

Michael D. Bordo

Michael D. Bordo is a professor of economics at Rutgers University and a research associate of the National Bureau of Economic Research. For excellent research assistance I would like to thank Jakob Koenes. For helpful comments and suggestions I am grateful to Barry Eichengreen, Allan Meltzer, Leslie Presnell, Hugh Rockoff and Anna Schwartz.

The Gold Standard, Bretton Woods and Other Monetary Regimes: A Historical Appraisal

INTRODUCTION

Two Questions

Which international monetary regime is best for economic performance? One based on fixed exchange rates, including the gold standard and its variants? Adjustable peg regimes such as the Bretton Woods system and the European Monetary System (EMS)? Or one based on floating exchange rates? This question has been debated since Nurkse's classic indictment of flexible rates and Friedman's classic defense.¹

Why have some monetary regimes been more successful than others? Specifically, why did the classical gold standard last for almost a century (at least for Great Britain) and why did Bretton Woods endure for only 25 years (or less)? Why was the EMS successful for only a few years?

This paper attempts to answer these questions. To answer the first question, I examine empirical evidence on the performance of three monetary regimes: the classical gold standard, Bretton Woods, and the current float. As a backdrop, I examine the mixed regime interwar period. I answer the second question by linking regime success

to the presence of credible commitment mechanisms, that is, to the incentive compatibility features of the regime. Successful fixed-rate regimes, in addition to being based on simple transparent rules, contained features that encouraged a center country to enforce the rules and other countries to comply.

The Issues

These questions touch on a number of important issues raised in economic literature. The first is the effect of the exchange rate regime on welfare. The key advantage of fixed exchange rates is that they reduce the transactions costs of exchange. The key disadvantage is that in a world of wage and price stickiness the benefits of reduced transactions costs may be outweighed by the costs of more volatile output and employment.

Helpman and Razin (1979), Helpman (1981) and others have raised the welfare issue. This theoretical literature concludes that it is difficult to provide an unambiguous ranking of exchange rate arrangements.²

Meltzer (1990) argues the need for empirical

¹See Nurkse (1944) and Friedman (1953).

²See DeKock and Grilli (1989 and 1992).

measures of the excess burdens associated with flexible and fixed exchange rates—the costs of increased volatility on the one hand compared with the output costs of sticky prices on the other hand. His comparison of EMS and non-EMS countries in the postwar period, however, does not yield clear-cut results.

Earlier literature comparing the macroeconomic performance of the classical gold standard, Bretton Woods and the current float also yielded mixed results. Bordo (1981) and Cooper (1982) showed that the classical gold standard was associated with greater price level and real output volatility than post-World War II arrangements for the United States and United Kingdom. On the other hand, Klein (1975) and Schwartz (1986) presented evidence that the gold standard provided greater long-term price stability than did the post-World War II arrangements.³

Bordo (1993) compared the means and standard deviations of nine variables for the Group of Seven countries under the three regimes, as well as the interwar period.⁴ According to these measures, the Bretton Woods convertible period from 1959 to 1970 was the most stable regime for the majority of countries and variables examined. Eichengreen (1992a) measured volatility applying two filters (the first difference of logarithms and a linear trend).⁵ Comparing Bretton Woods and the float for a sample of 10 countries, he found no clear-cut connection between the volatility of real growth and the exchange rate regime. He also found no significant difference in the correlation of output volatility across countries between the two regimes.

A second issue is whether the exchange rate regime provides insulation from shocks and monetary policy independence. Under fixed rates, coordinated monetary policy may provide effective insulation from common supply shocks, but not from country-specific shocks. Under

flexible rates, country-specific shocks can be offset by independent monetary policy.⁶

The evidence on this issue is limited. Bayoumi and Eichengreen (1992a) applied the Blanchard-Quah approach to show that both supply (permanent) and demand (temporary) shocks, for a sample of five countries, were considerably greater under the gold standard than under post-World War II regimes. However, they found little difference in the incidence of shocks between Bretton Woods and the floating exchange rate regime. Their results also showed that the dispersion of shocks across countries was higher under the gold standard than under the two more recent regimes and slightly higher under Bretton Woods than under the floating exchange rate regime. They attributed the ability of the gold standard to withstand greater shocks to evidence of a faster speed of adjustment of both prices and output, as measured by impulse response functions.⁷

A third issue is the case for rules vs. discretion. A fixed exchange rate may be viewed as a commitment mechanism or rule. It binds the hands of policymakers to prevent them from following inflationary discretionary policies.⁸ The monetary authority, in a closed economy or under flexible rates, might be tempted to engineer an inflation surprise to raise revenue.⁹ The outcome is higher inflation because the public, assuming rational expectations, will anticipate the policy. Were some credible mechanism, such as a monetary rule, in place the expansionary policy would not be implemented. Alternatively, a commitment to a fixed exchange rate through a pledge to maintain gold convertibility, for example, could achieve the same results, but because it is more transparent, it would possibly cost less.¹⁰ Such binding commitments may, however, be undesirable in the presence of extreme emergencies such as major wars, supply shocks or financial crises.¹¹ Under such circumstances

³This result is disputed by Meltzer and Robinson (1989).

⁴The Group of Seven countries are Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

⁵Eichengreen followed the methodology of Baxter and Stockman (1989).

⁶Similarly a monetary union such as the proposed European Monetary Union could provide effective insulation from common supply shocks for its members. However, giving up monetary independence imposes additional burdens in the case of member-specific (regional) shocks, Feldstein (1992).

⁷Addressing the issue of the optimum currency area, Bayoumi and Eichengreen (1992b, 1992c and 1992d) also

apply this methodology to examine the incidence of shocks within Western Europe and within regions of North America.

⁸See Kydland and Prescott (1977), Barro and Gordon (1983), and Persson and Tabellini (1990).

⁹Alternatively the monetary authority may create an inflation surprise to offset a labor market distortion that raises the unemployment rate above some desired level.

¹⁰See Giavazzi and Pagano (1988).

¹¹See Rogoff (1985a) and Fischer (1990).

a contingent rule, or one with escape clauses that allow member countries to suspend parity (convertibility) temporarily, may be optimal.¹²

The rule constrains the government to adhere to the fixed exchange rate except in the case of a well-understood emergency, when it can suspend parity (convertibility under the gold standard) and issue fiat money. Once the emergency has passed, with allowance for a suitable delay, the authority is expected to return to the rule—that is, to the fixed rate at the original parity. If the public believes in the government's commitment to return to the rule, the government will be able to raise more revenue than it could with no credibility. The inflation rate during the emergency would be higher than under the rule (when presumably it would be zero) but less than in the case of pure discretion. The pattern of alternating fixed and floating exchange rate regimes over the past 200 years may be well explained by adherence to a rule with an escape clause.¹³

On the other hand, in a regime of floating exchange rates the inflationary bias of discretionary policy may be overcome by instituting credible monetary rules or other commitment mechanisms, such as an independent conservative central bank.¹⁴ Such mechanisms may prevent the perceived disadvantage of sacrificing national sovereignty to the supernational dictates of a fixed exchange rate.

A fourth issue is that of international cooperation and policy coordination. Recent game theory literature has demonstrated that coordination of policies (by fixing exchange rates) can offset spill-over effects from uncoordinated policy actions.¹⁵ Cooperative fixed exchange rate arrangements, however, unless enforced by a supernational authority whose power exceeds national sovereignty, tend to break down as individual members devalue. Cooperation is more likely, without a supernational authority, in a world of repeated games because the benefits of reputation can offset the advantages to each country of cheating.¹⁶ But even in this case, cooperation between nations may produce an inflationary bias when no credible commitment mechanism is present to prevent governments from following discre-

tionary policies.¹⁷ Thus for an international monetary arrangement to be effective both between countries and within them, a consistent credible commitment mechanism is required. Such a mechanism likely prevailed under the gold standard but was less evident under Bretton Woods.

A fifth and final issue is the case for international monetary reform. Several, prominent proposals have been made to reform the present managed floating exchange rate regime and move it back toward one of greater fixity. These proposals in part derive from a perception, based on the historical record, that fixed exchange rates are preferable to the current float. These proposals include McKinnon's case for a gold standard without gold, Mundell's proposal to target the real price of gold and the case for target exchange rate zones presented by Williamson and Bergsten.¹⁸ Even more immediate is the move to convert the adjustable peg of the EMS to a unified currency area with irrevocably fixed exchange rates.

Overview

The paper accomplishes a number of tasks. The next section answers the first question, which international monetary regime is best for economic performance, by presenting a compilation of statistical evidence on different aspects of the performance of alternative monetary regimes. The measures cover the stability of several macroeconomic variables; the dispersion of macroeconomic variables across countries; the persistence of inflation; forecast errors in inflation and growth; the incidence of supply (permanent) and demand (temporary) shocks; the dispersion of shocks between countries; and the mean response of prices and output to supply and demand shocks. The third section stresses the importance of adhering to credible rules in a historical examination of three international monetary regimes: the classical gold standard, Bretton Woods and the EMS. The final section answers the question why some regimes endured longer than others. It concludes by discussing why even a regional exchange rate arrangement—the EMS—has considerable difficulty surviving.

¹²See Bordo and Kydland (1992), Flood and Isard (1989a and 1989b), and DeKock and Grilli (1989 and 1992).

¹³See DeKock and Grilli (1989) and Giovannini (1992).

¹⁴See Rogoff (1985a).

¹⁵See Hamada (1979) and Canzoneri and Henderson (1988 and 1991).

¹⁶See Dominguez (1993).

¹⁷See Rogoff (1985b).

¹⁸See McKinnon (1988), Mundell (1992), Williamson (1985a) and Bergsten (1992).

The statistical evidence on performance of alternative monetary regimes in the next section makes it clear that the performance of regimes in the post-World War II era is superior to that of the regimes in the preceding half century. The key exception is the classical gold standard, which exhibits the lowest inflation persistence and a relatively high degree of financial market integration. The Bretton Woods convertible regime from 1959 to 1970 performed the best by far on virtually all criteria.

The greater durability of the gold standard compared with Bretton Woods cannot be explained by a lower incidence of shocks. The key explanation for its success lies with the credibility of the commitment to the gold standard rule of convertibility by England and the other core countries and its near universal acceptance. As a contingent rule, it was flexible enough to withstand the major shocks that buffeted it. The Bretton Woods adjustable peg was in some respects similar to the gold standard contingent rule, but it invited speculative attack hence weakening the escape clause. Unlike England, the leading country before World War I, the United States, the dominant country under Bretton Woods, maintained a credible commitment to a noninflationary policy for only a few years. The world, faced with imported inflation in the late 1960s, lost the incentive to follow its leadership, and the system collapsed in 1971.

The longevity of general floating exchange rate regimes since 1973 suggests that the lessons of Bretton Woods have been well learned. Countries are willing to subject their domestic policy autonomy neither to that of another country whose commitment they cannot be sure of in a stochastic world, nor to a supernational monetary authority they cannot control. Even the recent experience of the EMS—a regional exchange rate arrangement between countries supposedly pursuing common goals—revealed differing national priorities in the face of asymmetric shocks that placed intolerable strains on the system.

THE PERFORMANCE OF ALTERNATIVE MONETARY REGIMES

To make the case for one monetary regime over another, empirical and historical evidence on their performance is crucial. In this section I present some evidence on different aspects of the macroeconomic performance of alternative international monetary regimes over the past 110 years. The comparison for the seven largest (non-Communist) industrialized countries (the Group of Seven countries) is based on annual data for the classical gold standard (1881–1913), the interwar period (1919–39), Bretton Woods (1946–70), and the present floating exchange rates regime (1971–89). The Bretton Woods period (1946–70) is divided into two subperiods: the preconvertible phase (1946–58) and the convertible phase (1959–70).¹⁹

The comparison relates to the theoretical issues raised by the debate over fixed vs. flexible exchange rates. According to the traditional view, adherence to a (commodity-based) fixed exchange rate regime, such as the gold standard, ensured long-run price stability for the world as a whole because the fixed price of gold provided a nominal anchor to the world money supply. Individual nations, by pegging their currencies to gold, fixed their price levels to that of the world.²⁰ A fixed-rate system based on fiat money, however, may not provide a stable nominal anchor unless a credible commitment mechanism constrains the growth of the world's money supply.²¹ The disadvantage of fixed rates is that individual nations are exposed to both monetary and real shocks transmitted from the rest of the world through the balance of payments and other channels of transmission.²² The advantage of floating exchange rates is to provide insulation from foreign shocks. The disadvantage is the absence of the discipline of the fixed-exchange-rate rule because monetary authorities might adopt inflationary policies.

¹⁹I also examined the period (1946–73) 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 1946–70 period.

²⁰The common world price level under the gold standard, however, exhibited secular periods of deflation and inflation reflecting shocks to the demand for and supply of gold. See Bordo (1981) and Rockoff (1984). A well-designed monetary rule, it is argued, could have prevented the long-run swings that characterized the price level under the gold standard. See Cagan (1984).

²¹See Giovannani (1992).

²²See Bordo and Schwartz (1989a).

Theoretical developments in recent years have complicated the simple distinction between fixed and floating exchange 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.²³ Moreover, according to recent real business cycle approaches, there may be no relationship between the international monetary regime and the transmission of real shocks.²⁴ Nevertheless, the comparison between regimes may shed light on these issues.

One important caveat is that the historical regimes presented here do not represent clear examples of fixed and floating exchange rate regimes. The interwar period 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 1939.²⁵ 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 *de facto* fixed dollar standard.²⁶ Finally, although the period since 1973 has been characterized as a floating exchange rate regime, at various times it has experienced varying degrees of management.

Stability and Convergence

Table 1 presents descriptive statistics on nine macroeconomic variables for each Group of Seven country, with the data for each variable converted to a continuous annual series from 1880 to 1989. The nine variables are the rate of inflation; real per capita growth; money growth; short-term nominal interest rates; long-term nominal interest rates; short-term real interest rates; long-term real interest rates; and the absolute rates of change of nominal and real exchange rates. The definition of the variable

used, for example, M1 vs. M2, was dictated by the availability of data over the entire period. For each variable and each country I present two summary statistics: the mean and standard deviation. For the countries taken as a group, I show two summary statistics: the grand mean and a simple measure of convergence defined as the mean of the absolute differences between each country's summary statistic and the grand means of the group of countries.²⁷ I comment on the statistical results for each variable.

Inflation. Countries using the classical gold standard had the lowest rate of inflation and displayed mild deflation during the interwar period. 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. The average rate of inflation in the two Bretton Woods subperiods was virtually the same. This comparison, however, conceals the importance of two periods of rapid inflation in the 1940s and 1950s and in the late 1960s. See figure 1.²⁸ Thus the evidence based on country and period averages of very low inflation in the gold standard period and of a lower inflation rate during Bretton Woods than the subsequent floating period is consistent with the traditional view on price behavior under fixed (commodity-based) and flexible exchange rates.

In addition, the inflation rates show the highest degree of convergence between countries during the classical gold standard and to a lesser extent during the Bretton Woods convertible subperiod compared with the floating rate period and the mixed interwar regime. This evidence also 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 independence under floating rates.²⁹

²³See Bordo and Schwartz (1989a).

²⁴See Baxter and Stockman (1989).

²⁵To be more exact, the United States stayed on the gold standard until 1933, and France stayed until 1936. For a detailed comparison of the performances of these three regimes in the interwar period, see Eichengreen (1991a).

²⁶Within the sample of seven countries, Canada floated from 1950 to 1961.

²⁷This is a very crude measure of convergence or divergence between the different countries' summary statistics. Because it is based on the average for the whole period, it suppresses unusual movements within particular subperiods. Bayoumi and Eichengreen (1992d) presented an alternative measure of convergence or dispersion—the GDP-weighted standard deviation of the individual country

series around the G-7 aggregate. I calculated this alternative measure of convergence for the data in table 1. The results are very close to those reported here for virtually every variable.

²⁸The data sources for figure 1 and all subsequent figures are listed in the Data Appendix to Bordo (1993).

²⁹For similar evidence see Bordo (1981), Darby, Lothian et al. (1983) and Darby and Lothian (1989).

Table 1
**Descriptive Statistics of Selected Open Economy Macroeconomic Variables, the Group of Seven Countries
 1881-1989 Annual Data: Mean, Standard Deviation**

	Gold Standard (1881-1913)		Interwar (1919-1938)		Bretton Woods (Total) (1946-1970)		Bretton Woods (Preconvertible) (1946-1958)		Bretton Woods (Convertible) (1959-1970)		Floating Exchange (1974-1989)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Inflation PGNP¹												
United States	0.3	3.1	-1.8	7.6	2.4	2.6	2.8	3.5	2.6	1.5	5.6	2.4
United Kingdom	0.3	3.1	-1.5	7.8	3.7	2.2	4.6	2.5	3.4	1.5	9.4	6.1
Germany	0.6	2.6	-2.1	4.7	2.7	4.0	2.1	6.2	3.2	1.8	3.3	1.2
France	0.0	4.9	2.2	9.1	5.6	4.1	5.6	5.1	5.5	3.6	8.8	3.2
Japan	4.6	5.5	-1.7	7.3	4.5	4.6	4.7	7.3	5.1	1.3	2.6	2.4
Canada	0.4	1.4	-1.9	6.1	2.7	3.0	3.9	3.9	2.9	1.5	7.3	2.6
Italy	0.6	3.2	-1.1	11.7	3.8	11.5	5.8	16.0	3.8	2.1	12.9	4.6
mean	1.0	3.4	-1.1	7.8	3.6	4.6	4.2	6.4	3.9	1.9	7.1	3.2
convergence	0.9	1.0	1.0	1.5	0.9	2.0	1.1	3.0	0.9	0.5	2.8	1.2
Real per capita growth¹												
United States	1.8	5.1	0.0	8.1	2.0	2.8	1.8	3.4	2.9	1.9	2.1	2.7
United Kingdom	1.1	2.4	1.2	4.5	2.1	1.8	2.1	2.2	2.3	1.4	1.5	4.2
Germany	1.7	2.9	2.6	8.5	5.0	3.3	7.3	3.9	3.5	2.6	2.1	1.9
France	1.5	4.6	1.3	7.2	3.9	2.1	4.6	2.7	3.9	1.3	1.7	1.5
Japan	1.4	3.8	2.0	6.1	8.1	2.7	5.7	1.1	8.9	2.5	3.5	1.1
Canada	2.3	2.8	0.2	8.8	2.5	2.6	2.4	3.3	3.5	1.7	1.3	2.4
Italy	1.0	4.0	0.9	4.7	5.6	3.3	5.2	4.4	5.8	1.9	2.5	2.2
mean	1.5	3.7	1.2	6.8	4.2	2.7	4.2	3.0	4.4	1.9	2.1	2.3
convergence	0.3	1.0	0.7	1.5	1.7	0.4	1.7	0.9	1.6	0.4	0.5	0.7
Money Growth¹												
United States	6.1	4.1	0.6	8.6	6.3	5.8	6.4	8.3	7.0	1.5	8.6	2.4
United Kingdom	2.1	1.7	0.8	4.7	3.2	3.2	1.7	2.9	5.5	2.9	13.5	5.5
Germany	5.7	4.7	1.3	10.1	12.8	5.9	17.6	5.6	10.9	4.7	5.7	4.5
France	2.1	4.7	6.4	8.5	11.5	7.5	14.7	7.2	8.6	6.5	8.8	3.4
Japan	7.2	14.5	0.5	9.7	16.2	16.2	20.1	21.8	14.9	7.0	5.8	6.3
Canada	7.4	5.3	1.1	4.7	6.0	4.0	5.1	3.2	8.3	3.9	10.6	3.9
Italy	3.2	3.1	3.6	6.2	13.3	7.8	15.9	10.5	12.4	2.0	13.4	4.9
mean	4.8	5.4	2.0	7.5	9.9	7.2	11.6	8.5	9.7	4.1	9.5	4.4
convergence	2.1	2.4	1.7	2.0	4.1	3.7	6.2	4.4	2.6	1.7	2.1	1.0

	Gold Standard (1881-1913)		Interwar (1919-1938)		Bretton Woods (Total) (1946-1970)		Bretton Woods (Preconvertible) (1946-1958)		Bretton Woods (Convertible) (1959-1970)		Floating Exchange (1974-1988)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Short-term interest rate												
United States	4.8	0.9	3.5	2.0	3.4	1.9	2.0	0.9	4.8	1.6	8.9	2.6
United Kingdom	2.8	0.8	3.0	1.8	4.0	2.5	2.3	1.8	5.8	1.6	11.2	2.1
Germany	3.2	0.9	4.6	1.6	4.0	1.5	4.1	1.1	4.0	1.7	5.9	2.4
France	2.5	0.6	3.1	1.4	4.1	1.9	3.2	1.5	5.1	1.9	10.3	2.6
Japan	2.4	0.5	2.0	0.5	6.5	0.8	6.9	1.0	6.3	0.6	5.2	2.0
Canada	n.a.		0.9	0.4	2.9	2.0	1.4	1.1	4.6	1.3	10.3	2.8
Italy	n.a.		n.a.		n.a.		n.a.		n.a.		n.a.	
mean	3.1	0.7	2.9	1.3	4.2	1.8	3.3	1.2	5.1	1.4	8.6	2.4
convergence	0.7	0.2	0.9	0.6	0.8	0.4	1.5	0.3	0.6	0.4	2.1	0.3
Long term interest rate												
United States	3.8	0.3	4.2	0.6	3.9	1.3	3.0	0.4	5.0	1.1	10.4	2.1
United Kingdom	2.9	0.2	4.1	0.7	5.2	1.8	3.9	0.8	6.6	1.3	12.1	2.8
Germany	3.7	0.2	6.8	1.6	6.3	0.7	5.9	0.5	6.7	0.7	7.8	1.5
France	3.2	0.3	4.6	0.8	5.7	0.8	5.8	0.5	5.7	1.0	10.9	2.4
Japan	n.a.		n.a.		7.0	0.1	n.a.		7.0	0.1	7.1	1.8
Canada	3.5	0.4	4.7	0.8	4.5	1.5	3.3	0.5	5.8	1.1	11.0	2.0
Italy	4.2	0.5	5.9	0.6	6.0	0.7	6.3	0.4	5.7	0.7	13.7	3.3
mean	3.6	0.3	5.1	0.9	5.5	1.0	4.7	0.5	6.1	0.9	10.4	2.3
convergence	0.4	0.1	0.9	0.3	0.8	0.5	1.3	0.1	0.6	0.3	1.7	0.5
Real short term interest rate ²												
United States	4.8	2.0	3.8	6.7	0.3	3.9	-1.6	4.7	2.4	0.4	2.5	2.8
United Kingdom	2.9	2.3	4.2	7.1	-0.1	3.4	-2.4	3.2	2.3	1.1	1.3	5.1
Germany	2.4	2.3	5.1	5.2	2.2	2.6	3.0	3.6	1.6	1.5	2.5	1.9
France	2.8	6.4	1.2	14.7	-0.9	5.2	-3.3	6.9	1.2	1.4	2.1	2.8
Japan	-1.5	5.5	1.4	8.8	1.9	2.5	3.4	3.5	1.1	1.6	1.4	3.5
Canada	n.a.		-0.8	1.3	-0.3	4.2	-2.6	4.8	2.2	0.8	3.1	3.2
Italy	n.a.		n.a.		n.a.		n.a.		n.a.		n.a.	
mean	2.3	3.7	2.5	7.3	0.5	3.6	-0.6	4.5	1.8	1.1	2.2	3.2
convergence	1.5	1.8	1.9	3.0	1.0	0.8	2.5	1.0	0.5	0.4	0.6	0.7

Table 1 (continued)
 Descriptive Statistics of Selected Open Economy Macroeconomic Variables, the Group of Seven Countries
 1881-1989 Annual Data: Mean, Standard Deviation

	Gold Standard (1881-1913)		Interwar (1919-1938)		Bretton Woods (Total) (1946-1970)		Bretton Woods (Preconvertible) (1946-1958)		Bretton Woods (Convertible) (1959-1970)		Floating Exchange (1974-1989)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Real long term interest rate ²												
United States	3.7	2.2	4.6	6.8	0.8	3.6	-0.7	4.4	2.5	0.7	3.9	3.8
United Kingdom	3.0	2.5	5.4	7.1	1.1	2.8	-0.8	2.6	3.2	1.0	2.2	3.7
Germany	2.9	2.4	6.9	6.0	4.3	2.8	4.3	4.4	4.3	0.9	4.4	0.9
France	3.5	6.5	1.0	15.1	0.4	4.4	-1.2	6.2	1.8	1.0	2.7	3.1
Japan	n.a.		n.a.		1.7	1.3	n.a.		1.7	1.3	2.0	4.2
Canada	2.9	4.1	5.4	6.5	1.3	3.8	-0.7	4.4	3.4	0.7	3.8	3.1
Italy	4.2	2.4	3.4	9.3	0.3	9.4	-1.5	12.9	2.3	2.2	1.4	4.8
mean convergence	3.4	3.4	4.5	8.5	1.4	4.0	-0.1	5.8	2.9	1.1	2.9	3.5
	0.4	1.3	1.5	2.5	0.9	1.6	1.5	2.5	0.8	0.4	1.0	0.7
Nominal exchange rate ⁵												
United States ⁴	0.2	0.2	6.8	7.9	0.7	0.8	3.3	7.9	0.7	0.8	10.0	4.7
United Kingdom	0.2	0.1	3.9	9.5	2.4	6.2	2.4	5.3	1.5	4.0	9.3	8.2
Germany	0.0	0.0	18.4	15.6	1.8	3.8	4.4	11.3	1.3	2.1	10.7	7.8
France	2.9	4.5	6.8	9.0	2.5	7.7	30.5	47.9	1.1	3.3	8.8	9.5
Japan	0.0	0.0	2.7	3.4	15.9	37.2	1.8	1.9	0.2	0.2	3.7	2.4
Canada	1.4	1.5	13.6	20.1	1.6	1.9	14.1	27.4	1.4	2.0	10.9	9.0
Italy					7.4	20.6			0.2	0.2		
mean convergence	0.7	0.9	7.5	9.4	4.6	11.2	8.1	14.5	0.9	1.8	8.9	6.9
	0.9	1.3	4.5	4.2	4.0	10.1	7.7	12.9	0.6	1.2	1.8	2.3

	Gold Standard (1881-1913)		Interwar (1919-1938)		Bretton Woods (Total) (1946-1970)		Bretton Woods (Preconvertible) (1946-1958)		Bretton Woods (Convertible) (1959-1970)		Floating Exchange (1974-1989)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Real exchange rate ^{3,5}												
United States ⁴	1.7	1.5	8.5	10.0	1.7	1.0	5.9	8.2	1.7	1.0	12.3	6.1
United Kingdom	2.4	1.2	5.8	9.2	4.2	6.5	3.9	7.3	2.5	3.9	8.8	8.2
Germany	4.3	5.0	9.0	6.9	4.1	5.6	6.2	7.7	1.9	1.8	9.2	7.7
France	6.6	5.5	7.8	7.2	3.5	2.9	4.8	4.1	2.7	1.5	9.6	8.9
Japan	2.6	2.2	3.2	2.8	2.4	2.3	3.3	2.5	1.5	1.7	3.8	2.0
Canada	2.1	1.7	13.3	16.9	8.0	18.7	13.1	25.2	2.4	1.6	8.6	7.8
Italy												
mean	3.3	2.9	7.9	8.8	3.8	6.0	6.2	9.2	2.2	2.1	8.7	6.8
convergence	1.5	1.6	2.3	3.2	1.3	3.8	2.3	5.4	0.5	0.8	1.4	1.8

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

²Calculated as the nominal interest rate minus the annual rate of change of the consumer price index (CPI).

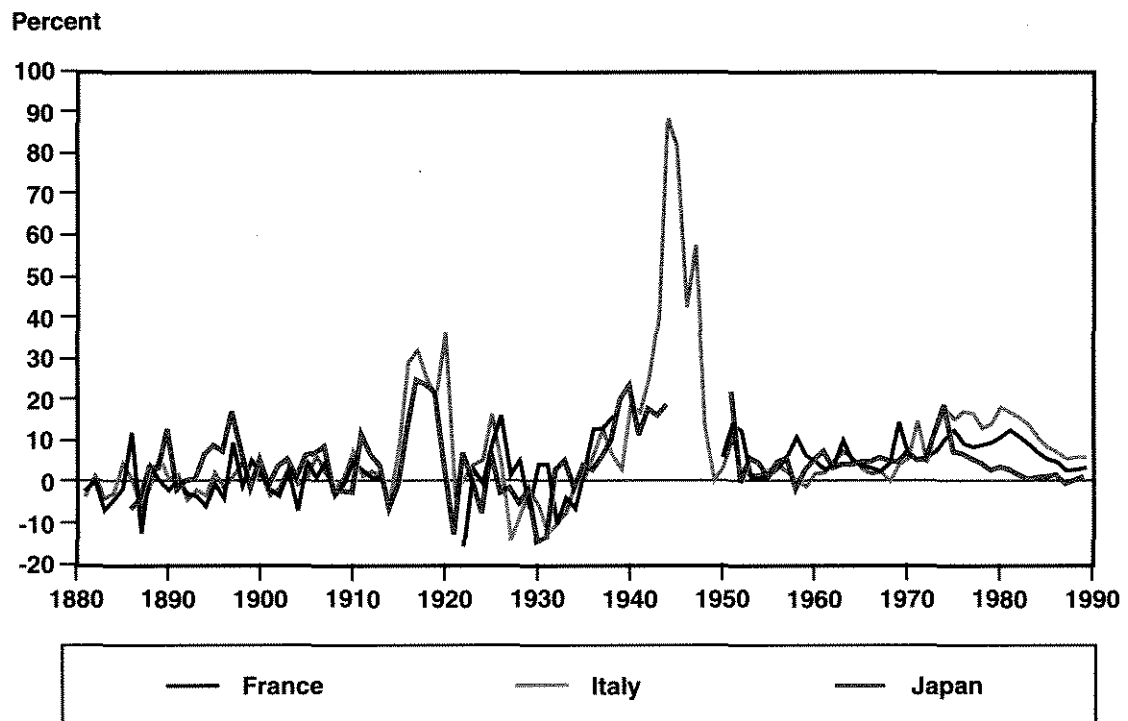
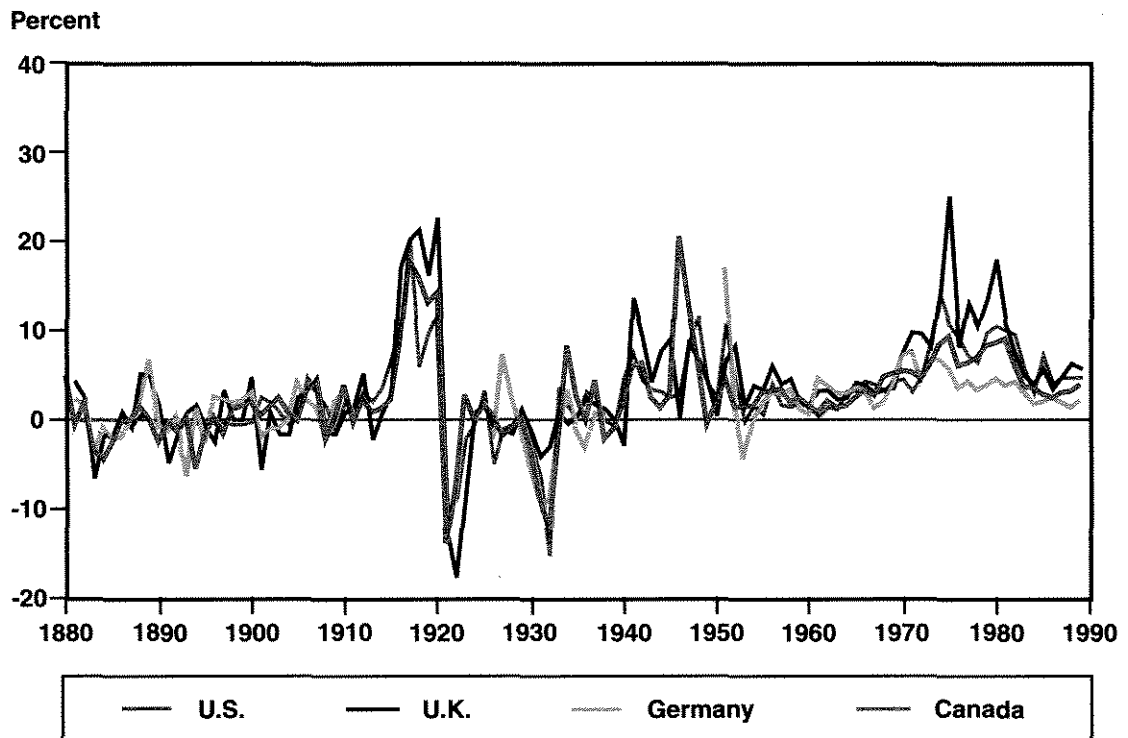
³Absolute rates of change.

⁴Trade-weighted nominal and real exchange rate starting in 1960.

⁵Calculated as the nominal exchange rate divided by the ratio of foreign CPI to the U.S. CPI.

Data Sources: See Data Appendix to Bordo (1993).

Figure 1
Inflation Rates, 1880-1989, G7 Countries



The Bretton Woods convertible subperiod had the most stable inflation rate of any regime as judged by the standard deviation. By contrast, the preconvertible Bretton Woods period exhibited greater inflation variability than either the gold standard period or the recent floating exchange rate period. The evidence of a high degree of price stability in the convertible phase of Bretton Woods is also consistent with the traditional view that fixed rate (commodity-based) regimes provide a stable nominal anchor; however, the remarkable price stability during this period may also reflect the absence of major shocks.

