MONETARY POLICY REGIMES AND ECONOMIC PERFORMANCE: THE HISTORICAL RECORD

Michael D. Bordo
Anna J. Schwartz

Working Paper **6201**

NBER WORKING PAPER SERIES

MONETARY POLICY REGIMES AND ECONOMIC PERFORMANCE: THE HISTORICAL RECORD

Michael D. Bordo
Anna J. Schwartz

Working Paper 6201
http://www.nber.org/papers/w6201

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
September 1997

This paper was prepared for the conference, "Recent Developments in Macroeconomics," held February 27-28, 1997, at the Federal Reserve Bank of New York and for the North-Holland *Handbook of Macroeconomics*, edited by John B. Taylor and Michael Woodford. For helpful suggestions we thank Milton Friedman, Marvin Goodfriend, Robert Gordon, Peter Ireland, Lars Jonung, Allan Meltzer, John Taylor, and Geoffrey Wood. Able research assistance was provided by Jong Woo Kim. This paper is part of NBER's research program in Monetary Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

Monetary Policy Regimes and Economic Performance: The Historical Record

Michael D. Bordo and Anna J. Schwartz

NBER Working Paper No. 6201
September 1997
JEL Nos. E42, E52
Monetary Economics

ABSTRACT

Monetary policy regimes encompass the constraints or limits imposed by custom, institutions and nature on the ability of the monetary authorities to influence the evolution of macroeconomic aggregates.

This paper surveys the historical experience of both international and domestic (national) aspects of monetary regimes from the nineteenth century to the present. We first survey the experience of four broad international monetary regimes: the classical gold standard 1880-1914; the interwar period in which a short lived restoration of the gold standard prevailed; the postwar Bretton Woods international monetary system (1946-1971) indirectly linked to gold; the recent managed float period (1971-1995). We then present in some detail the institutional arrangements and policy actions of the Federal Reserve in the United States as an important example of a domestic policy regime. The survey of the Federal Reserve subdivides the demarcated broad international policy regimes into a number of episodes.

A salient theme in our survey is that the convertibility rule or principle that dominated both domestic and international aspects of the monetary regime before World War I has since declined in its relevance. At the same time, policymakers within major nations placed more emphasis on stabilizing the real economy. Policy techniques and doctrine that developed under the pre-World War I convertible regime proved to be inadequate to deal with domestic stabilization goals in the interwar period, setting the stage for the Great Depression. In the post-World War II era, the complete abandonment of the convertibility principle, and its replacement by the goal of full employment, combined with the legacy of inadequate policy tools and theory from the interwar period, set the stage for the Great Inflation of the 1970s. The lessons from that experience have convinced monetary authorities to reemphasize the goal of low inflation, as it were, committing themselves to rule-like behavior.

Michael D. Bordo
Department of Economics
Rutgers University
New Brunswick, NJ 08904
and NBER
bordo@fas-econ.rutgers.edu

Anna J. Schwartz
National Bureau of Economic Research
50 East 42nd Street, 17th Floor
New York, NY 10017-5405
aschwar1@email.gc.cuny.edu

MONETARY POLICY REGIMES AND ECONOMIC PERFORMANCE: THE HISTORICAL RECORD

1. Policy Regimes, 1880-1995

1.1 Definition of a Policy Regime

Monetary policy regimes encompass the constraints or limits imposed by custom, institutions and nature on the ability of the monetary authorities to influence the evolution of macroeconomic aggregates.

We define a monetary regime as a set of monetary arrangements and institutions accompanied by a set of expectations -- expectations by the public with respect to policymakers' actions and expectations by policymakers about the public's reaction to their actions. By incorporating expectations, a monetary regime differs from the older concept of a monetary standard, which referred simply to the institutions and arrangements governing the money supply.[1]

1.2 Types of Regimes

Two types of regimes have prevailed in history: one based on convertibility into a commodity, generally specie, and the other based on fiat. The former prevailed in the U.S. in various guises until Richard Nixon closed the gold window in August 1971, thereby terminating the gold convertibility feature of the Bretton Woods international monetary system. The latter is the norm worldwide today.

The two types of regimes relate closely to the concept of a nominal anchor to the monetary system. A nominal anchor is a nominal variable that serves as a target for monetary policy. Under specie-convertible regimes, the currency-price of specie (gold and/or silver coin) is the nominal anchor. Convertibility at that price ensures that price

---

[1]See Leijonhufvud (1984) and Bordo and Jonung (1996). Eichengreen (1991a, p. 1) defines "a regime as an equilibrium in which a set of rules or procedures governing the formulation of public policy generates stable expectations among market participants." He views a monetary regime "as a set of rules or procedures affecting money's ability to provide one or more of [the] three functions [of money]."

levels will return to some mean value over long periods of time.[2]

Regimes have both a domestic (national) and international aspect. The domestic aspect pertains to the institutional arrangements and policy actions of monetary authorities. The international aspect relates to the monetary arrangements between nations. Two basic types of international monetary arrangements prevail -- fixed and flexible exchange rates, along with a number of intermediate variants including adjustable pegs and managed floating.

1.3 Rules vs. Discretion in Monetary Regimes

Alternative monetary regimes can be classified as following rules or discretion. The convertible metallic regimes that prevailed into the twentieth century were based on a rule -- adherence to the fixed price of specie. The rule operated in both the domestic and the international aspects of the regime. In the international aspect, maintenance of the fixed price of specie at its par value by its adherents ensured fixed exchange rates. The fixed price of domestic currency in terms of specie provided a nominal anchor to the international monetary system.

Fiat or inconvertible regimes can also be based on rules if the authorities devise and credibly commit to them. At the domestic level, setting the growth rates of monetary aggregates or those targeting the price level are examples of rules. At the international level, fixed exchange rate regimes such as the EMS are based on a set of well-understood intervention principles and the leadership of a country dedicated to maintaining the nominal anchor.

This paper surveys the historical experience of both international and domestic (national) aspects of monetary regimes from the nineteenth century to the present. We first survey the experience of four broad international monetary regimes: the classical gold standard 1880-1914; the interwar period in which a short lived restoration of the gold standard prevailed; the postwar Bretton Woods international monetary system (1946-1971)

---

[2]A moving nominal anchor is used by central banks today. The monetary authorities pursue an inflation target based on the desired growth rate of a nominal variable, treating the inherited past as bygones. In this regime, although the inflation rate is anchored, the price level rises indefinitely (Flood and Mussa 1994).

indirectly linked to gold; the recent managed float period (1971-1995). We then present in some detail the institutional arrangements and policy actions of the Federal Reserve in the United States as an important example of a domestic policy regime. The survey of the Federal Reserve subdivides the demarcated broad international policy regimes into a number of episodes.

A salient theme in our survey is that the convertibility rule or principle that dominated both domestic and international aspects of the monetary regime before World War I has since declined in its relevance. At the same time, policymakers within major nations placed more emphasis on stabilizing the real economy. Policy techniques and doctrine that developed under the pre-World War I convertible regime proved to be inadequate to deal with domestic stabilization goals in the interwar period, setting the stage for the Great Depression. In the post-World War II era, the complete abandonment of the convertibility principle, and its replacement by the goal of full employment, combined with the legacy of inadequate policy tools and theory from the interwar period, set the stage for the Great Inflation of the 1970s. The lessons from that experience have convinced monetary authorities to reemphasize the goal of low inflation, as it were, committing themselves to rule-like behavior.

2. International Monetary Regimes

2.1 The Gold Standard

The classical gold standard which ended in 1914 served as the basis of the convertibility principle that prevailed until the third quarter of the twentieth century. We discuss five themes that dominate an extensive literature. The themes are: gold as a monetary standard; gold and the international monetary system; central banks and the 'rules of the game'; the commodity theory of money; and the gold standard as a rule.

2.1.1 Gold as a Monetary Standard

Under a gold standard the monetary authority defines the weight of gold coins, or alternatively fixes the price of gold in terms of national currency. The fixed price is maintained by the authority's willingness freely to buy and sell gold at the mint price. There are no restrictions to the ownership or use of gold.

The gold standard evolved from earlier commodity money systems. Earlier

commodity money systems were bimetallic -- gold was used for high-valued transactions, silver or copper coins for low-valued ones. The bimetallic ratio (the ratio of the mint price of gold relative to the mint price of silver) was set close to the market ratio to ensure that both metals circulated. Otherwise, Gresham's Law ensured that the overvalued metal would drive the undervalued metal out of circulation.

The world switched from bimetallism to gold monometallism in the 1870s. Debate continues to swirl over the motivation for the shift. Some argue that it was primarily political (Friedman 1990a; Gallarotti 1995; Eichengreen 1996) -- nations wished to emulate the example of England, the world's leading commercial and industrial power. When Germany used the Franco-Prussian War indemnity to finance the creation of a gold standard, other prominent European nations also did so.[3]

Others argue that massive silver discoveries in the 1860s and 1870s as well as technical advances in coinage were the key determinants (Redish 1990). Regardless of the cause, recent research suggests that the shift both was unnecessary and undesirable since France, the principal bimetallic nation, had large enough reserves of both metals to continue to maintain the standard (Oppers 1996; Flandreau 1996); and because remaining on a bimetallic standard, through the production and substitution effects earlier analyzed by Irving Fisher (1922), would have provided greater price stability than did gold monometallism (Friedman 1990b).

The simplest variant of the gold standard was a pure gold coin standard. Such a system entails high resource costs and, consequently in most countries, substitutes for gold coin emerged. In the private sector, commercial banks issued notes and deposits convertible into gold coins, which in turn were held as reserves to meet conversion demands.

In the public sector, prototypical central banks (banks of issue) were established to help governments finance their ever expanding fiscal needs (Capie, Goodhart and Schnadt 1994). These notes were also convertible, backed by gold reserves. In wartime,

---

[3]Gallarotti (1995) describes the shift of political power in favor of the gold standard in Germany. See Friedman and Schwartz (1963) and Friedman (1990b) for a discussion of the U.S. switch de facto to gold in 1879.

convertibility was suspended, but always on the expectation of renewal upon termination of hostilities. Thus the gold standard evolved into a mixed coin and fiduciary system based on the principle of convertibility.

A key problem with the convertible system was the risk of conversion attacks -- of internal drains when a distrustful public attempted to convert commercial bank liabilities into gold; and external drains when foreign demands on a central bank's gold reserves threatened its ability to maintain convertibility. In the face of this rising tension between substitution of fiduciary money for gold and the stability of the system, central banks learned to become lenders of last resort and to use the tools of monetary policy to protect their gold reserves (Bagehot 1873; Redish 1993; Rockoff 1986).

The gold standard, both the pure coin variety and the more common mixed standards, were domestic monetary standards which evolved in most countries through market driven processes. By defining its unit of account as a fixed weight of gold or alternatively by fixing the price of gold, each monetary authority also fixed its exchange rate with other gold standard countries and became part of an international gold standard.

2.1.2 Gold and the International Monetary System

The international gold standard evolved from domestic standards by the fixing of the price of gold by member nations. Under the classical gold standard fixed exchange rate system, the world's monetary gold stock was distributed according to the member nations' demands for money and use of substitutes for gold. Disturbances to the balance of payments were automatically equilibrated by the Humean price-specie-flow mechanism. Under that mechanism, arbitrage in gold kept nations' price levels in line. Gold would flow from countries with balance of payments deficits (caused, for example, by higher price levels) to those with surpluses (caused by lower price levels), in turn keeping their domestic money supplies and price levels in line.

Some authors stressed the operation of the law of one price and commodity arbitrage in traded goods prices, others the adjustment of the terms of trade, still others the adjustment of traded relative to nontraded goods prices (Bordo 1984). Debate continues on the details of the adjustment mechanism; however, there is consensus that it worked smoothly for the core

countries of the world although not necessarily for the periphery (Ford 1962; DeCecco 1974; Fishlow 1985). It also facilitated a massive transfer of long-term capital from Europe to the new world in the four decades before World War I on a scale relative to income which has yet to be replicated.

Although in theory exchange rates were supposed to be perfectly rigid, in practice the rate of exchange was bounded by upper and lower limits -- the gold points -- within which the exchange rate floated. The gold points were determined by transactions costs, risk, and other costs of shipping gold. Recent research indicates that although in the classical period exchange rates frequently departed from par, violations of the gold points were rare (Officer 1986, 1996), as were devaluations (Eichengreen 1985). Adjustment to balance of payments disturbances was greatly facilitated by short-term capital flows. Capital would quickly flow between countries to iron out interest rate differences. By the end of the nineteenth century the world capital market was so efficient that capital flows largely replaced gold flows in effecting adjustment.

2.1.3 Central Banks and the Rules of the Game

Central banks also played an important role in the international gold standard. By varying their discount rates and using other tools of monetary policy they were supposed to follow "the rules of the game" and speed up adjustment to balance of payments disequilibria. In fact many central banks violated the rules (Bloomfield 1959; Dutton 1984; Pippenger 1984; Giovannini 1986; Jeanne 1995; Davayton and Parke 1995) by not raising their discount rates or by using 'gold devices' which artificially altered the price of gold in the face of a payments deficit (Sayers 1957). But the violations were never sufficient to threaten convertibility (Schwartz 1984). They were in fact tolerated because market participants viewed them as temporary attempts by central banks to smooth interest rates and economic activity while keeping within the overriding constraint of convertibility (Goodfriend 1988). An alternative interpretation is that violations of the rules of the game represented the operation of an effective target zone bordered by the gold points. Because of the credibility of commitment to gold convertibility, monetary authorities could alter their discount rates to affect domestic objectives by exploiting the mean reversion properties of exchange rates

within the zone (Svensson 1994; Bordo and MacDonald 1997).

An alternative to the view that the gold standard was managed by central banks in a symmetrical fashion is that it was managed by the Bank of England (Scammel 1965). By manipulating its Bank rate, it could attract whatever gold it needed; furthermore, other central banks adjusted their discount rates to hers. They did so because London was the center for the world's principal gold, commodities, and capital markets, outstanding sterling-denominated assets were huge, and sterling served as an international reserve currency (as a substitute for gold). There is considerable evidence supporting this view (Lindert 1969; Giovannini 1986; Eichengreen 1987). There is also evidence which suggests that the two other European core countries, France and Germany, had some control over discount rates within their respective economic spheres (Tullio and Wolters 1996).

Although the gold standard operated smoothly for close to four decades, there were periodic financial crises. In most cases, when faced with both an internal and an external drain, the Bank of England and other European central banks followed Bagehot's rule of lending freely but at a penalty rate. On several occasions (e.g., 1890 and 1907) even the Bank of England's adherence to convertibility was put to the test and, according to Eichengreen (1992), cooperation with the Banque de France and other central banks was required to save it. Whether this was the case is a moot point. The cooperation that did occur was episodic, ad hoc, and not an integral part of the operation of the gold standard. Of greater importance is that, during periods of financial crisis, private capital flows aided the Bank. Such stabilizing capital movements likely reflected market participants' belief in the credibility of England's commitment to convertibility.

By the eve of World War I, the gold standard had evolved de facto into a gold exchange standard. In addition to substituting fiduciary national monies for gold to economize on scarce gold reserves, many countries also held convertible foreign exchange (mainly deposits in London). Thus the system evolved into a massive pyramid of credit built upon a tiny base of gold. As pointed out by Triffin (1960), the possibility of a confidence crisis, triggering a collapse of the system, increased as the gold reserves of the center diminished. The advent of World War I triggered such a collapse as the belligerents

scrambled to convert their outstanding foreign liabilities into gold.

2.1.4 Theory of Commodity Money

The gold standard contained a self-regulating mechanism that ensured long-run monetary and price level stability, namely, the commodity theory of money. This was most clearly analyzed by Irving Fisher (1922) although well understood by earlier writers. The price level of the world, treated as a closed system, was determined by the interaction of the money market and the commodity or bullion market. The real price (or purchasing power of gold) was determined by the commodity market; and the price level was determined by the demand for and supply of monetary gold. The demand for monetary gold was derived from the demand for money while the monetary gold stock was the residual between the total world gold stock and the nonmonetary demand. Changes in the monetary gold stock reflected gold production and shifts between monetary and nonmonetary uses of gold (Barro 1979).

Under the self-equilibrating gold standard, once-for-all shocks to the demand for or supply of monetary gold would change the price level. These would be reversed as changes in the price level affected the real price of gold, leading to offsetting changes in gold production and shifts between monetary and nonmonetary uses of gold. This mechanism produced mean reversion in the price level and a tendency towards long-run price stability. In the shorter run, the shocks to the gold market or to real activity created price level volatility. Evidence suggests that the mechanism worked roughly according to the theory (Cagan 1965; Bordo 1981; and Rockoff 1984) but other factors are also important -- including government policy towards gold mining and the level of economic activity (Eichengreen and McLean 1994).

This simple picture is complicated by a number of important considerations. These include technical progress in gold mining; the exhaustion of high quality ores; and depletion of gold as a durable exhaustible reserve. With depletion, in the absence of offsetting technical change, a gold standard must inevitably result in long-run deflation (Bordo and Ellson 1985). Although there is evidence that the gold standard was self-regulating, the lags involved were exceedingly long and variable (between 10 to 25 years, according to Bordo

1981), so that many observers have been unwilling to rely on the mechanism as a basis for world price stability, and prominent contemporary authorities advocated schemes to improve upon its performance. Others, e.g., Keynes (1930), doubted the operation of the self-regulating mechanism and attributed whatever success the gold standard had before 1914 to purely adventitious acts -- timely gold discoveries in Australia and California in the 1850s, invention of the cyanide process in the 1880s, and gold discoveries in South Africa and Alaska in the 1890s.

2.1.5 The Gold Standard as a Rule

One of the most important features of the gold standard was that it embodied a monetary rule or commitment mechanism that constrained the actions of the monetary authorities. To the classical economists, forcing monetary authorities to follow rules was viewed as preferable to subjecting monetary policy to the discretion of well-meaning officials. Today a rule serves to bind policy actions over time. This view of policy rules, in contrast to the earlier tradition that stressed both impersonality and automaticity, stems from the recent literature on the time inconsistency of optimal government policy.

In terms of the modern perspective of Kydland and Prescott (1977) and Barro and Gordon (1983), the rule served as a commitment mechanism to prevent governments from setting policies sequentially in a time inconsistent manner. According to this approach, adherence to the fixed price of gold was the commitment that prevented governments from creating surprise fiduciary money issues in order to capture seigniorage revenue, or from defaulting on outstanding debt (Bordo and Kydland 1996; Giovannini 1993). On this basis, adherence to the gold standard rule before 1914 enabled many countries to avoid the problems of high inflation and stagflation that troubled the late twentieth century.

The gold standard rule in the century before World War I can also be interpreted as a contingent rule, or a rule with escape clauses (Grossman and Van Huyck 1988; DeKock and Grilli 1989; Flood and Isard 1989; Bordo and Kydland 1996). The monetary authority maintained the standard -- kept the price of the currency in terms of gold fixed -- except in the event of a well understood emergency such as a major war. In wartime it might suspend gold convertibility and issue paper money to finance its expenditures, and it could sell debt

issues in terms of the nominal value of its currency, on the understanding that the debt would eventually be paid off in gold or in undepreciated paper. The rule was contingent in the sense that the public understood that the suspension would last only for the duration of the wartime emergency plus some period of adjustment, and that afterwards the government would adopt the deflationary policies necessary to resume payments at the original parity.

Observing such a rule would allow the government to smooth its revenue from different sources of finance: taxation, borrowing, and seigniorage (Lucas and Stokey 1983; Mankiw 1987). That is, in wartime when present taxes on labor effort would reduce output when it was needed most, using future taxes or borrowing would be optimal. At the same time positive collection costs might also make it optimal to use the inflation tax as a substitute for conventional taxes (Bordo and Vegh 1996). A temporary suspension of convertibility would then allow the government to use the optimal mix of the three taxes.[4]

It is crucial that the rule be transparent and simple and that only a limited number of contingencies be included. Transparency and simplicity avoided the problems of moral hazard and incomplete information (Canzoneri 1985; Obstfeld 1991), i.e., prevented the monetary authority from engaging in discretionary policy under the guise of following the contingent rule. In this respect a second contingency -- a temporary suspension in the face

---

[4]The evidence on revenue smoothing is mixed. According to Mankiw (1987), both the inflation tax and conventional taxes should follow a Martingale process and a regression of the inflation rate on the average tax rate should have a positive and significant coefficient as the former as well as Poterba and Rotemberg (1990) and Trehan and Walsh (1990) found for the post-World War I United States.

However, Bordo and White (1993) for the Napoleonic War suspension of convertibility by Britain, Lazaretou (1995) for Greece in periods of inconvertibility in the nineteenth century, and Goff and Toma (1993) for the U.S. under the classical gold standard reject the hypothesis of revenue smoothing but not that of tax smoothing. As Goff and Toma (1993) argue, seigniorage smoothing would not be expected to prevail under a specie standard where the inflation rate does not exhibit persistence (which was the case during the British and during the Greek inconvertibility episodes). The Bordo and White, and Lazaretou results suggest that, although specie payments were suspended, the commitment to resume prevented the government from acting as it would under the pure fiat regime postulated by the theory.

of a financial crisis, which in turn was not the result of the monetary authority's own actions -- might also have been part of the rule. However, because of the greater difficulty of verifying the source of the contingency than in the case of war, invoking the contingency under conditions of financial crisis, or in the case of a shock to the terms of trade -- a third possible contingency -- would be more likely to create suspicion that discretion was the order of the day.

The basic gold standard rule is a domestic rule and it was enforced by the reputation of the gold standard itself, i.e., by the historical evolution of gold as money. An alternative commitment mechanism was to guarantee gold convertibility in the constitution as was done in Sweden before 1914 (Jonung 1984).

The gold standard contingent rule worked successfully for the 'core' countries of the classical gold standard: Britain, France, and the U.S. (Bordo and Schwartz 1996a). In all these countries the monetary authorities adhered faithfully to the fixed price of gold except during major wars. During the Napoleonic War and World War I for England, the Civil War for the U.S., and the Franco-Prussian War for France, specie payments were suspended and paper money and debt were issued. But in each case, after the wartime emergency had passed, policies leading to resumption at the prewar parity were adopted. Indeed, successful adherence to the pre-World War I rule may have enabled the belligerents to obtain access to debt finance more easily in subsequent wars. In the case of Germany, the fourth 'core' country, no occasions arose for application of the contingent aspect of the rule before 1914. Otherwise its record of adherence to gold convertibility was similar to that of the other three countries. Unlike the core countries, a number of peripheral countries had difficulty in following the rule and their experience was characterized by frequent suspensions of convertibility and devaluations.

One author argues that the commitment to gold convertibility by England and the other core countries was made possible by a favorable conjuncture of political economy factors. The groups who were harmed by the contractionary policies, required in the face of a balance of payments deficit to maintain convertibility, did not have political power before 1914. By contrast, in some peripheral countries, powerful political groups, e.g., Argentine

ranchers and American silver miners, benefited from inflation and depreciation (Eichengreen 1992).

The gold standard rule originally evolved as a domestic commitment mechanism but its enduring fame is as an international rule. As an international standard, the key rule was maintenance of gold convertibility at the established par. Maintenance of a fixed price of gold by its adherents in turn ensured fixed exchange rates. The fixed price of domestic currency in terms of gold provided a nominal anchor to the international monetary system.

According to the game theoretic literature, for an international monetary arrangement to be effective both between countries and within them, a time-consistent credible commitment mechanism is required (Canzoneri and Henderson 1991). Adherence to the gold convertibility rule provided such a mechanism. Indeed, Giovannini (1993) finds the variation of both exchange rates and short-term interest rates within the limits set by the gold points in the 1899-1909 period consistent with market agents' expectations of a credible commitment by the core countries to the gold-standard rule. In addition to the reputation of the domestic gold standard and constitutional provisions which ensured domestic commitment, adherence to the international gold-standard rule may have been enforced by other mechanisms (see Bordo and Kydland 1996). These include: the operation of the rules of the game; the hegemonic power of England; central bank cooperation; and improved access to international capital markets.

Indeed the key enforcement mechanism of the gold standard rule for peripheral countries was access to capital obtainable from the core countries. Adherence to the gold standard was a signal of good behavior, like the 'good housekeeping seal of approval;' it explains why countries that always adhered to gold convertibility paid lower interest rates on loans contracted in London than others with less consistent performance (Bordo and Rockoff 1996).

2.1.6 The Viability of the Gold Standard

The classical gold standard collapsed in 1914. It was reinstated as a gold exchange standard between 1925 and 1931, and as the gold dollar standard from 1959 to 1971. The gold standard, while highly successful for a time, lost credibility in its 20th century

reincarnations and was formally abandoned in 1971.

Among the weaknesses which contributed to its abandonment were the cost of maintaining a full-bodied gold standard. Friedman (1953) estimated the cost for the U.S. in 1950 as 1 1/2 percent of real GNP. Shocks to the demand for and supply of gold that produced drift in the price level also weakened support for the gold standard, leading many economists to advocate schemes for reform (Cagan 1984). Finally, in a growing world, the gold standard, based on a durable exhaustible resource, posed the prospect of deflation.

The key benefits of the gold standard, in hindsight, were that it provided a relatively stable nominal anchor and a commitment mechanism to ensure that monetary authorities followed time consistent policies. However, the gold standard rule of maintaining a fixed price of gold meant, for a closed economy, that continuous full employment was not a viable policy objective and, for an open economy, that domestic policy considerations would be subordinated to those of maintaining external balance. In the twentieth century few countries have been willing to accept the gold standard's discipline (Schwartz 1986b).

2.2 Interwar Vicissitudes of the Gold Standard

The outbreak of World War I in August 1914 led to a massive worldwide financial crisis as investors across the world scrambled to liquidate sterling and other financial assets in exchange for domestic currency and gold. The response to the crisis and the need by the European belligerents for gold to pay for war material led to the breakdown of the gold standard.

After the war the U.K. and other countries expressed a strong preference to return to gold parity at the original parity following the gold standard contingent rule (see Cunliffe 1918). At the Genoa Conference in 1922, the Financial Commission, under British leadership, urged that the world return to the gold standard. However, the system they advocated was a gold exchange standard that encouraged member countries to make their currencies convertible into gold but to use foreign exchange (the currencies of key reserve countries, the U.K. and the U.S.) as a substitute for gold. The experts also encouraged members to restrict the use of gold as currency, thus establishing a gold bullion standard, and to cooperate when raising or lowering their discount rates to prevent competition for

gold. The motivation to economize on gold was a belief that the world would suffer a severe gold shortage in coming decades.

The gold standard was restored worldwide in the period 1924-1927. It only lasted globally until 1931. The key event in its restoration was the return in April 1925 by the U.K. to convertibility at the prewar parity of $4.86. It is believed to have overvalued sterling between 5 and 15 percent depending on the price index used (Keynes 1925; Redmond 1984).[5]

Countries with high inflation, such as France and Italy, returned to gold but at a greatly devalued parity. It took France seven years to stabilize the franc after the war. As described by Eichengreen (1992), the franc depreciated considerably in the early 1920s reflecting a war of attrition between the left and the right over the financing of postwar reconstruction and over new fiscal programs (Alesina and Drazen 1991). The weakness of the franc was halted by Poincaré's 1926 stabilization program which restored budget balance, low money growth, and an independent central bank (Sargent 1984; Prati 1991). Germany, Austria, and other countries, which had endured hyperinflation, all stabilized their currencies in 1923/24 and, with the aid of the League of Nations, all returned to gold convertibility at greatly devalued parities.[6]

The gold standard was restored on the basis of the recommendations of Genoa. Central bank statutes typically required a cover ratio for currencies of between 30 and 40 percent, divided between gold and foreign exchange. Central reserve countries were to hold

---

[5]A vociferous debate continues between the followers of Keynes who attribute the U.K.'s weak economic performance and high unemployment in the 1920s to the decision to return to gold at an overvalued parity, and those who attribute the high unemployment to policies that raised the replacement ratio (the ratio of unemployment benefits to money wages), as well as other supply side factors. See, e.g., Pollard (1970); Thomas (1981); and Benjamin and Kochin (1979, 1982). For a recent discussion of the economics of resumption in 1925, see Bayoumi and Bordo (1996).

[6]According to Sargent (1984), because the reform package was credibly believed to signal a change in the monetary regime, the price level stabilized with no adverse real effects. Wicker (1986), by contrast, presents evidence of a substantial increase in unemployment in Austria, Hungary, and Poland, which persisted for several years.

reserves only in the form of gold.

The gold exchange standard suffered from a number of serious flaws compared to the prewar gold standard (Kindleberger 1973; Temin 1989; Eichengreen 1992, 1996). The first problem was the adjustment problem. The U.K. with an overvalued currency ran persistent balance of payments deficits and gold outflows which imparted deflationary pressure, and in the face of sticky prices and wages, low growth, and high unemployment. This also required the Bank of England to adopt tight monetary policies to defend convertibility. At the other extreme, France with an undervalued currency enjoyed payments surpluses and gold inflows. The Banque de France did not allow the gold inflows to expand the money supply and raise the price level. It sterilized the inflows and absorbed monetary gold from the rest of the world.[7] At the same time the U.S., the world's largest gold holder, also sterilized gold inflows and prevented the adjustment mechanism from operating (Friedman and Schwartz 1963).

The second problem was the liquidity problem. Gold supplies were believed to be inadequate to finance the growth of world trade and output. This in turn was a legacy of high World War I inflation which reduced the real price of gold. The League of Nations in the First Interim Report of the Gold Delegation (1930) tried to forecast the world demand for and supply of gold in the next decade. The Report argued that, unless further attempts to economize on gold succeeded, the world was destined to suffer from massive deflation. That happened in the period 1929 to 1933, not because of a gold shortage but because of the Great Depression (Bordo and Eichengreen 1997).

In the face of the perceived gold shortage, following the strictures of Genoa, central banks substituted foreign exchange for gold. This in turn created a confidence problem. As outstanding pounds and dollars increased relative to gold reserves in London and New York,

---

[7]According to Eichengreen (1992), a change in the statutes of the Banque de France following the Poincaré stabilization, prevented the Banque from using open market operations to expand the money supply. Meltzer (1995, Chapter 5) disputes this interpretation, arguing that the Banque was not required to deflate the world economy by selling foreign exchange for gold.

the greater the likelihood that some shock would lead to a speculative attack on sterling or the dollar by foreign holders fearful that they would be unable to convert their balances. Indeed this is what happened to sterling in 1931 (Capie, Mills and Wood 1986) and to the dollar in 1933 (Wigmore 1987).

The final problem plaguing the gold exchange standard was a lack of credibility. A change in the political complexion of many European countries (the growth of labor unions and left-wing parties) after World War I made it more difficult to defend convertibility if it meant adopting deflationary monetary policy (Eichengreen 1992, 1996; Simmons 1994). Speculative attacks made short-term capital flows destabilizing instead of stabilizing, as they were before World War I. The lack of credibility could have been offset, according to Eichengreen (1992), by increased central bank cooperation but it was not forthcoming. The system collapsed in the face of the shocks of the Great Depression.[8]

2.3 Bretton Woods

Bretton Woods was the world's last convertible regime. It fits within the context of the gold standard because the U.S., the most important commercial power, defined its parity in terms of gold and all other members defined their parities in terms of dollars.

