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BUSINESS CYCLES IN INTERNATIONAL HISTORICAL PERSPECTIVE

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ABSTRACT

This paper examines business cycles theoretically and empirically, with a quantitative study based on experience over the long run and in a cross section of countries. Several major questions in business cycle theory are explored. Theoretical concerns indicate that the properties of business cycle models depend not only on important structural aspects of the model such as money neutrality, labor market structure, and price adjustment, but also on the closure of the model in international markets. Econometric considerations suggest that more information about the country-specific versus universal features of cycles could be gleaned from the study of panel data. A review of business cycle properties in a sample of over a dozen countries is considered in light of these issues.

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Business cycle models seek to answer the question of why economies go through cycles of recession and recovery, or boom and bust. Any theory of the business cycle makes two sorts of claims: what shocks are most important in disturbing the economy and what economic structure is necessary for propagating these shocks. For example, one common explanation of business cycles begins with monetary shocks, and then seeks to explain why monetary shocks are not purely neutral, as neoclassical theory would have it, and instead have real effects, at least in the short term. Early models in this vein were often implicitly or explicitly based on the proposition that markets do not clear continuously. Early equilibrium "real business cycle" theories instead emphasized the importance of real shocks, especially to technology, which may cause socially efficient fluctuations even when markets are always in equilibrium. More recent models have attempted to marry the equilibrium approach to macroeconomics with the substantive Keynesian ideas that money is not neutral and that economic fluctuations are costly. New Keynesian theories of the business cycle admit the possibility of a number of economic shocks, including monetary and technology shocks, but then focus on explaining how nominal price rigidities within the economy can turn these shocks into recessions or booms. Other models show that business cycles driven by Keynesian "animal spirits" are consistent with rigorous microfoundations and rational expectations

Seeking empirical evidence for and against these various approaches, we turn business cycle theories loose on perhaps the greatest macroeconomic laboratory available: the extant record of macroeconomic historical statistics for a broad cross-section of countries since the late 19th century. We have annual time-series data running from circa 1870 to the present on output, prices, real wages, exchange rates, total consumption (public plus private), investment, and the current account for 15 countries.[1] Over this time frame, this is the largest such panel of data ever studied in terms of country coverage.

We will further focus our discussion by dividing the last 130 years into four time periods that, not coincidentally, echo the usual division of this time frame into four distinct international

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[1] The countries are: Argentina, Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, United Kingdom, United States. This empirical approach is an extension of Backus and Kehoe (1992). We owe many debts to scholars who helped us collate the data, especially Michael Bordo. Bergman, Bordo and Jonung (1998) performed a similar exercise; unlike them, we also examine the cyclicality of real wages, drawing on the historical real wage database assembled by Williamson (1995, and more recent revisions). For more details of the data so assembled see Obstfeld and Taylor (1999). A summary of the data sources is contained in a longer, working-paper version of the present article. That paper, and the data, are available upon request from the authors.

monetary regimes (Eichengreen, 1996; Obstfeld and Taylor, 1999). The first period from about 1870 up to 1914, represents the time when much of the world economy worked according to the classical gold standard. This system was for most countries a stable and credible regime, characterized by fixed exchange rates and monetary discipline, and it facilitated the integration of global capital markets (Eichengreen, 1996; Eichengreen and Flandreau, 1996; Bordo and Kydland, 1995; Bordo and Rockoff, 1996; Edelstein, 1982). In the second period, from 1919 to 1939,[2] this well-integrated global economy was destroyed; it went from globalized to almost autarkic in the space of a few decades. Capital controls became widespread, capital flows were minimal, and international investment was regarded with suspicion (Eichengreen, 1992; Temin, 1989). In the third period, the Bretton Woods era from 1945 to 1971, an attempt to rebuild the global economy took shape, and global trade and capital flows increased. However, exchange rates remained largely fixed by international treaty and the design of the International Monetary Fund allowed capital controls as a means for governments to prevent currency crises and runs, and to provide scope for activist monetary policy (Bordo and Eichengreen, 1993; Eichengreen, 1996). The fourth period, the era of floating exchange rates, has lasted from the early 1970s to the present. Floating rates meant that capital controls were no longer needed: shifts in market sentiment now resulted in exchange rate shifts rather than pressure for a flow of capital (Obstfeld and Rogoff, 1995; Eichengreen, 1996; IMF, 1997). This generally encouraged the integration of capital markets, although important setbacks to that global movement of capital were seen in the developing economy debt crisis of the early 1980s and in the emerging markets financial crises of 1997–98.

Dividing the time period according to these monetary regimes represents our judgement that although goods and labor markets evolved too, the change in capital mobility probably deserves the greatest scrutiny as a factor affecting business cycle fluctuations. Indeed, such a focus on capital-market shocks dominates most of the specialist literature just as it does most popular writing—past and present—discussing the impact of the global economy on local economies in crisis or depression

A variety of historical data strongly support the division of economic history into these four segments (Obstfeld and Taylor, 1999, ch. 2). For example, from 1870 to 1914, the average size of international capital flows in our 15 countries, as measured by current account deficits,

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[2] We omit both World Wars from our sample.

was often as high as 4-5 percent of national income before World War I. Foreign assets rose from 7 percent of world GDP in 1870 to just under 20 percent in the years from 1900–14. As global capital markets integrated, interest rates in different countries clustered at similar levels. During the period from 1919-1939, international capital flows diminished in the 1920s and were typically less than 2 percent of national income in the late 1930s. Foreign assets were only 8 percent of world output by 1930 and just 5 percent in 1945. As global capital markets disintegrated, the dispersion of real interest rates doubled in the 1920s (Lothian, 1985). During the third period, from 1945 through the 1960s, the size of international capital flows declined to an all-time low, around 1 percent of national income. Only during the floating exchange rate period of the late 1970s and 1980s have international capital flows increased, although the annual flows are still not yet to levels comparable to those of a century ago. Today, gross foreign assets have risen again, to about 50 percent of world GDP. As global capital markets have stabilized and reintegrated, the dispersion of real interest rates has returned to its pre-1914 levels.

Thus, our approach in this paper is to see what an international and historical perspective has to say about the sources and structures of business cycles. One advantage of this approach is that a robust and useful theory of business cycles should be able to account for the patterns seen in the long-run data for many countries. This ought to be a more discriminating test than, say, applying one theory to selected years for one country. Moreover, the division into four different time periods does not just reflect the obvious differences in monetary regimes—each regime also restricts the set of possible economic shocks and propagation mechanisms while allowing others, and thus affects the behavior of many non-monetary economic variables over the business cycle. The analysis of business cycles at the global level forces us to confront the open-economy extensions of all the theories and the extent to which such theories can then fit into the historical record of an evolving global economy.

We will not seek to build up a particular model of business cycles and then strive to defend it. Instead, we will search for regularities in the historical and international data in an attempt to whittle down the set of acceptable business cycle models. Our empirical evidence starts with a look at the behavior of the macroeconomic aggregates during the four time periods—like income, consumption, investment, the current account, and the price level—both as a way of becoming acquainted with the data and to address the question of whether business cycles have become less volatile over time. We then lay out a set of issues on which business cycle theory must take a stand and then examine cross-country data from several historical periods that point to some answers. We explore evidence that monetary shocks are not neutral in their effect on the economy, and then consider whether this is because nominal prices, or wages, are slow to adjust. We consider whether the labor market clears, at least to a first approximation, and find somewhat ambivalent results. We then debate whether we can continue to think of business cycles in closed-economy settings, or if the explanations of the sources of economic shocks and the structures that may propagate them are more plausibly explored in an open-economy model. Finally, based on these discussions of the characteristics of business cycles, we offer some preliminary thoughts about what sorts of business cycle models we believe will offer the most fertile approach for future research.

Patterns of Macroeconomic Aggregates

The first major question in all historical accounts of the evolution of the business cycle is whether the cycle has become more or less volatile over time. Controversy has raged over whether the postwar period has witnessed a diminution of volatility, perhaps reflecting institutional developments and the successful application of macro-management policies, or whether the business cycles across nations are no less volatile than they were during the late 19th century. Some of this debate has been focused on U.S. business cycles, as discussed by Christina Romer in her contribution to this symposium. For international and historical evidence, the interested reader might begin with Backus and Kehoe (1992) and Bergman, Bordo and Jonung (1998). Interpretations of the historical international evidence are complicated by the fact that they use annual data, rather than higher frequency data, which makes it hard to measure the length of cycles accurately. Moreover, the sample size, as measured by the number of business cycles that has occurred, remains relatively small.

One simple way to look at economic volatility is to compare the standard deviation of key economic variables during various time periods. This information is presented in the first five rows of Table 1.[3] If one pools the data for the 15 countries during each of the four time

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[3] Following recent practice, we detrend all our series as necessary using a bandpass filter that is designed to isolate fluctuations at business-cycle frequencies: those lasting between 2 to 8 years. See Baxter and King (1995) for details, and for a comparison with the usual Hodrick-Prescott filter. They argue that the bandpass filter has more desirable transfer properties for the isolation of specific business-cycle frequencies in the data. It is the filter used by Stock and Watson (1998) and Bergman, Bordo, and Jonung (1998). In contrast, the Hodrick-Prescott filter used in earlier studies passes much of the undesirable lower-frequency content in the series outside the business-cycle range. For this reason our findings do not

periods, one finds that the standard deviation of output, consumption, investment, and the current account (as a share of GDP) rises by about one-half from the time of the gold standard (1870-1914) to the interwar period (1919-1939). Then, in the Bretton Woods period (1945-1971), these standard deviations fall back to the level seen during the gold standard period, and in the more recent period of floating exchange rates, the level of volatility falls lower still. Given the uncertainties of interpreting annual historical data, it would be difficult to make a definitive case that today's business cycles are less volatile than those of a century ago in this cross section of 15 countries, although Bergman, Bordo and Jonung (1998) make an effort along these lines. However, the notion of significantly higher volatility in the interwar period can be easily supported.[4]

Although the volatility of consumption and the current account ratio are similar to that of output, the volatility of investment is about three to four times higher. It is striking that the ratio of investment volatility to consumption or output volatility seems to be fairly stable across all four time periods, even though economic structures within countries and international linkages across countries varied considerably. An adequate business cycle theory should seek to explain the relatively high volatility of investment as compared to other aggregate quantities.

What might explain the common pattern of rising and then falling volatility over the very long run? At one level, this pattern simply documents the enormous dislocations associated with the Great Depression. This raises the question of whether the Depression should be treated as a singular, anomalous event, or a litmus test for any general theory of business cycles. A middle-of-the-road approach might attempt to develop a universal business cycle theory that includes small and big recessions, while recognizing that something different may have occurred in the 1930s. For example, one possibility is that the interwar era was potentially a more volatile era, at least in part, because World War I and various restrictions of the 1920s and 1930s led to a sharp reduction in flows of international goods and capital. In turn, this meant that the ability to spread risk in production and consumption activities via capital markets could also have led to autarkic

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necessarily match previous findings. An example would be the autocorrelation of output: our study finds much lower values for this parameter than is the case with Hodrick-Prescott (or linear, or quadratic) detrending. This is another way of saying that other methods make the growth component "too smooth" and the cyclical component more volatile and autocorrelated.

4. Most of our findings hold at the individual country level as well as in the pooled data. In what follows, we try to indicate important cases when they do not. The longer working paper version of this analysis, available from the authors upon request, provides a fuller depiction of the country-level results.

tendencies in these economies, exacerbating any economic shocks that occurred (Obstfeld and Taylor, 1999). Under this view, the more recent integration of the world's economies would help to explain the lower amplitude of contemporary business cycles (Bergman, Bordo and Jonung, 1998). However, this explanation is not without its problems, or offsetting considerations. For example, any shocks to an economy that affect investment productivity ought to have relatively small effects on investment in autarkic economies, where investment is constrained by the supply of domestic savings, but big effects in open economies, since foreign capital can move in or out freely. However, investment volatility was higher in the period of interwar autarky than in other eras. Thus, perhaps a more complex model is needed, or perhaps differing shocks need to be admitted in different periods.

The evidence on volatility of price levels, in the fifth row of Table 1, gives a slightly different perspective. There is clear evidence that the two periods of mostly fixed exchange rates—the gold standard and Bretton Woods—delivered far less price volatility than the interwar period. However, price level volatility in recent years seems to be slightly higher than in the periods of fixed exchange rates. It should be noted that the pooled results mislead a little here: they are heavily influenced by two outlandish episodes of inflation, the German hyperinflation in the 1920s and the Argentine hyperinflations of the 1980s. But more broadly, it seems true that when countries are committed to fixed nominal exchange rates, they are restrained from engaging in discretionary monetary policy, and price levels move by less. The price evidence offers some *prima facie* evidence that monetary policy and its interaction with exchange rate regimes is one potential source of economic shocks. From this perspective, it seems somewhat remarkable that the recent period of floating exchange rates has not unleashed any truly substantial increase in price volatility as compared to the Bretton Woods era (with the egregious exception, in our sample, of Argentina).

