Azariadis (1975), and Taylor (1977). Ackerloff and Yellin (1985) and Mankiw (1985) present more recent work in this tradition. While product and labor markets are the historical favorite preserves for nominal rigidities, some other work concentrates on rigidities and information problems in credit markets, e.g., Blinder and Stiglitz (1983), Bernanke and Gertler (1987).

An essentially equivalent sort of rigidity is postulated by Lucas (1972). In his work, Lucas develops an information-based monetary business cycle, where *ad hoc* information differences play the same sort of role as sticky wages or prices or credit-market problems. The point of all of this work is to develop theories that depart from the complete-markets competitive-equilibrium paradigm and allow nominal disturbances to influence real decisions.

these models, monetary policy clearly can play a useful role in stabilizing real output by offsetting other nominal disturbances that would otherwise cause undesirable real output fluctuations. More generally, if there are real shocks to aggregate demand that arise from nonmonetary sources, but would cause undesirable fluctuations in output, then monetary policy can act to offset (at least partially) the undesirable real effects of these shocks.

Shocks can also occur, however, on the supply side of the economy, for which the economically desirable response is an adjustment of quantities as well as of prices. If monetary policy is used to offset such shocks, the result may be a reduction, rather than an improvement, in economic welfare. Of course, if it is possible to know the nature of the shock affecting the economy and respond in a timely and appropriate manner, then interventionist monetary policy should be a force for good. However, the information requirements for this situation to prevail in practice may not usually be met. If, because of lack of adequate information, monetary policy focuses invariably on the stabilization of output, then the results are likely to be beneficial (on average) only if the shocks affecting output are primarily on the demand side. Also, as a practical matter of great importance, monetary policy appears to affect the real economy only with a considerable and somewhat unpredictable lag. This significantly complicates and limits the potential usefulness of monetary policy in attempting to correct even demand-side disturbances of limited magnitude and duration.

With this general background, it is useful now to turn to two specific developments that have helped shape monetary-policy literature in recent years.

2. The importance of expectations

It has long been recognized that expectations about future economic developments exert an important influence on current economic behavior. With the shift away from nominal anchors that provided long-run stability of the price level, to nominal stability measured in terms of positive long-run inflation rates, the issue of inflationary expectations gained increasing importance in discussions of the effects of monetary policy. Through the 1960s, much of the analysis of monetary policy and its role in macroeconomic stabilization used a variety of econometric models that generally assumed some form of "adaptive expectations." In this approach, it was assumed that expectations about future inflation (and about some other relevant variables) were formed by taking backward-looking weighted average of past experience and adjusting expectations partially in response to deviations of new data from this backward-looking weighted average. Such a backward-looking approach to the modelling of expectations was appropriate *during times of policy stability*, when the evolution of variables like the inflation rate was reasonably well described as an evolutionary and adaptive process.

During the 1970s, however, it came to be recognized that this backward-looking approach to expectations formation could prove seriously

misleading, especially in evaluating different possible regimes for the conduct of monetary policy for purposes of macroeconomic stabilization. Specifically, if expectations of inflation were inevitably backward-looking, then it appeared, from many standard macroeconomic models, that a policy of continually accelerating the rate of money creation and hence the rate of price inflation could induce a permanent increase in the level of output above its normal equilibrium level. This was the so-called *accelerationist controversy*, which was a major focus of Milton Friedman's (1968) Presidential Address to the American Economic Association.

In that address Friedman argued in favor of the idea that there was no permanent trade-off between higher inflation and lower unemployment and that any effort to continually accelerate the inflation rate to exploit a possible short-run trade-off would be defeated by the forward-looking adjustment of expectations to take account of such acceleration. An essential idea that was introduced in Friedman's thinking and in other macroeconomic theorizing at that time was the "expectations-augmented Phillips curve," which we represent formally as:

$$y = \beta(\pi - \gamma\pi^{x}) + u, \quad \beta > 0, \; 0 < \gamma \leq 1 \tag{1}$$

where y is the level of output, π is the inflation rate, π^{x} is the anticipated rate of inflation and u is a residual that captures all aspects of aggregate supply not captured elsewhere. 1/

The accelerationist controversy may be characterized in terms of modeling π^{x} and setting γ. In Friedman's original work, $\gamma = 1$ and expectations are forward looking; implying that there is no way to induce, on average over the longer-term, a divergence between the actual and the expected inflation rate. If inflationary expectations were necessarily adaptive and backward looking or if $\gamma < 1$, however, then by pushing the inflation rate to progressively higher levels, it should be possible to induce a permanent divergence between actual and expected inflation. This would imply the possibility that accelerating inflation could produce a long-term output gain.

Solow (1969) and Gordon (1969), assuming adaptive expectations, produced econometric estimates of γ below unity and thus it appeared

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1/ Friedman's argument was presented in terms of the relation made popular by A.W. Phillips (1958) in which he related U.K. unemployment to the rate of change of the U.K. nominal wage. The disturbance u may be regarded as bringing composed, in part, by the errors made in converting from wages to prices and from unemployment to output.

For present purposes we allow u to incorporate all predetermined aspects of current-output determination.

initially that steady inflation could result in a long-term output gain. Later work by Sargent (1971), who assumed rational expectations, found γ to be insignificantly different from one. Operationally, rational expectations means that the individuals being modeled form their anticipations as mathematical expectations based on information concerning private and government behavior in the model at hand.

Introduction of the assumption of rational expectations into many standard macroeconomic models turned out to have dramatic implications. Specifically, returning to equation (1), replace π^x by $E\pi$, where E is the mathematical expectation operator. Now, since $\gamma = 1$, the term involving current magnitudes affecting y involves only $\pi - E\pi$. With expectations formed rationally, this difference must correspond exclusively to the unexpected part of (or surprise in) the inflation rate. This implies that monetary policy can influence output only by creating a surprise in the inflation rate. As a minimal requirement of rationality, given a well-understood regime for the conduct of monetary policy, such surprises should average out to be zero.

