Historical Evidence on Business Cycles: The International Experience

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This paper adopts a historical perspective to examine the characteristics of business cycle fluctuations within and across a large set of countries. Following the classical work by Burns and Mitchell (1946), we define business cycles as recurrent, but not necessarily periodic, fluctuations in economic activities with a duration of two to eight years. According to them, business cycles are characterized by their average duration and amplitude and the co-movement of economic activities. Our objective is to document regularities of these cyclical movements both across countries and across time.

Most recent empirical work within this strand of research has dealt with the American record; see, for example, Lucas (1977), Kydland and Prescott (1990), and Stock and Watson (1998). A number of recent studies have made international comparisons of business cycles, among others Sheffrin (1988), Baxter and Stockman (1989) and Backus and Kehoe (1992), or they have dealt with the record of countries other than the United States, among others Englund, Persson and Svensson (1992).[1] Our study focusing on many countries, including the United States, should be looked upon as fitting into this tradition of comparative international research on the business cycle. The issues we address in this paper concern, first, the behavior of cycles within countries ("country-specific"

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[1] Also see Zarnowitz (1992) for earlier international cyclical comparisons.

cycles); second, the sources of business cycles; and third, the interaction between business cycles across countries (the "international business cycle").

The approach we take in this paper is an empirical one, not guided directly by any one theory of the business cycle, although we are cognizant that meaningful empirical work is always driven by theory. Business cycle theory has evolved from an emphasis on the cycle as an independent, well-identified entity earlier in the century, to the Keynesian approach in the 1940s and 1950s emphasizing exogenous fluctuations in aggregate demand, to the monetarist approach of the 1960s and 1970s stressing the role of monetary shocks, to the recent real business cycle approach close to the classical view, stressing technology shocks, and the new-Keynesian emphasis on sticky prices and menu costs.[2]

Our approach also complements the traditional narrative approach to the study of business cycles, best exemplified in Thorp (1926) and Gayer, Rostow, and Schwartz (1953). In this approach contemporary press and periodical literature and similar sources are culled to give a picture of what contemporary opinion viewed as both a chronicle of business events and a list of causal factors. To follow such an approach is a gigantic task, beyond the limits of an essay. Instead, we present a bird's eye view of central features of the cyclical experience of advanced countries. We search for a number of empirical regularities as suggested by past and contemporary business cycle research.

We pay special attention to monetary regimes, more specifically to the institutions determining monetary arrangements within the economy as well as between economies. We focus on three distinct regimes: the classical gold standard era, the interwar period, and the post-World War II period, which we split into the Bretton Woods period and the post-Bretton Woods period.[3] The following 13 "advanced" countries are included in our sample: the United States, the United Kingdom, Germany, France, Japan, Italy, Canada, Belgium, the Netherlands, Denmark, Finland, Norway, and Sweden. The European experience is emphasized, partly by choice and partly because of data limitations.

Our empirical work extends the earlier literature in several directions. First, we examine a broader set of countries than did Backus and Kehoe (1992), who studied 10 countries. We have also extended their historical data backward and forward in time.

Second, we apply the Baxter-King (1995) band-pass filter to extract all variations of a variable at business cycle frequencies. We use the data extracted in this way to perform empirical tests of the hypothesis that the

[2] See Zarnowitz (1992, ch. 2).

[3] The rationale for this chronology is spelled out in Bordo and Jonung (1997) and Bordo and Schwartz (1998).

volatility of business cycle fluctuations has been dampened during the post-World War II period, compared to the classical gold standard era. We reconsider this hypothesis and perform empirical tests allowing us to examine this issue both for each country individually and for all 13 countries in our sample.

Third, we apply the band-pass filter to the components of national expenditures to determine whether their cyclical patterns are similar across cycles. We also use a panel data regression to ascertain the extent to which various expenditure components predict recessions.[4]

Fourth, we present evidence on common cyclical movements between countries. We observe patterns of the interrelationships between countries under different monetary regimes that reflect the growth and interdependence of markets and changing patterns of economic performance among countries.

The paper is organized in the following manner. The first section briefly discusses the relationship between monetary regimes and the business cycle. The next section seeks to document regularities (the amplitude and the asymmetry) of country-specific business cycles measured by band-pass-filtered GDP during the three major monetary regimes. In the third section we explore some issues concerning the co-movement of country-specific national income and the expenditure components — consumption, investment, government expenditures and revenues, exports and imports — as well as the money supply and the price level. We also extract expenditure components during recessions, to explore whether these can account for shortfalls in real GDP. The fourth section then examines some aspects of the international business cycle experience. The main question posed in this section is whether we can identify common cyclical patterns across groups of countries. The final section summarizes the paper.

Monetary Regimes and the Business Cycle

Demarcating the data by monetary regimes, we believe, is a fruitful approach for an empirical study such as ours, as different cyclical patterns may emerge within as well as between countries under different monetary regimes. Traditional theory posits that a convertible regime, such as the classical gold standard that prevailed from around 1880 until the outbreak of World War I, is characterized by a set of self-regulating market forces that tend to ensure long-run price level stability. These forces operated through the mechanism commonly described by the classical commodity theory of money (Bordo 1984). According to that

[4] It was not possible to amass the data required to analyze the impact on the business cycle of technology shocks, the variable emphasized by the real business cycle approach.

theory, changes in gold production will eventually offset any inflationary or deflationary price level movements. The problem, however, is that unexpected shocks to the supply or demand for gold can have significant short-run effects on the price level and on real output, in the face of nominal rigidities.

In an international convertible regime, pegging nations' currencies to the fixed price of gold provides a stable nominal anchor to the international monetary system. Such stability, however, comes at the expense of exposure to foreign shocks, which can produce volatile output and employment. Adherence to the international convertible regime also implies a loss of monetary and fiscal independence, since under such a regime the authorities' prime commitment is to maintain convertibility of their currencies into the precious metal, and not to stabilize the domestic economy.

In a fiat money regime, in theory, monetary authorities could use open market operations, or other policy tools, to avoid the types of shocks that may jar the price level and real activity under a specie standard and hence provide both short-run and long-run nominal stability. Such a regime also allows greater fiscal policy autonomy. In addition to giving the authorities policy independence, adhering to a flexible exchange rate fiat regime provides insulation against foreign shocks.[5]

As in a convertible regime, countries following fiat money regimes can adhere to fixed exchange rates with each other. The key advantage of doing so is avoidance of the transaction costs of exchange in international trade. However, a fixed-rate system based on fiat money does not provide the stable nominal anchor of the specie convertibility regime unless all the members define their currencies in terms of the currency of one dominant country (for example, the United States under Bretton Woods or Germany in the European Monetary System), which in turn follows a rule that requires it to maintain price stability.

Finally, in a fiat money, flexible-rate regime, the absence of the nominal anchor of the fixed price of specie opens up the possibility that monetary authorities could use the printing press to engineer high inflation in order to satisfy the political goals of the government, for example, its fiscal demands or demands to maintain full employment.

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[5] 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 do not necessarily provide complete insulation from either real or monetary shocks (Bordo and Schwartz 1989). Moreover, according to recent real business cycle approaches, there may be no relationship between the international monetary regime and the transmission of real shocks (Baxter and Stockman 1989).

The Classical Gold Standard

Under the pre-World War I classical gold standard, where nations' money supplies were determined by their monetary gold stocks, the business cycle was strongly influenced by shocks to the gold market, such as gold discoveries and changes in the demand for gold as new countries adopted the standard. Monetary and fiscal policies had a limited role in this era.

Central banks were supposed to follow the "rules of the game" and accommodate gold flows. Although violations were common, and monetary authorities on occasion sterilized gold flows and geared their policies to domestic objectives such as smoothing interest rates and possibly offsetting cyclical disturbances, in addition to serving as a lender of last resort to provide adequate liquidity to allay banking panics, the violations were never serious enough to force any of the advanced countries to abandon gold convertibility (Bordo 1998). The only situation when expansionary monetary policy was deliberately used was in the case of a major war, when convertibility would be temporarily suspended and government expenditures financed by the issue of inconvertible notes (Bordo and Kydland 1995). Fiscal policy also had a very limited role in this period. Debt-financed government expenditures were temporarily expanded during wartime as a form of tax smoothing (Bordo and Jonung 1997).

Financial crises (banking panics) were important sources of cyclical disturbances under the gold standard. They occurred regularly in England as part of the upper turning point of the business cycle in the years before 1866, after which the Bank of England learned to act as a lender of last resort. Similar experiences occurred on the Continent. In the United States, which did not have an effective lender of last resort and had a unit banking system unable to diversify portfolios in the face of shocks to various regions, banking panics were an important source, if not an aggravating factor, of the business cycle.

Finally, the pre-1914 era was considerably less industrialized than the subsequent years in most of the countries in our sample. Hence shocks to the agricultural sector such as harvest failures constituted important sources of disturbances. These country-specific shocks were in turn transmitted between countries via the fixed exchange rate linkages of most countries adhering to gold parity. They were transmitted via the current account and via capital flows in an era absent controls. Despite the presence of business cycles, the era was one of rapid growth and relative stability compared to the interwar years. Many attribute its success to the fact that it was dominated (in terms of trade flows and cyclical fluctuations) by the United Kingdom, which generally followed very stable financial policies.

The Interwar Period

The interwar period was a mixed regime of floating in the beginning, convertibility in the middle, and managed floating with extensive capital and exchange controls at the end. The early years were characterized by chaotic monetary and fiscal conditions on the continent of Europe and floating exchange rates in most countries. The attempt to restore gold convertibility after the war was responsible for a very serious worldwide recession between 1919 and 1921.

The restored gold exchange standard from 1925 to 1931 reintroduced many of the attributes of the classical gold standard including the conduit of international business cycle transmission via the monetary standard (Fisher 1935; Choudhri and Kochin 1980). It also suffered from fatal flaws that both made it more fragile and imposed deflationary pressure on world monetary gold stocks (Bordo and Eichengreen 1998).[6] The most serious problem of that era, and a key cause of the Great Depression, was the pursuit of pro-gold contractionary policies by the United States and France. The Great Depression originated in the United States but was transmitted abroad by the gold standard. Only when the links with gold were cut did recovery take place.[7]

Although the interwar period was by far the most unstable in our comparison, the 1920s were characterized by relative stability. Many attribute this experience to the effective use of monetary policy in the United States (Friedman and Schwartz 1963a) and central bank cooperation (Eichengreen 1992). The considerable instability that followed in the 1930s is attributed by these authors to the failure of Federal Reserve policy and the breakdown of cooperation.

The Postwar Period: Bretton Woods

The Bretton Woods System was designed to incorporate the perceived lessons of the monetary turmoil of the interwar period. Bretton Woods was the last global convertible regime.

The Articles of Agreement signed at Bretton Woods, New Hampshire, in 1944 represented a compromise between American and British

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[6] The fatal flaws included: the adjustment problem, with asymmetric adjustment between deficit countries (Britain) and surplus countries (France and the United States); the failure by countries to follow the rules of the gold standard game (for example, both the U.S. and France sterilized gold flows); the liquidity problem (inadequate gold supplies, the wholesale substitution of key currencies for gold as international reserves leading to a convertibility crisis when countries subsequently tried to convert the key currencies back into gold); and the confidence problem, leading to sudden shifts among key currencies and between key currencies and gold (Bordo 1993; Eichengreen 1992).

[7] An alternative explanation for the Great Depression focuses on real factors: structural and demographic adjustments to the upheavals of World War I (Temin 1989).

plans. They combined the flexibility and freedom for policymakers of a floating-rate system, which the British representatives wanted, with the nominal stability of the gold standard rule emphasized by the United States. The system established was one of pegged exchange rates, but members could alter their parities in the face of a fundamental disequilibrium. Members were encouraged to use domestic stabilization policy to offset temporary disturbances. Thus, the Agreement explicitly made room for discretionary monetary and fiscal policies, whose use was minimal at best under the classical gold standard. These policies would be effective because of the presence of capital controls. The International Monetary Fund was to provide temporary liquidity assistance and to oversee the operation of the system.

The era was characterized by rapid growth, especially in Europe and Japan, and few serious recessions. The international transmission of cyclical disturbances was muted by capital controls and domestic financial policies. As was Britain under the gold standard, the United States was the dominant country of the Bretton Woods era, and Bretton Woods became a gold dollar standard. The system eventually broke down because of fatal flaws similar to those of the gold exchange standard and because the United States followed inappropriate policies for the center country (Bordo 1993).

The Postwar Period: The Managed Float

The move to a managed, floating exchange rate regime in the 1970s gave greater independence to monetary and fiscal policies. This was exhibited in higher money growth rates, rising fiscal deficits, and high debt-to-GDP ratios (Bordo and Jonung 1997). Most countries followed full employment policies in this period and exploited the Phillips curve trade-off to high inflation. The oil shocks of the 1970s were important aggravating factors (see Daniel 1997). Many believe that they precipitated serious recessions, which were transmitted between countries despite the policy independence afforded by floating rates. In this period, return to greater capital mobility made the world more close-knit and also may have more closely interconnected the business cycle. The high inflation period of the 1970s was followed by disinflation in the 1980s and 1990s and a return to more stable monetary and fiscal policies in the mid 1990s (Bordo and Jonung 1997).

To conclude, it has proved fruitful to adopt a monetary regime perspective to examine long-run patterns. Monetary regimes are an important determinant of the long-run behavior of nominal variables such as the money stock, the price level, and nominal interest rates. There is no clear-cut relationship between monetary regimes and the long-run behavior of real variables, however.

Here we focus instead on the relationship between monetary regimes

and the short-run behavior of the economy, as a priori reasons suggest that the regime may influence cyclical behavior as well. However, we are aware that any cyclical differences found across regimes may be due to a host of factors. Various structural changes may be at work, such as the decline of agriculture and the industrial sector, and the rise of the service sector, the public sector, and the welfare state in a large number of countries in our sample. These structural developments may have exerted an influence on the characteristics of the business cycle.

Properties of Country-Specific Business Cycles

In this section we examine the business cycle properties of real GDP. We examine and compare the data for three different monetary regimes: the classical gold standard era 1873 to 1913, the interwar period 1920 to 1938, and the postwar period 1948 to 1995. The latter period is also split into the Bretton Woods period 1948 to 1972, and the post-Bretton Woods period 1973 to 1995. The data sources are listed in Appendix A.