A second important property of macroeconomic time series, along with volatility, is persistence, which can be measured as the autocorrelation of each variable with its value in the previous time period. Evidence on persistence is presented in the second five rows of Table 1. The level of persistence has been fairly low over the last 100 years for output, consumption, and investment, but higher in the interwar and float periods. The interpretation of these results is not straightforward, since over such a long time span the structure of the economy has probably changed. Still, the association of higher persistence with floating-rate regimes again supports a focus on money as an important part of the business cycle dynamic.

The persistence of current accounts shows a pattern consistent with the descriptive data on the evolution of the global capital market. As we have seen, capital flows were large in the first and last sample periods; we now also see that they were much more persistent (Taylor, 1996). One rationalization for this pattern is that, under autarkic capital markets, not only do capital flows tend to zero in size, they also become less sustainable over time. One way to think of this is in terms of the adjustment speed towards equilibrium as defined by an economy's long-run budget constraint. For that constraint to be met, the current account must be stationary (Wickens and Uctum, 1993; Trehan and Walsh, 1991). The ability to sustain persistent current account deficits may be seen as a facet of the autarky versus openness continuum in capital markets. Markets with information imperfections or transaction-cost barriers may be less likely to support a prolonged one-way flow of capital (and, in the stock dimension, the corresponding build up of indebtedness) as compared to perfectly functioning open markets.

A third characteristic of business-cycle data is the extent to which other series move with output. The correlation of consumption with output, for example, seems to be about 0.6–0.7 in all four time periods. This correlation is strikingly high, and suggests that consumption-smoothing has been fairly uniform over time. This paints a very gloomy picture of the capacity of individual countries to insulate themselves from output shocks through international risk-sharing.[5] Investment has also been highly correlated with output, though less so during the Bretton Woods era. Here again, an open-economy perspective might argue that the pervasive capital controls of the Bretton Woods era dampened the impact of foreign capital flows, thus lessening the investment response in booms and busts, and moving an economy closer toward autarkic capital market constraints. However, a parallel argument would then hold that the interwar period should have had less volatility in investment as well, which clearly is not true. This suggests trying to identify some structural differences in the interwar period that may have exacerbated investment volatility, perhaps leaning on financial aspects of the Great Slump or debt-deflation issues. The current account has generally moved in countercyclical fashion, as predicted by most standard models with real shocks (Mendoza, 1991; Glick and Rogoff, 1992; Backus, Kehoe, and

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5. An attempt was also made to isolate local from global shocks by constructing a correlation of just the country-specific components of the quantity series; that is, each of the data was first detrended for the average world patterns, and then the correlations were re-estimated. These results do not greatly differ from the raw results just reported, although the correlations of country-specific shocks to consumption and output are smaller than in the raw data. This approach represents a standard test, in the case of consumption, for the extent of international risk-sharing (Lewis, 1996).

Kydland, 1994). But note that this correlation was strong under Bretton Woods, when the option to use the current account as a buffer was seemingly weakest. In some dimensions, then, the quantity evidence does not always line up simply and predictably with the stylized facts on market integration. Here again, some further analysis of the types of admissible shocks seems desirable.

Finally, we can look at the comovements across countries, arbitrarily selecting the United States as a benchmark. We soon encounter some more anomalies of the kind seen in earlier studies (Backus, Kehoe and Kydland, 1993). There is very little cross-country correlation in consumption. This demonstrates the extreme lack of risk-sharing in the global economy, for if all country-specific risks were insured and diversified, then all consumption paths would move together in response to shocks. Another striking finding is that investment is very positively correlated across countries. In a standard model, where mobile capital is flowing in response to a shock by leaving one country and heading overseas, one would expect a negative correlation (unless all shocks are global in nature). Perhaps this result is an artifact of using two-country models when the world has many more countries, so that investment booms on one country do not automatically crowd out investment everywhere else: this is clearly a direction for future research. The price correlations across countries line up with the predictions of the changing monetary regimes. In the fixed exchange rate regimes, the rapid transmission of prices from country to country was assured by relatively open markets for goods and a fixed exchange rate. In the interwar period, this correlation broke down; prices had no need to move so much when nominal exchange rates could do the adjusting. Bretton Woods was a return to the former dynamic, and the float a rerun of the latter. It would be hard to imagine a business cycle model that could produce predictions of these patterns in a cross-section of countries without explicit attention to the changing monetary regime and the integration of global markets.

Some Key Issues in Choosing Between Business Cycle Models

Certain key questions arise across a range of plausible business cycle models. Should monetary shocks be treated as neutral? Are nominal prices sticky? Do labor markets clear? Can a plausible model of business cycles be set in a closed economy, or should presumption favor an open-economy model? Although the preceding discussion has already hinted strongly at our beliefs on some of these issues, it is useful to discuss why these questions matter in various business cycle models and what our historical and international evidence has to say about them.

Is Money Neutral?

In basic neoclassical models, money is neutral; that is, it does not affect real variables like output or employment at any time horizon. One avenue for explaining business cycles is to argue either that shocks to the money supply may have real effects on the economy, or that money may play a role in propagating non-monetary shocks through an economy. A huge literature has attempted to test for the effects of money on output, while attempting to control for reverse causality from output to money. The literature is usually partitioned into the "narrative approach," which tries to identify exogenous changes in money from institutional records (Friedman and Schwartz, 1963; Romer and Romer, 1989), and the statistical approach, which attempts to do the same thing using an econometric model (Christiano, Eichenbaum, and Evans, 1998, summarize recent work). Both approaches have found strong evidence that money is not always neutral, especially in the short run.

However, the fundamental issue of causality continues to bedevil the literature on links between money and output. Even if changes in money precede changes in output, one can argue that there is a *post hoc, ergo propter hoc* fallacy (Tobin, 1970). We believe that the behavior of real exchange rates provides compelling evidence that money is not neutral, and evidence of a sort that is easier to defend against the possibility of reverse causation.

If money is neutral, then the nominal exchange rate should move with inflation, while the real exchange rate adjusts to changes in economic fundamentals (e.g., changes in national saving). In an excellent survey, Devereux (1997) argues that the available evidence argues in support of the notion that real exchange rates adjust to reflect purchasing power parity (PPP), but the speed of adjustment toward the PPP exchange rate is extremely slow.[6] In the short run, nominal exchange rates remain much more volatile than macroeconomic fundamentals would predict (Meese and Rogoff, 1983). In their useful summary of the evidence on the behavior of real exchange rates, Frankel and Rose (1995) point out that real and nominal exchange rates seem to move virtually one-for-one.

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6. For further discussions of the adjustment speed, see Froot and Rogoff (1995) and Taylor (1995). Some more recent work using nonlinear methods suggests that reversion might be "only" one or two years (Obstfeld and Taylor, 1997; O'Connell and Wei, 1997), but even that speed of reversion would still seem to indicate substantial impediments to short-run nominal adjustment.

Table 2 presents some basic evidence on the relationship between monetary regime and exchange rate volatility. The first row shows the volatility of nominal exchange rates based on pooled data from 20 countries, as measured by the standard deviation of the log of the exchange rate. The second row shows volatility of real exchange rates, calculated in the same way, where the real exchange rate is calculated by converting all currencies into U.S. dollars. The third row presents an alternative measure of real exchange rates, where the exchange rate for each country is calculated relative to a basket of the 19 other currencies. Floating-rate eras such as the interwar and the post-1971 years clearly show higher volatility of both real and nominal rates as compared with fixed-rate eras such as the classical gold standard and Bretton Woods. This association holds up just as well on a country-by-country basis.

While we believe that the evidence from real and nominal exchange rates demonstrates convincingly that money is not neutral, several issues and puzzles remain. First, in looking at exchange rate regimes to study the neutrality of money, it is important to remember that the regime itself may be endogenous. Countries that face larger real shocks may allow their exchange rates to float, while stable countries may use a fixed exchange rate as a nominal anchor (Stockman, 1987). However, for certain major historical regime switches such an explanation appears implausible. When Bretton Woods collapsed, for example, almost every country abandoned fixed exchange rates at once. When the gold standard fell apart in the interwar period, there was a systematic relationship between regime choice and real outcomes inconsistent with the endogenous response story: those who abandoned gold did better (Eichengreen and Sachs, 1985; Obstfeld and Taylor, 1998)—apparently, they were not being buffeted by larger real shocks!

Second and more seriously, apart from a watershed historical event like the Great Depression, there is little evidence that the behavior of real exchange rates matters for other macroeconomic aggregates (Baxter and Stockman, 1989; Frankel and Rose, 1995). This finding is a puzzle for models of all types, since every economic model argues that prices should matter for the determination of quantities, even if models differ in their accounts of how these prices are set.

Finally, what models can we use to explain the long-lasting real effects of money that are evident in the behavior of real exchange rates? A variety of models with satisfactory microfoundations have been proposed (see Devereux, 1997, for a survey), but so far none can plausibly explain the persistence of the deviation of nominal exchange rates from their purchasing power parity levels. We believe that models with nominal rigidities of some sort hold the most promise, and discuss such models in the next two subsections. Here, we simply conclude that a good business cycle model should be able to deliver both short-run monetary nonneutrality and long-run reversion to neutrality. For exchange rates, such a model should produce what may seem like too much volatility in the short run, combined with a long-run reversion to the purchasing power parity exchange rate. Further, the model should be able to explain why properties like the degree of volatility in exchange rates will vary under different monetary regimes.

Are Prices Sticky?

A variety of economic institutions could allow monetary shocks to have real effects. One family of models is designed to obtain real effects of monetary shocks even with perfectly flexible wages and prices. Perhaps the best-known of these models remains Lucas's striking (1972) paper, which shows that monetary shocks can have real effects if people have incomplete information and cannot distinguish between changes in relative prices and changes in the overall price level. However, by the mid-1980s enough evidence had accumulated against this particular model that it fell out of favor (Blanchard, 1990). A more recent model in a similar spirit stresses the lack of continuous adjustment of real money balances (Lucas, 1990; Fuerst, 1992). In these "liquidity" models, a change in the stock of high-powered money typically changes the real interest rate, which affects the cost of working capital, and thus the aggregate demand for labor and aggregate output, even though prices are flexible.

However, the earliest models of the real effects of money, dating back at least to Hume’s 1752 essay (reprinted 1955), have stressed slow adjustment of wages and/or prices. The "New Keynesian" literature has emphasized flexible wages and sticky output prices. Given some assumed nominal friction—for example, a small fixed cost of changing prices, often termed a "menu cost"—this literature attempts to derive Keynesian results from rigorous foundations. For analytical tractability, dynamic New Keynesian models typically assume that prices are set for a fixed length of time: a so-called time-dependent rule. The alternative is to assume a state-dependent rule: firms face some cost of price adjustment, and thus do not change their prices continuously or at fixed intervals of time, but rather when the benefit of changing the price exceeds the cost. Dynamic state-dependent models are extremely difficult to analyze (Caplin and

Leahy, 1997).[7] However, Ball, Mankiw and Romer (1988) had the insight that one can combine some of the appealing features of both time- and state-dependent models in a tractable framework. In their model, firms in each country follow a time-dependent pricing rule, but choose the length of time between price changes to be optimal on average. They showed that in such a framework, firms in high-inflation countries should change prices more frequently, because the loss of keeping one's nominal price fixed is higher when inflation is high.

Kiley (1999) extends this insight to consider the persistence of output fluctuations. He notes that in sticky-price models, output deviates from its long-run growth rate only as long as there is significant nominal price inertia. But, following the logic of Ball, Mankiw and Romer (1988), nominal prices change more quickly in countries with high average inflation rates. Thus, countries with high mean inflation should have less persistent deviations of output from trend—a linking of real and nominal variables that is difficult to rationalize unless sticky prices are a major force propagating business cycles.[8] Kiley tests this insight in a regression framework. The dependent variable is a measure of output persistence, the first autocorrelation of detrended (log) output growth for each country. The explanatory variable is the level of mean (log) inflation. Using a sample of 43 countries over the 1948–96 period, Kiley finds a statistically significant, negative connection between these variables, as the theory predicts.[9]

Kiley's findings offer a simple and robust implication of fixed-price models, and it is difficult to see how other classes of models would explain them. Since his model relates output persistence to the frequency of price change, one can interpret his results using that frequency as

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[7] The first "New Keynesian" models of price stickiness, by Akerlof and Yellen (1985) and Mankiw (1985), are static and state-dependent.

[8] As Ball, Mankiw and Romer note, such a link certainly does not arise in the Lucas (1972) model. As for the liquidity models, they typically have little to say about the persistence of output fluctuations. Christiano, Eichenbaum, and Evans (1997) argue that a liquidity model can explain the behavior of corporate profits over the cycle better than a sticky-price model. However, the profit data that one observes are accounting profits, not economic profits; Rotemberg and Woodford (1998) explain at length why non-liquidity models can account equally well for the procyclical behavior of accounting profits.