Real per capita GNP. 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 (see figure 2). Output variability was also lowest in the convertible subperiod of Bretton Woods, but because of higher variability in the preconvertible period, the Bretton Woods system as a whole was more variable than the floating exchange rate period. Both pre-World War II regimes exhibit higher variability than their post-World War II counterparts.³⁰ The divergence of output variability between countries was also lowest during the Bretton Woods regime, with the interwar regime showing the highest divergence.³¹ The greater convergence of output variability under Bretton Woods may reflect conformity between countries' business fluctuations, created by the operation of the fixed exchange rate regime.³²

Money growth (M2). Money grew considerably more rapidly across all countries after World War II than before the war (see figure 3). There is not much difference between Bretton Woods and the subsequent floating exchange rate regime. Within the Bretton Woods regime, money grew more rapidly in the preconvertibility period than in the convertibility period. Money growth rates showed the least divergence between

countries during the fixed-exchange-rate gold standard and the convertible Bretton Woods regime, with the greatest divergence in the preconvertible Bretton Woods period and the interwar period.

Like inflation and real output variability, money growth variability was lowest in the convertible Bretton Woods period. This, however, was not the case for the preconvertible period, which was the most variable of any regime. It also exhibited the greatest divergence in variability between countries. To the extent that one of the properties of adherence to a fixed-exchange-rate regime is conformity of monetary growth rates between countries, these results are sympathetic to the view that the Bretton Woods system really began in 1959.

Short-term and long-term interest rates. The underlying data for short-term and long-term interest rates are seen in figures 4 and 5. As in other nominal series, the degree of convergence of mean short-term interest rates is highest in the convertible Bretton Woods period. Long-term rates are most closely related in the classical gold standard regime, with the convertible Bretton Woods period not far behind. McKinnon (1988) has similar findings. He views them as evidence of capital market integration under fixed exchange rates. The lack of convergence in the preconvertibility Bretton Woods period reflects the presence of pervasive capital controls. Convergence of nominal interest rates would not be expected under floating exchange rates. Convergence of standard deviations is also highest in the gold standard period followed by Bretton Woods. Long-term rates were most stable and least divergent under the classical gold standard, followed by the two Bretton Woods subperiods, with floating exchange rates the least stable. The evidence that nominal interest rates are more stable and convergent between countries under fixed exchange rate (commodity-based) regimes is consistent with the traditional view.

³⁰Baxter and Stockman (1989) and Eichengreen (1992a) use residuals from a linear trend to the logarithm of real output as a detrending filter rather than the logarithmic first difference used here. According to their results, real output variability is not greater in the floating than in the fixed period.

³¹However, using their alternative measure of convergence—the GDP-weighted standard deviation of the individual country series around the G-7 aggregate—Bayoumi and Eichengreen (1992a) report that the lowest degree of dispersion of real GDP growth was in the floating rate period, followed by the Bretton Woods convertible period. Similar results hold for the real GNP per capita data in table 1. For Bayoumi and Eichengreen (1992a) the decline in the

dispersion of real growth and the rise in the dispersion of inflation rates between the Bretton Woods convertible period and the float have the following explanations: the move to flexible rates allowed countries to stabilize their relative growth rates in the face of asymmetric supply shocks at the expense of their relative inflation rates. They also report that, when they apply the linear trend filter of Baxter and Stockman (1989), evidence of a rise in the cross country correlation between output movements after 1970 is considerably reduced.

³²See Bordo and Schwartz (1989a) and Darby and Lothian (1989).

Figure 2
 Per Capita Income Growth Rates, 1880-1989, G7 Countries

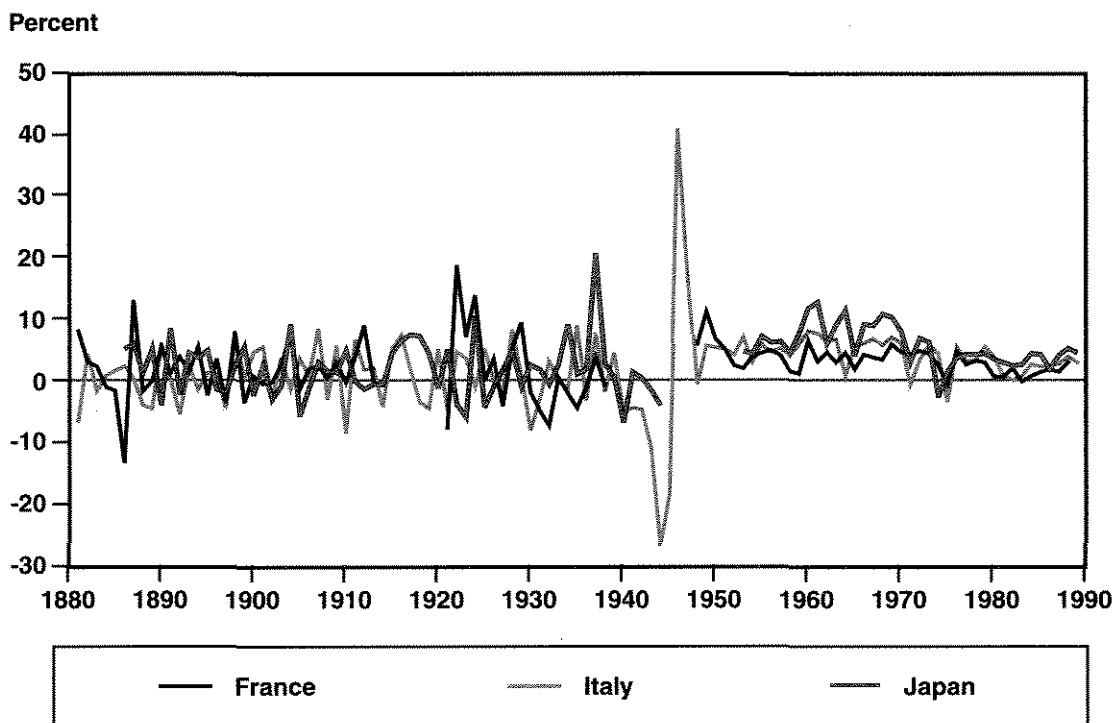
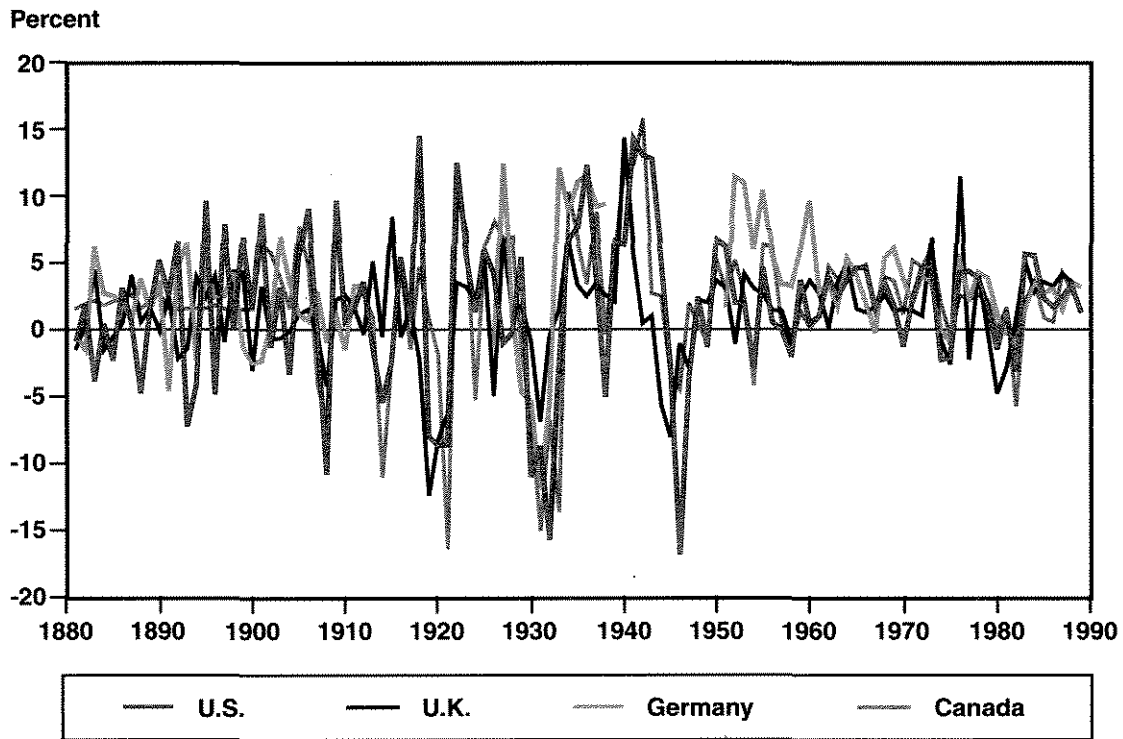


Figure 3
 Money Growth Rates, 1880-1989, G7 Countries

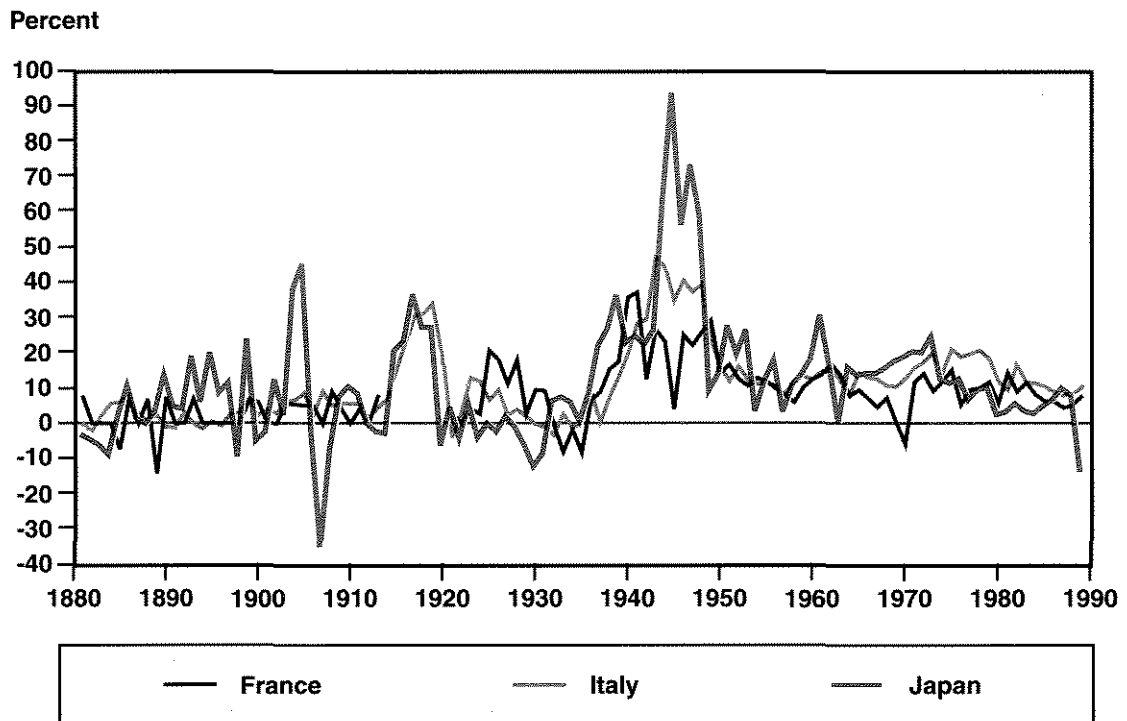
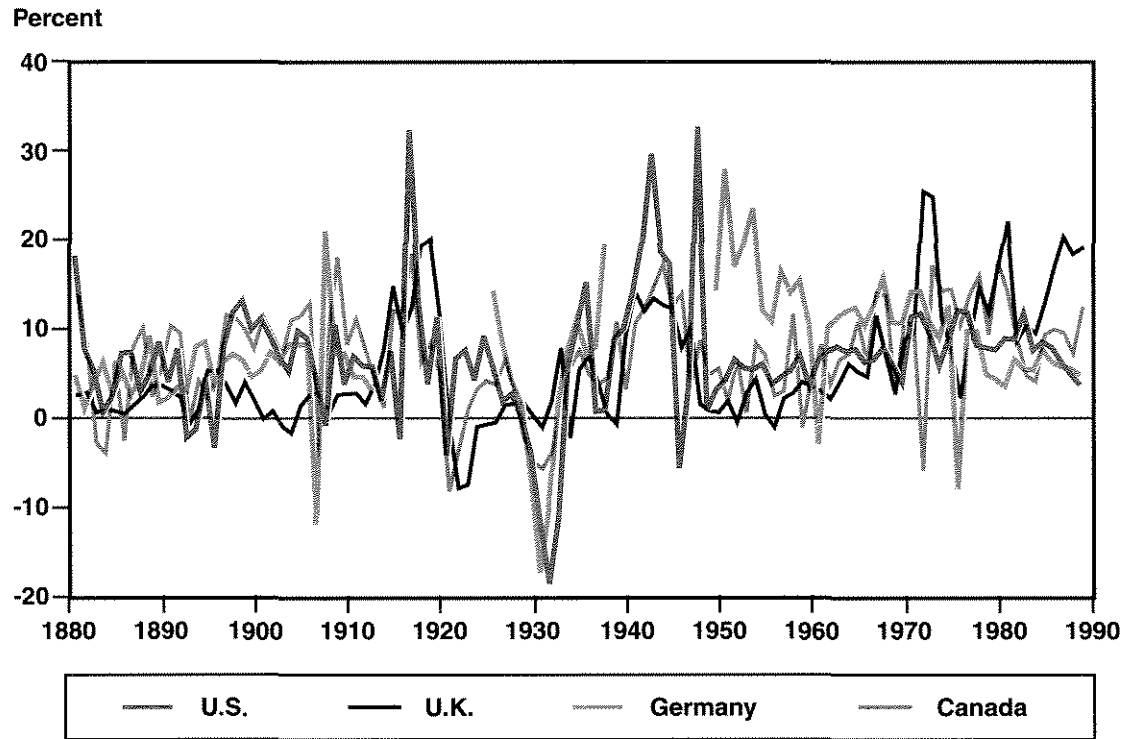
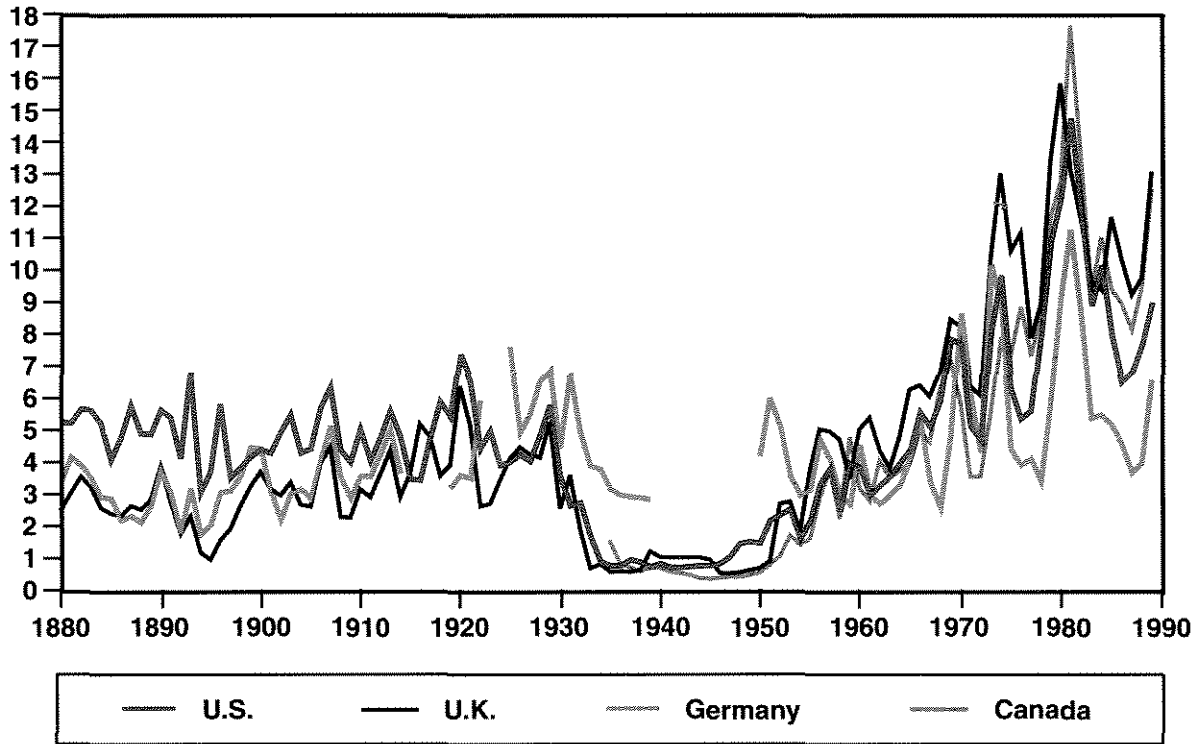


Figure 4
Short-Term Interest Rates, 1880-1989, G7 Countries

Percent



Percent

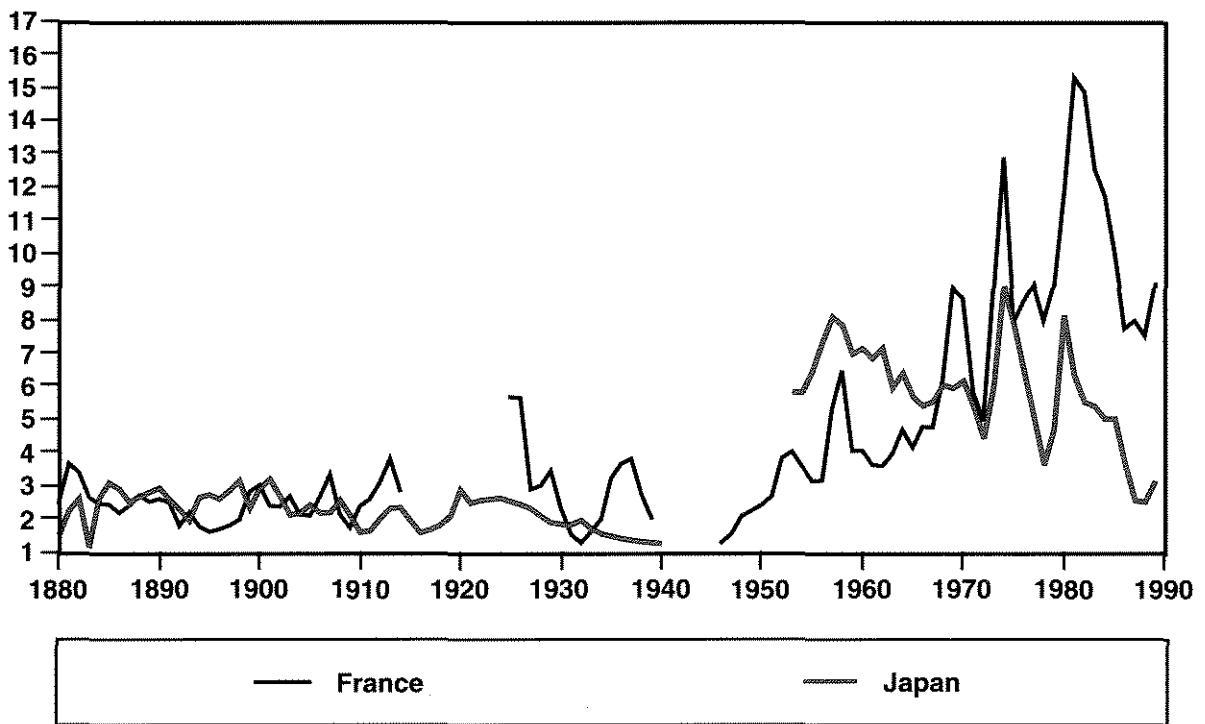
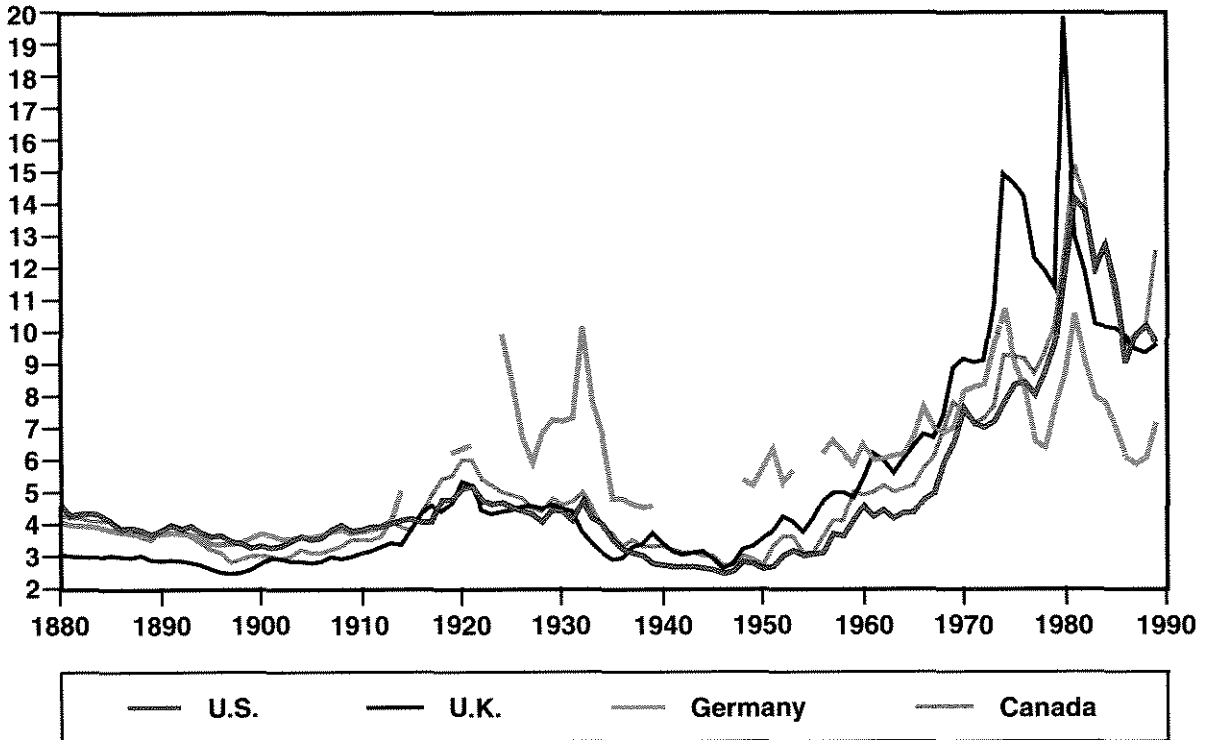
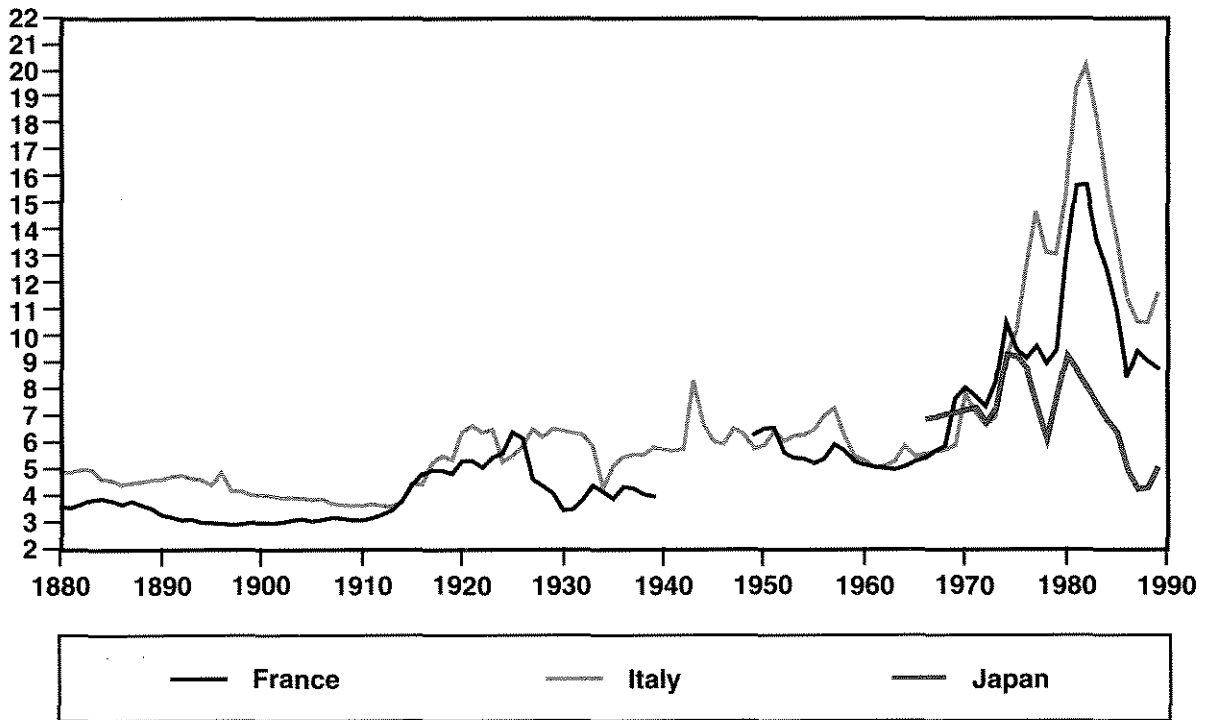


Figure 5
 Long-Term Interest Rates, 1880-1989, G7 Countries

Percent



Percent



Real short-term and real long-term interest rates. For the underlying real short-term and real long-term interest rate data, see figures 6 and 7. The real interest rates are *ex post* rates calculated using the rate of change of a consumer price index.³³ Unlike the nominal series, the degree of convergence in means between real short-term interest rates is lowest in the floating exchange rate period, next lowest in the Bretton Woods convertible period and highest in the preconvertible period. For long-term real rates, as in the case of nominal rates, convergence is highest under the gold standard followed by the Bretton Woods convertible regime. It is lowest under preconvertible Bretton Woods. The real short-term interest rate is most stable across countries during the Bretton Woods convertible period. It also shows the least amount of divergence in standard deviations. The same holds for real long-term interest rates.

The behavior of real interest rates across regimes is consistent with McKinnon's explanation.³⁴ He argued that fixed exchange rates encourage capital market integration by eliminating devaluation risk. This reduces variability in short-term real interest rates. Similarly, real long-term interest rates are stabilized by pooling across markets, which reduces capital market risk.

Nominal and real exchange rates. The lowest mean rate of change of the nominal exchange rate and the least divergence between rates of change occurred during the Bretton Woods convertible and gold standard periods, with the former exhibiting the lowest degree of divergence. Exchange rates during the preconvertible Bretton Woods regime changed almost as much as during the floating period. This mainly reflected the major devaluations of 1949 (see figure 8).³⁵ Nominal exchange rates were least variable in the gold standard and convertible Bretton Woods periods and the most variable and most divergent in the Bretton Woods preconvertible period.

As with the nominal exchange rate, the lowest mean rate of change in the real exchange rate

across countries and the least divergence between countries was in the Bretton Woods convertible period, with the divergence in gold standard period next smallest (see figure 9). The highest rate of change was in the floating exchange rate period. Similarly data from the Bretton Woods convertible period had the lowest standard deviation across countries and the least divergence between standard deviations, with the gold standard again next in these rankings. The other regimes were characterized by much greater variability and divergence. These results shed light on the relationship between the nominal exchange rate regime and the behavior of real exchange rates. Mussa (1986) presented evidence for 16 industrial countries in the post-World War II period showing the similarity between nominal and real exchange rate variability under floating rates. His explanation for greater real exchange rate variability under floating rates than under fixed rates is nominal price rigidity.³⁶ The explanation may, however, be questioned. For example, a fixed nominal exchange rates may produce greater trade stability that will be reflected in the real exchange rate, as is evident for both the Bretton Woods and gold standard periods. Yet as Eichengreen (1991b) points out and as can be seen in table 4, these results could be explained by the fact that both periods were characterized by few shocks.³⁷

Finally, based on monthly data between 1880 and 1986 for the United Kingdom and the United States, Grilli and Kaminsky show that, with the exception of the post-World War II period, no clear connection exists between the nominal exchange rate regime and the variability of real exchange rates.³⁸ My results for the Group of Seven countries show a clear correlation between nominal exchange rate rigidity and lower real exchange rate variability for the gold standard and Bretton Woods convertible regime. For the preconvertible Bretton Woods period—*de jure* a type of fixed exchange rate regime—the correlation is not evident. I do not distinguish between fixed and flexible periods in the interwar segment as do Grilli and Kaminsky,

³³Define the real interest rate as $r_t = i_t - \Delta \log P_t$; where i_t is the nominal interest rate and $\Delta \log P_t = \log P_t - \log P_{t-1}$ is the percentage change in the consumer price index.

³⁴See McKinnon (1988).

³⁵See Bordo (1993) table 2.

³⁶Also see Dornbusch (1976).

³⁷Stockman (1983 and 1988) argues that greater variability

in real exchange rates under floating rates than under fixed rates reflects the response of real exchange rates to productivity shocks, with changes in the real exchange rate producing nominal exchange rate volatility. This volatility is offset under fixed rates by exchange market intervention.

³⁸See Grilli and Kaminsky (1991).

