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Abstract
This paper studies the changing characteristics of post-war international comovement under fixed and flexible exchange regimes. I find that business cycle comovement among all the G7 economies was highest in the universally flexible exchange rate era following the collapse of Bretton Woods (BW) and before the Basle-Nyborg agreement tightened the bands governing the European Exchange Rate Mechanism (ERM). With the exception of a few examples (Canada/US and Germany/France) G7 business cycles were far less synchronized in the universally fixed exchange rate BW era. More recently the ERM period in which continental Europe maintained fixed exchange rates, is characterized by a high degree of comovement among continental Europe and the English-speaking G7 countries, with little synchronization across these groups. I find that these changing patterns of comovement were driven by changes in the propagation of shocks rather changes in the relative volatility of shocks themselves across these time periods.

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* The views expressed herein are those of the author and not necessarily those of the Federal Reserve Bank of Chicago or the Federal Reserve System.

1 Introduction

In 1999 Europe took the final step in the most ambitious monetary experiment of the postwar era by establishing a common currency area (the European Monetary Union [EMU]), which is an extreme form of fixed exchange rate regime where member countries use the same currency. There is widespread belief, based largely on the Mundell-Flemming model, that countries tied to a fixed exchange rate regime are more susceptible to foreign disturbances, particularly monetary disturbances. In other words there is a belief that flexible exchange rates offer greater insulation from foreign disturbances. A major concern surrounding EMU and fixed exchange rate regimes, in general, is that business cycles of member countries may become more volatile under a common currency or fixed exchange rate because they would be subject to not only domestic shocks but also increased sensitivity to foreign disturbances.

This conventional view of fixed vs. flexible exchange rate regimes stems more from anecdotal evidence than statistical evidence. Two recent events add to this body of evidence. First, is the experience of the United Kingdom (UK) and its continental counterparts in the early 1990s. Member countries of the European Exchange Rate Mechanism (ERM), which stayed tied to the German mark (DM) after German reunification, such as, France were forced to tighten monetary policy and suffered a severe and persistent economic downturn. The UK chose to leave the ERM in 1992 and devalue the pound against the DM rather than raise domestic interest rates to maintain its currency peg with the DM. Unlike its continental counterparts, the UK experienced a strong recovery (see Figure 1). Second, severe economic downturns in Mexico in 1994, and Asia in 1997 came about because of massive capital outflows and banking collapses that flowed from a currency crisis involving a U.S. dollar exchange rate peg that was inconsistent with the market's desired level. Looking to the past, monetary historians, like Eichengreen (1992), frequently argue that countries that abandoned the Gold Exchange Standard experienced an economic downturn that was far less severe than that of countries who stayed pegged to the United States' (U.S.) during the depression of the 1930s.

One empirical observation that seems to be at odds with this view is the emergence of a stronger international business cycle in the post-Bretton Woods (PBW), flexible exchange rate period from 1971 to 1987 (see Table 1). The key stylized fact supporting this is the observed correlations of industrial output fluctuations of the G7 countries in the PBW period which were considerably higher than in the Bretton Woods (BW) fixed exchange rate period from 1947 to 1971 and the ERM period from 1987 to 1998.[1] This evidence works against the conventional view of fixed vs. flexible regimes because cross-country correlations of output fluctuations rise if the importance of foreign shocks rises. Moreover, it questions the insulation properties of flexible exchange rates over fixed exchange rates. It also suggests that the behavior of international business cycles maybe intimately related to the exchange rate regime.

This paper is an exploratory analysis of the link between exchange rate regimes and the behavior of international business cycles. I estimate statistical models of G7 countries over the three postwar periods: the BW universally fixed exchange rate period BW; the universally flexible exchange rate period labeled PBW; and subsequent ERM period in which the EMU countries adopted a fixed exchange rate, while the remaining G7 countries maintained flexible exchange rates.[2] I use these empirical models to get a better sense of the factors underlying the higher degree of business cycle comovement between G7 nations in the PBW period. There are essentially two factors that lead to higher correlations of international output fluctuations. First, was the change due to the nature of shocks affecting the G7 economies? In particular, did the relative size of innovations affecting output change such that there is rise in the volatility of

[1] The Group of Seven (G7) countries are Canada, France, Germany, Italy, Japan, UK and U.S.
[2] The EMU countries are France, Germany and Italy.

common and foreign disturbances affecting the G7 economies? Second, did the propagation of these shocks change in a way to produce more similar cycles? More specifically, did the responses to innovations change so that there was increased sensitivity to foreign disturbances and/or a change in responses to all disturbances so that they become more alike? My empirical results suggest that higher output comovement observed in the PBW era was due to fact that the G7 economies had similar responses to shocks from all sources.

The remainder of this paper proceeds as follows Section 2 discusses the various exchange rates regimes used by the G7 over the last century. Section 3 describes the changing character of international business cycles over the periods governed by BW, PBW and the ERM. I review other approaches to understanding international comovement in section 4. Section 5 describes in detail this paper's empirical strategy. The paper's main findings (details of impulse response functions, variance decompositions, relative size of structural disturbances across the three exchange rate periods, and counterfactual simulations) are reported in section 6. Section 7 concludes by summarizing the paper's main findings.

2 A review of G7 exchange rate regimes

In July 1944, representatives from 44 countries met in Bretton Wood, New Hampshire to draft and sign the Papers of Agreement that established the International Monetary Fund.[3] The system set up by the BW agreement called for fixed exchange rates against the U.S. dollar and an unvarying dollar price of gold, of $35 an ounce. Member countries held their official international reserves in gold or dollar assets and had the right to sell dollars to the Federal Reserve for gold at the official price. The system was thus a gold exchange standard, with the dollar as its principal reserve currency.

[3] This section draws on material in Krugman and Obstfeld (1994), chapter 19.

The earliest sign that BW was near collapse came in early 1968 when central bankers announced the creation of a two-tier gold market, with one private tier and the other official. Private traders freely traded on the London gold market and the gold price set there was allowed to fluctuate. In contrast, central banks would continue to transact with another in the official tier at the fixed price of $35 dollars an ounce. This came about because of speculation of a rise in the official gold conversion rate following the devaluation of the British pound in November 1967. A prime goal of the gold exchange standard was to prevent inflation by tying down gold's dollar price. By severing the link between the supply of dollars and a fixed market price of gold central bankers had removed the systems built-in safeguard against inflation.

The U.S. experienced a widening current account deficit in early 1971. This set off a massive private purchase of the DM as most traders expected a revaluation of the DM against the dollar. By August of 1971 the markets forced the U.S. to devalue the dollar and suspend gold convertibility with other central banks. At the Smithsonian agreement in December 1971 the U.S. dollar was devalued roughly 8 percent against all other currencies. An ever-widening U.S. current account deficit led to further speculative attacks against the dollar in February of 1973. By March of 1973 the U.S. dollar was floating against the currencies of Europe and Japan. This marked the official end of the fixed exchange period for the U.S. Although one could argue that the U.S. abandoned fixed exchange rates in August of 1971. In response to this my data analysis treats August 1971 as the end of the BW universally fixed exchange rate period.