[9] We duplicated Kiley's exercise for our cross-section sample of 15 countries, but the results were not statistically significant in any of four major time periods, and were of the "wrong" sign in several of the periods. Our different findings seem to be caused by our different sample period and countries. Ssince our sample consists predominantly of countries with stablemacroeconomic histories, we are probably lacking some useful variation that would help pin down the relationship between inflation and output persistence. For example, we are missing Brazil, Israel, and Peru, which are all high-inflation, low-persistence countries in Kiley's sample. When we used Kiley's (1999) sample period (and detrending method) with our 15 countries, we still get essentially no significant relationship between the two variables.

a metric. Kiley’s results imply that in the United States, which had 4 percent mean annual inflation over the postwar period and highly serially correlated output, the average price was changed once about every 2.5 years. On the other hand, in Argentina, which had mean inflation of 58 percent and little output persistence, prices changed more than once a year—an economically significant difference. However, this implication of Keynesian theory is hard to reconcile with one of the facts we have noted above. According to the Ball-Mankiw-Romer/Kiley hypothesis, business-cycle fluctuations should have been much more volatile and persistent in the Gold Standard period, which had very low mean inflation, than in the Floating period, which had much higher inflation. But as Table 1 shows, this prediction was not borne out. Thus, if one embraces the New Keynesian model, one has to find some offsetting factor in order to explain the low persistence of fluctuations in the early periods.

The Great Depression provides further evidence in support of theories with nominal rigidities. Countries that abandoned the gold standard, particularly those that devalued aggressively and used their newfound monetary policy freedom, experienced faster recoveries. Short-run competitive (real) depreciations drove current account balances to a surplus and stimulated the economy; though prices did rise, they adjusted less rapidly than the exchange rate. The experience of the Great Depression provides strong evidence, albeit based on one historical episode, that money is not neutral and that monetary policy can drive large output fluctuations. Given the magnitude of the Depression across so many countries, it seems implausible to attribute this particular downturn to unobserved real shocks. Instead, most authors have sought a monetary explanation of some sort or other. Friedman and Schwartz's (1963) magisterial account of the Depression attributes its severity to U.S. monetary policy mistakes. Recent accounts by economic historians such as Temin (1989) and Eichengreen (1992) also emphasize a monetary origin for the global depression by drawing attention to instabilities and asymmetries in the functioning of the interwar gold standard.

Thus, the data imply that nominal rigidities are important, and can lead even to such massive economic downturns as the Great Depression. But we face the same question in explaining large and long-lasting contractions in output as we do in explaining the exchange-rate evidence: Can we reproduce these facts in a model built from rigorous microfoundations? The New Keynesian research program has produced models where price stickiness comes from the optimizing behavior of firms. But these models also imply that prices will not be sticky for long periods of time, or in the face of large shocks, unless the private cost of price rigidity is small. In an insightful paper, Ball and Romer (1990) argue that there are two broad categories of reasons why the *private* cost of price rigidity might be small, even if price rigidity is *socially* very inefficient. First, the private cost is small if firms' marginal cost of production are not strongly cyclical. Second, even if marginal cost is procyclical, the private cost of keeping prices fixed is small if firms actually desire lower price-cost markups in booms. These features come from the real side of a model, and have no necessary connection with nominal rigidities *per se.* In Ball and Romer's terminology, one thus needs a model with a great deal of "real rigidity" to explain the observed *nominal* price rigidity.[10]

In practice, the most important real rigidities are probably those associated with the labor market. We noted that the evidence from exchange rates and output fluctuations supports the proposition that money is not neutral, but that evidence by itself fails to tell us whether the nominal rigidity is in prices or wages. The evidence from Ball, Mankiw and Romer (1988) and Kiley (1999) might apply equally well to pre-set nominal wages as to pre-set prices. The evidence that has been used to discriminate between these two Keynesian models is the cyclical behavior of the real wage. We discuss some of this evidence in the next section.

Does the Labor Market Clear?

Modeling the labor market is a challenge and a puzzle for all classes of business cycle theories. A model of business cycles should be able to explain one of the most robust stylized facts of economic fluctuations: that consumption and labor input both track the business cycle—labor hours almost one-for-one with output, consumption less than one-for-one. Reproducing this comovement, however, has proved a challenge for business cycle theory.

It is now usual in business cycle models to represent the household side of these models with a representative consumer who takes prices as given, and freely chooses consumption and labor supply. Then utility-maximizing households must, at all points in time, equate the marginal utility of leisure to the real wage multiplied by the marginal utility of consumption. Barro and King (1984) point out that under reasonable conditions, this relationship implies that if consumption and labor supply are rising and falling together over the business cycle, then real

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[10] Ball and Romer (1990) derived their propositions in the static setting of the early menu cost models. Kimball (1995) confirms that their results hold in a dynamic setting, in a model that is also consistent with the facts about long-run growth. However, Kimball (1995) and Chari, Kehoe and McGrattan (1996) disagree on the extent to which reasonable real rigidities can explain large and persistent output

wages must be procyclical as well.[11] In this framework, which is common to most modern business-cycle models, *only* a procyclical real wage can rationalize the positive comovement of consumption and labor over the business cycle. This conclusion holds regardless of the other details of the model—whether the cycle is driven by supply or demand shocks, whether firms are imperfect competitors, or whether nominal prices are sticky.

Thus, business-cycle theorists face two choices: They can build models in which the real wage is procyclical, or they can deny the proposition that workers freely choose labor and consumption at given wages and prices. We discuss these two alternatives in turn.

To consider models in which the real wage is procyclical, suppose a representative firm is assumed to be a price taker in factor markets; thus, the firm equates its nominal marginal revenue product of labor to the going nominal wage. However, the firm may be operating in an imperfectly competitive market for its output, and thus have some market power to mark up price over marginal cost. In this framework, there are three main ways in which a procyclical real wage can be consistent with cost minimization by firms.

First, the markup may fall during booms. In sticky price models, for example, the markup falls during booms as firms leave their prices fixed but face increasing marginal costs of production in a boom—especially a higher real wage. Other models assume that prices are flexible but show that firms may lower their optimal markups in booms, either because they want to "lock-in" new customers (Bils, 1989; Warner and Barsky, 1995), or because they cannot sustain a high degree of collusion in times of high demand (Rotemberg and Woodford, 1995). This approach has been the focus of most New Keynesian theories of the business cycle.

Second, technology may improve during booms. This is the domain of the standard real business cycle model where cycles are driven by exogenous changes in technology, and where improved technology drives both higher wages and higher output. A variant of this approach in Shleifer (1986) presents a model where technical improvements are demand-induced. A recent literature stresses, however, that the short-run effects of technology improvements can be quite different in a world where prices are sticky. Gali (1998) and Basu, Fernald and Kimball (1998)

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fluctuations.

[11] This implication is not a general consequence of consumer optimization, but it holds if there is a representative consumer whose utility at each date is a function only of consumption and leisure at that date. This framework does allow for "preference shocks" which can change the marginal rate of substitution between consumption and leisure, even at a fixed real wage. However, it is unappealing to

argue that if prices are sticky, a technology improvement lowers employment in the short run, and may lower output as well. Thus, the assumption of flexible prices in the real business cycle model is not merely an assumption of convenience; it is essential for generating the desired outcomes of the story.

Third, if there are increasing returns to scale of a particularly strong form, the marginal product of labor might *rise* as more labor is employed during booms. A number of papers have shown that if this effect is sufficiently strong multiple equilibria may exist, with higher output equilibria being superior in welfare terms; for early work in this area, see the symposium in the 1994 *Journal of Economic Theory*. However, there is no evidence that returns to scale are large enough to produce these multiple equilibria (Basu and Fernald, 1997; Schmitt-Grohé, 1997). An alternative approach has been to substitute sufficiently countercyclical markups for economies of scale (Gali, 1994), but this approach also requires a markup that is too high to be plausible (Schmitt-Grohé, 1997). A more recent approach has attempted to produce multiple equilibria with smaller returns to scale by using multi-sector models (Benhabib and Farmer, 1996; Benhabib and Nishimura, 1998). The major difficulty of most multi-sector models is that they tend to have one or more sectors that contract while the overall economy is expanding—a phenomenon that is not observed in the data (Murphy, Shleifer and Vishny, 1989).

"Equilibrium" models with labor markets that clear are obviously attractive to economists, but they now appear implausible. Remember, labor fluctuates almost as much as output over the business cycle. However, the elasticity of labor supply with respect to wages appears to be relatively small. If workers willingly supply so much more labor, then the required change in the real wage to call forth this labor supply is immense. In general, therefore, a clearing labor market is an embarrassment for all business-cycle theories that assume workers are on their labor supply curves. In the context of the real business cycle and other real models, it means that the shocks hitting the economy must be extremely large—and such shocks are hard to identify. In the context of sticky-price models, it means that firms' marginal costs are extremely procyclical—so much so that they would not hold prices fixed.[12]

One alternative is to posit so-called "Old Keynesian" models in which workers are not on their labor supply curves. Keynes (1936, ch. 20) clearly believed that quantity rationing in the

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embrace a model that implies some recessions are times of spontaneous laziness.

[12] Romer (1993) has an insightful discussion of labor market rigidity and its relationship to New

labor market was an essential feature of his theory of unemployment. Most early Keynesian models thus assumed that nominal wages are sticky, and also that employment is determined by labor demand. These assumptions allowed for the possibility of involuntary unemployment in recessions, if the real wage exceeded its market-clearing level. In contrast to the "equilibrium" models we have discussed, these models generally predict that real wages should be countercyclical.[13] Almost from its inception, however, the literature on nominal wage stickiness was criticized precisely because it implied a countercyclical real wage. Dunlop (1938), for example, argued that the evidence contradicts this implication of Keynes's *General Theory*. [14]

Another possibility is to marry some of the equilibrium models discussed above with labor market imperfections that keep workers off their labor supply curves. These models typically also imply that real wages are procyclical, but not as procyclical as they would be if the labor market cleared. The desire to have a model that predicts roughly acyclical real wages has led a number of New Keynesian macroeconomists to embrace labor market imperfections. For example, Akerlof and Yellen (1985) assume that there are efficiency wages in the labor market, where workers are paid above their marginal product to encourage effort and discourage turnover, along with sticky prices in the product market. The problem with this approach is that it does not suffice to explain all the facts. If efficiency-wage theory is correct and effective labor supply is very elastic, then we should observe a high participation elasticity (large movements in and out of the labor force in response to real wage changes), even if the labor supply elasticity of employed workers is low. It is true that the participation elasticity is usually estimated to be larger than the hours elasticity of employed workers, but not by so much as to make a major difference for business-cycle modeling.[15] Thus, the real challenge is to explain how the real wage that firms pay can be relatively acyclical even when *both* estimated elasticities are relatively small.

Finally, one can marry the New and Old Keynesian approaches, and argue that real wages

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Keynesian theory.

[13] It is logically possible to have a model with sticky nominal wages but with markups so countercyclical that real wages rise in expansions. However, this model makes the unappealing prediction that increases in aggregate demand reduce the price level.

[14] Dunlop (1998) discusses his exchange with Keynes.

[15] The same objection applies to the "indivisible labor" model of Hansen (1985) and Rogerson (1988). That model, which is widely used in the real-business-cycle literature, implies that the observed participation elasticity should be infinite.

may be not be strongly procyclical because *both* wages and prices have nominal inertia (Barro and Grossman, 1971; Erceg, 1997). However, this approach has some of the same costs as Old Keynesian theory, one of which is that one must abandon equilibrium modeling of household decisions—in this model, households are quantity-constrained in the labor market.

If workers are not on their labor supply curves, either because of real imperfections in the labor market or due to nominal wage rigidity, business cycle modeling becomes dramatically easier. If real wages, and hence firms' marginal costs, are not strongly procyclical, then nominal inertia will last much longer, and nominal shocks will have the large real effects in the models that they seem to have in the data.

Thus, business cycles models with clearing labor markets predict strongly procyclical real wages, while models with imperfect labor markets predict acyclical or countercyclical real wages. We can examine the empirical evidence on real wages over the business cycle with historical and international data. Table 4 presents evidence on the real wage, pooling data across 13 countries. In keeping with the format of Table 1, earlier, the first two rows present information on the volatility and persistence of real wages. The last row presents evidence on the comovement of wages and output.[16]

The real wage is basically acyclical during the first two periods of our study and reasonably procyclical in the third and fourth. At face value, these results are something of a puzzle. In the first two periods, the wage is not so procyclical as to support the hypothesis that the labor market clears, but neither is it strongly countercyclical, as "old" Keynesian theory predicts it should be. These results admit of several lines of interpretation: we can question the validity of the data itself, or we can seek explanations for the observed patterns.

One data issue that makes us hesitate to endorse the conclusion that real wages were actually acyclical for most of our sample concerns a built-in composition bias in the wage data. Stockman (1983) suggests that workers hired during a boom may be of lower average quality. Solon, Barsky and Parker (1994) show that Stockman's conjecture is correct: real wages controlling for worker characteristics are much more procyclical than average wage indices of the sort that we are forced to use. However, the composition bias applies to data from all periods, so it does not obviously explain the subsample differences we observe.

A second issue conceming the wage data is that the real wage we observe need not be the

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[16] Once again, we employ bandpass prefilters; see note 2 for a discussion.

effective real wage. For example, Bils (1987) argues that in the United States the marginal wage is more procyclical than the average wage because of the statutory overtime premium mandated by the Fair Labor Standards Act of 1938. The overtime premium may be relevant only for particular countries and recent historical periods, but other reasons along these lines may be more general. The possibility of a gap between actual and effective wages raises difficult issues for studying the behavior of wages over the business cycle.