Moreover, the appearance of this term clarifies the possible role for monetary policy. In particular, monetary policy is effective in influencing output only to the extent that such policy can influence *inflation surprises*. Policy can stabilize the real economy, therefore, only if policymakers can engineer appropriate private-sector inflation surprises. Government monetary policy actions that are understood and fully expected by the private sector are, by definition, not a surprise in relation to the information used to form $E\pi$ and therefore do not influence output. This is the famous *policy ineffectiveness* result first proposed by Sargent and Wallace (1975).

This result, however, does not mean that monetary policy can have no systematic effect on the behavior of output; it just means that to have an effect the government must have an information advantage. 1/ In particular, it is consistent with the Sargent and Wallace result that policies based on current information that was unavailable to private decision makers when they formed their expectations can influence the amplitude of business-cycle fluctuations. 2/

In our consideration below of various nominal-anchor policies we will adopt rational expectations and we will study models that are consistent with the Sargent and Wallace result. The policies that we study influence

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1/ Formally, the policy must be based on information that is not available to individuals when forming $E\pi_t$. In many models $E\pi_t$ is based on information from time t-1, so that variables from time t can influence output.

2/ To trace out the full business-cycle results of an inflation surprise would require that we specify fully the dynamics of the residual u, which is outside the scope of the current discussion.

the volatility of shocks to output due to a government information advantage. 1/

3. Policy rules

How do we go about modeling and evaluating hypothetical economic policy? The type of formal analysis of economic policy that is currently popular was introduced to macro-analysis by Poole (1970) who studied how to set monetary policy optimally in a simple IS-LM model. At the time Poole wrote, the IS-LM structure was the standard for studying output and interest rate *outcomes* of particular policy actions. Poole's innovation was to shift attention from particular outcomes of policy actions to the properties of the *distributions* of the variables of interest to policymakers, such as mean and variance of inflation, output or unemployment. In particular, Poole studied how the joint distribution of output and the nominal interest rate were influenced by the stance of monetary policy. In Poole's work, a policy was not a particular movement of a policy-controlled variable it was a systematic rule for setting that variable. 2/

Poole's methods have become popular because they allow researchers to model policy from outside the actual policymaking environment. In particular, these methods give policymakers a specific set of rules for policy and then allow the researcher to study how well, on average, a model economy adopting these rules would perform. While Poole's work established a role and a method for the study of monetary rules it did not build a case for why actual policy *should be* conducted in accord with predetermined rules rather than on a discretionary basis in response to actually realized events and its to this problem that we turn next.

Is it better for policymakers to respond to events according to a preset list of instructions as in Poole (1970) or should they maintain the freedom to react to events as they are realized? There is an extensive literature on this issue, which demonstrates, in theory, the potential gains to an economy that come from having the monetary authority adopt a set of policy rules rather than act at their own discretion to stabilize the economy.

The basic ideas in the rules-versus-discretion literature were used first in the macroeconomic setting by Kydland and Prescott (1977) and Calvo (1978) to help understand inflation in post-WWII industrial countries. The ideas were subsequently popularized by Barro and Gordon (1983a, b).

Crucial to the results in these models is the notion that distortions in the economy may lead private and public goals to diverge and thus the

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1/ See Henderson and McKibbin (1993) on the role of expectations in the wage-price sector of large-scale econometric models.

2/ The rules Poole studied were a rule that fixed the interest rate and a rule that fixed the money supply.

public finance and political economy considerations we mentioned in Section II may need to be supplemented. In the models, the government prefers a higher level of real activity than does the private sector. This may result, for example, if the private sector is distorted by an income tax to over-consume leisure activities. In the models, the real distortion is immutable and the only method available to the monetary authority to induce additional real activity is to surprise the private sector with unexpectedly high inflation, as in equation (1). Even though the government also dislikes inflation, a large enough divergence in basic goals will lead the government to tolerate some inflation in order to induce additional real activity. Understanding the monetary authority's motives and options, the private sector is aware that the government will attempt a surprise inflation unless the inflation rate is driven so high that it no longer is worthwhile for the government to attempt such a surprise.

If the private sector and the government could get together and cooperate they could arrange a noninflationary equilibrium that would improve social welfare. But the way the models are setup the two sides cannot get together and the only way the private sector can be confident of their expectations of government behavior is when the inflation rate is driven so high, on average, that the government's valuation of the activity gains from an inflation surprise exactly balance the costs associated with the additional inflation. The equilibrium that results, therefore, is an inflationary one with the inflation perfectly anticipated and producing no activity gains.

In this literature the noncooperative interaction that develops between the private and public sectors is known as a *game* and this game's equilibrium results in the government attempting to trick the private sector into producing more, but in the end only damaging the economy with excessive inflation. One answer to this type of problem is for the private sector to closely proscribe government actions so that the government is effectively prohibited from playing policy games. What is often recommended in this literature is that the government behave according to simple easy-to-monitor rules and in the next subsection we will review some simulations of such rules.

We recognize that our attention to fixed rules is very far from the immediately-relevant type of question that policymakers must ask themselves on a day-to-day basis, which is essentially: "What should be done today?" At first we will proceed as if the answer is always "Follow the rule." After the next subsection we will expand our discussion to recognize the possibility that rules may be abandoned temporarily during exceptional circumstances.

4. Specific policy rules evaluated in multi-country models

Our aim here is to try to find out how many of the major economies would behave if their monetary authorities followed some specific moving nominal anchor policies. Of course, in economics there is never really an

opportunity to conduct controlled experiments *on actual economies* in order to sort out the performance of policy alternatives. Instead economists construct econometric models from historical data, build the policy alternatives into the models and then hope that the altered models behave as history would have behaved had the policies actually been followed. Such experiments are called *policy simulations*. If economists had great confidence in their models then they might also have confidence in the results. Unfortunately such is not the case.