Figure 6
Real Short-Term Interest Rates, 1880-1989, G7 Countries

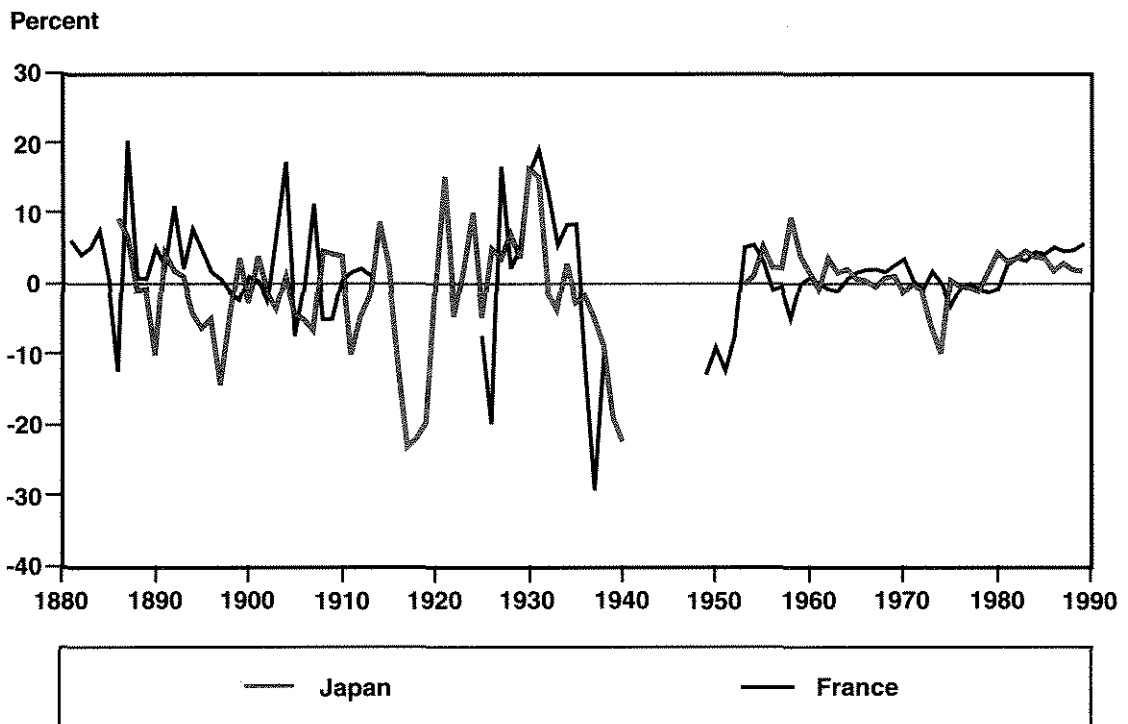
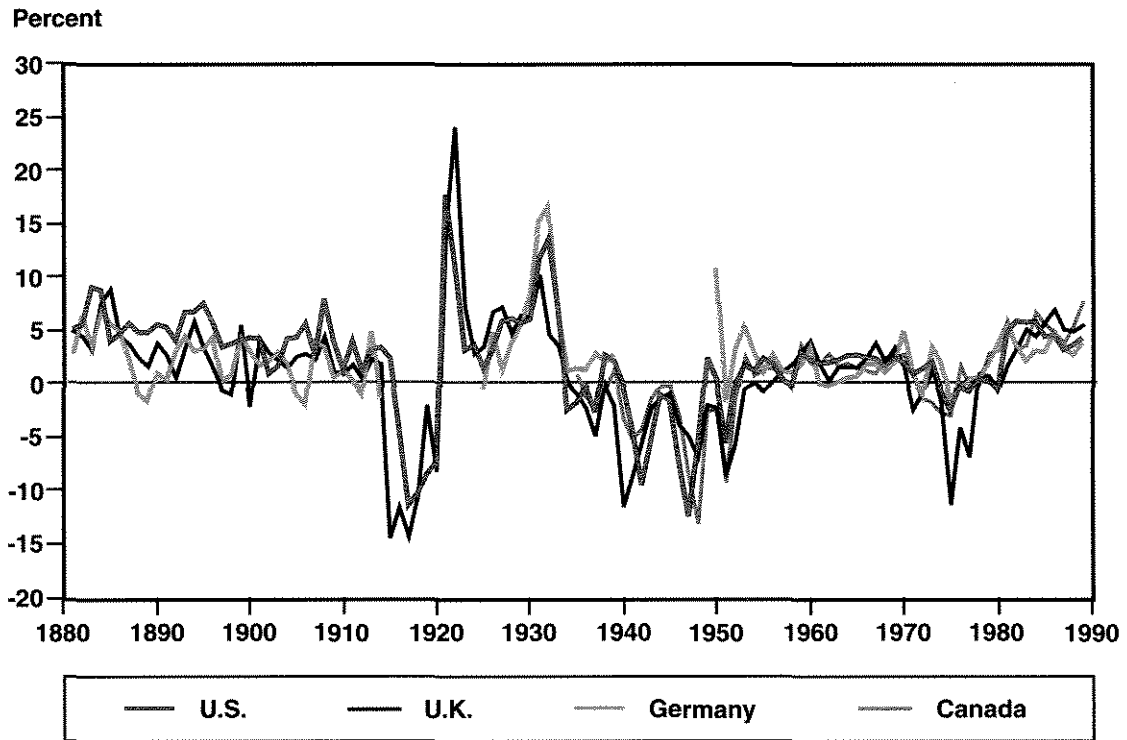
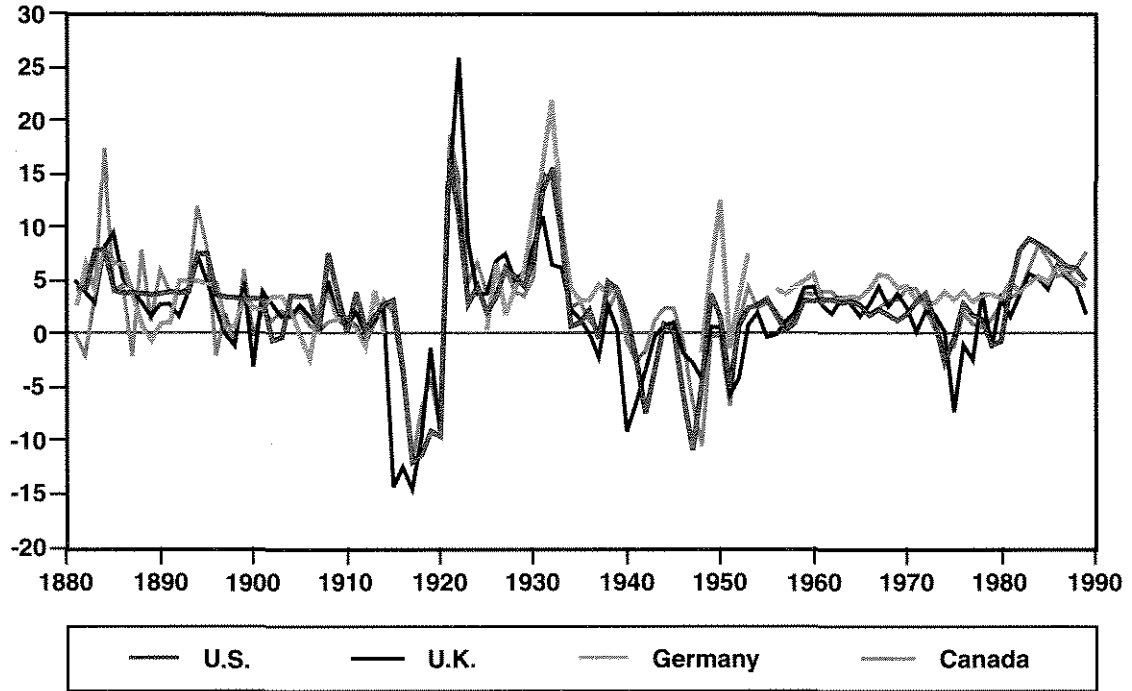


Figure 7

Real Long-Term Interest Rates, 1880-1989, G7 Countries

Percent



Percent

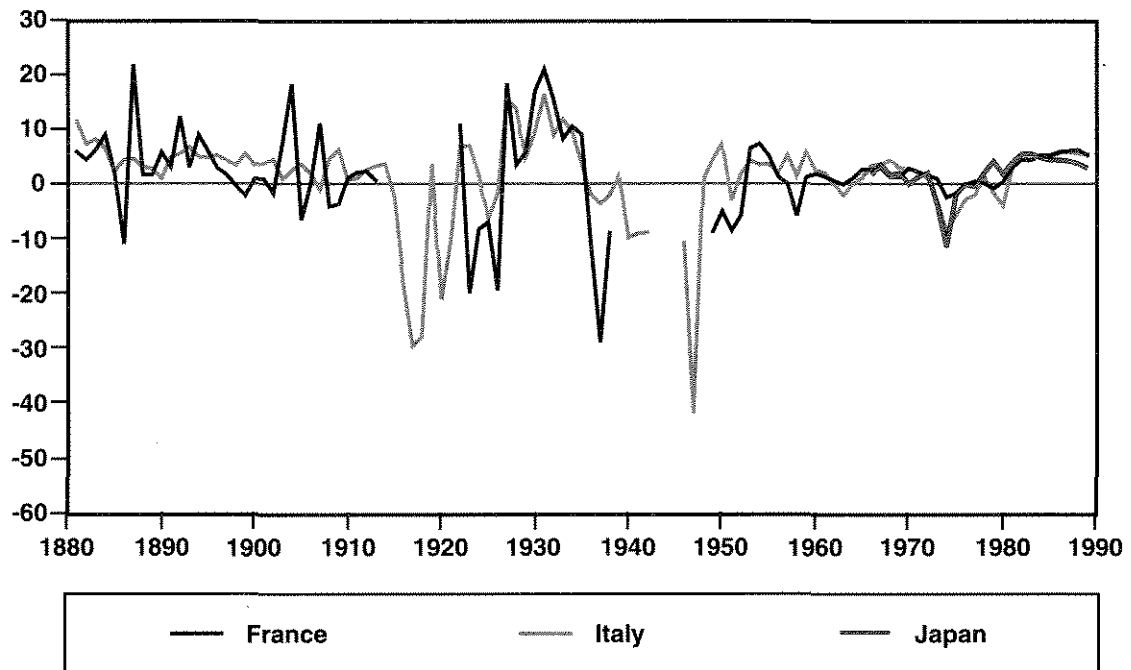
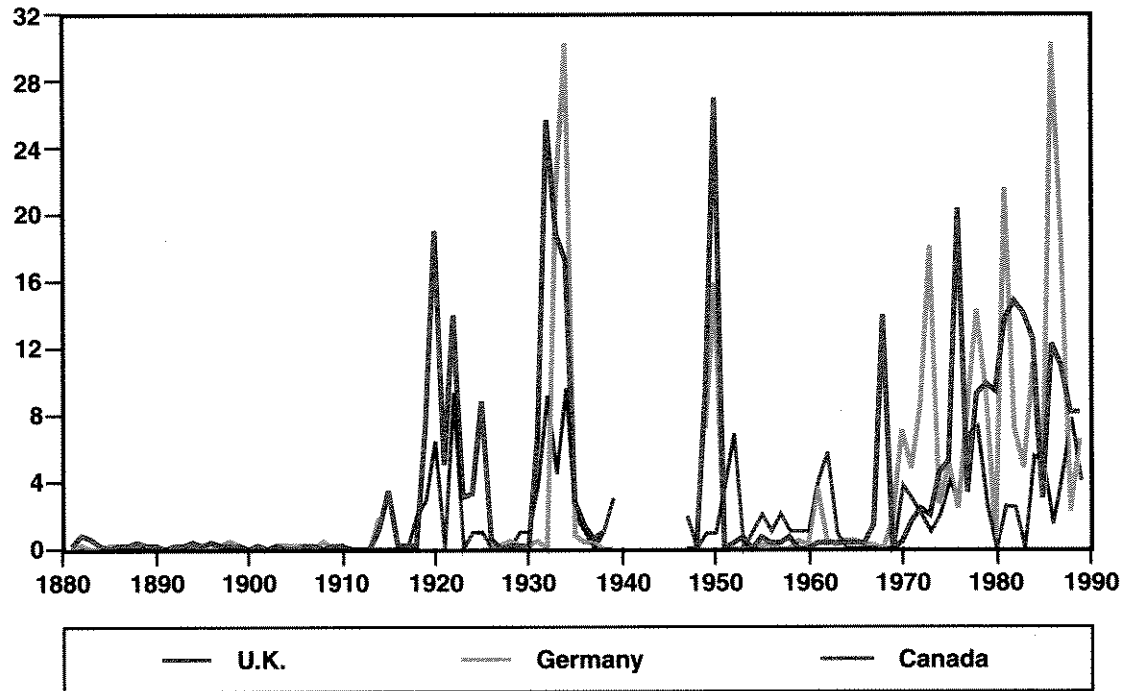


Figure 8
Absolute Change in Nominal Exchange Rates, 1880-1989, G7 Countries

Percent



Percent

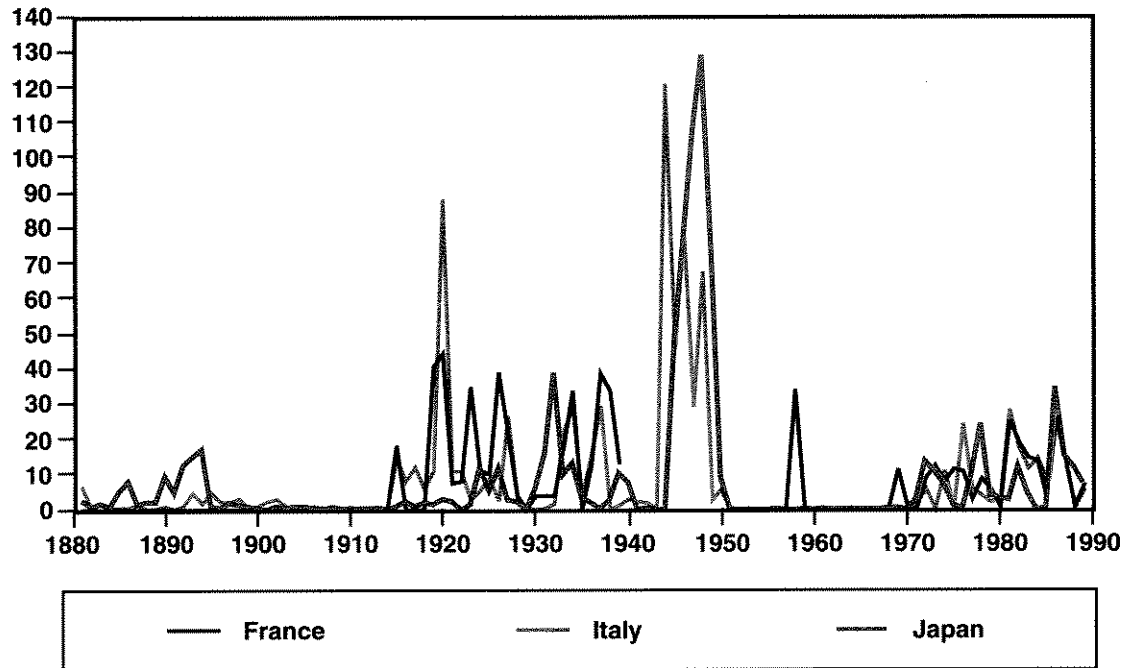
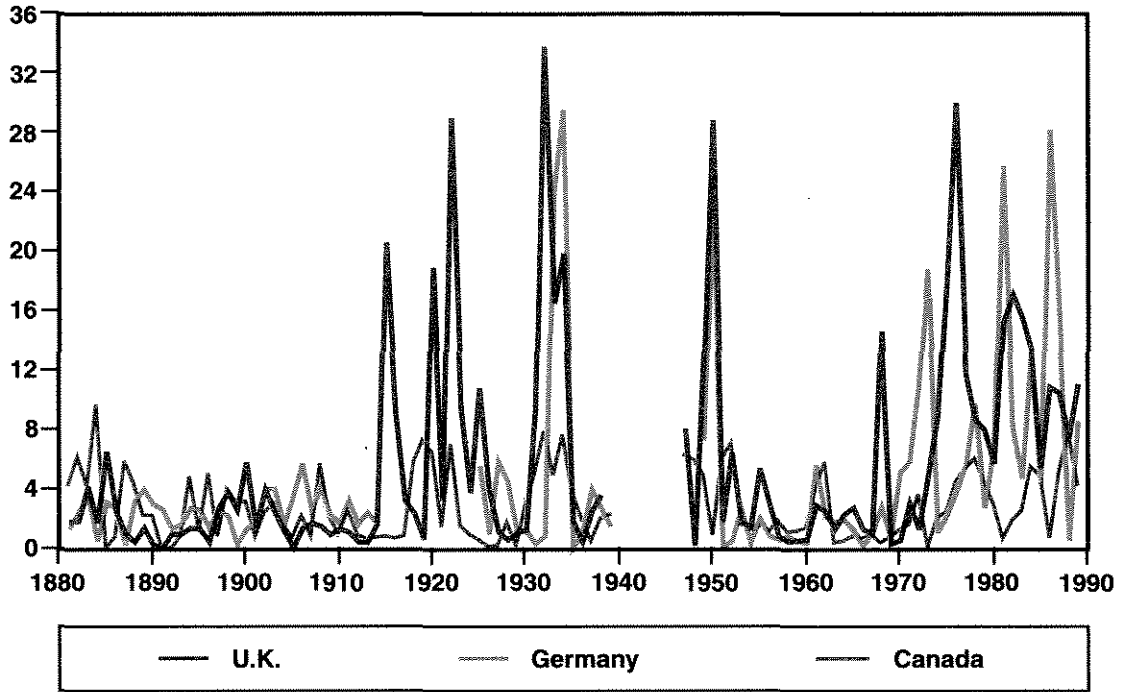
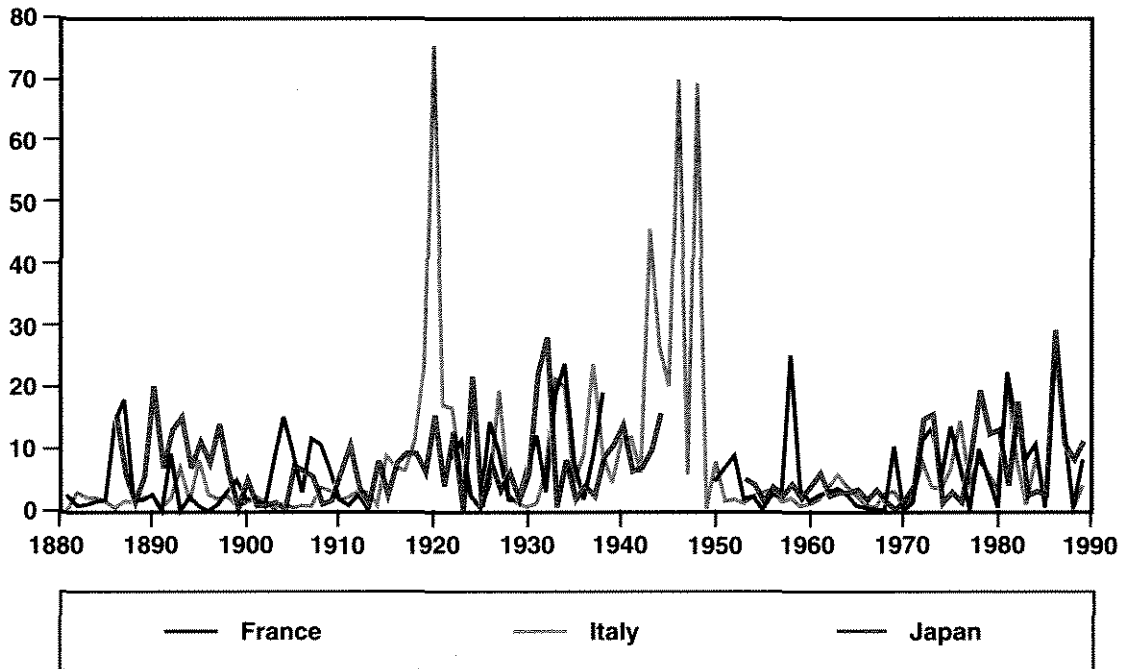


Figure 9
Absolute Change in Real Exchange Rates, 1880-1989, G7 Countries

Percent



Percent



hence that period cannot be used in the comparison.³⁹

In summary, the Bretton Woods regime exhibited the best overall macroeconomic performance of any regime. This is especially so for the convertible period (1959–70).⁴⁰ As the summary statistics in table 1 show, both nominal and real variables were most stable in this period. The floating exchange rate regime, on most criteria, was not far behind the Bretton Woods convertible regime, whereas the classical gold standard exhibited the most stability and the closest convergence of financial variables.

The preconvertible Bretton Woods period (1946–58) was considerably less stable for the average of all countries for both nominal and real variables than other regimes. Also both nominal and real variables did not vary nearly as closely together. These differences likely reflect the presence of pervasive exchange and capital controls before 1958 and, related to these, more variable and more rapid monetary growth. These data, however, are limited. Although they show excellent performance for the convertible Bretton Woods regime, they do not tell us why it did well—whether it reflected a set of favorable circumstances, whether it reflected the absence of aggravating shocks, whether it reflected stable monetary policy by the key country of the system, the United States, or whether it masked underlying strains to the system.

Inflation Persistence

A second piece of evidence is persistent inflation. Evidence of persistence in the inflation rate suggests that market agents expect the monetary authorities to continually follow an inflationary policy; its absence would be consistent with the belief that the authorities are following a stable monetary rule, such as the gold standard's convertibility rule. Barsky (1987) presented evidence for the United Kingdom and United States based on both autocorrelations and time series models that inflation under the

gold standard was very nearly a white-noise process, whereas in the post–World War II period, the inflation rate exhibited considerable persistence. Alogoskoufis and Smith (1991) also show, based on AR(1) regressions of the inflation rate, that inflation persistence in the two countries increased between the classical gold standard period and the interwar period and between the interwar period and the post–World War II period.⁴¹

Table 2 presents the inflation-rate coefficient from the type of AR(1) regressions on consumer price index inflation estimated by Alogoskoufis and Smith, for the Group of Seven countries over successive regimes since 1880, as well as the standard errors and the Dickey-Fuller tests for a unit root.⁴²

The results, as in Alogoskoufis and Smith, 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. Within the post–World War II period, inflation persistence is generally lower, with the exceptions of France and Japan, in the preconvertible Bretton Woods than the convertible period. This suggests that though the immediate post–World War II period was characterized by rapid inflation, market agents may have expected a return to a stable price regime. The higher degree of persistence in the convertible regime suggests that this expectation lost credence. Finally, the evidence that persistence was generally highest during the floating exchange rate regime may imply that the public realized that there was no longer a stable nominal anchor.

Forecast Errors in Inflation and Growth

A third piece of evidence relates to the forecast errors of inflation and real output growth. According to Meltzer and Robinson (1989), "a welfare maximizing monetary rule would reduce variability to the minimum inherent in nature and

³⁹Meltzer (1990) in a comparison of EMS and non-EMS countries in the floating rate period also finds a strong correlation between changes in nominal and real exchange rates.

⁴⁰McKinnon (1992) treats the period 1950 to 1970 as the *de facto* dollar standard. He views this period rather than 1959 to 1971 as the appropriate one for making the type of regime comparisons undertaken here. I made the same calculations as those shown in table 1 for the period 1950 to 1971. Virtually every variable for each country exhibited greater instability than in the 1959 to 1970 period. This reinforces my choice of dates.

⁴¹Also see Alogoskoufis (1992), who attributes the increase in persistence to the accommodation by the monetary authorities of shocks. This evidence is also consistent with the results of Klein (1975).

⁴²Eichengreen (1992b) also presents these statistics for four of the countries.

Table 2
Persistence of CPI Inflation: Group of Seven Countries 1880-1989
Annual Data: Coefficient of AR1 Regression; (Standard error); t - statistic for unit root test

	United States			United Kingdom			Germany			France		
	AR1 Coefficient	Standard Error	t - statistic	AR1 Coefficient	Standard Error	t - statistic	AR1 Coefficient	Standard Error	t - statistic	AR1 Coefficient	Standard Error	t - statistic
Gold Standard Interwar	0.27	(0.18)	4.05	0.30	(0.17)	4.03	0.51	(0.16)	3.06	-0.22	(0.18)	6.78
Bretton Woods (Total)	0.45	(0.17)	3.18	0.35	(0.19)	3.37	0.51	(0.21)	2.33	0.42	(0.24)	2.42
Bretton Woods (Preconvertible)	0.49	(0.19)	2.68	0.33	(0.20)	3.35	-0.03	(0.21)	4.90	0.56	(0.16)	2.75
Bretton Woods (Convertible)	0.41	(0.27)	2.19	0.15	(0.29)	2.93	-0.07	(0.31)	3.00	0.60	(0.27)	1.48
Floating Exchange Post World War II	1.07	(0.20)	-0.35	0.57	(0.34)	1.26	0.44	(0.31)	1.81	0.12	(0.14)	6.29
	0.68	(0.18)	1.78	0.69	(0.19)	1.63	0.83	(0.14)	1.21	0.85	(0.16)	0.94
	0.65	(0.12)	2.92	0.75	(0.10)	2.50	0.31	(0.15)	4.60	0.69	(0.11)	2.82

	Japan			Canada			Italy		
	AR1 Coefficient	Standard Error	t - statistic	AR1 Coefficient	Standard Error	t - statistic	AR1 Coefficient	Standard Error	t - statistic
Gold Standard Interwar	0.22	(0.18)	4.33 ¹	0.08	(0.18)	5.11	0.28	(0.14)	5.14
Bretton Woods (Total)	0.70	(0.25)	1.20	0.35	(0.20)	3.25	0.28	(0.18)	4.00
Bretton Woods (Preconvertible)	0.52	(0.18)	2.67	0.39	(0.19)	3.21	0.21	(0.12)	6.58
Bretton Woods (Convertible)	0.47	(0.27)	1.96	0.32	(0.28)	2.43	0.18	(0.18)	4.56
Floating Exchange Post World War II	0.18	(0.31)	2.64	0.81	(0.20)	0.95	0.38	(0.29)	2.14
	0.70	(0.19)	1.58	0.75	(0.17)	1.47	0.75	(0.17)	1.47
	0.54	(0.13)	3.54	0.65	(0.11)	3.18	0.28	(0.10)	7.20

For data sources see table 1.

The 5 percent significance level for unit root test with 25 observations is 3.00.

¹GNP deflator was used because of unavailability of CPI data.

institutional arrangements." They measure variability by the mean absolute error (MAE) of a one-period forecast based on the univariate multistate Kalman Filter (MSKF). Following their approach, table 3 presents the MAEs for inflation and real growth for the Group of Seven countries over successive regimes. The MSKF forecasts incorporate both transitory and permanent shocks to the rate-of-change series.⁴³

The smallest forecast errors for inflation on average were for the Bretton Woods convertible period, followed by the gold standard and the floating rate periods. The largest errors were for the interwar period, followed by the preconvertible Bretton Woods period. The most notable exception to the pattern was the United Kingdom, where the floating rate period exhibited the largest variability.

For real growth, as for the inflation rate, the lowest MAE, on average, occurred in the convertible Bretton Woods period. Another exception to this pattern was Japan. The highest MAE was again in the interwar and the preconvertible Bretton Woods period. The floating exchange rate period, though more variable than the convertible Bretton Woods period, was slightly less variable than the gold standard regime.

These results are quite consistent with those of table 1. The Bretton Woods convertible period was the most stable both in an *ex post* and *ex ante* sense. The performance of the gold standard and the float, however, are not much worse, at least for real growth for the float and inflation for the gold standard.

Demand and Supply Disturbances

An important issue is the extent to which the performance of alternative monetary regimes, as revealed by the data in the preceding tables, 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, following earlier work by Bayoumi and Eichengreen, is to identify underlying shocks to aggregate supply and demand.⁴⁴ According to them, 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.

The approach used to calculate aggregate supply and demand shocks is an extension of the bivariate structural vector autoregression (VAR) methodology developed by Blanchard and Quah.⁴⁵ Following Bayoumi and Eichengreen (1992a), I estimated a two-variable VAR on the rate of change of the price level and output.⁴⁶ Restrictions on the VAR identify an aggregate demand disturbance, which is assumed to have only a temporary effect on output and a permanent effect on the price level, and an aggregate supply disturbance, which is assumed to have a permanent effect on both prices and output.⁴⁷ Overidentifying restrictions, namely, restrictions that demand shocks are positively correlated and supply shocks are negatively correlated with prices, can be tested by examining the impulse response functions to the shocks.

The methodology has important limitations that suggest that the results should be viewed with caution. The key limitation is that one can easily imagine frameworks in which demand shocks have permanent effects on output, whereas supply shocks have only temporary effects.⁴⁸

I estimated supply (permanent) and demand (temporary) shocks, using annual data for each of the Group of Seven countries, over alternative regimes in the period 1880–1989. The VARs are based on three separate sets of data—1880–1913, 1919–39 and 1946–89—with the war years omitted because complete data on them were available for only four of the countries.⁴⁹ The VARs have two lags. I also did the estimation for

⁴³Meltzer and Robinson (1989) present their results for levels, growth rates, and permanent growth rates of the series. I present only growth rates to make the results comparable to those in table 1.

⁴⁴See Bayoumi and Eichengreen (1992a, 1992b, 1992c and 1992d).

⁴⁵See Blanchard and Quah (1989).

⁴⁶Both variables were rendered stationary by first differencing.

⁴⁷Specifically, four restrictions are placed on the matrix of the shocks: two are simple normalizations, which define the variances of the shocks to aggregate demand and aggregate supply; the third assumes that demand and

supply shocks are orthogonal; the fourth is that demand shocks have only temporary effects on output, that is, that the cumulative effect of demand shocks on the rate of change in output must be zero.

⁴⁸See Keating and Nye (1991).

⁴⁹For results using the complete data set for these four countries, see appendix table 1 and appendix figure 1.

Table 3
Forecast Errors in Inflation and Real Growth: Group of Seven Countries 1880-1989
Annual Data: Mean Absolute Errors Using the Multistate Kalman Filter

	Gold Standard (1880-1913)		Interwar (1919-1939)		Bretton Woods (Total) (1946-1970)		Bretton Woods (Preconvertible) (1946-1958)		Bretton Woods (Convertible) (1959-1970)		Floating Exchange (1973-1989)	
	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation
United States	2.04	1.59	4.79	4.61	3.22	2.32	5.02	3.44	1.28	1.12	1.65	2.46
United Kingdom	1.42	2.10	4.11	4.41	1.41	1.47	1.82	1.76	0.97	1.15	2.83	4.66
Germany	1.69	1.69	8.07	3.97	2.77	2.59	3.24	4.99	2.49	1.18	1.49	1.30
France	2.25	2.47	5.54	7.07	1.51	3.13	2.28	4.62	0.87	2.14	1.47	2.74
Japan	1.69	3.95	2.71	6.83	1.59	2.63	0.98	5.48	1.60	0.96	1.34	2.95
Canada	1.58	0.80	7.16	3.99	2.19	1.92	3.06	2.96	1.24	0.79	1.72	2.29
Italy	2.08	2.01	2.08	7.58	4.21	6.35	7.04	10.53	1.15	1.81	1.14	3.84
Average	1.82	2.09	4.92	5.50	2.41	2.92	3.35	4.82	1.37	1.31	1.66	2.89

Note: For data sources, see table 1.

aggregated price and output data for the Group of Seven countries.⁵⁰

The overidentifying restrictions that demand shocks be positively correlated and supply shocks be negatively correlated with the price level are satisfied for all countries for the two post-World War II regimes. But for the period before World War II, for a number of countries, including the United States, United Kingdom, and France, they are not. Supply shocks were positively correlated with prices. This can be seen in the impulse response functions displayed in figure 10. Figure 10 shows the impulse responses, to one standard deviation shocks in aggregate supply and aggregate demand, on output and prices for the Group of Seven countries aggregate by regime.⁵¹

Keating and Nye (1991) attempted to explain this result by possible hysteresis effects. Bayoumi and Eichengreen (1992a) argued that the perverse impulse response patterns for the classical gold standard and interwar periods reflected the interaction of a positive aggregate demand curve with a very steep aggregate supply curve. They explain the positively sloped aggregate demand curve as reflecting the effects of gold discoveries induced by the supply shock of agricultural settlements in the United States and Australia. These results may also reflect a limitation of the Blanchard-Quah methodology.

Table 4 presents the standard deviations of supply and demand shocks for the Group of Seven countries and the Group of Seven countries taken as a whole (Group of Seven aggregate) by regime. I also show, following Bayoumi and Eichengreen, the weighted average of the individual country shocks.⁵² Figures 11 and 12 show the shocks for the Group of Seven aggregate and for each of the seven countries.

Table 4 shows for the Group of Seven aggregate that the convertible Bretton Woods regime was the most tranquil of all the regimes—neither supply nor demand shocks dominated. It was not, however, that much less turbulent than the succeeding float. The interwar period, unsurprisingly, shows the largest supply and demand shocks.⁵³ Sizeable supply and demand shocks that are two or three times greater than the post-World War II period also characterize the classical gold standard.⁵⁴

For individual countries, the Bretton Woods convertible period was the most stable in four countries and the flexible exchange rate period was the most stable in three. The difference between the convertible Bretton Woods period and the floating exchange rate period, however, was not great in any country. The interwar period as expected was the most volatile. Both types of shocks were the largest in every country except the United Kingdom. Finally, in the majority of countries, with the principal exceptions being the United Kingdom and Germany, both supply and demand shocks were considerably greater in the gold standard period than in the post-World War II period.

The dispersion of demand shocks across countries, as measured by the GNP-weighted standard deviation of the individual country shocks around the Group of Seven aggregate, reveals very little difference between the gold standard and the post-World War II regimes, with the convertible Bretton Woods regime displaying the highest degree of convergence. Dispersion is much greater in the interwar period. The dispersion of supply shocks is considerably greater during the gold standard and the interwar periods than in any of the post-World War II regimes.

⁵⁰The Group of Seven aggregate income growth and inflation rate are a weighted average of the rates 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 Group of Seven countries, where the national income data are converted to U.S. dollars using the actual exchange rates.

⁵¹The impulse response functions were calculated from VARs run for the separate regime periods. Because the number of observations was limited, the Bretton Woods regime could not be split into the two subperiods shown in preceding tables.

⁵²See Bayoumi and Eichengreen (1992a).

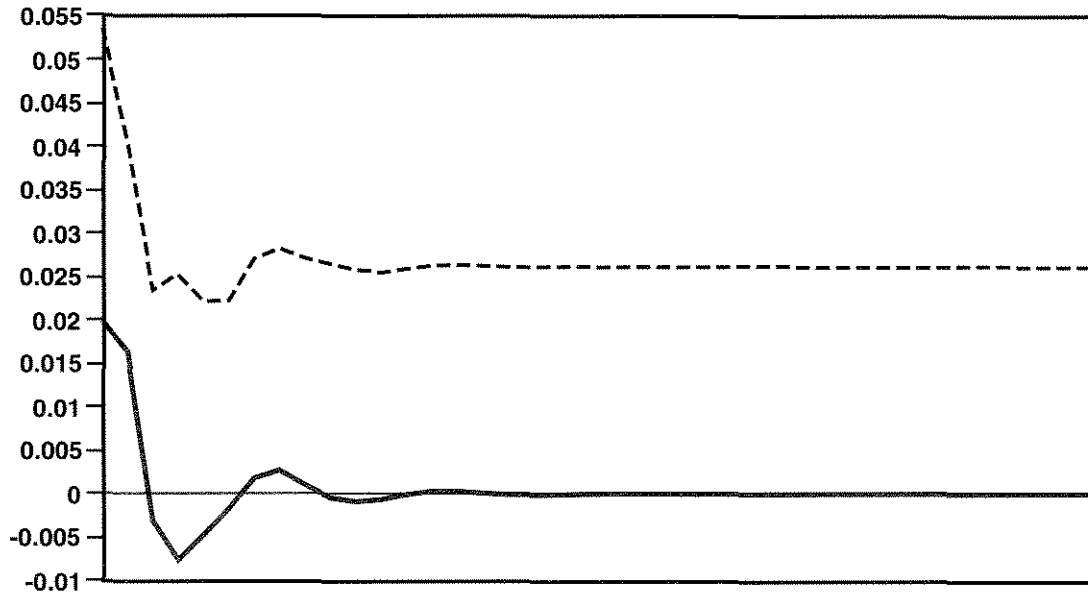
⁵³The results for the Group of Seven in the interwar period (figures 11 and 12) as well as those for four countries (appendix figure 1) are similar to those reported for the United States by Cecchetti and Karras (1992), who estimate a three-variable VAR with monthly data. The late

1920s and early 1930s reveal a major negative demand shock consistent with Friedman and Schwartz's (1963) attribution of the onset of the Great Depression to monetary forces. After 1931, negative supply shocks predominate, consistent with Bernanke's (1983) and Bernanke and James (1991) explanation for the severity of the Great Depression that stresses the collapse of the financial system.

⁵⁴Though the shocks are smaller, the rankings by regime for the weighted average of individual country shocks are similar to the G-7 aggregate.