While the U.S., Canada and Japan have maintained flexible exchange rates regimes in the PBW era, European G7 countries have dabbled with various fixed/managed exchange rate regimes. The first of these regimes was the so-called European Snake in the Tunnel, implemented in the Spring of 1972, which attempted to keep BW alive by allowing bilateral trading bands for

European currencies of ± 1 percent and common trading band of ± 2.25 percent against the U.S. dollar. This arrangement ended with BW in early 1973.

The second regime grew out of meeting between German Chancellor Helmut Schmidt and French President Valery Giscard d' Estaing in 1978. The Exchange Rate Mechanism was created in 1979 as part of the European Monetary System (EMS). The ERM included Germany, France and Italy, while all European Community (EC) countries were part of the broader EMS. The UK by virtue of its EC membership was a member of the EMS, but initially opted out of the ERM. They joined the ERM arrangement briefly in the early 1990s. Monetary historians divide the ERM into three periods. The first version ran from 1979 to 1987. All ERM currencies were fixed to each other, with a band of fluctuations of ± 2.25 percent around bilateral parity (Italy was allowed a margin of ± 6 percent, in recognition of its higher rate of inflation and political difficulties). Although this was established as a fixed exchange rate regime, bilateral parities could with the approval of the EMS be adjusted. Realignments were frequent, leading most observers to view this as a period of flexible exchange rates. In light of this, I treat the period following March 1973 to the end of 1986 as universally flexible exchange rate period, since all industrial countries has moved to flexible exchange systems by this date. I label this era PBW.

The second version of ERM was the result of the Basle-Nyborg agreement and ran from September 1987 to September 1992. During this period there were infrequent realignments. In contrast to the earlier regime where member countries attempted to maintain stability with a basket of EC currencies, under the second ERM regime the DM (the perennial low inflation currency) became the anchor currency; just as the U.S. dollar had been under BW. In this setting the Bundesbank was the only ERM member with the freedom to act on its own. The UK joined the ERM in October 1990, but quickly abandoned it in September 1992 when they found that the Bundesbank's stance on monetary policy to be inconsistent with their own fundamentals, returning to a flexible exchange rate regime with the other G7 European countries, which they still maintain. Italy also abandoned the ERM in September 1992, but returned in November 1996 as a condition of entry to the EMU to which it is a member.

The crisis of 1992 led to the final stanza of the ERM, which ran from 1993 to the introduction of the EMU in 1999. This was a continuation of the previous regime with wider bands over which currencies could fluctuate against the DM. Bilateral parties could move by as much as $\pm$15 percent, suggesting this was little different from a floating exchange rate regime. Although it is true that the French franc (FF) fluctuated slightly outside its earlier narrow $\pm$2.25 percent, suggesting that the French monetary authorities were fully committed to maintaining a fixed exchange rate with Germany during and after this turbulent period. In light of this, I consider the period from 1987 to 1998 to be a fixed exchange rate era for the EMU G7 economies, which I label ERM.

The ERM eventually gave way to the EMU in January 1999, with the introduction of a single currency across 12 European countries. One of the preconditions to EMU entry was membership in the ERM. The EMU does not afford Germany any special status as in the second and third eras of the ERM.

3 International business cycles and exchange rate regimes

There is a wealth of empirical research documenting the changing properties of macroeconomic time series of the G7 countries over the postwar era. A subset of this literature has focused on the behavior of international business cycles over various global and regional exchange rate regimes. The picture that emerges from that emerges from this research is that there has been little tendency towards increasing international synchronization of cyclical fluctuations across G7 countries, with a marked decline the average coherence of international cyclical fluctuations occurring over the second half of the 1980s through to the 1990s. The other image developing from this work is that there appears to have been a bifurcation in the mid-1980s. During this period the English-speaking G7 economies (Canada, the UK and the U.S.) displayed similar business cycles, while the EMU countries, along with Japan, displayed similar business cycles, with little to no coherence across these groups over this period.[4]

This large body of research has focused on gross domestic product (GDP), consumption and investment data, which limits their analysis to quarterly and in many cases annual data. One of the drawbacks of this approach is that there are often very few degrees of freedom in exchange rate sub-periods, such as BW and ERM, which makes it difficult to obtain precise estimates and make sharp statements about the changing nature of business cycles. I add to this literature by studying the dynamics of industrial production, which is available on a monthly basis from the International Monetary Funds, International Financial Statistics. While it is true that the importance of the industrial sector of G7 economies has been declining over time--which possibly makes that sector less important in terms of national business cycle dynamics--it should be noted that the key characteristic of the national business cycles of G7 economies is that there is very high comovement of all sectors of the economy, so industrial production typically displays the same cyclical characteristics as GDP (see Christiano and).

Tables 1 and 2 describe the cyclical behavior of industrial production over the BW, PBW and ERM periods. Working down Table 1 I highlight the correlation of U.S., German and Japanese cyclical fluctuations with the other G7 economies. Following the mainstream business cycle literature I isolate the cyclical fluctuations of industrial production using a band-pass filter (BPF) that captures frequencies of 18 months to 96 months. I do so using Baxter and King's (1999) approximate band-pass methodology, with a moving average of 36 months. In order to avoid

[4] See Stock and Watson (2003) for a survey of recent papers documenting international business cycles of the postwar era.

using data from a previous/future sub-period I ignore the first and last 3 years of filtered data for each sub-period.

Three results emerge from Table 1. First, the PBW era displays a strong G7 business cycle in which the fluctuations of all seven economies tended to be above or below trend at the same time. Second, there is no apparent G7 business cycle in the BW era. The only apparent comovement over this period occurs between the U.S. and Canada, and between Germany, France and the UK. Finally, this paper adds to the finding that there was a bifurcation in the ERM period, which is characterized by strong comovement among the English-speaking flexible exchange rate G7 countries (Canada, the UK and the U.S.) and strong comovement among the fixed exchange rate EMU countries (France, Germany, and Italy) and flexible exchange rate Japan, with no apparent relationship between these two groups. The point made by these correlation statistics is that there is no consistent fact describing the behavior of international business cycles and exchange rate regimes, since we observe strong comovement across pairs of countries under both fixed and flexible exchange rate regimes. This statement is especially true for the U.S. and Canada, and France and Germany.