In fact there are a large number of carefully-constructed models built by different groups, using the same historical data that are really quite different from each other. While each modeling group may have confidence in its own work, it is likely that each group is equally confident that other models are lacking in various ways. In view of such doubts, rather than report the results of policy simulations in one particular economic model we use the approach recommended by McCallum (1988), which is to report the results of policy simulations across a wide range of state-of-the art models. 1/ The work that we draw on here is that reported by Bryant, Hooper and Mann (1993), BHM, where nine multi-country econometric models were asked to simulate the effects of adopting a set of monetary policy rules. 2/ The rules studied are: (1) a money targeting rule; (2) a nominal income targeting rule; (2a) a combination inflation and real output targeting rule; and (3) an exchange rate targeting rule. The precise rules that the various modelling groups were asked to study are:

$$\text{(Regime 1)} \quad RS_t - RS_t^* = -5 \log (M_t^*/M_t)$$

$$\text{(Regime 2A)} \quad RS_t - RS_t^* = -1.5 \log [(PY)_t/(PY)_t^*]$$

$$\text{(Regime 2B)} \quad RS_t - RS_t^* = -1.5 [(\pi_t - \pi_t^*) + \log (Y_t/Y_t^*)]$$

$$\text{(Regime 3)} \quad RS_t - RS_t^* = 2.5 \log (S_t^*/S_t),$$

where

RS = the short-term nominal interest rate measured in percentage points per year divided by 100

M = the monetary base (or some other narrow monetary aggregate)

P = the price level (GNP or GDP deflator)

Y = real GNP or GDP

1/ We are, of course, not protected if all of the models make the same sort of error.

2/ The models that participated in this study are listed in the Appendix.

π = the rate of inflation in the price level P (expressed as percent per year)

S = the nominal exchange rate, measured in U.S. dollars per unit of local currency

and where an asterisk superscript (*) denotes a target (baseline) value. 1/ The baselines are country-specific and are discussed in BHM.

The specific rules that are studied were chosen because of their relevance to actually-used or proposed rules. The money targeting rule (Regime A) is similar in form to the type of monetary targeting reported in Isard and Rojas-Suarez (1986), which studies monetary targeting in major industrial countries in the period 1975-85. The nominal income targeting rule (Regime 2A) is similar to the types of rules studied by McCallum (1986) and by Hall and Mankiw (1993) for the United States. Regime 2B, which targets a combination of inflation and the level of real output is pursued as a possibly relevant variant of Regime 2A. In regime 2B equal weight is given to deviations of inflation from its baseline and deviations of output-growth from its baseline. Regime 3 is designed to smooth exchange rate fluctuations and mimics exchange rate smoothing by major countries. 2/

The simulations work as follows. First the models are estimated country-by-country and behavioral parameters are taken to be invariant to changes in policy. The properties of the residuals from the estimated equations set the stochastic structure (the variance-covariance matrix) for shocks in the simulations. Second, the regime-specific equations for short-term interest rates replace previously relevant interest rate equations *for all countries*. In other words, if one country adopts, for example, a nominal income anchor, all countries adopt similar anchors. Third, the model produces a simulated history built around the new policy by drawing new disturbances whose stochastic properties are similar to the historical ones. 3/

1/ BHM were very specific with respect to units because the policy rules are specified as semi-log linear ones in which the parameters are not units free.

2/ This rule is actually set up to mimic a "loose" version of the Bretton Woods system since the United States is assumed to target its money supply while all other countries target their exchange rates relative to the United States.

3/ The simulations match the first two moments of unpredicted residuals, mean, and variance-covariance matrix. The predicted portion of the residuals are modeled using various time-series techniques with the results taken to be policy invariant. This approach ignores higher moments, which could be important if loss functions were asymmetric.

The models are simulated assuming the individuals being modeled have rational expectations and understand government policy sufficiently well so that expectations are correct on average. This implies that what is being simulated is a sort of steady position that the economy would come to if the relevant policy had been in place for some time. No attempt is being made to simulate the transition from one policy to another.

The actual simulations changed the suggested rules slightly to fit the structure of the models being used. Table 1, which is taken directly from BHM, reports one aspect of the results of the simulations. The table reports the regime, for each country and each model that provides the *best performance* of the indicator of interest. The left-hand column of the table lists countries and characteristics of simulated series for the countries in question. The first entry in the column, for example, is for the United States and it is "Loss: Real GNP alone." What this means is that the model characteristic that is being compared across regimes is the minimization of average surprises in real U.S. GNP. 1/ In column 2 of the table, which gives the results for the GEM model it is reported that Regime 2BX minimizes this measure of real-output variance. The "X" attached to regime 2B in 2BX means that simulations of the GEM model changed rule 2B to be compatible with the GEM model. BHM report the model-specific rule changes.

Rules 2A and 2B, the nominal income targeting rule and the variant on the nominal income rule, which targets inflation plus real output out-perform money targeting and exchange rate targeting by a wide margin, with the two nominal income variants producing a better loss-function value around 80 percent of the time. From the reported results there is little to choose from between the nominal-income-based rules, 2A and 2B, which perform best about an equal number of times.

The results of this section are clear. In a wide variety empirically based open-economy models, monetary policy rules that are directed toward some version of nominal income stabilization perform better in terms of output stability and inflation stability in realistic simulations than do rules based on stabilizing exchange rates or money supplies. While confidence in any single simulation model may be low, it is noteworthy that the models have similar results and that these results match those obtained by McCallum (1988) and Hall and Mankiw (1993) in single-economy simulations.