The planning that led to Bretton Woods aimed to avoid the chaos of the interwar period (Ikenberry 1993). The ills to be avoided were deduced from the historical record: floating exchange rates, condemned as prone to destabilizing speculation in the early 1920s; the subsequent gold exchange standard that enforced the international transmission of deflation in the early 1930s; and devaluations after 1933 that were interpreted as beggar-thy-neighbor actions and declared to be wrong, as was resort to trade restrictions, exchange

---

[8]Eichengreen (1990) contrasts two alternative explanations for the collapse of the gold exchange standard: it collapsed after the start of the Great Depression in 1929 because of a scramble by central banks for gold in the face of a loss of confidence in the reserve country currencies; it collapsed as a consequence of inappropriate policies followed by the U.S. and France in sterilizing gold inflows and thereby creating deflationary pressure on the international monetary system. Cross-country regressions for 24 countries over the period 1929-35 explaining the demands for international reserves, gold and foreign exchange, including dummy variables for the U.S. and France, provide strong support for the latter hypothesis.

controls, and bilateralism (Nurkse 1944). To avoid these ills, an adjustable peg system was designed that was expected to combine the favorable features of the fixed exchange rate gold standard and flexible exchange rates.

Both John Maynard Keynes representing the U.K. and Harry Dexter White representing the United States planned an adjustable peg system to be coordinated by an international monetary agency. The Keynes plan gave the International Clearing Union substantially more resources and power than White's United Nations Stabilization Fund, but both institutions were to exert considerable power over the domestic financial policy of the members. The British plan contained more domestic policy autonomy than did the U.S. plan, while the American plan put more emphasis on exchange rate stability.

The Articles of Agreement signed at Bretton Woods, New Hampshire, in July 1944 represented a compromise between the American and British plans. It combined the flexibility and freedom for policy makers of a floating rate system which the British team wanted, with the nominal stability of the gold standard rule emphasized by the U.S. The system established was a pegged exchange rate, but members could alter their parities in terms of gold and the dollar in the face of a fundamental disequilibrium. Members were encouraged to rely on domestic stabilization policy to offset temporary disturbances to their payments balances and they were protected from speculative attack by capital controls. The International Monetary Fund (IMF) was to provide temporary liquidity assistance and to oversee the operation of the system (Bordo 1993a).

Although based on the principle of convertibility, with the U.S. rather than England as the center country, Bretton Woods differed from the classical gold standard in a number of fundamental ways. First, it was an arrangement mandated by an international agreement between governments, whereas the gold standard evolved informally. Second, domestic policy autonomy was encouraged even at the expense of convertibility, in sharp contrast to the gold standard where convertibility was key. Third, capital movements were suppressed by controls (Marston 1993; Obstfeld and Taylor 1997).

The Bretton Woods system faced a number of problems in getting started, and it took twelve years before the system achieved full operation. Each of the two key problems in the

early years -- bilateralism and the dollar shortage -- was largely solved by developments outside the Bretton Woods arrangements. The dollar shortage was solved by massive U.S. Marshall Plan aid and the devaluation of sterling and other currencies in 1949. Multilateralism was eventually achieved in Western Europe in 1958 following the establishment in 1950 of the European Payments Union (Eichengreen 1995).

The period 1959 to 1967 was the heyday of Bretton Woods. The system had become a gold dollar standard whereby the United States pegged the price of gold and the rest of the world pegged their currencies to the dollar. The dollar emerged as the key reserve currency in this period, reflecting both its use as an intervention currency and a growing demand by the private sector for dollars as international money. This growth in dollar demand reflected stable U.S. monetary policy.

Also the system evolved a different form of international governance than envisioned at Bretton Woods. The IMF's role as manager was eclipsed by that of the U.S. in competition with the other members of the G-10. According to Dominguez (1993), although the IMF provided many valuable services, it was not successful in serving as a commitment mechanism.

The Bretton Woods system, in its convertible phase from 1959 to 1971, was characterized by exceptional macroeconomic performance in the advanced countries (see Section 4 below). It had the lowest and most stable inflation rate and highest and most stable real growth rates of any modern regime. However, it was short lived. Moreover, it faced smaller demand and supply shocks than under the gold standard. This suggests that the reason for the brevity of its existence was not the external environment but, as with the gold exchange standard, structural flaws in the regime and the lack of a credible commitment mechanism by the center reserve country.

The three problems of adjustment, liquidity, and confidence dominated academic and policy discussions during this period. The debate surrounding the first focused on how to achieve adjustment in a world with capital controls, fixed exchange rates, and domestic policy autonomy. Various policy measures were proposed to aid adjustment (Obstfeld 1993).

For the United States, the persistence of balance of payments deficits after 1957 was a

source of concern. For some it demonstrated the need for adjustment; for others it served as the means to satisfy the rest of the world's demand for dollars. For monetary authorities the deficit was a problem because of the threat of a convertibility crisis, as outstanding dollar liabilities rose relative to the U.S. monetary gold stock. U.S. policies to restrict capital flows and discourage convertibility did not solve the problem. The main solution advocated for the adjustment problem was increased liquidity. Exchange rate flexibility was strongly opposed.

The liquidity problem evolved from a shortfall of monetary gold beginning in the late 1950s. The gap was increasingly made up by dollars, but, because of the confidence problem, dollars were not a permanent solution. New sources of liquidity were required, answered by the creation of Special Drawing Rights (SDRs). However, by the time SDRs were injected into the system, they exacerbated worldwide inflation (Genberg and Swoboda 1993).

The key problem of the gold-dollar system was how to maintain confidence. If the growth of the monetary gold stock was not sufficient to finance the growth of world real output and to maintain U.S. gold reserves, the system would become dynamically unstable (Triffin 1960; Kenen 1960). Indeed the system was subject to growing speculative attacks, in which market agents anticipated the inconsistency between nations' financial policies and maintenance of pegged exchange rates (Garber and Flood 1984; Garber 1993). Although capital flows were blocked in most countries, controls were increasingly evaded by various devices including the use of leads and lags -- the practice of accelerating payments in domestic currency and delaying foreign currency receipts in the expectation of a devaluation of the domestic currency (Obstfeld and Taylor 1997). Thus successful attacks occurred against sterling in 1947, 1949 and 1967 and the franc in 1968 (Bordo and Schwartz 1996b).

From 1960 to 1967, the United States adopted a number of policies to prevent conversion of dollars into gold. These included the Gold Pool, swaps, Roosa bonds, and moral suasion. The defense of sterling was a first line of defense for the dollar. When none of the measures worked the dollar itself was attacked via a run on the London gold market in March 1968 leading to the adoption of the two-tier gold market arrangement. This solution

temporarily solved the problem by demonetizing gold at the margin and hence creating a de facto dollar standard.

The Bretton Woods system collapsed between 1968 and 1971 in the face of U.S. monetary expansion that exacerbated worldwide inflation. The United States broke the implicit rules of the dollar standard by not maintaining price stability (Darby et al. 1983). The rest of the world did not want to absorb dollars and inflate. They were also reluctant to revalue. The Americans were forced by British and French decisions to convert dollars into gold. The impasse was resolved by President Richard Nixon's closing of the gold window, ending convertibility on 15 August 1971.

Another important source of strain on the system was the unworkability of the adjustable peg under increasing capital mobility. Speculation against a fixed parity could not be stopped by either traditional policies or international rescue packages. The breakdown of Bretton Woods marked the end of U.S. financial predominance in the international monetary system. The absence of a new center of international management set the stage for a multipolar system.

Under the Bretton Woods system, as under the classical gold standard, a set of rules was established, based on the convertibility of domestic currency into gold, although under Bretton Woods only the United States was required to maintain it.[9] Also, as under the gold standard, the rule was a contingent one. Under Bretton Woods the contingency, which would allow a change of parity, was a fundamental disequilibrium in the balance of payments, although fundamental disequilibrium was never clearly defined.

Unlike the example of Britain under the gold standard, however, the commitment to maintain gold convertibility by the U.S., the center country, lost credibility by the mid-1960s. Also the contingency aspect of the rule proved unworkable. With fundamental disequilibrium being ill-defined, devaluations were avoided as an admission of failed policy. In addition, devaluations invited speculative attack even in the presence of capital controls.

---

[9]McKinnon (1993) also views Bretton Woods and the gold standard as regimes based on a set of rules.

Once controls were removed, the system was held together only by G-10 cooperation and once inconsistencies developed between the interests of the U.S. and other members, even cooperation became unworkable.

In conclusion, under Bretton Woods gold still served as a nominal anchor. This link to gold likely was important in constraining U.S. monetary policy, at least until the mid-1960s, and therefore that of the rest of the world. This may explain the low inflation rates and the low degree of inflation persistence observed in the 1950s and 1960s (Alogoskoufis and Smith 1991; Bordo 1993b). However, credibility was considerably weaker than under the gold standard and it was not as effective a nominal anchor (Giovannini 1993). Moreover, when domestic interests clashed with convertibility, the anchor chain was stretched and then discarded (Redish 1993). This was evident in the U.S. reduction and then removal of gold reserve requirements in 1965 and 1968, the closing of the Gold Pool in 1968 and the gold window itself in 1971. The adoption of the Second Amendment to the IMF Articles of Agreement in 1976 marked the absolute termination of a role for gold in the international monetary system.

With the closing of the gold window and the breakdown of the Bretton Woods system, the last vestiges of the fixed nominal anchor of the convertibility regime disappeared. The subsequent decade under a fiat money regime and floating exchange rates exhibited higher peacetime inflation in advanced countries than in any other regime. An interesting unanswered question is whether the demise of the fixed nominal anchor and the convertibility principle explains the subsequent inflation or whether a change in the objectives of monetary authorities -- full employment rather than convertibility and price stability -- explains the jettisoning of the nominal anchor.

2.4 The Recent Managed Float and the European Monetary System (EMS)

As a reaction to the flaws of the Bretton Woods system, the world turned to generalized floating exchange rates in March 1973. Though the early years of the floating exchange rate were often characterized as a dirty float, whereby monetary authorities extensively intervened to affect both the levels of volatility and exchange rates, by the 1990s it evolved into a system where exchange market intervention occurred primarily with the

intention of smoothing fluctuations.

Again in the 1980s exchange market intervention was used by the Group of Seven countries as part of a strategy of policy coordination. In recent years, floating exchange rates have been assailed from many quarters for excessive volatility in both nominal and real exchange rates, which in turn increase macroeconomic instability and raise the costs of international transactions.

Despite these problems, the ability of the flexible regime to accommodate the problems of the massive oil price shocks in the 1970s as well as other shocks in subsequent years without significant disruption, as well as the perception that pegged exchange rate arrangements amongst major countries are doomed to failure, render the prospects for significant reform of the present system at the world level remote. Based upon the Bretton Woods experience, major countries are unwilling to compromise their domestic interests for the sake of the dictates of an external monetary authority or to be subject to the constraints of an international exchange rate arrangement which they cannot control (Bordo 1995).

This is not the case at the regional level where there is a greater harmony of interests than between major countries. Indeed Europe is moving unsteadily towards creating a monetary union with a common currency. On the road to that end, the EMS established in 1979 was modelled after Bretton Woods (although not based on gold), with more flexibility and better financial resources (Bordo 1993b). It was successful for a few years in the late 1980s when member countries followed policies similar to those of Germany, the center country (Giavazzi and Giovannini 1989). It broke down in 1992 to 1993 in a manner similar to the collapse of Bretton Woods in 1968 to 1971. It also collapsed for similar reasons -- because pegged exchange rates, capital mobility, and policy autonomy do not mix. It collapsed in the face of a massive speculative attack on countries that adopted policies inconsistent with their pegs to the D-mark and also on countries that seemingly observed the rules, but whose ultimate commitment to the peg was doubted. The doubt arose because of rising unemployment in the latter.

The lesson from this experience is that the only real alternatives for the European countries are monetary union, perfectly fixed exchange rates and the complete loss of

monetary independence, or else floating. Halfway measures such as pegged exchange rate systems do not last. Schemes to reimpose capital controls (Eichengreen, Tobin, and Wyploz 1995) will be outwitted and will only misallocate resources.

The legacy of the gold standard and its variants for EMU is the role of gold as the nominal anchor and of a credible policy rule to maintain it. Cooperation and harmonization of policies under the gold standard was episodic and not by design -- in contrast with Bretton Woods, EMS and EMU. For the EMU to succeed, members must have the same credible commitment to their goal as did the advanced nations to the gold standard rule a century ago. That is, they must sacrifice domestic to international stability.

The advent of generalized floating in 1973 allowed each country more flexibility to conduct independent monetary policies. In the 1970s inflation accelerated as advanced countries attempted to use monetary policy to maintain full employment. However, monetary policy could be used to target the level of unemployment only at the expense of accelerating inflation (Friedman 1968; Phelps 1968). In addition, the U.S. and other countries used expansionary monetary policy to accommodate oil price shocks in 1973 and 1979. The high inflation rates that ensued led to a determined effort by monetary authorities in the U.S. and U.K. and other countries to disinflate.

The 1980s witnessed renewed emphasis by central banks on low inflation as their primary (if not sole) objective. Although no formal monetary rule has been established, a number of countries have granted their central banks independence from the fiscal authority and have also instituted mandates for low inflation or price stability. Whether we are witnessing a return to a rule like the convertibility principle and a fixed nominal anchor is too soon to tell.

We now turn from the general discussion of domestic and international monetary regimes to survey an important example of a domestic regime -- the United States.

3. Episodes in U.S. Central Banking History

3.1 Origins of U.S. Central Banking

Before the passage of the Federal Reserve Act in 1913, the United States did not have a central bank, but it did adhere successfully to a specie standard from 1792 on, except for a

brief wartime suspension at the end of the War of 1812 and the 17-year greenback episode from 1862 to 1879. From 1879 to 1914, the United States adhered to the gold standard without a central bank. With the exception of a period in the 1890s, when agitation for free coinage of silver led to capital flight and threats of speculative attacks on the dollar (Grilli 1990; Calomiris 1993), U.S. commitment to gold convertibility was as credible as that of the other core countries (Giovannini 1993).

Although a formal central bank was not in place before 1914, other institutions performed some of its functions. The Independent Treasury, established in 1840, served as a depository for federal government tax receipts in specie. On a number of occasions, by transferring specie to commercial banks, by judicious timing of its debt management, and by disbursement of the budget surplus, the Treasury mitigated financial stress. It even engaged in primitive open market operations, according to Timberlake (1993, Ch. 6). Clearing house associations in various financial centers, beginning with New York in 1857, provided lender of last resort services of a central bank by issuing emergency currency (Timberlake, Ch. 14), but often after rates became extremely high -- 100 percent in 1907.

The Federal Reserve system was established to deal more systematically than had the Treasury and the clearing houses with the perceived problems of the banking system including periodic financial panics and seasonally volatile short-term interest rates. It came into existence at the end of the classical gold standard era, yet it was founded directly upon the precepts of central banking under the gold standard: use of discount rate policy to defend gold convertibility, and the importance of a lender of last resort (Meltzer 1995a, Ch. 2). In addition, the new institution was organized to smooth seasonal movements in short-term interest rates by providing an elastic money supply. By accommodating member bank demand for rediscounts, based on eligible, self-liquidating commercial bills, the reserve banks were designed to promote sufficient liquidity to finance economic activity over the business cycle (Meltzer 1996, Ch. 3).

The remaining subsections cover episodes of the eighty-odd years of the Federal Reserve's existence within the broad regimes demarcated in section 2: 1919-1941; 1946-

1971; 1971-1995.[10] The environment in which the system operated in each of these episodes was vastly different from that envisioned by the founders. Monetary policy changes took place. The changes reflected the influence of three sets of players, who shaped the saga of the system: Congress, by legislation and oversight; the system's officials, by their efforts to fulfill its mission, as they understood it; and the research community, by its interpretation and evaluation of the system's performance. Our discussion comments on these sources of influence on the system.

To accompany the discussion, Figure 3.1 a-f presents annual series for six important macroeconomic aggregates, 1914-1995: CPI and real per capita income; M2 and the monetary base; the short-term commercial paper rate, and a long-term bond yield. Vertical lines on each plot mark the separate monetary policy episodes that distinguish the Federal Reserve era.

3.2 Federal Reserve 1914

In the 30 sections of the Federal Reserve Act that was signed into law on 13 December 1913 Congress sketched the outlines of the system it sought to create. Its structure included a board based in Washington, D.C., of five (increased to six, June 1922) appointees of the President, one of whom he would designate as the Governor, plus the Comptroller of the Currency, and the Secretary of the Treasury as ex officio chairman; no fewer than eight and no more than twelve Federal Reserve banks, each located in a principal city, the final number and boundaries of the districts to be determined by a committee of the Secretaries of Treasury and Agriculture, and the Comptroller of the Currency; a Federal Advisory Council of one banker elected by each reserve bank.

By this structure Congress intended to create a system of semi-autonomous regional reserve banks, loosely subject to the supervision of the Washington board. Over the next two decades the board and the reserve banks and the reserve banks among themselves would be pitted against one another in a struggle to determine which one was dominant.

---

[10]We omit war years, 1915-1918 and 1941-1946. World War II for the U.S. began later than for the European countries, hence the difference between the dating of the Fed episodes and the broad international regimes in sections 2 and 4.

The principal change the Federal Reserve Act introduced was the provision of an "elastic currency," Federal Reserve notes (or, equivalently, member bank deposits at the reserve banks). "Elastic" meant that the new Federal Reserve money would be subject to substantial change in quantity over short periods, thus requiring some body to control the creation and retirement of the money, some means for creating and retiring the money, and some criteria to determine the amount to be created or retired (Friedman and Schwartz 1963).

Both the board and the reserve banks, without clear lines of demarcation of their respective powers, were given joint control of the creation and retirement of Federal Reserve money. The means for creating it were gold inflows, rediscounting of "eligible" paper, discounting of foreign trade acceptances, and open market purchases of government securities, bankers' acceptances, and bills of exchange. Retirements involved the converse. The criteria for determining the amount of Federal Reserve money, on the one hand, was a gold standard rule, imposing the requirement of a 40 percent gold reserve against notes and a 35 percent gold reserve against deposits, and convertibility of Federal Reserve money in gold on demand at the Treasury Department or in gold and lawful money at any Federal Reserve bank; and, on the other hand, a real bills doctrine, according to which the amount issued would be linked to "notes, drafts, and bills of exchange arising out of actual commercial transactions" (section 13), offered for discount at rates to be established "with a view of accommodating commerce and business" (section 14d). In addition to gold backing, each dollar of Federal Reserve notes was also to be secured by a 60 percent commercial paper collateral requirement.

The two criteria were on the surface contradictory. While the gold standard rule requires the stock of notes and deposits to be whatever is necessary to balance international payments over the long run, in the short run, the stock of gold reserves and international capital market flows can accommodate temporary imbalances. However, the gold standard does not determine the division of the stock of money between currency and deposits, although facilitating shifts between the two forms of money was a crucial attribute of the new institution. The real bills criterion, by contrast, which was linked to this division, sets no

limit to the quantity of money.

A basic monetary problem that the Federal Reserve Act was intended to solve was an attempt by the public to shift from holding deposits to holding currency. Such attempts had led to a series of banking crises before 1914 (Schwartz 1986a). The solution was to introduce a form of currency that could be rapidly expanded -- the role of the Federal Reserve note -- and to enable commercial banks readily to convert their assets into such currency -- the role of rediscounting. By limiting the lender of last resort to rediscounting only such paper as arose from "actual commercial transactions" as opposed to paper arising from "speculative transactions" (i.e., loans backed by stock market collateral), the Federal Reserve Act sustained the real bills doctrine but, in so doing, it confused the elasticity of one component of the money stock relative to another and the elasticity of the total.

Systemwide open market operations were not contemplated in the Act. Each reserve bank had discretion to choose the amount of government securities to buy and sell and first claim on the earnings of its government securities portfolio.

The Federal Reserve Act gave the board and the reserve banks the right to regulate interest rates. As a result, the behavior of short-term interest rates changed. Before the Federal Reserve began operations, nominal interest rates displayed extreme seasonality, which was linked to financial crises (Kemmerer 1910, Ch. 2; Macaulay 1938, chart 20; Shiller 1980, 136-7; Clark 1986; Miron 1986; Mankiw, Miron, and Weil 1987; Miron 1996). Once in operation, it apparently altered the process generating short-term interest rates. According to Barro (1989), the shifts in monetary policy involved changes in the process for monetary-base growth.

Federal Reserve policy did not completely eliminate seasonality in nominal interest rates, but substantially reduced its amplitude. Why the policy of smoothing was quickly effective in reducing seasonality and other transitory movements in nominal interest rates has been the subject of debate. Was it the founding of the Federal Reserve, as Miron (1986) and Goodfriend (1991) contend, or the abandonment of the gold standard by many countries in 1914 that led to diminished interest rate seasonality, as Truman Clark (1986) contends, or was there no regime change at all, as Fishe and Wohar (1990) maintain?

Whichever interpretation one adopts, if one regards the nominal interest rate as the implicit tax on holding real money balances, smoothing the nominal interest rate over the year is a benefit but only of small consequence in raising welfare. McCallum (1991) suggests, however, that seasonal interest rate smoothing encouraged Federal Reserve smoothing in nonseasonal ways also, which was probably detrimental to monetary policy more generally.

Goodfriend (1988) asks how the Federal Reserve was able to combine a commitment to a fixed dollar price of gold, on its founding, with interest rate smoothing. His answer is that, under a gold standard, the Federal Reserve could choose policy rules for both money and gold. It varied its stockpile of gold in supporting a fixed price of gold, and used monetary policy to target interest rates.

Semi-autonomous reserve banks, according to the Federal Reserve Act, would each establish discount rates in accordance with regional demand for and supply of rediscounts, subject to review and determination of the board (section 13). Discount rates were to vary by types of eligible paper and by different maturities. Where the power rested to initiate discount rate changes would become contentious. The example of the Bank of England in setting its rate above market rates influenced early reserve bank belief that discount rates should be penalty rates. This belief conflicted with the political interest to use the Act to achieve a low level of interest rates (Meltzer 1996, Ch. 3).

The Federal Reserve Act also included a fiscal provision (section 7). Member banks own the reserve banks, and are paid a 6 percent cumulative dividend on their capital stock, as if the reserve banks were a public utility and the board were the regulatory body (Timberlake 1993). Expenses of both the reserve banks and the board were paid from earnings on assets. Timberlake finds a contradiction between regarding the reserve banks as both the income-earning utility and regulators of the commercial banking system.

The net earnings of the reserve banks, according to the law, after payment of dividends were to be divided between the surplus account and the Treasury. However, before they needed to turn over any part of their earnings to the government, the reserve banks could build up their surplus until the accounts equaled (originally 40 percent, changed

in March 1919 to 100 percent of) their subscribed capital and, even then, 10 percent of net earnings would continue to be added to the surplus before the remainder was paid to the Treasury as a franchise tax on the note issue.

The objective of the Federal Reserve was to serve as a lender of last resort and thus eliminate financial crises, to be achieved by interest rate smoothing, according to the consensus view of writers on its founding. It would issue notes and deposits, based on real bills, and convertible into gold on demand.

Toma (1997) regards the foregoing specification of the intent of the Federal Reserve Act as misconceived. Based on a public choice approach, he describes the reserve banks as a network of competitive clearinghouses that were to provide liquidity for retail banks. Assigning money creation powers to the Federal Reserve was a way of funding the general government, which could indeed raise revenue for itself by granting monopoly status to a clearinghouse and taxing its profits. That strategy, however, would reduce the liquidity the clearinghouse were to offer banks. Greater government financing needs meant less liquidity supplied by the reserve industry and greater bank fragility. Hence, for Toma, the founding of the Federal Reserve reflected a tradeoff between government revenue needs and financial stability. Since prospective government seigniorage requirements were low in 1913, financial stability goals dominated.

Toma also disputes the role of interest rate smoothing. The solution to the financial crisis problem in his view did not rely on interest rate control. Instead, the Federal Reserve rebated earnings to large city banks through an in-kind payment of check-clearing services, and subsidized loans during the fall when discount rates were constant and market interest rates rose. Hence probability of a financial crisis was reduced. Manipulation of market interest rates was not required.

Toma's emphasis on government revenue needs as an important element in the thinking of the founders of the Federal Reserve would carry weight if he would cite evidence to this effect during the lengthy debate preceding the law's enactment. As it is, his evidence is that public finance considerations accounted for the creation of the national banking system and 19th century central banks. These examples do not clinch his case. Similarly, Toma's

argument that interest rate smoothing was not needed for financial stability because it was achieved by the alternative means he identifies does not challenge the fact that smoothing occurred.

3.3 Interwar Years, 1919-1941

3.3.1 1919-1929

The system's experiences during World War I and the aftermath left the policy guidelines of the Federal Reserve Act of questionable value. The gold criterion had become operative only when inflation rose in 1919-20, and the system's gold reserve ratio plunged. In the face of that decline, the system had contracted. However, when gold inflows followed, and the gold criterion signaled the need to lower interest rates, the real bills criterion signaled the opposite policy. The real bills criterion had been emasculated by wartime finance considerations, but in 1920 member bank indebtedness to the reserve banks and their large portfolios of government securities signaled a need for higher interest rates. Moreover, the steep discount rates in 1920-21 were not penalty rates since they were lower than open market rates on commercial paper (Meltzer 1996, Ch. 3). In the deep contraction of 1920-21 the system had no compass by which to steer to keep to a chosen course.

The violent swings of prices that marked the inflation of 1919 and deflation of 1920 was the background to Federal Reserve performance in the years before the Great Depression. No disputes exist about what the Federal Reserve's actions were, but a contentious literature has arisen about the interpretation of those actions. The issues concern the Federal Reserve's commitment to the gold standard criterion and the real bills doctrine, and whether stabilization of the business cycle became its goal.

With respect to the gold standard criterion, the problem for the Federal Reserve was that gold standard rules appeared to be inapplicable in a world where only the United States maintained gold payments. The flow of gold to the United States in 1921-22 threatened monetary stability if the authorities responded with expansionary actions. But gold sterilization was incompatible with using the gold reserve ratio as a guide to Federal Reserve credit.

From 1923 on gold movements were largely offset by movements in Federal Reserve

credit, so essentially no relation is observed between the gold movements and the monetary base (Friedman and Schwartz 1963, pp. 279-84). The system justified sterilization of gold movements on three grounds: pending the return to gold standards by countries abroad, much of the gold was in this country only temporarily; gold movements could not serve their equilibrating role with most of the world not on the gold standard; sterilization of the inflow was desirable to increase the gold stock in view of increased short-term foreign balances here. Once other countries returned to the gold standard, however, these reasons were no longer valid, although the system still repeated them.

Wicker's (1965, pp. 338-39) objection to regarding gold sterilization as a significant indicator of monetary policy is that "Federal Reserve monetary policy may not have been at all times rationally conceived and administered" (p. 338). He sees a conflict between sterilization for domestic considerations and the commitment to fully convertible gold currencies abroad, but he concedes that the Federal Reserve rejected the reserve ratio as a guide, although only until the international gold standard would be fully restored.

To replace the gold reserve ratio, the *Tenth Annual Report* (1923) of the Federal Reserve system maintained that credit would not be excessive "if restricted to productive uses." This seems to be a procyclical needs of trade doctrine. The Report distinguishes between "productive" and "speculative" use of credit, the latter referring to speculative accumulation of commodity stocks, not stock market speculation.

Wicker argues that the Report emphasized a quantitative as well as a qualitative criterion for the adequacy of bank credit, and that the system was not guilty of the real bills fallacy (1965, pp. 340-41). How the quantitative criterion was to be applied in practice Wicker does not explain. Strong in 1922 in a speech at Harvard showed that he understood that the qualitative criterion was ineffectual, noting that "the definition of eligibility does not affect the slightest control over the use to which the proceeds [of Federal Reserve credit] are put" (Chandler 1958, p. 198; Meltzer 1996, Ch. 3).

A third issue that divides commentators on monetary policy during the 1920s is whether the system consciously pursued the goal of stabilizing the business cycle. After its unfortunate experience with the discount rate in 1919-20 as the instrument to implement

monetary policy, in the following years the system experimented with open market operations. They were initially regarded as a means to obtain earnings for the reserve banks. The banks individually bought government securities without apparent concern for the influence of those purchases on the money market, with the result that their uncoordinated operations disturbed the government securities market. The Treasury's dismay led the reserve banks in May 1922 to organize a committee of five governors from eastern reserve banks to execute joint purchases and sales and to avoid conflicts with Treasury plans for new issues or acquisitions for its investment accounts. The committee met for the first time on 16 May at the New York reserve bank and elected Strong as permanent chairman. Although the centralization of open market operations led to a recognition of the bearing of purchases and sales on monetary policy, it did not happen immediately.

Opposition to open market operations was voiced by Adolph Miller, an economist member of the reserve board. He argued that changes in member bank borrowing offset open market operations and therefore had no effect on credit conditions. In his view the reserve banks should limit provision of credit to rediscounting bills that member banks submitted.

Opposition to open market operations was related to a general view of monetary policy that distinguished sharply between discounts and bankers' acceptances, on the one hand, and government securities on the other as sources of credit expansion. Reserve creation by buying bills and discounting bills was regarded as financing a genuine business transaction, while reserve creation by buying government securities had no such direct connection with the needs of trade. Reserve creation in the latter case might filter into loans on Wall Street.

These conflicting domestic policy positions were intertwined with international considerations. The system attached great importance to the reestablishment of a worldwide gold standard, but official literature contained no discussion of the policy measures appropriate to achieve the objective. Strong played the leading role in the system's relations with other countries, promoting credit arrangements with countries that returned to the gold standard during the 1920s.

From Strong's standpoint, easing measures in 1927 served two purposes: overcoming slack business conditions, despite his concern about speculation in the stock market; and helping to strengthen European exchange rates. Recession in the United States reached a trough in November 1927, and European exchange rates strengthened.

Wicker (1965, p. 343) disputes that stabilization through skilful open market operations was Strong's objective. He contends that open market purchases in 1924 and 1927 were intended to reduce U.S. interest rates relative to Britain's to encourage a gold flow to London. According to Wicker, for Strong it was through the restoration of the world gold standard that stabilization of national economies would automatically occur. Wicker concludes, "The error of assigning too much weight to domestic stability as a major determinant of monetary policy has arisen . . . out of a faulty and inadequate account of the nature of Benjamin Strong's influence on open market policy and a tendency to exaggerate the extent to which some Federal Reserve officials understood the use of open market policy to counteract domestic instability."

Wheelock (1991) models econometrically the Federal Reserve's open market policy from 1924 to 1929 with alternative explanatory variables. His results confirm that the Federal Reserve attempted "to limit fluctuations in economic activity, to control stock market speculation, and to assist Great Britain retain gold" (p. 29). He is unable, however, to discriminate between Wicker's approach and that of Friedman and Schwartz.

Toma (1997) disputes the Friedman and Schwartz view that the Federal Reserve in the 1920s discovered how to use open market policy to fine tune the economy and that those years were the high tide of the system. He contends that the system had no such stabilization powers. Open market purchases tend to reduce the volume of discounting and open market sales to increase it -- the so-called scissors effect -- that Adolph Miller had earlier mentioned, for reasons different from Toma's. For Toma the private banking system eliminated any lasting effect these operations might have had on Federal Reserve credit (p. 80), and the relative stability of the 1920s cannot be attributed to fine-tuning by the Federal Reserve (p. 87). In his view the stability is associated with monetary restraint that competitive open market operations of profit-seeking reserve banks induced. The period of the 1920s, for

him, was "one of reserve bank competition interrupted by occasional episodes of coordination" (p. 73).