Given the relatively small sample size of the industrial output data it may be the case that the correlations in the PBW period are driven by one or two influential data points. I explore this issue in Figures 1 and 2 by plotting the filtered G7 industrial production series over the fixed and flexible regimes, using the U.S. and Germany, respectively, as the reference cycles. The low coherence between the U.S. and other G7 economies (excluding Canada) is obvious in the BW period, the period before the first solid vertical line. Similarly, for the U.S. and EMU countries in the ERM period, the period after the second solid vertical line. The high correlation in the PBW period appears to be linked to the 1973-75 period, which coincides with the first oil price shock, and the 1979-83 period, which coincides with the second oil price shock and the period when the

U.S. Federal Reserve experimented with direct targeting of monetary aggregates. While, the separation in the ERM period, is clearly tied the U.S. slowdown in the early 1990s, which was echoed by Canada and the UK, and the German post-reunification slowdown which occurred a little later in the 1990s with obvious spillovers to France and Italy.

As has been noted by a host of researchers (see Stock and Watson (2003) for details) the volatility of business cycles fell dramatically in the U.S. in the latter part of the 1980s through to the 1990s. Table 2 reveals that this observation extends to the G7 BPF industrial production data, with the ERM period percentage standard deviations being no higher than their PBW counterparts. What is new is that that I find that that with the obvious exception of Germany the BW period was also characterized by less volatile fluctuations than the PBW era.

4 Approaches to modeling business cycle comovement

One branch of the international finance literature has attempted to explain the international business cycle through quantitative theoretical models of international trade. So far these models are real in the sense that there is no role for monetary disturbances. They completely ignore monetary aspects of the international business cycle by relying wholly on international business cycle transmission through real routes such as goods and asset trade. In there extensive surveys, Baxter (1995) and Backus, Kehoe and Kydland (1995) report that models which allow for realistic trade in capital are unable to generate international comovement. In contrast, less realistic models that ignore trade in capital goods, such as Stockman and Tesar (1995), have been shown to generate international comovement. This analysis suggests that monetary or nominal factors maybe an important component in explaining international business cycles of industrial countries.

Others have approached the issue by studying international business cycles within the context of a structural econometric models. Other empirical attempts have relied on cross sectional econometric methods. For example, Canova and Dellas (1993) study the relationship between trade interdependence and business cycle comovement. They argue that comovement in the PBW period seems to be due to common shocks rather than changes in the international transmission of business cycles. There are a range of individual country analyses such as Hutchinson and Walsh (1992) which studies the U.S.--Japanese business cycles over the fixed and flexible regimes. In addition to multicountry analysis such as Ahmed et al. (1993) and Bayoumi and Eichengreen (1994) who study U.S.-aggregate G7 business cycles. A common finding among these studies is that the nature of underlying disturbances changed over the fixed and flexible period. In particular, global shocks became more volatile relative to national shocks. There is some disagreement over whether there was any change in the way the U.S. and G7 responded to these underlying disturbances when they shifted from fixed to floating rates. Ahmed et al. (1992) argue that there was no change in the response to shocks under the flexible regime. Hutchinson and Walsh (1992) and Bayoumi and Eichengreen (1994) argue that there were changes in the response to shocks in the flexible period. Hutchinson and Walsh find that flexible exchange rates afforded Japan some additional insulation from foreign disturbances, while Bayoumi and Eichengreen argue that the shift to flexible exchange rates steepened the aggregate demand curve of the G7, which tended to make prices (output) more (less) sensitive to supply shocks.

5 Empirical strategy

One way of summarizing interactions among a set of variables is through a structural vector autoregression (SVAR). There is a wide range of variables one can use in analyzing G7 business cycles. I extend the analysis of Eichenbaum and Evans (1995) by estimating a series of bilateral SVARs for the G7. I limit the bilateral pairs to one anchor country (U.S., Germany or Japan) and one of the remaining six G7 countries. In each case the SVAR includes six endogenous variables:

log levels of the anchor country's (y_t) and G7 partners industrial production (y_t^*); anchor country's CPI inflation level (π_t); the inflation differential between the G7 partner and anchor country ($\pi_t^* - \pi_t$); anchor country nominal short-term interest rate (r_t); and nominal short term interest differential between the anchor country and G7 partner ($r_t^* - r_t$). This variable list extends Eichenbaum and Evans' analysis by adding a variable for the G7 partners' industrial production and by studying more than U.S.-G7 country pairs.

One of the challenges facing researchers is the limited degrees of freedom over the BW and ERM periods, since these periods are restricted to samples of 12 or less years. Following Eichenbaum and Evans, I overcome the data limitation by using monthly data, and limiting the lag length of the estimates vector auto regressions (VAR) to six months.[5] This yields the following model focusing on the dynamic behavior of a 6×1 vector,

$$Z_t = [y_t, y_t^*, \pi_t, \pi_t^* - \pi_t, r_t, r_t^* - r_t]'$$

where the dynamics of Z_t are represented by a VAR,

$$Z_t = \Phi_i(L) Z_{t-1} + \varepsilon_t \qquad (1)$$

where $\Phi_i(L)$ is a 6×6 matrix of polynomials in the lag operator L; and $\varepsilon_t = [\varepsilon_{yt}, \varepsilon_{y^*t}, \varepsilon_{\pi t}, \varepsilon_{\pi^*-\pi t}, \varepsilon_{rt}, \varepsilon_{r^*-rt}]$ is a 6×1 vector of disturbances assumed to be serially uncorrelated, with covariance matrix Σ_i. I estimate this model over three independent time periods, Bretton Woods $\{\Phi_{BW}, \Sigma_{BW}\}$ are estimated using data from $t \in [1958M1, 1971M6]$, post-Bretton Woods $\{\Phi_{PBW}, \Sigma_{PBW}\}$ are estimated using data from $t \in [1973M1, 1985M12]$ and

[5] Varying the length of the VAR had no appreciable effect on the results reported in this paper.

Exchange Rate Mechanism $\{\Phi_{ERM}, \Sigma_{ERM}\}$ are estimated using data from $t \in [1987M6, 1998M12]$.[6]

Before I can shed light on the issue of whether increased comovement in national output occurred because of changes in the relative volatility of international versus national disturbances and/or changes in the response to international and national disturbances I need to impose some structure on the system of equations described by (1). There are numerous forms of indentifying restrictions in the literature. In their work on Japan, Hutchinson and Walsh (1992) impose long-run restrictions on the data. Identification in Ahmed et al. (1993) and Bayoumi and Eichengreen (1994) comes from different theoretical models. I use a recursive structure popularized by Sims (1972). This approach imposes restrictions on the covariance matrix of the disturbances of the model. In particular, structural disturbances are identified by imposing a recursive information ordering. Throughout the analysis I impose the following information ordering: anchor industrial production; G7 partner industrial production; anchor inflation, G7-anchor inflation differential, anchor nominal interest rate, G7-anchor interest differential. One interpretation of this approach is that the anchor country's monetary authority first chooses the value of the monetary instrument (in this case the anchor country's short-term interest rate) after observing contemporaneous movements in anchor country output, G7 partner output, anchor country inflation and the inflation differential between the anchor and G7 partner. The G7 partner then reacts to the anchor country's monetary policy with a lag of one period by choosing the value of its monetary