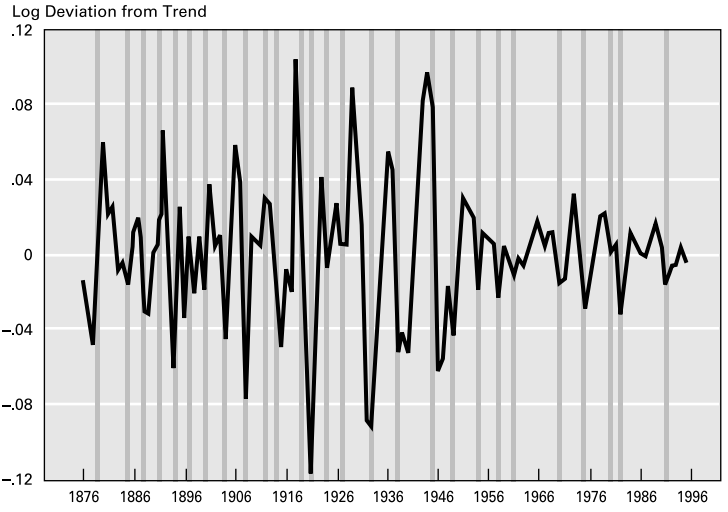
Prior to our empirical analysis, we must extract the cyclical component from the macroeconomic time series. Recently, Baxter and King (1995) have developed a band-pass filter that isolates cyclical components of economic time series. This filter can be designed to isolate cyclical components of the data with durations conforming to the Burns-Mitchell definition of the business cycle, that is, cycles with durations between two and eight years.[8] We use a third-order, two-sided filter following Baxter and King (1995) that produces cyclical components with lengths between two and eight years. When applying this filter, we lose three observations at both ends of our sample. Initial conditions for the filter are actual observations on GDP for the three years preceding 1876 and projections of GDP from 1995 until 1998 based on fourth-order, univariate autoregressive models.[9]

The NBER chronology has long been a common starting point for business cycle analysis. To evaluate our band-pass filter technique we compare the NBER chronology for the United States with our estimated cyclical component, in Figure 1. This figure demonstrates a striking resemblance between NBER peaks and troughs and peaks and troughs estimated by the band-pass filter. Our filter detected 22 out of 26 troughs indicated by the NBER chronology since 1885. In 15 cases, our filter correctly dates the troughs, and we miss four troughs by plus/minus one

[8] Baxter and King (1995) compare the properties of cyclical components of U.S. GNP generated by different detrending techniques and find that the band-pass filter usually is superior to other filters in isolating cyclical variation within certain frequency bands.

[9] Stock and Watson (1998) also use univariate autoregressive models to construct predicted values used as initial conditions.

Figure 1
U.S. Business Cycle: Cyclical Components of GDP



Note: The chart shows NBER chronology vs. band-pass-filtered GDP data. Shaded areas indicate NBER troughs.

year. Three troughs cannot be dated correctly by our filter. This result supports the findings in Stock and Watson (1998), who also apply the band-pass filter to U.S. real GDP. Our interpretation is that the band-pass filter produces a good measure of the U.S. business cycle, as it conforms quite closely to the NBER chronology. Therefore, we apply this filter for our 13 countries to both national income and the components of national income. Plots of band-pass-filtered real GDP for the other 12 countries are shown in Appendix B.

Table 1 displays the average length (in years) of business cycles using band-pass-filtered data for the three monetary regimes. The number of cycles identified is given in parentheses. A comparison across regimes indicates that the typical business cycle lasted on average 3.8 years in the 13 countries in our sample for the classical gold standard period. In this period, cycles ranged from 2.9 years in Italy to 4.7 years in Sweden. The duration increased to 5.4 years on average during the interwar years and then fell back to 4.8 years in the postwar period. We suggest that the business cycle has been a fairly regular empirical phenomenon across time and that the duration is similar across our sample of countries.

Table 1
Average Length of Business Cycles under Different Monetary Regimes

Period	United States	United Kingdom	Germany	France	Canada	Italy	Japan
Gold Standard	4.1 (9)	3.5 (10)	4.0 (10)	4.2 (9)	3.4 (11)	2.9 (12)	4.0 (6)
Interwar	6.3 (3)	6.0 (3)	5.2 (4)	6.5 (2)	4.5 (4)	3.2 (5)	4.0 (5)
Postwar	5.5 (8)	5.6 (8)	4.8 (9)	4.3 (9)	5.1 (9)	4.8 (8)	4.8 (8)

	Belgium	Netherlands	Denmark	Finland	Norway	Sweden	All Countries
Gold Standard	3.7 (10)	3.4 (11)	3.8 (10)	3.8 (8)	3.9 (8)	4.7 (7)	3.8
Interwar	8.3 (3)	5.5 (2)	4.2 (4)	6.3 (3)	4.8 (4)	5.0 (4)	5.4
Postwar	4.1 (9)	5.1 (7)	4.6 (8)	5.8 (8)	3.6 (11)	4.8 (8)	4.8

Note: Gold standard is the period 1873–1913, interwar is 1920–38, and postwar is 1948–95. The numbers in the table refer to the average length in years of estimated cycles peak-to-peak (or trough-to-trough) that fall in each regime. The number of cycles is shown in parentheses.

Mild versus Serious Recessions

One theme in the literature on the business cycle states that severe downturns are of a different character from mild recessions (Burns and Mitchell 1946; Friedman and Schwartz 1963b). According to this view, the severe recessions that occurred before World War II were commonly associated with financial crises. As can be seen from Figure 1 and the graphs in Appendix B, severe recessions generally occurred before 1946. In the case of the United States and a few other countries, these recessions were associated with financial crises (Bordo 1986).

A striking feature of Figure 1 and the graphs in Appendix B is the lower amplitude displayed for the postwar period. However, disregarding the severe recessions in these graphs, volatility seems to have remained fairly constant over time. Next we perform empirical tests of the hypothesis that the business cycle has been dampened.

Has the Business Cycle Been Dampened?

A recent controversy concerns whether the volatility of the business cycle has been reduced, comparing the post-World War II period with the pre-World War II period. Many have argued that the evidence that business cycles have been dampened since World War II reflects the institution and successful application of stabilization policies including automatic stabilizers (DeLong and Summers 1986; Zarnowitz 1992). However, Romer (1989) disputes the basic evidence for the United States. Her reworking of Kuznets' national income series leads to the conclusion that there is little difference in cyclical amplitude between the pre- and post-World War II eras. The counterargument for the U.S. case is

provided by Balke and Gordon (1989). International evidence that generally supports the traditional view has been provided by Sheffrin (1988), Backus and Kehoe (1992), and others. Bergman and Jonung (1993), however, do not find strong support for a dampening of the Swedish business cycle.

To provide evidence on this issue for the 13 countries in our sample, we measure the amplitude of the business cycle as the variance of band-pass-filtered real GDP. Our empirical analysis extends previous studies. Besides using band-pass-filtered data, we examine a larger set of countries than in previous studies. Sheffrin (1988) covers six European countries, whereas Backus and Kehoe (1992) cover 10 countries. In addition to testing whether the variance of the business cycle is invariant to monetary regimes for each country separately, we also test to see whether volatility has changed simultaneously across all 13 countries.

According to the standard deviations in Table 2 for the band-pass-filtered data (the cyclical component of GDP), volatility was considerably higher during the interwar years than during the pre-World War I gold standard and the post-World War II periods. This result confirms the conclusions from earlier studies showing that the interwar years displayed relatively high volatility.[10] There is consensus on this point. The deflation and depression of the early 1920s and the Great Depression of the 1930s brought havoc to the world economy in these years.

Table 2 also throws light on the issue of the possible dampening of the business cycle over time when comparing the classical gold standard era with the post-World War II period. The point estimates of volatility displayed in Table 2 are lower during the later period for 10 out of 13 countries. Figure 2 plots standard deviations of the cyclical component taken from Table 2 for two subperiods, pre-World War I and post-World War II. It shows that the point estimates of volatility are lower during the post-World War II period for all countries except Belgium, Norway, and Denmark.

To construct a formal test of the hypothesis that volatility measured by the variance of the band-pass-filtered GDP declined over time, we set up a Seemingly Unrelated Regression (SUR) system with 13 equations where the dependent variable is the variance of the bandpass filtered GDP and the independent variables are two dummy variables. The first dummy has the value one for the classical gold standard period and zero otherwise, whereas the second dummy takes on the value zero for the gold standard period and one otherwise. In this setup, each coefficient on the two dummy variables is a measure of the variance of the business cycle under each regime.

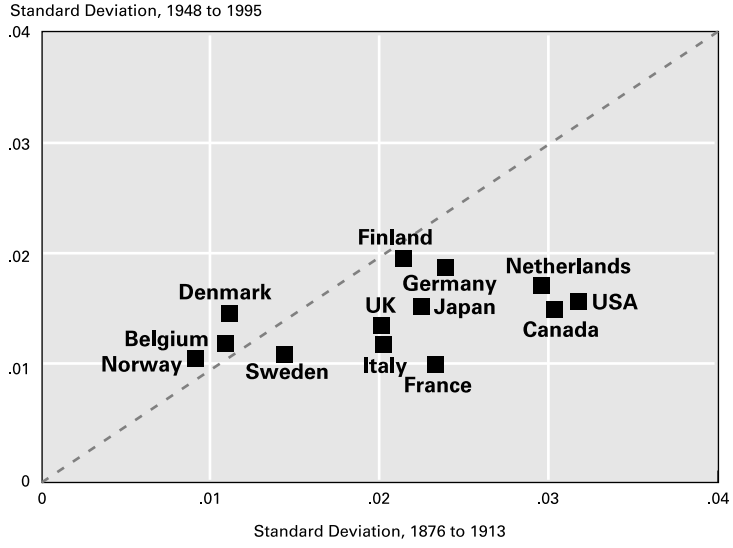
To test whether the variance is constant for each country separately

[10] See for example, Backus and Kehoe (1992, p. 873).

Table 2
Volatility and Skewness of Band-Pass-Filtered Real GDP during Different Monetary Regimes

	Entire Period 1876–1995		Gold Standard 1876–1913		Interwar 1920–38		Postwar 1948–95		Bretton Woods 1948–72		Post-Bretton Woods 1973–95	
Country	Stand. Dev.	Skewness	Stand. Dev.	Skewness	Stand. Dev.	Skewness	Stand. Dev.	Skewness	Stand. Dev.	Skewness	Stand. Dev.	Skewness
United States	.035	−.018	.032	−.145	.053	−.459	.016	−.435	.016	−.494	.016	−.378
United Kingdom	.022	−.205	.020	−.300	.029	−.700	.014	.628	.011	−.194	.017	.724
Germany	.054	−1.530	.024	.491	.077	−1.471	.019	−.057	.019	−.909	.020	.719
France	.044	−1.581	.024	−.803	.037	−.380	.010	.201	.011	.379	.010	−.178
Canada	.032	−.437	.031	−.237	.051	−.588	.015	−.335	.015	−.212	.015	−.498
Italy	.042	−5.092	.020	−.141	.025	.194	.012	.104	.012	.387	.012	−.132
Japan	.050	−2.078	.023	.541	.037	.272	.015	.353	.018	.012	.012	1.424
Belgium	.029	−2.392	.009	1.587	.025	−.208	.011	.043	.010	−.323	.012	.239
Netherlands	.049	−3.440	.030	−.158	.020	−.137	.017	.361	.022	.212	.010	−.512
Denmark	.038	2.208	.011	−.406	.024	.640	.015	−.149	.016	−.154	.013	−.187
Finland	.030	−1.853	.022	−.075	.027	−.390	.020	.034	.017	−.669	.022	.350
Norway	.036	−3.440	.011	−.099	.032	.470	.012	.322	.013	.554	.012	−.004
Sweden	.018	.151	.015	−.008	.025	.351	.011	−.213	.010	.797	.012	−.823

Figure 2
Standard Deviation of Cyclical Components during the Classical Gold Standard (1876 to 1913) and Post-World War II Periods (1948 to 1995)



and also test the joint hypothesis that the variance is constant for all countries simultaneously, we use Wald tests. The results from these tests are summarized in Table 3. Judging from the p-values in this table, this hypothesis can often be rejected for each country by itself, that is, we reject constant variance in six out of 13 cases. Most notable is the fact that we cannot reject constant variance for Sweden, the country most associated with an active stabilization policy, but we can reject the null for the United States. A joint test covering all countries also rejects this hypothesis at very low significance levels. Thus, although the evidence is not overwhelming, the business cycle does appear to have changed its amplitude when this hypothesis is tested simultaneously for all these countries.

Empirical evidence of lower volatility in the postwar data has often been interpreted as resulting from successful stabilization policies. One alternative interpretation is that the international business cycle has been diversified such that developments in one core country no longer influence all other countries. For example, the United Kingdom dominated the world economy prior to the World War I period, and mistakes of the Bank of England could initiate severe recessions not only in the domestic economy but also in its trading partners (see Levy-Leboyer

Table 3
Wald Tests of the Hypothesis That the Variance of the Cyclical Component of Real GDP Is Constant across the Classical Gold Standard and the Postwar Periods.

	United States	United Kingdom	Germany	France	Canada	Italy	Japan
Wald test	14.749	2.384	1.773	6.397	10.036	11.417	5.734
p-value	.000	.122	.183	.011	.002	.001	.017
	Belgium	Netherlands	Denmark	Finland	Norway	Sweden	All 13 countries
Wald test	.342	7.437	3.390	.340	1.151	2.024	74.379
p-value	.559	.006	.560	.560	.283	.155	.000

Note: All tests are based on SUR regressions of the variance of band-pass-filtered GDP for each country on two dummy variables, where the first dummy takes on the value 1 for the classical gold standard (1888–1913) period and 0 otherwise (1948–95), whereas the second dummy takes on the value 0 for the classical gold standard period and 1 otherwise. The Wald tests are χ^2 distributed with 1 degree of freedom for the country tests and 13 degrees of freedom for the joint test.

1982). The increased integration of the world economy would limit negative influences from dominating economies, thus reducing the amplitude of the business cycle, a pattern consistent with the plots in both Figure 1 and Appendix B, as well as the empirical described tests above.

Other explanations include structural changes in the economy linked to the rise of the service sector and the public sector (both less cyclical than the primary and secondary sectors) and the incidence of smaller macroeconomic disturbances after World War II than during the classical gold standard era (see Zarnowitz 1992).

Is the Business Cycle Symmetrical?

The symmetry of the business cycle has been an issue for a long time. Mitchell (1927) and Keynes (1936), among others, were of the opinion that the business cycle was asymmetrical, the upswing being longer and more gradual than the downswing. A large number of empirical studies have dealt with tests of asymmetry without reaching a consensus; see, for example, Neftçi (1984), DeLong and Summers (1986), Falk (1986), Hamilton (1989), Stock (1987), and Bergman and Jonung (1992).

Here, using band-pass-filtered data, we present evidence on this unsettled issue using estimates of the skewness of the cyclical component. If the business cycle is symmetric, skewness would be zero. A negative skewness indicates that upturns are longer than downturns.

Table 2, reporting the skewness of the cyclical component of GDP, reveals that the business cycle is negatively skewed for a majority of the countries in our sample (including the major countries) during the classical gold standard period (10 out of 13 countries) and to some extent

during the interwar years (eight out of 13 countries). However, during the post-World War II period only five out of 13 countries display negative skewness. Splitting this postwar period into a Bretton Woods period and a post-Bretton Woods period, we note that skewness has become more pronounced in the latter period. The U.S. business cycle remains asymmetrical across all regimes, whereas for all other countries the sign for skewness varies across regimes. These results suggest that the business cycle is still asymmetrical.