But let us assume that the wage patterns we have found—namely, acyclicality over the first two time periods and procyclicality in the two most recent periods—do in fact hold, despite concerns over the data. How might a business-cycle model explain such a pattern?

First, perhaps demand shocks lead to countercylical changes in real wages, in the spirit of traditional Keynesian models, while supply shocks lead to procyclical changes, in the spirit of real business cycle models. Thus, it could be that in earlier time periods, supply and demand shocks roughly offset each other. However, the more recent period of floating exchange rates includes several large oil price shocks, both negative shocks in the 1970s and a positive shock in the 1980s. Perhaps the strong procyclicality of the real wage in the most recent period is due to the greater importance of supply shocks. This possible answer arrives with its own questions. Under standard conditions—perfect competition and the existence of a value-added production function for GDP—the ratio of the nominal wage to the GDP deflator should be unaffected by changes in oil price (Rotemberg and Woodford, 1996). But we are deflating the nominal wage by the Consumer Price Index, and Barsky and Kilian (1998) establish that the CPI changes far more than the GDP deflator during oil shocks. Thus, increases in oil prices will tend to lower our measure of the real wage at the same time that they lower output (either directly, or because central banks try to fight the inflationary effects of oil price increases).

To find support for a pattern of countercyclical wages at times of demand shocks, an obvious place to look is at a business cycle that is broadly agreed to have resulted from demand shocks—the Great Depression. In their path-breaking paper on the Depression, Eichengreen and Sachs (1985) argued in favor of the traditional sticky-wage story. Their empirical work has been extended in a careful paper by Bernanke and Carey (1996) who find that real wages were strongly countercyclical in a 22-country sample over the years 1931–36. We sought to replicate these results in a 13-country sample. Our data show some heterogeneity in the cyclicality of real wages across countries, and sensitivity to the sample period. For the Bernanke and Carey sample period from 1931–36, mostly the recovery phase of the Great Depression, we find that although eight of our 13 countries experienced countercyclical real wages over this period, some of the others had strongly procyclical real wages, including the United States and United Kingdom. However, for the Eichengreen-Sachs sample period from 1929–35, which includes the downturn phase of the Depression, nine out of 13 had countercyclical real wages and only one (Spain) had markedly procyclical real wages. Clearly, this sample problem is a matter of concern, as is the precise approach to defining real wages given the data.[17] More work is needed to formulate robust findings about the degree of stickiness in wages and prices during the Depression, and there is some suggestion that stickiness might have been more of an issue during the onset of the Depression than during the recovery (Bordo, Erceg and Evans, 1997).

A second possible interpretation is that the the real wage may have been approximately acyclical in the early periods, even in response to demand shocks, if prices and wages were about equally sticky. Real wages may then be procyclical in the last period because prices have become less procyclical, or nominal wages more so. Hanes (1999) finds evidence that prices were more procyclical before World War II than in the postwar period—a change that he attributes to an increase in the number of stages of processing of the typical product. More roundabout production can increase price stickiness—a conjecture dating at least to Means (1935), and investigated formally by Blanchard (1987) and Basu (1995).

Although many business cycle models seek to deliver a procyclical relationship between real wages and output, we believe that such a pattern occurs only at certain times and places. Real wages have been more procyclical in the recent past than at any previous time, which may explain the recent popularity of models that predict strongly procyclical real wages. But based on our examination of the historical data, we urge business cycle theorists to consider models that can produce wage patterns that are procyclical, countercyclical, and sometimes just acyclical. Part of the payoff to such an effort, we suspect, will be a model in which it is easier to explain the large fluctuations in labor supply that we observe over the business cycle.

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17. Twelve of our 13 countries are in the Bernanke and Carey (1996) sample; Spain is the exception. We do prefer our real wage data because our nominal wages are deflated by the Consumer Price Index, the theoretically-correct price index for studying the tradeoff between consumption and leisure. By contrast, Bernanke and Carey use the Wholesale Price Index which, because of the large weight it gives to commodity prices, is extremely cyclically sensitive. Thus, we suspect that their use of the WPI is at least partially responsible for their finding of an extremely countercyclical real wage. This is not the only data problem: there still remains the problem of composition bias alluded to in our earlier discussion of wage cyclicality; however, its importance in the Great Depression period is now in doubt (Dighe, 1997).

Business Cycles and the Open Economy

Some business cycle models assume a purely closed economy, but such models are obviously questionable when applied to the open global economy of the late 19th century, and perhaps to the increasingly globalized world of the last few decades. Other studies explicitly admit models of capital mobility, with adjustments in consumption and investment relative to output mediated via the current account. Yet these models may not be appropriate in a world of limited capital mobility, as was the case for several decades in the middle of the 20th century.

One potentially useful approach here would be to specify the underlying conditions that lead the economy to be open or closed, and then to bring those conditions into one's model of the busines cycle. Obstfeld and Taylor (1998) offer a political economy interpretation based on what they call the *macroeconomic policy trilemma*. In this view, policymakers have wrestled with three basic macroeconomic challenges for over 100 years: a desire to have fixed exchange rates to avoid instability; a desire to have free capital mobility, to ensure efficient allocation and permit smoothing; and a desire to engage in activist monetary policy to address domestic policy goals. The trilemma points out that three goals are mutually inconsistent: only two out of three are attainable. The gold standard solved the trilemma by choosing fixed exchange rates and capital mobility, but left no room for activist policies—that is, interest rates were set in the world market. The 1920s and the Depression saw the rise of capital controls in some countries, and floating exchange rates in others, as a means to admit activist monetary policy. These events have been seen as a response to a changing distribution of political power away from orthodox financial interests, and toward non-elites, the working classes, organized labor, and the like (Polanyi, 1944; Eichengreen, 1996; Obstfeld and Taylor, 1998). Bretton Woods made a compromise; to let fixed rates back in, while still allowing discretionary monetary policy, capital mobility had to be sacrificed. The more recent period of floating exchange rates gave up on fixed rates, but allowed capital mobility and activist monetary policy. Save for a few unusual experiments, like the move to European Monetary Union (a common currency offering something of an escape from the country-level trilemma), this is where we stand today, and Eichengreen's (1996, p. 192) conclusion appears to hold: floating rates are here to stay.

Any business-cycle theory with long-run applicability needs to keep in mind the tradeoff between macroeconomic activism, capital controls, and fixed exchange rates. Any naïve attempt to approach the macrohistorical data without some knowledge of these institutional events, and the broad contours of change in the global capital market, could lead to major misinterpretations. Our empirical work underscores the importance of changing external constraints. For example, it seems likely that an open capital market should lead to more volatile investment, thanks to an inflow and outflow of capital, and less volatile consumption, because of greater possibilities for smoothing consumption (Razin and Rose, 1994). By definition it will lead to more a volatile current account (that is, one not fixed at zero). However, different models can sometimes produce unexpected results, depending on the separability of saving and investment decisions, differences in the variability and persistence of shocks, and by differences across countries in technology and preferences (Mendoza, 1994). In another example, we know that in a world of perfect risk-sharing across nations, all agents would hold an internaionally diversified wealth portfolio, and all wealth shocks would then be identical across countries! In practice, however, most countries seem far from that diversified outcome—an observation termed the "home bias" or "international diversification" puzzle. However, depending again on the degree of integration in capital markets, we may expect to see more or less of this kind of diversification going on, and accordingly more or less cross-country similarities in consumption patterns (Obstfeld, 1994; Lewis, 1996). These and other features of the data are issues that the next generation of open-economy business-cycle models must confront.

Conclusion

The evidence strongly suggests that money is not neutral. It is certainly difficult to explain the Great Depression without citing the effects of the gold standard, and it is difficult to reconcile the large changes in the time-series properties of real variables across different exchange rate regimes without admitting some role for money. However, the channel by which money has its effects on the economy is still very much an open question. We have noted some evidence that favors models with nominal rigidities, but we need more evidence on this point. Even within the class of Keynesian models, it is not clear whether the sticky-price or the sticky-wage model is more plausible. More attention to these questions seems desirable, though sensitivity to country- and time-specific features—history and institutions—is likely to color this line of inquiry.

However, even if one accepts our views regarding the class of plausible models, there is still a large gap between the models and the data. Most reasonably-parameterized models imply that marginal cost is very procyclical, but in fact, prices seem to move by relatively little. Thus, much of modern business-cycle theory amounts to a search for empirically-supported mechanisms to explain why marginal cost should not rise much when output expands (for example, nominal or real wage rigidity), or reasons why firms should accept lower profit margins in booms. While economists debate the ultimate form of "the" right business cycle model, there is scope for much useful research on general sources of propagation which will be useful for explaining business cycles in almost any model. We see this line of research as both necessary and fruitful, and urge a renewed focus on studying the labor market.

Our work has also raised important questions about research on business cycles that fails to take international linkages into account. Closed-economy macroeconomics may have been well suited to a few decades in the middle of the twentieth century, but its relevance in other historical episodes—and in the globalized worlds of the present and future—seems inherently limited. Surely, both theory and empirical will move more in the direction of open economy models, with closed economy models derived as a special case.

Finally, our work highlights the political economy choices available and the constraints facing policymakers—such as the classic trilemma—and how these can inform the model, its structure, its shocks, its calibration, its predictions, and its scope for policy activism at different times in different regimes. We cannot claim to understand the determinants of business cycles without being able to explain why some of their characteristics have changed significantly over the past century and why some have not. Only with attention to the historical and institutional context can we achieve a more complete understanding of economic fluctuations.

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Table 1
Macroeconomic Aggregates

		Statistic			
		Gold Standard	Interwar	Bretton Woods	Float
Volatility	log Y	0.027	0.036	0.025	0.016
	log C	0.034	0.042	0.032	0.016
	log I	0.113	0.186	0.103	0.068
	CA/Y	0.051	0.042	0.024	0.027
	log P	0.033	0.742	0.046	0.163
Persistence	log Y	-0.062	0.185	-0.028	0.221
	log C	-0.012	0.060	-0.008	0.199
	log I	-0.128	0.125	-0.093	0.176
	CA/Y	0.835	0.565	0.395	0.774
	log P	0.164	0.175	0.405	0.489
Comovement with Output	log C	0.650	0.664	0.727	0.613
	log I	0.461	0.487	0.368	0.778
	CA/Y	-0.054	-0.073	-0.233	-0.175
	log P	-0.277	-0.041	-0.135	-0.356
Comovement with U.S.	log C	0.084	-0.008	0.035	0.150
	log I	0.074	0.427	0.276	0.237
	CA/Y	0.033	-0.266	-0.104	-0.058
	log P	0.128	0.038	0.241	0.055

Notes: Pooled data for 15 countries: Argentina, Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, United Kingdom, United States. For series x, volatility is standard deviation of x; persistence is is autocorrelation of x with its first lag; comovement with output is correlation of x with log Y; comovement with U.S. is correlation of x with the U.S. series x. All series are bandpass prefiltered. See text.

Table 2
Real and Nominal Exchange-Rate Volatility

		Statistic			
		Gold Standard	Interwar	Bretton Woods	Float
Volatility	E	0.051	0.162	0.145	0.424
	RER-US	0.056	0.173	0.094	0.129
	RER-W	0.054	0.088	0.062	0.110

Notes: Pooled data for 20 countries: Argentina, Australia, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Italy, Japan, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States. E is the nominal exchange rate, RER-US the real exchange rate relative to the U.S. dollar, and RER-W is the real exchange rate relative to a basket of the 19 other currencies. Volatility is standard deviation of log x, for x = E, RER-US, and RER-W. All series are difference prefiltered. See text.

Table 3

Real Wage Cyclicality

	Statistic			
	Gold Standard	Interwar	Bretton Woods	Float
Volatility	0.038	0.042	0.042	0.033
Persistence	0.138	0.098	0.151	0.166
Comovement with Output	0.025	-0.059	0.162	0.271

Notes: Pooled data for 13 countries: Argentina, Australia, Canada, Denmark, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, United Kingdom, United States. Given the real wage w, volatility is standard deviation of log w; persistence is is autocorrelation of log w with its first lag; comovement with output is correlation of log w with log Y. All series are bandpass prefiltered. See text.

Appendix 1: Data

This study uses the dataset of Obstfeld and Taylor (1999). Full bibliographic details of the sources, and the complete dataset, are available from the authors upon request. Summary details are provided below.

Real output is denoted *Y* and the real wage *w*. The price series *P* was based on consumer prices. Real investment *I* was calculated as the investment-to-GDP ratio *I/Y* times real output *Y*. Real consumption (public plus private) *C* was calculated as one minus the saving-to-GDP ratio (1-*S/Y*) times real output *Y*. Current-account-to-GDP ratio *CA/Y* was calculated as the investment-to-GDP ratio *I/Y* minus the saving-to-GDP ratio *S/Y*.

Argentina
Y: 1884–1994, ADEBA.
w: 1850–1992, Williamson.
S/Y: 1885–1992, Taylor.
I/Y: 1885–1992, Taylor.
P: 1884–1994, ADEBA.