5. Specific monetary policy rules are temporary

The previous subsection evaluated specific rules based on the assumption that the rules would last *indefinitely*. In practice, price-fixing regimes and some other nominal anchors for monetary policy are temporary as demonstrated, for example, by the ending of past gold standards, the abandonment of fixed Bretton Woods parities and the frequent

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1/ These surprises are measures as root-mean-square deviations from the baseline.

Table 1. Identification of the Regime Minimizing Three Simple Illustrative Loss Functions 1/

Country and Loss Function	Model								
	GEM	Intermod-A	Intermod-C	Liverpool	MPS	MSG	MULTIMOD	MX3	Taylor
United States									
Loss: Real GNP alone	**2BX**	**2B**	**2B**	**3X**	**2BX**	**2BX**	**2BX**	**2B**	**2AX**
Loss: Inflation alone	**2BX**	**2A**	**2AX**	**3X**	**2AX**	**2AX**	**2BX**	**2AX**	**2BX**
Loss: Real GNP + inflation	**2AX/2BX**	**2B**	**2AX**	**3X**	**2BX**	**2BX**	**2BX**	**2B**	**2AX**
Japan									
Loss: Real GNP alone	**2BX**	**2B**	**2B**	**2A**	n.a.	**2AX**	**1**	**2B**	**2BX**
Loss: Inflation alone	**2AX**	**2A**	**2AX**	**1X**	n.a.	**1X**	**1X/2BX**	**2AX**	**3X**
Loss: Real GNP + inflation	**2BX**	**2B**	**1/2AX**	**1X/2A**	n.a.	**2AX**	**1**	**2AX**	**2BX**
Germany									
Loss: Real GNP alone	**2BX**	**2B**	**2B**	**2AX**	n.a.	**2BX**	**2AX**	**2B**	**2AX**
Loss: Inflation alone	**2AX**	**2B**	**2AX**	**1X**	n.a.	**2A**	**2BX**	**2AX**	**1X/2BX**
Loss: Real GNP + inflation	**2AX**	**2B**	**2AX**	**1X**	n.a.	**2BX**	**2AX**	**2B**	**2BX**
United Kingdom									
Loss: Real GNP alone	n.a.	**2B**	**2B**	**2AX**	n.a.	n.a.	**3X**	n.a.	**2AX**
Loss: Inflation alone	n.a.	**2A**	**2AX**	**2A**	n.a.	n.a.	**2BX**	n.a.	**3X**
Loss: Real GNP + inflation	n.a.	**2B**	**2AX**	**2A**	n.a.	n.a.	**3X**	n.a.	**2AX**
Canada									
Loss: Real GNP alone	n.a.	**2B**	**2B**	**3X**	n.a.	n.a.	**1X/2AX**	n.a.	**2BX**
Loss: Inflation alone	n.a.	**2A/2B**	**2AX**	**2A**	n.a.	n.a.	**2BX**	n.a.	**2AX/2BX**
Loss: Real GNP + inflation	n.a.	**2B**	**2AX**	**2A**	n.a.	n.a.	**1X/2AX**	n.a.	**2BX**

Source: B-1 tables in annex B.
n.a.: Results not available.

1/ When the RMSDs for two regimes differ by 1 percent or less, the table identifies the regimes as tied. When an entry in a cell is in boldface type, that regime is associated with a reduction in the value of the loss function by 10 percent or more relative to the second-best type of regime. See the text for further explanation.

central-parity changes in the EMU. Recent research has begun to trace out the implications of such impermanence for the behavior of private individuals and governments. Most of this work starts from the basic idea that when a government targets a specific market price as a nominal anchor for monetary policy, stabilizing that nominal price *is not the government's primary policy goal*. If a government adopts a fixed exchange rate, for example, then it is understood that if the fixed exchange rate gets in the way of other, more important, policy goals then the fixed rate will be abandoned. This literature also shows that it may be *desirable* 1/, even in light of the rules-versus-discretion issues studied above, for the government to abandon a policy rule in some situations.

This literature's application to price-fixing regimes began with the work of Salant and Henderson (1978) and Krugman (1979) who showed how the collapse of a government price-fixing regime can be a natural economic event based on economic fundamentals and devoid of expected profit opportunities. Krugman's example involved a crisis in a fixed exchange rate regime, which is developed as a privately-driven transition from a fixed exchange rate regime to a flexible one. In Krugman's work the timing of a crisis for a fixed exchange rate rule and its collapse is determined by speculators pursuing profit opportunities. It is the competition among speculators that determines the timing of a crisis and removes expected profit opportunities from the crisis. In this sort of model, as speculators see the crisis approaching they attempt to borrow large quantities of the currency whose devaluation is suspected, convert the borrowed funds into foreign exchange and then repay in terms of a devalued currency. Even without a government interest rate defense, short-term market interest rates can be driven to levels unheard of in normal times. Krugman-style modeling of an exchange rate crisis is based on speculators having unlimited access to short-term credit markets, which describes well the available markets for industrial countries but may overstate market access in some controlled developing-country financial markets.

Following Krugman's work, it came to be recognized that a crisis precipitated by economic fundamentals was not the only crisis that could be explained in the context of the Krugman-style model. It was shown that if the crisis caused a fundamental change in government policy then the crisis could be triggered by a speculative whim and validated by the very policy change it triggered. In other words, instead of a fundamentals-driven event, the crisis and the attack could be just one of a multiciplicity of possible outcomes with the exchange rate regime surviving, or not, as dictated by speculative fancy. 2/

1/ Judgemental language in this section, e.g., "desirable," "ideal," "valuable," should be interpreted in terms of the standard Barro and Gordon (1983a,b) loss functions.

2/ This multiplicity was noted by Flood and Garber (1984) in the context of a gold-price fixing model and was applied to exchange rates by Obstfeld (1986).