Country-Specific Co-movements

Cross-Correlations

In the table in Appendix C, we study the cyclical behavior of the components of national income, the money supply, and the price level, and their relation to the cyclical component of real GDP. All variables are filtered through the bandpass filter. The eight variables we consider are consumption, investment, government expenditures and revenues, exports, imports, the money stock, and consumer prices. The first column of the Appendix C Table reports the volatility ratio, measured as the ratio of the standard deviation of each of the eight different variables to the standard deviation of national income. A ratio greater than one implies that this variable has greater volatility than does real output.

Looking first at the expenditure components, a clear result emerges. All expenditure components, with the exception of consumption, are more volatile than output. The volatility ratio is greater than one for all countries and for all regimes with a single exception, the Netherlands during the gold standard period. The ratio for investment is in all countries in the range between 2 and 5, with the exception of Italy during the gold standard and interwar periods. The volatility ratio for the other components is as a rule within the same range as for investment. The volatility ratios for exports and imports are generally larger for the small European countries like Belgium, the Netherlands, Denmark, Finland, Norway, and Sweden than for larger countries like the United States and Germany.

The volatility ratio of consumption is close to one, and in 14 out of 25 cases below one. We regard this as indicating consumption smoothing over the business cycle — aside from the fact that consumption is the major component of national income, which implies that its volatility should be similar to that of national income.[11]

The variability of the money stock is greater than the variability of output for all countries and for all regimes with the following exceptions:

[11] These results are in line with those of Backus and Kehoe (1992) where comparable.

the United States, the United Kingdom, and Italy during the gold standard period and Canada, Denmark, and Norway during the interwar period. We also note that money stock variability has remained higher than output variability during the post-World War II period.

Turning to consumer prices, the Appendix C Table reveals that the U.S. price level is less variable than is output for all regimes. The same holds for Germany except during the interwar years. Consumer prices are more variable than output for Japan, the United Kingdom, France, and Italy, except during the gold standard era, and for the small European countries, with the exception of the Netherlands during the gold standard and the post-Bretton Woods periods.

The next three columns (columns 2 to 4) show the cross-correlations of each variable with national income at a one-period lead and lag, as well as the contemporaneous correlations. These columns reveal, first of all, that most of the significant correlations are registered for simultaneous observations. The business cycle is in this sense a phenomenon that occurs at the same time for most of the expenditure components. There is no clear-cut pattern across countries or across regimes.

Consumption and investment are strongly procyclical, according to the Appendix C Table. The same holds for exports and imports, in particular for imports. The volume of imports, as expected, seems to be determined by domestic activity. Exports are less frequently significantly correlated with domestic output, consistent with the common view that foreign demand is driving exports. This result suggests that cyclical activity across countries is not perfectly correlated; otherwise, exports would more frequently display a significant simultaneous correlation with output.[12]

Government expenditures and revenues do not display any clear-cut pattern, being neither procyclical nor countercyclical. The level of significance is low for most observations. Concerning leads and lags, the Appendix C Table shows no clear pattern either across countries or across regimes.

The correlation between money and output — where significant — is always positive for all countries and all regimes, except for the Netherlands during the gold standard era and Belgium during the post-Bretton Woods period. The United States is an exception in the sense that money and output are significantly and positively correlated for all three major regimes and of particular interest, in that the largest correlations are for the interwar period, as found in earlier studies such as Friedman and Schwartz (1963b). Other countries show no clear pattern. The same conclusions hold for money leading and lagging output by one year.

[12] This issue could be explored by a breakdown of exports on a country-by-country basis — a task that is beyond this paper.

Consumer prices and output are negatively related in 14 cases and positively related in three cases (with the United States before World War II the most notable), counting only significant correlations. The correlation is always negative during the post-World War II period. The price level thus tends to be countercyclical — a result found in other studies as well.

The lead and lag patterns can also be analyzed using regression analysis. For example, we can compare the R^2 from a regression of real GDP (y) on lags of real GDP and consumption (x) with the R^2 from the same regression but excluding lags of consumption. The difference between these two R^2 values, $R^2(y.x)$, then represents the additional explanatory power of lags of consumption for real GDP. Similarly, we can reverse the variables to illustrate the explanatory power of lagged real GDP for consumption, $R^2(x.y)$. These tests correspond to standard block-exogeneity tests (or Granger-causality tests) within vector autoregressive systems. A high relative $R^2(y.x)$ from these regressions does not imply causality, however. The tests only indicate that including the x-component in the information set increases our ability to predict the y-variable one period ahead.

Columns 5 and 6 in the Appendix C Table report the marginal R^2 from these regressions using two lags. A high $R^2(y.x)$ in column 5 implies that the addition of lags of the x-variable increases the prediction of real GDP, thus the x-variable leads real GDP. Similarly, a high relative $R^2(x.y)$ in column 6 indicates that lags of real GDP increase the ability to predict the x-variable, implying that the x-variable lags real GDP.

A few cases show large relative improvements for the R^2, but in most cases the percentage increase is below 20 percent. This result confirms our previous finding that most of the cyclical co-movement occurs for simultaneous observations and that there is no clear-cut pattern across countries and regimes.

Looking more closely at the empirical results, we find that the leads and lags relationship between cyclical components of consumption and the business cycle remains fairly stable over time for the nine countries for which data are available. Consumption leads the business cycle for about half the sample of countries in all monetary regimes. During the postwar period, for example, consumption leads output in the G–7 countries, with the exceptions of France and Italy, but it lags the business cycle in the small open European countries.

A similar pattern is also observed for investment. In all small European countries except Norway, investment lags the business cycle, whereas it leads the business cycle in the G–7 countries except the United Kingdom and Germany. Comparing the relationship between investment and output across monetary regimes reveals that investment tends to lag the business cycle more often during the postwar period than in earlier periods.

This tendency is also evident for government expenditures. The cyclical component of government expenditures lags output in four out of 13 countries during the gold standard period and in seven out of 13 countries during the postwar period.

The money stock leads the business cycle in six out of 13 countries during the gold standard period, in nine out of 13 countries during the interwar period, and in 10 out of 13 countries during the postwar period. The money stock also tends to lag the business cycle in the small open European countries, but it leads output in the G–7 countries. A similar pattern is evident for the price level.

The annual pre-World War I data used to generate the results in the Appendix C Table and Table 4 may have significant deficiencies, making the empirical results less than completely reliable, as discussed in Romer (1989). In addition, the use of annual data suppresses potential lead and lag relationships more evident in high-frequency data. For these reasons, it is useful to compare our results (for the postwar period, when comparable higher-frequency data are available) with results using quarterly data.

Stock and Watson (1998) employ the same empirical approach as we do, but use quarterly data. They find empirical results remarkably similar to the ones reported in the Appendix C Table. For example, they also find that consumption, investment, and imports are strongly procyclical, whereas consumer prices are countercyclical, and that all these variables lead the business cycle (by two quarters in Stock and Watson and by one year in our study). Money is procyclical with a lead of one or two years when using our annual data, whereas using quarterly data, Stock and Watson find that the money stock is procyclical with a lead of two quarters. Thus, the historical U.S. data we use in our study exhibit similar behavior to quarterly data, which we believe buttresses our findings. Whether the same holds for the other countries is a subject for further research.

The Behavior of Economic Aggregates during Recessions

The cross-correlations examined in the previous section provide information on the co-movements of economic aggregates and real GDP over both upturns and downturns. To explore the behavior of these aggregates during recessions, we pick out data for the trough years for all countries in our sample. The dates for the troughs are selected from the band-pass-filtered real GDP data shown in Figure 1 and in Appendix B. As mentioned earlier, the cyclical components represent deviations from trend and are measured in percents.

In Table 4, we report the average deviation from trend of band-pass-filtered real GDP, the components of national income and the nominal money stock. The first column reports the number of troughs identified in

Table 4
Average Deviation from Trend of Real GDP, the Components of National Income, and the Nominal Money Stock during Recessions

Country	Number of Recession Troughs	Y	C	I	G	T	X	M	M2
United States	22	−3.8	−1.9	−7.1	−2.9	−3.8	−3.5	−6.4	−2.2
United Kingdom	22	−2.6	−.4	−1.1	−2.3	−.8	−2.7	−4.3	−.3
Germany	25	−4.9	−.5	−7.7	3.1	.1	−2.4	−6.0	−.4
France	24	−3.4	−.2	−1.0	−1.4	−3.3	−5.7	−12.0	−.1
Canada	24	−3.5	−2.8	−4.1	−.8	−2.7	−4.9	−5.7	−.9
Italy	27	−3.2	−1.8	−8.9	1.1	−.9	−1.3	−2.7	−.4
Japan	23	−3.7	−1.2	−.5	2.5	.8	−.2	2.1	−.7
Belgium	23	−2.3		−5.8	−1.3	−.8	−3.3	−3.0	−1.0
Netherlands	23	−4.2		−2.8	1.2	−7.4	−4.9	−5.9	−1.2
Denmark	27	−2.8		−5.3	2.3	−1.9	−3.5	−6.9	.4
Finland	24	−2.9		−1.8	.4	−5.1	−16.8	−15.4	−1.9
Norway	27	−2.2	.2	−3.6	−1.3	−.8	−7.2	−3.4	.3
Sweden	23	−1.8	−1.4	−5.0	5.8	1.5	−4.7	−4.4	1.0

Note: Y = real GDP, C = private consumption, I = gross fixed capital formation, G = government expenditures, T = government revenues, X = exports, M = imports, and M2 = money stock.

the sample for each country and the second column shows the average deviation of real GDP from its trend during recessions. From this column, we observe that recessions tend to be deeper in large countries compared to the small open European countries. The average deviation from trend in the United States, Germany, France, Canada, and Italy is considerably higher than the average of the four Nordic countries and Belgium.

The deviations from trend of real GDP can be compared to deviations from trend of the components of national income, that is, private consumption (C), gross fixed capital formation (I), government expenditures (G), government revenues (T), exports (X) and imports (M). Consider, for example, the behavior of economic aggregates in the United States during recessions. The average deviation of real GDP from trend is -3.8 percent. From Table 4, we note that both capital formation, which was on average 7.1 percent below trend, and foreign trade (exports and imports) represent large fractions of the downturns in the U.S. economy, whereas private consumption and government expenditures represent only a minor proportion.

Similar results hold for other countries, in particular for Germany, Canada, Belgium, Denmark, Norway, and Sweden, even if the relative importance of these three economic aggregates differs. In France, the Netherlands, and Finland, foreign trade and government revenues represent the major part of the shortfall in real GDP. For example, for the Netherlands government revenues were 7.4 percent below trend, whereas real GDP was 4.2 percent below trend.

Table 5
Effects of Bandpass-Filtered Economic Aggregates on Real GDP during Recessions.
Pooled panel data regression

C	I	G	T	X	M	M2	R^2	Durbin Watson
.282	.072	.022	−.033	.075	−.003	.009	.803	1.871
(3.473)	(4.871)	(1.224)	(−1.203)	(3.288)	(−.146)	(.388)		

Note: The regression coefficients are OLS estimates, and the standard errors in their t-statistics shown below each coefficient are corrected for heteroscedasticity. The number of observations is 174. The regression also includes country dummies. The corresponding parameters are all statistically different from zero at conventional significance levels and are not reported to save space. See Table 4 for definitions of aggregates. Belgium, Denmark, Finland, and Norway are excluded from the data set for private consumption.

The last column of Table 4 shows the average shortfall of the money stock during recessions. From this column, we find that the nominal money stock only represents a minor share of the troughs in real GDP except for the United States, where the nominal money stock was 2.2 percent below trend during recessions.

Another way to characterize the behavior of the economic aggregates during recessions is to stack the data for our sample of countries and formulate a regression model to study the effects of deviations from trend of economic aggregates on deviations from trend of real GDP. The OLS estimates of this pooled regression are shown in Table 5. We constrain all parameters to be equal across the 13 countries. We also include country dummies in the regression to capture potential differences in units.

Since we lack data on private consumption for four countries (Belgium, Denmark, Finland, Norway), we exclude them from the data set. The estimates of the parameters associated with the dummy variables are not reported in Table 5. However, they are all statistically different from zero at conventional significance levels. According to the estimates in Table 5, three expenditure components, private consumption, investment, and exports, are statistically significant at the 5 percent level. This conclusion is consistent with the averages presented in Table 4 and implies that deviations of real GDP from trend can be allocated to these three economic aggregates. Three measures of economic policy, government expenditures and revenues and the money stock, are not significant in this regression and account only for small fractions of the shortfalls in real GDP during troughs, as is also the case in Table 4.

The fact that the money stock is not significant in these regressions may reflect the pooling of small open economies with larger, less open ones like the United States, and the pooling across fixed and flexible exchange rate regimes. Under fixed exchange rates, which covered much of the period investigated in the regression, one would not expect domestic monetary factors to be significant determinants of recessions for

small open economies except indirectly via the balance of payments, whereas with larger, less open economies they could have significant effects. Under flexible exchange rates, monetary factors could have significant effects even for small open economies.

Although these results suggest that recessions are strongly associated with sharp declines in consumption, investment, and exports, we cannot infer causality from them. Cyclical declines in the various expenditure components may be due to factors not explicitly included in our analysis, such as productivity shocks. Thus, like the recent study by Cochrane (1994) for the postwar United States, the cross-country evidence over a century of data does not suggest a single cause of recessions.

International Co-movements of Output and Prices

In this section we examine the co-movements of band-pass-filtered real GDP and price levels between countries. We retain the regime division used in the previous section.

Co-movements of Real Output

In Table 6 we report contemporaneous correlations of output for the 13 countries. A major impression from this table is that the correlations tend to increase over time. Most of the significant correlations are reported from the post-Bretton Woods period. We view this as indicating an increase in integration of the world economy in the past 20 years. Table 6 also reveals that the correlation between the United States and Canada has been high during all regimes for concomitant changes.[13]

Under the gold standard, U.K. output was significantly and positively correlated with output for only one country — Japan. The corresponding number for the post-Bretton Woods period is six. A similar picture emerges for Germany. The lack of apparent real output correlation under the gold standard in an era of high mobility in both good and factors of production is a puzzle. It may reflect the quality of the data. However, our results are consistent with earlier empirical evidence. See, for example, Baxter and Stockman (1989).

In the interwar period, significant correlations are observed between the United States and seven other countries. Such correlation is not found for any other country. These results seem consistent with the view that the United States was the epicenter of the Great Depression.

[13] We also calculated correlations across countries for leads and lags up to two years. These calculations, not reported here, but available from the authors on request, generally suggest no significant patterns. Most of the international co-movements seem to take place concurrently.