Toma also contends that the Federal Reserve did not use centralized open market operations to smooth interest rates during the 1920s (p. 80). He reports that seasonal behavior of Federal credit during 1922-28 was "driven by the demands of the private banking system [i.e., discount loans and bankers' acceptances] rather than by" open market operations.

Two fallacies undermine Toma's positions. He treats the scissors effect as if it were a one-to-one offset of open market operations. The inverse relation between borrowing and open market operations was hardly that close (Meltzer 1995b, Ch. 5). In addition, Toma's insistence that open market operations continued to be decentralized after the OMIC was established is incorrect. His portrayal of the system in a public choice framework seems far removed from the facts.

3.3.2 The Great Depression of 1929-33

No period of Federal Reserve history has elicited as much discussion as the four years that set off the economic collapse that began in August 1929 and ended in March 1933. Since our subject is monetary regimes, we exclude the view that the contraction can be explained by real business cycle theory (Prescott 1996).[11] Instead we deal with issues on which opinions are divided among students of the period for whom monetary policy is the central focus.

---

[11]Bernanke and Carey (1996) note that "any purely real theory" (p. 880) is unable to give a plausible explanation of the strong inverse relationship they find (across a panel of countries over the period 1931-36) between output and real wages, and of their finding that countries that adhered to the gold standard typically had low output and high real wages, while countries that left the gold standard early had high output and low real wages. The dominant source of variation between the two sets of countries was differences in money stocks and hence in levels of aggregate demand.

Another view attributes the severity of the Great Depression to the collapse of world trade following the passage of the Smoot-Hawley tariff in 1930 (Meltzer 1977; Crucini and Kahn 1996). The importance of the tariff act and the retaliation it provoked are minimized as an important cause of the downturn in Eichengreen (1989) and Irwin (1996).

There are six principal issues: (1) Was there a significant change in Federal Reserve conduct of monetary policy between 1923-29 and 1929-33? (2) Were bank failures a significant contributor to the economic collapse? (3) How was the monetary collapse transmitted to the real economy? (4) Did the stock market crash in October 1929 play an important role in initiating the economic decline? (5) Had the Federal Reserve not allowed the money stock to decline, would the depression have been attenuated? (6) Did gold standard policies transmit the depression to the rest of the world?

- Policy Continuity?

Friedman and Schwartz (1963) maintain that during the 1920s the Federal Reserve responded effectively to fluctuations in economic activity, but during the depression it did not. They attribute the change to the death of Benjamin Strong in 1928. It removed from the scene the dominant figure in the system who had the best understanding of its capabilities. No one with equal authority replaced Strong. Power within the system shifted from him to a leaderless conference of reserve bank governors and a board that had no stature.

Challenges to the foregoing position have been mounted by Wicker (1965), Brunner and Meltzer (1968), Temin (1989), Wheelock (1991), and Meltzer (1995b, Ch. 5). They find no shift in Federal Reserve performance between the Strong years and the depression years.

For Wicker, who believes international considerations dominated open market operations in the 1920s, the reason the Federal Reserve saw no need for action in 1929-31 was that those years posed no threat to the gold standard. When Britain abandoned the gold standard in 1931, however, the system raised discount rates in order to maintain convertibility. It was acting on the consistent principle that domestic stability was subordinate to the gold standard. Temin agrees with Wicker.

Brunner and Meltzer (1968, p. 341) do not accept the argument for continuity based on the primacy of international considerations. Rather, they trace the continuity to the Federal Reserve's mistaken monetary policy strategy, which they assert has been an unchanging characteristic of its performance. For the system, a low level of nominal interest

rates and of member bank borrowing are indicators of monetary ease, a high level, of monetary tightness. In 1924 and 1927, interest rates and bank borrowing had declined only moderately, hence they indicated relative monetary tightness, justifying open market purchases. During the depression years, since interest rates and member bank borrowing were at exceptionally low levels, they signified to the Federal Reserve that there was monetary ease and that injections of reserves were unneeded.

Based on regression estimates of the demand for borrowed reserves for all member banks in the New York reserve district and for weekly reporting member banks in New York City, Wheelock (1991) also finds Federal Reserve behavior largely consistent throughout the 1920s and the depression.

Meltzer (1995b, Ch.5) disagrees with the view that, had Strong lived, policies would have differed. He describes Strong as an ardent upholder of market interest rates and borrowing as the main indicators of monetary policy. Since Strong approved of the deflationary policy of 1920-21, he sees no reason to believe that Strong would have opposed deflation from 1929 to 1931.

Meltzer notes that, while the real bills doctrine and member bank borrowing as policy indicator were the prevailing principles of Federal Reserve officials, and some so-called liquidationists supported a more deflationary policy, support for expansionary policy was at best a future possibility, "much of the time" not under consideration during the depression years. For Friedman and Schwartz, Strong was not a slavish follower of the prevailing principles of the Federal Reserve, and there is enough evidence in his speeches and Congressional testimony to suggest that he would not have passively observed cataclysmic economic decline without championing policies he knew had succeeded in 1924 and 1927. Hetzel (1985) provides the evidence on Strong's views. The expansionist position taken by the New York reserve bank during 1930 is also persuasive evidence that policy would have been different had Strong then been alive.

•Banking Panics

Friedman and Schwartz (1963) identified four banking panics between October 1930 and March 1933, and found them largely responsible for the steep contraction in the stock of

money that took place. A bank failure not only eliminated its deposits from the money stock, but also diminished the public's confidence in other banks, with the result that holding currency became preferable to holding a bank's liabilities. A withdrawal of deposits in the form of currency reduced bank reserves. Given Federal Reserve policy to hold back on the provision of reserves, both the deposit-currency and the deposit-reserve ratios declined, contributing far more to the decline in the money stock than did a bank failure.

Recent research on banking panics has centered on whether it is accurate to designate the cluster of bank failures in November 1930-January 1931 as the first banking panic, as Friedman and Schwartz do; the geographical boundaries of each of the panics and whether they had a national impact; whether periods additional to those Friedman and Schwartz designated qualify as bona fide panics; whether panics during the Great Depression differed from pre-1914 examples; causes of bank suspensions.

Wicker (1996) is the author of the most substantial empirical work on the microeconomic level of banking panics during the Great Depression. He has combed old newspaper files to learn the names and locations of failed banks, and compiled data on currency inflows and outflows by Federal Reserve districts to track the fallout from a concentration of bank failures in panic subperiods.

Controversy over the validity of the assignment by Friedman and Schwartz of special significance to the failure of the Bank of United States in December 1930 dates back to Temin (1976). He asserted that failures were induced by the decline in agricultural income and in the prices of relatively risky long-term securities held by banks, and that the failure of the Bank of United States did not precipitate a liquidity crisis. In his Lionel Robbins lecture (1989), he repeated the view that the first banking panic was a minor event.

White (1984), who found that balance sheets of failed banks in the 1930s did not differ from those of the 1920s, denied the characterization by Friedman and Schwartz of bank failures in 1930 as cases of illiquidity, unlike pre-1914 cases of insolvency. White overlooks the fact that runs on banks in distress in the 1920s were rare (Schwartz 1988), but in the 1930s were common.

Wicker (1980) called attention to the omission by Friedman and Schwartz of the

failure in November 1930 of Caldwell and Company, the largest investment banking house in the South, that led to runs on 120 banks in four states. He concludes (1996, p. 32) that, on the evidence of Temin, White, and his own research, "the 1930 crisis was a region specific crisis without noticeable national economic effects." He believes the second crisis from April to August 1931 perhaps is also region specific, and without clearly identifiable national effects (p. 18). Wicker also identifies a fifth panic in June 1932 in the city of Chicago, comparable in severity, he says, to the 1930 panic.

Measured by the deposit-currency ratio, however, and the money stock, which are national in coverage, their fall unmistakably records the incidence of the first two bank crises. Regional disparities are not incompatible with national effects. As for the absence of noticeable national economic effects, does Wicker suggest that economic activity did not deteriorate between October 1930 and August 1931?

Some attention has been given to the question whether banks that fail during panics are in the main illiquid or insolvent. Calomiris and Gorton (1991) find the answer depends on which of two rival theories applies. The random withdrawal theory associates bank suspensions with illiquidity induced by contagion of fear. The asymmetric information theory associates suspensions with insolvency due to malfeasance. Saunders and Wilson (1993) found contagion effects in a sample of national banks 1930-32, but did not examine separately panic and nonpanic months. Wicker also notes contagion effects in the Caldwell collapse in November 1930.

Wicker (1996) highlights a difference between pre-1914 and Great Depression panics. In the former the New York money market was the center of the crisis. In 1930 and 1931, however, the crisis originated in the interior of the country, with minimal central money market involvement. Wicker credits the Federal Reserve with this result: "there were no spikes in the call money rate or other short-term interest rates" (p. 23). However, he faults the Federal Reserve for not attempting to restore depositor confidence through open market purchases.

- Transmission of the Monetary Collapse to the Real Economy

The literature on the propagation of the depression takes two different approaches.

One stresses real wage and price rigidity as the propagator (on price setting in product markets and wage setting in labor markets, see Gordon 1990). The other approach stresses the consequences of price deflation, whether anticipated or unanticipated. The disruption of the process of financial intermediation owing to bank failures has also been studied as a nonmonetary link to output decline.

O'Brien (1989) provides empirical evidence on nominal wage rigidity in the late 1920s and thereafter. Manufacturing firms became convinced following the 1920-22 steep wage and price decline that maintaining wage rates during a downturn was necessary if precipitous sales declines were to be avoided. They did so collectively and voluntarily. The puzzle is why firms adhered to the policy once the severity of the sales decline in 1929-31 became evident. It took until the fall of 1931 for many firms to decide that wage cuts would not have adverse consequences for productivity.

Based on data for 22 countries, 1929-36, Bernanke and Carey (1996) assess empirically whether slow adjustment of nominal wages was an important factor in the depression. They found a strong inverse relationship between output and real wages. They do not offer their own explanation of the failure of wages and other costs to fall along with prices that thus contributed to the rise in unemployment and the decline in sales. They cite conjectures by other researchers that coordination failures or politicization of wage- and price-setting as possible explanations.[12]

The issue whether the price deflation during the Great Depression was anticipated or not is important for choosing between the debt-deflation hypothesis or high ex ante real interest rates as the explanation for the severity of the Great Depression. According to the debt-deflation hypothesis, unanticipated deflation increases the real burden of nominal debt, curtails expenditures, and makes it more difficult for borrowers to repay bank loans. As a

---

[12]Bordo, Erceg, and Evans (1997) simulate over the interwar period an equilibrium model of the business cycle with sticky wages embodied in Fischer (1977) and Taylor (1980) staggered contracts. They show that monetary contraction closely replicates the downturn in output until early 1933. Thereafter, their monetary model produces a much faster recovery than actually occurred. Other forces, such as Roosevelt's NIRA policy (Weinstein 1981) and technology shocks may be important in accounting for the recovery.

result bank balance sheets deteriorate, and banks ultimately may fail. Financial intermediation is reduced, with negative effects on economic activity. However, if deflation was anticipated, the debt-explanation for the severity of the Great Depression turns on a collapse of consumption and investment expenditures driven by high real interest rates.

No conclusive evidence can be cited in support of deflation as either unanticipated or anticipated. Research findings diverge. Barsky (1987) and Cecchetti (1992) concluded that simple time series models predicted price changes. An opposite conclusion was reached by Dominguez, Fair, and Shapiro (1988), on the basis of forecasts from VAR models using data ending at various dates between September 1929 and June 1930. Hamilton (1987, 1992) links unanticipated deflation to the Federal Reserve's tight monetary policy in 1928, and shows that deflation was not anticipated in selected commodities markets for which he examined the relationship between spot and futures prices. Nelson (1991) found in reviewing the contemporary business press that there was some expectation that prices would decline but not the degree or the duration of the decline.

Evans and Wachtel (1993) construct a test using data on inflation and interest rates that suggests that time series forecasts of price change, such as Cecchetti reported, are not accurate representations of what people expected prices would be. The prospect of future policy changes or knowledge of past changes of policy made them highly uncertain about the future behavior of prices. They expected little of the deflation that actually occurred. Evans and Wachtel indicate that, in 1930-33, with anticipated deflation of no more than 2 percent and nominal interest rates ranging between 5 percent and 1 percent, the ex ante real rate of interest was unlikely to have exceeded 7 percent and was probably much smaller.

The foregoing studies focus on the United States. Bernanke and James (1991) in an examination of the experience of 24 countries find that the extent of the worldwide deflation was less than fully anticipated in view of two facts: the nominal interest rate floor was not binding in the deflating countries, and nominal returns on safe assets were similar whether countries did or did not remain on the gold standard.

The issue whether price deflation during the Great Depression was anticipated or unanticipated is still unresolved. Another nonmonetary channel that served to propagate the

depression has also been studied. Bernanke (1983) introduced the decline in financial intermediation as a nonmonetary shock, operating as an independent force in producing real economic decline in the 1930s. The disruption of financial markets as a result of the reduction in banks' ability to lend engendered a fall in the net worth of households and firms holding nominally fixed debt. The ensuing debt crisis became an important propagator of economic contraction, increasing the number of bankruptcies (see also Bernanke 1995; Bernanke and Gertler 1989; Calomiris 1993).

Brunner and Meltzer (1988, 1993) accept Bernanke's emphasis on the importance of the credit market in the transmission of shocks but not his treatment of it and the debt crisis as a separate and independent exogenous shock. They regard it as an induced response to the monetary authorities' failure to counter deflation.

●The October 1929 Stock Market Crash

The Dow Jones Industrial Index was between 300 and 320 during the first half of 1929 until the end of June, when it stood at 333. It climbed during the following months and peaked at 381 on 2 September. By the end of September, the index had fallen to 343. On 23 October stock prices dropped to 305. The crash came on 24 October, "Black Thursday." By 6 November the index was down to 231. A week later the index had fallen to 199. This was the low following the crash (Wigmore 1985, pp. 4-26 and Table A-19).

It is commonly believed that the stock market crash reduced the willingness of consumers to spend. It is said to have caused "a collapse in domestic consumption spending" (Romer 1993, p. 29) because it created uncertainty, decreased wealth and reduced the liquidity of households' balance sheets (Mishkin 1978). Temin (1976) specifically rejects an explanation of the fall in consumption as reflecting the effect on wealth of the stock market crash, on the ground that the wealth effect was too small. He regards the fall as autonomous and unexplained.

Yet econometric evidence in support of this proposition is far from convincing. In her recent paper Romer bases her regressions on her intuition that stock market variability made people temporarily uncertain about the level of their future income and thus caused them to postpone durable goods purchases and stimulate consumer spending on nondurables.

Her model predicts a greater fall in 1930 in durables than actually occurred, does not predict the slight fall in perishables, and overpredicts a rise in semidurables.

Romer goes on to examine the estimated effect of stock market variability following the October 1987 crash and suggests that uncertainty was both more severe and more persistent in 1929-30 than in 1987-88, and that this explains why consumers began spending again in 1988 while they continued to defer purchases of durable goods in 1930. A key difference that Romer does not note is that the stock of money grew 4.9 percent (M1; 5.5 percent M2) in the year following the 1987 crash.

A policy issue that has not been addressed in recent research on the 1929 stock market crash is whether the Federal Reserve then should have made itself an "arbiter of security speculation" (in the words of the press statement released by the board on 9 February 1929). The board wrangled with the reserve banks by insisting that moral suasion rather than raising the discount rate would curb speculation. In the end the discount rate was raised. It broke the bull market but also sacrificed stable economic growth. The question of the system's responsibility for stock market valuations applies not only to 1929 but to 1987 and 1997.

- Would Stable Money Have Attenuated the Depression?

McCallum (1990) showed that his base rule (with feedback) would have avoided the severe decline in nominal income that occurred between 1929 and 1933. Following McCallum's methodology of using an empirical model of the economy based on interwar data to examine how a counterfactual policy would have performed, Bordo, Choudhri, and Schwartz (1995) considered two variants of Milton Friedman's constant money growth rule and estimated separate relations for output and the price level.

Basic simulations of both variants yielded results consistent with claims that, had a stable money policy been followed, the depression would have been mitigated and shortened. The view that a k percent rule (constant money growth rule) is suboptimal (Eichenbaum 1992) compares economic performance under constant money growth with alternative rules or discretion that yield a superior outcome. Focus on the constant money growth policy relative to actual performance during the depression shows that it was clearly preferable.

●Gold Standard Policies in Transmitting the Great Depression

Recent research gives the gold standard a major role in the causation and transmission of the depression, but assigns no special significance to U.S. monetary policy, although Bernanke and James (1991) note that U.S. panics may have contributed to the severity of the world deflation. They stress the close connection between deflation and nations' adherence to the gold standard, but find the case for nominal wage stickiness or real interest rates as transmission mechanisms dubious. They favor financial crises as the mechanism by which deflation can induce depression.

Another view (Temin 1989, 1993) is that gold-standard ideology, which accorded external balance more weight than internal balance, produced the transmission, with financial crises constituting another transmission channel. According to Temin (1989, p. 84), dealing only with the United States, it is hard to explain how the initial downturn was spread and intensified to produce three or four years of contraction, much less the international propagation mechanism.[13]

The operation of the gold standard in interwar years was impaired by forced contraction in countries losing gold without producing expansion in countries gaining gold (Eichengreen 1992). Instead of gold-standard ideology, Meltzer emphasizes the hold of the belief that there had been a speculative situation between 1921 and 1929. He (1995b, Ch. 5) asks why deficit countries chose to deflate rather than suspend convertibility, which happened many times in the 19th century. His answer is that policy makers in many of these countries believed that deflation was the corrective needed in response to previous speculative excesses. What was paramount in their minds was not so much the gold standard imperative

---

[13]A response to this view was made by Haberler (1976, p. 8):

> Given the dominant position of the U.S. economy and the monetary arrangements and policy maxims of the time -- fixed exchanges under the new gold standard -- the depression that came about in the United States was bound to spread to the four corners of the world. This does not mean that there were no other focal points of depression elsewhere in the world, for example in Central Europe; but the American infection clearly was the most virulent and the United States was in the strongest position to stop the slide.

as it was the real bills doctrine.

Similarly, with respect to Federal Reserve failure to purchase government securities in 1930 and most of 1931, when the system's reserve ratio was generally twice the required ratio, and subsequently when the "free gold problem"[14] was alleged to prevent such action, the explanation for Meltzer was the real bills doctrine, the belief that deflation was exacted by earlier speculative credit expansion. The board could have suspended reserve requirements in 1932-33 rather than compel intensified contraction, but did not.[15]

Meltzer's perspective suggests that it was not an unyielding commitment to the gold standard that enforced deflation on the world. It was the failure of policy makers to exercise temporary release from the commitment, which was a well-established feature of the gold standard, in response to an internal or external drain (Bordo and Kydland 1995). And the failure can be traced to the hold of the real bills doctrine and unawareness of the distinction between nominal and real rates.

A subject that needs to be explored is whether it is true that expansionary monetary policy by the Federal Reserve would have been futile because it would have aroused suspicion that the United States intended to leave the gold standard, and consequently resulted in gold losses. For two reasons this scenario is hard to credit. In the first place, it does not acknowledge the enormous size of U.S. gold reserves. In February 1933, when there was both an internal and external drain, reflecting lack of confidence in Roosevelt's commitment to gold, the gold loss was $263 million. Gold reserves of $4 billion remained. In the second place, had expansionary monetary policy been in place, it would have stabilized the money supply and propped up the banking system. A quantitative estimate of the gold loss coefficient under these conditions, we conjecture, would reveal it to be modest

---

[14]Eichengreen (1992) argues that low free reserves prevented the system from conducting expansionary policy after 1931. Friedman and Schwartz (1963) and Meltzer (1995b, Ch. 5) regard free reserves as a pretext for the system's inaction that is explained by totally different reasons.

[15]On 3 March 1933, when the New York reserve bank's reserve percentage fell below its legal limit, the board suspended reserve requirements for thirty days, too late to alter the imminent collapse of the system.

in size, and would dispose of the argument that the possibility of expansionary monetary policy was illusory.

3.3.3 1933-41

The passivity of the Federal Reserve during the depression continued after it ended but under wholly different circumstances. New Deal institutional changes transformed monetary policy.

Institutional changes that enhanced the authority of the board at the expense of the reserve banks ironically were the setting in which the Federal Reserve was overshadowed by the Treasury. The Treasury became the active monetary authority, while the Federal Reserve was passive.

The main source of growth in the base was gold imports, which surged as foreigners took advantage of the steadily higher price of gold in 1933 that was fixed at $35 by the Gold Reserve Act. When the Treasury bought gold, it paid with a check at a reserve bank, which increased member bank reserves. The Treasury could print a corresponding amount of gold certificates, which it could deposit at the reserve bank to restore its deposits. These transactions accounted for the major movements in the monetary base.

However, as a result of the gold sterilization program the Treasury adopted in December 1936, in the first nine months of 1937 the monetary base did not reflect the growth of the gold stock. During that period, the Treasury paid for the gold it bought by borrowing rather than by using the cash balances it could create on the basis of the gold. This was similar to sterilization by the Federal Reserve in the 1920s, when it sold government securities to offset the effect on the monetary base of gold inflows. The difference was that in the 1930s the Treasury rather than the Federal Reserve sold the bonds and took the initiative in sterilizing gold.

The Treasury's gold sterilization program became effective at a time when the Federal Reserve undertook its first monetary policy action since the New Deal was in place. The sharp rise in member bank excess reserves beginning after the banking panic of 1933 was seen as raising dangers of future inflation. Sales of securities would have been desirable but for the need for adequate earnings. The system's room for maneuver was further limited by

the political context within which it had to operate, since the Treasury could nullify anything it wished to do. The one option the Federal Reserve thought it had was to reduce excess reserves by exercising the power to double reserve requirements that the Banking Act of 1935 gave it. It did so in three steps between August 1936 and May 1937. Given the banks' demand for prudential reserves, the action backfired and led to recession.

Reserve requirements were not reduced until April 1938 to a level that eliminated one-quarter of the combined effect of earlier rises.

A start toward Treasury desterilization was made in September 1937, when the board requested the Treasury to release $300 million from the inactive gold account. The board itself, of course, could have taken the economic equivalent by buying $300 million of government securities. On 19 April 1938 the Treasury discontinued the inactive gold account.

Romer (1992) highlights money growth in stimulating real output growth between 1933 and 1942. Three other studies examine Federal Reserve behavior during those years: Eichengreen and Garber (1991), Calomiris and Wheelock (1997), and Toma (1997).

Eichengreen and Garber regard monetary policy in 1933-40 as foreshadowing wartime practices. The Federal Reserve acceded to Treasury requests in 1935 to moderate the rise in interest rates, and it purchased long-term government bonds for the first time in its history. In April 1937 after the second increase in reserve requirements the Federal Reserve again bought government bonds to moderate interest rate rises, acknowledging in 1938 its responsibility for "orderly conditions in the government securities market." The reason it did so, according to Eichengreen and Garber, was that changes in bond prices might endanger financial and economic security.

Calomiris and Wheelock attribute the Treasury's dominance to the increase in its resources generated by gold and silver purchase programs which enabled it to alter bank reserve positions and to intervene directly in financial markets. In fact, the Treasury always had these powers. It was the New Deal political environment which was hospitable to their use. That had not been the case in preceding administrations. A shift in the focus of monetary policy away from markets for commercial paper and bankers acceptances and

toward the market for government securities seems to Calomiris and Wheelock less a result of economic conditions than of Administration pressure.

With the gold standard constraint absent and Federal Reserve independence diminished, monetary policy was free to monetize government debt, Calomiris and Wheelock conclude. Of course, it was the continued growth of the monetary gold stock that freed the Federal Reserve from the gold reserve constraint, not the absence of a legal gold standard constraint.

In Toma's (1997) interpretation of the New Deal period, the government's financing requirements took center stage and induced changes in monetary institutions. In his view, New Deal legislation increased the seigniorage capacity of the monetary sector and fundamentally changed the Treasury's monetary authority. The Treasury took possession of the monetary gold stock and with the allowance for change in the dollar price of gold (the weight of the gold dollar at any level between 50 and 60 percent of its prior legal weight, of which the President specified 59.06 percent), a long-run constraint on the government's monetary powers was relaxed. A positive probability of future upward revaluation of the official gold price created the opportunity for future Treasury profits. The Treasury had money-creating powers equal to those of the Federal Reserve.

Neither the Federal Reserve nor the Treasury had to share with each other revenue from money creation. After 1933 the Federal Reserve could keep all its earnings and make no transfers to the Treasury. And only the Treasury benefited from gold inflows since the gold certificates the Federal Reserve received did not give it legal title to the gold.

Toma explains the Federal Reserve constant credit policy as a way of assigning monopoly rights to the Treasury as the money producer. The Treasury happened to be the least cost producer; it could provide the government's seigniorage requirement by the increase in the monetary base that was equal to or less than the value of gold inflows. In effect, the Federal Reserve paid the Treasury for the right to operate by forgoing its role as money producer.

The doubling of reserve requirements, on Toma's interpretation, occurred because of an increase in the government's financing needs. The legislative authorization of flexibility

in reserve requirements provided not only for the government's needs but also for the Federal Reserve's earnings objective. Had reserve requirements not been increased, the government's seigniorage revenue would have been lower, and income tax rates would have been higher, damaging real economic activity. Higher reserve requirements imposed costs on retail banks, so policy makers established federal deposit insurance as one way to moderate adverse stability implications for the financial system.

Toma's version of events does not square with the record. The Federal Reserve was concerned with its own earnings needs, not with maximizing the government's seigniorage revenue. The reserve requirement increases led to government securities sales by member banks that raised interest rates for the Treasury, hardly the optimal principal agent relationship. Toma's linkage of the passage of federal deposit insurance with the reserve requirement increases rewrites the history of that act, which was a response to depression bank failures.

3.4 Bretton Woods, 1946-1971

3.4.1 1946-1951

As in World War I, FR credit outstanding rather than gold accounted for the increase in the monetary base during World War II. The Federal Reserve again became the bond-selling window of the Treasury and used its powers almost entirely for that purpose. After World War II ended, as after World War I, the system continued the wartime policy of providing the reserves demanded at a fixed cost: through supporting the price of government securities at unchanged levels.

During the immediate postwar period and for some time thereafter, the Federal Reserve did not question the desirability of supporting the price of government obligations. On 10 July 1947, however, the posted 3/8 of 1 percent buying rate on Treasury bills and the repurchase option granted to sellers of bills were terminated. The Treasury, which had been reluctant to see any change in the pattern of rates, was reported to have consented to the rise in interest costs on its short-term debt owing to the offset created by the adoption on 23 April 1947 by the system of a policy of paying into the Treasury approximately 90 percent of the net earnings of the reserve banks.

The next step in the program of raising the support rates somewhat was the sharp narrowing of the difference between short- and long-rates as a result of a rise in rates on bills and certificates. This led to a shift to short-term securities by individual holders and to a reverse shift by the Federal Reserve. The $5 billion of bonds the system bought was offset by a reduction of some $6 billion in its holdings of short-term securities, so there was monetary contraction in 1948. It was not, however, recognized and inflation fears prevailed, when inflationary pressure in fact was waning. Banks were urged to avoid making nonessential loans, discount rates were raised to 1.5 percent in 1948, reserve requirements were raised in September after Congress authorized a temporary increase in the legal maximum, and consumer credit controls were reinstated.

The system was slow in reacting to the cyclical decline that began in November 1948. Not until March-April 1949 were credit controls eased. Between May and September, six successive reductions were made in reserve requirements. In June the system announced that it would not seek to prevent bond prices from rising. For the time being, the system regained some control over its credit outstanding. After the final reduction in reserve requirements in September 1949, the system held outstanding credit roughly constant for the balance of the year and early 1950, and hence refrained from offsetting the expansionary influence of the released reserves.

The outbreak of the Korean War in June 1950 unleashed a speculative boom. The accompanying rise in interest rates pushed up yields to levels at which the Federal Reserve was committed to support government security prices. Concern grew that the support program would become the engine for an uncontrollable expansion of the money stock. The system's desire to be freed from this commitment was, however, accomplished only after protracted negotiations with the President and the Treasury, which was fearful of losing the advantage of a ready residual buyer of government securities and of low interest rates. In March 1951 an agreement with the Treasury was finally reached, relieving the system of responsibility for supporting the government security market at pegged prices.

Eichengreen and Garber (1991) contend that the existing literature lacks a formal analysis of why investors were willing to hold Treasury securities at low interest rates in the

1940s, and why this willingness disappeared at the end of the decade. They build on the explanation by Friedman and Schwartz (1963) that expectations of deflation after the war induced the public to hold higher amounts of liquid assets than they otherwise would, and that expectations of inflation after 1948 induced the public to hold smaller amounts of liquid assets than they otherwise would. In 1946-48, the implication of the target-zone approach that they adopt is that the 1948 increases in reserve requirements and the 1949 bond sales by the Federal Reserve can be thought of as keeping the price level below the upper bound. Bank liquidity declined, and inflationary pressure subsided. Eventually the Federal Reserve reduced reserve requirements as if the price level was approaching the lower bound of the implicit price zone, and by the end of 1949 M1 began to rise. Interest rates rose with inflationary expectations and the cap on interest rates became inconsistent with Korean War imperatives. That is why the Accord with the Treasury was negotiated, if the Eichengreen and Garber analysis is accepted.

A question Eichengreen and Garber pose and answer is why the Federal Reserve was concerned about price and interest rate stability -- referring to an interest rate peg, not a target -- in the aftermath of World War II and not in other periods. They say it was not the system's subservience to the Treasury's pursuit of low debt-service costs that is the answer. Instead, it was fear that a rise in interest rates would cause capital losses on commercial bank portfolios and undermine the stability of the banking system. Despite the fact that by 1951 the banks' vulnerability to capital losses had been attenuated, the Federal Reserve was still concerned to minimize them, and the Treasury helped by offering at par nonmarketable bonds with 2.75 percent yields in exchange for 2.5 percent long-term bonds marketed in 1945.

Toma (1997) disagrees with Eichengreen and Garber that the Federal Reserve adopted the stable interest rate program for financial stability reasons. He assigns the seigniorage motive as the driving force with financial stability as at best a secondary consideration. According to Toma, coordination between the Treasury and the Federal Reserve as the two money producers substituted for the gold standard in limiting monetary growth.

It seems to us quixotic, however, to describe wartime inflationary monetary growth as

a substitute for the gold standard.

3.4.2 Federal Reserve Discretionary Regime, 1951-65

The Treasury-Federal Reserve Accord overthrew the dominance of Treasury financing needs over monetary policy. In 1951, after more than 20 years of depression and war, the Federal Reserve had to formulate the criteria by which it would operate as an independent central bank. At that date the Bretton Woods system was in a formative stage, but under its aegis the U.S. commitment to the convertibility of the dollar into gold initially seemed impregnable. By the end of the 1950s, however, as the gold stock began to decline, preventing gold outflows became a major objective of the Treasury as well as the Federal Reserve.