Models of crises in government price-fixing rules are all based on the idea that price fixing is not the government's primary objective and that the resources the government is willing to commit to price fixing are limited. If a government's commitment to a nominal price of any asset or commodity in units of its own currency is absolute then it is unquestioned that the price target can be preserved and speculation against the fixed price would be futile. If the commitment is limited, however, then well-financed speculators can provoke a crisis in the system and have the incentive to do so when economic fundamentals are inconsistent with the policy or when the crisis itself provokes a change in the basic stance of government policy.

The implications of temporariness of other policies is explored in models of policy rules with an escape clause, where it is recognized that inflexible monetary-policy rules, such as those studied in the last section, do not have the ring-of-truth in the sense that it is almost unimaginable that central bankers would consult a mathematical rule in a time of crisis in the financial system. 1/ The point developed here is that following a monetary rule may not be ideal all of the time, even accounting for the rules-versus-discretion issues as outlined above. In particular, while following a rule may be ideal, on average, during "normal" times, society may benefit from having the policymaker abandon the rule in exceptional circumstances and confront events as warranted by the situation at hand. 2/ The lesson from this work is that following a rule can be valuable even if the rule must be abandoned temporarily during extraordinary situations.

The formal study of policy temporariness is in its infancy but two of its lessons for policy design are clear already. First, in existing models, less than complete government commitment to a price-fixing target can bring powerful speculative forces to bear that may provoke a crisis and end or modify the price-fixing policy. The real-world relevance of this theoretical point is illustrated by the European Currency Crisis of 1992 and the changes in European Monetary Union's exchange rate arrangements provoked by that crisis. 3/ Second, while it is hard to imagine actual central bankers seriously consulting a mathematical rule before setting policy, it is easier to think of a monetary policy rule as being modeling shorthand for policymakers systematically checking on a set of widely available indicators of the state of the economy with different rules then being different weighting schemes for actions responding to the various indicators. With this broad interpretation of a rule, the rules-versus-discretion literature simply recommends keeping the weighting schemes constant and making them

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1/ See Flood and Isard (1989), and Persson and Tabellini (1990).

2/ Notice in Figure 1 that commodity standards were abandoned in wartime but later reinstituted and recall that the Bretton Woods fixed parities could be adjusted for "fundamental disequilibrium."

3/ See Goldstein et al. (1993).

public during normal times responding differently only during times of crisis.

V. Summary and Conclusions

Our selective nominal anchors survey has reached three broad conclusions. First, post-WWII industrial countries have moved from a commodity standard to an inflation standard and maintaining reliably and reasonably low inflation requires that seignorage as a percent of GDP usually be kept below one to two percent. Second, when we studied the results of particular rules for monetary policy, it was found that rules targeting nominal income out-perform rules targeting the money supply or the exchange rate in large-scale econometric models when performance is measured in terms of the stability of inflation and stability of output growth. Third, through actual examples and guided by the template of economic theory we saw that anything less than a government's full commitment to a price-fixing policy in models with realistic capital markets can end in a privately-engineered crisis.

Finally, it should be emphasized that in the actual conduct of monetary policy, governments and central banks do not generally behave in a manner that can easily be summarized in a mathematical equation. Almost always, some degree of judgement is exercised by a country's monetary authority. Nevertheless, the conduct of monetary policy is not random and undisciplined; it is governed by reasonably well-defined objectives, in the context of a broad understanding of how monetary policy affects the real economy, the financial system, and the price level. In the end, it is the fact that there is something systematic about the conduct of monetary policy, and about its effects, that allows economic analysis to shed some light, at least potentially, on the effects of alternative monetary policies in supplying a nominal anchor for the economic system. The practical importance and implications of any such analytical exercise, of course, need to be interpreted with an appropriate degree of caution.

APPENDIX

From BHM pp. 20-21.

GEM: A version of the Global Economic Model developed by the National Institute for Economic and Social Research (NIESR) in London and jointly maintained with the London Business School (LBS). Ray Barrell and David Currie, working with colleagues from both the NIESR and LBS, coordinated the model simulations prepared for the project.

INTERMOD: A policy-simulation model originally developed by a Canadian team under the direction of John Helliwell (following the International Monetary Fund effort to construct MULTIMOD), sponsored by the Canadian Department of Finance and subsequently supported also by the Bank of Canada. Two versions of the model were used (see below). Guy Meredith and Mary MacGregor managed the models for this project.

LIVERPOOL: The model developed by Patrick Minford and several associates at the University of Liverpool.

MPS: The model, primarily of the U.S. economy but also with an external sector, developed by the domestic divisions of the Federal Reserve Board (following earlier work by teams of economists at MIT, the University of Pennsylvania, and the Federal Reserve, financed by the Social Science Research Council). Flint Brayton and colleagues ran the simulations for this project.

MSG: An updated version of a policy-simulation model originally developed by Warwick McKibbin and Jeffrey Sachs at Harvard University, run for the purposes of this project by Warwick McKibbin at the Brookings Institution.

MULTIMOD: The policy-simulation model developed in the Research Department of the International Monetary Fund, managed for this project by Paul Masson and Steven Symansky.

MX3: A policy-simulation model developed in the Division of International Finance of the Federal Reserve Board and managed for this project by Joseph Gagnon and Ralph Tryon.

TAYLOR: The multicountry policy-simulation model developed by John Taylor and associates at Stanford University, run for this project by Peter Klenow.