Table 6
International Contemporaneous Output Links, Band-Pass-Filtered Real GDP

		UK	Germany	France	Canada	Italy	Japan	Belgium	Netherlands	Denmark	Finland	Norway	Sweden
United States	prewar	.151	−.140	.063	**.510**	**.340**	−.278	**.318**	.109	**.140**	−.090	.134	.051
	interwar	**.644**	.003	**.412**	**.839**	.295	−.191	.312	**.396**	**.499**	.360	**.425**	**.584**
	postwar	**.473**	.276	.143	**.721**	.124	**.377**	.190	−.138	.156	.136	.177	−.037
	Bretton Woods	.138	.329	−.064	**.645**	−.205	.331	.090	−.412	−.141	.010	.065	−.181
	post-Bretton Woods	**.744**	.224	**.427**	**.812**	**.487**	.465	.285	**.533**	**.586**	.249	.321	.098
United Kingdom	prewar		**−.201**	.245	.039	.165	**.333**	.170	.345	.146	−.015	−.100	.020
	interwar		.140	.273	**.681**	.331	.584	−.020	.059	.241	.247	.276	**.301**
	postwar		.223	**.468**	.299	.251	.163	**.279**	.272	**.498**	**.466**	.085	**.385**
	Bretton Woods		**.494**	**.381**	−.090	−.058	−.076	.274	.357	**.416**	.377	.136	**.550**
	post-Bretton Woods		.057	**.590**	**.587**	**.470**	.431	.280	.300	**.628**	**.516**	.057	.298
Germany	prewar			.259	−.016	.108	−.114	.424	.117	.088	.326	−.066	.368
	interwar			.152	.148	−.009	**.478**	.063	.442	**−.568**	.293	−.023	.278
	postwar			.350	.087	.266	**.470**	**.523**	**.397**	**.320**	.124	.233	.237
	Bretton Woods			.319	.192	−.016	**.408**	**.500**	.352	.257	**.607**	.196	**.527**
	post-Bretton Woods			.389	−.017	**.536**	**.587**	**.552**	**.594**	**.407**	−.249	**.274**	−.005
France	prewar				.257	.366	−.085	**.450**	.260	−.160	.153	.095	.091
	interwar				**.380**	.214	.290	**.610**	**.373**	**.399**	**.512**	**.639**	.282
	postwar				.111	**.435**	.154	**.589**	**.454**	**.275**	**.520**	−.025	**.434**
	Bretton Woods				−.042	.144	−.091	**.443**	**.426**	.212	**.509**	.119	**.505**
	post-Bretton Woods				.327	**.785**	**.604**	**.777**	**.582**	**.375**	**.559**	−.228	.374
Canada	prewar					.126	−.280	**.316**	.004	−.149	−.043	**.259**	.125
	interwar					**.380**	−.028	.301	**.452**	.415	**.547**	**.505**	**.592**
	postwar					.109	.151	.206	−.035	.015	.176	.104	.105
	Bretton Woods					**−.264**	.076	.128	−.242	−.227	−.191	−.094	−.216
	post-Bretton Woods					**.516**	.280	**.274**	**.496**	**.361**	**.494**	.354	**.405**
Italy	prewar						−.175	.105	−.078	**.458**	**.330**	.071	.043
	interwar						−.229	.162	.039	.072	.260	.236	−.002
	postwar						**.441**	**.504**	**.485**	.220	**.317**	.292	**.308**
	Bretton Woods						**.408**	.141	**.418**	.044	.084	.338	.101
	post-Bretton Woods						**.515**	**.836**	**.749**	**.450**	**.506**	.241	**.485**

Table 6 continued
International Contemporaneous Output Links, Band-Pass-Filtered Real GDP

		UK	Germany	France	Canada	Italy	Japan	Belgium	Netherlands	Denmark	Finland	Norway	Sweden
Japan	prewar							**−.154**	−.158	.074	−.089	**−.344**	−.073
	interwar							.419	.338	**−.386**	.356	−.133	−.130
	postwar							**.482**	.208	.083	**.288**	.186	.055
	Bretton Woods							**.479**	.137	−.067	**.343**	**.382**	−.014
	post-Bretton Woods							**.528**	**.465**	.375	.255	−.146	.149
Belgium	prewar								.247	.099	.414	.142	.229
	interwar								**.602**	.228	**.502**	**.524**	.338
	postwar								**.506**	.109	**.551**	.192	**.443**
	Bretton Woods								**.511**	−.044	**.747**	.379	**.471**
	post-Bretton Woods								**.682**	.294	**.412**	.010	**.425**
Netherlands	prewar									−.282	.051	−.114	.248
	interwar									−.097	**.391**	.364	**.425**
	postwar									**.430**	**.322**	**.437**	**.369**
	Bretton Woods									**.420**	**.442**	**.460**	**.432**
	post-Bretton Woods									**.511**	**.235**	**.451**	**.371**
Denmark	prewar										**.356**	**−.191**	.140
	interwar										.128	**.401**	.317
	postwar										.120	**.348**	**.259**
	Bretton Woods										.122	.231	**.351**
	post-Bretton Woods										.126	**.523**	.168
Finland	prewar											.121	**.460**
	interwar											**.459**	.427
	postwar											.105	**.652**
	Bretton Woods											.362	**.492**
	post-Bretton Woods											−.124	**.761**
Norway	prewar												.294
	interwar												**.603**
	postwar												.087
	Bretton Woods												−.033
	post-Bretton Woods												.205

Note: Bold numbers denote correlations statistically significant at the 5 percent level using Newey-West optimal bandwidth standard errors.

Table 7
International Contemporaneous Price Level Linkages, Band-Pass-Filtered Price Levels

		UK	Germany	France	Canada	Italy	Japan	Belgium	Netherlands	Denmark	Finland	Norway	Sweden
United States	prewar	.396	.097	−.265	**.451**	**.405**	.339	.013	−.121	.020	.1148	.113	.157
	interwar	**.649**	−.148	.323	**.950**	**.428**	.161	.403	**.443**	.190	**.335**	.211	.460
	postwar	**.657**	**.554**	**.578**	**.752**	**.607**	**.422**	**.489**	**.313**	**.444**	**.413**	**.242**	**.521**
	Bretton Woods	**.664**	**.668**	**.650**	**.819**	**.624**	**.500**	**.761**	**.289**	.275	**.441**	.246	**.584**
	post-Bretton Woods	**.663**	**.443**	**.690**	**.695**	**.588**	**.516**	.252	.359	**.712**	**.426**	.243	**.470**
United Kingdom	prewar		**.591**	.172	**.621**	.077	.221	**.383**	**.421**	**.240**	**.489**	**.557**	**.480**
	interwar		**−.696**	**.355**	**.646**	**.543**	**.515**	.384	**.625**	**.359**	**.525**	**.609**	**.918**
	postwar		**.454**	**.392**	**.599**	**.690**	.236	**.625**	**.455**	**.459**	**.519**	**.408**	**.623**
	Bretton Woods		**.747**	.455	**.654**	**.728**	.202	**.756**	**.382**	**.575**	**.418**	.535	**.778**
	post-Bretton Woods		.284	**.608**	**.609**	**.716**	**.550**	**.572**	**.629**	**.453**	**.785**	.407	**.620**
Germany	prewar			**.275**	**.283**	.231	.105	**.551**	**.403**	**.509**	**.508**	**.580**	**.607**
	interwar			−.159	−.108	−.197	−.323	−.171	−.412	−.424	−.056	**−.708**	**−.766**
	postwar			**.495**	**.541**	**.652**	**.393**	**.682**	**.375**	**.419**	**.299**	**.274**	**.634**
	Bretton Woods			**.514**	**.596**	**.772**	**.425**	**.786**	.211	**.387**	**.253**	.269	**.768**
	post-Bretton Woods			**.576**	**.437**	**.459**	**.429**	**.542**	**.752**	**.401**	**.398**	.195	.306
France	prewar				−.068	.064	**−.402**	**.400**	.172	.256	.152	**.316**	.113
	interwar				**.404**	**.607**	.089	**.626**	**.382**	**−.361**	.115	−.026	.152
	postwar				**.643**	**.536**	**.569**	**.461**	**.270**	.239	**.408**	.107	**.348**
	Bretton Woods				**.661**	**.449**	**.564**	**.428**	.186	.121	.335	.025	.300
	post-Bretton Woods				**.789**	**.931**	**.604**	**.750**	**.657**	**.819**	**.751**	**.533**	**.590**
Canada	prewar					.002	.248	.265	.110	**.115**	.236	.273	.144
	interwar					**.448**	**.210**	.500	**.492**	.139	**.371**	.129	.456
	postwar					**.693**	.319	**.671**	**.571**	**.621**	**.658**	**.450**	**.588**
	Bretton Woods					**.682**	**.320**	**.831**	**.625**	**.561**	**.690**	.349	**.584**
	post-Bretton Woods					**.694**	**.479**	**.491**	**.484**	**.745**	**.636**	**.670**	**.588**
Italy	prewar						**.296**	.179	.046	.273	.152	.261	.236
	interwar						**.207**	.153	.131	−.175	.224	**.333**	**.362**
	postwar						.393	**.798**	**.517**	**.603**	**.563**	**.425**	**.639**
	Bretton Woods						**.381**	**.829**	**.418**	**.523**	**.442**	**.377**	**.618**
	post-Bretton Woods						**.634**	**.762**	**.696**	**.758**	**.824**	**.531**	**.674**

Table 7 continued
International Contemporaneous Price Level Linkages, Band-Pass-Filtered Price Levels

		UK	Germany	France	Canada	Italy	Japan	Belgium	Netherlands	Denmark	Finland	Norway	Sweden
Japan	prewar							−.105	**−.241**	−.169	−.136	.161	.014
	interwar							.199	**.708**	**.607**	**.807**	**.425**	**.442**
	postwar							**.294**	.032	−.046	.145	−.414	.009
	Bretton Woods							.238	−.077	−.167	.040	−.538	−.079
	post-Bretton Woods							**.660**	**.591**	**.603**	**.719**	.247	**.414**
Belgium	prewar								.252	**.417**	**.265**	**.508**	**.315**
	interwar								**.468**	−.120	.349	−.184	.276
	postwar								**.661**	**.488**	**.677**	**.468**	**.637**
	Bretton Woods								**.595**	**.502**	**.627**	**.504**	**.761**
	post-Bretton Woods								**.804**	**.453**	**.843**	**.428**	**.482**
Netherlands	prewar									**.513**	**.622**	.253	**.406**
	interwar									**.428**	**.624**	**.335**	**.611**
	postwar									**.403**	**.685**	**.414**	**.420**
	Bretton Woods									.386	**.666**	**.410**	**.370**
	post-Bretton Woods									**.394**	**.731**	.386	**.509**
Denmark	prewar										**.578**	**.591**	**.635**
	interwar										**.458**	**.734**	**.338**
	postwar										**.526**	**.540**	**.550**
	Bretton Woods										**.506**	**.527**	**.587**
	post-Bretton Woods										**.579**	**.526**	**.434**
Finland	prewar											**.475**	**.714**
	interwar											**.259**	.432
	postwar											**.404**	**.442**
	Bretton Woods											**.340**	**.359**
	post-Bretton Woods											**.596**	**.641**
Norway	prewar												**.747**
	interwar												**.591**
	postwar												**.628**
	Bretton Woods												**.734**
	post-Bretton Woods												.334

Note: Bold numbers denote correlations statistically significant at the 5 percent level using Newey-West optimal bandwidth standard errors.

Linkages between European countries have become more prevalent in the postwar period. The Netherlands is a nice illustration of this. Dutch output was not significantly correlated with output of any other country prior to 1914. During the post-Bretton Woods period, the correlation between Dutch output and that of 10 other countries turned significant.

The high and significant correlation between countries' output during the post-Bretton Woods period within a trade bloc consisting of Germany, France, Italy, Belgium, the Netherlands, and Denmark most likely demonstrates the establishment of a common market in Europe. It is tempting to speculate about this pattern as a prerequisite for a future European Monetary Union. Indeed, five of these six countries are identified by Bayoumi and Eichengreen (1993) as core European Union countries suitable for forming a monetary union.The more frequent incidence of significant international co-movements during the post-Bretton Woods period may also be due to large common shocks hitting in particular Europe, for example, OPEC I and OPEC II.

Co-movements of Price Levels

In Table 7 we report contemporaneous international price level correlations across the five time periods. The main impression of Table 7 compared to Table 6 covering international output correlations is the higher frequency of significant correlations. The incidence has also — as in Table 6 — increased over time. For example, the U.S. price level was correlated with only two countries during the gold standard era but with nine during the post-Bretton Woods period. In a similar way, Canadian prices were significantly correlated with prices in four countries under the gold standard. During the post-Bretton Woods period this number rose to 12, covering all countries in our sample. In the postwar period German prices are linked significantly to the prices of all other countries in our sample. These results, we believe, are consistent with evidence of increased global integration of goods markets in recent decades.

However, in contrast to the historical trend of increasing intercountry correlations over time, U.K. prices during the gold standard era were significantly correlated with prices in eight other countries. This pattern is most likely due to the central position held by Great Britain prior to 1914. Germany, another major economic power, also displayed significant correlations with many smaller European countries during the gold standard period. This evidence, we believe, is consistent with the operation of the 'law of one price' under the gold standard and the integration of global goods and factor markets before 1914 (see McCloskey and Zecher 1976, 1984; O'Rourke and Williamson 1998).

SUMMARY

This paper has examined business cycle fluctuations in a large sample of countries using more than a century of observations and adopting a monetary regime perspective. Our sifting through the empirical evidence suggests a number of conclusions bearing on current business cycle research. Among them, we would like to emphasize the following.

First, concerning the properties of country-specific business cycles, our evidence suggests that both the amplitude and the symmetry of cycles have changed over time. Echoing the conventional view, the interwar period is found to be more volatile than the classical gold standard era and the post-World War II period. In addition, the post-World War II period is marginally less volatile than the gold standard period. Formal empirical tests do not reject the hypothesis that the amplitude was equal during the classical gold standard and postwar periods for the majority of the countries in our sample. However, in testing whether the amplitude was constant in all countries simultaneously in these two periods, this hypothesis was strongly rejected. In our opinion, what may have caused the decline in volatility is an open question. The decline could be due to a host of structural changes, the conduct of stabilization policies, the construction of the data used, and so on.

Second, concerning the relationship between cycles in real GDP and in the expenditure components, we find a clear pro-cyclical pattern for consumption, investment, exports, and imports across all countries and all monetary regimes. The variability of investment, exports, and imports is higher than that of real GDP for all countries and periods. Consumption and real GDP display roughly the same variability. There is no clear cyclical pattern across countries and across regimes in the correlation between real GDP and government expenditures and revenues.

For the money stock we find evidence for a number of countries of a positive correlation with output, and evidence that the money stock leads the business cycle. It is of interest to note that for the United States, the largest correlations are for the interwar period. This result is consistent with the view attributing the Great Depression to inept Federal Reserve policy (Friedman and Schwartz 1963a). Also, with the key exception of the United States during the pre-World War II period, the price level is found to be pro-cyclical.

Third, it is striking that nearly all significant cyclical co-movements occur for concomitant observations. This pattern roughly holds for all countries and across all regimes, making it difficult to find lead and lag structures with our approach based on annual data.

Fourth, examining the behavior of cyclical variation during recessions, we find that the major proportion of the decline in real GDP can be

accounted for by declines in three expenditure components, consumption, investment, and exports. According to our analysis, neither government expenditures and revenues nor the money stock significantly contribute to the recessions, as measured with our technique. However, the lack of significance of the money stock may reflect the pooling of open and closed economies across fixed and flexible exchange rate regimes. We did not possess sufficient data for our 13 countries to determine whether technology shocks, a variable stressed by recent approaches, could be a possible significant determinant of recessions.