A more immediate criterion for monetary policy than the convertibility principle was that the Federal Reserve should "lean against the wind," by taking restrictive action during periods of economic expansion, and expansionary action during periods of economic contraction. The countercyclical theme in the period ending 1965 was generally described in terms of avoiding either inflation or deflation, but full employment was also accepted as an equally important goal of monetary policy.

The specific operating strategy for implementing "leaning against the wind" that the Federal Reserve adopted was unchanged from its practice in the 1920s (Calomiris and Wheelock 1997). It used open market operations to affect the level of discount window borrowing and free reserves -- excess reserves minus borrowings. The theory of bank borrowing the Federal Reserve developed was that a change in nonborrowed reserves i.e., reserves provided by open market operations, forced banks to adjust the amount they borrowed. A tradition at the Federal Reserve against borrowing acted to restrain borrowing, even if it were profitable for banks to do so. According to the theory, when free or net reserves were high, market interest rates tended to fall, and bank credit and the money supply tended to grow. When free reserves were low or negative, i.e., net borrowed reserves, market rates tended to rise, bank credit and the money supply tended to contract (Brunner and Meltzer 1964).

Because of this framework, the Federal Reserve has seen itself as exercising a

dominant influence on the evolution of short-term market interest rates. In the 1951-65 period, it targeted the Federal funds rate indirectly by using the discount rate and borrowed reserves target. This is now known as interest rate smoothing, a procedure that was earlier known as free reserves or net borrowed reserves targeting (Goodfriend 1991). The intention of indirect targeting is to avoid fluctuations and minimize surprise changes in interest rates. Removing seasonality in interest rates, however, is not the main aspect of smoothing under consideration here.

Goodfriend describes the modus operandi of indirect targeting in the 1950s as follows. The Federal Reserve estimated the banks' demand for reserves during a defined period and provided most of the reserves by open market purchases. The balance had to be obtained from the discount window where borrowing became a privilege not a right. The Federal Reserve thus targeted borrowed reserves. The amount the banks were willing to borrow, however, depended positively on the spread between the Federal funds rate and the discount rate. Accordingly, the Federal Reserve targeted the Federal funds rate indirectly. Because the demand for borrowed reserves was unstable, it could not target borrowing exactly. In the relation between borrowed reserves and a discount rate-Federal funds rate combination, there was no tight linkage between the Federal funds rate and the discount rate. As a result, the market could not readily determine precisely what the indirect Federal funds rate target was, but it could estimate the range in which the funds rate should fall.

Goodfriend's explanation for the Federal Reserve's preference for indirect targeting, even if the result was market misinterpretation of its intention, was that the procedure gave it the option to make changes quietly, keeping target changes out of the headlines. As we shall see, in 1994 it reversed the position it had held for decades and began to announce changes in the Federal funds rate, by that time a directly targeted rate, immediately after an FOMC decision. Capturing headlines did not have the adverse effects on monetary policy the Federal Reserve had for so long claimed would occur.

For monetarist criticism of interest rate smoothing one must turn to earlier studies (Brunner and Meltzer 1964; Meigs 1962). Essentially, the criticism of interest rate smoothing is that, if the Federal Reserve sets the price of bank reserves and lets the market

determine the quantity demanded, it abdicates control over the quantity. Goodfriend does not pose the normative question whether the procedure is optimal. Poole (1991), the discussant, does. He tries to make the case for the Federal Reserve's implementation of policy through the Federal funds rate rather than through monetary aggregates control, the preferable alternative for him. The smoothing arguments for interest-rate control -- it smooths the flow of revenue from the inflation tax; it stabilizes unemployment and inflation; it stabilizes rates at all maturities -- in Poole's analysis lack substance. The only argument that he finds plausible is the belief that asset prices under the alternative policy of steady money growth could differ significantly from full-employment equilibrium levels and that the Federal Reserve can anchor interest rates at approximately the correct level when the market cannot do as well.

Successful central banks, according to Poole, permit short-run fluctuations in monetary growth but adjust money market interest rates as necessary to constrain money aggregates in the long run from growing too fast or too slow. The Federal Reserve's performance since 1992 provides support for Poole's conclusion.

Interest rate smoothing by the Federal Reserve during the decade and a half from 1951 did not preclude a low average inflation rate, but it also yielded unstable industrial output, as contemporaries judged it. Whether this outcome could have been avoided had the Federal Reserve's objective been only the price level and not also output is a subject to which we return when we discuss the 1990s.

3.4.3 Breakdown of Bretton Woods, 1965-71

Money growth accelerated in the early 1960s and persisted through the 1970s. U.S. inflation began to accelerate in 1964, with a pause in 1966-67, and was not curbed until 1980. An inflationary monetary policy was inappropriate for the key reserve currency in the Bretton Woods system. U.S. balance of payments deficits from the late 1950s threatened a convertibility crisis as outstanding dollar liabilities rose and the monetary gold stock dwindled. To prevent conversion of dollars into gold, the United States and other central banks formed the London Gold Pool in 1961 to peg the price of gold at $35 an ounce, established a network of currency swaps with the other central banks, and issued bonds

denominated in foreign currencies. These measures fell short. If the link with the dollar was unbroken, U.S. inflation condemned the rest of the world to inflate. The only way to restrain U.S. policy was to convert dollars into gold. French and British intentions to do just that prompted U.S. suspension of gold convertibility in August 1971. Generalized floating of exchange rates followed (see Section 2.4 above).

3.5 Post-Bretton Woods, 1971-1995

3.5.1 1971-1980

As tenuous as the convertibility obligation had become by the mid-1960s, its absence after the early 1970s totally removed the discipline of convertibility from domestic monetary policy. The Federal Reserve was freed of commitment to future policy to maintain a stable price level. To cope with inflation that they blamed on supply-side shocks or shifts in demand for money, policy makers turned to incomes policy which soon failed.

Peacetime inflationary episodes as a result came to be associated with discretionary monetary policy. The episode from 1965 to 1980 is commonly attributed to the willingness of the Federal Reserve to fund government expenditures for the Vietnam war and Great Society social programs and to the authority's belief that it could exploit short-run Phillips curve tradeoffs. Raising monetary growth to provide employment was consonant with Federal Reserve discretion. When the inflation rate accelerated, the authority became ensnared in a trap it itself had set. Monetarist doctrine had convinced Federal Reserve officials that reducing monetary growth in order to curb inflation would produce a recession. They could not bring themselves to choose that option, because of the political costs. So they permitted continuance of high monetary growth rates and ever-rising inflation until Paul Volcker broke the spell in 1979.

Monetary policy in this period, as in earlier ones, was implemented by control over interest rates rather than control over money growth. The dangers of operating with an interest rate instrument became clear when rising interest rates from the mid-1960s on reflected growing fears of inflation, not restrictive monetary policy. Rising interest rates were accompanied by high money growth. In January 1970, in response to criticism of its policymaking, the FOMC for the first time adopted a money growth target. In 1975

Congress passed Joint Congressional Resolution 133 requiring the Federal Reserve to adopt and announce 1-year money growth targets and, in October 1979, the change in Federal Reserve operating procedures was said to be more precise control of money growth.

The Federal Reserve announced the target growth range each year on a base equal to the actual level of the money stock in the fourth quarter of the previous year. In the late 1970s, above-target money growth in one year was built into the target for the next year's target, and in 1981, below-target money growth was built into the 1982 target. The Federal Reserve thus permitted base drift, contributing to instability of money growth.
These differences between targets and actual money growth were a consequence of the Federal Reserve's policy of maintaining a narrow, short-run target range for the Federal funds rate, unchanged from its operating procedures before monetary growth targets were adopted.[16]

One change in Federal Reserve operational procedure during the period was its gradual shift during the early 1970s from indirect targeting to direct targeting of the Federal funds rate within a narrow band specified by the FOMC each time it met (Goodfriend 1991). The range within which the rate was allowed to move was commonly 25 basis points. The Federal Reserve managed the rate within the band by open market operations, adding reserves to maintain the rate at the upper bound of the band, subtracting reserves to maintain the rate at the lower bound. A move of the band up or down signaled a change in the target, which the market readily perceived. The financial press usually reported a change the day after the Federal Reserve implemented it (Cook and Hahn 1989).

To support the current target, the Federal Reserve had to accommodate changes in money demand. It had to supply the level of reserves that would keep the Federal funds

---

[16]Differences between an aggregate selected for monetary control and a stable relationship with prices and nominal income that existed before the adoption of the targeted aggregate are said to arise because of financial innovations. The breakdown of the relationship has come to be known as Goodhart's Law (Goodhart 1989). It is true that financial innovation does occur and affects the definition of any monetary aggregate and the predictability of its velocity. There is no evidence, however, that links monetary targeting to innovation.

target within the narrow band the FOMC set for periods between meetings. This is another way of explaining how it became an engine of inflation during the second half of the 1970s, given that it had no nominal anchor and that the current target could be too low. If the Federal Reserve was slow in raising the target and, when it did raise the target, did not raise it enough, as total nominal spending in the economy rose, rapid money growth resulted, and accordingly higher inflation.

Furthermore, interest rate smoothing could itself be a determinant of the inflation generating process. In Goodfriend's 1987 model, he shows that rate smoothing with a price level objective induces a nontrend-stationary process for the money stock and the price level. This contributes to both money stock trend and price level drift. Interest smoothing increases both the price level forecast error variance and the variability of expected inflation. So interest rate smoothing tends to create macroeconomic instability.[17]

3.5.2 Shifting the Focus of Monetary Policy, 1980-95

In the period following the inflation episode of 1965-80, operating procedures at the Federal Reserve underwent modifications.

The adoption by the FOMC on 6 October 1979 of targeting on nonborrowed reserves in place of direct Federal funds rate targeting represented an admission that earlier interest rate smoothing had failed to provide noninflationary monetary growth. The new procedure was designed to supply banks with the average level of total reserves that would produce the rate of monetary growth the FOMC desired over the period from a month before a meeting to some future month, without regard for the accompanying possible movement of the Federal funds rate outside a widened range of 400 basis points.

At each FOMC meeting a decision was made and never kept not only about the

---

[17]An empirical study of U.K. monetary policy, 1976-85, by Bordo, Choudhri, and Schwartz (1990) suggests that rate smoothing by the Bank of England allowed money stock base drift to reduce the predictability of the trend price level. Had the Bank of England followed a trend-stationary money supply rule, it would have reduced the variance of the trend in prices by more than one-half. Ireland (1992) extends this analysis to the U.S. case. He shows that the Friedman rule would have reduced long-run price uncertainty by 82 percent over the 1915-90 period.

desired growth rate of M1 and M2 but also about the average level of borrowed reserves that it was assumed the banks would desire over the intermeeting period. The staff then estimated a weekly total reserves path from which it subtracted the borrowing assumption to arrive at a nonborrowed reserves path on which the Open Market Desk targeted open market purchases. It sought to keep the average level of nonborrowed reserves between FOMC meetings equal to the nonborrowed reserves path.

Under this procedure an increase in the demand for reserves was not mechanically accommodated; in the event, to keep total reserves on its path, nonborrowed reserves might be decreased. When total reserves were above the path level, the level of the nonborrowed reserves path or the discount rate was adjusted to reduce deviations of the money aggregates from their desired rate of growth. When the nonborrowed reserves path was lowered, banks were compelled to increase their borrowings, as a result of which the Federal funds rate rose. A 3 percent surcharge on discount window borrowings by banks with deposits of $500 million or more that borrowed frequently that was first imposed by the Federal Reserve on 14 March 1980 was eliminated a few months later, then reimposed at a lower rate, which was subsequently raised, and later again lowered until finally eliminated on 17 November 1981.

Despite the official description of the operation of the nonborrowed reserves procedure, movements in the Federal funds rate were far from automatic (Cook 1989; Goodfriend 1993). There were judgmental adjustments to the nonborrowed reserve path at FOMC meetings and between FOMC meetings that changed the reserves banks were expected to borrow at the discount rate, in effect changing the funds rate target. There were also changes in the discount rate and, as just noted, in the surcharge. Goodfriend concludes that the 1979-82 period was one of aggressive Federal funds rate targeting rather than of nonborrowed reserve targeting.

At the 5 October 1982 FOMC meeting, it abandoned nonborrowed reserve targeting. The Federal Reserve interpreted its experience over the preceding three years as demonstrating that short-run control of monetary aggregates was inferior to interest rate smoothing for stabilization. The outcome of the experiment was that, although M1 growth

slowed on average, its volatility tripled compared to the period preceding October 1979 (Friedman 1984), the Federal funds rate became highly volatile (Gilbert 1994), and both nominal and real GDP displayed exceptionally large fluctuations quarterly (Friedman 1984).

Goodfriend (1983) attributed the Federal Reserve's difficulty with reserve targeting to the unreliability of the demand function for discount window borrowing on which its operating procedure critically depended. Pierce (1984) found that the flaw in the operating procedure was produced by lagged reserve accounting in effect at the time, under which required reserves were based on deposit liabilities two weeks earlier. Therefore, only free reserves could serve as a target and, hence, borrowing estimates, which were inaccurate, became crucial. The upshot was that open market operations destabilized money growth.

On 5 October 1982, the Federal Reserve suspended the nonborrowed reserves procedure and shifted to targeting borrowed reserves. In line with this change, the FOMC at each meeting stated its instruction to the Open Market Desk for open market operations to achieve either more or less reserve restraint. More restraint was equivalent to a higher level of borrowings, less, to a lower level. If the demand for total reserves increased, the Federal funds rate and borrowings would rise. In order to reduce borrowed reserves to their desired predetermined level, nonborrowed reserves had to increase, with the effect of reducing the Federal funds rate. No change in borrowed reserves or the funds rate would then occur. This amounted to indirect targeting of the Federal funds rate. To keep the total of reserves the banks borrowed near some desired level, the spread between the Federal funds rate and the discount rate had to be such that banks would have an incentive to borrow that level of reserves. An increase in the spread induced banks to increase their borrowings. It could be achieved by changing the discount rate or the Federal funds rate. The target level of borrowings was attained by providing the appropriate amount of nonborrowed reserves. The borrowed reserves target operated with loose control of the funds rate.

Sometime about 1992 the Federal Reserve began to target the Federal funds rate directly in a narrow band. Target changes were made in small steps of 25 to 50 basis points, usually separated by weeks or months, and not soon reversed. The FOMC directive has not, however, specified the target Federal funds rate, but refers to degrees of reserve restraint

that would be acceptable. The model of this regime that Rudebusch (1995) sets up and simulates replicates Federal Reserve operations.

Nevertheless, since February 1994, the Federal Reserve during FOMC meetings has announced a change in the funds rate if one has been made. A further procedural change was made in mid-December 1996 in Federal Reserve daily money-market operations, revealed at a press conference at the New York reserve bank. The system will announce when it enters the market the size of its open market operations, to be conducted from system accounts, rather than from its customer accounts. The objective is to inform the market about the amount of liquidity the open market operations provide to or withdraw from the banking system.

So in the 1920s and since the 1950s, the Federal Reserve in one way or another has targeted the Federal funds rate, while simultaneously announcing a money growth target. In the years since 1992 it has apparently taken low inflation as its sole objective and has succeeded in adjusting the target rate. A side effect is that monetary volatility has been low, and the real economy has not been buffeted by monetary shocks, facilitating low unemployment and financial market stability. Only possible inflation of equity market prices seems troubling.

The Federal Reserve along with other central banks changed its policy goals during this period. The primary goal became resisting inflationary pressures. It did so aggressively in 1980-82. Disinflation was largely accomplished by 1983, when the inflation rate declined to 4 percent per annum. Goodfriend (1993) interprets rising long-term rates in 1983 and 1987 as signaling expectations that the Federal Reserve might again allow inflation to increase. The Federal Reserve met the test by raising the Federal funds rate long enough to contain the inflation scare. Goodfriend remarks on the fragility of the credibility of the Federal Reserve and on how costly it is to maintain.

In 1996-97 the long rate at 6.5 to 7 percent was high enough to suggest that Goodfriend's assessment of the Federal Reserve's credibility is accurate. The duration of a 30-year bond at an interest rate of 6.75 percent is 14.8 years. Who would confidently predict that the then current inflation rate of 2.5 percent would not increase over that

horizon? So the expectations explanation for the success of monetary policy targeted on the funds rate seems questionable. The basic problem is that there are no institutional underpinnings of the low-inflation policy. There is no guarantee that the successor to the present chairman of the Federal Reserve will also have a strong aversion to inflation.

The durability of Federal Reserve commitment to price stability is a question that only the future will determine. Of the 82 years that the Federal Reserve has been in existence, only 18 can be termed years of stable (consumer) prices -- 1923 to 1929 (average per year change of 0.3 percent); 1960-65 (average per year price change of 1.3 percent); and 1992-95 (average per year price change of 2.8 percent). The most recent episode is too brief to take for granted its staying power.

Arguments in favor of a stable price level in preference to a low inflation rate have been advanced by Feldstein (1996, 1997) and Svensson (1996a, 1996b). Svensson compares price level and inflation targeting, when society (the principal) delegates the choice to a central bank (the agent), under the assumption that output and employment are at least moderately persistent. The decision rule the central bank follows under discretion for inflation targeting is a linear feedback rule for inflation on employment. The variance of inflation is proportional to the variance of employment. Under price level targeting, the decision rule is a linear feedback rule for the price level on employment. Inflation, the change in the price level, is a linear function of the change in employment. Based on a very special set of assumptions, Svensson concludes that society will be better off assigning a price level target rather than an inflation target to the central bank because the variance of inflation will be lower, there is no inflation bias, and employment variability will be the same as under inflation targeting.

Feldstein bases his argument on the interaction of taxes and inflation that bias the allocation of resources in favor of current consumption and in favor of owner-occupied housing. The higher the inflation rate, the bigger the bias. Reducing the inflation rate by 2 percent would raise the level of real GDP by 2/3 of 1 percent each year in the future as long as the inflation rate remained at the lower level. Feldstein maintains that the arguments against going from low inflation to price stability do not singly or collectively outweigh the

tax-inflation case for going to price stability or even to a lower inflation rate.

One argument for inflation targeting is that reducing the permanent rate of inflation requires a loss of output. With a target price path, the monetary authority offsets past errors, creating more uncertainty about short-term inflation than with an inflation target (Fischer 1994, pp. 281-84). Feldstein's response is that the output loss is temporary, a shortfall of GDP below what it would otherwise be of 2.5 percent for two years to reduce the inflation rate by 2 percentage points. That is why he compares the one-time loss of reducing the inflation rate with the permanent increase of real GDP from reducing the tax-inflation effect.

Another argument for inflation targeting has been made by Akerlof, Dickens and Perry (1996). They contend that a very low level of inflation may lead to higher unemployment than at a higher inflation level because workers are unwilling to accept nominal wage decreases. Feldstein's response is that, by reducing fringe benefits, it is possible to reduce a worker's compensation without reducing his money wage rate. They also assume that workers don't learn that falling prices raise real wages.

Whether the price level or inflation is the target, a central bank has to determine the pace at which to try to achieve either one. The question is whether it is optimal to move immediately to the target. One answer is that gradualism is acceptable in the absence of a cost in terms of growth foregone (Dornbusch 1996, p. 102). The information and transactions costs of moving from the old to the new regime also argue for a gradual return to a noninflationary position. Long-term borrowing and lending contracts and employment contracts arranged under the old regime need to be unwound. Advance announcement of the gradualism policy would give the private sector time to adjust its expectations. The speed of adjustment of monetary policy should respond to the speed with which expectations adjust and the gradualist prescription is that expectations adjust slowly. Feldstein suggests that this view needs to be modified and disinflation should proceed forthwith when political support for the policy permits it to go forward, since political support is indispensable but is not always at hand.

A stronger argument for speedy adjustment than Feldstein's is the rational

expectations approach that treats expectations as adjusting quickly, and hence finds shock treatment is preferable. Sargent's view (1986, p. 150) is that "gradualism invites speculation about future reversals, or U-turns in policy." A major consideration in the choice between gradualism and shock treatment is the initial position. With moderate inflation of 8-10 percent, as observed in advanced countries, gradualism may be the answer. With very high inflation rates of 1000 percent per year, as recently experienced in Latin America, gradualism is meaningless. Only shock treatment will suffice.

Still another view, dubbed "opportunistic disinflation" (Orphanides and Wilcox 1996), argues that the Federal Reserve should conduct contractionary monetary policy only during business expansions; during recessions, it should abstain, counting on recessionary tendencies themselves to produce further disinflation. McCallum (1996, p. 112) notes a confusion in this view between regime design, with which the paper advocating opportunistic disinflation is concerned, and the issue of managing the transition from one regime with higher inflation to a regime with a lower level of inflation. Opportunistic disinflation is not a contribution to the literature on the timing of disinflation during the transition.

If there is a temporary cost in bringing down inflation, how high is that cost? Unfortunately, no quantitative estimates exist of the cost in lost output and employment of a disinflation of a given magnitude pursued over a given period. Hypothetical scenarios based on differing models arrive at qualitatively different conclusions. The announcement of a perfectly credible disinflation will either entail no expected output loss (M. King 1996) or, perhaps, an increase in cumulative output (Ball 1994). The cost depends on the speed of adjustment of anticipations, which in turn depends on the underlying price level performance of the monetary regime.

Alan Greenspan at the Tercentenary Symposium of the Bank of England (1994, p. 259) remarked: . . . "the pressure towards reserving or rather focusing central bank activity to the equivalent of the gold standard will become increasingly evident." If this is a correct prediction that price stability will be the single goal of the Federal Reserve over the long term, and if it is achieved, price stability may well become a credible surrogate for convertibility. The system will then end up fulfilling a key element of the vision of its

founders.

3.6 Conclusion

Three events stand out in our survey of monetary policy episodes and macroeconomic performance. One is the breakdown of the gold standard in stages over the period from 1914 to 1971. The second is the Great Depression of 1929-33. The third is the Great Inflation of 1965-80. To escape from the macroeconomic experience that marked the economy in each of these watershed happenings became the driving force for change. The change was intellectual, reflecting what was perceived as the problem and deduced as its solution. It also led to a change in the monetary policy episode that succeeded each of these events. The new episode in turn exhibited unforeseen deficiencies. To conclude the section, we comment on the way the triad of events unfolded.

3.6.1 Breakdown of the Gold Standard, 1914-71

After World War I, the discipline of the gold standard came to be regarded as an impediment to the management of the economy to achieve the objectives of growth and high employment. The deep depressions of the interwar years were the measure by which the economy under a gold standard was judged to be a failure. The loosening of the link to gold after World War I presaged its abandonment fifty years later. Although price stability was generally included among the goals of the post-World War II era, stability of employment took precedence.

The instability of the interwar years led to the creation of the Bretton Woods system, which had a good record of price and output stability until the mid-1960s. Nevertheless, the convertibility principle lost favor. Improving the real performance of the economy was given pride of place. To achieve the improvement, the task was assigned to government management of monetary and fiscal policy, not to impersonal market forces.

The simple rule for governments to maintain a fixed price of gold was set aside in 1971, but the seeds of the downfall of that rule were sown earlier in the postwar years as country after country opted for monetary independence, full employment, and economic growth. Countries rejected the restraints that the operation of a fixed exchange rate imposed on the pursuit of these widely supported national objectives. In the United States, where the

share of international trade was a minor factor in aggregate national income, the view prevailed that the domestic economy should not be hostage to the balance of payments. Maintenance of the price of gold was not an objective of the Employment Act of 1946.

The growth of government itself has destroyed the viability of a gold standard. A real gold standard was feasible in a world in which government spent 10 percent of national income, as in Britain and the U.S. pre-World War I. It is not feasible in a world in which governments spend half or more of national income.

3.6.2 The Great Depression, 1929-33

The Deep Depression was sui generis. To explain it, it is necessary to examine policy errors and the weaknesses of the interwar gold standard.

It is a consensus view that monetary contraction began in the United States, and was transmitted to the rest of the world by fixed exchange rates. Monetary contraction began in 1928 to curb a boom on the New York Stock Exchange. Although the stock market crashed in October 1929, the policy of contraction was not then halted. Instead, it was pursued relentlessly by the Federal Reserve until the spring of 1932. The Federal Reserve mistakenly believed that monetary policy had been overexpansionary in the 1920s and that deflation was the proper remedy. In fact the system had achieved stable economic growth from 1922 to 1929 with falling wholesale prices.

The U.S. gold stock rose during the first two years of the 1929-33 contraction, but the Federal Reserve did not permit the inflow of gold to expand the U.S. money stock. It not only sterilized the inflow, it went much further. The U.S. quantity of money moved perversely, going down as the gold stock went up, contrary to gold standard rules.

Under a fixed exchange rate system, shocks in one country's income, employment, and prices tend to be transmitted to its trading partners' income, employment, and prices.

Absent policy changes in the U.S., the only recourse for countries on the gold standard was to cut the fixed-exchange rate link. The first major country to do so was Britain. After runs on sterling, it abandoned the gold standard in September 1931. The international monetary system split in two, one part following Britain to form the sterling area; the other part, the gold bloc, following the United States. The trough of the depression

in Britain and in other countries that accompanied her in leaving gold was reached in the third quarter of 1932.

In the two weeks following Britain's departure from gold, central banks and private holders in foreign countries converted substantial amounts of their dollar assets in the New York money market to gold. The U.S. gold stock declined by the end of October 1931 to about its level in 1929. The Federal Reserve, which had not responded to an internal drain from December 1930 to September 1931 as a series of runs on banks, bank failures, and shifts from bank deposits to currency by anxious depositors produced downward pressure on the U.S. quantity of money, responded vigorously to the external drain. A sharp rise in discount rates ended the gold drain but intensified bank failures and runs on banks. In October 1931, unlike the situation in 1920, the system's reserve ratio was far above its legal minimum. The system overreacted to the gold outflow and magnified the internal drain.

Federal Reserve officials believed that purchases of government securities, which would have relieved monetary contraction, were inconsistent with the real bills doctrine that the Federal Reserve Act enshrined. They resisted engaging in such purchases until March 1932, when they undertook doing so, following which there was widespread revival in the real economy in the summer and fall. The termination of the purchase program during the summer was followed in the six months from October 1932 by mounting banking difficulties. States began to declare banking holidays. By February 1933, fears of a renewed foreign drain added to the general anxiety. For the first time also, the internal drain took the form of a specific demand by depositors for gold coin and gold certificates in place of Federal Reserve notes or other currency.

The Federal Reserve reacted as it had in September 1931, raising discount rates in February 1933 in reaction to the external drain but not seeking to counter either the external or internal drain by extensive open market purchases. The drains continued until 4 March, when the Federal Reserve banks and all the leading exchanges did not open for business. A nationwide banking holiday was proclaimed after midnight on 6 March by the incoming administration, which ushered in a new regime.

3.6.3 <u>The Great Inflation, 1965-80</u>

By the mid-1960s, the convertibility principle no longer dominated central bank policies. The goal of full employment supplanted it in the minds of central bank and government officials. The Phillips curve presented them with a course of action that promised higher employment at the cost of rising inflation, a cost that was typically dismissed as insignificant. An additional factor that nurtured an acceleration of inflation was central bank reliance on short-term interest rates as the instrument to control monetary growth.

Under noninflationary conditions, this practice produced a procyclical movement in monetary growth. Under the gathering inflationary conditions from the mid-1960s, the inflation premium that became imbedded in interest rates made the instrument unreliable as an indicator of restriction or ease. Reliance on it contributed to a rise in the rate of monetary growth.

It was not until the 1970s, when ever higher inflation was accompanied by a decline in economic activity and a rise in unemployment that pressure arose to reverse the policies and procedures that led to the Great Inflation. The upshot was a shift to a new regime in 1979, in which disinflation was the guiding principle. The regime since the last decade has focused on price stability, reviving the peacetime domestic objective of the classical gold standard.

4. Monetary Regimes and Economic Performance: The Evidence

4.1 Overview

Having surveyed the history of international monetary regimes and of the institutional arrangements and episodes in Federal Reserve history viewed as a domestic policy regime, we ask the question, under what conditions is one or another type of monetary regime best for economic performance? One based on convertibility into specie (gold and or silver), in which the monetary authority defines its monetary unit in terms of a fixed weight of specie and ensures that paper money claims on the specie monetary unit are always interchangeable for specie? Or one based on government fiat? Alternatively, in the international monetary sphere, which international monetary regime is superior, one based on fixed exchange rates? One based on floating rates? Or some intermediate variant such as the adjustable peg that

characterized the Bretton Woods system and the European Monetary System (EMS)? Or the managed float which prevails in the world today? Evidence on the performance of alternative monetary regimes is crucial in assessing which regime is best for welfare.

4.2 Theoretical Issues

Traditional theory posits that a convertible regime, such as the classical gold standard that prevailed 1880-1914, is characterized by a set of self-regulating market forces that tend to ensure long-run price level stability. These forces operate through the classical commodity theory of money (Bordo 1984). According to that theory, substitution between monetary and nonmonetary uses of gold and changes in production will eventually offset any inflationary or deflationary price level movements.

The fixed nominal anchor also ensures long-run price predictability and hence protects long-term contracts. It also may foster investment in long-lived projects (Klein 1975; Leijonhufvud 1984; Flood and Mussa 1994).

Adherence to the fixed nominal anchor by providing credibility to monetary policy contributes to low inflation both by restraining money growth and by enhancing money demand (Ghosh et al. 1996).

However, while ensuring long-run price stability and predictability, a gold standard provided no immunity to unexpected shocks to the supply of or demand for gold. Such shocks could have significant short-run effects on the price level. In a world with nominal rigidities they would generate volatility in output and employment.[18] Indeed, because of the problem of wide swings in the price level around a stable mean under the gold standard, Fisher (1920); Marshall (1926); Wicksell (1898), and others advocated reforms such as the compensated dollar and the tabular standard that would preserve the fixed nominal anchor yet avoid swings in the price level (Cagan 1984).

In an inconvertible fiat money regime, without a nominal anchor, monetary authorities in theory could use open market operations, or other policy tools, to avoid the types of

---

[18]According to Fischer (1994), in a comparison of price level stability versus low inflation, these costs outweigh the benefits of long-run price level predictability.

shocks that may jar the price level under a specie standard and hence provide both short-run and long-run price stability. However, in the absence of a fixed nominal anchor, some other type of commitment would be required to prevent the monetary authority from using seigniorage to satisfy the government's fiscal demands, or to maintain full employment.

In its international dimension, the convertible regime was one of fixed exchange rates and a stable nominal anchor for the international monetary system. Stability, however, came at the expense of exposure to foreign shocks through the balance of payments. In the presence of wage and price stickiness, these shocks again could produce volatile output and employment. Adherence to the international convertible regime also implied a loss of monetary independence. Under such a regime the monetary authorities' prime commitment was to maintain convertibility of their currencies into the precious metal and not to stabilize the domestic economy.

In a fiat (inconvertible) money regime, adhering to a flexible exchange rate provides insulation against foreign shocks.[19] However, as in a convertible regime, countries in fiat money regimes can adopt fixed exchange rates with each other. The key advantage is that it avoids the transactions cost of exchange. However, a fixed-rate system based on fiat money may not provide the stable nominal anchor of the specie convertibility regime unless all members define their currencies in terms of the currency of one dominant country (e.g., the U.S. under Bretton Woods or Germany in the EMS). The dominant country in turn must observe the rule of price stability (Giavazzi and Pagano 1988).