APPENDIX

Table 2. Industrial and Other European Countries' Data Used in Charts

(RES is 100x Change in Reserves as a Ratio to GDP, INF is Inflation in percent per year)

	RES 1960-69	INF 1960-69	RES 1970-79	INF 1970-79	RES 1980-92	INF 1980-92	RES 1960-92	INF 1960-92
Industrial Countries								
United States	0.33	2.25	0.50	7.10	0.38	5.24	0.40	4.75
United Kingdom	0.44	3.24	0.81	12.63	0.20	7.19	0.46	7.39
Austria	1.08	3.04	0.99	6.10	0.44	3.77	0.80	4.18
Belgium	0.87	2.43	0.90	7.13	0.11	4.47	0.59	4.53
Denmark	0.62	4.66	0.22	9.29	0.33	5.86	0.39	6.43
France	1.08	4.98	0.68	8.92	0.30	6.33	0.65	6.61
Germany	0.64	2.25	1.02	4.89	0.56	3.02	0.73	3.29
Italy	2.38	3.04	3.03	12.45	1.53	10.14	2.24	8.36
Netherlands	0.73	3.71	0.52	7.06	0.53	2.98	0.59	4.39
Norway	0.69	3.49	0.86	8.37	0.28	7.18	0.58	6.26
Sweden	0.50	3.57	0.95	8.57	0.48	7.81	0.63	6.57
Switzerland	1.95	2.70	1.55	4.98	0.03	3.69	1.07	3.72
Canada	0.38	2.41	0.68	7.38	0.20	5.92	0.40	5.14
Japan	1.23	4.51	1.26	9.09	0.55	2.57	0.97	5.10
Finland	0.26	4.89	0.40	10.41	0.70	6.62	0.48	7.11
Greece	1.82	1.94	2.71	12.31	3.06	19.28	2.58	11.34
Iceland	2.10	10.25	2.48	29.55	1.82	32.15	2.11	23.90
Ireland	1.30	3.70	2.46	12.75	0.49	7.92	1.33	7.86
Portugal	1.66	3.57	4.08	17.14	3.76	16.16	3.22	12.12
Spain	1.54	6.52	2.18	14.39	2.44	9.31	2.09	9.80
Australia	0.38	2.31	0.72	9.83	0.44	7.35	0.51	6.33
New Zealand	-0.12	3.35	0.68	11.46	0.12	9.87	0.22	8.09
Europe								
Cyprus	1.85	1.33	2.95	6.79	3.16	5.69	2.70	4.51
Malta	6.20	1.76	13.28	5.56	2.11	3.30	7.06	3.42
Turkey	1.42	6.46	3.75	23.32	3.84	54.55	3.03	29.14
Yugoslavia *	3.24	10.97	4.62	16.67	18.17	217.87	8.68	85.67

* Observations may not be present in the charts for these countries, values were too high.

APPENDIX

Table 3. Western Hemisphere and Middle East Countries' Data Used in Charts
(RES signifies 100x Change in Reserves as a Ratio to GDP,
INF signifies Inflation in percent per year)

	RES 1960-69	INF 1960-69	RES 1970-79	INF 1970-79	RES 1980-92	INF 1980-92	RES 1960-92	INF 1960-92
Western Hemisphere								
Argentina*	3.30	31.16	11.49	132.94	6.97	628.26	7.23	282.02
Bolivia*	1.32	7.21	1.96	15.90	4.97	1155.85	2.89	415.17
Brazil*	3.83	42.74	1.99	30.54	3.92	583.36	3.31	240.06
Chile	2.21	26.28	8.76	174.56	10.00	21.30	7.27	66.80
Haiti	0.44	1.42	1.51	9.26	2.03	7.97	1.33	5.98
Mexico	0.68	3.49	3.08	14.68	3.51	58.10	2.52	26.97
Paraguay	1.01	4.90	2.26	11.08	2.34	21.71	1.90	12.91
Peru*	1.13	9.84	2.49	26.51	6.87	982.92	3.71	376.03
Barbados	1.21	5.65	1.59	13.87	0.64	6.48	1.09	9.23
Colombia	1.38	11.16	2.35	19.31	2.20	24.71	1.99	18.52
Costa Rica	0.75	1.88	2.11	9.79	4.45	26.19	2.62	13.17
Dominican Rp	0.87	0.90	1.43	9.20	2.25	25.74	1.58	12.50
Ecuador	0.99	3.56	2.43	11.87	2.10	37.81	1.86	18.66
Guatemala	0.37	0.44	1.46	8.86	1.20	15.78	1.03	8.54
Guyana	0.74	1.93	2.01	9.24	12.09	15.50	5.60	9.06
Honduras	0.49	1.87	0.98	6.63	0.94	10.77	0.81	6.54
Jamaica	0.65	3.60	1.27	17.27	3.55	23.57	1.98	14.92
Trinidad/Tob	0.28	3.07	1.86	11.66	0.37	10.66	0.79	8.34
Uruguay	4.64	46.53	3.74	59.26	3.32	66.06	3.85	57.42
Venezuela	0.36	1.72	1.73	6.61	1.86	25.92	1.36	12.11
Middle East								
Egypt	1.93	2.43	4.07	7.78	6.00	17.20	4.18	9.45
Israel	1.57	4.99	11.37	32.49	14.43	103.45	9.61	49.42
Saudi Arabia	1.20	1.99	2.80	12.47	0.30	0.56	1.38	4.96

Source: International Financial Statistics.

* Indicates that some observations for these countries may not be present in the charts as the values were so high, usually for inflation.