Figure 10
Impulse Response Functions of Demand and Supply Shocks on Prices (Dotted Lines) and Output (Solid Lines), G7 Aggregate by Regimes, Annual Data, 1881-1989

Effects of Aggregate Demand Shocks, 1881-1913



Effects of Aggregate Supply Shocks, 1881-1913

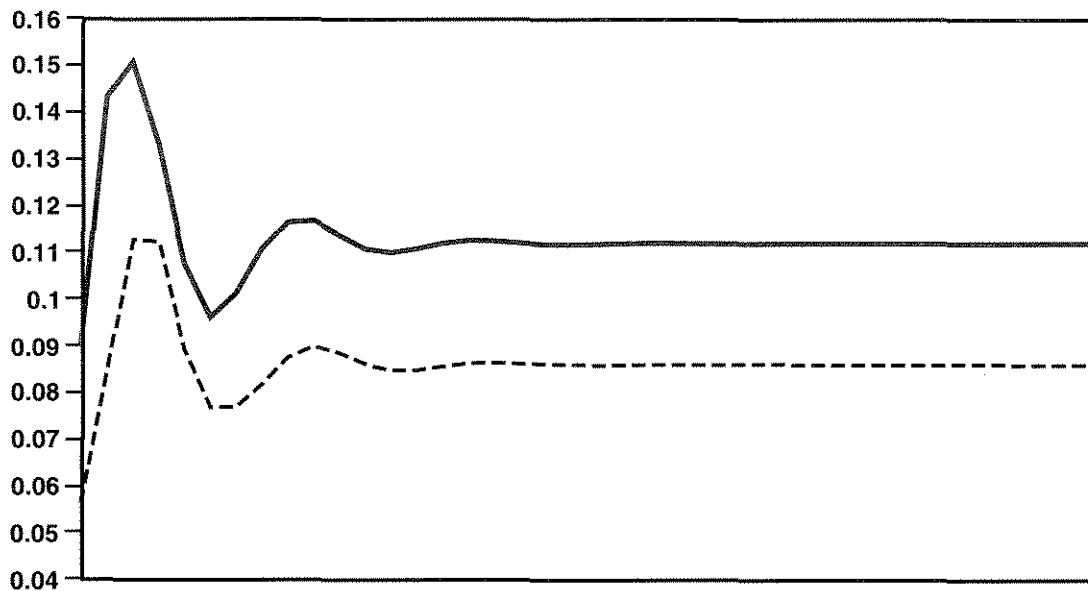
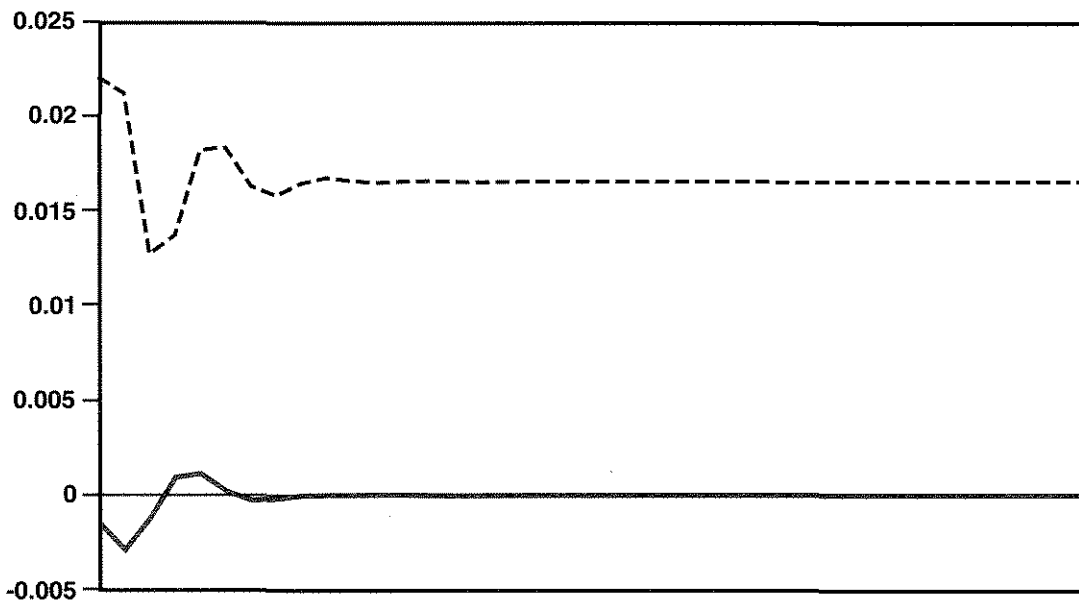


Figure 10 (continued)

Impulse Response Functions of Demand and Supply Shocks on Prices (Dotted Lines) and Output (Solid Lines), G7 Aggregate by Regimes, Annual Data, 1881-1989

Effects of Aggregate Demand Shocks, 1919-1939



Effects of Aggregate Supply Shocks, 1919-1939

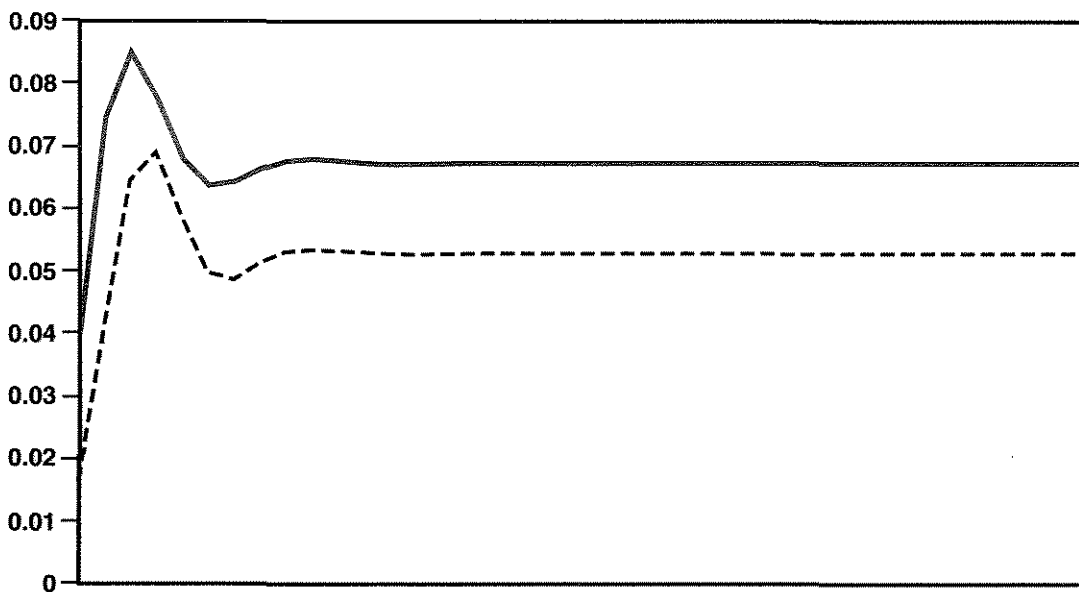
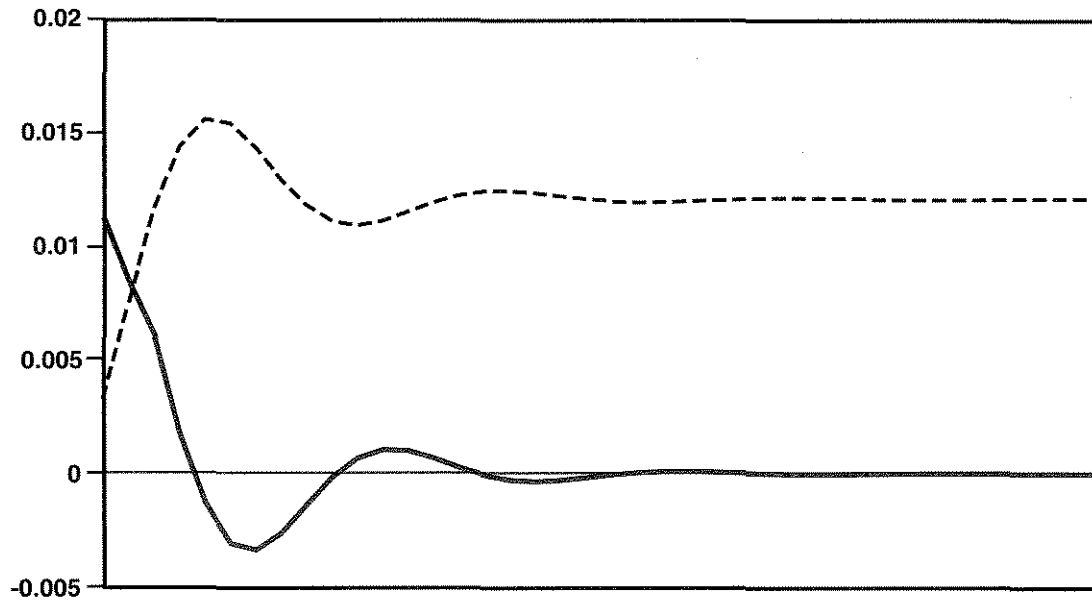


Figure 10 (continued)

Impulse Response Functions of Demand and Supply Shocks on Prices (Dotted Lines) and Output (Solid Lines), G7 Aggregate by Regimes, Annual Data, 1881-1989

Effects of Aggregate Demand Shocks, 1946-1970



Effects of Aggregate Supply Shocks, 1946-1970

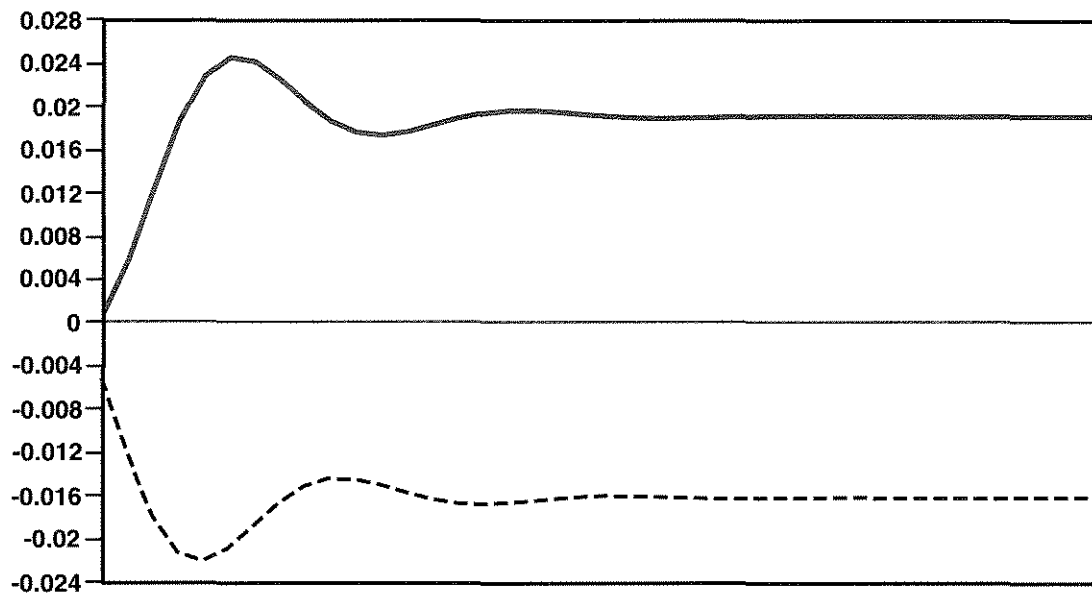
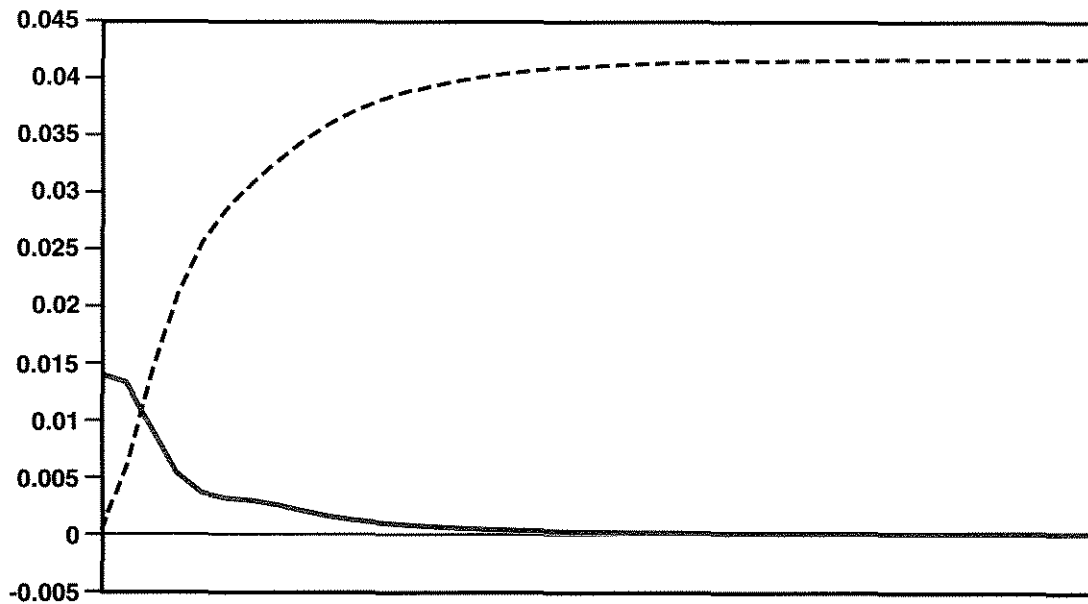


Figure 10 (continued)

Impulse Response Functions of Demand and Supply Shocks on Prices (Dotted Lines)
and Output (Solid Lines), G7 Aggregate by Regimes, Annual Data, 1881-1989

Effects of Aggregate Demand Shocks, 1946-1989



Effects of Aggregate Supply Shocks, 1946-1989

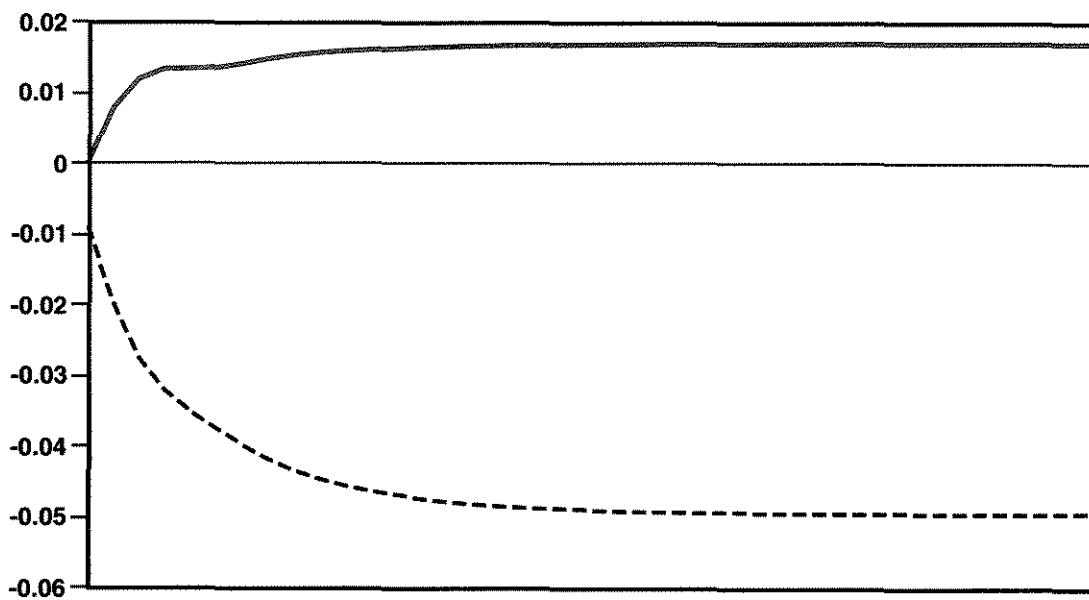
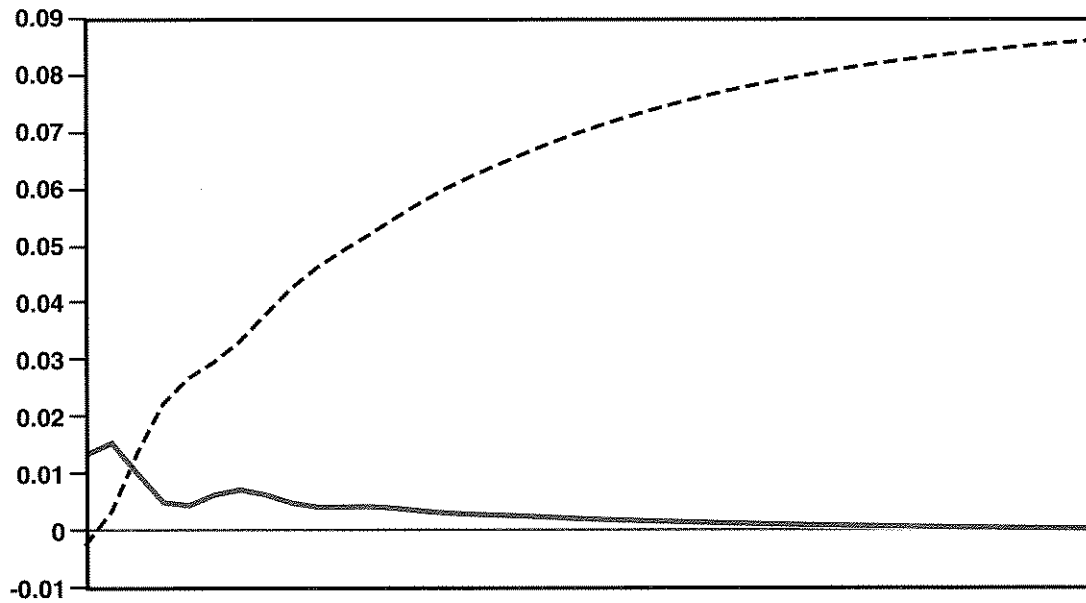


Figure 10 (continued)

Impulse Response Functions of Demand and Supply Shocks on Prices (Dotted Lines) and Output (Solid Lines), G7 Aggregate by Regimes, Annual Data, 1881-1989

Effects of Aggregate Demand Shocks, 1971-1989



Effects of Aggregate Supply Shocks, 1971-1989

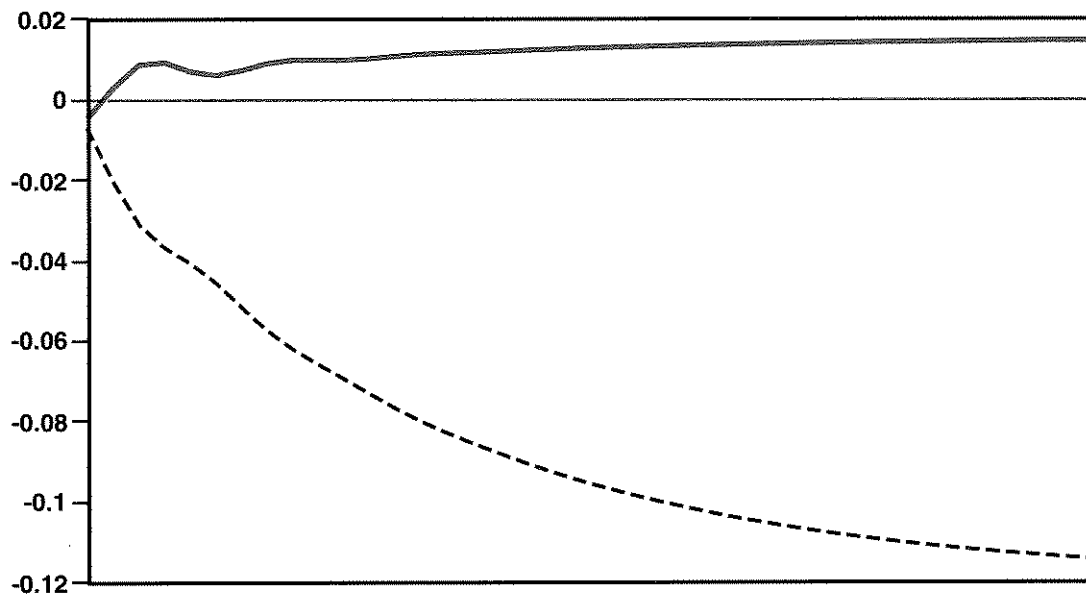


Table 4
Supply (Permanent) and Demand (Temporary) Shocks: 1880-1989
Annual Data: Standard Deviations of Shocks (percent); Dispersion of shocks across countries (percent)

	Gold Standard 1883-1913		Interwar 1921-1939		Bretton Woods (Total) 1948-1970		Bretton Woods (Preconvertible) 1948-1958		Bretton Woods (Convertible) 1959-1970		Floating Exchange 1973-1989		Post WW II 1948-1989	
	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply
United States	2.03	3.81	4.45	6.73	2.33	1.54	3.11	1.98	1.37	1.07	1.72	1.94	2.07	1.68
United Kingdom	2.66	2.16	1.93	3.52	2.62	1.95	3.06	2.61	2.26	1.14	3.57	4.31	3.03	3.10
Germany	2.37	2.32	4.47	3.13	2.88	2.65	1.85	2.87	3.34	2.66	1.66	1.39	2.36	2.20
France	4.58	3.75	7.17	5.19	3.50	1.75	3.23	1.61	3.77	1.84	1.93	1.52	2.84	1.70
Japan	4.85	3.39	6.28	5.36	3.18	2.56	4.05	1.97	2.83	2.78	2.39	2.50	2.75	2.69
Canada	0.93	2.75	4.01	8.61	2.42	2.60	3.09	3.70	1.74	0.98	2.66	2.10	2.48	2.47
Italy	3.16	3.13	7.40	4.14	2.76	1.75	2.93	1.85	2.56	1.73	3.58	1.91	3.30	2.47
G7	1.56	2.21	3.09	4.12	1.24	0.86	1.99	1.00	0.75	0.80	1.50	0.95	1.40	0.91
G7*	1.49	2.08	2.99	4.61	1.11	0.81	1.64	1.01	0.75	0.71	1.40	1.60	1.28	1.32
Dispersion	3.94	5.03	8.25	8.58	3.93	2.38	3.44	1.89	4.09	2.54	3.53	2.74	3.69	2.63

G7: G7-aggregate data

G7*: Weighted average of individual country shocks; the weights are calculated as the share of each country's National Income in the Total Income in the G7 countries, where the GNP/GDP data are converted to dollars using the actual exchange rate.

Dispersion = $\sum_i (\text{weight}_i \cdot \text{shock}_i)^2$

for i = United States, United Kingdom, Germany, France, Japan, Canada, Italy

Figure 11
Supply and Demand Shocks: G7 Aggregate, 1880-1989, Annual Data

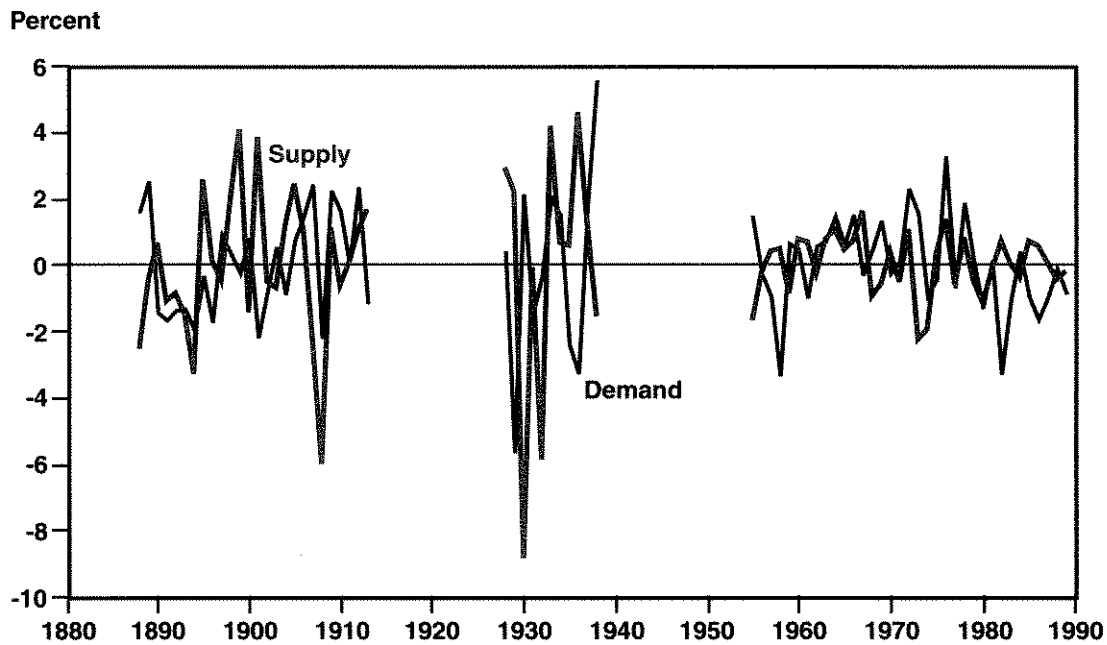


Figure 12
Supply and Demand Shocks: 1880-1989, United States

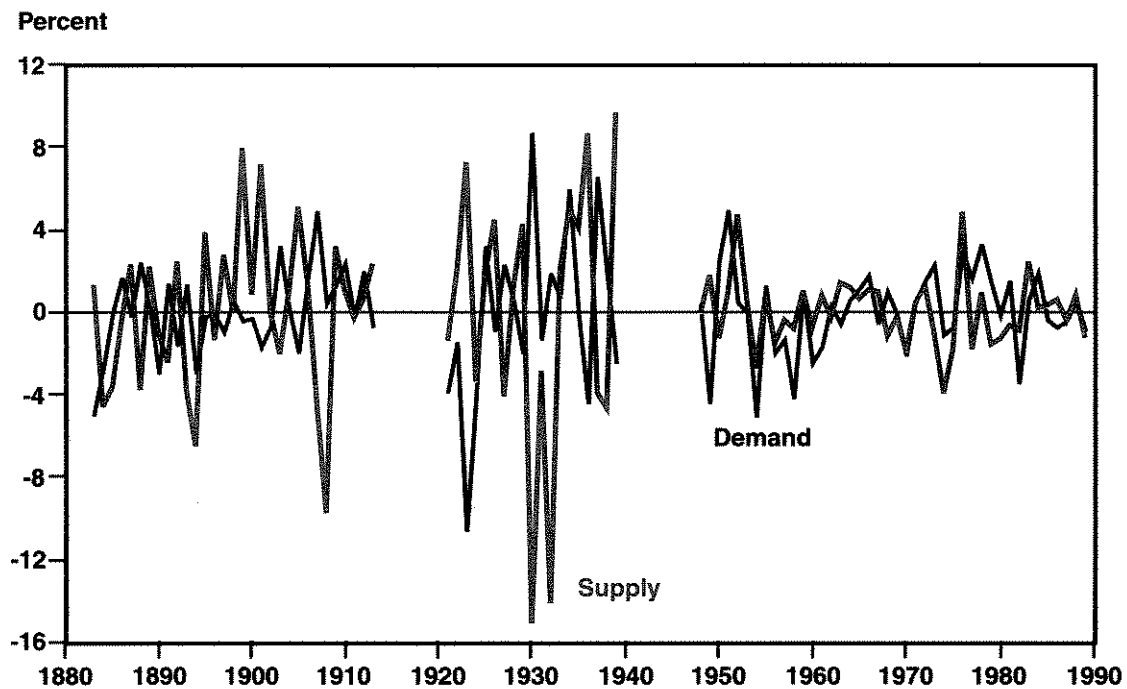
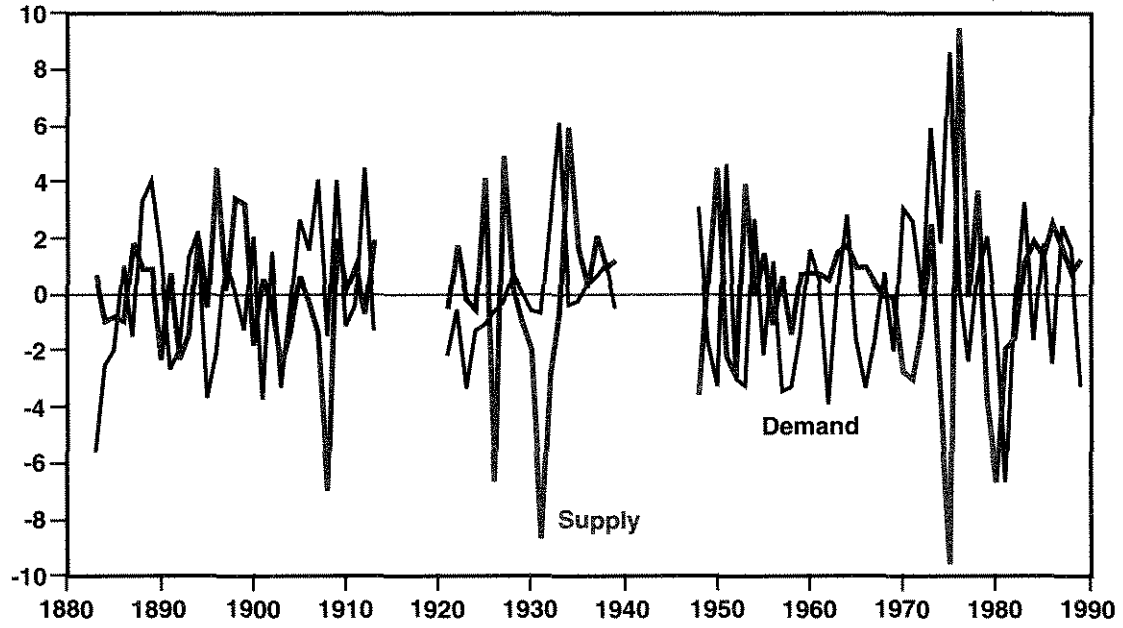


Figure 12 (continued)

Supply and Demand Shocks: 1880-1989, United Kingdom

Percent



Supply and Demand Shocks: 1880-1989, Germany

Percent

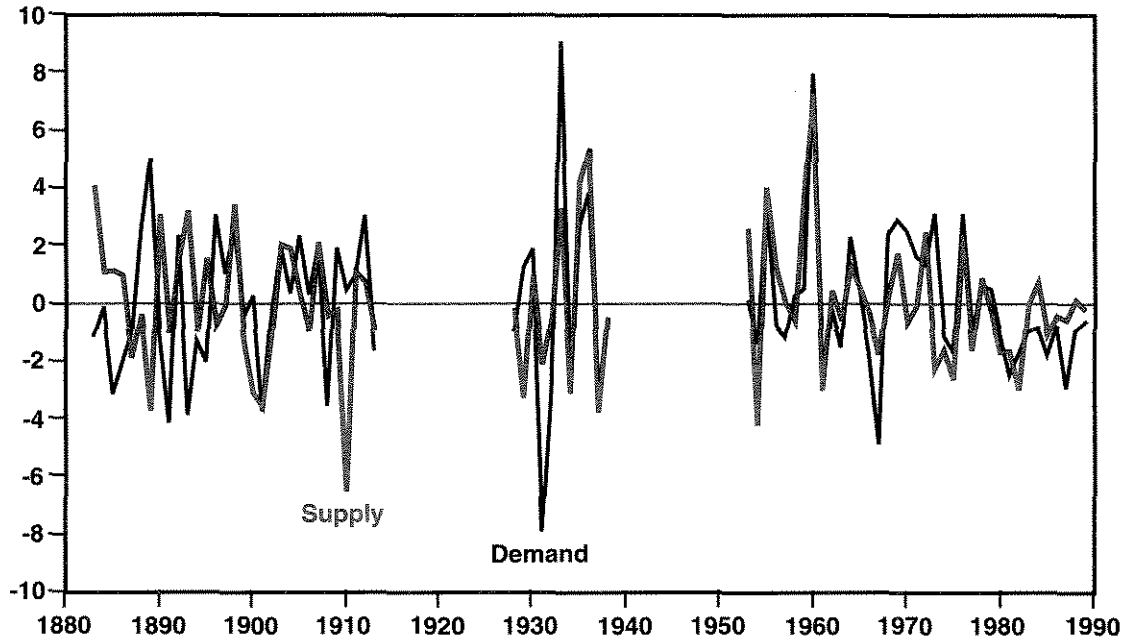
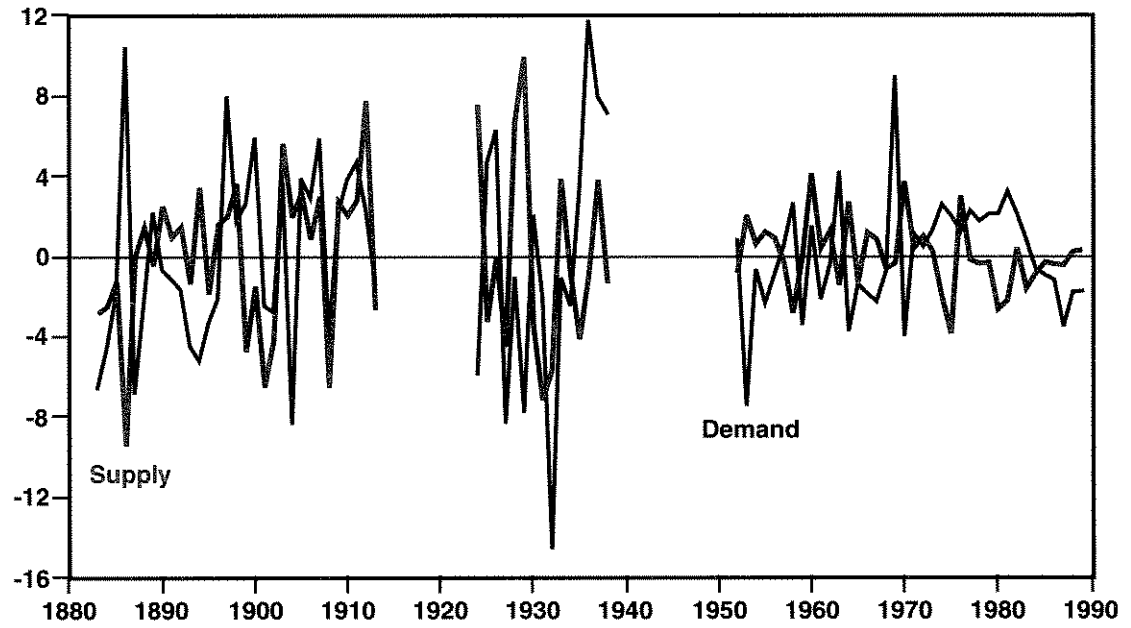


Figure 12 (continued)