[6] The U.S., Canadian and Japanese models are estimated over 1958M1 to 1998M12, the German, French, and Italian models are estimated over 1960M1 to 1998M12, and the UK models are estimated over 1964M1 to 1998M12. The limiting factor in these datasets is the availability of consistent short-term interest rate data. See appendix A for details.

instrument (in his case its short term interest rate) after observing the anchor country's reaction to all other variables in the international economy.[7]

I implement this approach by assuming that the fundamental exogenous process that drives the economy is a 6×1 vector process u_t of orthogonal serially-uncorrelated shocks, with a diagonal covariance matrix D_i. The VAR disturbance vector ε_t is assumed to be a linear function of a vector u_t of underlying economic shocks, as follows,

$$\varepsilon_t = A_i u_t \text{, for } i = \{BW, PBW, ERM\}.$$

The recursive information structure implies that A_i is the unique lower-triangular matrix with ones along the diagonal, which is recovered from the covariance matrix Σ_i,

$$\Sigma_i = A_i D_i A_i' \text{, for } i = \{BW, PBW, ERM\}.$$

With these models in hand I can isolate can explore whether higher degree of business comovement between the G7 nations in the PBW period is due to a change in the relative volatility of fundamental disturbances or a change in the propagation of these disturbances. Assessing changes in volatility of structural disturbances across the three periods is simply a matter of comparing estimates of the diagonal elements of D_{BW}, D_{PBW}, and D_{ERM}. While isolating changes in the propagation of fundamental shocks is done by comparing the shapes of the model's impulse response functions across the BW, PBW, and ERM time periods. I also highlight the degree of similarity of these propagation mechanisms by comparing the shape of the anchor and G7 partner country's industrial production responses to a given fundamental shock.

Finally, I isolate the importance changes in the relative volatility of shocks and propagation process in explaining changes in G7 output comovement through a series of counterfactual

[7] It is important to note that the results reported in this paper are robust to different recursive orderings. In particular, ordering the G7-partner ahead of the anchor country yields identical results.

experiments. First, to assess the whether changes in the relative volatility of shocks are important I simulate the models estimated in the BW and ERM periods under the assumption that the volatility of shocks was the same as in the PBW era, and then compare the implied business cycle correlations of industrial output with the actual estimates for the BW and ERM periods.[8] If the counterfactual correlation coefficients are larger than the actual BW or ERM correlations I take this is as evidence in favor of the hypothesis that changes in the volatility of disturbances underlies the higher G7 correlations in the PBW era. Second, I conduct the reverse experiment by simulating the PBW model under the assumption that the volatility of the fundamental disturbances is the same as the BW and ERM periods and compare the simulated business cycle correlation coefficients of industrial output with the actual correlations from the PBW era to see if there is evidence in favor of the hypothesis that changes in the volatility of disturbances underlies the higher G7 correlations in the PBW era. Lastly, I also compare this second set counterfactual business cycle correlations with actual business cycle correlations of industrial production from the BW and ERM periods to see if there is evidence in favor of the hypothesis that changes in the propagation of shocks underlie the higher G7 correlations in the PBW era, since higher counterfactual correlations would imply that changes in the propagation of shocks are the source of the higher PBW correlation coefficients.

6 Results

This section reports on various characteristics of the estimated bilateral VARs. I begin by providing a structural interpretation of the identified fundamental shocks. Then move on to a discussion of the relative importance of international and national shocks affecting the G7 economies across the three exchange rate eras. This leads me to analysis of the changing relative

[8] I generate business cycle statistics for the simulated VARs data that is comparable with the band-pass filtered data reported in Tables 1 and 2 by applying standard spectral techniques to the estimated time series

volatility of international and national shocks. I change gears by examining the similarity of responses to shocks and finish up the section with the series of counterfactual experiments described in the previous section.

6.1 A structural interpretation of a typical bilateral VAR

I begin my discussion of the estimated models by tracing through the impulse responses of the U.S.-German model estimated over the PBW era, with a view to ascribing a structural interpretation to the identified fundamental shocks. Figure 3 traces out the U.S. and German responses to a shock to U.S. industrial production. This shock has a temporary positive effect on U.S. and German output, U.S. inflation, the U.S. interest rate and a negative effect on the inflation and interest differential of the Germany and the U.S. I interpret this to be a U.S. demand shock. Turning to Figure 4, we see that the shock to German industrial production has a similar effect on the remaining variables of the system as did the U.S. demand shock, which leads me to interpret this as a German demand shock. Figure 5 traces out the responses to a positive U.S. inflation shock. The only significant response to this shock appear to be a negative output response in the U.S. and Germany, which suggest that this is a U.S. supply shock. Responses following a shock to the German-U.S. inflation differential also have a negative effect on U.S. and German industrial production albeit much weaker then the U.S. inflation, which suggests that this could be interpreted as a German supply shock. Figure 7 reveals the responses to a U.S. interest rate shock. Higher U.S. interest rates lead to a temporary fall in U.S. and German output with a lag of about one to two years. This shock also has a negative effect on the German-U.S. inflation differential, but it is far less persistent than the shock to U.S. interest rates which suggests that the German interest rate responds with a lag of about three months to a U.S. interest rate shock. The most obvious structural interpretation of this innovation is that it is a U.S. monetary policy shock.

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models to get a covariance matrix for industrial output at business cycle frequencies.

Shocks to the German-U.S. interest differential yield similar output responses to the U.S. interest rate shock. U.S. interest rates are estimated to respond with a similar lag as German rates to U.S. interest rate shocks of about three months. I interpret these innovations as being German monetary policy shocks.

6.2 Did the relative importance of international and national disturbances change?

Tables 3 to 5 report the relative importance of these six sources of disturbance across the three exchange rate periods for 14 bilateral pairs. Each panel describes the percentage share of the *n*-step ahead variation in anchor and G7 partner country industrial production attributable to the six structural disturbances (for *n*=3, 6, 12, 24, 36, and 60 months). I also report the share of the variance of industrial output at business cycle frequencies that is explained by the six fundamental innovations in the row labeled BCF.

These tables reveal that relative importance of the six disturbances to the G7 economies changed over the three exchange rate regimes, but not in a homogenous way. The most notable common change was the rise in the relative importance of own output shocks for the EMU countries and Japan in the ERM period. For example, the bottom panel of Table 3 shows that in the U.S.-German model, the German industrial production shock accounted for 88 percent of the variation in German industrial production at business cycle frequencies during the ERM period and less than 50 percent in the BW and PBW eras. This suggests that these countries were subject to shocks that were more idiosyncratic than in the past.

Before leaving these tables I make a final note in comparing the six bilateral models involving the U.S., Germany and Japan. These panels reveal that the variance decompositions at business cycle frequencies are invariant to the ordering of the anchor and G7 country.

6.3 Did the relative volatility of international and national shocks change?

Tables 6 to 8 report on the changing character of structural disturbances over the various exchange rate periods for 14 bilateral country models. Each row of a panel reports the percentage standard deviation of the six structural disturbances for a given exchange rate era. The bot two rows of the panel report the ratio of these standard deviations, with the PBW statistic in the denominator.