Fifth, the cyclical co-movements for real GDP and prices across countries suggest growing international linkages over time. They also suggest global integration, which began under the gold standard, and significant linkages between the United States and many other countries during the unstable interwar period.

Finally, it is tempting to speculate about the influence on the business cycle from technological changes, structural shifts of the economy, the rise of stabilization policies, and the public sector, as well as other long-run developments. We do not rule out the possibility that such features may have influenced the business cycle, but when they are taken together we do not see any clear pattern over time supporting any single "structural" interpretation. There is one major exception, however. We find a rise in the frequency of significant cyclical co-movements across countries. This pattern is consistent with the view that international economic integration has increased over time.

In our opinion, the cyclical pattern in a number of respects thus appears to remain surprisingly stable across time, regimes, and countries — ignoring any potential measurement error due to low-quality data and the like. We do not want to claim that "all cycles are alike," only that the business cycle is always and everywhere apparent in a broad sense and that we see no serious signs that this will not hold in the future as well.

Appendix A: Data Sources

Belgium

Real national income. 1880–1920: Not available. 1921–39: GNP, E. Buyst (1997), "New GNP Estimates for the Belgian Economy During the Interwar Period," *Review of Income and Wealth,* vol. 43, pp. 357–375, table 4. 1940–47: Not available. 1948: NNP, Mitchell (1992). 1949–53: GDP, Mitchell (1992), 1954–94: GDP, *International Financial Statistics (IFS),* series 99B.P. 1995: *OECD Economic Outlook.*

Prices. 1880–1948. CPI, Mitchell (1992), except 1914–20 and 1941–46: Not available. 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: M1, Statistical Appendix in J. Delbeke (1988), *Geld en Bankkrediet in Belgie, 1877–1983,* Klasse der Letteren, Jaargang 50, Nr. 129, Brussel: Koninklijke Academie voor Wetenschappen, Letteren en Schone Kunsten van Belgie, table 1.2, column 7 and table 1.3, column 9, except 1914–19 and 1941–46: Not available. 1972–95: Money, *IFS,* series 34.

Central government expenditures and revenues. 1880–1969: Mitchell (1978), except 1913–19 and 1940: not available. 1970–94: *IFS,* series 82 and 81. (Note: Change of definition in 1970.)

Exports. 1880–1988: Mitchell (1992), except 1901 and 1915–1918: not available. 1989–1996: *OECD National Accounts. Main aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992), except 1901 and 1915–1918: not available. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Consumption. Not available.

Canada

Real national income. 1880–1926: GNP, M. C. Urquhart (1986), "New Estimates of Gross National Product, Canada, 1870–1926: Some Implications for Canadian Development" in S. L. Engerman and R. E. Gallman (eds.), *Long-Term Factors in American Economic Growth,* pp. 9–94, *Studies in Income and Wealth,* Vol. 51, NBER, Chicago: The University of Chicago Press, table 2.9. 1927–48: GNP, Mitchell (1993). 1949–95: GDP, *IFS,* series 99B.R.

Prices. 1880–1914: Interurban–Intertemporal CPI, R. C. Allen (1990), *Real Income in the English Speaking World,* University of British Columbia Press. 1915–48: CPI, Urquhart and Buckley (1965). 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1948: M2, definition and sources are given in Bordo and Jonung (1987), pp. 154–55. 1949–95: Money plus quasi-money, *IFS,* series 35L.

Central government expenditures and revenues. 1880–1947: Mitchell (1993). 1948–94: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992) (Note: change of definition in 1959). 1989–1996: *OECD National Accounts. Main Aggregates (1998),* Volume I.

Imports. 1880–1988: Mitchell (1992) (Note: change of definition in 1959). 1989–1996: *OECD National Accounts. Main Aggregates (1998),* Volume I.

Consumption. 1926–1987: Liesner, T. (1989): *One Hundred Years of Economic Statistics,* The Economist Publications Ltd., London. 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Denmark

Real national income. 1880–1950: GDP, Mitchell (1992). 1951–95: GDP, *IFS,* series 99 B.P.

Prices. 1880–1949: CPI, Mitchell (1992). 1950–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: Borgernes Likviditet (M2), N. Kjærgård (1991), *Økonomisk vækst: En økonometrisk analyse af Denmark 1870–1981,* Copenhagen: Jurist- og Økonomforbundets Forlag, pp. 582–83, table 3, series AM. 1972–95: Money plus quasi-money, *IFS,* series 35 L.

Central government expenditures and revenues: 1880–1947: Mitchell (1992). 1948–95: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. Not available.

Finland

Real national income. 1880–1980: GDP, Statistical Appendix in R. Hjerppe (1989), *The Finnish Economy 1860–1985, Growth and Structural Change,* Bank of Finland, Helsinki: Government Printing Centre, table 1. 1981–95: GDP, *IFS,* series 99B.P.

Prices. 1880–1980: Cost-of-living index, Hjerppe (1989), table 13. 1981–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: M2, T. Haavisto (1992), *Money and Economic Activity in Finland 1866–1985,* Ph.D. thesis, Lund Economic Studies number 48, Lund University, average of end-of-month figures in table 4A.2. 1972–95: Money plus quasi-money, *IFS,* series 35L.

Central government expenditures and revenues. 1880–81: Not available. 1882–1948: Mitchell (1992). 1949–94: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. Not available.

France

Real national income. 1880–1950: GDP, Mitchell (1992), except 1914–20 and 1939–50: GDP, A. Maddison (1995), *Monitoring the World Economy 1820–1992,* OECD, table C-16a. 1951–95: GDP, *IFS,* series 99B.R.

Prices. 1880–1949: CPI, Mitchell (1992). 1950–95: CPI, *IFS,* series 64.

Money stock. 1880–1897: M1, Saint-Marc (1983). 1898–1977: M2, J.-P. Patat and M. Lutfalla (1990), *A Monetary History of France in the Twentieth Century,* London: Macmillan, tables 1.4, A2, A3 and A5. 1978–95: M2, *IFS,* series 38NB.

Central government expenditures and revenues. 1880–1949: Mitchell (1992). 1950–95: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. 1949–1897: Liesner, T. (1989); 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Germany

Real national income. 1880–1979: NNP, Sommariva and Tullio (1987), pp. 226–28. 1980–95: GDP, *IFS,* series 99B.R. (Unified Germany from 1991.)

Prices. 1880–1949: CPI, Sommariva and Tullio (1986), pp. 231–34. 1950–95: CPI, *IFS,* series 64.

Money stock. 1880–1913: M2, Data underlying M. D. Bordo (1986), "Financial Crises, Banking Crises, Stock Market Crashes and the Money Supply: Some International Evidence" in F. Capie and G. Wood (eds.), *Financial Crises and the World Banking System,* London: Macmillan. 1914–25: Not available. 1926–38: M2, Deutsche Bundesbank (1976), *Deutsches Geld und Bankwesen in Zahlen 1876–1975,* Frankfurt am Main: Fritz Knapp Gmbh, pp. 14 and 18. 1939–49: Not available. 1950–71: M2, Deutsche Bundesbank, *Monthly reports* (various issues). 1972–95: Money plus quasi-money, *IFS,* series 35L.

Central government expenditures and revenues. 1880–1951: Mitchell (1992), except 1922–23 and 1935–49: Not available. 1952–95: *IFS,* series 82 and 81. Note: Change of definition in 1970.

Exports. 1880–1988: Mitchell (1992), except 1914–1919 and 1944–1947: not available. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992), except 1914–1919 and 1944–1947: not available. 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. 1885–1987: Liesner, T. (1989), except 1914–1924 and 1940–1947: not available. 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I. Note: change of definition in 1960.

Italy

Real national income. 1880–1951: GNP, Mitchell (1992). 1952–60: GDP, Mitchell (1992). 1961–67: GDP, IMF (1997), *International Financial Statistics Yearbook 1997,* Washington D.C., series 99B.R.

Prices. 1880–1948: CPI, Statistical Appendix in M. Fratianni and F. Spinelli (1991), *Storia Monetaria d'Italia,* Milan: Arnoldo Mondadori Editor, pp. 66–71, series CLI. 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1980: M3, Fratianni and Spinelli (1991), pp. 48–51, series U1+U2+D. 1981–95: M2, IMF (1997), series 38N.

Central government expenditures and revenues. 1880–1949: Mitchell (1992). 1950–91: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992), except 1943–1946: not available. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992), except 1943–1946: not available. 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. 1885–1987: Liesner, T. (1989). 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I. Note: change of definition 1960.

Japan

Real national income. 1880–84: Not available. 1885–1929: GNP, B. R. Mitchell (1991). 1930–56: GDP, Mitchell (1991), except 1945 and 1952: GDP, Maddison (1995), table C-16a. 1957–95: GDP, *IFS,* series 99B.R.

Prices. 1880–1922: WPI, Mitchell (1991). 1923–48: CPI, Mitchell (1991). 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: M1, data supplied by the Bank of Japan. 1972–95: Money, *IFS,* series 34B.

Central government expenditures and revenues. 1880–1954: Mitchell (1991). 1955–93: *IFS,* series 82 and 81. (Note: changes of definitions in 1955 and 1976.)

Exports. 1880–1988: Mitchell (1991), except 1944–45: not available. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1991), except 1994–45: not available. 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. 1885–1929: Backus, D. and P. Kehoe (1992). 1930–1987: Liesner, T. (1989), except 1945: not available. 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Netherlands

Real national income. 1880–1960: GDP, A. Maddison (1995) table C-16a. 1961–95: GDP, *IFS,* series 99B.R.

Prices. 1880–1949: CPI, Mitchell (1992). 1950–95: CPI, *IFS,* series 64.

Money stock. 1880–1990: Currency, data supplied by Mr W. F. Vanthood at De Nederlandsche Bank. 1901–71: M2, Central Bureau voor de Statistiek (1976), *75 Jaar Statistiek van Nederland.* 1972–985: Money, *IFS,* series 34.

Central government expenditures and revenues. 1880–1899: Not available. 1900–1948: Mitchell (1992). 1949–95: *IFS,* series 82 and 81. Note: change of definition in 1973.

Exports. 1880–1988: Mitchell (1992), except 1944–1946: not available. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992), except 1944–1946: not available. 1989–1996: *OECD National Accounts, Main Aggregates* (1998), Volume I.

Consumption. Not available.

Norway

Real national income. 1880–1949: GDP, Mitchell (1992), except 1940–46: Data supplied by J. T. Klovland. 1950–95: GDP, *IFS,* series 99B.P.

Prices. 1880–1948: CPI, Statistisk sentralbyrå (1994), *Historisk statistikk 1994,* Oslo. 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: M2, J. T. Klovland (1978), *Quantitative Studies in the Monetary History of Norway,* Ph.D. thesis, Bergen: Norwegian School of Economics and Business Administration. 1972–95: Broad money (M2), *IFS,* series 38N.

Central government expenditures and revenues. 1880–1953: Mitchell (1992). 1954–94: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates (1998), Volume I.*

Imports. 1880–1988: Mitchell (1992). 19891996: *OECD National Accounts, Main Aggregates* 1998), Volume I.

Consumption. 1880–1987: Backus, D. and P. Kehoe (1992) except 1941–1946: not available. 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Sweden

Real national income. 1880–1950: GDP, O. Krantz and C-A. Nilsson (1975), *Swedish National Product; 1861–1970: New Aspects on Methods and Measurements,* Lund: C.W.K. Glerup/Liber Läromedel, table .1 and table 1:2, columns 2 + 4 (GDP at factor cost plus indirect taxes and customs duties deflated by the implicit GDO-deflator at factor cost). 1951–95: GDP, Statistics Sweden (1996), *Statistiska Meddelanden SM 9601 N10,* table 1

Prices. 1880–1948: CPI, Statistiska Centralbyrån (1996), *Statistiska Meddelanden P15 SM9501,* p. 22. 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: Money stock (M2), L. Jonung (1975), *Studies in the Monetary History of Sweden,* Ph.D. thesis, Los Angeles: UCLA, Appendix A, table A-1, column (5). 1972–95: Broad money (M3), *IFS,* series 38N.

Central government expenditures and revenues. 1880: Not available. 1881–1947: Mitchell (1992). 1948–95: *IFS,* series 82 and 81. (Note: Change of definition in 1966.)

Exports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts, Aggregates* (1998), Volume I.

Consumption. 1880–1884: Krantz and Nilsson (1975). 1885–1987: Liesner, T. (1989) 1988–1996: *OECD National Accounts. Main aggregates* (1998), Volume I.

United Kingdom

Real national income. 1880–1948 GDP, B. R. Mitchell (1988), pp. 831–835. 1949–95: GDP, *IFS,* series 99B.R

Prices. 1880–1948: Feinstein's retail price series, F. Capie and A. Webber (1985), *A Monetary History of the United Kingdom, Volume 1,* London: George Allen and Unwin, table III, column 12. 1949–95: CPI, *IFS,* series 64.

Money stock growth. 1880–1966: Net money Supply (M2), Sheppard (1971), table A.3.3, column 6. 1967–95: Money plus quasi-money, *IFS,* series 35L.

Central government expenditures and revenues. 1880–1947: Mitchell (1992). 1948–95: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992), except 1813: not available; includes Eire up to and including 1920. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Imports. 1880–1988: Mitchell (1992), except 1813: not available; includes Eire up to and including 1920. 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Consumption. 1885–1987: Liesner, T. (1989). 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I; includes Eire up to and including 1920.

United States

Real national income. 1880–1948 GNP, N. S. Balke and R. J. Gordon (1989), Appendix B, Historical data in R. J. Gordon (ed.) *The American Business Cycle, Continuity and Change,* Chicago: The University of Chicago Press, pp. 781–83. 1949–95: GDP, *IFS,* series 99B.R.

Prices. 1880–1948: CPI, U.S. Bureau of the Census, 1975. *Historical Statistics of the United States: Colonial Times to 1970,* series E135. 1949–95: CPI, *IFS,* series 64.

Money stock. 1880–1971: M2, Balke and Gordon (1989), pp. 784–86. 1972–95: Money plus quasi-money, *IFS,* series 35L.