Supply and Demand Shocks: 1880-1989, France

Percent



Supply and Demand Shocks: 1880-1989, Japan

Percent

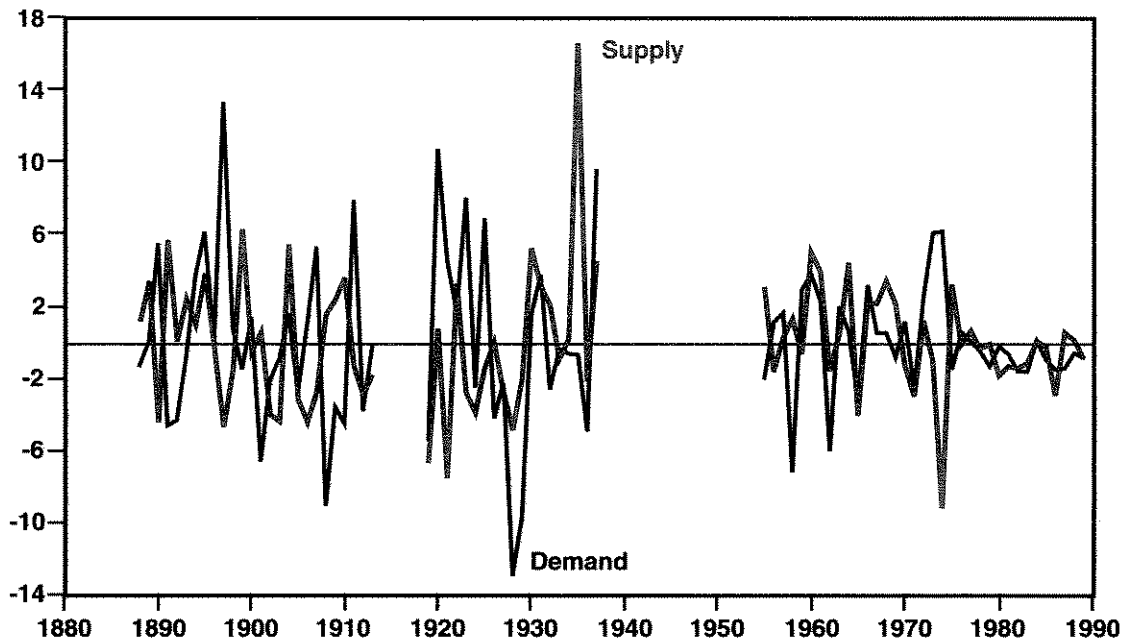
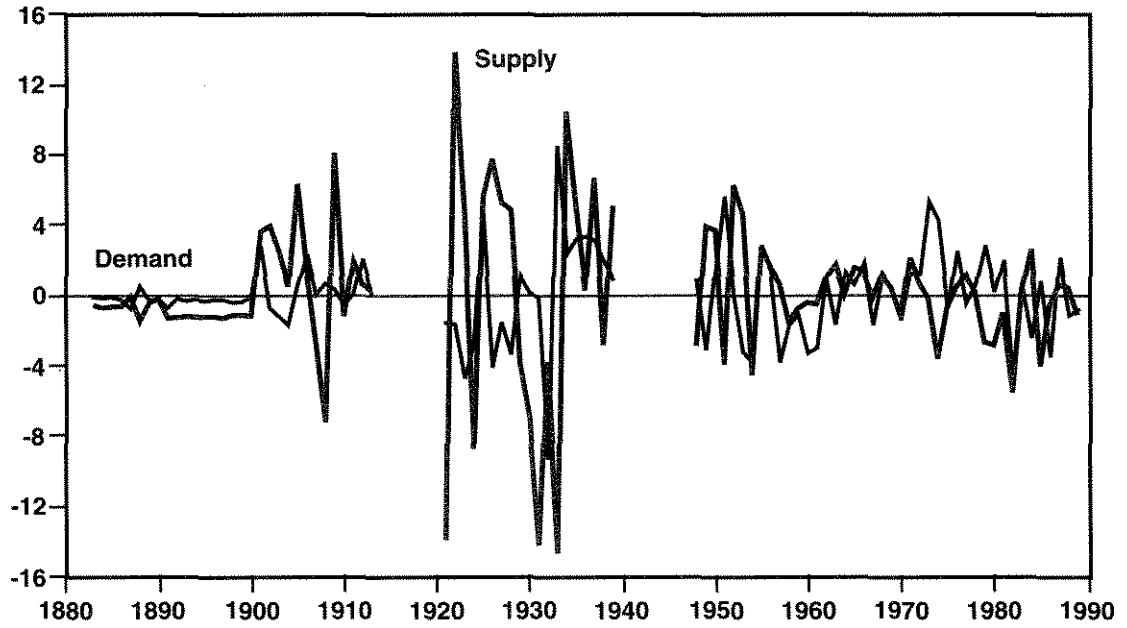


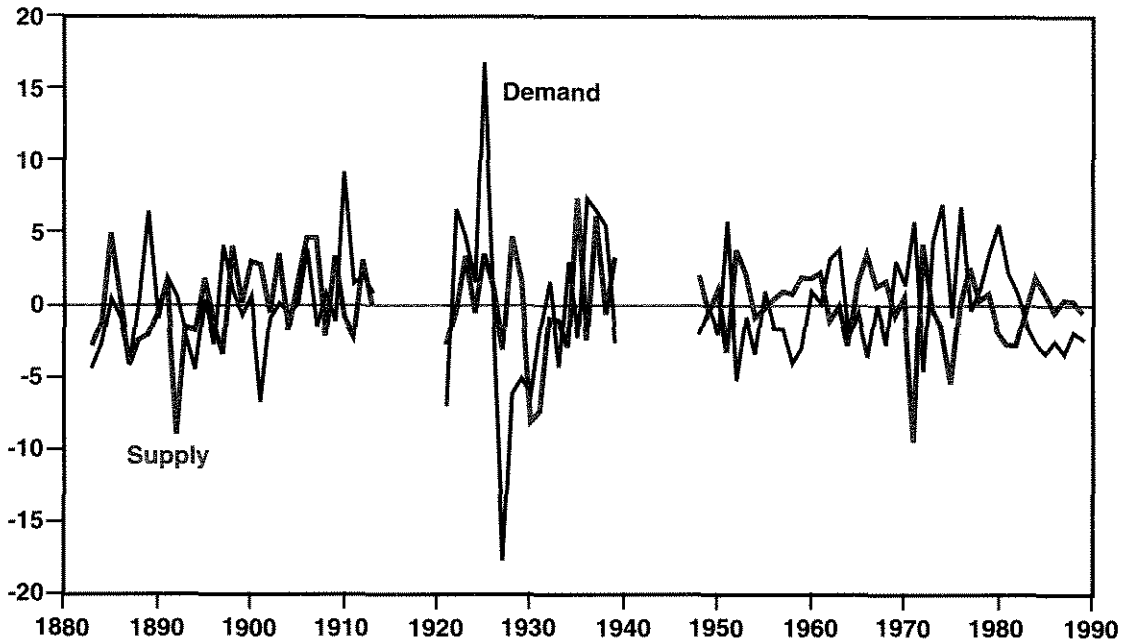
Figure 12 (Continued)

Supply and Demand Shocks: 1880-1989, Canada

Percent

**Supply and Demand Shocks: 1880-1989, Italy**

Percent



In sum, the evidence on supply and demand shocks is quite similar to the measures of volatility drawn from the forecast errors using the MSKF. The gold standard regime, as well as the interwar period, emerges as a relatively unstable period stressed by widely dispersed supply shocks. By contrast, the Bretton Woods convertible period is the most stable, with the floating exchange rate period not far behind.

These results raise the interesting question, why in the past century was the classical gold standard so durable in the face of substantial shocks, whereas Bretton Woods was so fragile in the face of the mildest shocks?

Responsiveness to Shocks

The final piece of evidence to be calculated in the comparison of regime performance is the response of the price level and output to the aggregate supply (permanent) and aggregate demand (temporary) shocks. Evidence of a more rapid adjustment of prices and output to shocks may help explain why one regime may have been more durable than another.

A measure of speed of response can be gleaned from the impulse response functions derived from the bivariate VARs. In addition, as a crude measure of response speed, which allowed easy comparison of all seven countries during the four regimes, I calculated the mean absolute lag of the response functions.⁵⁵ Table 5 presents these measures.

The response of output to both demand and supply shocks for the Group of Seven aggregate and for most of the individual countries was markedly more rapid under the gold standard regime than under the postwar regimes (an exception is the U.S. response to demand shocks) and within the postwar regimes was slightly more rapid under the Bretton Woods regime than the floating exchange rate regime. The response of prices to both demand and supply shocks was considerably more rapid during the gold standard (and the interwar) regime than the postwar regimes for the Group of Seven and most countries.⁵⁶ Within the postwar period, it was considerably more rapid under

Bretton Woods than under the floating exchange rate period.

Perhaps the gold standard was able to endure the greater shocks that it faced because of both greater price flexibility and greater factor mobility before World War I. Alternatively, the gold standard was more durable than Bretton Woods because before World War I, 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 for the monetary authorities to pursue full employment policies, which would threaten adherence to convertibility.

In addition, the Bretton Woods regime was both more stable and seemingly more flexible than the floating exchange rate regime and yet more fragile. This suggests that its collapse is attributable less to outside shocks to the environment or the structure of the Group of Seven economy and more to flaws in the design of the regime.

Summary

The performance of alternative international monetary regimes suggests that the Bretton Woods convertible regime (1959–70) was the most stable, followed by the floating exchange rate and the classical gold standard regimes. The stability of forecast errors to both inflation and growth paralleled that of the *ex post* data. Limited inflation persistence—evidence for credibility of the nominal anchor—was lowest during the classical gold standard. Though considerably higher than under the gold standard, persistence was less under Bretton Woods than under the float. Under Bretton Woods the nominal anchor of the U. S. commitment to peg the price of its currency to gold was apparently still effective. Finally, supply shocks were greater and less symmetric, and demand shocks were greater under the classical gold standard than under the post–World War II regimes. A more rapid response of both prices and output to these shocks also occurred under the gold standard.

The question still remains why some fixed exchange rate regimes endured longer than others

⁵⁵The formula was $\sum_i |\Delta c_i| / \sum |\Delta c_i|$ for $i = 1$ to 40, where i is the year and Δc_i the impulse response, calculating absolute changes because of the presence of both positive and negative responses. This measure is only a rough approximation because it is not possible to calculate the standard errors.

⁵⁶As mentioned above, according to the overidentifying restrictions of the Bayoumi-Eichengreen-Blanchard-Quah approach, supply shocks should have produced a negative response in prices, not the positive one shown here for the pre-World War II periods.

Table 5
The Mean Lag of Adjustment to Demand and Supply Shocks,
G7 Countries 1880-1989¹

		Gold Standard	Interwar	Post World War II	Bretton Woods	Floating Exchange
United States	a)	2.77	3.79	2.16	2.29	3.65
	b)	1.65	2.89	2.68	1.85	6.48
	c)	1.61	1.65	2.21	2.12	4.64
	d)	2.24	2.31	2.55	3.06	5.52
United Kingdom	a)	2.52	2.01	3.38	4.24	3.43
	b)	2.13	1.97	4.93	3.06	4.46
	c)	1.88	1.48	1.96	2.39	2.62
	d)	3.14	3.06	3.04	2.23	2.44
Germany	a)	2.74	3.08	2.70	3.48	3.53
	b)	2.23	2.86	2.67	3.13	6.06
	c)	1.87	3.09	1.86	1.80	2.22
	d)	2.03	3.50	1.92	2.85	4.14
Canada	a)	1.76	2.53	2.55	3.12	2.40
	b)	1.75	1.87	2.75	1.79	2.67
	c)	1.20	1.36	2.32	1.52	2.26
	d)	2.51	2.62	2.87	2.98	2.98
France	a)	1.79	3.84	2.19	3.50	4.97
	b)	1.70	2.60	1.83	3.06	5.53
	c)	1.85	2.05	2.54	2.19	3.79
	d)	2.85	4.80	1.92	3.50	6.02
Japan	a)	2.67	4.16	2.94	3.14	4.55
	b)	1.85	3.87	2.70	1.99	9.42
	c)	1.96	3.41	2.97	1.96	3.66
	d)	1.52	3.13	4.69	2.81	8.34
Italy	a)	2.13	2.50	3.51	1.86	2.99
	b)	1.71	1.60	4.20	1.43	5.57
	c)	2.43	1.57	6.20	1.63	1.94
	d)	1.66	2.19	6.68	1.66	3.02
Average	a)	2.34	3.13	2.77	3.09	3.63
	b)	1.86	2.52	3.11	2.33	5.74
	c)	1.83	2.09	2.87	1.94	3.02
	d)	2.27	3.09	3.38	2.73	4.63
G7 aggregate	a)	2.19	3.61	3.27	4.59	5.16
	b)	1.38	2.68	6.00	5.14	11.83
	c)	1.78	2.63	4.18	6.03	6.14
	d)	2.10	3.35	4.74	5.11	11.26

- a) Effect of temporary shock on output
 b) Effect of temporary shock on prices
 c) Effect of permanent shock on output
 d) Effect of permanent shock on prices

¹the mean lag of adjustment is calculated as:

$$\frac{\sum i|\Delta c_i|}{\sum |\Delta c_i|} \text{ for } i = 1 \text{ to } 40$$

where c_i is the value of the impulse response function in period i .

or why the world periodically shifted between fixed and flexible rates. The durability of the gold standard may be due to greater price flexibility and factor mobility before World War I that allowed the world economy to respond to shocks more rapidly. It also may be due to the absence of discretionary monetary policies dedicated to maintaining full employment. But the fragility of the most stable regime, Bretton Woods, in the face of mild shocks, suggests that an understanding of its demise requires a closer look at the history, institutions and rules of behavior of alternative monetary regimes.

THE GOLD STANDARD, BRETTON WOODS, AND THE EMS AS COMMITMENT MECHANISMS

Perhaps the answer to the foregoing questions concerning regime performance and durability may be linked to the commitment technology of the regime. In this section I argue that the gold standard rule of convertibility was a credible commitment mechanism that was crucial to its success and that the absence of such a mechanism underlies the failure of the Bretton Woods variant. The EMS, though not anchored to gold convertibility, may have been successful for several years because it embodied a commitment technology reminiscent of the gold standard. However, like Bretton Woods, it was subject in September 1992 to intolerable strains because the commitment mechanism proved to be not credible for many of the members.

Under the classical gold standard, the monetary authorities committed themselves to fix the prices of their currencies in terms of a fixed weight of gold and to buy and sell gold freely in unlimited amounts. The pledge to fix the price of a country's currency in terms of gold represents the basic rule of the gold standard. The fixed price of domestic currency in terms of gold provided a nominal anchor to the international monetary system. Under the Bretton Woods system only the United States fixed the price of its currency in terms of gold. All other convertible currencies were pegged to the dollar. Also, under Bretton Woods, free convertibility of gold into dollars was limited. Thus Bretton Woods was a weak variant of the gold standard. Although the Bretton Woods system in its convertible phase (1959–71) was the most stable monetary regime of the past

century, it was short lived. It collapsed both because of fatal flaws in its design (the adjustable peg in the face of improved capital mobility and the confidence problem associated with the gold dollar standard) and the lack of commitment by the United States to the gold standard convertibility rule.

The EMS, although not based on gold, incorporated many of the features of the Bretton Woods adjustable peg system. Its success in promoting the convergence of inflation rates among its members in the 1980s has been linked to the presence of an effective commitment mechanism—the adherence by the German central bank to price stability and the willingness of other members to tie their currencies to the German mark. However, like Bretton Woods, it suffered serious stress in September 1992 in the face of massive shocks because of the basic incompatibility of pegged exchange rates, capital mobility and policy autonomy. Both the center country and the members were unwilling to commit to a common policy.

An overview of the three regimes as embodying the operation of credible monetary rules follows.

The Gold Standard as a Commitment Mechanism

In the recent literature on the time inconsistency of optimal government policy, the absence of a credible commitment mechanism leads governments, in pursuing stabilization policies, to produce an inflationary outcome.⁵⁷ In a closed economy environment, once the monetary authority has announced a given rate of monetary growth, which the public expects it to validate, the authority then has an incentive to create a monetary surprise to either reduce unemployment or capture seigniorage revenue. The public, with rational expectations, will come to anticipate the authorities' perfidy, leading to an inflationary equilibrium. A credible precommitment mechanism, by preventing the government from cheating, can preserve long-run price stability. The gold standard rule of maintaining a fixed price of gold can be viewed as such a mechanism.

The gold standard rule can be viewed as a form of contingent rule or a rule with escape clauses.⁵⁸ The monetary authority maintains the standard—that is, keeps the price of the currency in terms of gold fixed—except in the event of a well-understood

⁵⁷See Kydland and Prescott (1977) and Barro and Gordon (1983).

⁵⁸See Grossman and Van Huyck (1988), DeKock and Grilli (1989), and Bordo and Kydland (1992).

emergency, such as a major war or a financial crisis. In wartime it may suspend gold convertibility and issue paper money to finance its expenditures, and it can sell debt issues in terms of the nominal value of its currency on the understanding that debt will eventually be paid off in gold. The rule is contingent in the sense that the public understands that the suspension will last only for the duration of the wartime emergency plus some period of adjustment. It assumes that afterward the government will follow the deflationary policies necessary to resume payments at the original parity. Following such a rule will also allow the government to smooth its revenue from different sources of finance, such as taxation, borrowing and seigniorage.⁵⁹

According to Bordo and Kydland (1992), the gold standard contingent rule worked successfully for three core countries of the classical gold standard: the United Kingdom, the United States, and France. 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 United States, 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 were adopted.⁶⁰ Indeed, successful adherence to the rule may have enabled the belligerents to obtain access to debt finance more easily in subsequent wars. Other countries, such as Italy, which did not continuously maintain gold convertibility, nevertheless adopted policies consistent with long-run convertibility.⁶¹

The gold standard rule may also have been enforced by reputational considerations. Long-run adherence to the rule was based on the

historical evolution itself of the gold standard. Gold was accepted as money because of its intrinsic value and desirable properties. Paper claims, developed to economize on the scarce resources tied up in a commodity money, became acceptable only because they were convertible into gold. An alternative commitment mechanism was to guarantee gold convertibility in the constitution. This was the case for example in Sweden before 1914, when laws pertaining to the gold standard could be changed only by two identical parliamentary decisions with an election in between.⁶² Convertibility was also enshrined in the laws of a number of gold standard central banks.⁶³

The gold standard originally evolved as a domestic commitment mechanism, but its enduring fame is as an international rule. The classical gold standard emerged as a true international standard by 1880 following the switch by the majority of countries from bimetallism, silver monometallism and paper to gold as the basis of their currencies.⁶⁴ 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. Recent evidence suggests that, indeed, exchange rates throughout the 1880-1914 period were characterized by a high degree of fixity in the principal countries. Although exchange rates frequently deviated from par, violations of the gold points and devaluations were rare.⁶⁵

According to game theory literature, for an international monetary arrangement to be effective both between countries and within them, a time-consistent credible commitment mechanism is required. Adherence to the gold convertibility rule provided such a mechanism. In addition to the

⁵⁹See Lucas and Stokey (1983) and Mankiw (1987).

⁶⁰A case study comparing British and French finances during the Napoleonic Wars shows that Britain was able to finance its wartime expenditures by a combination of taxes, debt and paper money issue—to smooth revenue; whereas France had to rely primarily on taxation. France had to rely on a less efficient mix of finance than Britain because she had used up her credibility by defaulting on outstanding debt at the end of the American Revolutionary War and by hyperinflating during the Revolution. Napoleon ultimately returned France to the bimetallic standard in 1803 as part of a policy to restore fiscal probity, but because of the previous loss of reputation France was unable to take advantage of the contingent aspect of the bimetallic standard rule. See Bordo and White (1991).

⁶¹The behavior of asset prices (exchange rates and interest rates) suggests that market agents viewed the commitment to gold as credible. See Roll (1972) and Calomiris (1988),

who present evidence of expected appreciation of the greenback during the American Civil War based on a negative interest differential between bonds that were paid in greenbacks and those paid in gold.

Giovannini (1992) finds that the variation of both exchange rates and short-term interest rates varied within the limits set by the gold points in the 1899-1909 period consistent with market agents' expectations of a credible commitment by the four "core" countries to the gold standard rule in the sense of this paper.

⁶²See Jonung (1984).

⁶³See Giovannini (1993).

⁶⁴See Eichengreen (1985).

⁶⁵See Officer (1986) and Eichengreen (1985).

reputation of the domestic gold standard and constitutional provisions that ensured domestic commitment, adherence to the international gold-standard rule may have been enforced by other mechanisms. These include improved access to international capital markets, the operation of the rules of the game, and the hegemonic power of England.

Support for the international gold standard likely grew because it provided improved access to the international capital markets of the core countries. Countries were eager to adhere to the standard because they believed that gold convertibility would be a signal to creditors of sound government finance and the future ability to service debt.⁶⁶

This was the case both for developing countries seeking access to long-term capital, such as Austria-Hungary and Latin America, and for countries seeking short-term loans, such as Japan, which financed the Russo-Japanese war of 1905–06 with foreign loans seven years after joining the gold standard.⁶⁷ Once on the gold standard, these countries feared the consequences of suspension.⁶⁸ That England, the most successful country of the nineteenth century, as well as other progressive countries were on the gold standard was probably a powerful argument for joining.⁶⁹

The operation of the rules of the game, whereby the monetary authorities were supposed to alter the discount rate to speed up the adjustment to a change in external balance, may also have been an important part of the commitment mechanism to the international gold standard rule. To the extent the rules were followed and adjustment facilitated, the commitment to convertibility was strengthened and conditions conducive to abandonment were lessened.

Evidence on the operation of the rules of the game questions their validity. Bloomfield (1959), in a classic study, showed that, with the principal exception of England, the rules were frequently violated in the sense that discount rates were

not always changed in the required direction (or by sufficient amounts) and in the sense that changes in domestic credit were often negatively correlated with changes in gold reserves. In addition, a number of countries used gold devices—practices to prevent gold outflows.

For the major countries, however (at least before 1914) such policies were not used extensively enough to threaten the convertibility to gold—evidence of commitment to the rule.⁷⁰ Moreover, as McKinnon (1992) argues, to the extent that monetary authorities followed Bagehot's rule and prevented a financial crisis while seemingly violating the rules of the game, the commitment to the gold standard in the long run may have been strengthened.

An additional enforcement mechanism for the international gold standard rule may have been the hegemonic power of England, the most important gold standard country.⁷¹ A persistent theme in the literature on the international gold standard is that the classical gold standard of 1880 to 1914 was a British-managed standard.⁷² Because London was the center for the world's principal gold, commodities and capital markets, because of the extensive outstanding sterling-denominated assets, and because many countries substituted sterling for gold as an international reserve currency, some argue that the Bank of England, by manipulating its bank rate, could attract whatever gold it needed and, furthermore, that other central banks would adjust their discount rates accordingly. Thus the Bank of England could exert a powerful influence on the money supplies and price levels of other gold standard countries.

The evidence suggests that the Bank did have some influence on other European central banks.⁷³ Eichengreen (1987) treats the Bank of England as one engaged in a leadership role in a Stackelberg strategic game with other central banks as followers. The other central banks accepted a passive role because they benefited from using sterling as a reserve asset. According to this interpretation, the gold standard rule may

⁶⁶A case study of Canada during the Great Depression provides evidence for the importance of the credible commitment mechanism of adherence to gold. Canada suspended the gold standard in 1929 but did not allow the Canadian dollar to depreciate nor the price level to rise for two years. Canada did not take advantage of the suspension to emerge from the depression because of concern for its credibility with foreign lenders. See Bordo and Redish (1990).

⁶⁷See Yeager (1984), Fishlow (1989) and Hayashi (1989).

⁶⁸See Eichengreen (1989a) and Fishlow (1987 and 1989).

⁶⁹See Friedman (1990) and Gallarotti (1991).

⁷⁰See Schwartz (1984).

⁷¹See Eichengreen (1989b).

⁷²See Bordo (1984).

⁷³See Lindert (1969).

have been enforced by the Bank of England.⁷⁴ Thus the monetary authorities of many countries may have been constrained from following independent discretionary policies that would have threatened adherence to the gold standard rule.

Indeed, according to Giovannini (1989), the gold standard was an asymmetric system. England was the center country. It used its monetary policy (bank rate) to maintain gold convertibility. Other countries accepted the dictates of fixed parities and allowed their money supplies to respond passively. His regressions support this view—the French and German central banks adapted their domestic policies to external conditions, whereas the British did not.

The benefits to England as leader of the gold standard—from seigniorage earned on foreign-held sterling balances to returns to financial institutions generated by its central position in the gold standard and to access to international capital markets in wartime—were substantial enough to make the costs of not following the rule extremely high.

The classical gold standard ended in the face of the massive shocks of World War I.⁷⁵ The gold exchange standard, which prevailed for only a few years from the mid-1920s to the Great Depression, was an attempt to restore the beneficial features of the classical gold standard while allowing a greater role for domestic stabilization policy. This in turn created a growing conflict between adherence to the rule and discretion. It also attempted to economize on gold reserves by restricting its use to central banks and by encouraging the use of foreign exchange as a substitute. As is well known, the gold exchange standard suffered from a number of fatal flaws.⁷⁶ These include the use of two reserve currencies (the pound and the dollar), the absence of leadership by a hegemonic power, the failure of cooperation between the

key members (England, France and the United States), and the unwillingness of its two strongest members, the United States and France, to follow the rules of the game. Instead they exerted deflationary pressure on the rest of the world by persistent sterilization of balance-of-payment surpluses. The gold exchange standard collapsed, but according to Friedman and Schwartz, Temin, and Eichengreen, not before transmitting deflation and depression across the world.⁷⁷

The Bretton Woods International Monetary System

The planning that led to Bretton Woods aimed to prevent the chaos of the interwar period.⁷⁸ The perceived ills to be prevented included (1) floating exchange rates that were condemned as subject to destabilizing speculation; (2) a gold exchange standard that was vulnerable to problems of adjustment, liquidity and confidence, which enforced the international transmission of deflation in the early 1930s; and (3) the resort to beggar-thy-neighbor devaluations, trade restrictions, exchange controls and bilateralism after 1933. To prevent these ills, the case for an adjustable peg system was made by Keynes, White, Nurkse and others.⁷⁹ The new system would combine the favorable features of the fixed exchange rate gold standard—stability of exchange rates—and of the flexible exchange rate standard—monetary and fiscal independence.

Both Keynes, leading the British negotiating team at Bretton Woods, and White, leading the American team at Bretton Woods, planned an adjustable peg system to be coordinated by an international monetary agency. The Keynes plan gave the International Currency Union substantially more reserves and power than the United Nations Stabilization Fund proposed by White, but both institutions would have had considerable control over the domestic financial policy of the members.

The British plan contained more domestic policy autonomy than did the U.S. plan, whereas the

⁷⁴According to Eichengreen (1989a), the Bank of England's ability to ensure convertibility was aided by the cooperation of other central banks. In addition, as mentioned above, belief based on past performance that England attached highest priority to convertibility encouraged stabilizing private capital movements in times of threats to convertibility, such as in 1890 and 1907.

⁷⁵The standard deviations of both supply and demand shocks during World War I for the countries for which we have continuous data were two to three times as great as during the classical gold standard. See appendix table 1 and figure 1.

⁷⁶See Kindleberger (1973), Temin (1989), and Eichengreen (1992c).

⁷⁷See Friedman and Schwartz (1963), Temin (1989) and Eichengreen (1992c).

⁷⁸This section draws heavily on Bordo (1992).

⁷⁹See Bordo (1993).

American plan put more emphasis on exchange rate stability. Neither architect was in favor of a rule-based system.⁸⁰ The British were most concerned with preventing the deflation of the 1930s, which they attributed to the constraint of the gold standard rule and to deflationary U.S. monetary policies. Thus they wanted an expansionary system.

The American plan was closer to the gold standard rule in that it stressed the fixity of exchange rates. It did not explicitly mention the importance of rules as a credible commitment mechanism, but there were to be strict regulations on the linkage between UNITAS (the proposed international reserve account) and gold. Members, in the event of a fundamental disequilibrium, could change their parities only with approval from a three-quarters majority of all members of the fund.⁸¹

The Articles of Agreement of the International Monetary Fund incorporated elements of both the Keynes and White plans, although in the end, U.S. concerns predominated.⁸² The main points of the articles were: the creation of the par value system; multilateral payments; the use of the fund's resources; its powers; and its organization.

The Par Value System

Article IV defined the numeraire of the international monetary system as either gold or the U.S. dollar of the weight and fineness on July 1, 1944. All members were urged to declare a par value and maintain it within a 1 percent margin on either side of parity. Parity could be changed in the event of a fundamental payments disequilibrium at the decision of the member, after consultation with other fund members. The fund would not, however, reject the change if it was not more than 10 percent; if the change was more than 10 percent, the fund would decide

within 72 hours. Unauthorized changes in the exchange rate could make members ineligible to use the fund's resources, and if a member continued to make unauthorized changes, it could be expelled from the fund. A uniform change in par value of all currencies (in terms of gold) required approval by a majority of all voting fund members and also had to be approved by every member with 10 percent or more of the total quota.

Multilateral Payments

Members were supposed to make their currencies convertible for current account transactions (Art. VIII), but capital controls were permitted (Art. VI.3). They were also to avoid discriminatory currency and multiple currency arrangements. Countries could avoid declaring their currencies convertible, however, by invoking Art. XIV, which allowed a three-year transition period after establishment of the fund. During the transition period, existing exchange controls could be maintained.⁸³

The Fund's Resources

As under the White plan, members could obtain resources from the fund to help finance short- or medium-term payments disequilibria. The total fund, contributed by members quotas (25 percent in gold and 75 percent in currencies) was set at \$8.8 billion. It could be raised every five years if the majority of members wanted to do so. The fund set a number of conditions on the use of its resources by deficit countries to prevent it from accumulating soft currencies and from depleting its holdings of harder currencies.⁸⁴ It also established requirements and conditions for repurchase (repayment of a loan), including giving the fund the right to decide the currency in which repurchase would be made.

⁸⁰In the sense of a commitment mechanism to prevent the time consistency problem. According to Meltzer (1988) and Moggridge (1986), Keynes had a strong preference for rules over discretion, interpreting rules in the traditional sense.

⁸¹See Giovannini (1993).

⁸²At the same time as the Articles of Agreement for the International Monetary Fund were signed, the International Bank for Reconstruction and Development (the World Bank) was established. The Charter of the International Trade Organization (ITO) was drafted and signed in 1947 but never ratified. It was succeeded by the General Agreement for Tariffs and Trade (GATT) originally negotiated in Geneva in 1947 as an interim institution until the ITO came into force.

⁸³Under Art. XIV, three years after March 1, 1947, the IMF would begin reporting on the countries with existing controls, two years later it would begin consulting with individual members and advising them on policies to restore payments equilibrium and convertibility. Countries that did not make satisfactory progress would be censured and ultimately asked to leave the fund. In fact, the fund always accepted the member's reason for remaining under Art. XIV.

⁸⁴Members could draw on their quotas without condition. Beyond that, referred to later as the credit tranches, although not spelled out in the articles, increasingly more exacting conditions were required.

In the case of countries prone to running large surpluses, the scarce currency clause (Art. VII) would come into play. If the fund's holdings of a currency were insufficient to satisfy the demand for it by other members, it could declare it scarce and then urge members to ration its use by discriminatory exchange controls.

The Powers of the Fund

The fund had considerably less discretionary power over the domestic policies of its members than either of the architects wanted, but it still had power to influence the international monetary system strongly. These powers included its authority to approve or reject changes in parity; the use of multiple exchange rates and other discriminatory practices; the conditionality implicit in members' access to the credit tranches of their quotas, which was made explicit by 1952; its authority to declare currencies scarce; its authority to declare members ineligible to use its resources (used against France in 1948 following an unapproved devaluation); and its ultimate authority to expel members.⁸⁵ The fund also had considerable power as the premier international monetary organization in consulting and cooperating with national and other international monetary authorities.

Organization

The fund was to be governed by a board of governors appointed by the members. The board would make the major policy decisions, such as approving a change in parity. Operations of the fund were to be directed by executive directors appointed by the members and a managing director selected by the executive directors. Major changes such as a uniform change in the par value of all currencies or the second amendment to the articles, which created the special drawing right (SDR), would require a majority vote by the members. The number of votes in turn was tied to the size of each member's quota, which was determined by its economic size.

Though the articles could not be interpreted strictly as a return to the gold standard rule of the fixed price of gold with free convertibility,

the fixed price of gold at \$35 per ounce, which the U.S. was to maintain, represented the nominal anchor of the system. Members were required to maintain parity of their exchange rates in terms of dollars (or gold). Also, like the gold standard, it was a rule with an escape clause. Members at their initiative could alter their parities in the event of a fundamental disequilibrium.

The architects never spelled out exactly how the system was supposed to work. Subsequent writers, however, have suggested a number of salient features.⁸⁶ First, currencies were treated as equal in the articles. This meant that in theory each country was required to maintain its par value by intervening in the currency of every other country—a practice that would have worked at cross purposes. In fact, because the United States was the only country that pegged its currency in terms of gold (bought and sold gold), all other countries would fix their parities in terms of dollars and would intervene to monitor their exchange rates within 1 percent of parity with the dollar.

Second, countries would use their international reserves or draw resources from the fund to finance payments deficits. In the case of surpluses, countries would temporarily build up reserves or repurchase their currencies from the fund. In the event of medium-term disequilibria, they would use monetary and fiscal policy to alter aggregate demand. In the event of a fundamental disequilibrium, which was never defined but presumably reflected either some permanent structural shock or sustained inflation, a member was supposed to alter parity by an amount sufficient to restore external equilibrium.