As has been noted by Stock and Watson (2003) and a host of other papers using different identification strategies, the volatility of shocks to G7 economies declined significantly from the PBW to the ERM period. My estimates add to this finding. Tables 6 to 8 reveal that with a few exceptions the percentage standard deviations of all structural disturbances from the 14 bilateral G7 models in the ERM period were significantly smaller than their counterparts in the PBW era. The exceptions are Japanese industrial production shocks, German inflation shocks, and Italian interest differentials. Although higher than their ERM analogs, structural disturbances in the BW era also appear to be less volatile than counterparts in the PBW period.

One possible explanation for the higher business cycle comovement in the PBW era was that the volatility of international shocks rose relative to national shocks. In most cases the decline in the volatility of structural shocks attributable to the anchor country and the G7 partner were fairly uniform, which suggests that the changing character of business cycle comovement cannot be explained by a shift in the relative volatility of disturbances affecting the G7 economies.

6.4 Were responses to national and international shocks more alike in PBW?

Figures 9 to 21 consider another avenue of change in the G7 economies. They reveal the similarity of the anchor and G7 country's industrial production responses to structural innovations across the three different exchange rate eras.

Figure 9 is a useful starting place since it shows that the responses of the U.S. and Canadian industrial production to all six structural disturbances were similar during all three periods. This was expected given the high level of comovement between U.S. and Canadian industrial production over the entire sample. Jumping to Figure 11 we see a contrasting view in which the U.S. and German responses are quite similar in the PBW era, but somewhat different in the BW and ERM eras. It is pretty much the case that all U.S. and German responses differed in the BW era. The differences are subtle in the ERM period, with significant differences appearing in the responses to German industrial production shocks and U.S. interest rate shocks. Figures 10, 12 and 13 reveal a similar picture for the bilateral models of the U.S., France, Italy and Japan. Figure 14 in contrast, highlights different U.S. and UK responses in the BW period and quite similar responses in the PBW and ERM periods, which mirrors the comovement pattern between these countries: low on the BW era and high in the PBW and ERM periods.

Just as in the case of the U.S.-Canada model, the Germany-France model reveals that the similarity of responses for German and French industrial production are invariant to exchange rate period (see Figure 15). The similarity of German, Italian and Japanese responses over the PBW and ERM eras are also evident in Figures 16 and 17. These figures also highlight the dissimilarity of their responses during the BW period. Differences in the German-UK responses are harder to discern from Figure 18. The most noticeable difference in the ERM period is in the German and UK response to shock to German industrial production, which matches the German-U.S. case. I find that the results are robust to the change of ordering of anchor countries (see Figures 19 to 21).

6.5 Counterfactual experiments: Shocks vs. Propagation

Table 9 quantifies these observations of the last three subsections through a series of counterfactual simulation experiments. The first column of Table 9 reports the simulated business comovement of G7 industrial production using the PBW propagation mechanism $\{\Phi_{PBW}, A_{PBW}\}$ and the PBW structural disturbance covariance matrix D_{PBW}. These simulated correlations mirror the actual correlations reported in Table 1. Columns 2 and 5 report similar simulated statistics for the BW and ERM models. The simulated ERM correlations are extremely close to their actual couterparts in Table1. The simulated BW correlations are somewhat higher than their analogs in Table 1, but they preserve pattern of G7 correlations observed in the BW era, such as the U.S. displaying significantly higher comovement with Canada.

Column 3 considers the role played by changes in the volatility of shocks in explaining the increase in PBW correlations by simulating the BW model under the assumption that the fundamental shocks to the BW economies were the same as the PBW economies. In other words, I simulate business comovement of G7 industrial production using the BW propagation mechanism $\{\Phi_{BW}, A_{BW}\}$ and the PBW structural disturbance covariance matrix D_{PBW}. Comparing columns 2 and 3 we see that simulating the BW model using the more volatile PBW disturbances generates business comovement that has the same pattern as that observed using the BW disturbances. I repeat this exercise for the ERM period, by simulating the ERM model under the assumption that the fundamental shocks to the ERM economies were the same as the PBW economies. The results are reported in column 6. Just as in the BW case, the pattern of comovement is the same as that observed using the ERM disturbances. Columns 4 and 7 report the findings of complimentary experiments in which the PBW model is simulated under the assumption that the shocks facing the G7 economies were the same as those in the BW and PBW eras, respectively. In both cases the pattern of comovement is the same as that observed in the PBW era. This says that the pattern of comovement is invariant to the changes in the relative volatility of structural disturbances over the three exchange rate periods. It also implies that that the changing pattern of comovement is tied to changes in the propagation of shocks. In the case of the PBW era vs. other exchange rate periods, Figures 9 to 21, the most obvious change to the propagation mechanism was that the G7 economies responded to international and national shocks in a similar. My ongoing research is exploring whether this reflects fundamental changes in the policy reaction functions of the G7 economies.

7 Conclusion

The pattern of international comovement among the largest industrial nations changed significantly over the BW, PBW and ERM exchange rate eras. One of the key lessons learned from these statistics is that there is no consistent pattern regarding international comovement and the exchange rate regime, since there are many examples of high and low international comovement under both fixed and flexible exchange rate regimes.

These statistics also provide a fertile ground in which to examine the factors that underlie the changing characteristics of international business cycle comovement. I exploit these data in this paper for that purpose. Using a series of bilateral SVARs for various G7 pairs estimated over the three exchange rate eras, I show that the changing patterns of international comovement observed in three postwar exchange rate eras was due to changes in the propagation of shocks, rather changes in the relative volatility of shocks themselves, across these time periods. The key result underlying this finding is that, in contrast to the BW and ERM periods, all G7 economies responded to international and national shocks in a similar way during the PBW era. One possible interpretation of this discovery is that the policy reaction functions of the G7 economies were more alike over this period. A test of that hypothesis is left to future research.

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Appendix A: Data sources and definitions

Industrial production

Source: International Monetary Fund, International Financial Statistics

Anchor inflation

Log first difference of consumer price index (CPI), annualized by multiplying by 12.

Source: Author's calculations using data from International Monetary Fund, International Financial Statistics

G7-anchor Inflation differential

Log first difference of real exchange rate, annualized by multiplying by 12.

Real exchange rate = G7 partner CPI/(anchor CPI * nominal G7 partner/anchor exchange rate)

Source: Author's calculations using exchange rate and CPI data from International Monetary Fund, International Financial Statistics

Interest rates

U.S.: Federal funds rate

Source: Board of Governors of the Federal Reserve System

Germany, France, Japan: Call money rate

Source: International Monetary Fund, International Financial Statistics

Canada, Italy, UK: 3 month Treasury bill rate

Source: International Monetary Fund, International Financial Statistics

G7-anchor interest differential

G7-partner interest rate - anchor interest rate

Source: Author's calculations using interest rate data from International Monetary Fund, International Financial Statistics.