The theoretical debate on the merits of fixed and flexible exchange rates stemming from Nurkse's (1944) classic indictment of flexible rates and Friedman's (1953) classic

---

[19]Theoretical developments in recent years have complicated the simple distinction between fixed and floating rates. In the presence of capital mobility, currency substitution, policy reactions, and policy interdependence, floating rates no longer necessarily provide insulation from either real or monetary shocks (Bordo and Schwartz 1989). Moreover, according to recent real business cycle approaches, no relationship may exist between the international monetary regime and transmission of real shocks (Baxter and Stockman 1989).

defense is inconclusive.[20] It is difficult to defend an unambiguous ranking of exchange rate arrangements.[21] Hence, evidence on the performance of alternative monetary regimes is crucial in assessing the condition under which one or another regime is best for welfare.[22]

4.3 Measures of Macroeconomic Performance, by Regime

In Table 4.1 we present annual data on two key measures of economic performance, the inflation rate (GNP deflator) and the growth rate of real per capita income (GNP) for the five largest industrial countries across four regimes over the period 1881-1995.[23] The regimes covered are: the classical gold standard (1881-1913); the interwar period (1919-1938); Bretton Woods (1946-1970); and the present floating exchange rate regime (1973-1995).[24] We divide the Bretton Woods period into two subperiods: the preconvertible

---

[20]For surveys, see Frenkel and Mussa (1985) and Bordo and Schwartz (1989). Also see McCallum (1997) p. 15.

[21]See, for example Helpman and Razin (1979), and Helpman (1981).

[22]Meltzer (1990) argues the need for empirical measures of the excess burdens associated with flexible and fixed exchange rates -- the costs of increased volatility, on the one hand, compared to the output costs of sticky prices on the other hand. His comparison between EMS and non-EMS countries in the postwar period, however, does not yield clear-cut results.

[23]For similar comparisons for the G-7 see Bordo (1993b). For 21 countries including advanced and developing countries see Bordo and Schwartz (1996b). Other studies comparing historical regime performance include: Bordo (1981); Cooper (1982); Meltzer (1986); Schwartz (1986); Meltzer and Robinson (1989); Eichengreen (1993b); Mills and Wood (1993).

[24]One important caveat is that the historical regimes presented here do not represent clear-cut examples of fixed and floating exchange rate regimes. The interwar period is not an example of either a fixed or floating rate regime. It comprises three regimes: a general floating rate system from 1919 to 1925, the gold exchange standard from 1926 to 1931, and a managed float to 1939. For a detailed comparison of the performances of these three regimes in the interwar period, see Eichengreen (1991b). We include this regime as a comparison to the other three more clear-cut cases. The Bretton Woods regime cannot be characterized as a fixed exchange rate regime throughout its history. The preconvertibility period was close to the adjustable peg envisioned by its architects, and the convertible period was close to a defacto fixed dollar standard. Finally, although the period since 1973 has been characterized as a floating exchange rate regime, at various times it has been subject to varying degrees of management.

phase (1946-1958) and the convertible phase (1959-1970).[25] We divide the recent float into two subperiods: high inflation (1973-1982) and low inflation (1983-1995).

For the United States over the period 1880-1929, we show data from two sources: Balke-Gordon (1986) and Romer (1989). All sources for the U.S. and other countries are shown in the Data Appendix. For each variable and each country we present two summary statistics: the mean and standard deviation. As a summary statistic for the countries taken as a group, we show the grand mean.[26] We comment on the statistical results for each variable.

4.4 Inflation and Output Levels and Variability

4.4.1 Inflation

The rate of inflation was lowest during the classical gold standard period (Figure 4.1). This was true for every country except Japan which did not go on the gold standard until 1897. During the interwar period mild deflation prevailed. The rate of inflation during the Bretton Woods period was on average and for every country except Japan lower than during the subsequent floating exchange rate period.

During the Bretton Woods convertible period the inflation rate in the U.S., the U.K. and France was higher than in the preceding subperiod; the reverse was true for Germany and Japan but on average there was not much difference between the subperiods. During the floating regime inflation has been lower in the recent subperiod of low inflation than during the Bretton Woods convertible subperiod except in the U.S. and U.K.[27]

---

[25]We also examined the period (1946-1973), which includes the three years of transition from the Bretton Woods adjustable peg to the present floating regime. The results are similar to those of the 1946-1970 period.

[26]Bordo (1993b) also presents data on seven other variables: money growth, nominal and real short-term and long-term interest rates and nominal and real exchange rates. Bordo and Schwartz (1996b) show the same data plus the government budget deficit relative to GDP for fourteen additional countries.

[27]The dispersion of inflation rates between countries was lowest during the classical gold standard and to a lesser extent during the Bretton Woods convertible subperiod compared to the floating rate period and the mixed interwar regime (Bordo 1993b). This evidence is consistent with the traditional view of the operation of the classical price-specie-flow mechanism and commodity arbitrage under fixed rates and insulation and greater monetary

The Bretton Woods period had the most stable inflation rate as judged by the standard deviation. The managed float and the gold standard periods were next. The interwar period was the most unstable. However, when subperiods of the regimes are distinguished, the recent decade of low inflation was the most stable, followed by the Bretton Woods convertible regime, then the inflation phase of the float, and last, the gold standard period.

In general, the descriptive evidence of lower inflation under the gold standard and the Bretton Woods convertible regime than is the case for the other regimes is consistent with the view that convertible regimes provide an effective nominal anchor. The marked low inflation of the recent decade suggests that the equivalent of the convertibility principle may be operating. At the same time, evidence that inflation variability on average was higher in the classical gold standard period than in most other regimes is consistent with the commodity theory of money and the price-specie-flow-mechanism which posits offsetting changes in the monetary gold stock.[28]

The evidence on inflation and inflation variability is also consistent with the behavior of two other nominal variables (Bordo 1993b). First, money growth was generally lowest under the gold standard across all countries, followed by the Bretton Woods convertible regime. It was most stable during the Bretton Woods convertible regime. Second, long term nominal interest rates were lowest during the classical gold standard period. During Bretton Woods they were lower than in the recent float (also see McKinnon 1988).

---

independence under floating rates.

[28]Supporting evidence is provided in a recent study by Ghosh et al. (1996). Classifying the exchange rate systems for 136 countries over the period 1960 to 1990 into pegged, intermediate, and floating, they adopt a methodology similar to that of Table 4.1. They find that the unconditional mean inflation rate for countries on pegged exchange rates was significantly lower than for those that did not peg. This result holds up, controlling for the 1960s during which most countries adhered to Bretton Woods. The only exception was high-income floating countries which had lower than average inflation rates. Their results are unchanged when conditioned on a set of determinants of inflation, and when account is taken of possible endogeneity of the exchange rate regime. With respect to the volatility of inflation, they found it to be highest among floaters, again with the exception of high income countries. For them, it was the lowest.

4.4.2 Real Per-capita Income Growth

Generally, the Bretton Woods period, especially the convertible period, exhibited the most rapid output growth of any monetary regime, and, not surprisingly, the interwar period the lowest (Figure 4.2). Output variability was also lowest in the convertible subperiod of Bretton Woods, but because of higher variability in the preconvertibility period, the Bretton Woods system as a whole was more variable than the floating exchange rate period. Both pre-World War II regimes exhibit considerably higher variability than their post-World War II counterparts. The comparison does not apply to the U.S. based on the Romer data.[29,30,31]

To link rapid growth in the industrialized countries in the quarter century following World War II to the Bretton Woods international monetary system (Bretton Woods Commission 1994), seems less compelling than for other aspects of macroeconomic performance. First, there is little conclusive evidence linking exchange rate volatility to either trade flows or the level of investment (Mussa et al. 1994), avenues by which a stable exchange rate regime might have affected economic growth. Although Ghosh et al. (1996) find evidence linking real growth to the growth of investment and trade for pegged countries, they also find total factor productivity growth to be an important channel of growth for floaters.

Second, although trade liberalization may have played an important role in the acceleration of growth rates in the European economies during the Golden Age, most of the liberalization of trade, before nations declared Article VIII current account convertibility in

---

[29]The Bretton Woods regime also exhibited the lowest dispersion of output variability between countries of any regime, with the interwar regime the highest (Bordo 1993b). The lower dispersion of output variability under Bretton Woods may reflect conformity between countries' business fluctuations, created by the operation of the fixed-exchange rate regime (Bordo and Schwartz 1989).

[30]The Hodrick-Prescott filter alternative to the first differences used in Table 4.1, yields basically the same rankings of regimes.

[31]In their 1960-1990 sample, Ghosh et al. (1996) find little connection between adherence to a pegged exchange rate and growth, once account is taken of the 1960s experience. High-income floaters generally had more rapid growth than low-income floaters. There was little correlation between output volatility and the regime.

December 1958, was under the aegis of institutions developed outside of the Bretton Woods framework -- the Marshall Plan, Organization for European Economic Cooperation (OEEC), European Payments Union (EPU), and European Coal and Steel Community (ECSC) (Eichengreen 1995).

Finally, the Bretton Woods arrangements might have contributed to postwar growth by being part of the overall package creating political and economic stability -- 'the Pax Americana,' that was a reaction to the chaos of the interwar and World War II periods. In this view, rapid postwar growth represented a 'catch up' by the European nations and Japan from low levels of per capita output compared to that of the leading industrial country, the U.S. The 'catch up' by these nations was encouraged by the U.S. They adopted the leader's best-practice technology and hence grew at a much more rapid rate than before (Abramovitz 1986).[32]

Adherence to the convertibility rules of the Bretton Woods system by the U.S. and other industrialized countries may possibly explain the stability of real output in that regime. Money growth, but not the growth of real government spending, was less variable under Bretton Woods than under the succeeding float (Bordo 1993b; Eichengreen 1993a). Also temporary (aggregate demand) shocks, measured using the Blanchard-Quah (1989) procedure, presumably incorporating policy actions, were lowest under Bretton Woods of any regime (Bordo 1993b, Bayoumi and Eichengreen 1994a and b). According to Eichengreen (1993b), the credibility of commitment to the nominal anchor, as evidenced by the low degree of inflation persistence under Bretton Woods, made inflationary expectations mean reverting

---

[32]In an institutional vein, it has been argued that the Bretton Woods framework (plus GATT) contributed to growth by providing an overall framework of rules. Within them Western European nations solved a hierarchy of coordination problems, allowing them to encourage investment in growth-generating export sectors (Eichengreen 1995). Without the Bretton Woods framework it might not have been possible to solve prisoner's dilemma games between labor and capital within each country taken in isolation and, for the OEEC, EPU, Marshall Plan, and ECSC to liberalize trade on comparative advantage lines between the members. Given that the European regional arrangements occurred outside of, and because of, shortcomings in the Bretton Woods arrangements, one wonders if institutional developments would have been much different if the European countries were not party to Bretton Woods at all.

(see Table 4.2). This produced a flatter short-run aggregate supply curve than under the float where, in the absence of a nominal anchor, inflationary expectations became extrapolative. Under these conditions stabilization policy could be effective in stabilizing output.

That activist stabilization policy is in the main responsible for the low real output variability under Bretton Woods is doubtful. For the U.S., activist Keynesian policies were a product of the late 1960s and 1970s and, for the other countries, the ongoing conflict between internal and external balance dominated policy making. A more likely explanation for real output stability was the absence of serious permanent (aggregate supply) shocks. Bordo (1993b) and Bayoumi and Eichengreen (1994 a and b) show permanent (supply) shocks -- presumably independent of the monetary regime -- to be the lowest under Bretton Woods of any regime.

In sum, there is compelling evidence linking convertible regimes to superior nominal performance. Whether such a connection can be made for the real side is less obvious. More evidence is required.

4.5 Stochastic Properties of Macro Variables

We investigated the stochastic properties (of the log) of the price level and (of the log) of real per capita GNP across monetary regimes.[33] Economic theory suggests that the stochastic properties of the price level and other nominal series would be sensitive to the regime. Under convertible regimes based on a nominal anchor, the price level should follow a trend stationary process, whereas under a regime not so anchored, it should follow a difference stationary process or a random walk. By contrast there are few predictions that

---

[33]A controversial literature has centered on whether real GNP and other time series are trend stationary or difference stationary (Nelson and Plosser 1982) or, alternatively, whether GNP and other series contain a substantial unit root. This debate pertains to different theories of the business cycle: those emphasizing real factors positing a unit root (the primacy of real shocks), and those emphasizing monetary and other actions in the face of price rigidities positing reversion to a long-run trend (the primacy of transitory shocks).

can be made about the stochastic properties of real output under different regimes.

To ascertain the stochastic properties of the (log of) the price level and the (log of) real per capita GNP across monetary regime we follow the approach of Cochrane (1988) and Cogley (1990) and calculate the variance ratio. This statistic, defined as the ratio of 1/k times the variance of the series k differences divided by the variance of first differences, provides a point estimate of the size of the unit root, rather than a test for the existence or absence of a unit root, as in the earlier literature.

The variance ratio is the variance of the unit root component of a series relative to the variance of the trend stationary component. If the ratio is above one, the series contains a substantial unit root and is clearly difference stationary. When it is below one, the unit root represents a much smaller fraction of the variance of the series; and when it is zero, the series is completely trend stationary.[34]

Figure 4.3, shows the variance ratio of the log of the price level for the five countries and their aggregate by regime.[35] From the figure there appears to be a marked difference between the gold standard, interwar, and Bretton Woods regimes on the one hand and the recent float on the other. For the U.S., the ratio rises above three during the float and then declines below one after eight years; under the gold standard it gradually rises above two for thirteen years and then declines to zero. In the other regimes it declines to zero. For the other four countries and for the aggregate, for all regimes except the float, the ratio quickly declines below one. These results, which suggest that the price level is trend stationary under convertible regimes, but apparently not in the inconvertible fiat regime, generally are

---

[34]Initially we tested for a unit root in both series in the different regimes using the Dickey-Fuller test (1979) and the Kwiatowski-Philips-Schmidt-Shin (KPSS) test (1992). The results detecting the presence of absence of a unit root were inconclusive. The Dickey-Fuller test rejected the hypothesis of a unit root for the price level for the U.S. only during the Bretton Woods period. For real output, the unit root is rejected only for the U.S. and France during Bretton Woods. These results are generally in accordance with the original Nelson and Plosser (1982) findings. On the other hand, the KPSS test could not reject the hypothesis that both series are trend stationary universally across regimes at the five percent level.

[35]To calculate the aggregates we used current GNP weights in current U.S. dollars.

consistent with the evidence on persistence and price predictability described in the following subsection. The findings, however, are at best suggestive, since they are based on short samples of annual data for which it may not be possible to draw on asymptotic theory and perform tests of statistical significance.

In Figure 4.4, which shows the variance ratio of the log of real per capita GNP, it is difficult to detect a distinct pattern across countries by regimes. The only exception is a marked rise in the variance ratio in the interwar period in the U.S. and Germany, the two countries hardest hit by the Great Depression. For the aggregate, however, it appears as if the gold standard and interwar ratios decline quickly below one, whereas in both postwar regimes they do so only after three to five years. That shocks to output seem to be more long-lived in the post-World War II period than prewar is more likely consistent with explanations other than the nature of the monetary regime.

4.6 Inflation Persistence, Price Level Predictability, and Their Effects on Financial Markets

4.6.1 Inflation Persistence

An important piece of evidence on regime performance is the persistence of inflation. Evidence of persistence in the inflation rate suggests that market agents expect that monetary authorities will continue to pursue an inflationary policy; its absence would be consistent with market agents' belief that the authorities will pursue a stable monetary rule such as the gold standard's convertibility rule.

Evidence of inflation persistence can be gleaned from an AR(1) regression on CPI inflation. Table 4.2 presents the inflation rate coefficient from such regressions for five countries over successive regimes since 1880, as well as the standard errors, and the Dickey-Fuller tests for a unit root. The results show an increase in inflation persistence for most countries between the classical gold standard and the interwar period, and also between the interwar period and the post-World War II period as a whole.[36] Within the post-World

[36]Alogoskoufis and Smith (1991) also show, based on AR (1) regressions of the inflation rate, that inflation persistence in the U. S. and the U. K. increased between the classical gold standard period and the interwar period and between the interwar period and the post-World War II period. Also see Alogoskoufis (1992), who attributes the increase in persistence to

War II period, inflation persistence is generally lower (but not in France and Japan) in the preconvertible Bretton Woods than in the convertible period. This suggests that, though the immediate post-World War II period was characterized by rapid inflation, market agents might have expected a return to a stable price regime. The higher degree of persistence in the convertible regime suggests that this expectation lost credence. Persistence was generally highest during the float and it did not decline much between the high inflation and low inflation episodes.[37] This may mean that the public is aware of the absence of a stable nominal anchor.[38]

4.6.2 Price Level Uncertainty

An important distinction between a convertible or fixed nominal anchor regime (or even one dedicated to price level stability) compared to an inconvertible regime (or one following an inflation target) is lower long-run price level uncertainty. This reflects the trend stationary (mean reversion) process underlying a convertible regime, compared to the difference stationary process of an inconvertible regime. Moreover, forecast errors should increase linearly as the time horizon is lengthened (Leijonhufvud 1984; Fischer 1994).

Early evidence, by Klein (1975) for the U.S., showing long-run price-level uncertainty under the pre-1914 gold standard, the interwar period and the 1950s, compared to the 1960s and 1970s, is supported by stochastic simulations of hypothetical price level paths by Fischer (1994), Duguay (1993) and Lebow, Roberts and Stockton (1992).[39]

---

the accommodation of shocks by the monetary authorities.

[37]However, Emery (1994), using quarterly data, finds that inflation persistence in the U.S. declined significantly between 1973-1981 and 1981-1990.

[38]Supportive evidence, based on autocorrelations and time series models of CPI and WPI inflation for the U.S., U.K., France, and Italy in the nineteenth and twentieth centuries, shows that inflation under the gold standard was very nearly a white noise process, whereas in the post World War II period exhibited considerable persistence (Klein 1975; Barsky 1987; Bordo and Kydland 1996).

[39]Bordo and Jonung (1996), using the univariate Multi-State Kalman Filter methodology, measured forecast errors in inflation at one-, five-, and ten-year horizons for sixteen countries over the period 1880-1990, across regimes. They found that forecast errors at the

While a convertible regime (or one dedicated to price level stability) yields lower long-run price level uncertainty, short-run price level uncertainty may be higher as a consequence of the equilibrating changes in the monetary gold stock (or offsetting changes in money supply required to maintain price stability) than under an inconvertible (or inflation targeting) regime, where price level increases need not be reversed. In this regard, Klein (1975) using annual data for the U.S., Meltzer (1986) using quarterly U.S. data, and Meltzer and Robinson (1984) using annual data for seven countries observed higher short-run price level uncertainty for the gold standard than under subsequent regimes.[40]

4.6.3 Effects on Financial Markets

Adherence or non-adherence to a nominal anchor also had implications for financial markets. Mean reversion in price-level expectations anchored the term-structure of interest rates. Under the gold standard in the U.S. and the U.K., the long-term-short-term interest rate spread predicted short-term rates according to the expectations theory. Under the subsequent fiat money regime, in which monetary authorities smoothed short-term interest rates, the relationship broke down. Similarly the response of long-term rates to shocks to short-term rates increased after 1914 as short-term rates exhibited more persistence (Mankiw and Miron 1986; Mankiw, Miron and Weil 1987; Miron 1996). Moreover, the Fisher effect -- the correlation between nominal interest rates and expected inflation -- is hard to detect before 1914 because inflation was a white noise process whereas, later in the twentieth century, when inflation became more persistent, it became more apparent (Barsky 1987; Mishkin 1992).

---

one-year horizon were lowest on average for the advanced G-11 countries during the Bretton Woods convertible regime, followed by the gold standard and the floating rate period. Also they found that the inflation forecast error increased with time across all regimes, but much more so under the recent float, as Leijonhufvud (1984) predicted.

[40]Klein (1975) based his conclusions on a 6-year moving standard deviation of the annual rate of price change; Meltzer (1986) and Meltzer and Robinson (1989) calculated 1-period ahead forecast errors, using a univariate Multi-State Kalman Filter. Simulations by Fischer (1994) of univariate models showed higher short-run forecast errors under a price level target than under a low inflation target.

4.7 Temporary and Permanent Shocks

An important issue is the extent to which the performance of alternative monetary regimes, as revealed by the data in Table 4.1, reflects the operation of the monetary regime in constraining policy actions or the presence or absence of shocks to the underlying environment. One way to shed light on this issue is to identify such shocks.

Authors have used structural VARs to calculate permanent and temporary output shocks to identify differences in behavior across regimes. In a number of recent papers Bayoumi and Eichengreen (e.g. 1994a and 1994b) have extended the bivariate structural vector autoregression (VAR) methodology developed by Blanchard and Quah (1989) which identified permanent shocks as shocks to aggregate supply and temporary shocks as shocks to aggregate demand. According to Bayoumi and Eichengreen, aggregate supply shocks reflect shocks to the environment and are independent of the regime, but aggregate demand shocks likely reflect policy actions and are specific to the regime.[41]

There are econometric issues that the methodology that Blanchard and Quah (1989) originally developed raises.[42] More controversial, however, is the labeling of the shocks as aggregate supply and demand shocks, as Bayoumi and Eichengreen do (1994a and 1994b). Interpreting shocks with a permanent impact on output as supply disturbances and shocks with a temporary impact on output as demand disturbances implies that one accepts the aggregate demand-aggregate supply model as correct. For our purpose, it is not necessary to

---

[41]Restrictions on the VAR identify an aggregate demand disturbance, which is assumed to have only a temporary impact on output and a permanent impact on the price level, and an aggregate supply disturbance, which is assumed to have a permanent impact on both prices and output. Overidentifying restrictions, namely, that demand shocks are positively correlated and supply shocks are negatively correlated with prices, are tested by examining the impulse response functions to the shocks.

[42]Lippi and Reichlin (1993) point out that the Blanchard-Quah procedure assumes that the error terms in the model are fundamental, whereas results are different with nonfundamental representations. This comment, however, applies to all dynamic econometric analyses, not the Blanchard-Quah procedure in particular (Blanchard and Quah 1993). Likewise, the comment by Faust and Leeper (1994) that using finite-horizon data and problems of time aggregation cast doubt on the identification of the shocks applies also to other strategies for isolating shocks from responses, and analyzing the speed of adjustment.

take a stand on this issue. We reach no conclusion that depends on differentiating the two types of shocks, or whether one type predominates. It is enough to retain the more neutral descriptions of temporary and permanent shocks when relying on the VAR results to identify underlying disturbances across regimes.[43]

Figure 4.3 summarizes the results of this line of research.[44] It displays the permanent (aggregate supply) and temporary (aggregate demand) shocks for the five-country aggregate for the data underlying Table 4.1.[45] For these countries, both temporary and permanent

---

[43]For two reasons Bayoumi and Eichengreen (1994b) strongly defend use of the aggregate demand-aggregate supply framework. First, it allows attributing the difference in macroeconomic behavior between fixed and floating exchange rate regimes to a change in the slope of the aggregate demand curve. Second, the model implies that demand shocks should raise prices, supply shocks lower them. These responses are not imposed, hence can be thought of as "over-identifying restrictions" that the data satisfy. However, they acknowledge that the shocks could be misidentified as supply, when they are temporary, and demand, when they are permanent.

Finally, a limitation of this approach is that it is difficult to identify the historical events in each monetary regime that correspond to the statistical results. Some authors have conjectured what these events might be.

[44]Meltzer (1986) and Meltzer and Robinson (1989) use the univariate Multi-State Kalman Filter methodology to distinguish between permanent and transitory shocks to the price level and real output for cross-regime comparisons.

Authors who use the bivariate structural VAR methodology to identify underlying shocks to demand and supply include Bordo (1993b), who extends the approach to historical regime comparisons over the 1880-1990 period for G-7 countries. Bordo and Schwartz (1996a) and Bordo and Jonung (1996) apply the methodology for comparisons over a larger set of countries. Cecchetti and Karras (1994), Betts, Bordo, and Redish (1996) follow Gali (1992) in decomposing the aggregate demand shock into an LM (money) shock and an IS (rest of aggregate demand) shock, applying it to historical data over the interwar period for the U.S. and Canada, respectively. A different labeling has been adopted by Robinson and Wickens (1992) who refer to shocks with a temporary impact on output as nominal shocks, and those with a permanent effect on output as real shocks.

[45]The shocks were calculated from a two variable vector autoregression in the rate of change of the price level and real output.

The VARs are based on three separate sets of data: 1880-1913, 1919-1939, and 1946-1995, omitting the war years because complete data are available for only two of the countries. The VARs have two lags. We derived the number of lags using the Akaike (1974) procedure. We rendered the two series stationary by first differencing.

The aggregate income growth and inflation rates are a weighted average of the rates

shocks were considerably larger before World War II than afterwards. Both types of shocks, but especially permanent shocks, were much larger under the classical gold standard than during the two post-World War II regimes. There is not much difference in the size of both types of shocks between Bretton Woods and the subsequent float, although the Bretton Woods convertible regime was the most tranquil of all the regimes. Thus, this evidence suggests that the superior real performance of the Bretton Woods convertible period may have a lot to do with the lower incidence of shocks compared to the gold standard and interwar periods.

This raises an interesting question: why was the classical gold standard durable in the face of substantial shocks (it lasted approximately 35 years), whereas Bretton Woods was fragile (the convertible phase lasted only 12 years) in the face of the mildest shocks in the past century?

One possible answer is more rapid adjustment of prices and output to shocks under the gold standard than under the postwar regimes. Evidence in Bordo (1993b), based on calculations from the impulse response functions derived from the bivariate autoregressions underlying Figure 4.3, reveals that the response of both output and prices to both temporary and permanent shocks in the G-7 aggregate and in most of the individual countries was markedly more rapid under the gold standard than under the postwar regimes. Within the postwar regimes, the response was also more rapid under Bretton Woods than under the float (also see Bayoumi and Eichengreen 1994a).

Perhaps countries under the gold standard were able to endure the greater shocks that they faced owing to both greater price flexibility and greater factor mobility before World War I (Bordo 1993b). Alternatively, perhaps the gold standard was more durable than Bretton Woods because, before World War I the suffrage was limited, central banks were often privately owned and, before Keynes, there was less understanding of the link between monetary policy and the level of economic activity. Hence, there was less of an incentive

---

in the different countries. The weights for each year are the share of each country's nominal national income in the total income in the five countries, where the national income data are converted to U.S. dollars using current exchange rates.

for the monetary authorities to pursue full employment policies which would threaten adherence to convertibility (Eichengreen 1992).

Another explanation for the relative longevity of the international gold standard and the short life of Bretton Woods may be the design of the monetary regime and specifically the presence or absence of a credible commitment mechanism (or a monetary rule). As shown in Section 2, although Bretton Woods, like the gold standard, was a regime based on rules, the system did not provide a credible commitment mechanism, such as the gold standard contingent rule for the core countries. That outcome may in turn have reflected a shift in society's objectives away from convertibility and price stability towards domestic real stability.

5. Overall Assessment of Monetary Policy Regimes

The historical record and evidence on the performance of monetary policy regimes leave unanswered questions concerning the forces that predispose policy makers to adopt and then to abandon a regime. We do not know in detail why so many countries chose the gold standard before World War I as the monetary regime par excellence. Was it simply path dependence, since monetary systems evolved from specie-based regimes, and the success of England, the leading commercial power, which accidentally shifted to gold in the early 18th century, led many silver and bimetallic adherents as well as those on paper standards in turn to switch to gold? Was it the opinion of experts who testified before commissions regarding the choice that swayed the decision makers? Was it economic theory that convinced the leaders of public opinion? Was it the experience of inflationary fiat money in preceding regimes that carried the day? Finally, was the gold standard viable because the scope of government activity was limited?

In the case of the United States, we know that the combination of real bills and gold standard rules in the Federal Reserve Act reflected the influence of bankers and public servants as well as the testimony of representatives of foreign central banks. Yet the wartime departures from the arrangements that the Act prescribed were never undone.

The explanation of the abandonment of the gold standard under wartime conditions, in both wars, poses no problem. When financing government becomes the primary concern of

both wars, poses no problem. When financing government becomes the primary concern of the monetary and fiscal authorities, gold standard rules cannot be sustained. Peacetime limits on money creation give way to the requirement to provide the financial sinews of war in tandem with contributions from taxation and government debt issues.

Accounting for the monetary regime choices in postwar eras, however, raises many questions. Did the rise of the democracy and the power of the labor movement make adherence to the strictures of the gold standard less acceptable? Has the growth of government been inimical to the requirements of a real gold standard? Were the political disorders of the post-World War I decades so crippling -- reparations, war debts, U.S. isolationism, rearmament, fascist and communist dictatorships -- that, after the brief restoration of the gold standard, no international monetary regime was viable? Was the brief restoration possible only because the American Benjamin Strong and the Englishman Montagu Norman willed it? Bretton Woods, post-World War II, again represented the will of an American Harry Dexter White and an Englishman Maynard Keynes, but this time, more so than in the 1920s, the economic weight of the U.S. backing of its representative was overwhelming. Is that why countries fell into line to apply for membership in the system? Or, alternatively, was the Anglo-Saxon system imposed on other leading countries, which because they were either occupied or were enemies during the war, had no input in constructing Bretton Woods?

Post-Bretton Woods, the questions center on the commonality of the experience of stagflation in the 1970s and the switch since the 1980s to low inflation as the objective of domestic monetary policy regimes. We can observe the change in procedures that central banks adopted in order to achieve the low inflation result, but pinpointing the forces that led country after country to the change its monetary policy objective is less apparent. We have learned much about the virtues and shortcomings of the monetary regimes that the world has experienced since 1880. Much more still has to be learned.

References

Abramovitz, Moses (1986). "Catching Up, Forging Ahead, and Falling Behind." *Journal of Economic History* 46, No. 2 (June): 385-406.

Akaike, H. (1974). "A New Look at the Statistical Model Identification," *IEEE Transactions on Automatic Control* A619: 716-723.

Akerlof, George A., William T. Dickens, and George L. Perry (1996). "The Macroeconomics of Low Inflation." *Brookings Papers on Economic Activity* (1): 1-76.

Alesina, A. and A. Drazen (1991). "Why Are Stabilizations Delayed?" *American Economic Review* 81, No. 5: 1170-1188.

Alogoskoufis, George S. (1992). "Monetary Accomodation, Exchange Rate Regimes and Inflation Persistence." *Economic Journal* 102, No. 412 (May): 461-480.

Alogoskoufis, George S. and Ronald Smith (1991). "The Phillips Curve, the Persistence of Inflation and the Lucas Critique: Evidence from Exchange-Rate Regimes." *American Economic Review* 81, No. 2: 1254-1273.

Bagehot, Walter [1873] (1969). *Lombard Street*. Reprint of the 1915 edition. New York: Arno Press.

Balke, Nathan S. and Robert J. Gordon (1986). "Appendix B: Historical Data." In Robert J. Gordon (ed.) *The American Business Cycle: Continuity and Change*. Chicago, University of Chicago Press, 781-783.

Ball, Lawrence (1994). "Credible Disinflation with Staggered Price-Setting." *American Economic Review* 84 (March): 282-289.