Third, capital controls were permitted to prevent destabilizing speculation from forcing members to alter their parities prematurely or unintentionally.

THE HISTORY OF BRETTON WOODS: PRE-CONVERTIBILITY 1946–58

The international monetary system that began after World War II was far different from the system that the architects of Bretton Woods envisioned. The transition period from war to

⁸⁵See Diz (1984) for a discussion of conditionality implicit in members' access to the credit tranches of their quotas.

⁸⁶See, for example, Tew (1988), Scammell (1976) and Yeager (1976). For Williamson (1985b) it was a comprehensive set of rules for assigning macroeconomic pol-

icies—exchange rates to medium-run external balance, monetary and fiscal policy to short-run internal balance and international reserves—to provide a buffer to allow short-run departures from external balance.

peace was much longer and more painful than anticipated. Full convertibility of the major industrial countries was not achieved until the end of 1958, although the system had started functioning normally by 1955. Two interrelated problems dominated the first postwar decade: bilateralism and the dollar shortage.

Bilateralism

The legacy of World War II for virtually every country except the United States was one of pervasive exchange controls and controls on trade. No major currency except the dollar was convertible.⁸⁷ Under Art. XIV of the Bretton Woods agreement, countries could continue to use exchange controls for an indefinite transition period after the establishment of the International Monetary Fund (IMF) on March 1, 1947. In conjunction with exchange controls, every country negotiated a series of bilateral payments agreements with each of its trading partners. The rationale for the continued use of controls and bilateralism was a shortage of international reserves. After the war, the economies of Europe and Asia were devastated. To produce the exports needed to generate foreign exchange, industries required new and improved capital. There was an acute shortage of key imports, both foodstuffs to maintain living standards and raw materials and capital equipment. Controls allocated the scarce reserves.

The Dollar Shortage

By the end of World War II, the United States held two-thirds of the world's monetary gold stock (see figure 13). The gold avalanche in the United States in the 1930s was the consequence of both the dollar devaluation in 1934, when the Roosevelt administration raised the price of gold from \$20.67 per ounce to \$35.00, and capital flight from Europe. During the war, gold

inflows continued to finance wartime expenditures by the allies. At the end of World War II, gold and dollar reserves in Europe and Japan were depleted. Europe ran a massive current account deficit, reflecting the demand for essential imports and the reduced capacity of the export industries. The Organization for European Economic Cooperation (OEEC) deficit, aggravated by the bad winter of 1946-47, reached a high of \$9 billion in 1947. The OEEC deficit equaled the amount of the U.S. current account surplus, which was large because the United States, as the only major industrial country operating at full capacity, supplied the needed imports. The dollar shortage was likely aggravated by overvalued official parities set by the major European industrial countries at the end of 1946.⁸⁸

By the mid-1950s both problems had been solved. The currencies of western Europe were virtually convertible by 1955 and their current accounts were generally in surplus. The key developments in this progress were the Marshall Plan and the European Payments Union.

The Marshall Plan

The Marshall Plan funneled approximately \$13 billion in aid (grants and loans) to western Europe between 1948 and 1952.⁸⁹ The plan required the recipients to cooperate in the liberalization of trade and payments. Consequently, the OEEC was established in April 1948. It presided over the allocation of aid to members based on the size of their current account deficits. U.S. aid was to pay for essential imports and to provide international reserves. Each recipient government provided matching funds in local currency to be used for investment in the productive capacity of industry, agriculture and infrastructure. Each country also had a delegation of U.S. administrators that advised the host government on the spending of its counterpart funds.

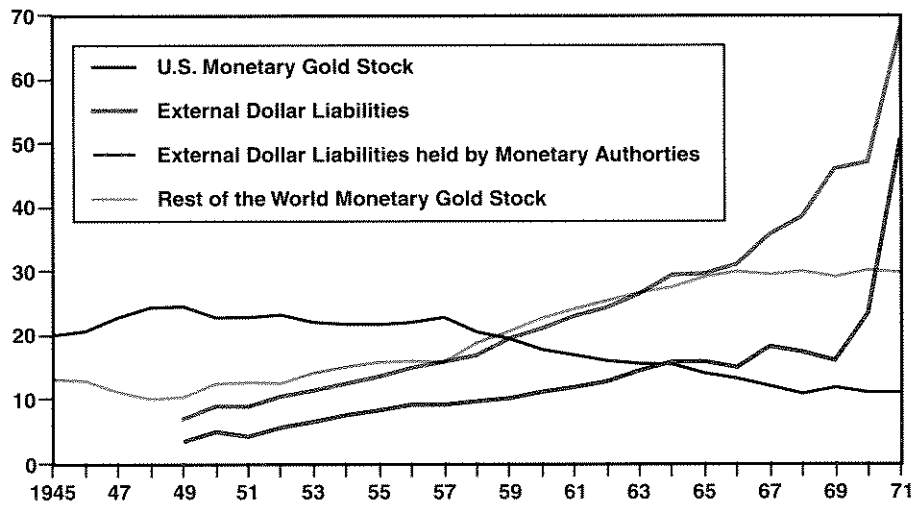
⁸⁷Under the classical gold standard, convertibility meant the ability of a private individual to freely convert a unit of any national currency into gold at the official fixed price. A suspension of convertibility meant that the exchange rate between gold and national currency became flexible but the individual could still freely transact in either asset. See Triffin (1960). By the eve of World War II, convertibility referred to the ability of a private individual to freely make and receive payments in international transactions in terms of the currency of another country. Under Bretton Woods, convertibility meant the freedom for individuals to engage in current account transactions without being subject to exchange controls. Tew (1988) defines this as market convertibility and distinguishes it from official convertibility whereby the monetary authorities of each country freely

buy and sell foreign exchange (primarily dollars) to keep the parity fixed (within the 1 percent margin) and the United States freely buys and sells gold to maintain the fixed price of \$35 an ounce (within the 1 percent margin). He refers to both market and official convertibility as Bretton Woods convertibility. See also McKinnon (1979) and Black (1987).

⁸⁸See Triffin (1957).

⁸⁹See Milward (1984) and Hoffman and Maier (1984).

Figure 13
Monetary Gold and Dollar Holdings: the United States and the Rest of the World, 1945-1971 Billions of U.S. dollars



The plan encouraged the liberalization of intra-European trade and payments by granting aid to countries that extended bilateral credits to other members. Finally, the European Payments Union (EPU) was established in 1950, under the auspices of the OEEC, to simplify bilateral clearing and pave the way to multilateralism.

By 1952, in part thanks to the Marshall Plan, the OEEC countries had achieved a 39 percent increase in industrial production, a doubling of exports, an increase in imports by one-third and a current account surplus.⁹⁰

The European Payments Union and the Return to Convertibility

It took 12 years from the declaration of official par values by 32 nations in December 1946 to achieve convertibility for current transactions by the major industrial countries, as specified by the Bretton Woods Articles. The Western European nations tried several schemes to facilitate the payments process before establishing the EPU in 1950.⁹¹

The EPU, established September 19, 1950, by the OEEC countries, initially was to run for two years, renewable thereafter on a yearly basis. It followed the basic principle of a commercial

bank clearinghouse. At the end of each month, each member would clear its net debit or credit position (against all other members) with the EPU (the BIS acting as its agent). The unit of account for these clearings was the U.S. dollar. The EPU also provided extensive credit lines. The EPU was highly successful in reducing the volume of payments transactions and provided the background for the gradual liberalization of payments so that by 1953 commercial banks were able to engage in multicurrency arbitrage.⁹² On December 27, 1958, eight countries declared their currencies convertible for current account transactions.

The movement to convertibility was aided by the devaluations of 1949. Following a speculative run on the pound in the summer of 1949, the British, 24 hours after informing the IMF, devalued the pound by 30.5 percent. Shortly thereafter, 23 countries reduced their parities by similar magnitudes in most cases.

The devaluations of 1949 were important for the Bretton Woods system for two reasons. First, they, along with the Marshall Plan aid, helped move the European countries from a current account deficit to a surplus, a movement important to the eventual restoration of convertibility. Second, they revealed a basic weakness of the

⁹⁰Solomon (1976).

⁹¹Kaplan and Schleiminger (1989).

⁹²Tew (1988) and Yeager (1976).

adjustable peg arrangement—the one-way option of speculation against parity. By allowing changes in parity only in the event of a fundamental disequilibrium, the Bretton Woods system encouraged the monetary authorities to delay adjustment until they were sure it was necessary. By that time, speculators also would be sure and they would take a position from which they could not lose. If the currency is devalued, they win and if it is not, they just lose the interest (if any) on the speculative funds.⁹³ The crisis associated with the 1949 sterling devaluation in turn created further resistance by monetary authorities to changes in parity, which ultimately changed the nature of the international monetary system from the adjustable peg intended by the Bretton Woods Articles to a fixed rate regime.

Other developments in the preconvertibility period included the decline of sterling as a reserve asset and the reduced prestige of the IMF. The IMF by intention was not equipped to deal with the postwar reconstruction problem. Although some limited drawings occurred before 1952, most of the structural balance of payments assistance in this period was provided by the Marshall Plan and other U.S. assistance, including the Anglo-American Loan of 1946. The consequence of this development is that other institutions such as the BIS, the agent for the EPU, emerged as competing sources of international monetary authority.⁹⁴

The fund's prestige was dealt a severe blow by three events in the preconvertibility period. The first event was the French devaluation of January 1948, which created a multiple exchange rate system. The fund censured France for creating broken cross rates between the dollar and the pound. France was denied access to the fund's resources until 1952. France ended the broken cross rates in October 1948 and adopted a unified rate in the devaluation of 1949. Since France had access to the Marshall Plan, the fund's actions had little effect. The second event was the sterling devaluation of September 1949, when the fund, instead of being actively involved in consultation, was given 24 hours perfunctory notice. The third event was the decision by Canada to float its currency in September 1950. Though the fund was highly critical of the action, it was unable to prevent it. The Canadian dollar floated successfully until 1961.

Finally, the fund's resources were inadequate to solve the emerging liquidity problem of the 1960s. The difference between the required growth of international reserves (to finance the growth of real output and trade and to avoid deflation) and the growth in the world's monetary gold stock was met largely by an increase in official holdings of U.S. dollars resulting from growing U.S. balance-of-payments deficits. By the time full convertibility was achieved, the U.S. dollar was serving the buffer function intended by the Bretton Woods Articles for the fund's resources.⁹⁵

THE HISTORY OF BRETTON WOODS: THE HEYDAY OF BRETTON WOODS 1959-1967

With current account convertibility established by the western European industrial nations at the end of December 1958, the full-blown Bretton Woods system was in operation. Each member intervened in the foreign exchange market, either buying or selling dollars, to maintain its parity within the prescribed 1 percent margins. The U.S. Treasury in turn pegged the price of the dollar at \$35 per ounce by freely buying and selling gold. Thus each currency was anchored to the dollar and indirectly to gold. Triangular arbitrage kept all cross rates within a band of 2 percent on either side of parity. Through much of this period, capital controls prevailed in most countries except the United States in one form or another, although by the mid-1960s their use declined while increasing in the United States.

The system that operated in the next decade turned out to be quite different from what the architects had in mind. First, instead of a system of equal currencies, it evolved into a variant of the gold exchange standard—the gold-dollar system. Initially, it was a gold exchange standard with two key currencies, the dollar and the pound. But the role of the pound as key currency declined steadily throughout the 1960s. Concurrently with the decline of sterling was the rise in the dollar as a key currency. Use of the dollar as both a private and official international money increased dramatically in the 1950s and continued into the 1960s. With full convertibility, the dollar's fundamental role as

⁹³See Friedman (1953).

⁹⁴See Mundell (1969).

⁹⁵See Mundell (1969).

intervention currency led to its use as international reserves. This was aided by stable and low monetary growth and relatively low inflation (before 1965). See figure 1 and table 1.

The gold exchange standard evolved in the post-World War II period for the same reasons it did in the 1920s—to economize on non-interest-bearing gold reserves. By the late 1950s, the growth of the world's monetary gold stock was insufficient to finance the growth of world real output and trade.⁹⁶ The other intended source of international liquidity—the resources of the fund—was also insufficient.

The second important difference between the convertible Bretton Woods system and the intentions of the Bretton Woods Articles was the evolution of the adjustable peg system into a virtual fixed exchange rate system. Between 1949 and 1967, very few changes in parities of the Group of Ten countries occurred.⁹⁷ The only exceptions were the Canadian float in 1950, devaluations by France in 1957 and 1958, and minor revaluations by Germany and the Netherlands in 1961. The adjustable peg system became less adjustable because the monetary authorities, based on the 1949 experience, were unwilling to accept the risks associated with discrete changes in parities—loss of prestige, the likelihood that others would follow and the pressure of speculative capital flows if even a hint of a change in parity were present.

As the system evolved into a fixed exchange rate gold dollar standard, the three key problems of the interwar system reemerged: adjustment, liquidity and confidence. These problems dominated academic and policy discussions during the period.

The Adjustment Problem

The adjustment issue focused on how to achieve it in a world with capital controls, fixed exchange rates and domestic policy autonomy. Various policy measures were proposed to aid adjustment, including income policies, rescue packages, capital and trade controls, a mix of monetary and fiscal policy, and the injection of new liquidity.

Of particular interest during the period was asymmetry in adjustment between deficit countries like the United Kingdom and surplus countries like Germany and between the United States as the reserve currency country and rest of the world.

Both the United Kingdom and Germany ran the gauntlet between concern over external convertibility and domestic stability. The United Kingdom alternated between expansionary policy that led to balance-of-payments deficits and austerity. Germany alternated between a balance-of-payments surplus that led to inflation and austerity.

The United States had an official settlements balance-of-payments deficit in 1958 that persisted, with the notable exception of 1968–69, until the end of Bretton Woods. See figure 14. With the exception of 1959, however, the United States had a current account surplus until 1970. The balance-of-payments deficit under Bretton Woods arose because capital outflows exceeded the current account surplus. In the early postwar years, the outflow consisted largely of foreign aid. By the end of the 1950s, private long-term investment abroad (mainly direct investment) exceeded military expenditures abroad and other official transfers.⁹⁸

The balance-of-payments deficit was perceived as a problem by the U.S. monetary authorities because of its effect on confidence. As official dollar liabilities held abroad mounted with successive deficits, the likelihood increased that these dollars would be converted into gold and eventually the U.S. monetary gold stock would reach a point low enough to trigger a run. Indeed the U.S. monetary gold stock by 1959 equalled total external dollar liabilities and the rest of the world's monetary gold stock exceeded that of the United States. See figure 13. By 1964 official dollar liabilities held by foreign monetary authorities exceeded the U.S. monetary gold stock.

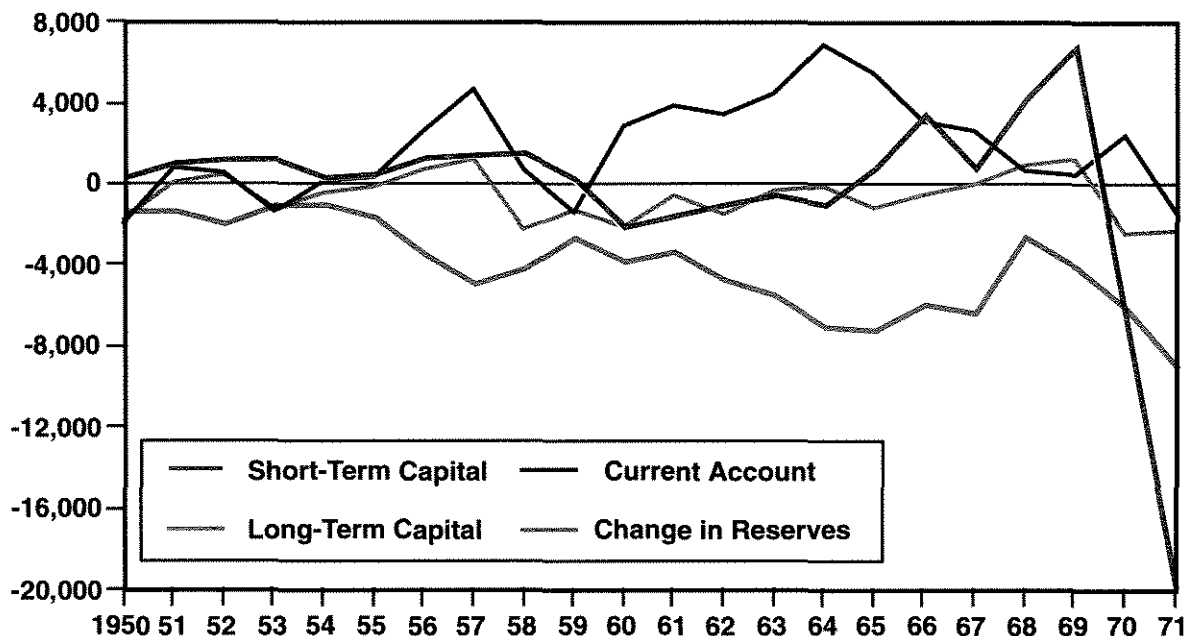
A second reason the balance-of-payments deficit was perceived as a problem was the dollar's role in providing liquidity to the rest of the world. Elimination of the U.S. deficit would create a worldwide liquidity shortage.

⁹⁶See Triffin (1960) and Gilbert (1968).

⁹⁷The Group of Ten countries were Belgium, Canada, France, West Germany, Italy, Japan, the Netherlands, Sweden, United Kingdom, and the United States. Switzerland was an associate member.

⁹⁸See Eichengreen (1991c).

Figure 14

Balance of Payments: United States, 1950-1971 Millions of U.S. dollars

For the Europeans, the U.S. balance-of-payments deficit was a problem for different reasons. First, as the reserve currency country, the United States did not have to adjust its domestic economy to the balance of payments. As a matter of routine, the Federal Reserve automatically sterilized dollar outflows. The asymmetry in adjustment was resented. The Germans viewed the situation as the United States exporting inflation to surplus countries through its deficits. Their remedy was for the United States (and the United Kingdom) to pursue contractionary monetary and fiscal policy.⁹⁹ In fact, U.S. inflation was less (on a GNP-weighted average basis) than that of the rest of the Group of Seven countries before 1968. See figures 1 and 15. The French resented U.S. financial dominance and the seigniorage they believed the United States earned on its outstanding liabilities. Acting on this perception, the French in 1965 began to systematically convert outstanding dollar liabilities into gold. The French solution to the dollar problem was to double the price of gold—the amount by which

the real price of gold had declined since 1934. The capital gains earned on the revaluation of the world's monetary gold reserves would be sufficient to retire the outstanding dollar (and sterling) balances. Once the United States returned to balance-of-payments equilibrium, the world could return to a fully functioning classical gold standard.¹⁰⁰

Some economists argued that the U.S. balance-of-payments deficit was not really a problem. The rest of the world held dollars voluntarily because of their valuable service flow; the deficit was demand determined.¹⁰¹

The policy response of the U.S. monetary authorities was fourfold: to impose controls on capital exports; to institute measures to improve the balance of trade; to alter the monetary fiscal policy mix; and to employ measures to stem the conversion of outstanding dollars into gold.

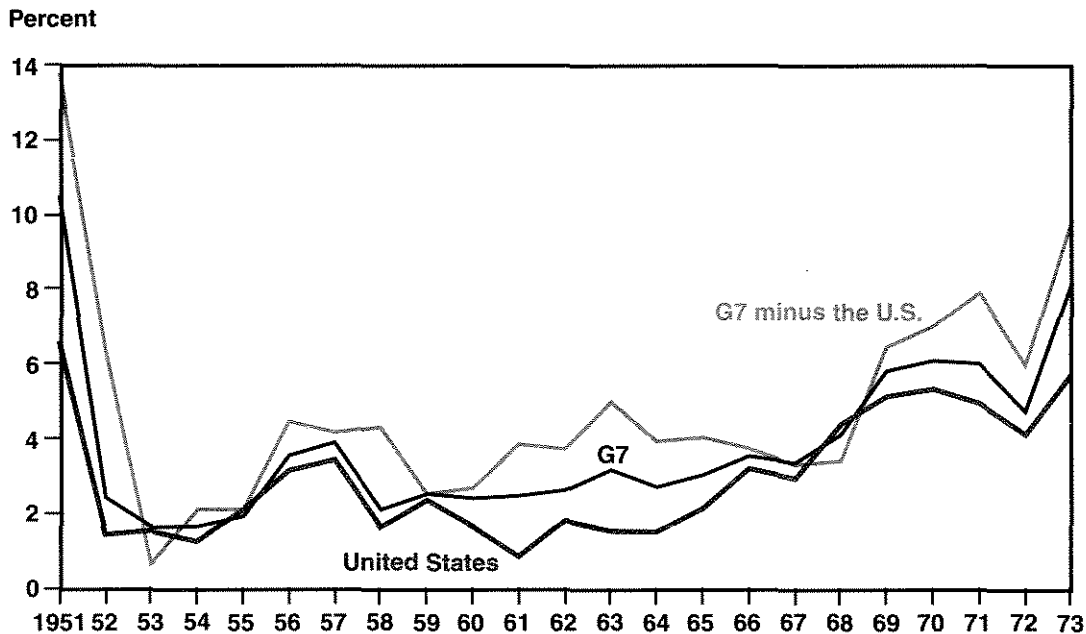
During this period, various solutions to the U.S. adjustment problem were proposed: provision of an alternative international reserve

⁹⁹See Emminger (1967).

¹⁰⁰See Rueff (1967).

¹⁰¹See Despres, Kindleberger and Salant (1966).

Figure 15
Inflation Rates in the United States, G7 and G7 Excluding the United States, 1951-1973



media to increase world liquidity; an increase in the price of gold, either unilaterally, which would devalue the dollar against other currencies, or by a uniform change in all parities as under Art. IV; and increased exchange rate flexibility.¹⁰²

The U.S. balance-of-payments policies were in the main ineffective.¹⁰³ As long as the United States maintained relatively stable prices, as it did before 1965, the system could be preserved for a number of years. The real problem was that of the gold exchange standard—a convertibility crisis was ultimately inevitable. The twin solutions advocated at the time of an increase in the price of gold and an increase in world liquidity by creation of an artificial reserve asset would not have permanently eradicated the problem.¹⁰⁴

The Liquidity Problem

The liquidity problem, posed by Robert Triffin and others, evolved from a shortfall of monetary gold beginning in the late 1950s. The real price of gold had been falling since World War II and would eventually reduce world gold production. This happened in the early 1950s but was offset by new sources of production. Gold production declined again in 1966. Moreover, the falling real price would stimulate private demand for gold and it seemed unlikely that Russian gold sales would make up much of the shortfall. The prospect of the world monetary gold stock growing enough to finance the growth of world real output and the value of trade (without deflation) seemed dim. As can clearly be seen in figure 16 for the Group of

¹⁰²The official view, which was strongly opposed to increased exchange rate flexibility, is in marked contrast to the academic view, which by the end of the decade was solidly in favor of increased flexibility, as evident at the famous Burgenstock Conference. See Halm (1970) and also Johnson (1972a).

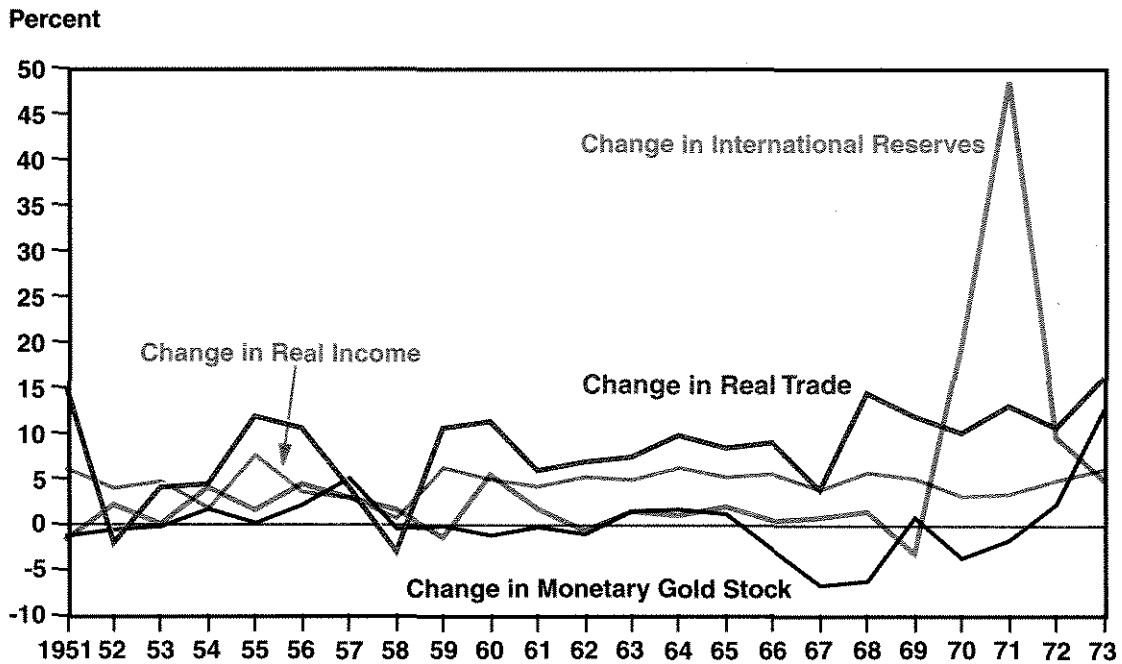
¹⁰³See Meltzer (1991).

¹⁰⁴Even at a higher gold price, world gold production would eventually be inadequate to produce long-run price stability. In the long-run, when account is taken of gold as a durable exhaustible resource, deflation is inevitable. See

Bordo and Ellson (1985). Moreover, an increase in world liquidity by an artificial reserve asset, if convertible into gold, would not remove the basic convertibility problem. See McKinnon (1988). Finally as Townsend (1977), Salant (1983) and Buiter (1989) point out, the gold exchange standard as a type of commodity stabilization scheme is bound to collapse in the face of unforeseen shocks. See Garber (1993). According to Meltzer (1991), however, a 50 percent gold revaluation would have succeeded in preserving the Bretton Woods system well into the 1970s had the United States not followed an inflationary policy in the late 1960s.

Figure 16

The Growth of the Monetary Gold Stock, the Growth in International Reserves and the Growth of the Volume of Real Trade and Real Income, G7, 1951-1973



Seven countries, this was the case. A large gap opened in 1958 between the growth of output and the volume of trade and the growth of Group of Seven gold reserves. As can be seen in figure 17, the shortfall for the Group of Seven countries, *excluding the United States*, was made up by a drain on the U.S. monetary gold reserves until 1966.

As Triffin (1960) pointed out, dollars supplied by the U.S. deficit could not be a permanent solution to the impending gold shortage because with continuous deficits, U.S. monetary gold reserves would decline both absolutely and relatively to outstanding dollar liabilities until an eventual convertibility crisis. Should the U.S. monetary authorities close the deficit before such a crisis, however, it would create a massive shortage of international liquidity and the prospect of world deflation. New sources of liquidity were required, answered by the creation of the special drawing rights in 1967. By the time SDRs were injected into the system in 1970, however, they exacerbated worldwide inflation.

The Confidence Problem

The perceived key problem of the convertible Bretton Woods period was the confidence crisis for the dollar.¹⁰⁵ As argued by Triffin (1960), Kenen (1960) and Gilbert (1968), the gold-dollar system that evolved after 1959 was bound to be dynamically unstable if the growth of the world monetary gold stock was insufficient to finance the growth of world output and trade and to prevent the U.S. monetary gold stock from declining relative to outstanding U.S. dollar liabilities. The pressure on the U.S. monetary gold stock would continue, as growth of the world monetary gold stock declined relative to the growth of world output and trade and as the world substituted dollars for gold, until it triggered a confidence crisis that led to the collapse of the system, as occurred in 1931. At the same time, however, as fears over U.S. gold convertibility threatened the dynamic stability of the Bretton Woods system, gold still served two positive roles.

Gold was the numeraire of the system; all

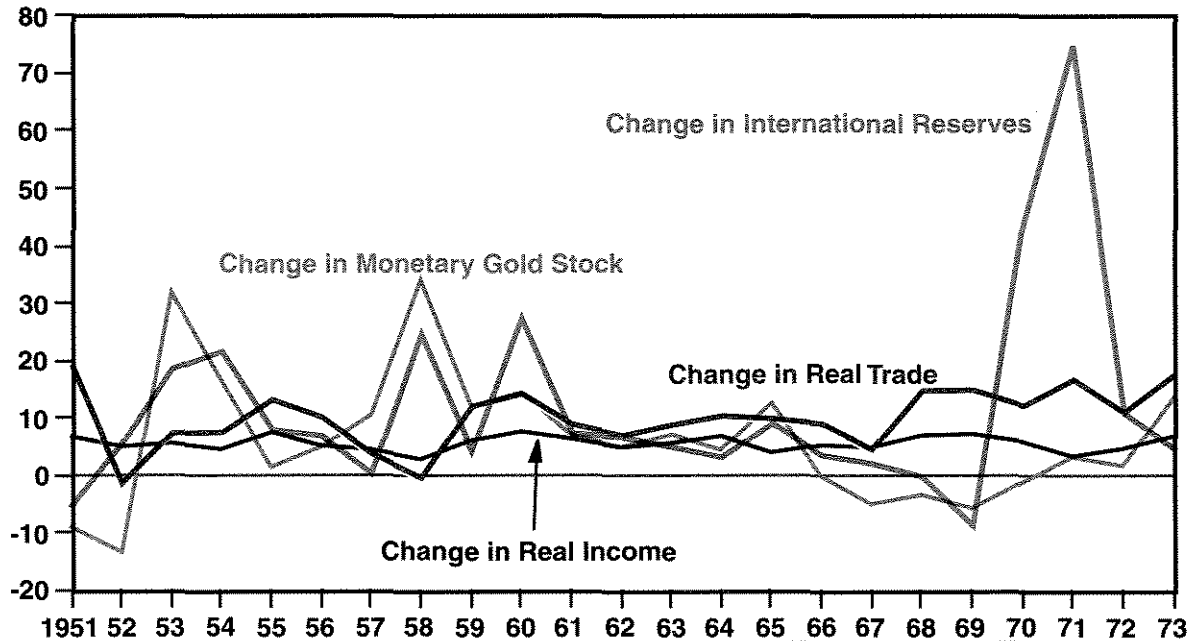
¹⁰⁵Although according to Meltzer (1991), there is little evidence in asset markets through the 1960s of a growing loss of confidence in the dollar. Real interest rates did not

rise significantly relative to trade weighted real interest rates. Nor did the gold and foreign exchange markets suggest a flight from the dollar.

Figure 17

The Growth of the Monetary Gold Stock, the Growth in International Reserves and the Growth of the Volume of Real Trade and Real Income, G7 Minus the United States, 1951-1973

Percent



currencies were anchored to its fixed price through the U.S. commitment to peg its price. Until 1968 gold still served as backing to the U.S. dollar with a 25 percent gold reserve requirement against Federal Reserve notes; the requirement may have served as a brake on U.S. monetary expansion.

The first glimpse of a confidence crisis was the gold rush of October 1960 when speculators pushed the free market price of gold on the London market up from \$35.20 (the U.S. Treasury's buying price) to \$40. See figure 18. This first significant runup in gold prices since the London gold market was reopened in 1954 was supposedly triggered by concerns over a Democratic victory in the 1960 U.S. Presidential election.

U.S. monetary authorities feared that private speculation in the gold market might spill into official demands for conversion. Consequently, remedial action was taken quickly. The Treasury supplied the Bank of England sufficient gold to restore stability, and the monetary authorities of the Group of Ten countries agreed to refrain from buying gold above \$35.20. In suc-

ceeding months, the London Gold Pool, which agreed to buy or sell gold to peg the price at \$35 an ounce, was formed between the United States and seven other countries. The pool became official in November 1961. For the next six years, it succeeded in stabilizing the price of gold but did not prevent a steady decline in the U.S. monetary gold stock. See figure 13. In fact, though the central banks in the seven other countries supplied 40 percent of the gold required to stabilize the price of gold, they replenished their monetary gold stocks outside the pool by converting outstanding dollar balances into gold at the U.S. Treasury.¹⁰⁶

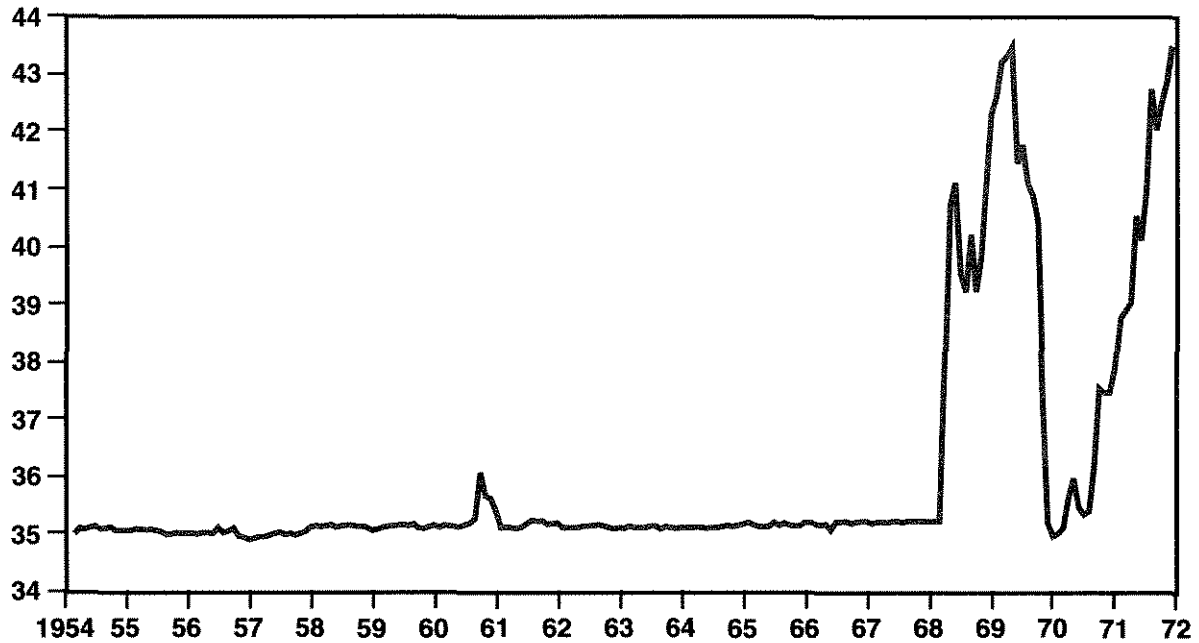
During the period 1961-67, the United States made a series of arrangements to protect its monetary gold reserves. These included a network of swap arrangements with other central banks, the issue of Roosa bonds, and moral suasion. France, however, did not go along with these efforts and began its campaign against the dollar in February 1965.