Table 1

International Business Cycle Comovement Under Fixed and Flexible Exchange Rate Regimes

Correlation of Industrial Production with US

	BW	PBW	ERM
Canada	0.75	0.73	0.84
France	-0.23	0.83	0.24
Germany	-0.16	0.78	-0.01
Italy	-0.10	0.50	0.32
Japan	-0.68	0.83	-0.19
UK	-0.01	0.71	0.89
US	1.00	1.00	1.00

Correlation of Industrial Production with Germany

	BW	PBW	ERM
Canada	0.35	0.77	-0.25
France	0.48	0.92	0.95
Germany	1.00	1.00	1.00
Italy	-0.55	0.84	0.68
Japan	0.03	0.97	0.85
UK	0.72	0.59	0.02
US	-0.16	0.78	-0.01

Correlation of Industrial Production with Japan

	BW	PBW	ERM
Canada	-0.53	0.77	-0.33
France	0.22	0.91	0.81
Germany	0.03	0.97	0.85
Italy	0.25	0.85	0.58
Japan	1.00	1.00	1.00
UK	0.23	0.55	-0.09
US	-0.68	0.83	-0.19

Source: Author's calculations using International Monetary Fund monthly industrial production data from International Financial Statistics on CD-ROM.

Notes: All reported data are filtered using Baxter/King band pass filter using a moving average of 36 months, designed to capture frequencies of 18 months to 96 months (8 years). Correlation coefficients are calculated using data from the specified exchange rate period. For example, correlation coefficients in the BW column are calculated from data covering the years from the beginning of the sample 1958M1 to 1971M6

Table 2

International Business Cycle Volatility Under Fixed and Flexible Exchange Rate Regimes

Standard Deviation of Industrial Production

	BW	PBW	ERM
Canada	1.61	2.80	2.41
France	2.18	3.03	2.20
Germany	3.56	2.92	3.07
Italy	2.89	4.19	2.30
Japan	4.06	3.95	3.46
UK	2.17	3.77	1.78
US	2.03	3.70	0.95

Relative Standard Deviation (PBW) of Industrial Production

	BW	PBW	ERM
Canada	0.58	1.00	0.86
France	0.72	1.00	0.73
Germany	1.22	1.00	1.05
Italy	0.69	1.00	0.55
Japan	1.03	1.00	0.88
UK	0.58	1.00	0.47
US	0.55	1.00	0.26

Relative Standard Deviation (U.S.) of Industrial Production

	BW	PBW	ERM
Canada	0.79	0.75	2.53
France	1.07	0.82	2.31
Germany	1.75	0.79	3.22
Italy	1.42	1.13	2.41
Japan	2.00	1.07	3.64
UK	1.07	1.02	1.87
US	1.00	1.00	1.00

Source: Author's calculations using International Monetary Fund monthly industrial production data from International Financial Statistics on CD-ROM.

Notes: All reported data are filtered using Baxter/King band pass filter using a moving average of 36 months, designed to capture frequencies of 18 months to 96 months (8 years). Correlation coefficients are calculated using data from the specified exchange rate period. For example, correlation coefficients in the BW column are calculated from data covering the years from the beginning of the sample 1958M1 to 1971M6.

Table 3

Forecast error decompostion for industrial production of G7 countries across exchange rate regimes

U.S.--Canada Model

U.S.

Percentage of forecast error due to:

Months	U.S. Industrial Production			Canadian Industrial Production			U.S. Inflation			U.S.--Canadian Inflation Differential			U.S. Interest Rate			U.S.--Canadian Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	96	97	91	1	0	3	1	0	1	1	0	0	2	0	3	0	2	1
6	79	87	85	12	1	6	1	2	3	2	1	2	6	4	3	0	5	1
12	51	66	51	33	1	6	3	9	4	3	2	7	9	16	9	0	6	24
24	21	40	27	22	1	3	31	24	2	1	1	13	24	29	9	1	5	47
36	17	27	19	24	1	5	36	33	1	1	2	14	21	34	14	1	4	47
60	14	17	19	34	4	12	35	39	0	1	2	14	16	35	19	1	3	36
BCF	24	32	19	28	9	22	25	24	2	2	6	8	20	23	12	1	6	37

Canada

Percentage of forecast error due to:

Months	U.S. Industrial Production			Canadian Industrial Production			U.S. Inflation			U.S.--Canadian Inflation Differential			U.S. Interest Rate			U.S.--Canadian Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	9	15	11	85	79	71	4	1	3	0	1	3	0	4	6	2	0	4
6	8	22	9	86	61	69	4	3	8	1	2	3	1	11	7	1	0	4
12	5	23	6	83	39	68	8	11	7	1	5	2	2	22	5	1	0	12
24	4	15	3	57	17	46	26	28	5	1	3	5	10	37	5	2	0	36
36	5	10	3	53	9	31	30	37	3	0	3	8	10	41	13	2	0	41
60	6	6	11	54	9	28	29	42	2	0	3	9	8	41	21	2	0	29
BCF	10	11	8	51	25	50	26	26	3	1	9	4	9	26	14	2	3	22

U.S.--France Model

U.S.

Percentage of forecast error due to:

Months	U.S. Industrial			French Industrial			U.S. Inflation			U.S.--French			U.S. Interest Rate			U.S.--French		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	95	97	94	2	2	2	0	0	1	0	0	0	1	0	3	1	0	0
6	88	90	83	8	5	5	1	3	7	0	0	1	2	2	3	1	0	1
12	81	69	60	10	4	4	3	11	6	0	4	1	6	10	25	0	3	5
24	54	39	40	10	2	8	7	24	2	1	6	1	19	27	43	8	2	6
36	48	24	30	12	2	6	6	33	1	1	8	1	17	31	58	15	2	4
60	47	17	16	15	2	6	6	43	1	1	9	0	16	27	72	14	2	5
BCF	41	34	42	8	6	21	7	24	3	2	5	1	23	25	27	19	7	7

France

Percentage of forecast error due to:

Months	U.S. Industrial			French Industrial			U.S. Inflation			U.S.--French			U.S. Interest Rate			U.S.--French		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	3	5	1	89	92	90	1	1	2	0	0	2	4	0	3	3	1	2
6	9	15	2	81	80	86	1	2	6	1	1	2	4	1	3	3	1	2
12	15	26	2	72	56	84	1	5	5	1	5	1	4	2	2	8	6	5
24	25	24	4	54	36	77	1	12	5	1	6	1	5	14	2	14	7	11
36	31	18	10	46	26	74	3	21	4	1	7	1	7	22	2	12	5	9
60	31	14	14	38	18	61	4	33	3	1	8	1	10	23	15	16	4	6
BCF	16	22	6	30	37	77	3	11	3	2	4	1	17	14	5	31	12	7

U.S.--Germany Model

U.S.