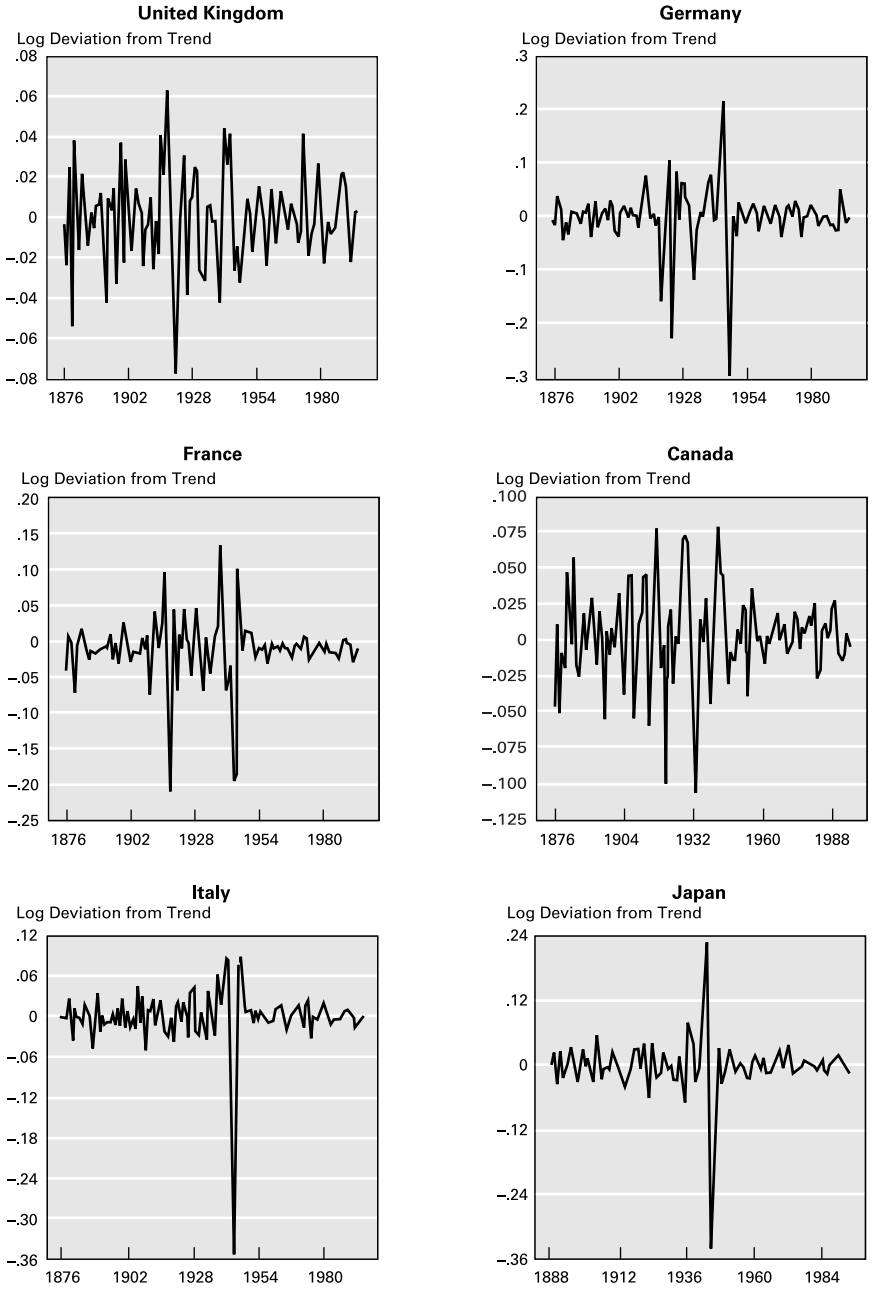
Central government expenditures and revenues. 1880–1958: Mitchell (1993). 1959–95: *IFS,* series 82 and 81.

Exports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

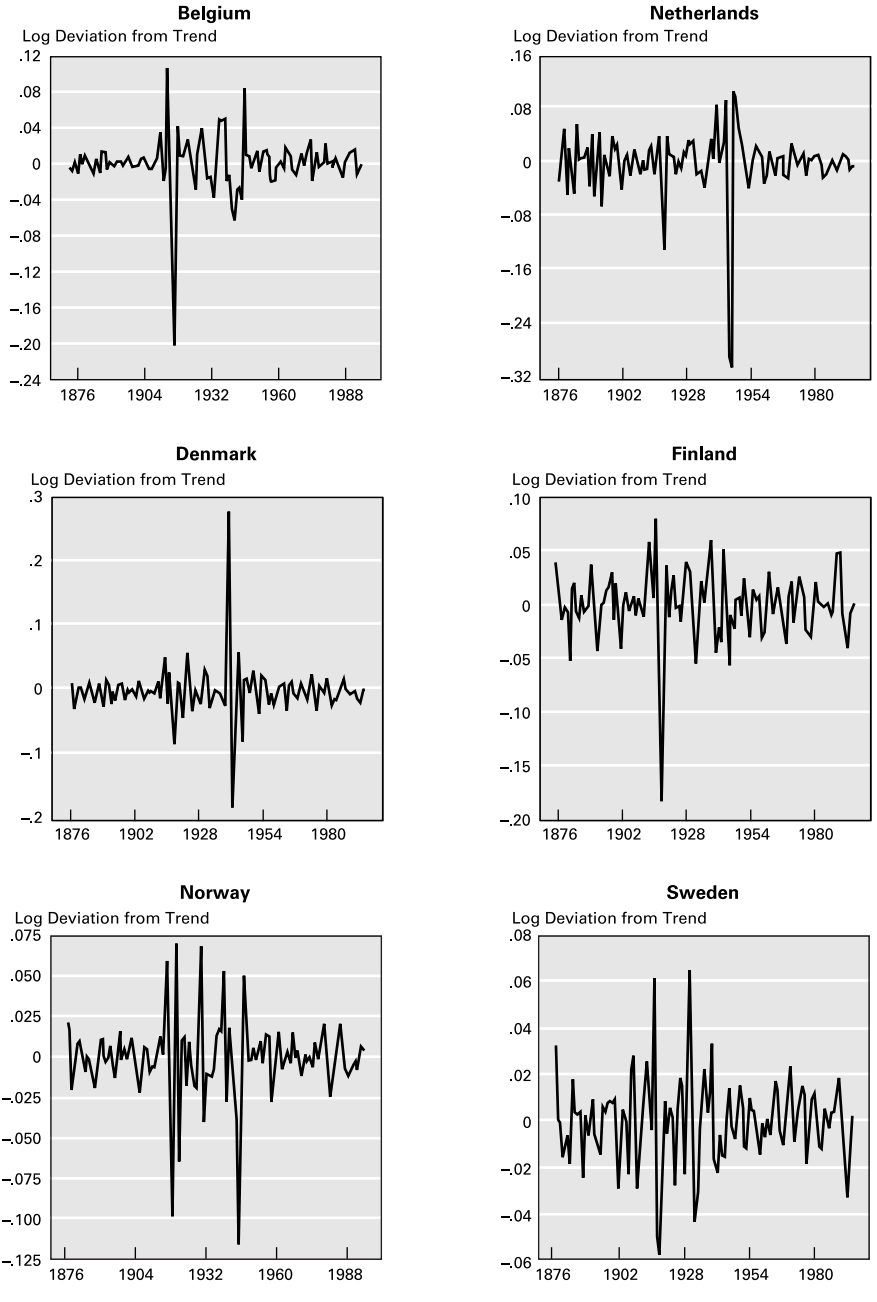
Imports. 1880–1988: Mitchell (1992). 1989–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Consumption. 1989–1987: Liesner, T. (1989). 1988–1996: *OECD National Accounts. Main Aggregates* (1998), Volume I.

Appendix B
Band-Pass-Filtered GDP Data for 12 Countries



Appendix B, continued
Band-Pass-Filtered GDP Data for 12 Countries



Appendix C
Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	United States					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	.748	**−.320**	**.478**	.149	.039	.144
Interwar	1.210	.488	**.912**	**.541**	.196	.106
Postwar	.626	−.218	**.553**	.127	.249	.085
Bretton Woods	.735	−.306	**.555**	.090	.295	.226
Post-Bretton Woods	.443	.030	**.598**	.163	.070	.002
Investment						
Gold Standard	2.385	−.091	**.817**	−.069	.004	.050
Interwar	3.578	.503	**.918**	**.460**	.179	.202
Postwar	2.979	−.046	**.601**	.040	.153	.141
Bretton Woods	2.975	−.230	.345	**−.332**	.191	.377
Post-Bretton Woods	2.988	.142	**.913**	**.376**	.027	.087
Government Expenditures						
Gold Standard	1.872	.063	−.162	−.078	.131	.017
Interwar	1.648	.113	.187	−.318	.002	.173
Postwar	3.577	.062	.064	.331	.037	.186
Bretton Woods	4.610	.159	**.221**	**.575**	.014	.363
Post-Bretton Woods	1.468	−.199	**−.525**	−.287	.064	.141
Government Revenues						
Gold Standard	1.779	**−.241**	.294	**.404**	.064	.184
Interwar	2.690	**.423**	**.605**	**.456**	.060	.254
Postwar	2.968	**−.432**	**.367**	**.754**	.337	.108
Bretton Woods	3.647	**−.398**	**.428**	**.828**	.499	.092
Post-Bretton Woods	1.799	**−.532**	**.279**	**.702**	.216	.349
Exports						
Gold Standard	1.736	.187	.251	.167	.115	.044
Interwar	2.303	**.579**	**.671**	**.215**	.138	.014
Postwar	4.156	**−.390**	**.352**	**.587**	.320	.195
Bretton Woods	4.334	**−.278**	**.450**	**.638**	.346	.334
Post-Bretton Woods	3.778	**−.441**	.214	**.515**	.188	.040
Imports						
Gold Standard	2.104	−.228	**.438**	**.238**	.010	.055
Interwar	2.680	**.557**	**.877**	**.152**	.112	.329
Postwar	3.605	.025	**.657**	.188	.091	.046
Bretton Woods	3.538	.189	**.738**	−.101	.135	.032
Post-Bretton Woods	3.645	−.109	**.561**	**.526**	.030	.358
Money Stock						
Gold Standard	.798	.043	**.658**	**−.102**	.062	.213
Interwar	1.134	**.373**	**.840**	**.633**	.177	.046
Postwar	1.214	.269	**.266**	−.069	.151	.023
Bretton Woods	1.320	.041	**.311**	−.004	.282	.156
Post-Bretton Woods	1.043	.310	.194	−.227	.092	.010
Consumer Prices						
Gold Standard	.375	**−.426**	**.107**	**.571**	.072	.214
Interwar	.550	**.361**	**.781**	**.626**	.039	.140
Postwar	.970	**−.645**	**−.391**	**.226**	.320	.028
Bretton Woods	.959	**−.586**	−.210	.398	.277	.140
Post-Bretton Woods	.983	**−.663**	**−.610**	**.100**	.270	.045

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	United Kingdom					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) R^2(y,x)	(6) R^2(x,y)
Consumption						
Gold Standard	.485	**−.288**	**.715**	−.073	.064	.087
Interwar	.539	−.302	.309	.580	.199	.089
Postwar	1.106	**.450**	**.742**	.120	.097	.020
Bretton Woods	1.003	**.583**	**.606**	−.293	.117	.231
Post-Bretton Woods	1.150	.390	**.796**	**.345**	.092	.023
Investment						
Gold Standard	2.240	.107	**.413**	−.065	.071	.082
Interwar	2.310	**−.421**	.029	.329	.121	.151
Postwar	2.896	.264	**.706**	**.330**	.016	.110
Bretton Woods	2.592	.091	**.529**	.104	.094	.267
Post-Bretton Woods	3.026	.434	**.788**	**.436**	.054	.006
Government Expenditures						
Gold Standard	7.072	.033	**.142**	.323	.120	.038
Interwar	2.674	.115	.190	.208	.121	.067
Postwar	2.992	**−.304**	**−.535**	**−.125**	.001	.195
Bretton Woods	4.024	−.023	−.251	−.047	.083	.125
Post-Bretton Woods	2.309	**−.538**	**−.841**	**−.291**	.155	.218
Government Revenues						
Gold Standard	3.378	−.003	.180	.336	.101	.170
Interwar	2.444	**−.711**	**−.398**	**.218**	.338	.004
Postwar	2.443	**−.342**	**−.511**	.040	.009	.131
Bretton Woods	2.875	−.068	**−.427**	−.077	.023	.111
Post-Bretton Woods	2.219	**−.408**	**−.583**	.064	.032	.082
Exports						
Gold Standard	2.663	−.164	.254	.222	.039	.049
Interwar	4.590	−.198	.281	**.352**	.042	.099
Postwar	3.055	−.206	**.294**	**.330**	.066	.183
Bretton Woods	4.321	**−.364**	−.205	.319	.213	.077
Post-Bretton Woods	2.286	.142	**.403**	**.369**	.044	.301
Imports						
Gold Standard	1.556	−.112	.341	.218	.012	.021
Interwar	3.436	−.136	**.437**	**.662**	.035	.451
Postwar	4.800	−.166	**.548**	**.427**	.068	.217
Bretton Woods	6.441	−.281	**.511**	.367	.139	.133
Post-Bretton Woods	3.824	.129	**.602**	**.513**	.040	.364
Money Stock						
Gold Standard	.855	−.040	**.374**	**.595**	.223	.168
Interwar	1.134	−.475	−.343	−.201	.192	.137
Postwar	4.181	.308	.265	.087	.078	.003
Bretton Woods	3.006	**.699**	.099	−.341	.210	.201
Post-Bretton Woods	4.580	.239	.310	.228	.052	.040
Consumer Prices						
Gold Standard	.866	.287	−.096	.221	.069	.170
Interwar	1.743	**−.600**	−.387	**.216**	.171	.368
Postwar	1.436	**−.428**	**−.645**	−.066	.060	.092
Bretton Woods	1.278	**−.357**	**−.505**	**.286**	.132	.036
Post-Bretton Woods	1.487	**−.406**	**−.729**	−.289	.067	.120

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Germany					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	.591	.031	**.567**	−.029	.066	.021
Interwar	.564	.248	**.744**	.898	.005	.401
Postwar	.687	.187	**.656**	**.415**	.102	.047
Bretton Woods	.818	**−.191**	**.566**	**.638**	.109	.179
Post-Bretton Woods	.577	**.488**	**.759**	.215	.349	.008
Investment						
Gold Standard	5.476	.073	**.821**	−.072	.149	.023
Interwar	—	—	—	—	—	—
Postwar	2.813	**.401**	**.798**	−.078	.000	.010
Bretton Woods	3.368	**.363**	**.953**	.028	−.022	.037
Post-Bretton Woods	2.456	**.427**	**.705**	−.170	.069	.031
Government Expenditures						
Gold Standard	5.286	**−.688**	**−.617**	−.321	.462	.039
Interwar	—	—	—	—	—	—
Postwar	4.029	**−.261**	.034	**.444**	.009	.164
Bretton Woods	6.120	−.333	−.053	.497	.008	.233
Post-Bretton Woods	1.534	**−.328**	.282	**.596**	.030	.098
Government Revenues						
Gold Standard	2.042	−.059	−.258	−.010	.014	.002
Interwar	1.616	**.351**	**.856**	**.535**	.447	.355
Postwar	3.439	−.095	.273	**.486**	.280	.232
Bretton Woods	4.740	−.086	**.249**	**.542**	.556	.345
Post-Bretton Woods	1.302	−.268	**.545**	**.662**	.070	.381
Exports						
Gold Standard	2.049	−.106	**.389**	−.030	.017	.023
Interwar	1.280	−.239	.080	**.663**	.242	.314
Postwar	3.245	−.012	**.437**	.077	.099	.198
Bretton Woods	4.318	.008	.412	.154	.157	.294
Post-Bretton Woods	2.157	.019	**.523**	.023	.144	.110
Imports						
Gold Standard	2.141	.036	**.343**	.154	.076	.026
Interwar	1.584	**.249**	**.825**	.185	.360	.127
Postwar	3.045	.097	**.674**	.088	.036	.043
Bretton Woods	3.721	.093	**.835**	**.243**	.151	.106
Post-Bretton Woods	2.473	.141	**.534**	−.041	.110	.067
Money Stock						
Gold Standard	1.693	.096	−.113	.186	.041	.082
Interwar	—	—	—	—	—	—
Postwar	1.312	**.518**	.019	−.245	.153	.017
Bretton Woods	1.722	**.468**	−.037	**−.588**	.058	.202
Post-Bretton Woods	.931	**.664**	.078	.130	.454	.114
Consumer Prices						
Gold Standard	.748	.050	−.402	−.166	.044	.024
Interwar	61.638	**−.105**	**−.721**	.505	.033	.134
Postwar	.779	**−.460**	**−.294**	.402	.188	.282
Bretton Woods	.993	**−.538**	**−.349**	.551	.297	.520
Post-Bretton Woods	.482	−.330	−.231	.244	.054	.064