Australia
Y: 1870–79, Bordo and Rockoff. 1880–1959, Bordo and Schwartz. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1861–1945, Jones and Obstfeld. 1946–64, Taylor. 1965–92, World Bank.
I/Y: 1861–1945, Jones and Obstfeld. 1946–64, Taylor. 1965–92, World Bank.
P: 1870–80, Bordo and Rockoff. 1880–1959, Bordo and Schwartz. 1960–92, World Bank.

Canada
Y: 1870–1914, Bordo and Rockoff. 1915–1959, Bordo and Schwartz. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1870–1945, Jones and Obstfeld. 1946–64, Taylor. 1965–92, World Bank.
I/Y: 1870–1945, Jones and Obstfeld. 1946–64, Taylor. 1965–92, World Bank.
P: Consumer price deflator.
1870–80, Bordo and Rockoff. 1880–1959, Bordo and Schwartz. 1960–92, World Bank.

Denmark
Y: 1850–1959, Mitchell. 1880–1959, 1850–1992, Bordo and Jonung. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1870–1945, Jones and Obstfeld. 1946–66, Taylor. 1967–92, World Bank.
I/Y: 1870–1945, Jones and Obstfeld. 1946–66, Taylor. 1967–92, World Bank.
P: 1850–80, Mitchell. 1880–1960, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

Finland
Y: 1860–79: Mitchell. 1880–1959, 1850–1992, Bordo and Jonung.
w: Not available.
S/Y: 1861–1945: Jones and Obstfeld. 1946–66: Mitchell. Converted from US dollars using E after 1948. 1967–92, World Bank.
I/Y: 1861–1945: Jones and Obstfeld. 1946–66: Mitchell. Converted from US dollars using E after 1948. 1967–92, World Bank.
P: 1860–1880: Hjerppe. 1880–1959, 1850–1992, Bordo and Jonung.

France
Y: Nominal: 1850–79, Jones and Obstfeld. 1880–1913, 1921–1938, 1949–59, 1850–1992, Bordo and Jonung. 1960–1992, World Bank. Price deflator: 1880–1913, 1921–38, 1949–60, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

w: 1850–1992, Williamson.
S/Y: 1850–1945, Jones and Obstfeld. 1949–66, Mitchell. 1967–1992, World Bank.
I/Y: 1850–1945, Jones and Obstfeld. 1949–66, Mitchell. 1967–1992, World Bank.
P: 1880–1913, 1921–38, 1948–60, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

Germany
1850–1913, 1925–38,1950–92, 1850–1992, Bordo and Jonung.
w: 1850–1992, Williamson.
S/Y: 1872–1945, Jones and Obstfeld. Correction: series based on Hoffman's net investment series. Assume a depreciation rate of 3% and a Y/K ratio of 3. Add 0.09 (9%) to obtain gross estimate. 1946–66, Taylor. 1967–92, World Bank.
I/Y: 1872–1945, Jones and Obstfeld. Correction: series based on Hoffman's net investment series. Assume a depreciation rate of 3% and a Y/K ratio of 3. Add 0.09 (9%) to obtain gross estimate. 1946–66, Taylor. 1967–92, World Bank.
P: 1850–70: Mitchell. 1870–1960, Maddison 1960–92: World Bank.

Italy
Y: Nominal: 1861–1959, Mitchell. 1960–92, World Bank. Deflator: 1861–1880, Mitchell. 1880–1959, 1850–1992, Bordo and Jonung. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1861–1945, Jones and Obstfeld. 1946–68, Taylor. 1969–92, World Bank.
I/Y: 1861–1945, Jones and Obstfeld. 1946–68, Taylor. 1969–92, World Bank.
P: 1861–1880, Mitchell. 1880–1959, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

Japan
Y: 1850–1992, Bordo and Jonung.
w: Not available.
S/Y: 1885–1945: Jones and Obstfeld. 1946–1964: Mitchell 1965–1992: World Bank
I/Y: 1885–1945: Jones and Obstfeld. 1946–1964: Mitchell 1965–1992: World Bank
P: 1850–1992, Bordo and Jonung.

Netherlands
Y: 1850–1913: Smits, Horling, and Van Zanden. 1914–1992: Bordo and Jonung
w: 1850–1992, Williamson.
S/Y: 1850–1913, Albers. 1921–1939, Mitchell. Correction: series based on net investment series. Assume a depreciation rate of 3% and a Y/K ratio of 3. Add 0.09 (9%) to obtain gross estimate. 1948-1968, Mitchell (I plus CA in US dollars converted using exchange rate). 1969–1992, World bank.
I/Y: 1850–1913, Albers. 1921–1939, Mitchell. Correction: series based on net investment series. Assume a depreciation rate of 3% and a Y/K ratio of 3. Add 0.09 (9%) to obtain gross estimate. 1948–1968, Mitchell. 1969–1992, World bank.
P: Consumer price deflator. 1850–1913, Smits, Horling, and Van Zanden. 1913–1960, Maddison. 1960–92: World Bank.

Norway
Y: Nominal: 1865–1939, 1946–59, Mitchell. 1960–92, World Bank. Deflator: 1870–1914, Norges Offisielle Statistikk. 1914–1939, 1946–59, 1850–1992, Bordo and Jonung. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1865–1945, Jones and Obstfeld. 1946–66, Taylor. 1967–92, World Bank.
I/Y: 1865–1945, Jones and Obstfeld. 1946–66, Taylor. 1967–92, World Bank.
P: Consumer price deflator. 1870–1914, Norges Offisielle Statistikk. 1914–1939, 1946–59, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

Spain
Y: 1850–1964, Prados. 1964–92, World Bank.
w: 1850–1992, Williamson.

S/Y: 1850–1964, Prados. 1965–1966, Carreras/Barciela (I) and Mitchell (CA converted using E). 1967–92, World Bank.
I/Y: 1850–1964, Prados. 1965–1966, Carreras/Barciela. 1967–92, World Bank.
P: 1880–1959, Bordo and Schwartz. 1960–92, World Bank.

Sweden
Y: Nominal: 1861–59, Mitchell. 1960–92, World Bank. Deflator: 1861–1880, Mitchell. 1880–59, 1850–1992, Bordo and Jonung. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1861–1945, Jones and Obstfeld. 1946–1966, Mitchell. 1967–92, World Bank.
I/Y: 1861–1945, Jones and Obstfeld. 1946–1966, Mitchell. 1967–92, World Bank.
P: 1850–1880, Mitchell. 1880–59, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

United Kingdom
Y: 1850–1880, Mitchell. 1880–1988, Y deflated by PY.
w: 1850–1992, Williamson.
S/Y: 1850–1945, Jones and Obstfeld. 1946–66, Taylor. 1967–92, World Bank.
I/Y: 1850–1945, Jones and Obstfeld. 1946–66, Taylor. 1967–92, World Bank.
P: 1850–70, Mitchell. 1870–79, Bordo and Rockoff. 1880–1959, Bordo and Jonung. 1960–92, World Bank.

United States
Y: Nominal: 1871–1939, Jones and Obstfeld. 1939–1959, Bordo and Jonung. 1960–92, World Bank. Deflator 1871–1959, 1850–1992, Bordo and Jonung. 1960–92, World Bank.
w: 1850–1992, Williamson.
S/Y: 1869–1945, Jones and Obstfeld. 1946–64, Taylor. 1965–92, World Bank.
I/Y: 1869–1945, Jones and Obstfeld. 1946–64, Taylor. 1965–92, World Bank.
P: 1870–79, Bordo and Rockoff. 1880–1959, 1850–1992, Bordo and Jonung. 1960–92, World Bank.

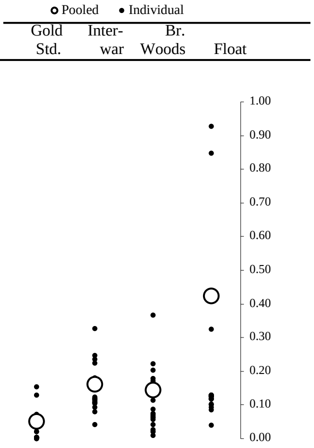
Appendix 2: Complete Empirical Results

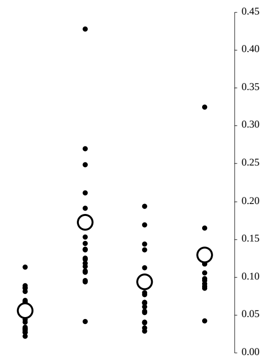
To conserve space, the main text reports only the pooled coefficients. This appendix shows at greater length the complete correlations of all variables for all countries.

Table A1
Exchange Rate Volatility

	Statistic				Sample Size			
	Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Volatility, E								
Argentina	0.130	0.120	0.179	0.928	29	21	26	23
Australia	0.004	0.116	0.071	0.125	34	20	24	21
Belgium	0.042	0.167	0.021	0.128	33	21	26	21
Brazil	0.154	0.180	0.223	0.848	24	21	26	20
Canada	0.000	0.043	0.026	0.041	34	21	25	21
Denmark	0.021	0.112	0.066	0.124	33	21	26	21
Finland	0.003	0.246	0.171	0.093	32	21	26	19
France	0.003	0.225	0.074	0.129	33	21	22	21
Germany	0.002	0.093	0.042	0.118	33	15	23	21
Italy	0.021	0.235	0.203	0.125	33	21	26	21
Japan	0.050	0.107	0.367	0.118	33	21	26	19
Mexico	0.067	0.081	0.088	0.325	34	21	26	21
Netherlands	0.003	0.108	0.057	0.118	34	21	26	21
Norway	0.003	0.170	0.062	0.086	34	21	26	21
Portugal	0.072	0.327	0.021	0.129	23	21	26	20
Spain	0.065	0.163	0.114	0.129	33	17	24	21
Sweden	0.000	0.123	0.074	0.103	33	21	26	21
Switzerland	0.042	0.117	0.010	0.130	33	21	26	20
United Kingdom	0.003	0.106	0.063	0.101	34	20	24	21
United States	—	—	—	—	—	—	—	—
Pooled	0.051	0.162	0.145	0.424	643	408	506	423
Volatility, RER-US								
Argentina	0.081	0.137	0.169	0.324	29	21	26	21
Australia	0.040	0.137	0.066	0.120	34	20	24	21
Belgium	0.070	0.428	0.040	0.125	33	19	25	21
Brazil	0.087	0.192	0.136	0.124	24	21	26	20
Canada	0.034	0.042	0.033	0.042	34	21	25	21
Denmark	0.044	0.108	0.089	0.127	33	21	26	21
Finland	0.048	0.270	0.144	0.088	32	21	26	19
France	0.066	0.115	0.067	0.118	33	17	22	21
Germany	0.027	0.094	0.055	0.120	33	15	23	21
Italy	0.027	0.211	0.194	0.106	33	21	26	21
Japan	0.086	0.107	0.029	0.125	28	21	21	18
Mexico	0.113	0.145	0.095	0.165	27	21	26	21
Netherlands	0.031	0.118	0.054	0.120	34	21	26	21
Norway	0.030	0.153	0.061	0.086	34	21	25	21
Portugal	0.088	0.249	0.080	0.091	23	21	26	10
Spain	0.068	0.177	0.113	0.118	33	17	24	21
Sweden	0.032	0.124	0.077	0.098	33	21	26	21
Switzerland	0.048	0.125	0.040	0.130	21	21	26	18
United Kingdom	0.022	0.096	0.066	0.096	34	20	24	21
United States	—	—	—	—	—	—	—	—
Pooled	0.056	0.173	0.094	0.129	619	402	499	400
Volatility, RER-W								
Argentina	0.075	0.106	0.150	0.360	21	11	21	10
Australia	0.036	0.085	0.049	0.131	21	11	21	10
Belgium	0.062	0.107	0.022	0.059	21	11	21	10
Brazil	0.088	0.135	0.144	0.109	21	11	21	10
Canada	0.030	0.057	0.027	0.085	21	11	21	10
Denmark	0.047	0.151	0.052	0.126	21	11	21	10
Finland	0.027	0.070	0.053	0.047	21	11	21	10
France	0.056	0.069	0.059	0.062	21	11	21	10
Germany	0.017	0.046	0.030	0.056	21	11	21	10
Italy	0.025	0.073	0.026	0.061	21	11	21	10
Japan	0.059	0.090	0.029	0.094	21	11	21	10
Mexico	0.118	0.104	0.063	0.119	21	11	21	10
Netherlands	0.034	0.063	0.025	0.056	21	11	21	10
Norway	0.026	0.076	0.032	0.033	21	11	21	10
Portugal	0.083	0.076	0.036	0.063	21	11	21	10
Spain	0.075	0.091	0.086	0.064	21	11	21	10
Sweden	0.022	0.055	0.018	0.029	21	11	21	10
Switzerland	0.037	0.053	0.020	0.081	21	11	21	10
United Kingdom	0.022	0.035	0.034	0.080	21	11	21	10
United States	0.027	0.086	0.023	0.072	21	11	21	10
Pooled	0.054	0.088	0.062	0.110	420	220	420	200