Percentage of forecast error due to:

Months	U.S. Industrial			German Industrial			U.S. Inflation			U.S.--German			U.S. Interest Rate			U.S.--German		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	97	99	96	1	0	0	1	0	1	1	1	0	2	0	2	0	0	0
6	93	95	88	1	1	0	0	2	7	2	1	1	2	1	4	1	0	1
12	70	79	65	6	1	2	4	11	8	2	1	1	15	6	22	4	2	3
24	45	44	46	4	5	3	15	21	5	5	2	0	29	17	40	2	11	5
36	47	26	37	5	11	2	16	25	4	5	2	0	24	22	53	2	13	4
60	41	18	30	11	13	3	13	33	3	6	2	0	24	23	63	4	12	2
BCF	27	36	34	6	16	20	18	18	4	8	1	0	33	16	34	9	13	8

Germany

Percentage of forecast error due to:

Months	U.S. Industrial			German Industrial			U.S. Inflation			U.S.--German			U.S. Interest Rate			U.S.--German		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	0	7	1	91	88	90	7	2	1	1	1	5	0	0	3	1	2	0
6	3	17	2	83	75	89	8	3	1	2	2	5	2	1	3	2	3	0
12	3	29	3	73	60	89	6	5	1	4	2	4	5	2	2	9	2	1
24	2	24	5	55	40	87	4	10	1	7	2	4	6	13	3	25	11	1
36	7	15	5	41	32	84	4	16	1	8	2	4	10	21	3	31	14	2
60	20	11	5	29	26	83	10	26	1	7	2	4	11	23	4	23	12	3
BCF	16	17	2	37	49	88	12	9	0	4	1	3	4	12	5	27	12	1

Table 3 (continued)

Forecast error decompostion for industrial production of G7 countries across exchange rate regimes

U.S.--Italy Model

U.S.

Percentage of forecast error due to:

Months	U.S. Industrial Production			Italian Industrial Production			U.S. Inflation			U.S.--Italian Inflation Differential			U.S. Interest Rate			U.S.--Italian Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	92	97	90	4	2	1	0	0	1	0	0	0	3	0	7	0	1	0
6	86	91	84	9	4	3	0	1	5	1	0	1	3	4	7	1	1	0
12	83	70	81	11	4	4	1	3	9	1	0	0	2	21	5	2	1	1
24	60	33	65	9	3	4	8	15	14	0	1	1	3	46	14	20	0	2
36	51	21	50	7	5	3	9	20	16	1	2	1	5	51	28	28	0	1
60	51	16	37	10	13	5	7	18	16	2	3	1	6	49	40	24	1	1
BCF	34	43	41	7	5	14	12	19	7	2	1	1	17	31	30	28	1	6

Italy

Percentage of forecast error due to:

Months	U.S. Industrial Production			Italian Industrial Production			U.S. Inflation			U.S.--Italian Inflation Differential			U.S. Interest Rate			U.S.--Italian Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	0	3	17	98	96	78	0	0	2	1	1	0	1	0	1	0	0	1
6	2	10	23	87	88	64	2	1	3	4	1	1	4	1	2	1	1	7
12	8	19	26	81	76	53	1	1	3	3	0	2	5	2	4	1	1	13
24	22	18	30	68	62	47	1	2	3	3	1	2	5	16	8	1	1	11
36	28	14	29	54	49	46	3	6	4	2	1	2	5	29	8	6	1	12
60	33	11	29	40	42	38	5	9	7	2	2	2	5	35	15	14	1	10
BCF	16	24	16	51	46	46	6	12	2	3	1	1	12	16	14	13	1	21

U.S.--Japan Model

U.S.

Percentage of forecast error due to:

Months	U.S. Industrial			Japaneseese			U.S. Inflation			U.S.--Japanese			U.S. Interest Rate			U.S.--Japanese		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	97	97	90	0	0	0	1	1	1	0	0	3	2	0	4	0	1	0
6	92	88	82	0	3	1	0	1	9	2	0	4	3	3	3	2	5	0
12	79	62	72	1	12	6	1	2	10	1	1	3	4	13	7	13	10	2
24	48	28	42	3	10	26	20	13	5	1	1	2	15	30	10	13	17	15
36	40	19	26	3	10	38	26	20	2	1	1	2	13	33	17	16	17	15
60	33	13	15	2	13	45	26	24	1	1	1	2	11	27	27	27	21	10
BCF	40	40	47	4	7	13	21	15	1	3	2	2	17	23	28	16	12	8

Japan

Percentage of forecast error due to:

Months	U.S. Industrial			Japaneseese			U.S. Inflation			U.S.--Japanese			U.S. Interest Rate			U.S.--Japanese		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	1	20	2	85	78	95	0	1	0	5	1	1	0	0	2	8	1	0
6	2	25	7	69	64	89	0	1	1	5	1	1	3	0	1	20	8	1
12	1	19	10	37	47	80	0	5	2	7	1	2	5	3	3	51	26	2
24	3	11	11	16	26	76	1	15	2	7	0	2	2	8	6	71	40	3
36	5	8	10	11	23	67	3	19	3	6	0	2	1	11	11	73	39	7
60	8	5	10	7	23	60	8	21	4	5	0	3	1	10	12	71	40	11
BCF	6	14	8	16	21	54	8	16	5	5	1	3	4	11	20	62	38	10

U.S.--UK Model

U.S.

Percentage of forecast error due to:

Months	U.S. Industrial			UK Industrial			U.S. Inflation			U.S.--UK Inflation			U.S. Interest Rate			U.S.--UK Interest		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	98	99	85	0	0	0	0	0	1	0	0	3	1	1	4	0	0	6
6	90	91	70	3	1	7	3	1	2	1	0	5	2	7	3	0	0	12
12	70	65	59	5	5	7	2	5	3	4	0	5	18	25	16	1	0	10
24	27	35	46	3	7	4	1	17	4	15	1	7	47	39	32	7	1	7
36	29	22	31	3	6	2	1	28	4	15	3	4	45	41	56	7	1	4
60	27	13	23	4	5	2	1	37	3	15	4	1	46	40	69	8	1	1
BCF	30	34	22	4	5	9	0	25	1	15	4	11	42	30	43	9	1	13

UK

Percentage of forecast error due to:

Months	U.S. Industrial			UK Industrial			U.S. Inflation			U.S.--UK Inflation			U.S. Interest Rate			U.S.--UK Interest		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	0	3	2	77	96	83	2	0	1	15	0	1	3	0	5	2	1	9
6	2	3	4	67	90	82	2	2	1	24	2	1	3	1	4	2	2	8
12	3	4	4	57	70	80	1	5	1	33	3	5	3	16	4	3	2	7
24	2	3	3	48	32	67	1	23	1	39	5	8	7	36	8	3	2	14
36	3	2	2	47	19	47	1	33	1	40	6	5	7	38	34	2	2	12
60	3	1	3	44	13	24	1	40	1	40	6	5	9	37	61	3	2	6
BCF	4	2	6	47	36	29	0	29	0	35	3	12	10	27	39	4	3	13