Bank of Canada (1993). *Economic Behavior and Policy Choice Under Price Stability.* Ottawa.

Barro, Robert J. (1989). "Interest-Rate Targeting." *Journal of Monetary Economics* 23 (January): 3-30.

Barro, Robert J. (1979). "Money and the Price Level Under the Gold Standard." *Economic Journal* 89: 12-33.

Barro, Robert J. and David B. Gordon (1983). "Rules, Discretion and Reputation in a Model of Monetary Policy." *Journal of Monetary Economics* 12: 101-121.

Barsky, Robert. B. and Lawrence H. Summers (1988). "Gibson's Paradox and the Gold Standard." *Journal of Political Economy* 96, No. 3 (June): 528-550.

Barsky, Robert B. (1987). "The Fisher Hypothesis and the Forecastability and Persistence of Inflation." *Journal of Monetary Economics* 19, No. 1 (January): 3-24.

Baxter, Marianne and Alan C. Stockman (1989). "Business Cycles and the Exchange-Rate Regime: Some International Evidence." *Journal of Monetary Economics* 23 (May): 377-400.

Bayoumi, Tamim and Michael D. Bordo (1996). "Getting Pegged: Comparing the 1879 and 1925 Gold Resumptions." NBER Working Paper No. 5497.

Bayoumi, Tamim and Barry Eichengreen (1994a). "Economic Performance Under Alternative Exchange Rate Regimes: Some Historical Evidence." In Peter Kenen, Francesco Papadia, Fabrizio Saccomani (eds.) *The International Monetary System.* Cambridge University Press, 257-297.

Bayoumi, Tamim and Barry Eichengreen (1994b). "Macroeconomic Adjustment Under Bretton Woods and the Post-Bretton Woods Float: An Impulse-Response Analysis." *Economic Journal* 104 (July): 813-827.

Benjamin, Daniel and Levis Kochin (1979). "Searching for an Explanation of Unemployment in Interwar Britain." *Journal of Political Economy* 87: 441-478.

Benjamin, Daniel and Levis Kochin (1982). "Unemployment and Unemployment Benefits in 20th Century Britain: A Reply to our Critics." *Journal of Political Economy* 90: 410-436.

Bernanke, Ben S. (1995). "The Macroeconomics of the Great Depression: A Comparative Approach." *Journal of Money, Credit, and Banking* 27 (February): 1-28.

Bernanke, Ben S. (1983). "Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression." *American Economic Review* 73 (June): 257-276.

Bernanke, Ben S. and Kevin Carey (1996). "Nominal Wage Stickiness and Aggregate Supply in the Great Depression." *Quarterly Journal of Economics* 111 (August): 853-883.

Bernanke, Ben S. and Harold James (1991). "The Gold Standard, Deflation and Financial Crisis in the Great Depression: An International Comparison." In R.G. Hubbard (ed.) *Financial Markets and Financial Crisis*. Chicago: University of Chicago Press, 33-68.

Bernanke, Ben S. and Mark Gertler (1989). "Agency Costs, Net Worth, and Business Fluctuations." *American Economic Review* 79 (March): 14-31.

Betts, Caroline M., Michael D. Bordo, and Angela Redish (1996). "A Small Open Economy in Depression: Lessons from Canada in the 1930s." *Canadian Journal of Economics* 29 (February): 1-36.

Blanchard, Olivier and Danny Quah (1989). "The Dynamic Effects of Aggregate Demand and Aggregate Supply Disturbances." *American Economic Review* 79 (September): 655-673.

Blanchard, Olivier and Danny Quah (1993). "The Dynamic Effects of Aggregate Demand and Supply Disturbances: Reply." *American Economic Review* 88 (June): 653-658.

Bloomfield, A. (1959). *Monetary Policy Under the International Gold Standard, 1880-1914.* New York: Federal Reserve Bank of New York.

Bordo, Michael D. (1995). "Is There a Good Case for a New Bretton Woods International Monetary System?" *AEA Papers and Proceedings* (May): 317-322.

Bordo, Michael D. (1993a). "The Bretton Woods International Monetary System. An Historical Overview." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform.* Chicago: University of Chicago Press.

Bordo, Michael D. (1993b). "The Gold Standard, Bretton Woods and Other Monetary Regimes: An Historical Appraisal." In *Dimensions of Monetary Policy: Essays in Honor of Anatole B. Balbach. Federal Reserve Bank of St. Louis Review, Special Issue.* April-May.

Bordo, Michael D. (1984). "The Gold Standard: The Traditional Approach." In Michael D. Bordo and Anna J. Schwartz (eds.) *A Retrospective on the Classical Gold Standard, 1821-1931.* Chicago: University of Chicago Press.

Bordo, Michael D. (1981). "The Classical Gold Standard: Some Lessons for Today." *Federal Reserve Bank of St. Louis Review* 63 (May): 2-17.

Bordo, Michael D., Ehsan U. Choudhri, and Anna J. Schwartz (1995). "Could Stable Money Have Averted The Great Contraction?" *Economic Inquiry* 33 (July): 484-505.

Bordo, Michael D., Ehsan U. Choudhri, and Anna J. Schwartz (1990). "Money Stock Targeting, Base Drift, and Price-Level Predictability: Lessons from the U.K. Experience," *Journal of Monetary Economics* 25 (March): 253-272.

Bordo, Michael D. and Barry Eichengreen (1997). "Implications of the Great Depression for the Development of the International Monetary System." In Michael D. Bordo, Claudia Goldin, Eugene N. White (eds.) *The Defining Moment: The Great Depression and the American Economy in the 20th Century.* Chicago: Chicago University Press (forthcoming).

Bordo, Michael D. and R.E. Ellson (1985). "A Model of the Classical Gold Standard with Depletion." *Journal of Monetary Economics* 16, No. 1 (July): 109-120.

Bordo, Michael D., Christopher J. Erceg and Charles L. Evans (1997). "Money, Sticky Wages and the Great Depression." NBER Working Paper No. 6071 (June).

Bordo, Michael D. and Lars Jonung (1996). "Monetary Regimes, Inflation and Monetary Reform." In Daniel Vaz and Kumarasvamy Velupillai (eds.) *Inflation, Institutions and Information, Essays in Honor of Axel Leijonhufvud.* London: Macmillan Press Ltd.

Bordo, Michael D. and Finn E. Kydland (1996). "The Gold Standard As a Commitment Mechanism" In Tamim Bayoumi, Barry Eichengreen and Mark Taylor (eds.) *Modern Perspectives on the Gold Standard.* Cambridge University Press.

Bordo, Michael D. and Finn E. Kydland (1995). "The Gold Standard As a Rule: An Essay in Exploration." *Explorations in Economic History* 32, No. 4 (October): 423-464.

Bordo, Michael D. and Ronald MacDonald (1997). "Violations of the 'Rules of the Game' and the Credibility of the Classical Gold Standard, 1880-1914." NBER Working Paper (July).

Capie, Forrest, Terence C. Mills and Geoffrey E. Wood (1986). "What Happened in 1931?" In Forrest Capie an Geoffrey E. Wood (eds.) *Financial Crises and the World Banking System*. London: Macmillan, pp. 120-148.

Bordo, Michael D. and Hugh Rockoff (1996). "The Gold Standard as a 'Good Housekeeping Seal of Approval'" *Journal of Economic History* 56(2) June: 384-428.

Bordo, Michael D. and Anna J. Schwartz (1996a). "Why Clashes between Internal and External Stability Goals End in Currency Crises, 1797 - 1994." *Open Economies Review* 7, Supplement 1: 437-468.

Bordo, Michael D. and Anna J. Schwartz (1996b). "The Operation of the Specie Standard: Evidence for Core and Peripheral Countries, 1880-1990." In Jorge Braga de Macedo, Barry Eichengreen and Jaime Reis (eds.) *Currency Convertibility: The Gold Standard and Beyond*. New York: Rutledge, 11-83.

Bordo, Michael D. and Anna J. Schwartz (1989). "Transmission of Real and Monetary Disturbances Under Fixed and Floating Rates." In James A. Dorn and William A. Niskanen (eds.) *Dollars, Deficits and Trade*. Boston: Kluwer, 237-258.

Bordo, Michael D. and Carlos Vegh (1996). "If Only Alexander Hamilton had been Argentinean: A Comparison of the Early Monetary Experiences of Argentina and the United States." Rutgers University. (Mimeo).

Bordo, Michael D. and Eugene White (1993). "British and French Finance During the Napoleonic Wars." In Michael D. Bordo and Forrest Capie (eds.) *Monetary Regimes in Transition*. Cambridge: Cambridge University Press.

Bretton Woods Commission (1994). *Bretton Woods: Looking to the Future, Commission Report, Staff Review, Background Papers.* Washington, DC.

Brunner, Karl and Allan H. Meltzer (1993). *Money in the Economy: Issues in Monetary Analysis*. Raffaele Mattioli Lectures. Cambridge: Cambridge University Press.

Brunner, Karl and Allan H. Meltzer (1988). "What Did We Learn from the Monetary Experience of the United States in the Great Depression?" *Canadian Journal of Economics* (May): 334-348.

Brunner, Karl and Allan H. Meltzer (1964). *An Analysis of Federal Reserve Monetary Policymaking*. House Committee on Banking and Currency. Washington, DC: Government Printing Office.

Cagan, Philip (1984). "On the Report of the Gold Commission 1982 and Convertible Monetary Systems." *Carnegie Rochester Conference Series on Public Policy* 21 (Spring): 247-267.

Cagan, Philip (1965). *Determinants and Effects of Changes in the Stock of Money 1875-1960.* New York: Columbia University Press.

Calomiris, Charles W. (1993). "Greenback Resumption and Silver Risk: The Economics and Politics of Monetary Regime Change in the United States, 1862-1900." In Michael D. Bordo and Forrest Capie (eds.) *Monetary Regimes in Transition.* Cambridge: Cambridge University Press.

Calomiris, Charles W. and David C. Wheelock (1997). "Was the Great Depression a Watershed for American Monetary Policy?" In Michael D. Bordo, Claudia Goldin, Eugene N. White (eds.) *The Defining Moment: The Great Depression and the American Economy in the 20th Century*. Chicago: Chicago University Press (forthcoming).

Calomiris, Charles W. and Gary Gorton (1991). "The Origin of Banking Panics: Models, Facts, and Bank Regulation." In R. Glenn Hubbard (ed.) *Financial Markets and Financial Crises*. Chicago: Chicago University Press, 109-173.

Canzoneri, Matthew B. (1985). "Monetary Policy Games and the Role of Private Information." *American Economic Review* 75 (December): 1056-1070.

Canzoneri, Matthew B. and Dale W. Henderson (1991). *Monetary Policy in Interdependent Economies*. Cambridge: MIT Press.

Capie, Forrest, Charles Goodhart and Norbert Schnadt (1994). "The Development of Central Banking." In Forrest Capie, Charles Goodhart, Stanley Fischer and Norbert Schnadt, *The Future of Central Banking*. Cambridge: Cambridge University Press, 1-231.

Capie, Forrest, Terence C. Mills, and Geoffrey E. Wood (1986). "What Happened in 1931?" In Forrest Capie and Geoffrey E.Wood (eds.) *Financial Crises and the World Banking System.* London: Macmillan, pp. 120-148.

Cecchetti, Stephen G. (1992). "Prices During the Great Depression: Was the Deflation of 1930-32 Really Unanticipated?" *American Economic Review* 92 (March): 141-156.

Cecchetti, Stephen G. and Georgios Karras (1994). "Sources of Output Fluctuations During the Interwar Period: Further Evidence on the Causes of the Great Depression." *Review of Economics and Statistics* 76 (February): 80-102.

Chandler, Lester V. (1958). *Benjamin Strong: Central Banker.* Washington, DC: Brookings.

Clark, Truman A. (1986). "Interest Rate Seasonals and the Federal Reserve." *Journal of Political Economy* 94 (February): 76-125.

Clark, Truman A. (1984). "Violations of the Gold Points, 1890-1908." *Journal of Political Economy* 92(5): 791-823.

Cochrane, John H. (1988). "How Big is the Random Walk in GNP?" *Journal of Political Economy* 96 (October): 893-920.

Cogley, Timothy (1990). "International Evidence on the Size of the Random Walk in Output." *Journal of Political Economy* 98 (June): 501-518.

Cook, Timothy (1989). "Determinants of the Federal Funds Rate: 1979-1982." *Federal Reserve Bank of Richmond Economic Review* 75 (January-February): 3-19.

Cook, Timothy and Thomas Hahn (1989). "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s." *Journal of Monetary Economics* 24 (November) 331-351.

Cooper, Richard (1982). "The Gold Standard: Historical Facts and Future Prospects." *Brookings Papers on Economic Activity* (1): 1-45.

Crucini, Mario and James Kahn (1997). "Tariffs and Aggregate Economic Activity: Lessons from the Great Depression." *Journal of Monetary Economics* 38 (December): 427-467.

Cunliffe Report [1918] (1979). *First Interim Report of the Committee on Currency and Foreign Exchanges after the War.* Cmnd 9182. Reprint. New York: Arno Press.

Darby, Michael R. and James R. Lothian et al. (1983) *The International Transmission of Inflation.* Chicago: University of Chicago Press.

Davatyan, Nathan and William R. Parke (1995). "The Operations of the Bank of England, 1890-1908: A Dynamic Probit Approach." *Journal of Money, Credit and Banking* 27, No. 4. (November Part I): 1099-1112.

DeCecco, Marcello (1974). *Money and Empire: The International Gold Standard: 1890-1914.* London: Rowman and Littlefield.

DeKock, Gabriel and Grilli, Vittorio. (1989) "Endogenous Exchange Rate Regime Switches." NBER Working Paper No. 3066. August.

Dickey, David A. and Wayne Fuller (1979). "Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, Part I, 74 (June): 427-431.

Dominguez, Kathryn (1993). "The Role of International Organizations in the Bretton Woods System." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System.* Chicago: University of Chicago Press.

Dominguez, Kathryn, Ray C. Fair, and Matthew D. Shapiro (1988). "Forecasting the Depression: Harvard versus Yale." *American Economic Review* 78 (September): 595-612.

Dornbusch, Rudiger (1996). "Commentary: How Should Central Banks Reduce Inflation? - Conceptual Issues." In Federal Reserve Bank of Kansas City, *Achieving Price Stability* (August): 93-103.

Duguay, Pierre (1993). "Some Thoughts on Price Stability versus Zero Inflation." Bank of Canada (Mimeo).

Dutton, John (1984). "The Bank of England and the Rules of the Game Under the International Gold Standard: New Evidence." In Michael D. Bordo and Anna J. Schwartz (eds.) *A Retrospective on the Classical Gold Standard.* Chicago: University of Chicago Press.

Eichenbaum, Martin (1992). "Comment on 'Central Bank Behavior and the Strategy of Monetary Policy: Observations from Six Industrialized Countries'." In Olivier Blanchard and Stanley Fischer (eds.) *NBER Macroeconomics Annual 1992*. Cambridge: MIT Press, 228-234.

Eichengreen, Barry (1996). *Globalizing Capital: A History of the International Monetary System*. Princeton University Press.

Eichengreen, Barry (1995). "Institutions and Economic Growth: Europe After World War II." In N.F.R. Crafts and Giovanni Toniolo (eds.) *Comparative Economic Growth of Postwar Europe*. Cambridge: Cambridge University Press.

Eichengreen, Barry (1993a). "History of the International Monetary System: Implications for Research in International Macroeconomics and Finance." In Frederick van der Ploeg (ed.) *Handbook of International Macroeconomics*. Oxford: Blackwell.

Eichengreen, Barry (1993b). "Three Perspectives on the Bretton Woods System." In Michael. D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System*. Chicago: University of Chicago Press and NBER.

Eichengreen, Barry (1992). *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939*. New York: Oxford University Press.

Eichengreen, Barry (1991a). "Editor's Introduction." In Barry Eichengreen (ed.) *Monetary Regime Transformations*, Cheltenham: Edward Elgar.

Eichengreen, Barry (1991b). "Comparative Performance of Fixed and Flexible Exchange Rate Regimes: Inter-war Evidence." In Neil Thygesen et al. (eds.) *Business Cycles: Theories, Evidence and Analysis*. Macmillan, 229-272.

Eichengreen, Barry (1990). *Elusive Stability*. New York: Cambridge University Press.

Eichengreen, Barry (1989). *The Political Economy of the Smoot-Hawley Tariff*. In R.L. Ransom, P.H. Lindert, and R. Sutch (eds.) *Research in Economic History* 12: 1-43. Greenwich, Conn.: JAI Press.

Eichengreen, Barry (1987). "Conducting the International Orchestra: Bank of England Leadership Under the Classical Gold Standard." *Journal of International Money and Finance* 6: 5-29.

Eichengreen, Barry (1985). "Editor's Introduction." In Barry Eichengreen (ed.) *The Gold Standard in Theory and History*. London: Methuen.

Eichengreen, Barry and Peter M. Garber (1991). "Before the U.S. Accord: U.S. Monetary-Financial Policy, 1945-51." In R. Glenn Hubbard (ed.) *Financial Markets and Financial Crises*. Chicago: University of Chicago Press, 175-205.

Eichengreen, Barry and I. McLean (1994). "The Supply of Gold Under the Pre-1914 Gold Standard." *Economic History Review* 48: 288-309.

Eichengreen, Barry, James Tobin, and Charles Wyploz (1995). "Two Cases for Sand in the Wheels of International Finance." *Economic Journal* 105 (January): 162-172.

Emery, Kenneth M. (1994). "Inflation Persistence and Fisher Effects: Evidence of a Regime Change." *Journal of Economics and Business* 46 (August): 141-152.

Evans, Martin and Paul Wachtel (1993). "Were Price Changes During the Great Depression Anticipated?: Evidence from Nominal Interest Rates." *Journal of Monetary Economics* 32 (August): 3-34.

Faust, Jon and Eric N. Leeper (1994). "When Do Long-Run Identifying Restrictions Give Reliable Results?" Federal Reserve Bank of Atlanta Working Paper 94-2.

Federal Reserve Board (1924). *Tenth Annual Report*. Washington, DC: Government Printing Office.

Feldstein, Martin (1997). "The Costs and Benefits of Going from Low Inflation to Price Stability." In Christina Romer and David Romer (eds.) *Monetary Policy and Inflation*. Chicago: University of Chicago Press (forthcoming).

Feldstein, Martin (1996). "Overview." In Federal Reserve Bank of Kansas City *Achieving Price Stability*, 319-329.

Fischer, Stanley (1994). "Modern Central Banking." In Forrest Capie, Charles Goodhart, Stanley Fischer and Norbert Schnadt, *The Future of Central Banking*. Cambridge: Cambridge University Press, 262-308.

Fischer, Stanley (1977). "Long-Term Contracts, Rational Expectations, and the Optimal Money Supply Rule." *Journal of Political Economy* 85 (February): 191-205.

Fisher, Irving [1922] (1965). *The Purchasing Power of Money*. Augustus M. Kelley Reprint. New York.

Fisher, Irving (1920). *Stabilizing the Dollar*. New York: Macmillan.

Fishe, Raymond P.H. and Mark E. Wohar (1990). "The Adjustment of Expectations to a Change in Regime: Comment." *American Economic Review* 80 (September): 968-976.

Fishlow, Albert (1985). "Lessons from the Past: Capital Markets During the 19th Century and the Interwar Period." *International Organization* 39: 383-439.

Flandreau, Marc (1996). "The French Crime of 1873: An Essay on the Emergence of the International Gold Standard, 1870-1880." *Journal of Economic History* 51, No. 4 (Dec.): 862-897.

Flood, Robert P. and Peter Isard (1989). "Simple Rules, Discretion and Monetary Policy." NBER Working Paper No. 2934.

Flood, Robert P. and Michael Mussa (1994). "Issues Concerning Nominal Anchors for Monetary Policy." In Tomas J.T. Balino and Carlo Cottarelli (eds.) *Framework for Monetary Stability: Policy Issues and Country Experiences*. Washington, DC: International Monetary Fund.

Ford, A.G. (1962). *The Gold Standard 1880-1914: Britain and Argentina*. Oxford: Clarendon Press.

Frenkel, Jacob A. and Michael L. Mussa (1985). "Asset Markets, Exchange Rates, and the Balance of Payments." In Ronald W. Jones and Peter B. Kenen (eds.) *Handbook of International Economics*, Vol. 2. New York: North Holland, Chapter 14.

Friedman, Milton (1990a). "Bimetallism Revisited." *Journal of Economic Perspectives* 4, No. 4: 85-104.

Friedman, Milton (1990b). "The Crime of 1873." *Journal of Political Economy* 98 (December): 1159-1194.

Friedman, Milton (1984). "Lessons from the 1979-82 Monetary Policy Experiment." *American Economic Review* 74 (May): 397-400.

Friedman, Milton (1968). "The Role of Monetary Policy." *American Economic Review* 58, (March): 1-17.

Friedman, Milton (1953). "The Case for Flexible Exchange Rates." In *Essays in Positive Economics*. Chicago: University of Chicago Press, 157-203.

Friedman, Milton and Anna J. Schwartz (1963). *A Monetary History of the United States 1867 to 1960.* Princeton: Princeton University Press.

Galí, Jordi (1992). "How Well Does the IS-LM Model Fit Postwar U.S. Data?" *Quarterly Journal of Economics* 107 (May): 709-738.

Gallarotti, Giulio M. (1995). *The Anatomy of an International Monetary Regime: The Classical Gold Standard 1880-1904.* New York: Oxford University Press.

Garber, Peter (1993). "The Collapse of the Bretton Woods Fixed Exchange Rate System." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System.* Chicago: University of Chicago Press.

Garber, Peter and Robert P. Flood (1984). "Gold Monetization and Gold Discipline." *Journal of Political Economy* 92 (February): 90-107.

Genberg, Hans and Alexander Swoboda (1993). "The Provision of Liquidity in the Bretton Woods System." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform.* Chicago: University of Chicago Press, 269-306.

Ghosh, Atish R., Anne Marie Gulde, Jonathan D. Ostry and Holger Wolf (1996). "Does the Nominal Exchange Rate Regime Matter?" IMF Working Paper 121. November.

Giavazzi, Francesco and Alberto Giovannini (1989). *Limiting Exchange Rate Flexibility.* Cambridge, MA: MIT Press.

Giavazzi, Francesco and Marc Pagano (1988). "The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility." *European Economic Review* 32: 1055-1082.

Gilbert, R. Alton (1994). "A Case Study in Monetary Control: 1980-82." *Federal Reserve Bank of St. Louis Review* (September/October): 35-55.

Giovannini, Alberto (1993). "Bretton Woods and its Precursors: Rules versus Discretion in the History of International Monetary Regimes." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform*. Chicago: University of Chicago Press.

Giovannini, Alberto (1986). "'Rules of the Game' during the International Gold Standard: England and Germany." *Journal of International Money and Finance* 5: 467-483.

Goff, Brian L. and Mark Toma (1993). "Optimal Seigniorage, The Gold Standard, and Central Banking Financing." *Journal of Money, Credit and Banking* 25 (February): 79-95.

Goodfriend, Marvin (1993). "Interest Rate Policy and the Inflation Scare Problem: 1979-1992." *Federal Reserve Bank of Richmond Economic Quarterly* 79 (Winter): 1-24.

Goodfriend, Marvin (1991). "Interest Rates and the Conduct of Monetary Policy." *Carnegie Rochester Conference Series on Public Policy* 34: 7-30.

Goodfriend, Marvin (1988). "Central Banking Under the Gold Standard. *Carnegie-Rochester Conference Series on Public Policy* 19: 85-124.

Goodfriend, Marvin (1987). "Interest Rate Smoothing and Price Level Trend-Stationarity." *Journal of Monetary Economics* 19 (May): 335-348.

Goodhart, Charles A.E. (1989). "The Conduct of Monetary Policy." *Economic Journal* 99 (June): 293-346.

Gordon, Robert J. (1990). "What is New-Keynesian Economics?" *Journal of Economic Literature* 28 (September): 1115-1171.

Grilli, Vittorio U. (1990). "Managing Exchange Rate Crises: Evidence from the 1890s." *Journal of International Money and Finance* 9 (September): 258-275.

Grossman, Herschel J. and John B. Van Huyck (1988). "Sovereign Debt as a Contingent Claim: Excusable Default, Repudiation, and Reputation." *American Economic Review* 78: 1088-1097.

Haberler, Gottfried (1976). *The World Economy, Money, and the Great Depression 1919-1939.* Washington, DC: American Enterprise Institute for Public Policy Research.

Hamilton, James D. (1992). "Was the Deflation During the Great Depression Anticipated? Evidence from the Commodity Futures Market." *American Economic Review* 82 (March): 157-178.

Hamilton, James D. (1987). "Monetary Factors in the Great Depression." *Journal of Monetary Economics* 19 (March) 145-170.

Helpman, Elchanon (1981). "An Exploration in the Theory of Exchange Rate Regimes." *Journal of Political Economy* 89(5): 865-890.

Helpman, Elchanon and Assaf Razin (1979). "Toward a Consistent Comparison of Alternative Exchange-Rate Regimes." *Canadian Journal of Economics* 12: 394-409.

Hetzel, Robert L. (1985). "The Rules versus Discretion Debate Over Monetary Policy in the 1920s." *Federal Reserve Bank of Richmond Economic Quarterly* 71 (November/December): 3-14.

Ikenberry, G. John (1993). "The Political Origins of Bretton Woods." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform*. Chicago: University of Chicago Press, 155-182.

Ireland, Peter N. (1993). "Price Stability Under Long-Run Monetary Targeting." *Federal Reserve Bank of Richmond Economic Quarterly* 79(1) (Winter): 25-45.

Irwin, Douglas A. (1996). *Against the Tide: An Intellectual History of Free Trade*. Princeton: Princeton University Press.

Jeanne, Oliver (1995). "Monetary Policy in England 1893-1914: A Structural VAR Analysis." *Explorations in Economic History* 32: 302-326.

Jonung, Lars (1984). "Swedish Experience Under the Classical Gold Standard, 1873-1914." In Michael D. Bordo and Anna J. Schwartz (eds.) *A Retrospective on the Classical Gold Standard, 1821-1931*. Chicago: University of Chicago Press.

Kemmerer, Edwin W. (1910). *Seasonal Variations in the Demand for Currency and Capital in the United States*. National Monetary Commission. Washington, DC: Government Printing Office.

Kenen, Peter B. (1960). "International Liquidity and the Balance of Payments of a Reserve-Currency Country." *Quarterly Journal of Economics* (November): 572-586.

Keynes, John Maynard [1930] (1971). *The Applied Theory of Money: A Treatise on Money*. Volume 1 of *The Collected Writings*. Cambridge: Cambridge University Press.

Keynes, John Maynard [1925] (1972). "The Economic Consequences of Mr. Churchill." In *The Collected Writings of John Maynard Keynes, Vol. IX. Essays in Persuasion.* London: Macmillan.

Kindleberger, Charles P. (1973). *The World in Depression, 1929-1939.* Berkeley: University of California Press.

King, Mervyn (1996). "How Should Central Banks Reduce Inflation? - Conceptual Issues." Federal Reserve Bank of Kansas City *Achieving Price Stability* (August): 53-91.

Klein, Benjamin (1975). "Our New Monetary Standard: Measurement and Effects of Price Uncertainty, 1880-1973." *Economic Inquiry* 13: 461-484.

Kwiatkowski, Denis, Peter C.B. Phillips, Peter Schmidt, and Yongcheol Shin (1992) "Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root: How Sure are We that Economic Time Series Have a Unit Root?" *Journal of Econometrics* 54 (October/December): 159-78.

Kydland, Finn E. and Prescott, Edward (1977). "Rules Rather than Discretion: The Inconsistency of Optimal Plans." *Journal of Political Economy* 85: 473-491.

Lazaretou, Sophia (1995). "Government Spending, Monetary Policies and Exchange Rate Regime Switches: The Drachma in the Gold Standard Period." *Explorations in Economic History* 32(1) (January): 28-50.

League of Nations (1930). *First Interim Report of the Gold Delegation of the Financial Committee.* Geneva.

Lebow, David. E, John O. Roberts, and David J. Stockton (1992). "Economic Performance Under Price Stability." *Board of Governors Federal Reserve System, Division of Research and Statistics*. Working Paper No. 125. April.

Leijonhufvud, Axel (1984). "Constitutional Constraints on the Monetary Power of Government." In Richard B. McKenzie (ed.) *Constitutional Economics*. Lexington, MA: Lexington Books, 95-107.

Lindert, Peter (1969). *Key Currencies and Gold, 1900-1913*. Princeton Studies in International Finance. Princeton: Princeton University Press.

Lippi, Marco and Lucrezia Reichlin (1993). "The Dynamic Effects of Aggregate Demand and Supply Disturbances: Comment." *American Economic Review* 83 (June): 644-653.

Lucas, Robert E. Jr. and Nancy L. Stokey (1983). "Optimal Fiscal and Monetary Policy in an Economy Without Capital." *Journal of Monetary Economics* 12: 55-93.

Macaulay, Frederick R. (1938). *Some Theoretical Problems Suggested in the Movements of Interest Rates, Bond Yields, and Stock Prices in the United States Since 1856*. New York: National Bureau of Economic Research.

Mankiw, N. Gregory (1987). "The Optimal Collection of Seigniorage: Theory and Evidence." *Journal of Monetary Economics* 20: 327-342.

Mankiw, N. Gregory, Jeffrey A. Miron, and David N. Weil (1987). "The Adjustment of Expectations to a Change in Regime: A Study of the Founding of the Federal Reserve." *American Economic Review* 77 (June): 358-374.

Mankiw, N. Gregory and Jeffrey Miron (1986). "The Changing Behavior of the Term Structure of Interest Rates." *Quarterly Journal of Economics* 101 (May): 211-228.

Marshall, Alfred (1926). *Official Papers*. London: Macmillan.

Marston, Richard C. (1993). "Interest Differentials under Bretton Woods and the Post Bretton Woods Float: The Effects of Capital Controls and Exchange Risk." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform*. Chicago: University of Chicago Press, 515-540.

McCallum, Bennett T. (1997). "Issues in the Design of Monetary Policy Rules." National Bureau of Economic Research Working Paper No. 6016 (April).

McCallum, Bennett T. (1996). "Commentary: How Should Central Banks Reduce Inflation? - Conceptual Issues." Federal Reserve Bank of Kansas City *Achieving Price Stability* 105-114.

McCallum, Bennett T. (1991). "Seasonality and Monetary Policy: A Comment." *Carnegie Rochester Conference on Public Policy* 34: 71-76.

McCallum, Bennett T. (1990). "Could a Monetary Base Rule Have Prevented the Great Depression?" *Journal of Monetary Economics* 26(1): 3-26.

McKinnon, Ronald I. (1993). "International Money in Historical Perspective." *Journal of Economic Literature* 31, No. 1 (March): 1-44.

McKinnon, Ronald I. (1988). "An International Gold Standard Without Gold." *Cato Journal* 8 (Fall): 351-373.

Meigs, A. James (1962). *Free Reserves and the Money Supply*. Chicago: University of Chicago Press.

Meltzer, Allan H. (1997). "New Procedures, New Problems, 1923-29." A History of the Federal Reserve, Chapter 4, Carnegie Mellon (Mimeo).