Chart





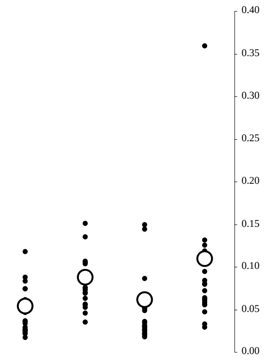


Table A2
Real Wage Comovements

	Statistic				Sample Size			
	Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Volatility								
Argentina	0.102	0.038	0.068	0.106	34	21	26	17
Australia	0.046	0.041	0.021	0.026	34	21	26	17
Canada	0.028	0.031	0.018	0.016	34	21	26	17
Denmark	0.027	0.054	0.021	0.014	34	21	26	17
France	0.018	0.035	0.021	0.006	34	21	26	17
Germany	0.019	0.025	0.021	0.010	34	16	22	17
Italy	0.014	0.074	0.066	0.015	34	21	26	17
Netherlands	0.029	0.034	0.020	0.015	34	21	26	17
Norway	0.031	0.030	0.017	0.021	34	21	26	17
Spain	0.033	0.062	0.103	0.030	34	21	26	17
Sweden	0.026	0.037	0.016	0.018	34	21	26	17
United Kingdom	0.023	0.028	0.019	0.016	34	21	26	17
United States	0.016	0.031	0.009	0.015	34	21	26	17
Pooled	0.038	0.042	0.042	0.033	442	268	334	221
Persistence								
Argentina	0.190	-0.051	0.172	0.163	34	21	26	17
Australia	0.103	0.187	0.210	0.083	34	21	26	17
Canada	-0.117	0.140	-0.126	0.265	34	21	26	17
Denmark	0.416	0.154	0.068	0.316	34	21	26	17
France	0.032	0.369	0.297	0.160	34	21	26	17
Germany	-0.042	0.114	0.498	0.547	34	15	21	17
Italy	0.118	-0.120	0.288	-0.315	34	21	26	17
Netherlands	0.076	-0.047	-0.071	0.204	34	21	26	17
Norway	-0.007	0.045	0.140	0.511	34	21	26	17
Spain	-0.033	0.283	0.070	0.119	34	21	26	17
Sweden	0.123	0.185	0.138	0.004	34	21	26	17
United Kingdom	0.015	0.263	0.035	0.096	34	21	26	17
United States	0.219	0.120	0.026	0.334	34	21	26	17
Pooled	0.138	0.098	0.151	0.166	442	267	333	221
Comovement With Output								
Argentina	-0.021	-0.135	0.708	0.502	30	21	26	17
Australia	0.013	0.190	-0.215	-0.225	34	21	26	17
Canada	-0.236	0.259	0.128	0.228	34	21	26	17
Denmark	0.147	-0.209	0.170	-0.214	34	19	26	17
France	0.120	-0.065	-0.094	0.239	34	18	23	17
Germany	0.412	-0.543	0.327	0.114	34	14	22	17
Italy	-0.214	-0.311	0.364	0.028	34	21	26	17
Netherlands	0.130	0.310	0.720	0.082	34	21	26	17
Norway	0.001	0.094	0.093	0.293	34	21	26	17
Spain	0.081	0.033	-0.358	-0.003	34	17	26	17
Sweden	-0.001	0.162	-0.154	0.208	34	21	26	17
United Kingdom	0.217	-0.610	0.112	0.596	34	21	26	17
United States	0.007	-0.444	0.381	0.503	34	21	26	17
Pooled	0.025	-0.059	0.162	0.271	438	257	331	221
Comovement With Output (Country-Specific Components)								
Argentina	-0.063	0.137	0.770	0.494	30	11	22	17
Australia	-0.080	-0.374	-0.008	-0.328	30	11	22	17
Canada	-0.204	0.483	0.212	0.160	30	11	22	17
Denmark	0.086	0.371	0.311	0.092	30	11	22	17
France	0.009	0.453	-0.239	0.613	30	11	22	17
Germany	0.028	-0.381	-0.041	0.154	30	11	22	17
Italy	0.116	-0.218	-0.475	-0.091	30	11	22	17
Netherlands	0.125	0.578	0.196	0.036	30	11	22	17
Norway	0.190	-0.033	0.020	0.524	30	11	22	17
Spain	0.006	0.250	-0.197	0.127	30	11	22	17
Sweden	0.194	0.603	0.053	-0.049	30	11	22	17
United Kingdom	0.107	0.076	0.175	0.561	30	11	22	17
United States	0.312	-0.496	0.720	0.637	30	11	22	17
Pooled	0.006	0.053	0.092	0.308	390	143	286	221
Comovement With U.S.								
Argentina	-0.156	-0.277	-0.406	-0.471	34	21	26	17
Australia	-0.249	-0.548	-0.160	-0.281	34	21	26	17
Canada	0.164	0.102	0.155	0.470	34	21	26	17
Denmark	-0.304	-0.112	-0.288	-0.211	34	21	26	17
France	0.259	-0.160	0.541	0.245	34	21	26	17
Germany	0.311	-0.416	-0.103	-0.038	34	16	22	17
Italy	0.328	0.031	-0.442	0.478	34	21	26	17
Netherlands	0.116	-0.360	0.060	-0.135	34	21	26	17
Norway	0.224	0.092	0.244	-0.101	34	21	26	17
Spain	-0.123	-0.493	0.049	0.189	34	21	26	17
Sweden	0.163	-0.281	-0.297	0.243	34	21	26	17
United Kingdom	0.034	-0.054	0.247	0.118	34	21	26	17
United States	—	—	—	—	—	—	—	—
Pooled	0.023	-0.124	-0.063	-0.051	442	268	334	221

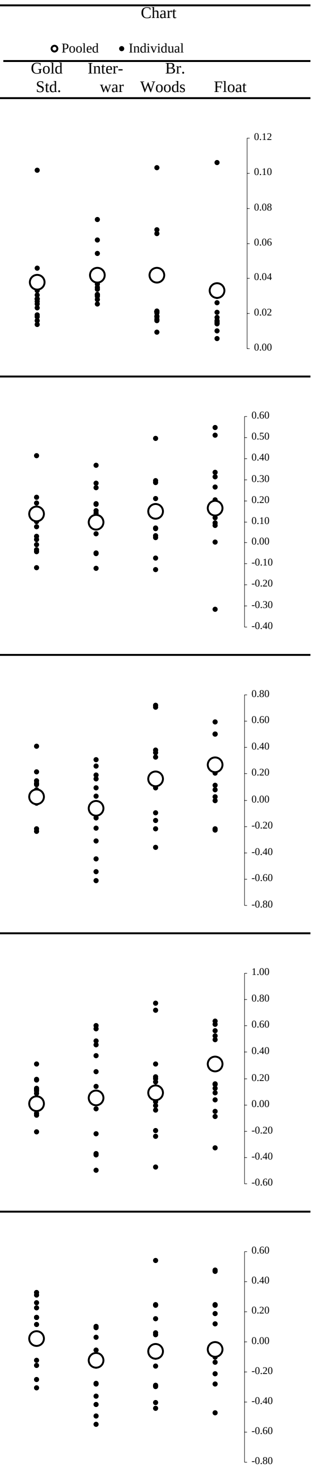


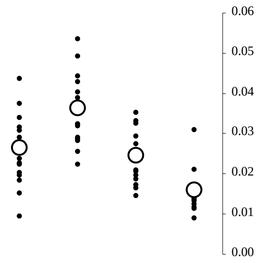
Table A3
Macroeconomic Aggregates, Volatility

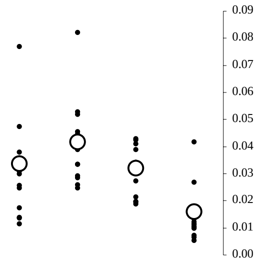
		Statistic				Sample Size			
		Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Volatility									
log Y	Argentina	0.044	0.029	0.030	0.031	30	21	26	23
	Australia	0.034	0.032	0.021	0.013	34	21	26	21
	Canada	0.032	0.054	0.017	0.015	34	21	26	21
	Denmark	0.023	0.043	0.028	0.014	34	19	26	21
	Finland	0.020	0.026	0.019	0.021	34	21	26	21
	France	0.029	0.044	0.024	0.009	34	18	23	21
	Germany	0.020	0.049	0.024	0.014	34	14	22	18
	Italy	0.026	0.029	0.033	0.014	34	21	26	21
	Japan	0.023	0.038	0.020	0.015	29	21	20	18
	Netherlands	0.038	0.028	0.035	0.012	34	21	26	19
	Norway	0.010	0.032	0.017	0.013	34	21	26	21
	Spain	0.024	0.022	0.024	0.014	34	17	26	17
	Sweden	0.015	0.040	0.015	0.011	34	21	26	21
	United Kingdom	0.031	0.033	0.033	0.017	34	21	26	21
	United States	0.019	0.039	0.021	0.017	34	21	26	21
	Pooled	0.027	0.036	0.025	0.016	501	299	377	305
log C	Argentina	0.077	0.029	0.043	0.042	29	21	26	21
	Australia	0.048	0.053	0.031	0.011	34	21	26	21
	Canada	0.033	0.045	0.020	0.011	34	21	26	21
	Denmark	0.031	0.046	0.043	0.010	34	19	26	21
	Finland	0.025	0.034	0.033	0.014	34	21	26	21
	France	0.038	0.052	0.034	0.005	34	15	23	21
	Germany	0.014	0.029	0.021	0.007	34	14	22	18
	Italy	0.017	0.026	0.031	0.012	34	21	26	21
	Japan	0.036	0.044	0.019	0.011	29	21	20	18
	Netherlands	0.035	0.082	0.034	0.012	34	10	24	19
	Norway	0.012	0.025	0.033	0.027	34	21	26	21
	Spain	0.030	0.034	0.041	0.013	34	17	26	17
	Sweden	0.014	0.042	0.020	0.007	34	21	26	21
	United Kingdom	0.034	0.039	0.039	0.014	34	21	26	21
	United States	0.026	0.044	0.027	0.010	34	21	26	21
	Pooled	0.034	0.042	0.032	0.016	500	285	375	303
log I	Argentina	0.147	0.140	0.123	0.094	29	21	26	21
	Australia	0.161	0.134	0.124	0.066	34	21	26	21
	Canada	0.097	0.233	0.070	0.060	34	21	26	21
	Denmark	0.060	0.084	0.073	0.073	34	19	26	21
	Finland	0.056	0.108	0.107	0.107	34	21	26	21
	France	0.081	0.293	0.045	0.046	34	15	23	21
	Germany	0.072	0.348	0.065	0.056	34	14	22	18
	Italy	0.260	0.160	0.232	0.065	34	21	26	21
	Japan	0.058	0.117	0.060	0.042	29	21	20	18
	Netherlands	0.153	0.226	0.050	0.050	34	19	24	19
	Norway	0.048	0.220	0.067	0.068	34	21	26	21
	Spain	0.110	0.100	0.089	0.048	34	17	26	17
	Sweden	0.084	0.100	0.041	0.076	34	21	26	21
	United Kingdom	0.050	0.070	0.081	0.079	34	21	26	21
	United States	0.062	0.309	0.135	0.068	34	21	26	21
	Pooled	0.113	0.186	0.103	0.068	500	294	375	303
CA/Y	Argentina	0.080	0.035	0.033	0.018	29	21	26	21
	Australia	0.052	0.070	0.039	0.018	34	21	26	21
	Canada	0.032	0.026	0.019	0.015	34	21	26	21
	Denmark	0.016	0.012	0.019	0.023	34	19	26	21
	Finland	0.025	0.054	0.022	0.023	34	21	26	21
	France	0.027	0.069	0.014	0.009	34	16	23	21
	Germany	0.007	0.016	0.012	0.020	34	14	22	21
	Italy	0.022	0.036	0.024	0.015	34	21	26	21
	Japan	0.029	0.017	0.014	0.016	29	21	26	21
	Netherlands	0.065	0.019	0.033	0.016	34	10	24	21
	Norway	0.030	0.050	0.026	0.057	34	21	26	21
	Spain	0.015	0.022	0.018	0.020	34	21	26	21
	Sweden	0.021	0.023	0.014	0.016	34	21	26	21
	United Kingdom	0.023	0.025	0.014	0.019	34	21	26	21
	United States	0.011	0.012	0.009	0.014	34	21	26	21
	Pooled	0.051	0.042	0.024	0.027	500	290	381	315
log P	Argentina	0.093	0.057	0.114	0.609	30	21	26	23
	Australia	0.023	0.030	0.026	0.019	34	21	26	21
	Canada	0.026	0.044	0.019	0.015	34	21	26	21
	Denmark	0.024	0.068	0.017	0.014	34	21	26	21
	Finland	0.034	0.055	0.048	0.020	34	21	26	21
	France	0.043	0.083	0.031	0.016	34	18	24	21
	Germany	0.019	2.918	0.022	0.017	34	21	26	21
	Italy	0.014	0.052	0.055	0.024	34	21	26	21
	Japan	0.038	0.060	0.092	0.026	29	21	22	18
	Netherlands	0.021	0.047	0.020	0.012	34	21	26	21
	Norway	0.020	0.069	0.026	0.015	34	21	26	21
	Spain	0.025	0.061	0.036	0.019	34	21	26	21
	Sweden	0.021	0.057	0.022	0.017	34	21	26	21
	United Kingdom	0.016	0.051	0.015	0.027	34	21	26	21
	United States	0.013	0.045	0.019	0.018	34	21	26	21
	Pooled	0.033	0.742	0.046	0.163	501	312	384	314