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	France					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	.972	.025	**.461**	.134	−.025	.078
Bretton Woods	1.291	**−.505**	.232	**.342**	.195	.045
Post-Bretton Woods	.730	**.532**	**.726**	−.114	.204	.063
Investment						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	3.828	.240	**.537**	**.360**	.050	.043
Bretton Woods	3.661	.039	.060	**.412**	.040	.341
Post-Bretton Woods	3.952	**.325**	**.796**	**.338**	.080	.049
Government Expenditures						
Gold Standard	3.510	**−.333**	**−.373**	−.337	.093	.003
Interwar	2.981	**−.164**	**.564**	.051	.297	.145
Postwar	6.020	.005	.042	.336	.115	.113
Bretton Woods	7.674	−.037	.091	.418	.154	.191
Post-Bretton Woods	1.825	**−.401**	**−.203**	.139	.085	.288
Government Revenues						
Gold Standard	1.071	**.356**	**.546**	.250	.251	.059
Interwar	2.708	−.137	**.646**	.197	.063	.093
Postwar	4.866	.246	.248	.114	.046	.114
Bretton Woods	6.086	.271	.232	.124	.061	.129
Post-Bretton Woods	2.064	−.153	**.459**	.158	.068	.046
Exports						
Gold Standard	2.832	.071	**.304**	.377	.141	.279
Interwar	3.032	.028	**.734**	**.497**	.097	.075
Postwar	5.630	.249	**.751**	.349	.005	.048
Bretton Woods	6.414	**.448**	**.834**	.386	.014	.032
Post-Bretton Woods	4.236	−.081	**.607**	**.285**	.119	.107
Imports						
Gold Standard	3.595	.450	.243	−.089	.197	.015
Interwar	2.665	.181	**.727**	**.224**	.157	.018
Postwar	5.590	−.156	**.607**	**.339**	.262	.265
Bretton Woods	5.229	−.099	**.620**	**.454**	.303	.364
Post-Bretton Woods	6.101	−.166	**.607**	**.212**	.218	.182
Money Stock						
Gold Standard	1.134	.000	−.220	−.129	.029	.018
Interwar	1.624	.070	−.104	.093	.160	.035
Postwar	2.090	.242	.363	**.257**	.030	.006
Bretton Woods	2.028	.177	.485	**.403**	.001	.124
Post-Bretton Woods	2.191	.317	.199	.092	.097	.236
Consumer Prices						
Gold Standard	.501	.186	−.002	−.488	.023	.300
Interwar	1.741	−.276	.322	.257	.038	.018
Postwar	2.311	.077	.064	.262	.107	.122
Bretton Woods	2.759	.344	.241	.363	.228	.209
Post-Bretton Woods	1.421	**−.495**	**−.448**	.072	.231	.065

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Canada					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	1.331	.338	**.664**	.141	.119	.009
Interwar	1.125	**.434**	**.891**	**.624**	.248	.274
Postwar	.838	−.137	**.406**	**.290**	.100	.027
Bretton Woods	.890	−.040	.471	.207	.122	.031
Post-Bretton Woods	.734	−.184	.306	.377	.100	.127
Investment						
Gold Standard	3.442	.210	**.601**	.286	.046	.077
Interwar	3.580	**.242**	**.874**	**.741**	.257	.282
Postwar	3.078	−.143	**.561**	**.502**	.068	.011
Bretton Woods	3.231	−.150	.520	**.400**	.054	.095
Post-Bretton Woods	2.915	−.075	**.615**	**.608**	.098	.070
Government Expenditures						
Gold Standard	2.787	**−.405**	−.160	.131	.137	.311
Interwar	1.359	−.275	.108	.021	.065	.071
Postwar	2.932	.134	.114	.126	.124	.014
Bretton Woods	3.611	.332	.281	.082	.318	.002
Post-Bretton Woods	1.827	**−.285**	−.273	.191	.097	.032
Government Revenues						
Gold Standard	2.034	−.080	**.294**	.215	.233	.094
Interwar	1.453	**.632**	**.661**	**.110**	.098	.050
Postwar	3.439	−.055	**.433**	.152	.048	.000
Bretton Woods	4.122	.144	**.533**	.042	.041	.027
Post-Bretton Woods	2.412	−.425	.267	**.352**	.243	.098
Exports						
Gold Standard	2.125	**−.326**	−.019	**−.219**	.126	.167
Interwar	2.191	**.750**	**.657**	.024	.197	.016
Postwar	2.941	**.241**	**.666**	.126	.022	.022
Bretton Woods	2.436	.249	**.627**	.112	.077	.044
Post-Bretton Woods	3.411	.290	**.710**	.143	.003	.114
Imports						
Gold Standard	2.472	−.092	**.529**	.132	.376	.106
Interwar	2.415	**.579**	**.912**	**.354**	.037	.058
Postwar	3.769	.169	**.730**	.154	.008	.036
Bretton Woods	3.257	**.136**	**.750**	.137	.013	.114
Post-Bretton Woods	4.258	.227	**.721**	.162	.012	.001
Money Stock						
Gold Standard	1.056	**.539**	**.323**	−.169	.240	.070
Interwar	.551	**.836**	**.808**	**.368**	.398	.030
Postwar	1.551	−.115	.085	.175	.054	.053
Bretton Woods	1.407	**.402**	−.143	−.084	.208	.106
Post-Bretton Woods	1.647	−.536	.277	**.397**	.433	.086
Consumer Prices						
Gold Standard	.839	.502	−.148	.041	.197	.060
Interwar	.524	**.329**	**.783**	**.674**	.031	.159
Postwar	.980	−.319	**−.310**	.150	.034	.026
Bretton Woods	1.089	−.015	−.075	**.258**	.012	.062
Post-Bretton Woods	.842	**−.665**	**−.675**	−.047	.339	.083

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Italy					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	.573	.093	**.602**	−.092	.294	.162
Interwar	1.148	−.004	**.389**	−.311	.055	.124
Postwar	1.180	.064	**.785**	**.382**	.067	.141
Bretton Woods	1.304	.112	**.742**	.478	.035	.244
Post-Bretton Woods	1.040	.037	**.847**	.426	.175	.080
Investment						
Gold Standard	9.431	−.197	**.661**	−.211	.073	.025
Interwar	7.272	−.255	.594	−.106	.144	.088
Postwar	4.038	.248	**.871**	**.565**	−.071	−.362
Bretton Woods	4.212	.144	.204	−.003	.058	.000
Post-Bretton Woods	—	—	—	—	—	—
Government Expenditures						
Gold Standard	5.999	.235	−.094	−.027	.042	.024
Interwar	8.268	.106	**−.309**	.237	.021	.040
Postwar	4.498	−.300	**−.656**	**−.230**	.385	.687
Bretton Woods	7.684	−.022	.339	.075	.037	.239
Post-Bretton Woods	4.498	−.300	−.656	−.230	.075	.584
Government Revenues						
Gold Standard	5.329	.146	.039	−.062	.030	.024
Interwar	1.468	.228	−.249	−.072	.026	.309
Postwar	3.403	**−.386**	.025	.206	.186	.053
Bretton Woods	3.116	**−.289**	.233	.251	.241	.082
Post-Bretton Woods	3.592	**−.394**	−.101	.081	.159	.088
Exports						
Gold Standard	2.324	.087	−.001	−.084	.049	.010
Interwar	4.548	.230	−.063	.011	.062	.417
Postwar	5.805	.290	**.316**	−.259	.073	.052
Bretton Woods	5.824	.154	**.312**	−.034	.100	.047
Post-Bretton Woods	5.728	**.486**	**.321**	**−.326**	.216	.051
Imports						
Gold Standard	2.578	**.494**	.014	−.061	.260	.001
Interwar	6.229	.280	.064	−.111	.057	.437
Postwar	6.494	−.137	**.587**	.149	.100	.039
Bretton Woods	7.301	.115	**.473**	**.278**	.047	.085
Post-Bretton Woods	5.798	−.289	**.698**	.074	.317	.030
Money Stock						
Gold Standard	.813	−.103	−.030	−.170	.085	.177
Interwar	1.137	−.168	.001	**.645**	.062	.439
Postwar	1.810	**.447**	.122	−.217	.201	.041
Bretton Woods	1.694	**.420**	.183	−.204	.179	.037
Post-Bretton Woods	1.801	**.548**	.084	−.213	.205	.018
Consumer Prices						
Gold Standard	.575	**.343**	**.164**	**−.168**	.223	.057
Interwar	1.609	**−.420**	−.011	**.409**	.106	.061
Postwar	1.767	**−.557**	**−.218**	**.176**	.288	.034
Bretton Woods	1.966	**−.468**	−.100	.081	.204	.035
Post-Bretton Woods	1.574	**−.605**	**−.331**	.121	.430	.059

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Japan					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	1.093	−.021	**.479**	**−.329**	.095	.140
Interwar	.647	.118	**.853**	−.060	.015	.049
Postwar	.917	.011	**.571**	**.419**	.234	.116
Bretton Woods	.864	−.177	**.455**	.489	.292	.148
Post-Bretton Woods	1.018	**.258**	**.780**	.175	.006	.077
Investment						
Gold Standard	3.660	−.099	−.197	.220	.119	.104
Interwar	5.047	.042	.285	.089	.037	.005
Postwar	3.673	−.046	**.447**	**.433**	.218	.177
Bretton Woods	4.025	.006	.370	**.362**	.223	.237
Post-Bretton Woods	2.803	.114	**.706**	**.620**	.031	.063
Government Expenditures						
Gold Standard	6.088	−.151	−.160	−.088	.063	.076
Interwar	1.852	.290	.056	−.166	.014	.001
Postwar	7.821	−.126	−.348	−.031	.126	.028
Bretton Woods	8.873	−.146	−.365	.088	.237	.076
Post-Bretton Woods	4.851	−.145	−.324	−.339	.057	.256
Government Revenues						
Gold Standard	6.578	−.141	−.119	−.067	.081	.015
Interwar	1.582	**.449**	**.269**	−.249	.058	.035
Postwar	8.714	−.122	−.184	.189	.092	.063
Bretton Woods	9.830	−.111	−.239	.229	.155	.095
Post-Bretton Woods	5.588	−.233	.006	.178	.039	.037
Exports						
Gold Standard	3.899	−.094	**.301**	**−.426**	.060	.075
Interwar	2.768	−.262	**.427**	.013	.017	.267
Postwar	7.007	.101	−.190	−.323	.227	.048
Bretton Woods	7.589	.205	**−.245**	−.524	.277	.030
Post-Bretton Woods	5.121	−.166	−.009	**.367**	.022	.078
Imports						
Gold Standard	3.999	.195	−.228	.246	.158	.076
Interwar	2.236	.397	**.342**	**−.472**	.156	.581
Postwar	8.417	−.002	.062	.033	.209	.133
Bretton Woods	7.861	.132	−.031	−.232	.240	.462
Post-Bretton Woods	9.391	.006	.238	**.441**	.014	.068
Money Stock						
Gold Standard	4.939	−.349	.118	**.453**	.072	.050
Interwar	1.362	−.121	.020	.059	.059	.002
Postwar	2.923	−.039	**.244**	.275	.203	.021
Bretton Woods	3.202	−.246	.207	.334	.355	.034
Post-Bretton Woods	2.226	−.068	.362	−.057	.168	.015
Consumer Prices						
Gold Standard	1.387	.025	−.261	.238	.061	.085
Interwar	1.052	−.137	.275	.290	.032	.068
Postwar	2.975	−.359	**−.432**	.114	.282	.161
Bretton Woods	3.428	−.321	**−.431**	.194	.323	.204
Post-Bretton Woods	1.650	−.300	**−.525**	.146	.090	.129

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Belgium					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	—	—	—	—	—	—
Bretton Woods	—	—	—	—	—	—
Post-Bretton Woods	—	—	—	—	—	—
Investment						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	5.152	.062	**.592**	−.003	.020	.026
Bretton Woods	4.697	.149	**.497**	.094	.028	.097
Post-Bretton Woods	5.494	.069	**.655**	−.065	.071	.060
Government Expenditures						
Gold Standard	10.063	−.107	.060	**.230**	.016	.081
Interwar	5.409	−.307	.257	.318	.098	.214
Postwar	4.141	**−.287**	−.077	.183	.071	.017
Bretton Woods	10.854	−.106	.135	.071	.049	.647
Post-Bretton Woods	1.622	−.185	−.390	.200	.028	.160
Government Revenues						
Gold Standard	2.495	.087	**.310**	.220	.048	.038
Interwar	3.121	**.597**	**.430**	−.121	.463	.380
Postwar	3.963	−.258	**.203**	.293	.070	.071
Bretton Woods	6.436	−.256	**.396**	.403	.194	.439
Post-Bretton Woods	1.281	−.269	−.107	.064	.134	.099
Exports						
Gold Standard	9.763	**.362**	.202	.011	.157	.001
Interwar	4.047	**.576**	**.755**	.219	.280	.270
Postwar	5.214	.102	**.691**	.057	.137	.021
Bretton Woods	6.757	.249	**.680**	.071	.248	.085
Post-Bretton Woods	3.696	−.054	**.785**	.055	.051	.001
Imports						
Gold Standard	8.522	.357	−.073	.266	.182	.184
Interwar	4.539	**.642**	**.862**	**.273**	.340	.257
Postwar	4.401	.039	**.738**	**.148**	.098	.033
Bretton Woods	4.768	**.359**	**.702**	.133	.316	.137
Post-Bretton Woods	4.140	−.144	**.774**	.157	.117	.018
Money Stock						
Gold Standard	4.799	−.068	**.471**	**.354**	.087	.157
Interwar	3.000	**.463**	.393	−.031	.145	.002
Postwar	1.841	.097	−.196	.096	.044	.036
Bretton Woods	1.796	−.065	.110	**.373**	.163	.201
Post-Bretton Woods	1.847	.134	**−.458**	−.091	.107	.044
Consumer Prices						
Gold Standard	5.694	**−.477**	.259	**.340**	.195	.077
Interwar	2.055	.286	.269	.117	.043	.027
Postwar	1.319	**−.412**	−.159	.084	.222	.072
Bretton Woods	1.359	**−.362**	.085	**.101**	.321	.101
Post-Bretton Woods	1.249	**−.421**	**−.408**	.046	.289	.027