Meltzer, Allan H. (1996). "In the Beginning." A History of the Federal Reserve, Chapter 3, Carnegie Mellon (Mimeo).

Meltzer, Allan H. (1995a). "The Development of Central Banking, Theory and Practice." A History of the Federal Reserve, Chapter 2, Carnegie Mellon (Mimeo).

Meltzer, Allan H. (1995b). "Why Did Monetary Policy Fail in the Thirties?" A History of the Federal Reserve, Chapter 5, Carnegie Mellon (Mimeo).

Meltzer, Allan H. (1986). "Some Evidence on the Comparative Uncertainty Experienced Under Different Monetary Regimes." In Colin D. Campbell and William R. Dougan (eds.) *Alternative Monetary Regimes*. Baltimore: Johns Hopkins University Press, 122-153.

Meltzer, Allan H. (1977). "Monetary and Other Explanations of the Start of the Great Depression." *Journal of Monetary Economics* 2: 455-471.

Meltzer, Allan H. and Saranna Robinson (1989). "Stability Under the Gold Standard in Practice." In Michael D. Bordo (ed.) *Monetary History and International Finance: Essays in Honor of Anna J. Schwartz*. Chicago: University of Chicago Press, pp. 163-195.

Mills, Terence C. and Geoffrey E. Wood (1993). "Does the Exchange Rate Regime Affect the Economy?" *Federal Reserve Bank of St.Louis Review* (July/August): 3-20.

Miron, Jeffrey A. (1996). *The Economics of Seasonal Cycles*. Cambridge, MA: MIT Press.

Miron, Jeffrey A. (1986). "Financial Panics, the Seasonality of the Nominal Interest Rate, and the Founding of the Fed." *American Economic Review* 76 (March): 125-140.

Mishkin, Frederic S. (1992). "Is the Fisher Effect for Real?" *Journal of Monetary Economics* 30, No. 2: 195-215.

Mishkin, Frederic S. (1978). "The Household Balance Sheet and the Great Depression." *Journal of Economic History* 38 (December): 918-937.

Mussa, Michael; Morris Goldstein; Peter B. Clark; Donald Matthieson and Tamim Bayoumi (1994). "Improving the International Monetary System: Constraints and Possibilities." International Monetary Fund (Washington, DC) Occasional Paper 116, December.

Nelson, Daniel B. (1991). "Was the Deflation of 1929-1930 Anticipated? The Monetary Regime as Viewed by the Business Press." In R. L. Ransom and R. Sutch (eds.) *Research in Economic History* 13: 1-65. Greenwich, Conn.: JAI Press.

Nelson, Charles R., and Charles I. Plosser (1982). "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications." *Journal of Monetary Economics* 10 (September): 139-62.

Nurkse, Ragnar. (1944) *International Currency Experience*. League of Nations.

O'Brien, Anthony P. (1989). "A Behavioral Explanation for Nominal Wage Rigidity During the Great Depression." *Quarterly Journal of Economics* 104 (November): 719-735.

Obstfeld, Maurice (1993). "The Adjustment Process." In Michael D. Bordo and Barry Eichengreen (eds.) *A Retrospective on the Bretton Woods System*. Chicago: University of Chicago Press.

Obstfeld, Maurice (1991). "Destabilizing Effects of Exchange Rate Escape Clauses." NBER Working Paper No. 3603.

Obstfeld, Maurice and Alan Taylor (1997). "The Great Depression as a Watershed: International Capital Mobility over the Long Run." In Michael D. Bordo, Claudia Goldin and Eugene N. White (eds.) *The Defining Moment: The Great Depression and the American Economy in the Twentieth Century*. Chicago: University of Chicago Press (forthcoming).

Officer, Lawrence (1996). *Between the Dollar-Sterling Gold Points: Exchange Rates, Parity and Market Behavior*. New York: Cambridge University Press.

Officer, Lawrence (1986). "The Efficiency of the Dollar-Sterling Gold Standard, 1890-1908." *Journal of Political Economy* 94 (October): 1038-1073.

Oppers, Stefan (1996). "Was the Worldwide Shift to Gold Inevitable? An Analysis of the End of Bimetallism." *Journal of Monetary Economics* 37: 143-162.

Orphanides, Athanasios and David W. Wilcox (1996). "The Opportunistic Approach to Disinflation." Federal Reserve Board Discussion Paper 96-24. Mimeo.

Phelps, Edmund S. (1968). "Money-wage Dynamics and Labor Market Equilibrium." *Journal of Political Economy* 76 (July-August): 678-711.

Pierce, James L. (1984). "Did Financial Innovation Hurt the Great Monetarist Experiment?" *American Economic Review* 74 (may): 392-396.

Pippenger, John (1984). "Bank of England Operations, 1893-1913." In Michael D. Bordo and Anna J. Schwartz (eds.) *A Retrospective on the Classical Gold Standard, 1821-1931*. Chicago: University of Chicago Press.

Pollard, S. (ed.) (1970). *The Gold Standard and Employment Policies Between the Wars*. London: Methuen.

Poole, William (1991). "Interest Rates and the Conduct of Monetary Policy." *Carnegie Rochester Conference Series on Public Policy* 34: 31-40.

Poterba, James M. and Julio Rotemberg (1990). "Inflation and Taxation with Optimizing Government." *Journal of Money, Credit and Banking* 22: 1-18.

Prati, Alessandro (1991). "Poincaré's Stabilization: Stopping a Run on Government Debt." *Journal of Monetary Economics* 27, No. 2 (April): 213-240.

Prescott, Edward (1996). "Profile." *The Region*, Federal Reserve Bank of Minneapolis.

Redish, Angela (1993). "Anchors Aweigh: The Transition From Commodity Money to Fiat Money in Western Economies." *Canadian Journal of Economics* 26, No. 4, (November): 777-795.

Redish, Angela (1990). "The Evolution of the Gold Standard in England." *Journal of Economic History* (December): 789-806.

Redmond, J. (1984). "The Sterling Overvaluation in 1925: A Multilateral Approach." *Economic History Review* 2nd ser. 37: 520-532.

Robertson, D. and M.R. Wickens (1992). "Measuring Real and Nominal Macroeconomic Shocks and Their International Transmission Under Different Monetary Systems." London Business School, Center for Economic Forecasting Discussion Paper.

Rockoff, Hugh (1986). "Walter Bagehot and the Theory of Central Banking." In Forrest Capie and Geoffrey E. Wood (eds.) *Financial Crises and the World Banking System.* London: Macmillan, pp. 160-180.

Rockoff, Hugh (1984). "Some Evidence on the Real Price of Gold, Its Cost of Production, and Commodity Prices." In Michael D. Bordo and Anna J. Schwartz (eds.) *A*

Retrospective on the Classical Gold Standard, 1821-1931. Chicago: University of Chicago Press.

Romer, Christina D. (1993). "The Nation in Depression." *Journal of Economic Perspectives* 7 (Spring): 19-39.

Romer, Christina D. (1992). "What Ended the Great Depression?" *Journal of Economic History* 52 (December): 757-784.

Romer, Christina D. (1989). "The Prewar Business Cycle Reconsidered: New Estimates of Gross National Product, 1869-1908." *Journal of Political Economy* 97, No. 1, (February): 1-37.

Rudebusch, Glenn D. (1995). "Federal Reserve Interest Rate Targeting, Rational Expectations, and the Term Structure." *Journal of Monetary Economics* (April): 245-274.

Sargent, Thomas (1986). *Rational Expectations and Inflation.* New York: Harper & Row.

Sargent, Thomas (1984). "Stopping Moderate Inflations: The Methods of Poincaré and Thatcher." In R. Dornbusch and M. H. Simonsen (eds.) *Inflation, Debt and Indexation.* Cambridge, MA: MIT Press.

Saunders, Anthony and B. Wilson (1993). "Contagious Bank Runs: Evidence From the 1929-1933 Period." New York University Salomon Center Mimeo.

Sayers, R.S. (1957). *Central Banking After Bagehot.* Oxford: Clarendon Press.

Scammell, W.M. (1965). "The Working of the Gold Standard." *Yorkshire Bulletin of Economic and Social Research* 12 (May): 32-45.

Schwartz, Anna J. (1988). "Financial Stability and the Federal Safety Net." In William S. Haraf and Rose Marie Kushmeider (eds.) *Restructuring Banking Financial Services in America*. Washington, DC: American Enterprise Institute, pp. 34-62.

Schwartz, Anna J. (1986a). "Real and Pseudo-Financial Crises." In Geoffrey E. Wood and Forrest Capie (eds.) *Financial Crises and the World Banking System*. London: Macmillan, pp. 10-31.

Schwartz, Anna J. (1986b). "Alternative Monetary Regimes: The Gold Standard." In Colin D. Campbell and William R. Dougan (eds.) *Alternative Monetary Regimes*. Baltimore: Johns Hopkins University Press, pp. 44-72.

Schwartz, Anna J. (1984). "Introduction." In Michael D. Bordo and Anna J. Schwartz (eds.) *A Retrospective on the Classical Gold Standard, 1821-1931*. Chicago: University of Chicago Press.

Shiller, Robert J. (1980). "Can the Fed Control Real Interest Rates?" In Stanley Fischer (ed.) *Rational Expectations and Economic Policy*. Chicago: University of Chicago Press, 117-156; 165-167.

Simmons, Beth (1994). *Who Adjusts: Domestic Sources of Foreign Economic Policy During the Interwar Years*. Princeton: Princeton University Press.

Svensson, Lars (1996a). "Commentary: How Should Monetary Policy Respond to Shocks While Maintaining Long-Run Price Stability? Conceptual Issues." Federal Reserve Bank of Kansas City *Achieving Price Stability*, pp. 209-219.

Svensson, Lars (1996b). "Price Level Targeting vs Inflation Targeting: A Free Lunch?" NBER Working Paper 5719 (August).

Svensson, Lars (1994). "Why Exchange Rate Bands?: Monetary Independence In Spite of Fixed Exchange Rates." *Journal of Monetary Economics* 33, No. 1: 157-199.

Taylor, John M. (1980). "Aggregative Dynamics and Staggered Contracts." *Journal of Political Economy* 88 (1) (February): 1-23.

Temin, Peter (1993). "Transmission of the Great Depression." *Journal of Economic Perspectives* 7 (Spring): 87-102.

Temin, Peter (1989). *Lessons from the Great Depression*. Cambridge: MIT Press.

Temin, Peter (1976). *Did Monetary Forces Cause the Great Depression?* New York: W.W. Norton.

Thomas, T.J. (1981). "Aggregate Demand in the United Kingdom 1918-45." In R. Floud and D.N. McCloskey (eds.) *The Economic History of Britain Since 1700* Vol. 2. Cambridge: Cambridge University Press.

Timberlake, Richard H. (1993). *Monetary Policy in the United States: An Intellectual and Institutional History*. Chicago: University of Chicago Press.

Toma, Mark (1997). *Competition and Monopoly in the Federal Reserve System*. Cambridge: Cambridge University Press (forthcoming).

Trehan, Bharat and Carl E. Walsh (1990). "Seigniorage and Tax Smoothing in the United States: 1914-1986." *Journal of Monetary Economics* 25: 97-112.

Triffin, Robert (1960). *Gold and the Dollar Crisis*. New Haven: Yale University Press.

Tullio, Giuseppe and Jürgen Wolters (1996). "Was London the Conductor of the International Orchestra or Just the Triangle Player? An Empirical Analysis of Asymmetries in Interest Rate Behaviour during the Classical Gold Standard, 1876-1913." *Scottish Journal of Political Economy* 43 (September): 419-443.

Weinstein, Michael M. (1981). "Some Macroeconomic Impacts of the National Industrial Recovery Act, 1933-1935." In Karl Brunner (ed.) *The Great Depression Revisited.* Boston: Martinus Nijoff, 262-281.

Wheelock, David C. (1991). *The Strategy and Consistency of Federal Reserve Monetary Policy 1924-1933.* Cambridge: Cambridge University Press.

White, Eugene N. (1984). "A Reinterpretation of the Banking Crisis of 1930." *Journal of Economic History* 44 (March): 119-138.

Wicker, Elmus (1996). *The Banking Panics of the Great Depression.* Cambridge: Cambridge University Press.

Wicker, Elmus (1986). "Terminating Hyperinflation in the Dismembered Hapsburg Monarchy." *American Economic Review* 76 (June): 350-364.

Wicker, Elmus (1980). "A Reconsideration of the Causes of the Banking Panic of 1980." *Journal of Economic History* 40 (September): 571-583.

Wicker, Elmus (1965). "Federal Reserve Monetary Policy, 1922-33: A Reinterpretation." *Journal of Political Economy* 73 (August): 325-343.

Wicksell, Knut (1898). *Interest and Prices: A Study of the Causes Regulating the Value of Money*, trans. from the original German by R.F. Kahn (London: Macmillan, 1936).

Wigmore, Barrie A. (1987). "Was the Bank Holiday of 1933 Caused by a Run on the Dollar? *Journal of Economic History* 47, No. 3 (September): 739:756.

Wigmore, Barrie A. (1985). *The Crash and Its Aftermath: A History of Securities Markets in the United States, 1929-1933*. Westport, CT: Greenwood Press.

Table 4.1

Descriptive Statistics of Inflation and Real Per Capita Growth, the Group of Five Countries, 1881-1995
Annual Data: Mean, Standard Deviation

	Gold Standard		Interwar		Bretton Woods						Floating Exchange Rate						Postwar	
					(Total)		(Preconvertible)		(Convertible)		(Total)		(High Inflation)		(Low Inflation)			
	(1881-1913)		(1919-1938)		(1946-1970)		(1946-1958)		(1959-1970)		(1974-1995)		(1974-1982)		(1983-1995)		(1946-1995)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Inflation (GDP deflator) [1]																		
United States (A)	0.3	3.0	-1.8	8.4	2.5	3.5	2.8	4.6	2.8	1.5	5.0	2.4	7.8	1.3	3.6	1.0	4.4	3.0
(B)	0.4	3.0	-1.4	6.5														
United Kingdom	0.3	3.1	-1.5	8.5	3.9	2.2	4.6	2.7	3.8	1.6	7.5	5.6	13.7	4.7	4.9	1.6	7.0	4.5
Germany	0.6	2.6	-2.1	4.7	2.7	4.0	2.1	6.2	3.2	1.8	3.2	1.3	4.1	1.1	2.7	0.9	3.7	2.9
France	-0.0	4.9	2.2	9.1	5.0	3.5	5.6	5.1	4.1	1.4	6.4	3.8	10.2	1.0	3.2	2.3	6.5	3.6
Japan	4.6	5.6	-1.7	8.7	4.7	4.5	4.7	7.3	5.4	1.2	2.3	4.0	4.8	4.9	1.3	0.8	4.9	4.4
Grand mean	1.2	3.8	-1.0	7.9	3.8	3.5	3.9	5.2	3.9	1.5	4.9	3.4	8.1	2.6	3.1	1.3	5.3	3.7
Real per capita growth [1]																		
United States (A)	1.8	4.9	0.0	8.1	2.0	4.6	1.8	6.0	2.8	1.7	1.5	2.3	1.3	2.8	1.5	1.7	1.8	3.6
(B)	1.6	2.7	-0.2	7.1														
United Kingdom	1.1	2.4	1.2	5.3	2.1	1.8	2.1	2.2	2.4	1.2	1.8	2.3	1.2	2.3	1.8	2.2	2.0	2.1
Germany	1.7	2.8	2.6	8.5	5.0	3.3	7.3	3.9	3.5	2.6	1.1	4.9	2.3	2.3	-0.3	6.2	2.9	4.5
France	1.5	4.7	1.3	7.2	4.1	2.1	4.6	2.7	4.4	1.4	1.7	1.5	2.2	1.4	1.6	1.5	3.1	2.2
Japan	1.4	3.8	2.0	5.9	7.9	2.3	5.7	1.1	8.6	1.9	3.2	1.9	3.3	1.9	3.2	2.0	5.2	3.2
Grand mean	1.5	3.7	1.4	7.0	4.2	2.8	4.3	3.2	4.3	1.8	1.9	2.6	2.1	2.2	1.6	2.7	3.0	3.1

1) The mean growth rate was calculated as the time coefficient from a regression of the natural logarithm of the variable on a constant and a time trend.

Data Sources: See Data Appendix
A = Balke and Gordon (1986)
B = Romer (1989)

Table 4.2

Persistence of CPI Inflation: Group of Five Countries 1881-1995
Annual Data: Coefficient of AR1 Regression; Standard error; t-statistic for Unit Root Test

	United States			United Kingdom			Germany		
	AR1 coeff.	Standard error	t-statistic	AR1 coeff.	Standard error	t-statistic	AR1 coeff.	Standard error	t-statistic
Whole Period	0.65	0.07	4.87*	0.71	0.07	4.43*	0.53	0.09	5.54*
Gold Standard	0.27	0.18	4.05*	0.30	0.17	4.03*	0.52	0.16	3.07*
Interwar	0.45	0.18	3.08*	0.35	0.19	3.34*	0.62	0.25	1.51
Bretton Woods (total)	0.49	0.19	2.77	0.33	0.20	3.38*	-0.16	0.20	5.68*
(preconvertible)	0.41	0.27	2.15	0.15	0.29	2.96	-0.24	0.30	4.15*
(convertible)	1.07	0.20	-0.33	0.57	0.34	1.28	0.44	0.31	1.79
Floating Exch (total)	0.78	0.15	1.48	0.77	0.15	1.52	0.79	0.12	1.81
(high inflation)	0.44	0.39	1.44	0.23	0.45	1.70	0.52	0.26	1.84
(low inflation)	0.44	0.29	1.92	0.60	0.26	1.54	0.67	0.23	1.44
Postwar	0.66	0.11	3.17*	0.76	0.09	2.61	0.27	0.14	5.24*

	France			Japan		
	AR1 coeff.	Standard error	t-statistic	AR1 coeff.	Standard error	t-statistic
Whole Period	0.39	0.09	6.54*	0.57	0.08	5.17* 1)
Gold Standard	-0.23	0.18	6.89*	0.13	0.19	4.52*
Interwar	0.48	0.23	2.29	0.35	0.19	3.42*
Bretton Woods (total)	0.52	0.18	2.61	0.27	0.25	2.90
(preconvertible)	0.59	0.33	1.24	0.37	0.48	1.33
(convertible)	0.55	0.30	1.49	0.06	0.33	2.88
Floating Exch (total)	0.93	0.07	1.05	0.57	0.07	6.28*
(high inflation)	0.51	0.30	1.66	0.41	0.14	4.28*
(low inflation)	0.63	0.10	3.57*	0.71	0.27	1.08
Postwar	0.73	0.10	2.64	0.64	0.12	2.93

1) GDP deflator was used because of the unavailability of CPI data.

The 5 percent significance level for a unit root test with 25 observations is 3.00.
* statistically significant at the 5 percent level.

Data Sources: See Data Appendix

FIGURE 3.1a REAL PER CAPITA INCOME, 1914–1995, US

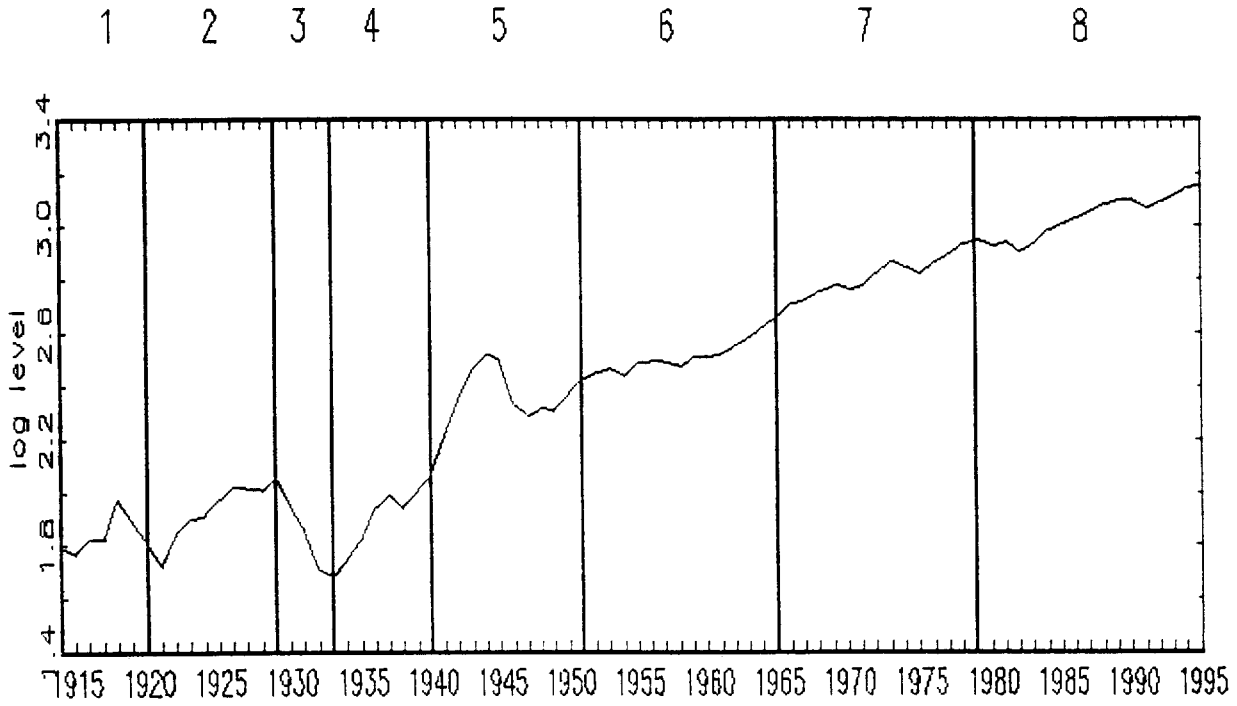


FIGURE 3.1b CPI, 1914–1995, US

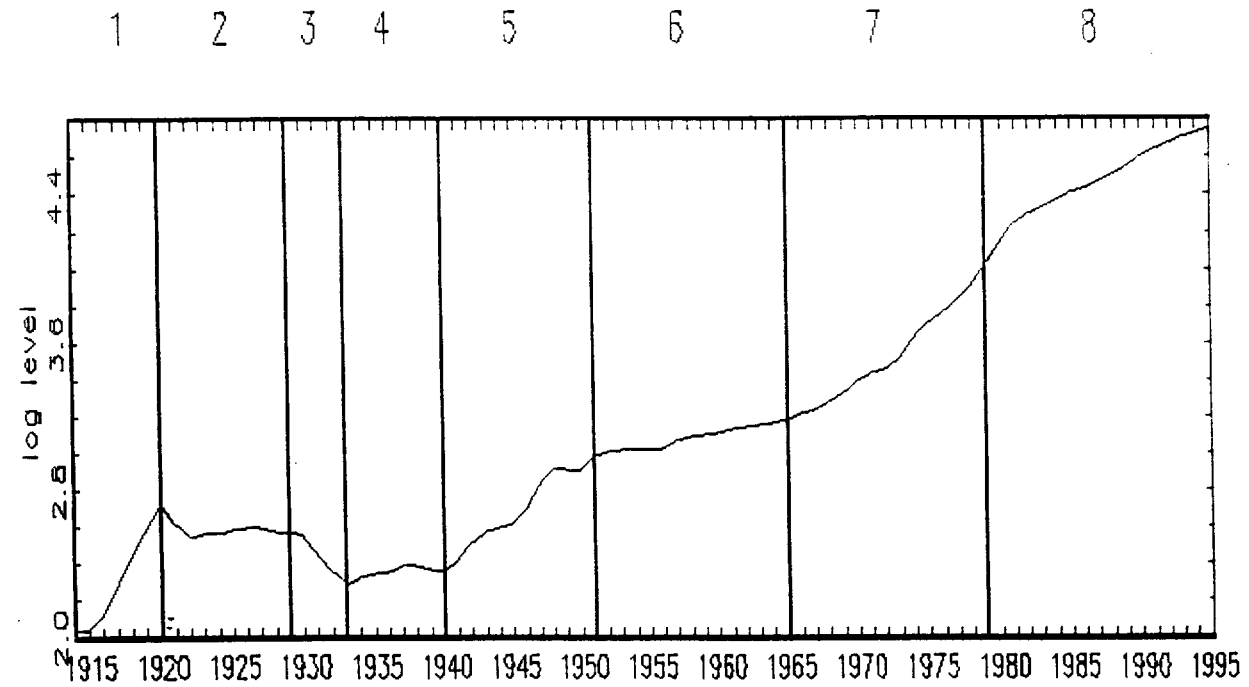


FIGURE 3.1c MONETARY BASE, 1914–1995, US

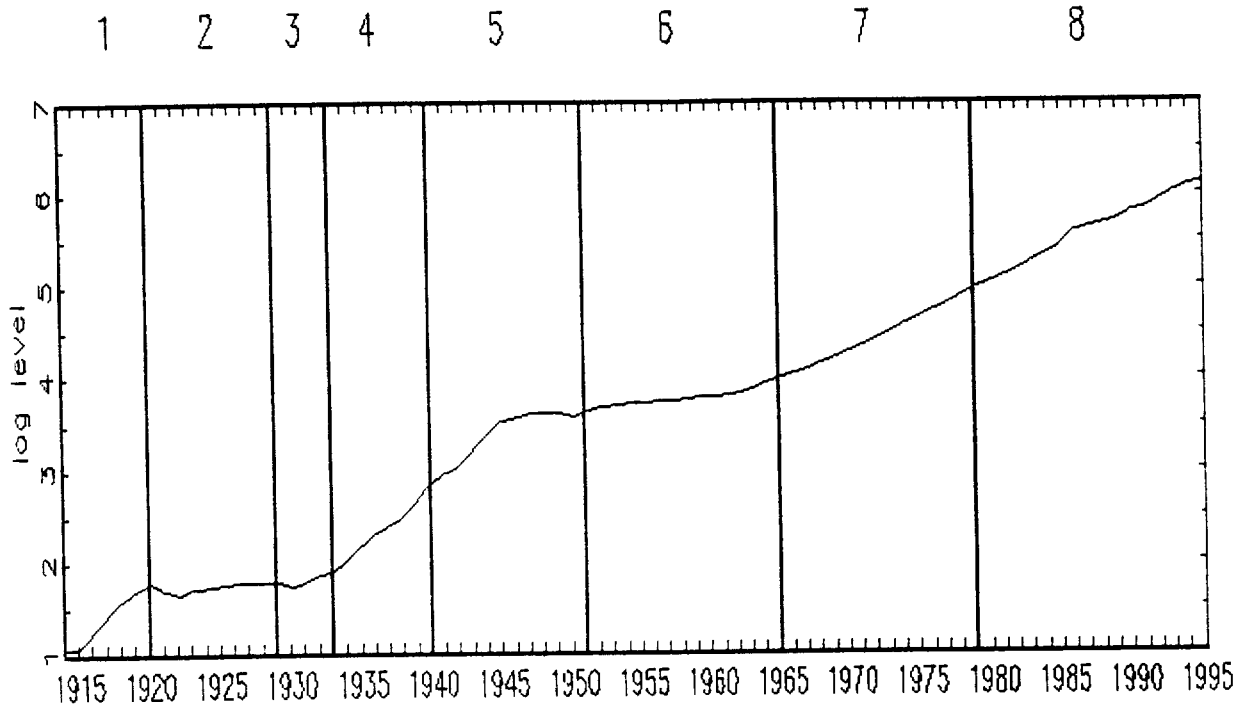


FIGURE 3.1d M2, 1914–1995, US

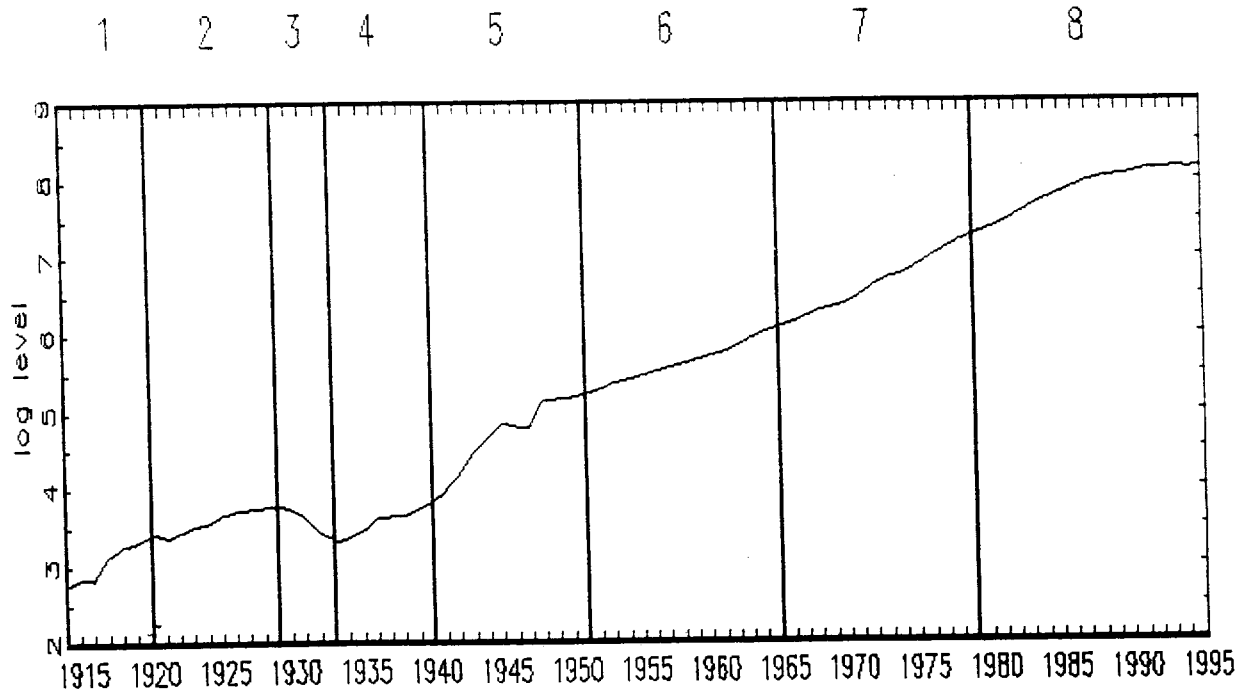


FIGURE 3.1e SHORT-TERM INTEREST RATE, 1914-1995, US

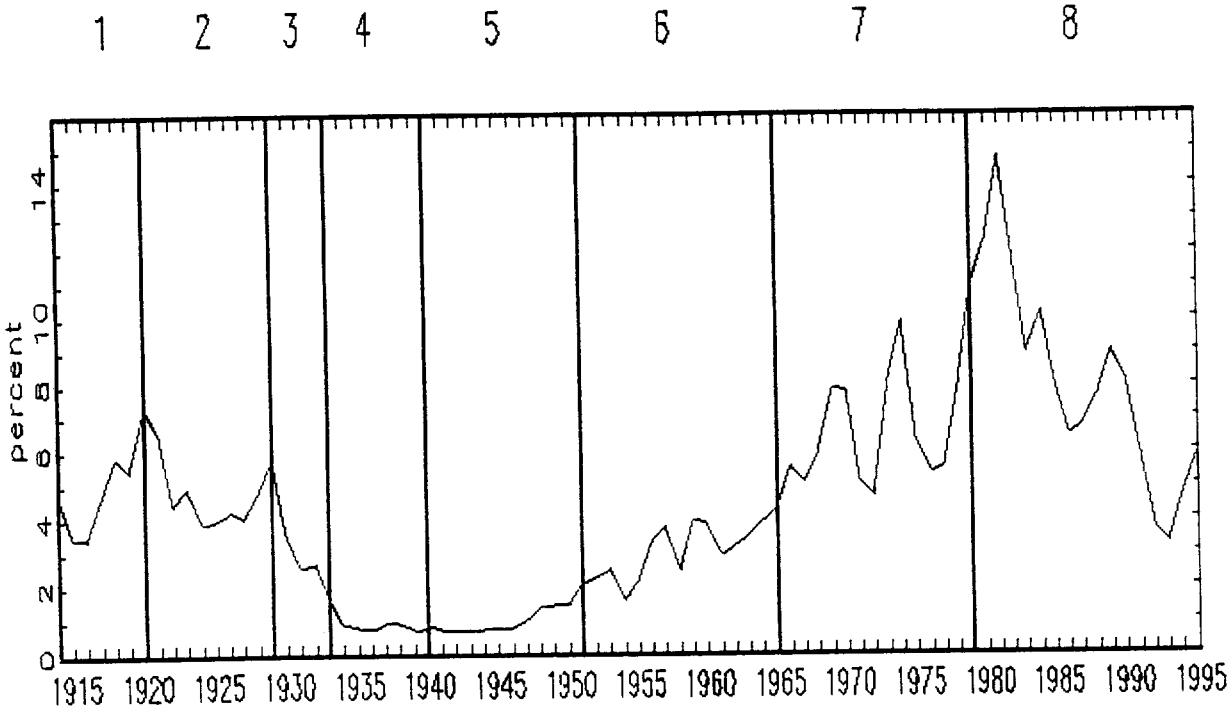
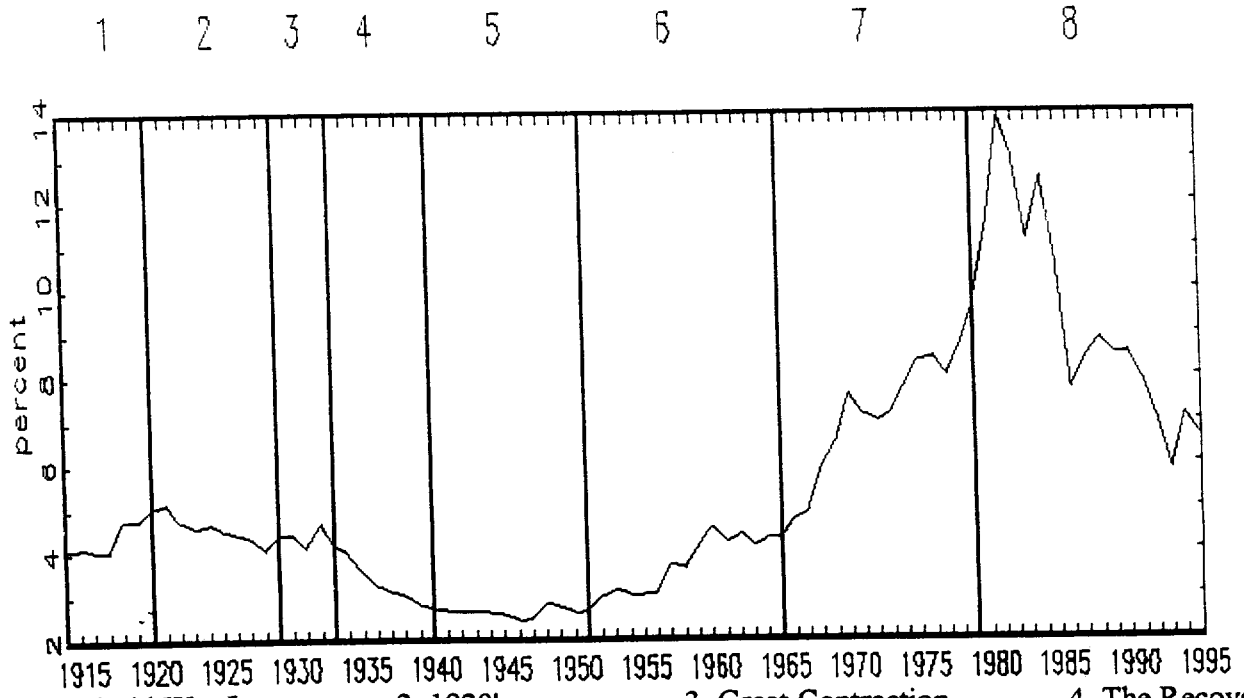