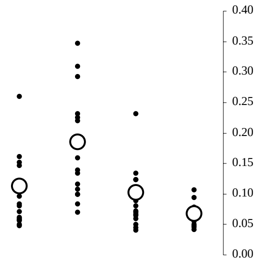
Chart

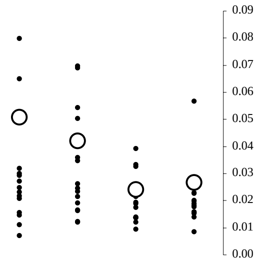
○ Pooled ● Individual

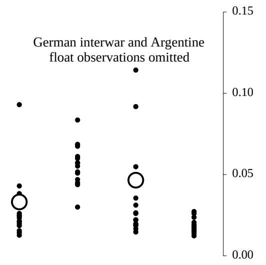
Gold Std. Inter-war Br. Woods Float











German interwar and Argentine float observations omitted

Table A4
Macroeconomic Aggregates, Persistence

		Statistic				Sample Size			
		Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Persistence									
log Y	Argentina	0.107	0.386	0.036	0.097	29	21	26	23
	Australia	-0.183	0.001	0.343	0.133	34	21	26	21
	Canada	0.121	0.265	0.064	0.227	34	21	26	21
	Denmark	0.280	0.310	-0.247	0.151	34	18	26	21
	Finland	0.003	0.446	0.209	0.457	34	21	26	21
	France	-0.165	0.137	-0.029	0.247	33	17	22	21
	Germany	0.144	0.473	0.028	0.284	34	13	21	18
	Italy	-0.465	0.009	-0.144	0.069	34	21	26	21
	Japan	-0.268	0.022	0.294	0.208	28	21	19	18
	Netherlands	-0.102	-0.030	-0.188	0.155	34	21	26	19
	Norway	0.247	-0.259	-0.165	0.464	34	21	25	21
	Spain	-0.029	-0.128	0.183	0.138	34	17	26	17
	Sweden	-0.083	0.128	0.036	0.293	34	21	26	21
	United Kingdom	-0.337	0.367	0.122	0.328	34	21	26	21
	United States	0.209	0.170	0.110	0.239	34	21	26	21
	Pooled	-0.062	0.185	-0.028	0.221	498	296	373	305
log C	Argentina	0.158	0.100	0.105	0.218	28	21	26	21
	Australia	-0.318	-0.403	-0.146	-0.213	34	21	26	21
	Canada	0.114	0.158	0.053	0.217	34	21	26	21
	Denmark	0.221	0.195	-0.133	0.000	34	18	26	21
	Finland	0.170	-0.329	0.022	-0.175	34	21	26	21
	France	-0.140	0.018	0.021	0.265	33	14	22	21
	Germany	-0.064	0.456	-0.129	0.349	34	13	21	18
	Italy	-0.015	0.038	0.026	0.375	34	21	26	21
	Japan	-0.004	-0.015	-0.082	-0.179	28	21	19	18
	Netherlands	0.027	0.906	0.119	0.235	34	9	23	19
	Norway	0.195	-0.462	-0.347	0.377	34	21	25	21
	Spain	-0.190	-0.371	-0.001	-0.171	34	17	26	17
	Sweden	-0.196	0.056	-0.109	-0.243	34	21	26	21
	United Kingdom	-0.316	0.409	0.050	0.405	34	21	26	21
	United States	-0.012	0.003	0.104	0.338	34	21	26	21
	Pooled	-0.012	0.060	-0.008	0.199	497	281	370	303
log I	Argentina	0.310	0.523	-0.018	0.230	28	21	26	21
	Australia	-0.381	-0.006	-0.125	-0.026	34	21	26	21
	Canada	0.296	0.280	-0.077	0.100	34	21	26	21
	Denmark	0.414	0.251	-0.118	0.098	34	18	26	21
	Finland	0.227	0.368	-0.199	0.325	34	21	26	21
	France	-0.285	0.092	0.161	-0.017	33	14	22	21
	Germany	0.065	0.265	0.194	0.212	34	13	21	18
	Italy	-0.343	-0.163	-0.133	-0.185	34	21	26	21
	Japan	0.018	0.089	0.102	0.312	28	21	19	18
	Netherlands	-0.137	0.201	0.212	0.103	34	18	23	19
	Norway	0.258	-0.411	-0.310	0.217	34	21	25	21
	Spain	0.148	0.115	0.260	0.402	34	17	26	17
	Sweden	-0.018	0.287	-0.166	0.242	34	21	26	21
	United Kingdom	0.233	0.375	-0.210	0.237	34	21	26	21
	United States	-0.287	0.310	-0.207	0.139	34	21	26	21
	Pooled	-0.128	0.125	-0.093	0.176	497	290	370	303
CA/Y	Argentina	0.643	0.460	0.332	0.442	28	21	26	21
	Australia	0.734	-0.070	-0.166	0.639	34	21	26	21
	Canada	0.906	0.724	0.722	0.787	34	21	26	21
	Denmark	0.381	0.504	0.160	0.707	34	18	26	21
	Finland	0.463	0.564	0.237	0.598	34	21	26	21
	France	0.864	0.785	0.181	0.154	34	15	22	21
	Germany	0.389	0.030	0.573	0.722	34	13	21	21
	Italy	0.802	0.911	0.654	0.347	34	21	26	21
	Japan	0.214	0.597	0.434	0.749	28	21	25	21
	Netherlands	0.564	0.616	0.502	0.557	34	9	23	21
	Norway	0.875	0.514	0.407	0.719	34	21	25	21
	Spain	0.434	0.439	0.628	0.644	34	21	26	21
	Sweden	0.762	0.277	0.145	0.495	34	21	26	21
	United Kingdom	0.884	0.547	0.353	0.733	34	21	26	21
	United States	0.870	0.788	0.448	0.839	34	21	26	21
	Pooled	0.835	0.565	0.395	0.774	498	286	376	315
log P	Argentina	0.136	0.220	0.287	0.487	29	21	26	23
	Australia	0.249	0.408	0.465	0.614	34	21	26	21
	Canada	0.148	0.395	0.307	0.660	34	21	26	21
	Denmark	0.296	0.358	0.262	0.519	34	21	26	21
	Finland	0.374	0.689	0.273	0.684	34	21	26	21
	France	-0.086	0.249	0.596	0.679	33	17	23	21
	Germany	0.230	0.174	0.121	0.816	34	21	26	21
	Italy	0.023	0.166	0.502	0.691	34	21	26	21
	Japan	0.325	0.438	0.912	0.441	28	21	21	18
	Netherlands	0.156	0.489	0.411	0.639	34	21	26	21
	Norway	0.311	0.353	0.174	0.477	34	21	25	21
	Spain	-0.008	0.621	0.212	0.752	33	21	26	21
	Sweden	0.371	0.774	0.213	0.471	34	21	26	21
	United Kingdom	0.125	0.444	0.282	0.513	34	21	26	21
	United States	0.126	0.438	0.315	0.560	34	21	26	21
	Pooled	0.164	0.175	0.405	0.489	497	311	381	314

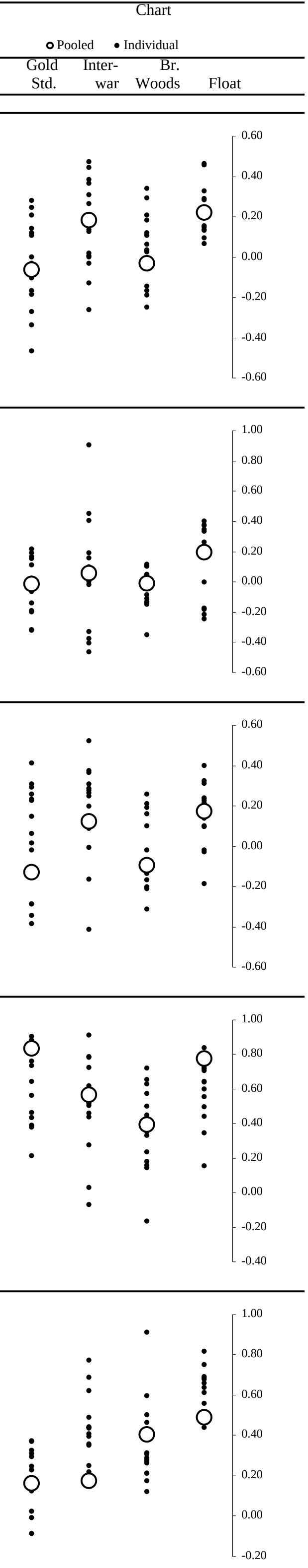


Table A5
Macroeconomic Aggregates, Comovement with Output

		Statistic				Sample Size			
		Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Comovement with Output									
log C	Argentina	0.858	0.633	0.614	0.825	29	21	26	21
	Australia	0.672	0.348	0.540	-0.159	34	21	26	21
	Canada	0.911	0.944	0.729	0.637	34	21	26	21
	Denmark	0.940	0.955	0.868	0.589	34	19	26	21
	Finland	0.704	0.461	0.786	0.432	34	21	26	21
	France	0.842	0.206	0.887	0.277	34	15	23	21
	Germany	0.632	0.908	0.882	0.580	34	14	22	18
	Italy	0.231	0.689	0.658	0.800	34	21	26	21
	Japan	0.568	0.860	0.777	0.694	29	21	20	18
	Netherlands	-0.466	0.160	0.654	0.301	34	10	24	19
	Norway	0.550	0.181	0.553	0.562	34	21	26	21
	Spain	0.927	0.883	0.722	0.729	34	17	26	17
	Sweden	0.751	0.897	0.773	0.121	34	21	26	21
	United Kingdom	0.958	0.906	0.944	0.856	34	21	26	21
	United States	0.865	0.894	0.655	0.833	34	21	26	21
	Pooled	0.650	0.664	0.727	0.613	500	285	375	303
log I	Argentina	0.407	0.746	0.643	0.649	29	21	26	21
	Australia	0.249	0.130	-0.367	0.855	34	21	26	21
	Canada	0.644	0.714	0.066	0.882	34	21	26	21
	Denmark	0.860	0.730	0.613	0.890	34	19	26	21
	Finland	0.443	0.770	-0.029	0.889	34	21	26	21
	France	0.074	0.353	0.177	0.822	34	15	23	21
	Germany	0.845	0.841	0.817	0.892	34	14	22	18
	Italy	0.837	0.400	0.715	0.921	34	21	26	21
	Japan	-0.009	0.573	0.693	0.752	29	21	20	18
	Netherlands	0.765	0.415	0.767	0.810	34	19	24	19
	Norway	0.567	0.702	0.313	0.417	34	21	26	21
	Spain	0.148	0.321	0.177	0.591	34	17	26	17
	Sweden	0.650	0.845	0.627	0.852	34	21	26	21
	United Kingdom	0.607	0.188	0.286	0.893	34	21	26	21
	United States	-0.098	0.163	0.187	0.961	34	21	26	21
	Pooled	0.461	0.487	0.368	0.778	500	294	375	303
CA/Y	Argentina	-0.404	0.029	-0.188	-0.279	29	21	26	21
	Australia	-0.008	0.158	0.020	0.131	34	21	26	21
	Canada	-0.380	-0.071	-0.439	-0.187	34	21	26	21
	Denmark	-0.575	-0.112	-0.715	-0.214	34	19	26	21
	Finland	-0.057	-0.111	-0.113	-0.404	34	21	26	21
	France	0.005	-0.422	0.005	-0.119	34	15	23	21
	Germany	-0.007	-0.493	-0.365	-0.164	34	14	22	18
	Italy	-0.146	0.317	-0.573	-0.596	34	21	26	21
	Japan	0.186	-0.234	-0.266	-0.104	29	21	20	18
	Netherlands	0.584	0.258	-0.641	-0.192	34	10	24	19
	Norway	-0.030	-0.214	-0.019	-0.257	34	21	26	21
	Spain	-0.242	-0.416	-0.340	-0.106	34	17	26	17
	Sweden	0.063	-0.196	-0.136	-0.045	34	21	26	21
	United Kingdom	-0.158	-0.018	-0.123	-0.502	34	21	26	21
	United States	0.059	-0.373	-0.481	-0.188	34	21	26	21
	Pooled	-0.054	-0.073	-0.233	-0.175	500	285	375	303
log P	Argentina	-0.567	0.379	-0.626	-0.602	30	21	26	23
	Australia	0.020	-0.085	-0.161	-0.456	34	21	26	21
	Canada	-0.013	0.467	0.183	-0.603	34	21	26	21
	Denmark	0.173	-0.384	-0.424	-0.725	34	19	26	21
	Finland	-0.481	-0.209	-0.280	-0.219	34	21	26	21
	France	-0.733	0.157	-0.211	-0.581	34	18	23	21
	Germany	-0.450	-0.079	-0.496	-0.539	34	14	22	18
	Italy	0.315	-0.173	0.492	-0.190	34	21	26	21
	Japan	-0.507	-0.238	-0.108	-0.763	29	21	20	18
	Netherlands	-0.127	-0.004	0.111	-0.300	34	21	26	19
	Norway	0.133	0.323	-0.127	-0.533	34	21	26	21
	Spain	0.238	-0.094	0.329	-0.459	34	17	26	17
	Sweden	-0.103	0.171	-0.413	-0.365	34	21	26	21
	United Kingdom	-0.034	-0.289	-0.309	-0.711	34	21	26	21
	United States	-0.518	-0.601	-0.295	-0.578	34	21	26	21
	Pooled	-0.277	-0.041	-0.135	-0.356	501	299	377	305