APPENDIX

Table 4. African Countries' Data Used in Charts
(RES signifies 100x Change in Reserves as a Ratio to GDP,
INF signifies Inflation in percent per year)

	RES 1960-69	INF 1960-69	RES 1970-79	INF 1970-79	RES 1980-92	INF 1980-92	RES 1960-92	INF 1960-92
Africa								
Congo	0.39	5.07	1.11	8.15	0.56	6.35	0.68	6.42
Ivory Coast	1.01	3.43	1.85	11.72	0.85	5.31	1.31	6.78
Ethiopia	0.54	0.26	1.41	10.42	3.18	7.49	1.89	7.50
Gabon	0.42	3.41	0.98	11.06	0.19	4.91	0.50	6.61
Gambia	1.33	1.74	4.29	9.63	1.57	15.77	2.53	10.17
Ghana	0.87	9.29	3.99	38.84	2.43	42.16	2.43	35.10
Kenya	2.14	1.80	1.02	10.92	1.24	14.03	1.26	9.38
Madagascar	0.32	2.60	0.99	7.90	1.41	16.96	1.02	11.16
Mauritius	0.34	2.88	3.01	10.98	2.27	10.51	1.91	9.14
Morocco	1.05	2.39	2.00	7.79	1.63	7.35	1.56	5.78
Niger	0.37	4.02	0.99	10.35	0.75	1.74	0.74	5.18
Nigeria	0.39	2.49	1.68	15.67	2.12	22.74	1.47	13.78
Rwanda	0.75	1.70	1.09.	12.46	0.20	6.18	0.62	8.08
Senegal	-0.55	2.04	1.07	9.79	1.19	5.20	0.69	6.78
Sierra Leone	0.65	2.73	1.54	10.83	5.03	70.04	2.85	30.04
South Africa	0.49	2.49	0.55	9.65	0.74	14.21	0.60	9.04
Sudan	0.85	3.29	2.40	15.34	5.96	51.43	3.25	24.61
Togo	0.66	1.33	1.55	9.52	3.86	4.32	2.04	6.04
Tunisia	0.87	2.13	1.43	5.24	1.12	8.09	1.14	5.24
Zambia	1.35	4.52	0.92	10.31	3.40	61.60	2.13	29.52

Source: International Financial Statistics.

Table 5. Asian Countries' Data Used in Charts
(RES signifies 100x Change in Reserves as a Ratio to GDP,
INF signifies Inflation in percent per year)

	RES 1960-69	INF 1960-69	RES 1970-79	INF 1970-79	RES 1980-92	INF 1980-92	RES 1960-92	INF 1960-92
Asia								
India	0.85	5.80	1.36	7.54	2.02	9.68	1.45	7.74
Indonesia	3.23	90.60	1.90	16.92	0.88	9.27	1.60	39.34
Korea	1.79	11.32	2.59	15.22	0.81	8.35	1.65	11.34
Malaysia	0.55	0.35	1.74	5.50	1.42	3.71	1.25	3.07
Myanmar	0.99	2.96	2.92	10.86	3.80	13.28	2.61	9.05
Nepal	1.00	5.06	0.96	7.81	2.03	11.49	1.40	9.03
Pakistan	1.30	3.05	2.20	11.76	2.23	7.67	1.94	7.27
Philippines	0.67	3.98	1.02	14.64	1.39	14.79	1.06	11.04
Singapore	1.37	1.18	2.48	6.56	1.61	2.85	1.86	3.54
Sri Lanka	0.91	2.04	1.32	6.89	1.55	13.33	1.29	7.62
Thailand	0.84	1.94	1.20	8.00	0.97	5.69	1.00	5.06

Source: International Financial Statistics.