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Netherlands					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	—	—	—	—	—	—
Bretton Woods	—	—	—	—	—	—
Post-Bretton Woods	—	—	—	—	—	—
Investment						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	3.300	**.313**	**.567**	**.133**	−.011	.049
Bretton Woods	2.934	.168	**.589**	.162	−.045	.127
Post-Bretton Woods	4.271	**.669**	**.546**	.087	.348	.080
Government Expenditures						
Gold Standard	4.328	**−.519**	**−.665**	−.106	.144	.033
Interwar	3.784	**−.374**	−.189	−.184	.087	.021
Postwar	3.107	−.092	−.135	−.041	.001	.083
Bretton Woods	2.580	.108	.024	−.217	.065	.083
Post-Bretton Woods	3.420	.048	.079	.280	.162	.121
Government Revenues						
Gold Standard	.811	**−.327**	.114	−.209	.225	.264
Interwar	3.112	.280	**.501**	**.492**	.010	.403
Postwar	3.014	**−.223**	−.116	−.011	.019	.006
Bretton Woods	4.131	.217	.280	−.283	.082	.143
Post-Bretton Woods	4.137	.071	**.259**	**.400**	.208	.155
Exports						
Gold Standard	2.119	**.376**	.011	.159	.274	.042
Interwar	5.999	.256	**.651**	**.642**	.014	.186
Postwar	2.976	−.009	**.411**	.139	.107	.006
Bretton Woods	2.023	.012	.432	.298	.211	.010
Post-Bretton Woods	5.302	.008	**.493**	−.055	.070	.041
Imports						
Gold Standard	2.118	**.612**	.000	.142	.296	.113
Interwar	6.160	.114	**.595**	**.664**	.042	.191
Postwar	3.595	−.150	**.455**	**.434**	.165	.055
Bretton Woods	3.183	−.234	**.425**	**.616**	.261	.104
Post-Bretton Woods	4.933	.083	**.569**	.005	.043	.027
Money Stock						
Gold Standard	1.440	.105	**−.277**	−.094	.000	.011
Interwar	2.481	−.265	.113	.493	.164	.337
Postwar	1.815	**.460**	−.076	−.211	.329	.026
Bretton Woods	1.539	**.497**	.004	−.239	.313	.024
Post-Bretton Woods	2.639	**.454**	−.262	−.193	.488	.191
Consumer Prices						
Gold Standard	.790	**−.400**	.140	−.132	.135	.208
Interwar	1.933	.165	.222	**.363**	.003	.518
Postwar	.906	**−.518**	**−.242**	.106	.232	.023
Bretton Woods	.857	**−.595**	**−.225**	.179	.285	.051
Post-Bretton Woods	1.058	**−.288**	**−.289**	−.128	.080	.004

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Denmark					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	—	—	—	—	—	—
Bretton Woods	—	—	—	—	—	—
Post-Bretton Woods	—	—	—	—	—	—
Investment						
Gold Standard	4.165	−.326	.045	.333	.061	.012
Interwar	5.009	.062	**.798**	.137	−.051	.021
Postwar	4.589	.018	**.872**	−.032	.037	.081
Bretton Woods	3.980	−.086	**.875**	**−.228**	.022	.097
Post-Bretton Woods	5.470	.127	**.893**	.142	.138	.138
Government Expenditures						
Gold Standard	11.204	−.045	−.065	**.142**	.057	.032
Interwar	1.887	.111	−.238	.152	.086	.056
Postwar	2.878	.026	**−.387**	−.001	.154	.029
Bretton Woods	3.295	.026	−.322	.208	.146	.133
Post-Bretton Woods	1.972	−.020	**−.613**	−.442	.216	.129
Government Revenues						
Gold Standard	4.174	−.147	−.002	.152	.086	.015
Interwar	2.172	−.112	**.517**	−.297	.025	.056
Postwar	2.948	−.043	−.019	.270	.225	.163
Bretton Woods	3.481	−.096	**−.184**	.223	.221	.194
Post-Bretton Woods	1.683	.023	**.553**	**.447**	.207	.113
Exports						
Gold Standard	3.514	.013	**.464**	.025	.088	.006
Interwar	3.672	.170	**.430**	.065	.151	.031
Postwar	2.276	−.219	.138	.217	.009	.055
Bretton Woods	2.180	−.153	.225	.309	.012	.077
Post-Bretton Woods	2.423	−.317	.002	.057	.085	.049
Imports						
Gold Standard	4.689	−.162	−.034	.113	.018	.002
Interwar	3.961	.107	**.577**	.086	.098	.025
Postwar	3.601	**−.406**	**.478**	.254	.140	.058
Bretton Woods	3.632	**−.436**	**.468**	.341	.071	.071
Post-Bretton Woods	3.549	−.224	**.499**	.077	.245	.028
Money Stock						
Gold Standard	2.538	−.076	.234	.091	.005	.006
Interwar	.994	**.539**	**.637**	−.065	.175	.059
Postwar	2.098	**.398**	−.037	−.229	.101	.094
Bretton Woods	1.213	**.509**	−.079	**−.319**	.101	.156
Post-Bretton Woods	3.018	**.607**	−.010	−.190	.156	.081
Consumer Prices						
Gold Standard	2.112	**−.150**	−.161	.207	.005	.147
Interwar	1.921	.170	.033	.122	.183	.035
Postwar	1.031	**−.286**	**−.614**	−.071	.243	.032
Bretton Woods	1.089	−.226	**−.618**	−.035	.249	.031
Post-Bretton Woods	.840	−.223	**−.658**	−.044	.301	.025

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued
Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Finland					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	—	—	—	—	—	—
Interwar	—	—	—	—	—	—
Postwar	—	—	—	—	—	—
Bretton Woods	—	—	—	—	—	—
Post-Bretton Woods	—	—	—	—	—	—
Investment						
Gold Standard	3.103	.076	**.390**	**.271**	.137	.131
Interwar	3.460	**.538**	**.750**	**.375**	.120	.131
Postwar	3.722	.149	**.824**	**.529**	.000	.045
Bretton Woods	3.230	−.205	**.717**	**.386**	.012	.013
Post-Bretton Woods	4.004	**.341**	**.886**	**.606**	.019	.146
Government Expenditures						
Gold Standard	5.192	−.354	−.011	.240	.146	.021
Interwar	4.690	−.118	.098	.331	.089	.194
Postwar	2.443	**−.251**	.044	.068	.074	.142
Bretton Woods	3.485	−.203	**.256**	−.035	.087	.109
Post-Bretton Woods	1.379	**−.492**	−.290	.257	.034	.417
Government Revenues						
Gold Standard	2.402	−.265	−.182	**.132**	.026	.027
Interwar	3.829	.048	**.626**	**.608**	.120	.151
Postwar	2.348	−.028	**.367**	.181	.046	.010
Bretton Woods	3.207	−.064	**.310**	−.099	.074	.056
Post-Bretton Woods	1.559	.009	.495	**.539**	.019	.126
Exports						
Gold Standard	4.090	**.436**	**.568**	.001	.188	.022
Interwar	5.988	.261	**.574**	.241	.082	.023
Postwar	4.539	.207	**.424**	**−.182**	.005	.095
Bretton Woods	6.419	.051	**.542**	−.169	.009	.041
Post-Bretton Woods	2.743	**.517**	**.341**	−.243	.010	.417
Imports						
Gold Standard	3.209	**.301**	**.600**	.200	.088	.054
Interwar	5.155	**.396**	**.752**	**.360**	.001	.046
Postwar	4.793	.091	**.642**	.161	.023	.024
Bretton Woods	6.433	−.085	**.711**	.143	.016	.009
Post-Bretton Woods	3.358	**.378**	**.632**	.204	.015	.092
Money Stock						
Gold Standard	1.926	**.149**	.273	**.399**	.091	.064
Interwar	1.423	−.004	.293	**.532**	.093	.262
Postwar	4.399	.270	.283	−.017	.020	.036
Bretton Woods	6.584	.128	.217	−.233	.033	.082
Post-Bretton Woods	1.904	**.407**	**.583**	**.593**	.026	.060
Consumer Prices						
Gold Standard	1.527	−.296	**−.429**	.158	.165	.132
Interwar	1.144	.270	.044	.399	.225	.180
Postwar	1.647	−.199	−.132	.047	.054	.095
Bretton Woods	2.449	.003	−.100	−.137	.062	.113
Post-Bretton Woods	.787	**−.607**	−.253	**.387**	.049	.033

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Norway					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	1.224	−.342	.050	**.566**	.051	.307
Interwar	.570	−.111	.150	**.873**	.129	.605
Postwar	2.716	−.032	.233	.239	.026	.104
Bretton Woods	3.227	.027	.162	.046	.034	.055
Post-Bretton Woods	2.214	−.106	**.326**	.473	.008	.177
Investment						
Gold Standard	4.486	.300	**.537**	.194	.118	.026
Interwar	—	—	—	—	—	—
Postwar	5.351	**−.181**	**.090**	**.179**	.074	.024
Bretton Woods	4.908	−.107	.099	.111	.256	.011
Post-Bretton Woods	5.673	−.246	.082	.227	.030	.044
Government Expenditures						
Gold Standard	6.498	.018	.296	.125	.062	.113
Interwar	1.751	.030	**.178**	**.192**	.071	.317
Postwar	3.954	−.010	.003	−.001	.001	.005
Bretton Woods	5.536	**.205**	.073	−.028	.082	.009
Post-Bretton Woods	1.532	**−.485**	−.219	.057	.093	.047
Government Revenues						
Gold Standard	6.747	−.136	.310	**.321**	.047	.192
Interwar	2.382	−.181	**.332**	**.208**	.006	.170
Postwar	4.489	−.118	.115	**.113**	.015	.038
Bretton Woods	5.871	−.023	.108	.045	.028	.044
Post-Bretton Woods	2.735	−.267	.145	.270	.090	.029
Exports						
Gold Standard	4.899	.230	.108	**−.486**	.020	.169
Interwar	3.573	**.295**	**.675**	**−.425**	.094	.122
Postwar	6.483	.035	.278	−.152	.018	.045
Bretton Woods	7.158	−.114	.429	.020	.037	.057
Post-Bretton Woods	5.874	.171	.131	−.327	.021	.159
Imports						
Gold Standard	4.309	**.336**	.345	−.046	.078	.016
Interwar	3.423	.241	**.539**	**.471**	.382	.119
Postwar	4.397	−.028	**.364**	.250	.011	.071
Bretton Woods	4.138	−.070	.295	.111	.002	.038
Post-Bretton Woods	4.587	−.032	**.414**	.355	.010	.143
Money Stock						
Gold Standard	1.819	.112	.298	**.460**	.122	.244
Interwar	.648	**−.486**	.022	**.633**	.277	.356
Postwar	2.212	.062	**.256**	.119	.017	.097
Bretton Woods	2.535	.141	**.144**	−.071	.066	.090
Post-Bretton Woods	1.794	.063	**.398**	**.340**	.043	.267
Consumer Prices						
Gold Standard	1.969	.261	.236	**.484**	.161	.222
Interwar	1.373	−.072	.173	−.104	.079	.050
Postwar	1.528	**−.257**	−.346	−.022	.089	.003
Bretton Woods	1.848	−.081	−.158	.038	.070	.015
Post-Bretton Woods	1.191	**−.515**	**−.609**	−.084	.125	.005

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

Appendix C continued

Cross-Correlations of Band-Pass-Filtered Real GDP with Expenditure Components, Money Stock and Prices

	Sweden					
	(1) Vol. ratio	(2) j = −1	(3) j = 0	(4) j = +1	(5) $R^2(y,x)$	(6) $R^2(x,y)$
Consumption						
Gold Standard	1.353	−.081	**.599**	.069	.224	.049
Interwar	1.275	−.084	**.712**	**.468**	.102	.057
Postwar	.994	.124	**.511**	.242	.012	.029
Bretton Woods	1.005	.253	**.497**	−.073	.014	.035
Post-Bretton Woods	.985	.031	**.523**	**.448**	.023	.125
Investment						
Gold Standard	5.349	−.032	**.588**	**.161**	.087	.134
Interwar	3.468	**.384**	**.883**	.098	.129	.088
Postwar	4.818	.154	**.573**	**.377**	.014	.192
Bretton Woods	4.359	−.003	.236	.230	.126	.196
Post-Bretton Woods	5.125	.249	**.785**	**.482**	.050	.098
Government Expenditures						
Gold Standard	1.815	−.368	−.182	−.046	.168	.022
Interwar	6.963	.279	**−.095**	**−.127**	.088	.052
Postwar	3.498	−.160	**−.519**	−.223	.049	.115
Bretton Woods	4.719	.013	**−.560**	**−.404**	.015	.167
Post-Bretton Woods	2.172	**−.497**	**−.555**	−.032	.189	.172
Government Revenues						
Gold Standard	3.412	.125	**.532**	.045	.014	.030
Interwar	7.523	.294	−.006	−.003	.095	.028
Postwar	4.546	**−.292**	−.246	.194	.013	.140
Bretton Woods	5.813	−.228	**−.620**	−.096	.028	.169
Post-Bretton Woods	3.322	−.406	.209	**.544**	.087	.105
Exports						
Gold Standard	3.724	**.262**	**.455**	.037	.064	.114
Interwar	5.384	.316	.472	−.022	.128	.053
Postwar	5.835	.121	**.456**	.131	.006	.071
Bretton Woods	7.014	−.293	**.408**	.444	.038	.031
Post-Bretton Woods	4.795	**.581**	**.526**	−.182	.050	.353
Imports						
Gold Standard	3.032	.291	**.592**	−.003	.085	.052
Interwar	6.546	.063	.273	**.269**	.020	.026
Postwar	6.881	.065	**.437**	.213	.005	.085
Bretton Woods	8.115	−.330	.362	.447	.017	.019
Post-Bretton Woods	5.796	**.475**	**.529**	−.040	.027	.323
Money Stock						
Gold Standard	1.476	**−.406**	−.070	**.254**	.302	.011
Interwar	1.359	−.134	.145	**.292**	.054	.039
Postwar	5.948	.179	−.115	−.273	.009	.096
Bretton Woods	8.370	.215	−.281	**−.409**	.009	.099
Post-Bretton Woods	2.949	.259	.186	.025	.023	.013
Consumer Prices						
Gold Standard	1.465	−.160	.248	**.264**	.163	.002
Interwar	1.900	.165	.113	.039	.005	.006
Postwar	1.615	**−.527**	**−.410**	**.276**	.064	.061
Bretton Woods	2.033	**−.552**	**−.530**	**.269**	.110	.052
Post-Bretton Woods	1.201	**−.540**	−.298	.298	.194	.112

Note: Bold numbers denote statistically significant correlations at the 5 percent level using Newey-West optimal bandwidth standard errors.

Column 5 shows the difference between the R^2 from regressions of y (the business cycle) on two lags of x (the candidate series) and y, and the R^2 from regressions of y on two lags of y, whereas Column 6 shows the relative R^2 when x and y are reversed.

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