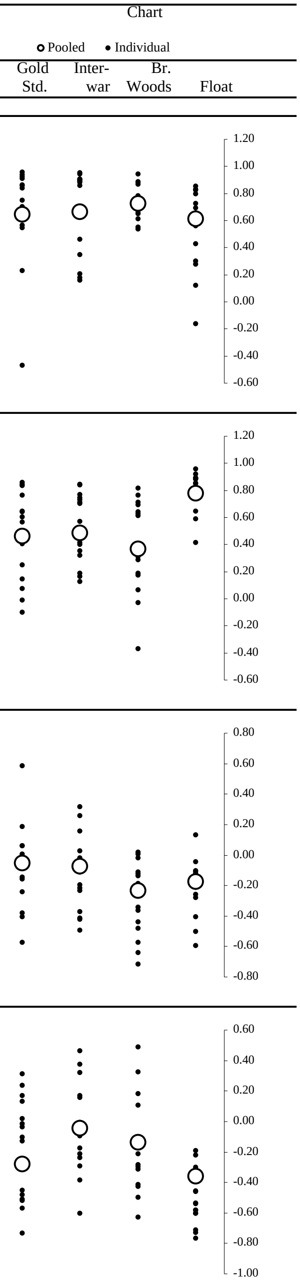


Table A6
Macroeconomic Aggregates, Comovement with Country-Specific Output

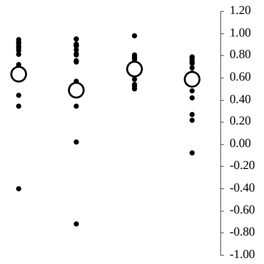
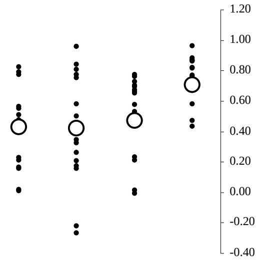
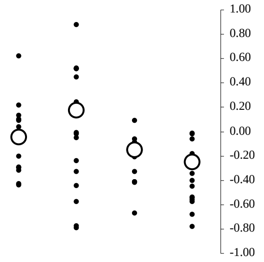
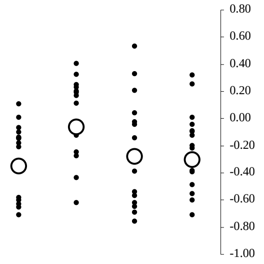
		Statistic				Sample Size				Chart			
										○ Pooled ● Individual			
		Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Comovement with Output (Country-Specific Components)													
log C	Argentina	0.845	0.905	0.540	0.695	29	6	20	17				
	Australia	0.720	0.021	0.622	-0.074	29	6	20	17				
	Canada	0.923	0.951	0.796	0.646	29	6	20	17				
	Denmark	0.887	0.753	0.503	0.586	29	6	20	17				
	Finland	0.600	0.856	0.768	0.486	29	6	20	17				
	France	0.813	0.343	0.785	0.739	29	6	20	17				
	Germany	0.346	0.809	0.621	0.272	29	6	20	17				
	Italy	0.446	0.816	0.779	0.790	29	6	20	17				
	Japan	0.622	0.900	0.733	0.730	29	6	20	17				
	Netherlands	-0.398	0.572	0.780	0.420	29	6	20	17				
	Norway	0.608	-0.716	0.527	0.553	29	6	20	17				
	Spain	0.909	0.955	0.699	0.762	29	6	20	17				
	Sweden	0.698	0.888	0.809	0.218	29	6	20	17				
	United Kingdom	0.946	0.745	0.978	0.783	29	6	20	17				
	United States	0.868	0.890	0.590	0.744	29	6	20	17				
	Pooled	0.632	0.493	0.683	0.586	435	90	300	255				
log I	Argentina	0.413	0.505	0.534	0.473	29	11	20	17				
	Australia	0.159	0.584	0.214	0.756	29	11	20	17				
	Canada	0.513	0.845	0.697	0.820	29	11	20	17				
	Denmark	0.551	0.776	0.656	0.886	29	11	20	17				
	Finland	0.215	0.175	-0.004	0.869	29	11	20	17				
	France	0.022	0.159	0.018	0.746	29	11	20	17				
	Germany	0.793	0.753	0.731	0.771	29	11	20	17				
	Italy	0.776	0.962	0.664	0.864	29	11	20	17				
	Japan	0.167	0.209	0.580	0.763	29	11	20	17				
	Netherlands	0.828	0.346	0.704	0.437	29	11	20	17				
	Norway	0.412	0.810	0.233	0.583	29	11	20	17				
	Spain	0.013	0.328	0.439	0.672	29	11	20	17				
	Sweden	0.565	0.264	0.674	0.816	29	11	20	17				
	United Kingdom	0.476	-0.220	0.764	0.871	29	11	20	17				
	United States	0.230	-0.264	0.775	0.964	29	11	20	17				
	Pooled	0.431	0.421	0.474	0.707	435	165	300	255				
CA/Y	Argentina	-0.426	-0.006	-0.209	-0.195	29	6	20	17				
	Australia	-0.049	0.880	0.093	-0.012	29	6	20	17				
	Canada	-0.295	-0.236	-0.165	-0.678	29	6	20	17				
	Denmark	-0.436	-0.576	-0.416	-0.543	29	6	20	17				
	Finland	0.134	0.447	-0.204	-0.781	29	6	20	17				
	France	0.105	0.244	-0.085	-0.400	29	6	20	17				
	Germany	0.217	-0.020	-0.201	-0.575	29	6	20	17				
	Italy	-0.200	-0.330	-0.327	-0.558	29	6	20	17				
	Japan	0.091	-0.788	-0.199	-0.250	29	6	20	17				
	Netherlands	0.620	-0.048	-0.414	-0.063	29	6	20	17				
	Norway	-0.064	0.523	-0.155	-0.181	29	6	20	17				
	Spain	-0.293	-0.777	-0.672	-0.343	29	6	20	17				
	Sweden	0.042	0.519	-0.059	-0.016	29	6	20	17				
	United Kingdom	-0.315	0.515	-0.413	-0.538	29	6	20	17				
	United States	-0.083	-0.442	-0.152	-0.449	29	6	20	17				
	Pooled	-0.047	0.178	-0.151	-0.252	435	90	300	255				
log P	Argentina	-0.581	0.250	-0.645	-0.483	29	11	20	17				
	Australia	0.011	0.173	-0.753	0.013	29	11	20	17				
	Canada	-0.140	0.409	-0.565	-0.092	29	11	20	17				
	Denmark	-0.067	0.197	-0.539	-0.553	29	11	20	17				
	Finland	-0.599	0.206	-0.619	0.259	29	11	20	17				
	France	-0.709	0.234	0.044	-0.087	29	11	20	17				
	Germany	-0.205	-0.119	-0.040	-0.381	29	11	20	17				
	Italy	-0.144	-0.060	-0.386	0.323	29	11	20	17				
	Japan	-0.648	-0.434	0.334	-0.597	29	11	20	17				
	Netherlands	-0.176	-0.106	0.536	-0.706	29	11	20	17				
	Norway	-0.137	0.114	-0.023	-0.214	29	11	20	17				
	Spain	0.110	0.326	0.208	-0.119	29	11	20	17				
	Sweden	-0.315	-0.270	-0.263	-0.040	29	11	20	17				
	United Kingdom	-0.097	-0.618	-0.139	-0.195	29	11	20	17				
	United States	-0.625	-0.246	-0.687	-0.393	29	11	20	17				
	Pooled	-0.346	-0.062	-0.278	-0.299	435	165	300	255				

Table A7
Macroeconomic Aggregates, Comovement with U.S.

		Statistic				Sample Size			
		Gold Std.	Inter-war	Br. Woods	Float	Gold Std.	Inter-war	Br. Woods	Float
Comovement with U.S.									
log C	Argentina	0.013	-0.330	-0.181	-0.021	29	21	26	21
	Australia	-0.085	0.117	0.343	0.067	34	21	26	21
	Canada	-0.215	-0.264	0.506	0.622	34	21	26	21
	Denmark	-0.028	-0.173	-0.474	0.152	34	19	26	21
	Finland	-0.134	-0.260	-0.019	-0.080	34	21	26	21
	France	0.099	0.029	0.255	-0.318	34	15	23	21
	Germany	-0.130	0.114	-0.120	0.174	34	14	22	18
	Italy	0.352	0.581	0.068	-0.056	34	21	26	21
	Japan	0.253	-0.120	0.143	0.199	29	21	20	18
	Netherlands	0.097	-0.056	-0.150	0.142	34	10	24	19
	Norway	0.091	-0.019	-0.019	0.332	34	21	26	21
	Spain	0.184	-0.259	-0.273	0.104	34	17	26	17
	Sweden	-0.094	-0.828	-0.440	-0.169	34	21	26	21
	United Kingdom	0.200	0.319	0.353	0.543	34	21	26	21
	United States	—	—	—	—	—	—	—	—
	Pooled	0.084	-0.008	0.035	0.150	500	285	375	303
log I	Argentina	-0.068	0.722	0.169	-0.306	29	21	26	21
	Australia	0.123	0.311	0.540	0.501	34	21	26	21
	Canada	0.082	0.746	0.645	0.487	34	21	26	21
	Denmark	-0.101	0.516	0.395	0.493	34	19	26	21
	Finland	-0.093	0.285	-0.694	-0.102	34	21	26	21
	France	-0.137	0.275	-0.104	0.254	34	15	23	21
	Germany	-0.157	0.331	0.323	0.590	34	14	22	18
	Italy	0.378	0.148	0.575	0.315	34	21	26	21
	Japan	-0.153	0.309	-0.242	0.529	29	21	20	18
	Netherlands	-0.053	0.501	0.302	0.575	34	19	24	19
	Norway	-0.173	0.196	-0.343	-0.183	34	21	26	21
	Spain	0.108	0.224	-0.172	-0.354	34	17	26	17
	Sweden	-0.061	0.518	0.199	-0.154	34	21	26	21
	United Kingdom	-0.023	0.461	0.577	0.575	34	21	26	21
	United States	—	—	—	—	—	—	—	—
	Pooled	0.074	0.427	0.276	0.237	500	294	375	303
CA/Y	Argentina	0.630	-0.010	0.338	0.295	29	21	26	21
	Australia	0.180	-0.232	0.236	0.618	34	21	26	21
	Canada	0.239	-0.151	0.392	0.075	34	21	26	21
	Denmark	-0.265	-0.004	-0.377	0.114	34	19	26	21
	Finland	-0.086	-0.833	0.250	-0.262	34	21	26	21
	France	0.423	-0.356	-0.190	0.025	34	16	23	21
	Germany	-0.314	-0.222	-0.294	-0.671	34	14	22	21
	Italy	0.690	-0.863	-0.613	-0.205	34	21	26	21
	Japan	-0.227	0.150	-0.361	-0.843	29	21	26	21
	Netherlands	-0.472	-0.068	-0.445	-0.172	34	10	24	21
	Norway	-0.719	-0.869	-0.575	-0.165	34	21	26	21
	Spain	0.113	0.530	-0.002	-0.473	34	21	26	21
	Sweden	0.151	-0.818	-0.707	-0.180	34	21	26	21
	United Kingdom	-0.544	0.389	-0.694	0.117	34	21	26	21
	United States	—	—	—	—	—	—	—	—
	Pooled	0.033	-0.266	-0.104	-0.058	500	290	381	315
log P	Argentina	-0.091	0.729	-0.017	-0.005	30	21	26	21
	Australia	0.035	0.767	0.255	0.365	34	21	26	21
	Canada	0.511	0.980	0.696	0.757	34	21	26	21
	Denmark	0.150	0.763	0.253	0.746	34	21	26	21
	Finland	0.200	0.212	0.601	0.523	34	21	26	21
	France	-0.045	0.469	0.718	0.717	34	18	24	21
	Germany	0.006	-0.027	0.438	0.153	34	21	26	21
	Italy	0.296	0.333	0.610	0.648	34	21	26	21
	Japan	0.116	0.458	-0.203	0.614	29	21	22	18
	Netherlands	0.362	0.848	0.010	0.403	34	21	26	21
	Norway	0.104	0.718	0.294	0.281	34	21	26	21
	Spain	0.334	0.719	0.497	0.168	34	21	26	21
	Sweden	0.191	0.777	0.557	0.507	34	21	26	21
	United Kingdom	0.359	0.834	0.561	0.699	34	21	26	21
	United States	—	—	—	—	—	—	—	—
	Pooled	0.128	0.038	0.241	0.055	501	312	384	312

Chart

○ Pooled ● Individual

Gold Std. Inter-war Br. Woods Float