The period was marked by two sets of under-

¹⁰⁶See Meltzer (1991).

Figure 18
London Gold Price

Dollars per ounce



lying forces that would undermine the dollar's relationship to gold—growing gold scarcity and a rise in U.S. inflation. World gold production leveled off in the mid-1960s and even declined in 1966, while at the same time private demand soared, precipitating a drop in the world monetary gold stock after 1966. Indeed, beginning in 1966, the London Gold Pool became a net seller of gold. Also, U.S. money growth accelerated in 1965, in part to finance the Vietnam War, and inflation began to rise (figures 1 and 15). The current account surplus began to deteriorate in 1964 (figure 14), as did U.S. competitiveness, mirrored in a rise in the ratio of U.S. unit labor costs relative to trade weighted unit labor costs.¹⁰⁷ The balance-of-payments deficit worsened between 1964 and 1966 but was reversed in 1966 by capital inflows triggered by tight monetary policy.

After the devaluation of sterling, which the United States tried unsuccessfully to prevent, pressure mounted against the dollar via the London Gold market. From December 1967 to

March 1968 the Gold Pool lost \$3 billion in gold, with the U.S. share at \$2.2 billion.¹⁰⁸ The immediate concerns of the speculators may have been fears of a dollar devaluation, but according to Gilbert and Johnson, it reflected the underlying gold scarcity.¹⁰⁹ In the face of the pressure, the Gold Pool was disbanded on March 17, 1968, and a two-tier arrangement replaced it. Henceforth, the monetary authorities of the Gold Pool agreed neither to sell nor to buy gold from the market. They would transact only among themselves at the official \$35 price. In addition, on March 12, 1968, the United States removed the 25 percent gold reserve requirement against Federal Reserve notes. The key consequence of these new arrangements was that gold was demonetized at the margin. The link between gold production and other market sources of gold and official reserves was cut. Moreover, in the following years, the United States put considerable pressure on other monetary authorities to refrain from converting their dollar holdings to gold.

¹⁰⁷See Meltzer (1991).

¹⁰⁸See Solomon (1976).

¹⁰⁹See Gilbert (1968) and Johnson (1968).

By 1968 the international monetary system had evolved very far indeed from the model of the architects of the Articles of Agreement. In reaction to both developments in financial markets and the confidence problem, the system had evolved into a *de facto* dollar standard. Gold convertibility, however, still played a role. Though the major industrial countries tacitly agreed not to convert their outstanding dollar liabilities into U.S. monetary gold, the threat of their doing so was always present. At the same time, as the countries of continental Europe and Japan gained economic strength relative to the United States, they became more reluctant to absorb outstanding dollars. They also were reluctant to adjust their surpluses by revaluing their currencies, increasingly coming to believe that adjustment should be undertaken by the United States.

The system had also developed into a *de facto* fixed exchange rate system. Unlike the classical gold standard, however, where the fixed exchange rate was the voluntary focal point for both internal and external equilibrium, in the Bretton Woods system exchange rates became fixed because members feared the consequences of allowing them to change. Nevertheless, because of increased capital mobility, the pressure for altering the parities of countries with persistent deficits and surpluses became harder to stop through the use of domestic policy tools and the aid of international rescue packages. Pressure increased from both academic and official sources for greater exchange rate flexibility.

By 1968, the system had also evolved a form of international governance that was quite different from that envisioned at the beginning. Instead of a community of equal currencies managed by the IMF, the system was managed by the United States in cooperation with the other members of the Group of Ten countries. In many respects, it was closer to the key currency system proposed by Williams.¹¹⁰

According to Dominguez (1993), the IMF was designed to facilitate international cooperation by serving as a commitment mechanism. It was to use its influence and its financial

to enforce the par value system. It did not, however, have sufficient power to prevent devaluations by major countries and its financial resources were too limited to provide adequate adjustment assistance for them. The IMF still had an important role as a clearinghouse for different views on monetary reform, as a center of information, as the principal voice for the countries of the world other than the Group of Ten countries, as these countries' primary source of adjustment assistance and finally as an important partner in the major Group of Ten rescue packages.

In sum, the problems of the interwar system that Bretton Woods was designed to prevent reemerged with a vengeance. The fundamental difference, however, was that the system was not likely to collapse into deflation as in 1931 but rather explode into inflation.

THE COLLAPSE OF BRETTON WOODS

After the establishment of the two-tier arrangement, the world monetary system was on a *de facto* dollar standard. The system became increasingly unstable until it collapsed with the closing of the gold window in August 1971. The collapse of a system beset by the fatal flaws of the gold exchange standard and the adjustable peg was triggered by an acceleration in world inflation, in large part the consequence of an earlier acceleration of inflation in the United States. Before 1968, the U.S. inflation rate was below that of the GNP weighted inflation rate of the Group of Seven countries excluding the United States (see figure 15). It began accelerating in 1964, with a pause in 1966–67. The increase in inflation in the United States and the rest of the world was closely related to an increase in money growth and in money growth relative to the growth of real output. (See figures 19 and 20.) Indeed, a prevalence of excess demand shocks in the mid- and late 1960s is apparent for the United States and other Group of Seven countries in figures 11 and 12.

Darby et al (1983) provided considerable evidence on the transmission of inflation in the

¹¹⁰See Williams (1936 and 1943) and Johnson (1972b).

Figure 19

Money (M1) Growth Rates in the United States, G7 and G7 Excluding the United States, 1951-1973

Percent

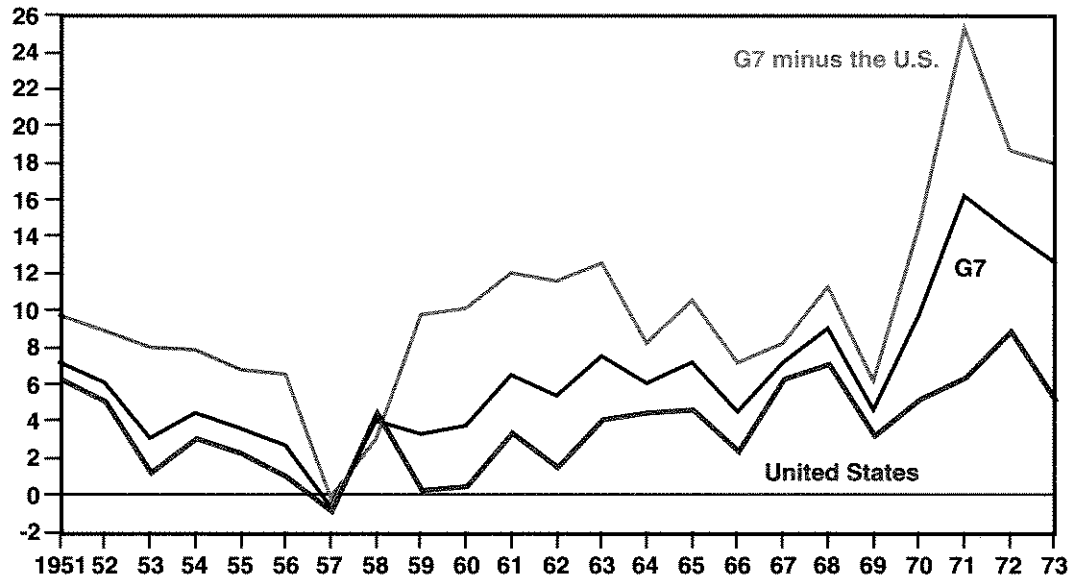
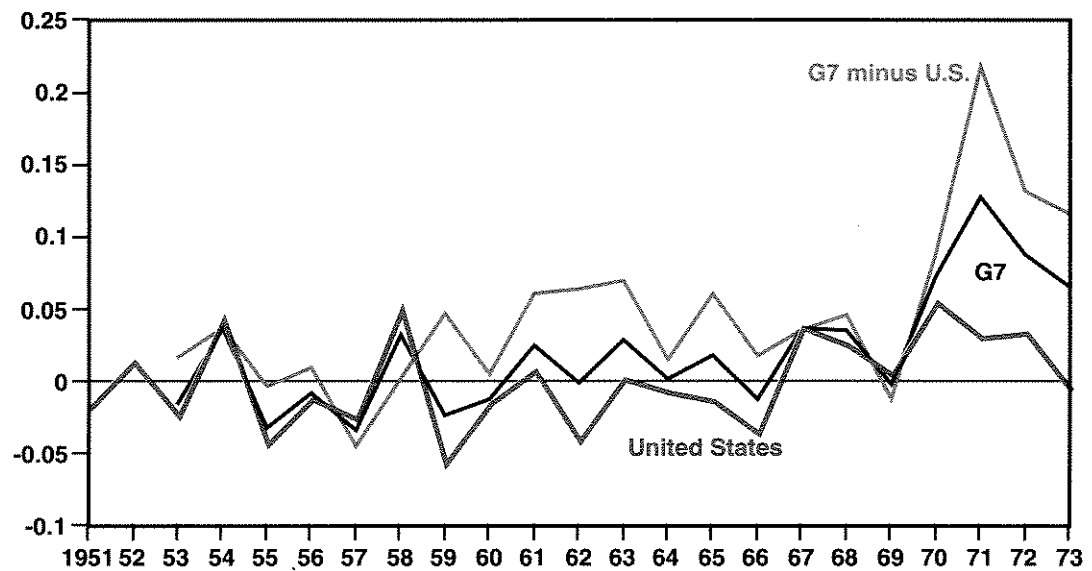


Figure 20

Money (M1) Less Real Output Growth in the United States, G7 and G7 Excluding the United States, 1951-1973

Percent



Bretton Woods system. Their regression analyses led to a number of important conclusions. First, U.S. inflation was caused by lagged U.S. money growth. Second, U.S. money growth was independent of changes in international reserves—the balance of payments had no effect on the Federal Reserve's reaction function. Third, U.S. money growth had strong and significant effects on money growth in seven major countries. These lags were very long—up to four years—and reflected the fact that central banks in the seven countries sterilized reserve flows partially. Finally, money growth in the seven countries explained inflation in these countries with a significant lag.¹¹¹

The key transmission mechanism of inflation was the classical price specie flow mechanism augmented by capital flows. Little evidence for other mechanisms including commodity market arbitrage was detected.¹¹² According to these authors, the Bretton Woods system collapsed because of the lagged effects of U.S. expansionary monetary policy. As the dollar reserves of Germany, Japan and other countries accumulated in the late 1960s and early 1970s, it became increasingly more difficult to sterilize them. This fostered domestic monetary expansion and inflation. In addition, world inflation was aggravated by expansionary monetary and fiscal policies in the rest of the Group of Seven countries, as their governments adopted full-employment stabilization policies. The only alternative to importing U.S. inflation was to float—the route taken by all countries in 1973.¹¹³

The crisis mounted from 1968 to 1971. The U.S. current account balance continued to deteriorate in 1968, but the overall balance of payments exhibited a surplus in 1968 and 1969 thanks to a large short-term capital inflow. The capital inflow was activated by events in the eurodollar market. In the face of tight monetary policy in 1968–69 and Regulation Q ceilings on time deposits, deposits shifted from U.S. banks to the eurodollar market. U.S. banks in turn borrowed in the eurodollar market, repatriating these funds. In 1970, as U.S. interest rates fell

in response to rapid monetary expansion and Regulation Q was suspended for large certificates of deposit, the borrowed funds returned abroad and the deficit grew to \$9 billion, exploding to \$30 billion by August 1971 (see figure 14). The dollar flood increased the reserves of the surplus countries, auguring inflation. German money growth doubled from 6.4 percent to 12 percent in 1971, and the German inflation rate increased from 1.8 percent in 1969 to 5.3 percent in 1971.¹¹⁴ Pressure mounted for a revaluation of the mark. In April 1971 the dollar inflow to Germany reached \$3 billion. On May 5, 1971, the German central bank suspended official operations in the foreign exchange market and allowed the deutsche mark to float. Similar action by Austria, Belgium, the Netherlands and Switzerland followed.¹¹⁵

In the following months, many began advocating ending the dollar's link with gold. In April 1971, the U.S. balance of trade turned to deficit for the first time and influential voices began urging dollar devaluation. The decision to suspend gold convertibility was triggered by French and British intentions in early August to convert dollars into gold. On August 15 at Camp David, President Nixon announced that he had directed Secretary Connolly "to suspend temporarily the convertibility of the dollar into gold or other reserve assets." The accompanying policy package included a 90-day wage-price freeze, a 10 percent import surcharge and a 10 percent investment tax credit.¹¹⁶

The U.S. decision to suspend gold convertibility ended a key aspect of the Bretton Woods system. The remaining part of the system—the adjustable peg—disappeared 19 months later.

The Bretton Woods system collapsed for three basic reasons. First, two major flaws undermined the system. One flaw was the gold exchange standard, which placed the United States under threat of a convertibility crisis. In reaction it pursued policies that in the end made adjustment more difficult.

¹¹¹See Darby et al (1983)

¹¹²See Darby et al (1983).

¹¹³Except for the case of Japan, there is little evidence for the leading alternative explanation for the collapse—that it reflected growing misalignment in real exchange rates between the United States and her principal competitors in the face of differential productivity trends. See Marston

(1987) and Eichengreen (1992b).

¹¹⁴See Meltzer (1991).

¹¹⁵See Solomon (1976).

¹¹⁶See Solomon (1976).

The second flaw was the adjustable peg. Because the costs of discrete changes in parities were deemed high, in the face of growing capital mobility, the system evolved into a reluctant fixed exchange rate system without an effective adjustment mechanism.

Finally, U.S. monetary policy was inappropriate for a key currency. After 1965, the United States, by inflating, followed an inappropriate policy for a key currency country. Though the acceleration of inflation was low by the standards of the following decade, when superimposed on the cumulation of low inflation since World War II, it was sufficient to trigger a speculative attack on the world's monetary gold stock in 1968, leading to the collapse of the Gold Pool.¹¹⁷ Once the regime had evolved into a *de facto* dollar standard, the obligation of the United States was to maintain price stability. Instead, it conducted an inflationary policy, which ultimately destroyed the system.

DID THE BRETTON WOODS SYSTEM OPERATE AS A SYSTEM BASED ON CREDIBLE RULES?

One can view the Bretton Woods system as a set of rules or commitment mechanisms.¹¹⁸ For nonreserve-currency countries the rules were to maintain fixed parities, except in the contingency of a fundamental disequilibrium in the balance of payments, and to use fiscal policy to smooth out short-run disturbances. The U.S. enforcement mechanism—access to its open capital markets—was presumably its dominant power because the IMF had little power.

For the United States, the center country, the rule was to fix the gold price of the dollar at \$35 per ounce and to maintain price stability. If a majority of Bretton Woods members (and every member with 10 percent or more of the total quotas) agreed, however, the United States could change the dollar price of gold. There was no explicit enforcement mechanism other than reputation and the commitment to gold convertibility. According

to Giovannini (1993), the Bretton Woods system was an asymmetric solution to Mundell's *n-1* currency problem.¹¹⁹ The United States as the *n*th country, had to maintain the nominal anchor by following a stable monetary policy. In addition, it had to supply the dollars demanded by the rest of the world as reserves.

The rest of the world had to accept, through its commitment to fixed parities, the price level set by the United States. But because of the adjustable peg, it had the option to change parities. The rule was defective for the nonreserve currencies because the fundamental disequilibrium contingency was never spelled out and no constraint was placed on the extent to which domestic financial policy could stray from maintaining external balance. In addition, with growing capital mobility, the option to change parities became less viable.

For the United States this rule suffered from a number of fatal flaws. First, because of the fear of a confidence crisis, the gold convertibility requirement may have prevented the United States in the early 1960s from acting as a center country and willingly supplying the reserves demanded by the rest of the world. Second, as became evident in the later 1960s, this requirement was useless in preventing U.S. monetary authorities from pursuing an inflationary policy. Finally, although a mechanism was available for the United States to devalue the dollar, monetary authorities were loath to use it for fear of undermining confidence. No effective enforcement mechanism existed. Ultimately, the United States attached greater importance to domestic economic concerns than to its role as the center of the international monetary system.

Thus although the Bretton Woods system can be interpreted as one based on rules, the system did not provide a credible commitment mechanism.¹²⁰ The United States was unwilling to subsume domestic considerations to the responsibility of maintaining a nominal anchor. At the same time, other Group of Seven countries became increasingly unwilling to follow the dictates of the U.S.-imposed world inflation rate.

¹¹⁷See Garber (1993).

¹¹⁸ See McKinnon (1992) for his version of the rules of the Bretton Woods Articles and the dollar standard. Also see Giovannini (1993) and Obstfeld (1993).

¹¹⁹See Mundell (1968).

¹²⁰Giovannini's (1993) calculations show that during the Bretton Woods convertible period credibility bounds on interest rates for the major currencies, in contrast to the classical gold standard, were frequently violated.

The failure of the Bretton Woods rule suggests a number of requirements for a well-designed fixed exchange rate system. These include the following:

- that the countries follow similar domestic economic goals (underlying inflation rates);
- that the rules be transparent; and
- that some central monetary authority enforce them.

The recent EMS system was quite successful for a number of years because it seemed to encompass these three elements. Its recent crisis, however, reflected the emergence of some of the same problems that led to the breakdown of Bretton Woods. I discuss these issues below in the following subsection.

POST BRETTON WOODS: MANAGED FLOATING AND THE 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 end of the 1970s it evolved into a system where exchange market intervention occurred primarily to smooth out fluctuations. Again in the 1980s exchange market intervention was used by the Group of Seven countries as part of a strategy of policy coordination.¹²¹ 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.

The attack cites the favorable experience of the EMS from 1987 to 1991 in producing exchange rate and price stability as a recommendation for a return to a global system of fixed exchange rates. It is argued that recent attempts at policy coordination can be formalized and extended to a more general managed system based on either close policy coordination (to keep exchange rates within specified target zones) or a

renewed gold standard. In this paper I do not consider the merits or drawbacks of policy coordination in general, but I examine the EMS briefly as a monetary regime similar to Bretton Woods.¹²² Of interest is whether lessons for the international monetary system can be derived from its experience.

The EMS, like the Bretton Woods system, represents an agreement among countries to set exchange rate parities, to manage intra-European Community exchange rates and to finance exchange market intervention. Like Bretton Woods, it is an adjustable peg system.

The origins of the EMS date back to the Bretton Woods period. The case for stable exchange rates within Europe was made in the context of the European Common Market (EEC). In addition to a strong dislike by Europeans for flexible exchange rates—based on their perception of inter-war experience and their belief that exchange rate volatility reduces trade in highly open economies—the key motivation for extensive policy coordination to stabilize exchange rates was the common agricultural policy established in 1959.¹²³

Food prices in the community are set in terms of a central unit of account (the ECU) but quoted in local currency. Consequently, any changes in exchange rates lead to changes in local prices. During the Bretton Woods era, a system of subsidies and taxes was worked out to insulate the local economy from policy realignments. This led to an asymmetric adjustment between hard currency countries reluctant to lower their agricultural prices and soft currency countries, which allowed their prices to rise. The result was overproduction of agricultural products and an ever-increasing fraction of the EEC budget allocated to subsidize agriculture.

Early attempts to stabilize intra-European exchange rates during the Bretton Woods era were unsuccessful, as was the Snake in the Tunnel agreement of the 1970s. The EMS, established in 1979, was a formal attempt to overcome earlier obstacles to exchange rate stabilization. It was designed to prevent the defects of the Bretton Woods system, including: the asymmetric adjustment mechanism, with the United States as the center, setting the tune for the rest of

¹²¹ See Bordo and Schwartz (1991).

¹²² See Feldstein (1988) and Bordo and Schwartz (1989a).

¹²³ See Giavazzi and Giovannini (1989).

the world; the problems associated with growing capital mobility; and the dramas of parity realignments. Instead, the EMS designed a set of intervention rules that would produce a symmetric system of adjustment; create a mechanism to finance exchange market interventions; and establish a code of conduct for realigning parities.¹²⁴

Like Bretton Woods, the EMS was based on a set of fixed parities called the exchange rate mechanism (ERM). Each country was to establish a central parity of its currency in terms of ECU, the official unit of account. The ECU consisted of a basket containing a set number of units of each currency. As the value of currencies varied, the weights of each country in the basket would change. A parity grid of all bilateral rates could then be derived from the ratio of members' central rates. Again, like Bretton Woods, each currency was bounded by a set of margins of 2.25 percent on either side of parity, creating a total band of 4.5 percent (for Italy, and later the United Kingdom, when it joined the ERM in 1990, the margin was set at 6 percent on either side of parity). The monetary authorities of both the depreciating and appreciating countries were required to intervene when a currency hit one of the margins. Countries were also allowed, but not required, to undertake intramarginal intervention. The indicator of divergences, which measured each currency's average deviation from the central parity, was devised as a signal for the monetary authorities to take policy actions to strengthen or weaken their currencies. It was supposed to work symmetrically.

Intervention and adjustment was to be financed under a complicated set of arrangements. These arrangements were designed to overcome the weaknesses of the IMF during Bretton Woods. The very short-term financing facility (VSTF) was to provide credibility to the bilateral parties by ensuring unlimited financing for marginal intervention. It provided automatic unlimited lines of credit from the creditor to the debtor members. The short-term monetary support (STMS) was designed to provide short-term finance for temporary balance of pay-

ments disequilibrium. The medium term financial assistance (MTFA) would provide longer term support.

Unlike Bretton Woods, where members (other than the United States) could effectively decide to unilaterally alter their parities, changes in central parities were to be decided collectively. Finally, like Bretton Woods, members could (and did) impose capital controls. These have recently been phased out.

The evidence on the performance of the EMS indicates that it was successful in the latter half of the 1980s at stabilizing both nominal and real exchange rates within Europe, at producing credible bilateral bands and at reducing divergence between members' inflation rates.¹²⁵

Giavazzi and Pagano (1988), Giavazzi and Giovannini (1989), and Giovannini (1989) make a strong case that the success of the EMS was largely due to the fact that it was an asymmetric system with Germany acting as the center country. The other EMS members adapted their monetary policies to maintain fixed parities with Germany. Also, according to the aforementioned writers, the Bundesbank exhibited a strong credible commitment to low inflation and the other members of the ERM, by tying their currencies to the deutsche mark, used an exchange rate target as a commitment mechanism to successfully reduce their own rates of inflation. Evidence for the asymmetry hypothesis is based on the fact that the Bundesbank intervened only when bilateral exchange rates were breached, whereas the other countries engaged in intra-marginal intervention, and on evidence of asymmetrical behavior of interest rates in Germany and the other EMS countries. In the period preceding several EMS realignments, non-German EMS interest rates changed drastically, whereas no change was observed in their German counterpart. Evidence that the Bundesbank's reputation was responsible for the disinflation of the 1980s is based on an out-of-sample simulation of a VAR to predict the inflation rate. Downward shifts in the predicted values of inflation for a number of countries after the advent of the EMS makes the case. That inflation expectations

¹²⁴See Giavazzi and Giovannini (1989).

¹²⁵ At its outset, there was considerable doubt that the EMS would be successful at withstanding the strains of greatly divergent money growth and inflation rates among its members. See Fratianni (1980). See Giavazzi and Giovannini (1989); Fratianni and von Hagen (1990 and 1992); and Meltzer (1990).

were significantly reduced only in France and Italy several years after the advent of the EMS (the argument goes) may reflect slow learning or alternatively that these countries used the EMS to justify following unpopular austerity policies.

Fratianni and von Hagen (1990 and 1992) dispute both the asymmetry and the imported disinflation hypotheses.¹²⁶ Evidence based on Granger causality tests from a structural VAR suggests that the German monetary base was not insulated from other EMS base movements nor were non-German EMS monetary bases insulated by the German monetary base from external shocks. In this interpretation, the EMS is a coordinated monetary policy system with all members playing a role.

Finally, Fratianni and von Hagen (1990) provide evidence that the EMS has reduced intra-European exchange rate volatility; however, this reduction has been at the expense of increased volatility of non-EMS currencies. Thus they argue that the EMS is on net balance beneficial to welfare because intra-EMS trade exceeds external trade. They also show that although the advent of the EMS has not reduced inflation uncertainty relative to non-EMS countries, it has reduced the effects of foreign inflation shocks on the members.

Despite its favorable performance since the mid-1980s, the EMS was recently subjected to the same kinds of stress that plagued Bretton Woods. September 1992 and November 1992 marked a series of exchange rate crises in Europe that paralleled the events of 1967 to 1971. Precipitated by concerns that French voters would reject the Maastricht Treaty on European Monetary Union in a referendum on September 20, speculators staged attacks early in the month on the Nordic currencies and then later on the Italian lira, the British pound, the French franc, and other weaker currencies. The crisis led to the disabling of the ERM. Both Italy and the United Kingdom left it while Spain, Portugal and Ireland reimposed or strengthened existing capital controls: in November Sweden floated and Portugal and Spain devalued.

The fundamental causes of the crisis, like the crises that plagued Bretton Woods, lay in large part with the exchange rate system. The EMS, like Bretton Woods, is a pegged exchange rate system that requires member countries to follow similar domestic monetary and fiscal policies and hence have similar inflation rates. This is difficult to do in the face of both differing shocks across countries and differing national priorities. Under Bretton Woods, capital controls and less integrated international capital markets allowed members to follow divergent policies for considerable periods. Under the EMS, the absence of controls (after 1990) and the presence of extremely mobile capital meant that any movement of domestic policies away from those consistent with maintaining parity would quickly precipitate a speculative attack. Also, just as under Bretton Woods, the adjustable peg in the face of such capital mobility became unworkable. Thus the difference between the two regimes when faced with asymmetric shocks or differing national priorities was the speed of reaction by world capital markets.

Though the fundamental cause of the crisis was similar in the two regimes, the source of the problem differed. Under Bretton Woods, the shock that led to its collapse was an acceleration of inflation in the United States, ostensibly to finance the Vietnam War, as well as social policies, and to maintain full employment. Under the EMS, the shock was bond financed German reunification and the Bundesbank's subsequent deflationary policy. In each case, the system broke down because other countries were unwilling to go along with the policies of the center country. The commitments to price stability by both the center country and the other members were not shown as credible. Under Bretton Woods, Germany and other western European countries were reluctant to inflate or revalue and the United States was reluctant to devalue. Under the EMS, the United Kingdom, Italy, Spain, Portugal, Ireland and Sweden were unwilling to deflate and Germany was unwilling to revalue. As under Bretton Woods, although the EMS had the option for a

¹²⁶Also, Collins (1988) and Eichengreen (1992d) present evidence that EMS membership may not have been responsible for reducing the inflation rates of EMS countries. Their cross-country regressions show that EMS membership had little effect on inflation performance. Changing public attitudes toward inflation within each country represent a more important determinant. See Giavazzi and Collins (1992).

general realignment, both improved capital mobility and the Maastricht commitment to a unified currency made it an unrealizable outcome.

Thus the lesson from both the EMS and Bretton Woods is that pegged exchange rate systems do not work for long no matter how well they are designed. Pegged exchange rates, capital mobility and policy autonomy just do not mix. During the heyday of Bretton Woods years ago, the case made for floating exchange rates for major countries still holds. This is not to say that if European countries were completely willing to give up domestic policy autonomy, they could not eventually form a currency union with perfectly fixed exchange rates. In an uncertain world subject to diverse shocks, the costs for individual countries of doing so are apparently extremely high.

CONCLUSION

This paper examines statistical evidence on the performance of alternative monetary regimes over the past century. It also examines some aspects of the history of these regimes. Both statistical and historical evidence may help provide answers to the question why some regimes have been more successful than others. They also have implications for current issues in international monetary reform and the ongoing debate over rules and discretion.

The statistical evidence on performance of alternative monetary regimes in the second section leads to the conclusion that the Bretton Woods convertible regime from 1959 to 1970 was by far the best on virtually all criteria, but that the recent floating regime is not much worse. Indeed, it is clear that the performance of the regimes in the post-World War II era is superior to the performance of regimes in the preceding half century. Finally, though the classical gold standard does relatively poorly in terms of the stability of real variables, it performed best on inflation persistence and financial market integration—evidence for the successful operation of gold as a nominal anchor.

This evidence leads to the following question: Why was Bretton Woods so stable yet so fragile and the classical gold standard so unstable and yet so durable? The answer may be due in part to the shocks the two regimes faced. This, however, seems unlikely because the gold standard was subject to both supply and demand shocks

that were a multiple of those facing Bretton Woods. It could also be due to greater flexibility of wages and prices and greater factor mobility before World War I, which meant that adjusting to the greater shocks did not have as serious consequences on real activity and employment as later in the twentieth century. Alternatively, political economy factors—such as a more limited suffrage; less concern over the maintenance of full employment; limited understanding of the link between monetary policy and the level of economic activity; and hence loss of an incentive for monetary authorities to pursue policies that would threaten adherence to convertibility—could be responsible. These hypotheses clearly need more investigation.

It also could be due to regime design and especially the incentive compatibility features of the regime. The classical gold standard may have been so successful because of the credibility of the commitment to the gold standard rule of convertibility and because of its near universal acceptance. In turn, the credibility of the gold standard may stem from the origins of gold as money and the importance of Great Britain, the most important commercial nation of the nineteenth century, in enforcing the rules. England's commitment to convertibility in turn was aided by stabilizing private capital flows.

The classical gold standard for the core countries worked as a contingent rule or a rule with escape clauses. As a consequence, it was flexible enough to withstand major shocks. It also enabled governments to finance major wars flexibly, by allowing them to leave the gold standard and temporarily use seigniorage to finance unusual government expenditures. The rule may have endured because the requisite deflation required to restore convertibility after the emergency had passed may not have had severe effects on real variables. This may have been because wages and prices were highly flexible. Alternatively the deflation accompanying resumption may have had significant real effects but no political constituency strong enough to oppose it existed.

The classical gold standard collapsed under the unprecedented shocks of World War I. It was reinstated as the short-lived gold exchange standard. Its brief life reflected the fatal flaws made famous by the Triffin dilemma. But regardless of the weakness of the gold exchange standard, it suffered from the absence of an effective commitment mechanism. There was no cen-

ter country to enforce the rule, just three rivals pulling in different directions. Also, it was the beginning of an era when countries were less willing to go along with the gold convertibility rule because they attached greater weight to the objective of domestic economic stability.

The Bretton Woods system was set up to prevent the perceived flaws of the classical gold standard and the trauma of the interwar period. The Bretton Woods adjustable peg was in some respects similar to the gold standard contingent rule, but it invited speculative attacks, hence compromising its role as an escape clause. Bretton Woods evolved into a gold exchange standard fraught with the adjustment, liquidity and confidence problems of the interwar period. Though the problems of the gold exchange standard could possibly have been corrected by raising the price of gold, as it turned out, it evolved into an asymmetric dollar standard. The United States maintained the credible commitment to a noninflationary policy for only a few years. By the mid-1960s it shifted to an inflationary policy to further its domestic interests. The rest of the world, faced with imported inflation, soon lost the incentive to follow U.S. leadership and the system collapsed in 1971.

The advent of the general floating exchange rate system in 1973 and its longevity suggests that the lessons of Bretton Woods have been learned well. Countries are not willing to subject their domestic policy autonomy to that of another country of whose commitment they cannot be sure in a stochastic world nor to a supernational monetary authority they cannot control. The key advantage of floating exchange rates stressed a generation ago by Milton Friedman and Harry Johnson—the freedom to pursue an independent monetary policy—still holds today. Major countries can design domestic monetary policy rules to achieve domestic price stability without the costs of giving up their policy autonomy.

The experience of the EMS reveals that countries that have similar goals and face similar shocks can establish a regional exchange rate regime. This regime requires both a credible commitment mechanism and the willingness of member countries to give up sovereignty for a higher purpose. As attested to by the events of

September and November 1992, however, the durability of such an arrangement seems doubtful, as was the case for Bretton Woods, in an uncertain world subject to diverse shocks where national priorities can change and commitments can be broken. Some have argued that the EMS can be preserved only by precommitment to price stability and fixed exchange rates by independent central banks.¹²⁷ Others argue that the only solution is rapid movement to a unified currency enforced by a European central bank.¹²⁸ As Feldstein (1992) points out, however, full-fledged monetary union completely precludes the use of domestic monetary policy. To the extent that country-specific shocks dominate common shocks and labor is relatively immobile between European countries, the benefits of permanently fixed exchange rates may not outweigh the cost of increased economic dislocation.¹²⁹

Finally, proposals for monetary reform, such as exchange rate target zones or targeting the real price of gold, though possibly of scientific merit, would work only if nations are willing to give up domestic autonomy and follow credible commitments. The history of international monetary regimes casts doubt on the likelihood that the nations of the world will do so in the foreseeable future.