APPENDIX

Figure 5. Long Price Level Histories: France, Italy and Spain

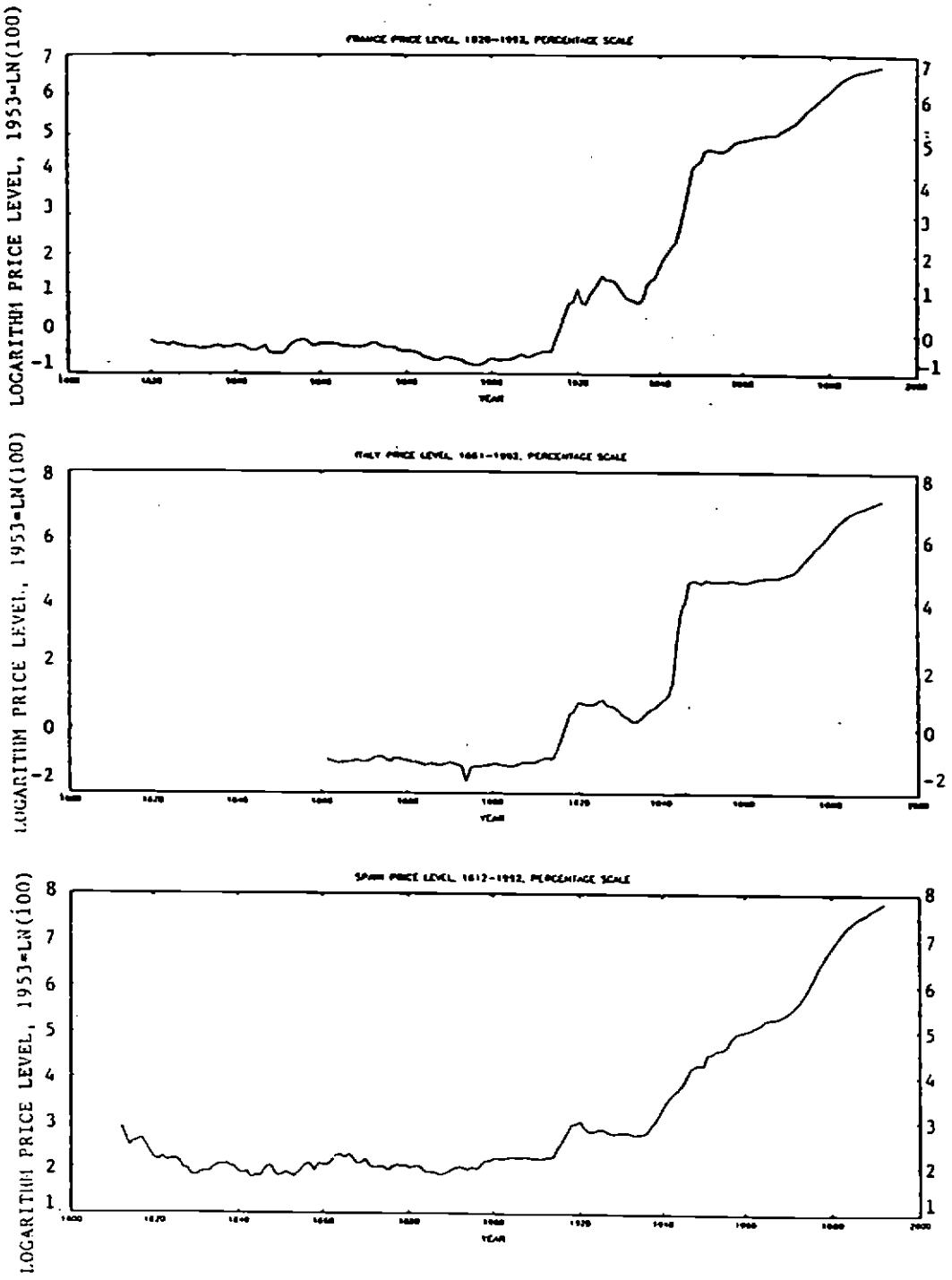
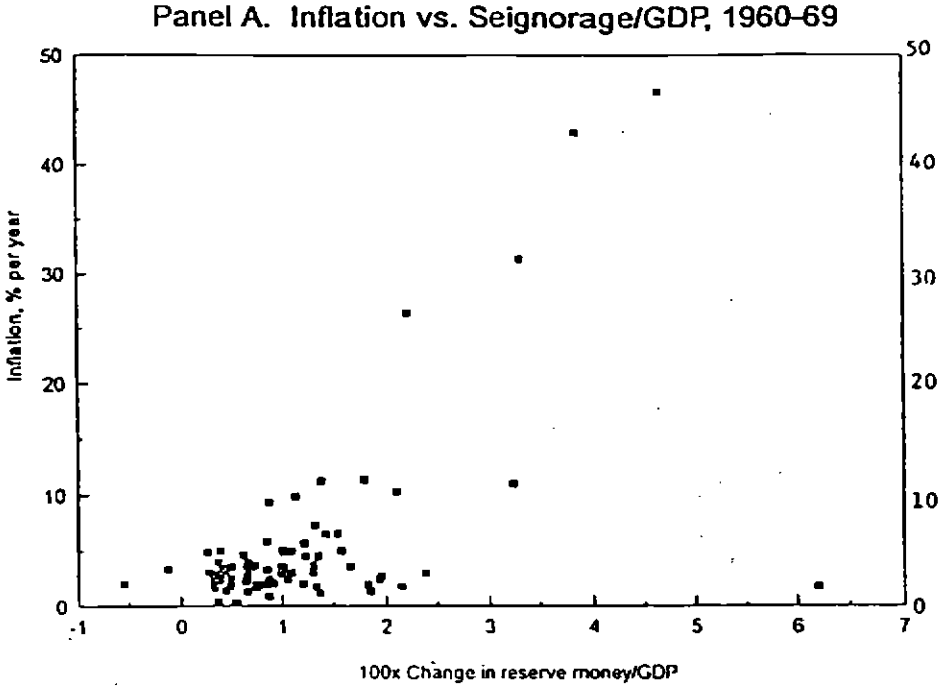
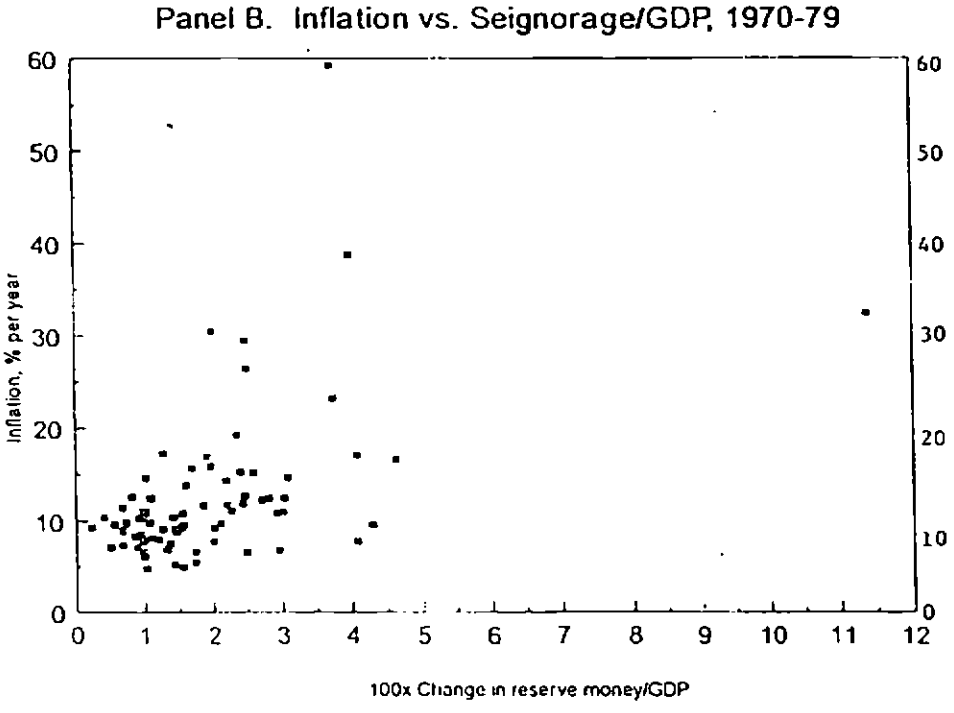


Figure 6. Inflation v.s. Seignorage/GDP: 1960-69, 1970-79





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