FIGURE 3.1f LONG-TERM INTEREST RATE, 1914-1995, US



Regimes: 1. World War I 2. 1920's 3. Great Contraction 4. The Recovery
5. Interest Rate peg 6. Fed. Discretionary Regime
7. Breakdown of Convertibility Principle 8. Shifting the Focus of Monetary Policy

Data Sources: See Data Appendix

FIGURE 4.1 ANNUAL INFLATION RATE, 1880-1995, FIVE COUNTRIES

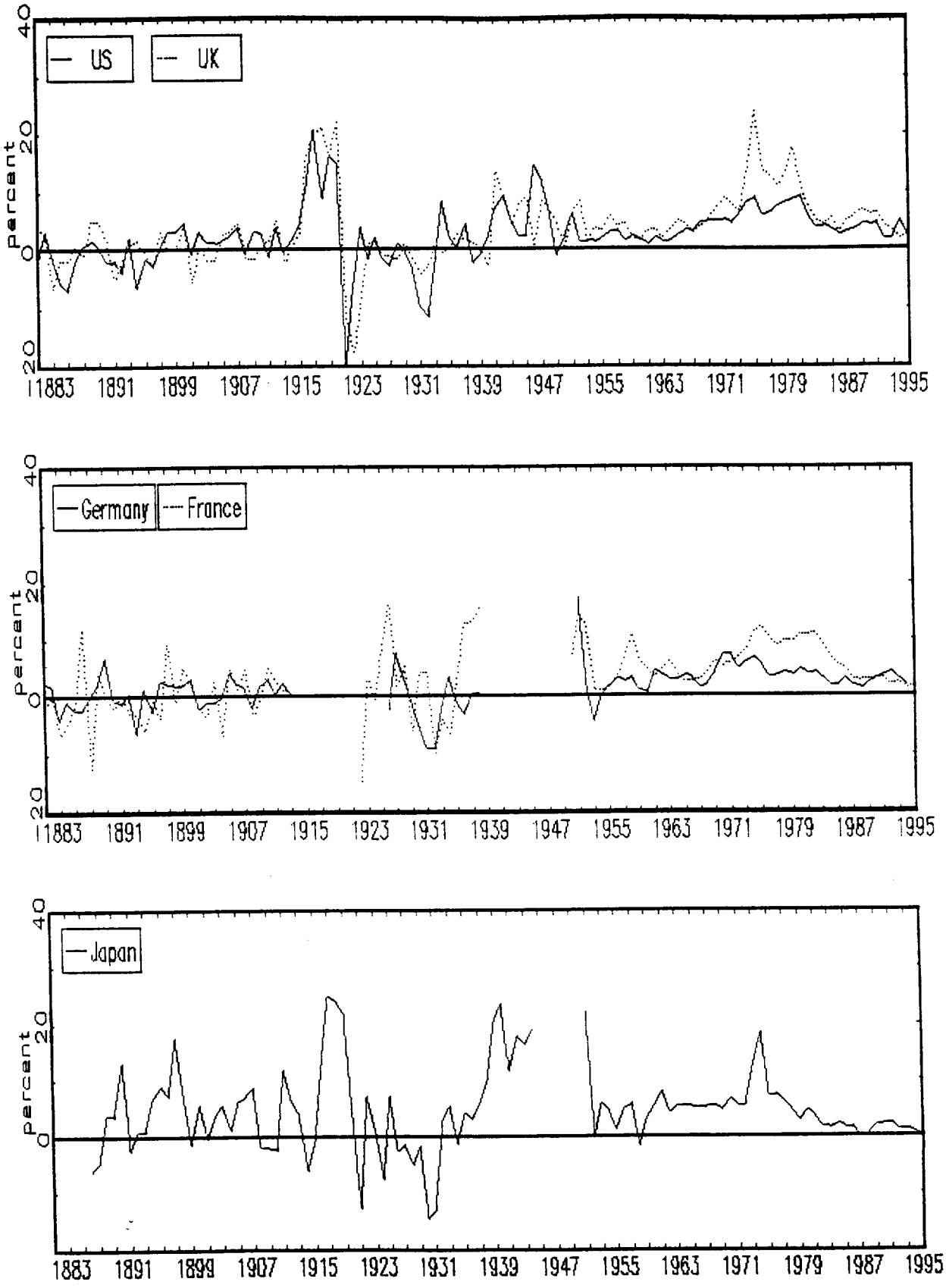


FIGURE 4.2 ANNUAL REAL PER CAPITA INCOME GROWTH, 1880-1995, FIVE COUNTRIES

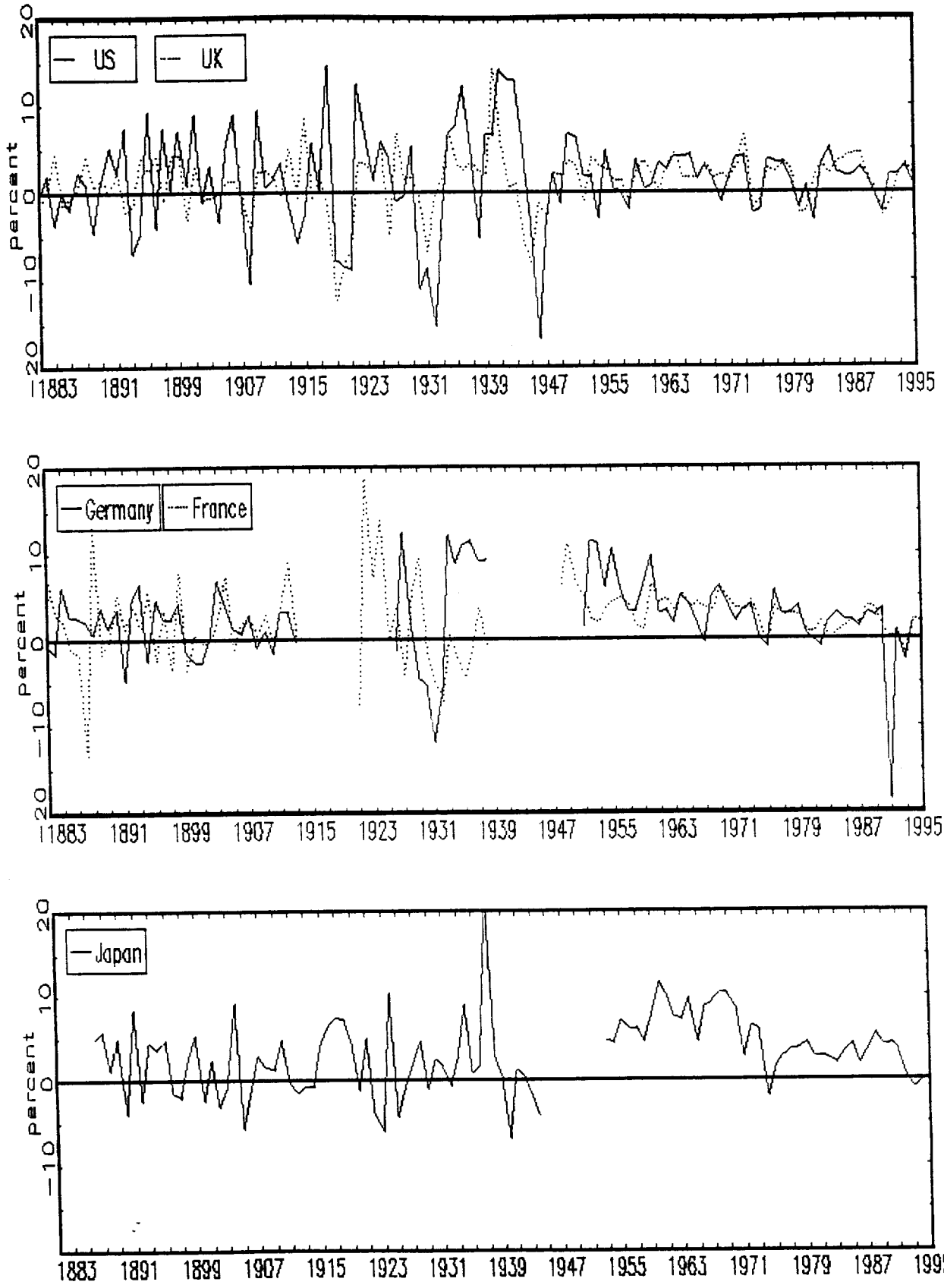


FIGURE 4.3 VARIANCE RATIO FOR THE PRICE LEVEL BY REGIMES

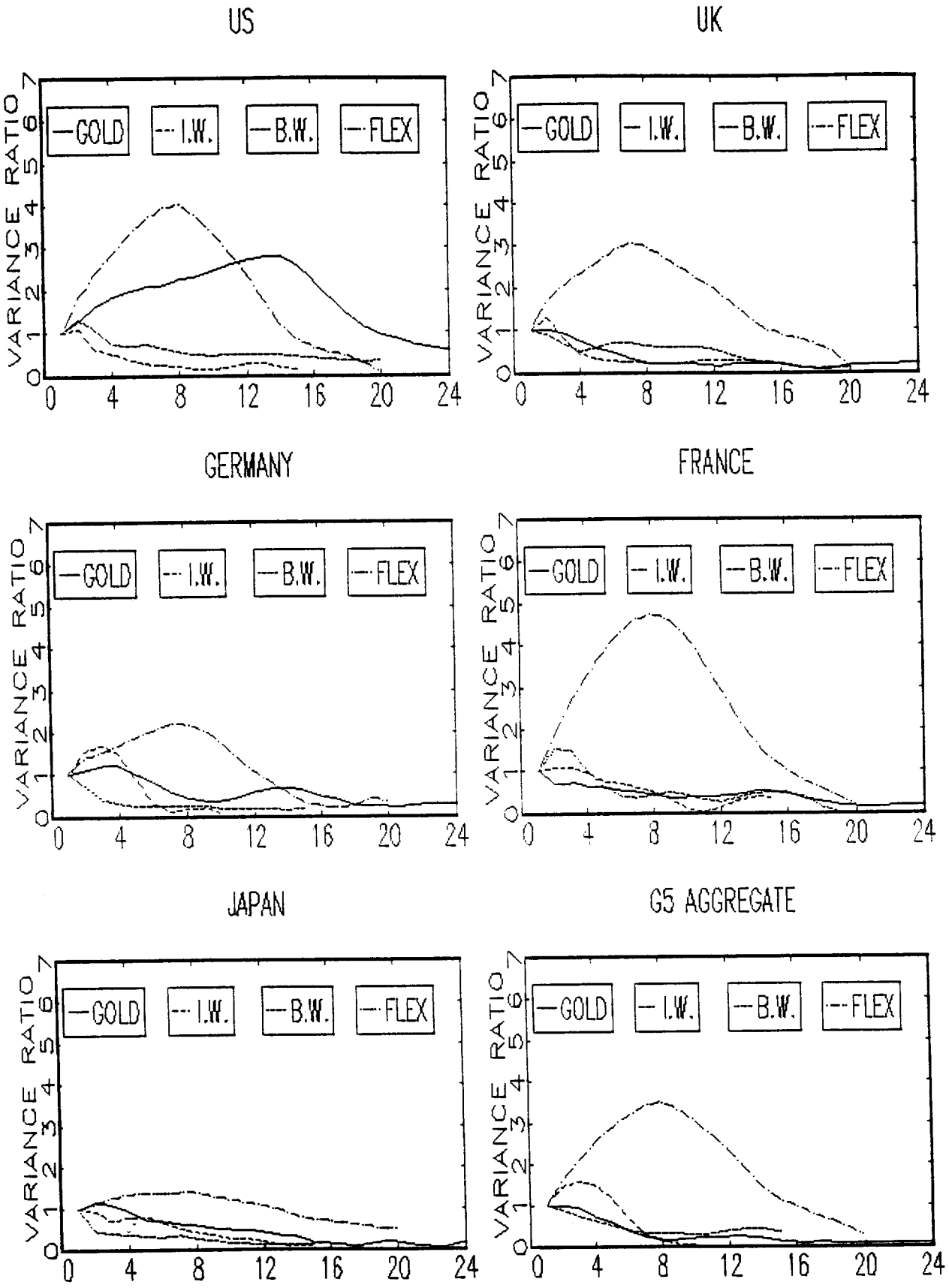


FIGURE 4.4 VARIANCE RATIO FOR REAL PER CAPITA INCOME BY REGIMES

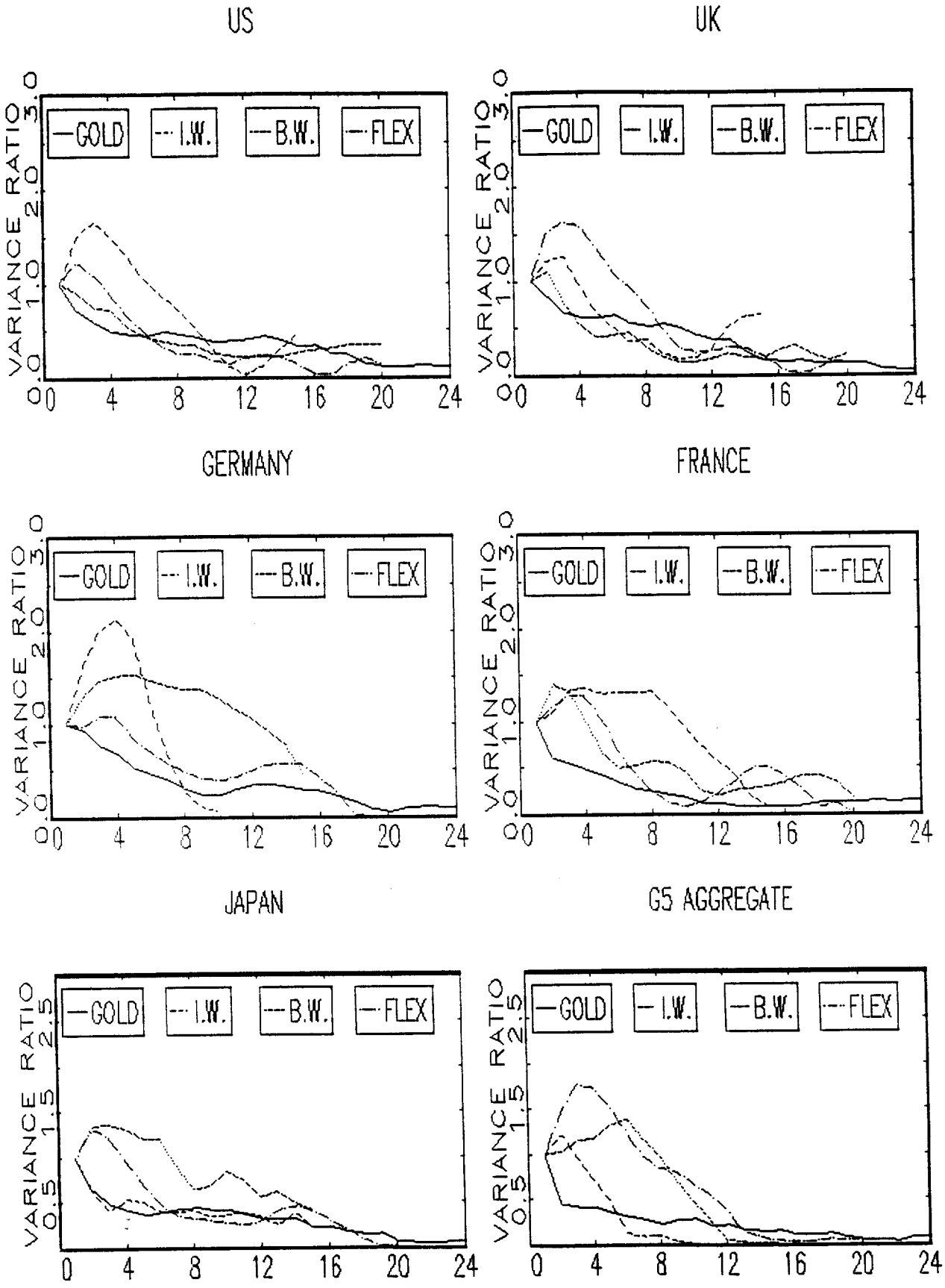
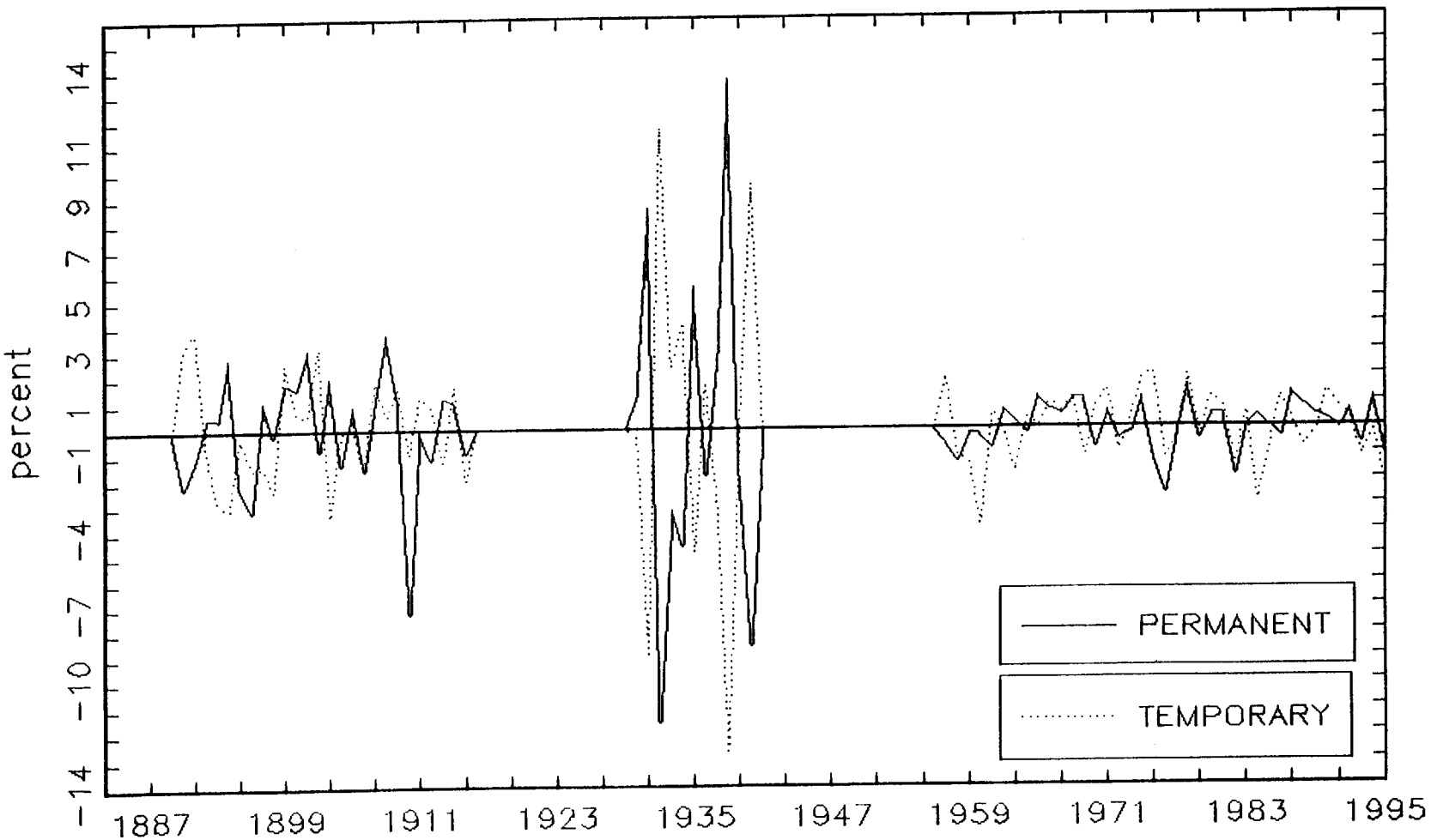


FIGURE 4.5 PERMANENT (AGGREGATE SUPPLY) AND TEMPORARY (AGGREGATE DEMAND) SHOCKS 1883–1995, OMITTING WAR YEARS, G5 AGGREGATE



Data Appendix

United States

(1) Population. 1880-1975, Bordo and Jonung (1987), *The Long-Run Behavior of the Velocity of Circulation: The International Evidence* (New York: Cambridge University Press). 1976-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 99z. (2) M2. 1880-1947, Bordo and Jonung (1987). 1948-89, Data supplied by Robert Rasche. 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 59mb. (3) Real GNP. 1880-1945, Nathan S. Balke and Robert J. Gordon (1986), "Appendix B: Historical Data," in *The American Business Cycle: Continuity and Change*, ed. Robert J. Gordon (Chicago: University of Chicago Press), pp 781-83, col. 2. 1946-89, *The Economic Report of the President*, 1991, p 288. Real GDP. 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 99br (4) Deflator. 1880-1945, Balke and Gorden (1986, 781-83, col. 2). 1946-89, *The Economic Report of the President*, 1991, p 290. 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 99bir. (5) Money Base. 1880-1982, Nathan S. Balke and Robert J. Gordon (1986), pp 784-86, col. 4. 1946-89. 1983-95. *International Financial Statistics Yearbook*, 1996, line 14. (6) Consumer Price Index. 1880-1970, US Bureau of the Census (1975), *Historical Statistics of the United States: Colonial Times to 1970: Bicentennial Edition* (Washington, D.C.), 210-11 (hereafter cited as *Historical Statistics*). 1971-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 64. (6) Short-Term Interest Rate. Commercial paper rate. 1880-1986, Bordo and Jonung (1987). 1987-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 60bc (7) Long-Term Interest Rate. Long-term government bond yield. 1880-1986, Bordo and Jonung (1987). 1987-1989, M.D. Bordo and L. Jonung (1990), "The Long-Run Behavior of Velocity: The Institutional Approach Revisited, " *Journal of Policy Modeling 12* (Summer): pp 165-97. 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 787-791, line 61

United Kingdom

(1) Population. 1880-1975, Bordo and Jonung (1987). 1976-1995, *International Financial Statistics Yearbook*, 1996, pp 782-785, line 99z. (2) Real NNP. 1880-1985, Bordo and Jonung (1987), 1986-89, Central Statistical Office, *Economic Trends* (various issues). Real GDP. 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 782-785, line 99br (3) Deflator. 1880-1985, Bordo and Jonung (1987), 1986-89, Central Statistical Office, *Economic Trends* (various issues). 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 782-785, line 99bir. (4) Consumer Price Index. 1880-1965, Feinstein's retail price series in F. Capie and A. Webber (1985), A Monetary History of the United Kingdom (London: Allen & Unwin), vol. 1, table III.(12). 1966-1995, *International Financial Statistics Yearbook*, 1996, pp 782-785, line 64. (5) Exchange Rate. US Dollar/Pound. 1880-1939, M. Friedman and A. J. Schwartz (1982), *Monetary Trends in the United States and the United Kingdom* (Chicago: University of Chicago Press), table 4.9, col. 8, pp 130-135..1947-95, *International Financial Statistics* (various issues), pp 782-785, line rh.

Germany

(1) Population. 1880-1979, A. Sommariva and G. Tullio (1987), *German Macroeconomic History, 1880-1979* (New York: St. Martin's), 234-36. 1980-1995, *International Financial Statistics Yearbook*, 1996, pp 376-79, line 99z. (2) Real GNP. 1880-1985, Data underlying A. H. Meltzer and S. Robinson (1989),

" Stability under the Gold Standard in Practice", in *Money, History, and International Finance: Essays in Honor of Anna J. Schwartz*, ed. M. D. Bordo (Chicago University of Chicago Press). Real GDP. 1986-1995, *International Financial Statistics Yearbook*, 1996, pp 376-79, line 99br (3) Deflator. 1880-1985, Meltzer and Robinson (1989). 1986-1995, *International Financial Statistics Yearbook*, 1996, pp 376-79, line 99bir. (4) Consumer Price Index. 1880-1979, Sommariva and Tullio (1987), pp 231-34. 1980-1995, *International Financial Statistics Yearbook*, 1996, pp 376-79, line 64. (5) Exchange Rate. Deutsche Mark/US Dollar. 1880-1979, Sommariva and Tullio (1987), pp 231-34. 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 376-79, line rh.

France

(1) Population. 1880-1949, B. R. Mitchell (1978), *European Historical Statistics*, 1750-1970 (New York: Columbia University Press), table A1. 1950-1995, *International Financial Statistics Yearbook*, 1996, pp 364-67, line 99z. (2) Real GDP. 1880-1900, Calculated from the Toutain Index, Michele Saint Marc (1983), *Histoire monetaire de la France*, 1800-1980 (Paris: Presses Universitaires de la France), pp 99-100. 1901-1949, Alfred Sauvy (1954), *Rapport sur le revenu national presente* (Paris: Conseil Economique, March). 1950-1988, INSEE, *Statistique annuaire de la France retrospectif* (1966) and *Statistique annuaire de la France* (various issues). 1989-1995, *International Financial Statistics Yearbook*, 1996, pp 364-67, line 99br (3) Deflator. Calculated as the ratio of nominal to real GDP. Nominal GDP, 1880-1913, M. Levy-Leboyer and F. Bourguignon (1990), *The French Economy in the Nineteenth Century* (New York: Cambridge University Press), table A-III. 1914-1988, INSEE, *Statistique annuaire de la France retrospectif* (1966) and *Statistique annuaire de la France* (various issues). 1989-1995, *International Financial Statistics Yearbook*, 1996, pp 364-67, line 99bir. (4) Consumer Price Index. 1880-1969, Saint Marc (1983), p 107, 1970-1995, *International Financial Statistics Yearbook*, 1996, pp 364-67, line 64. (5) Exchange Rate. French Fr/US Dollar. 1880-1969, Saint Marc (1983), p 107, 1970-1995, *International Financial Statistics Yearbook*, 1996, pp 364-67, line rh.

Japan

(1) Population. 1880-1949, Bureau of Statistics (1957), *Japan Statistical Yearbook*. 1950-1995, *International Financial Statistics Yearbook* (various issues), pp 458-61, line 99z. (2) Real GNP. 1885-1988, Data supplied by Robert Rasche. Real GDP. 1989-1995, *International Financial Statistics Yearbook*, 1996, pp 458-61, line 99br (3) Deflator. 1885-1988, Data supplied by Robert Rasche. 1989-1995, *International Financial Statistics Yearbook*, 1996, pp 458-61, line 99bir. (4) Consumer Price Index. 1950-1995, *International Financial Statistics Yearbook (various issues)*, pp 458-61, line 64. (5) Exchange Rate. Japan Yen/US Dollar. 1880-1989, Data Supplied by James Lothian, 1990-1995, *International Financial Statistics Yearbook*, 1996, pp 458-61, line rh.