REFERENCES

- Alogoskoufis, George S. and Ronald Smith. "The Phillips Curve, the Persistence of Inflation, and the Lucas Critique: Evidence from Exchange-Rate Regimes," *American Economic Review* (December 1991), pp. 1254–75.
- Alogoskoufis, George S. "Monetary Accommodation, Exchange Rate Regimes and Inflation Persistence," *Economic Journal* (May 1992), pp. 461–80.
- Barro, Robert J., and David B. Gordon. "Rules, Discretion and Reputation in a Model of Monetary Policy," *Journal of Monetary Economics* (July 1983), pp. 101–21.
- Barsky, Robert B. "The Fisher Hypothesis and the Forecastability and Persistence of Inflation," *Journal of Monetary Economics* (January 1987), pp. 3–24.
- Baxter, Marianne, and Alan C. Stockman. "Business Cycles and the Exchange-Rate Regime: Some International Evidence," *Journal of Monetary Economics* (May 1989), pp. 377–400.
- Bayoumi, Tamin, and Barry Eichengreen. *Economic Performance Under Alternative Exchange Rate Regimes: Some Historical Evidence* (University of California at Berkeley, 1992a).

¹²⁷See Neumann (1991).

¹²⁸See Delors (1989).

¹²⁹See Eichengreen (1992d).

- _____, and _____. *Shocking Aspects of European Monetary Unification*, NBER Working Paper No. 3949 (January 1992b).
- _____, and _____. *Is There a Conflict Between EC Enlargement and European Monetary Unification?* NBER Working Paper No. 3950 (January 1992c).
- _____, and _____. *Monetary and Exchange Rate Arrangements for NAFTA* (University of California at Berkeley, 1992d).
- Bergsten, C. Fred. "The Collapse of Bretton Woods: Implications for International Monetary Reform," in Michael D. Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods International Monetary System*, (University of Chicago Press, 1993), pp. 587-93.
- Bernanke, Benjamin. "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review* (June 1983), pp. 257-76.
- _____, and Harold James. "The Gold Standard, Deflation and Financial Crisis in the Great Depression: An International Comparison," in R. Glenn Hubbard, ed. *Financial Markets and Financial Crisis* (University of Chicago Press, 1991), pp. 33-68.
- Blanchard, Olivier, and Danny Quah. "The Dynamic Effects of Aggregate Demand and Aggregate Supply Disturbances," *American Economic Review* (September 1989), pp. 655-73.
- Black, Stanley W. "International Monetary Institutions," *New Palgrave Dictionary of Economics* (MacMillan, 1987), pp. 917-20.
- Bloomfield, Arthur. *Monetary Policy Under the International Gold Standard, 1800-1914* (Federal Reserve Bank of New York, 1959).
- Bordo, Michael D. "The Classical Gold Standard: Some Lessons for Today," *this Review* (May 1981), pp. 2-17.
- _____. "The Gold Standard: The Traditional Approach," in Michael D. Bordo and Anna J. Schwartz, eds. *A Retrospective on the Classical Gold Standard, 1821-1931* (University of Chicago Press, 1984), pp. 23-120.
- _____. "The Bretton Woods International Monetary System: An Historical Overview," in Michael D. Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods System* (University of Chicago Press, 1993).
- _____, and Richard E. Elson. "A Model of the Classical Gold Standard With Depletion," *Journal of Monetary Economics* (July 1985), pp. 109-20.
- _____, and Finn E. Kydland. *The Gold Standard As a Rule*, Federal Reserve Bank of Cleveland Working Paper No. 9205, (March 1992).
- _____, and Angela Redish. "Credible Commitment and Exchange Rate Stability: Canada's Interwar Experience," *Canadian Journal of Economics* (May 1990), pp. 357-80.
- _____, and Anna J. Schwartz. "Transmission of Real and Monetary Disturbances Under Fixed and Floating Rates," in James A. Dorn and William A. Niskanen, eds. *Dollars, Deficits and Trade* (Kluwer Academic Publishers, 1989a), pp. 237-58.
- _____, and _____. "The ECU—An Imaginary or Embryonic Form of Money: What Can We Learn From History?" in Paul DeGrauwe and Theo Peeters, eds. *The ECU and European Monetary Integration* MacMillan, 1989b), pp. 1-21.
- _____, and _____. "What Has Foreign Exchange Market Intervention Since the Plaza Agreement Accomplished?" *Open Economics Review* (vol. 2, no. 1, 1991).
- _____, and Eugene N. White. "A Tale of Two Currencies: British and French Finance During the Napoleonic War," *Journal of Economic History* (June 1991), pp. 303-16.
- Buiter, Willem H. "A Viable Gold Standard Requires Flexible Monetary and Fiscal Policy," *Review of Economic Studies* (January 1989), pp. 101-18.
- Cagan, Philip. "On the Report of the Gold Commission (1982)," *Carnegie Rochester Conference Series on Public Policy*, (Autumn 1984), pp. 247-67.
- Calomiris, Charles W. "Price and Exchange Rate Determination During the Greenback Suspension," *Oxford Economic Papers* (December 1988), pp. 719-50.
- Canzoneri, Matthew B., and Dale W. Henderson. "Is Sovereign Policymaking Bad?" *Carnegie Rochester Conference Series on Public Policy* (Spring 1988), pp. 93-140.
- _____, and _____. *Monetary Policy in Interdependent Economies* (Massachusetts Institute of Technology Press, 1991).
- Cecchetti, Stephen G., and Georgios Karras. *Sources of Output Fluctuations During the Interwar Period: Further Evidence on the Causes of the Great Depression*, NBER Working Paper No. 4049 (April 1992).
- Collins, Susan. "Inflation and the European Monetary System," in Francesco Giavazzi, Stefano Micossi and Marcus Miller, eds. *The European Monetary System* (Cambridge University Press, 1988), pp. 112-36.
- _____, and Francesco Giavazzi. "Attitudes Toward Inflation and the Viability of Fixed Exchange Rates: Evidence from EMS," in Michael Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods System*, (University of Chicago Press, 1993), pp. 547-77.
- Cooper, Richard. "The Gold Standard: Historical Facts and Future Prospects," *Brookings Papers on Economic Activity* (vol. 1, 1982), pp. 1-45.
- Darby, Michael R., James R. Lothian et. al. *The International Transmission of Inflation*. (University of Chicago Press, 1983).
- _____, and _____. "The International Transmission of Inflation Afloat," in Michael D. Bordo, ed. *Money, History, and International Finance: Essays in Honor of Anna J. Schwartz* (University of Chicago Press, 1989), pp. 203-36.
- DeKock, Gabriel, and Vittorio Grilli. *Endogenous Exchange Rate Regime Switches*, NBER Working Paper No. 3066 (August 1989).
- _____, and _____. *Fiscal Policies and the Choice of Exchange Rate Regime*, CEPR Discussion Paper No. 631 (March 1992).
- Delors, Jacques et al. *Report on Economic and Monetary Union in the European Community* (European Commission, 1989).
- Despres, Emile, Charles Kindleberger and William Salant. "The Dollar and World Liquidity: A Minority View," *The Economist* (February 1966), pp. 526-29.
- Diz, Adolfo C. "The Conditions Attached to Adjustment Financing: Evolution of the IMF Practice," in *The International Monetary System: Forty Years After Bretton Woods*, Federal Reserve Bank of Boston Conference Series No. 28 (May 1984), pp. 214-325.
- Dominguez, Kathryn. "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* (University of Chicago Press, 1993), pp. 357-97.
- Dornbusch, Rudiger. "Expectations and Exchange Rate Dynamics," *Journal of Political Economy* (December 1976), pp. 1161-76.
- Eichengreen, Barry. "Editor's Introduction," in Barry Eichengreen, ed. *The Gold Standard in Theory and History* (Methuen, 1985), pp. 1-36.

- _____. "Conducting the International Orchestra: Bank of England Leadership Under the Classical Gold Standard," *Journal of International Money and Finance* (March 1987), pp. 5-29.
- _____. *The Gold Standard Since Alec Ford*. (University of California at Berkeley, 1989a).
- _____. "Hegemonic Stability Theories," in Richard Cooper et al, eds. *Can Nations Agree: Issues in International Economic Cooperation* (Brookings Institution, 1989b), pp. 255-98.
- _____. "The Comparative Performance of Fixed and Flexible Exchange Rate Regimes: Inter-war Evidence," in Niel Thygesen et al, eds. *Business Cycles: Theories, Evidence and Analysis* (Macmillan, 1991a), pp. 229-72.
- _____. "Trends and Cycles in Foreign Lending," in Horst Siebert, ed. *Capital Flows in the World Economy* (World Institute of World Economics, 1991b), pp. 3-28.
- _____. *U.S. Foreign Relations in the 20th Century* (University of California Berkeley, 1991c).
- _____. "History of the International Monetary System: Implications for Research in International Macroeconomics and Finance," in Frederick van der Ploeg, ed. *Handbook of International Macroeconomics*. (Blackwell, 1993a).
- _____. "Epilogue: Three Perspectives on the Bretton Woods System," in Michael D. Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods System* (University of Chicago Press, 1993b), pp. 621-57.
- _____. *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939*, (Oxford University, 1992a).
- _____. *Should the Maastricht Treaty be Saved?* University of California at Berkeley Political Economy of European Integration Research Group Working Paper 1.10 (September 1992b).
- Emminger, Otmar. "Practical Aspects of the Problem of Balance-of-Payments Adjustment," *Journal of Political Economy* (August 1967), pp. 512-22.
- Feldstein, Martin. *International Economic Cooperation* (University of Chicago Press, 1988).
- Feldstein, Martin. "The Case Against EMU," *The Economist* (June 13, 1992), pp. 19-22.
- Fischer, Stanley. "Rules Versus Discretion in Monetary Policy," in Benjamin M. Friedman and Frank H. Hahn, eds. *Handbook of Monetary Economics, Vol. 2* (North Holland, 1990).
- Fishlow, Albert. *Market Forces or Group Interests: Inconvertible Currency in Pre-1914 Latin America* (University of California at Berkeley, 1987).
- _____. "Conditionality and Willingness to Pay: Some Parallels from the 1890s," in Barry Eichengreen and Peter Lindert, eds. *The International Debt Crisis in Historical Perspective* (Massachusetts Institute of Technology Press, 1989), pp. 86-105.
- Flood, Robert P., and Peter Isard. *Simple Rules, Discretion and Monetary Policy*, NBER Working Paper No. 2934 (April 1989a).
- _____, and _____. "Monetary Policy Strategies," *IMF Staff Papers* (September 1989b), pp. 612-32.
- Fratianni, Michele. "The European Monetary System: A Return to an Adjustable-Peg Arrangement," *Carnegie Rochester Conference Series on Public Policy* (Autumn 1980), pp. 93-140.
- _____, and Juergen von Hagen. "The European Monetary System Ten Years After," *Carnegie Rochester Conference Series on Public Policy* (Spring 1990), pp. 173-241.
- _____, and _____. *The European Monetary System and European Monetary Union* (Westview Press, 1992).
- Friedman, Milton. "The Case for Flexible Exchange Rates," in *Essays in Positive Economics* (University of Chicago Press, 1953), pp. 157-203.
- _____. "Bimetallism Revisited," *Journal of Economic Perspectives* (Fall 1990), pp. 85-104.
- _____, and Schwartz, Anna J. *A Monetary History of the United States, 1867-1960* (Princeton University Press, 1963).
- Gallarotti, Giulio. "Centralized Versus Decentralized International Monetary Systems: The Lessons of the Classical Gold Standard," in James Dorn, ed. *Alternatives to Government Fiat Money* [Kluwer Academic Publishers, 1991 (forthcoming)].
- Garber, Peter. "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* (University of Chicago Press, 1993), pp. 461-85.
- Giavazzi, Francesco, and Alberto Giovannini. *Limiting Exchange Rate Flexibility: The European Monetary System* (Massachusetts Institute of Technology Press, 1989).
- _____, and Marc Pagano. "The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility," *European Economic Review* (June 1988), pp. 1055-75.
- Gilbert, Milton. *The Gold-Dollar System: Conditions of Equilibrium and the Price of Gold* (Princeton Department of Economics, 1968).
- Giovannini, Alberto. "How Do Fixed-Exchange-Rate Regimes Work Evidence From the Gold Standard, Bretton Woods and the EMS," in Marvin Miller, Barry Eichengreen and Richard Portes, eds. *Blueprints for Exchange Rate Management* (Center for Economic Policy Research, 1989), pp. 13-41.
- _____. "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* (University of Chicago Press, 1993), pp. 109-55.
- Grilli, Vittorio, and Graciella Kaminsky. "Nominal Exchange Rate Regimes and the Real Exchange Rate: Evidence from the United States and Great Britain, 1885-1986," *Journal of Monetary Economics* (April 1991), pp. 191-212.
- Grossman, Herschel I. and John B. Van Huyck. "Sovereign Debt as a Contingent Claim: Excusable Default, Repudiation, and Reputation," *American Economic Review* (December 1988), pp. 1088-97.
- Halm, George. *Approaches to Greater Flexibility of Exchange Rates: The Bürgerstock Papers* (Princeton University Press, 1970).
- Hamada, Koichi. "Macroeconomic Strategy Coordination Under Alternative Exchange Rates," in Rudiger Dornbusch and Jacob Frankel, eds. *International Economic Policy* (The Johns Hopkins University Press, 1979), pp. 292-324.
- Hayashi, Fumio. *Japan's Saving Rate: New Data and Reflections*, NBER Working Paper No. 3205 (December 1989).
- Helpman, Elhanan. "An Exploration in the Theory of Exchange Rate Regimes," *Journal of Political Economy* (October 1981), pp. 865-90.
- _____, and Assaf Razin. "Towards a Consistent Comparison of Alternative Exchange Rate Systems," *Canadian Journal of Economics* (August 1979), pp. 394-409.
- Hoffman, Stanley, and Charles Maier, eds. *The Marshall Plan: A Retrospective* (Westview Press, 1984).
- Johnson, Harry G. "The Sterling Crisis of 1967 and the Gold Rush of 1968," *Nebraska Journal of Economics and Business* (Autumn 1968), pp. 3-17.

- _____. "The Case For Flexible Exchange Rates, 1969," in *Further Essays in Monetary Economics* (Harvard University Press, 1976), pp. 198-227.
- _____. "The Bretton Woods System, Key Currencies, and the 'Dollar Crisis' of 1971," *Three Banks Review* (June 1972), pp. 3-22.
- Jonung, Lars. "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* (University of Chicago Press, 1984), pp. 364-404.
- Kaplan, Jacob J., and Gunther Schleiminger. *The European Payments Union: Financial Diplomacy in the 1950s* (Clarendon Press, 1989).
- Keating, John W., and John V. Nye. *Permanent and Transitory Shocks in Real Output: Estimates from Nineteenth Century and Postwar Economics*, Washington University Working Paper No. 160 (July 1991).
- Kenen, Peter B. "International Liquidity and the Balance of Payments of a Reserve-Currency Country," *Quarterly Journal of Economics* (November 1960), pp. 572-86.
- Kindleberger, Charles. *The World in Depression, 1929-1939* (University of California Press, 1973).
- Klein, Benjamin. "Our New Monetary Standard: The Measurement and Effects of Price Uncertainty, 1880-1973," *Economic Inquiry* (December 1975), pp. 461-84.
- Kydland, Finn E., and Edward Prescott. "Rules Rather than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy* (June 1977), pp. 473-91.
- Lindert, Peter. *Key Currencies and Gold, 1900-1913*, Princeton Studies in International Finance, No. 24 (Princeton University Press, 1969).
- Lucas, Robert E. Jr., and Nancy L. Stokey. "Optimal Fiscal and Monetary Policy in an Economy Without Capital," *Journal of Monetary Economics* (July 1983), pp. 55-93.
- Mankiw, Gregory. "The Optimal Collection of Seigniorage—Theory and Evidence," *Journal of Monetary Economics* (September 1987), pp. 327-41.
- Marston, Richard. "Real Exchange Rates and Productivity Growth in the United States and Japan," in Sven Arndt and David Richardson, eds. *Real-Financial Linkages Among Open Economies* (Massachusetts Institute of Technology Press, 1987), pp. 71-96.
- McKinnon, Ronald I. *Money in International Exchange: The Convertible Currency System* (Oxford University Press, 1979).
- _____. "An International Gold Standard Without Gold," *Cato Journal* (Fall 1988), pp. 351-73.
- _____. "Alternative International Monetary Systems: The Rules of the Game Reconsidered," *Journal of Economic Literature* (forthcoming 1993).
- Meltzer, Allan H. *Keynes's Monetary Theory: A Different Interpretation* (Cambridge University Press, 1988).
- _____. "Some Empirical Findings on Differences Between EMS and Non-EMS Regimes: Implications for Currency Blocs," *Cato Journal* (November 1990), pp. 455-83.
- _____. "U.S. Policy in the Bretton Woods Era," *this Review* (May/June 1991), pp. 54-83.
- _____, and Saranna Robinson. "Stability Under the Gold Standard in Practice," in Michael D. Bordo, ed. *Monetary, History and International Finance: Essays in Honor of Anna J. Schwartz* (University of Chicago Press, 1989), pp. 163-95.
- Milward, Alan S. *The Reconstruction of Western Europe 1945-1951* (University of California Press, 1984).
- Moggridge, Donald E. "Keynes and the International Monetary System, 1909-46," in John Cohen and Gregory C. Harcourt, eds. *International Monetary Problems and Supply Side Economics* (MacMillan, 1986), pp. 56-83.
- Mundell, Robert A. *International Economics* (MacMillan, 1968).
- _____. "The International Monetary Fund," *Journal of World Trade Law* (1969) pp. 455-97.
- _____. Untitled, in Michael D. Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods International Monetary System* (University of Chicago Press, 1993), pp. 604-12.
- Mussa, Michael. "Nominal Exchange Rates and the Behavior of Real Exchange Rates: Evidence and Implications," *Carnegie Rochester Conference Series on Public Policy* (Autumn 1986) pp. 117-214.
- Neumann, Manfred J.M. "Precommitment by Central Bank Independence," *Open Economies Review* (1991), pp. 95-112.
- Nurske, Ragnar. *International Currency Experience* (Columbia University Press, 1944).
- Obstfeld, Maurice. "The Adjustment Mechanism," in Michael D. Bordo and Barry Eichengreen, eds. *A Retrospective on the Bretton Woods System* (University of Chicago Press, 1993), pp. 201-56.
- Officer, Lawrence. "The Efficiency of the Dollar-Sterling Gold Standard, 1890-1908," *Journal of Political Economy* (October 1986), pp. 1038-73.
- Persson, Torsten and Guido Tabellini. *Macroeconomic Policy, Credibility and Politics* (Harwood Press, 1990).
- Rockoff, Hugh. "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* (University of Chicago Press, 1984), pp. 613-50.
- Rogoff, Kenneth. "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics* (November 1985a), pp. 1169-90.
- _____. "Can International Monetary Policy Cooperation Be Counterproductive?" *Journal of International Economics* (May 1985b), pp. 199-217.
- Roll, Richard. "Interest Rates and Price Expectations During the Civil War," *Journal of Economic History* (June 1972), pp. 476-98.
- Rueff, Jacques. "Increase the Price of Gold," in Lawrence H. Officer and Thomas D. Willett, eds. *The International Monetary System: Problems and Proposals* (Prentice Hall, 1964), pp. 179-85.
- Salant, Stephen W. "The Vulnerability of Price Stabilization Schemes to Speculative Attack," *Journal of Political Economy* (February 1983), pp. 1-38.
- Scammell, William M. *International Monetary Policy: Bretton Woods and After* (Halsted Press, 1975).
- Schwartz, Anna J. "Introduction," in Michael D. Bordo and Anna J. Schwartz, eds. *A Retrospective on the Classical Gold Standard, 1821-1931* (University of Chicago Press, 1984), pp. 1-22.
- _____. "Alternative Monetary Regimes: The Gold Standard," in Colin D. Campbell and William R. Dougan, eds. *Alternative Monetary Regimes* (The Johns Hopkins University Press, 1986), pp. 44-72.
- Solomon, Robert. *The International Monetary System, 1945-1976: An Insider's View* (Harper and Row, 1976).

- Stockman, Alan C. "Real Exchange Rates Under Alternative Nominal Exchange Rate System," *Journal of International Money and Finance* (August 1983), pp. 147-66.
- _____. "Real Exchange-Rate Variability Under Pegged and Floating Nominal Exchange-Rate Systems: An Equilibrium Theory," *Carnegie Rochester Conference Series on Public Policy* (Autumn 1988) pp. 259-94.
- Temin, Peter. *Lessons from the Great Depression* (Massachusetts Institute of Technology Press, 1989).
- Tew, Brian. *The Evolution of the International Monetary System, 1945-77*, 4th ed. (Hutchinson, 1988).
- Townsend, Robert M. "The Eventual Failure of Price Fixing Schemes," *Journal of Economic Theory* (February 1977), pp. 190-99.
- Triffin, Robert. *Europe and the Money Muddle* (Yale University Press, 1957).
- _____. *Gold and the Dollar Crisis* (Yale University Press, 1960).
- Williams, John H. Extract from A Paper On "The Adequacy of Existing Currency Mechanisms Under Varying Circumstances," in K. Horsefield, ed. *International Monetary Fund: 1945-1965*. Volume III: Documents (International Monetary Fund, 1969a), pp. 119-23.
- _____. Extract from "Currency Stabilization: The Keynes and White Plans," in K. Horsefield, ed. *The International Monetary Fund: 1945-1965*. Volume III: Documents (International Monetary Fund, 1969b), pp. 124-27.
- Williamson, John. *The Exchange Rate System* (Institute for International Economics, 1985a).
- _____. "On the System in Bretton Woods," *American Economic Review* (May 1985b), pp. 74-9.
- Yeager, Leland B. *International Monetary Relations: Theory, History Policy*, 2nd ed. (Harper and Row, 1976).
- _____. "The Image of the Gold Standard," in Michael D. Bordo and Anna J. Schwartz, eds. *A Retrospective on the Classical Gold Standard, 1821-1931* (University of Chicago Press, 1984), pp. 651-70.

Appendix Table 1

**Supply (Permanent) and Demand (Temporary) Shocks: 1880-1989
Annual Data: Standard Deviations of Shocks (percent); Dispersion of shocks across countries (percent)**

	Gold Standard		World War I		Interwar		World War II		Bretton Woods	
	1883-1913		1914-1918		1919-1939		1940-1945		(Total) 1946-1970	
	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply
United States	2.36	4.77	4.27	9.36	6.73	6.31	2.22	7.10	3.69	5.72
United Kingdom	3.09	3.09	4.34	4.32	6.18	5.23	5.59	7.15	2.42	2.47
Canada	1.01	2.80	6.47	6.45	6.28	8.01	2.31	6.68	2.67	2.73
Italy	4.79	5.00	10.60	8.50	11.56	6.46	18.29	4.92	8.15	5.86
G4	2.23	3.53	4.53	6.82	6.73	4.67	2.49	5.91	2.67	4.33
G4*	2.10	3.30	4.30	6.64	6.35	5.12	1.99	6.30	2.76	4.38
Dispersion	2.69	4.30	3.87	7.03	4.15	5.50	5.62	6.96	2.82	3.40

	Bretton Woods (Preconvertible) 1946-1958		Bretton Woods (Convertible) 1959-1970		Floating Exchange		Post WW II	
	1946-1958		1959-1970		1973-1989		1946-1989	
	Demand	Supply	Demand	Supply	Demand	Supply	Demand	Supply
United States	5.06	7.76	1.15	1.87	1.46	2.47	2.92	4.55
United Kingdom	2.96	3.18	1.71	1.32	3.27	4.81	2.85	3.49
Canada	3.65	3.55	0.97	1.56	2.41	2.71	2.59	2.75
Italy	10.98	7.95	2.71	2.21	3.43	2.63	6.78	5.01
G4	3.66	5.87	0.95	1.50	1.41	2.56	2.25	3.80
G4*	3.79	5.89	0.90	1.47	1.56	2.37	2.34	3.59
Dispersion	3.93	4.60	1.61	2.10	2.07	2.05	2.57	2.79

G4, G4-aggregate data

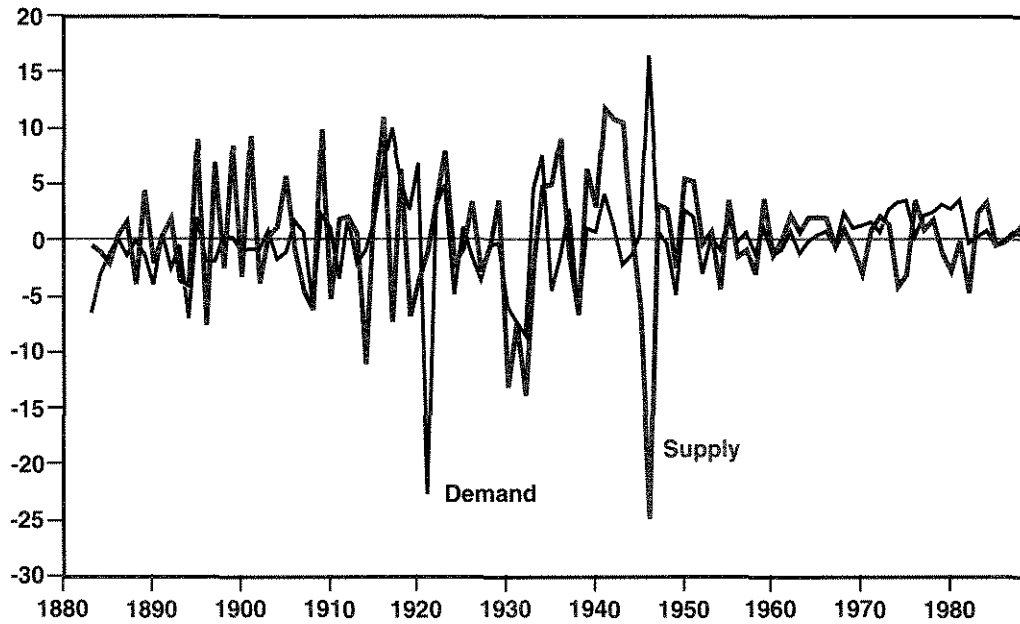
G4*: Weighted average of individual country shocks; the weights are calculated as the share of each country's National Income in the Total Income in the G4 countries, where the GNP/GDP data are converted to dollars using the actual exchange rate.

Dispersion = $\sum (\text{weight} \cdot (\text{shock}_i - \bar{\text{shock}})^2)^{0.5}$ for $i = \text{United States, United Kingdom, Canada, Italy}$

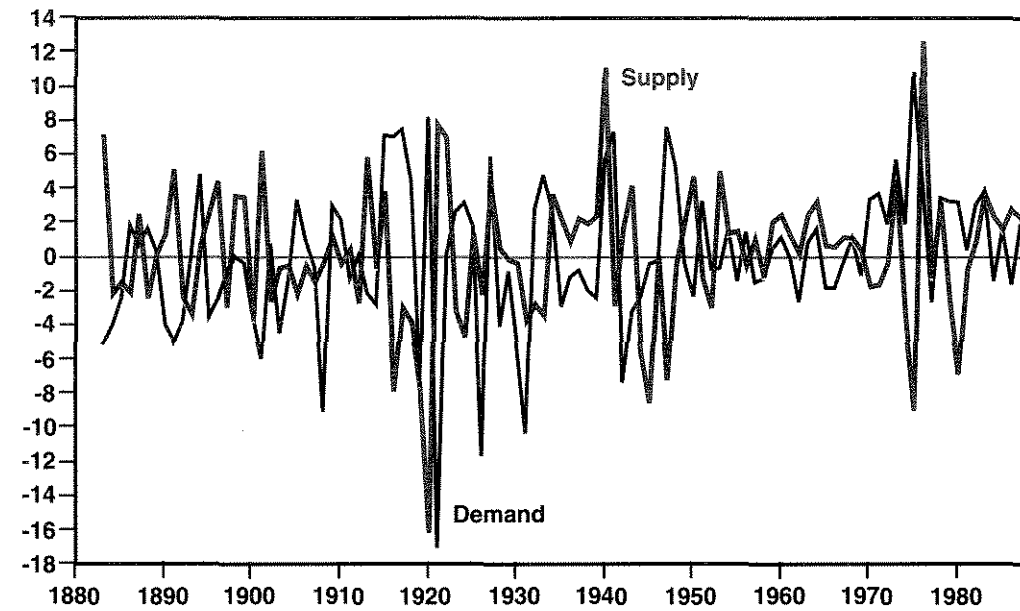
Appendix Figure 1

**Supply and Demand Shocks: 1880-1989, Including the War Years, Annual Data,
United States**

Percent

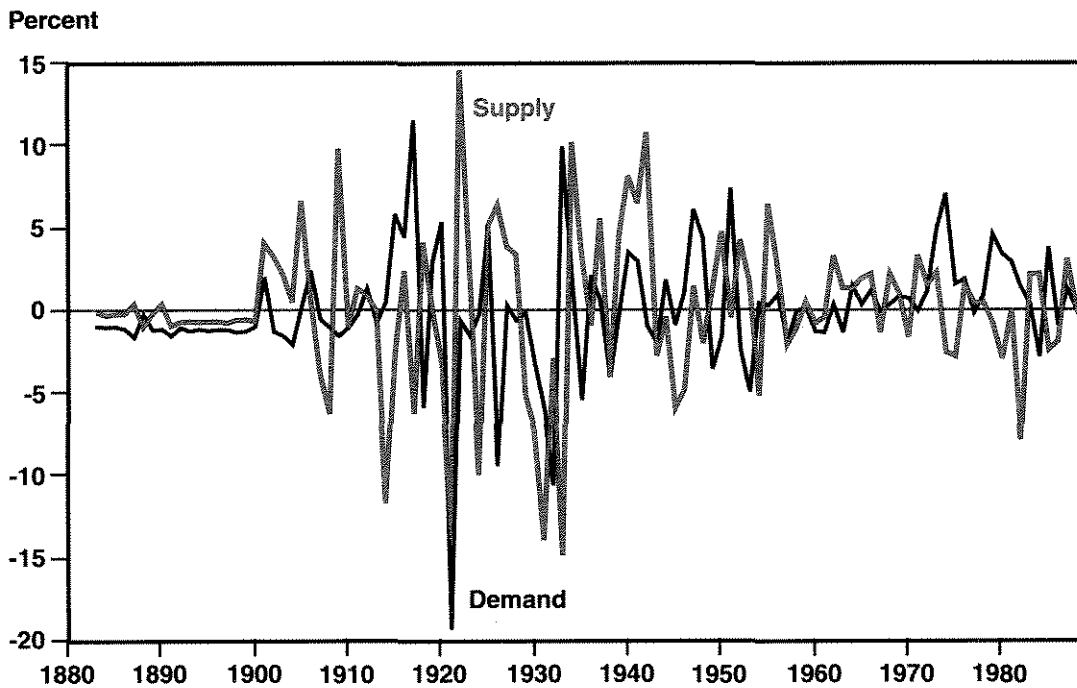
**Supply and Demand Shocks: 1880-1989, Including the War Years, Annual Data,
United Kingdom**

Percent

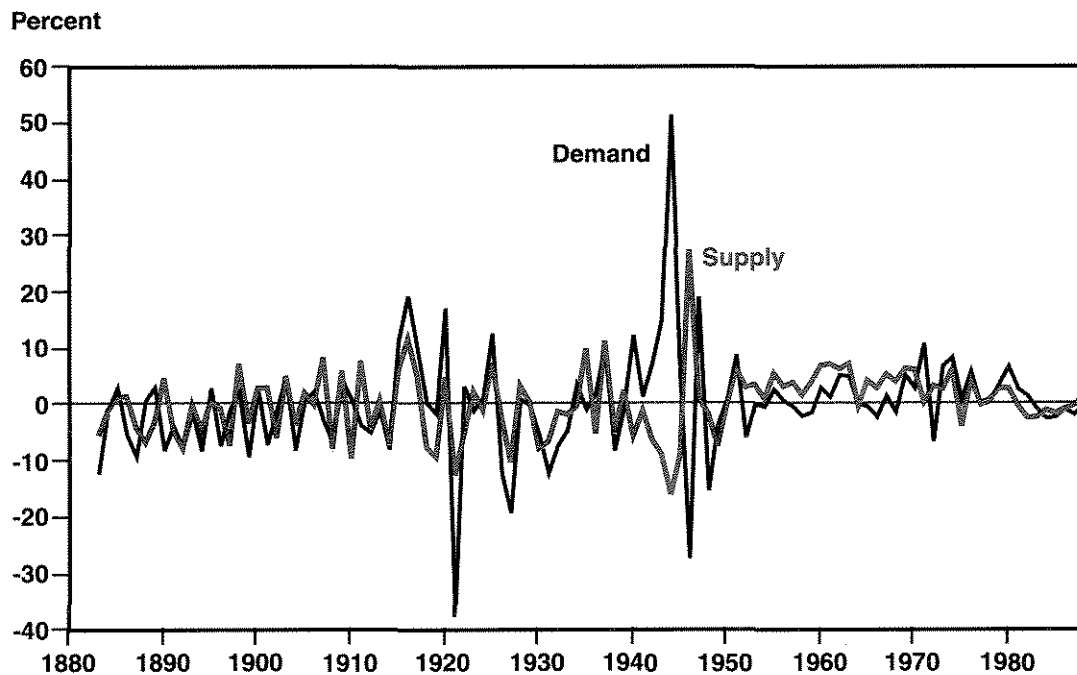


Appendix Figure 1 (continued)

Supply and Demand Shocks: 1880-1989, Including the War Years, Annual Data, Canada



Supply and Demand Shocks: 1880-1989, Including the War Years, Annual Data, Italy



Appendix Figure 1 (continued)

Supply and Demand Shocks: 1880-1989, Including the War Years, Annual Data, G4

Percent