Table 4

Forecast error decompostion for industrial production of G7 countries across exchange rate regimes

Germany--Canada Model

Germany

Percentage of forecast error due to:

Months	German Industrial Production			Canadian Industrial Production			German Inflation			German--Canadian Inflation Differential			German Interest Rate			German--Canadian Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	96	90	96	2	3	1	0	3	0	0	2	1	0	1	0	2	1	1
6	92	74	93	3	17	1	0	3	2	1	4	1	2	1	0	1	1	2
12	89	55	94	6	27	1	0	5	2	3	8	1	2	4	0	1	1	2
24	78	35	93	13	23	1	0	11	2	4	8	2	5	14	0	1	9	2
36	66	30	91	19	17	3	0	12	2	3	6	2	9	18	0	3	17	2
60	57	27	83	25	12	3	0	12	2	3	4	3	10	17	2	5	28	6
BCF	70	39	80	12	16	2	0	7	2	3	5	4	10	11	3	3	21	10

Canada

Percentage of forecast error due to:

Months	German Industrial Production			Canadian Industrial Production			German Inflation			German--Canadian Inflation Differential			German Interest Rate			German--Canadian Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	0	1	1	93	95	92	1	0	1	3	2	1	3	0	2	1	1	3
6	0	2	1	76	83	91	1	1	2	6	7	1	14	1	3	2	5	2
12	1	2	4	60	61	78	1	7	4	3	13	2	25	4	2	11	14	10
24	2	1	8	53	36	35	0	13	2	1	9	9	22	11	12	22	31	35
36	10	4	4	52	23	16	0	14	1	1	6	14	18	15	17	19	38	48
60	23	10	7	47	13	6	0	13	1	1	3	15	15	16	17	15	44	54
BCF	18	14	20	36	20	9	0	10	1	2	5	13	22	13	14	22	38	43

Germany--France Model

Germany

Percentage of forecast error due to:

Months	German Industrial			French Industrial			German Inflation			German--French			German Interest			German--French		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	92	94	90	2	1	4	1	3	1	4	1	0	1	1	4	1	0	1
6	82	92	81	2	3	8	1	2	1	11	1	1	1	1	6	2	0	4
12	64	87	71	4	5	14	1	2	2	18	1	1	7	3	8	5	1	5
24	36	62	65	11	6	17	0	9	1	20	3	1	25	19	8	7	2	7
36	24	41	59	15	7	17	0	13	2	21	7	2	33	29	12	6	2	8
60	18	30	48	19	13	15	0	13	2	22	13	3	36	27	22	5	4	9
BCF	24	46	58	15	6	11	1	9	2	17	7	1	36	26	22	7	7	5

France

Percentage of forecast error due to:

Months	German Industrial			French Industrial			German Inflation			German--French			German Interest			German--French		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	4	23	17	91	73	79	0	0	1	0	2	1	1	1	2	3	1	1
6	13	44	23	74	49	71	3	1	2	4	6	1	2	1	3	4	1	1
12	17	50	25	65	41	64	3	1	1	6	7	1	3	1	4	6	1	4
24	21	42	17	45	35	52	2	5	1	12	9	3	14	10	15	7	1	12
36	17	31	14	35	28	31	1	9	3	16	11	5	24	20	34	6	1	13
60	14	23	12	32	28	18	1	10	4	18	15	7	30	20	46	5	3	13
BCF	18	40	22	32	20	17	1	7	4	14	6	5	29	22	42	6	5	10

Germany--U.S. Model

Germany

Percentage of forecast error due to:

Months	German Industrial			U.S. Industrial			German Inflation			German--U.S.			German Interest			German--U.S.		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	92	91	93	1	5	1	1	2	0	4	1	3	2	1	0	0	0	2
6	83	82	89	4	13	1	1	1	3	8	2	4	2	1	0	2	1	3
12	66	67	88	4	27	2	1	1	4	12	1	3	10	1	0	6	3	3
24	45	44	85	3	25	4	1	7	4	14	1	3	28	6	1	11	18	3
36	31	35	83	5	16	5	0	12	5	12	1	3	31	8	1	20	28	4
60	25	30	81	11	10	5	1	16	5	10	0	3	27	8	1	26	36	5
BCF	28	54	81	11	14	3	0	9	7	13	1	2	35	6	0	12	16	7

U.S.

Percentage of forecast error due to:

Months	German Industrial			U.S. Industrial			German Inflation			German--U.S.			German Interest			German--U.S.		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	0	1	1	95	98	96	3	0	0	0	1	0	0	0	0	1	0	2
6	1	3	1	91	93	94	3	1	0	1	0	0	2	0	0	2	3	4
12	4	3	2	67	83	73	4	2	1	1	1	1	3	1	3	22	11	20
24	3	6	3	37	52	54	2	9	1	0	0	0	2	6	6	56	26	36
36	6	13	3	35	31	43	2	14	1	1	0	0	4	8	5	53	34	48
60	16	17	2	25	18	36	2	17	2	2	0	0	6	8	3	47	40	58
BCF	8	21	17	20	37	38	1	11	5	5	0	0	18	7	7	49	24	33

Table 4 (continued)

Forecast error decompostion for industrial production of G7 countries across exchange rate regimes

Germany--Italy Model

Germany

Percentage of forecast error due to:

Months Ahead	German Industrial Production			Italian Industrial Production			German Inflation			German--Italian Inflation Differential			German Interest Rate			German--Italian Interest Rate Differential		
	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	94	92	97	0	3	1	1	2	0	2	0	1	1	1	2	2	2	0
6	87	82	88	2	13	2	1	1	1	5	1	6	3	1	2	3	3	2
12	85	74	83	3	15	2	1	2	2	6	1	10	2	3	1	3	6	2
24	76	51	74	9	14	2	2	8	2	5	2	9	3	15	1	4	10	12
36	67	39	64	18	14	5	3	11	2	5	5	9	3	20	3	5	11	18
60	56	32	47	30	17	12	3	11	2	4	9	11	3	21	11	5	10	16
BCF	68	62	56	11	8	7	2	6	2	7	5	14	5	13	10	7	6	11

Italy

Percentage of forecast error due to:

Months Ahead	German Industrial Production			Italian Industrial Production			German Inflation			German--Italian Inflation Differential			German Interest Rate			German--Italian Interest Rate Differential		
	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	1	6	6	96	90	89	2	0	1	0	3	2	0	1	2	0	0	0
6	1	18	8	89	75	82	4	1	1	2	6	1	4	1	7	0	1	1
12	2	33	11	85	61	63	3	1	2	2	4	4	4	1	18	4	1	2
24	2	33	8	82	51	45	2	2	2	2	4	5	3	6	35	9	3	4
36	5	26	9	78	46	38	2	5	2	2	6	10	3	13	35	10	5	6
60	7	21	9	77	44	34	1	6	2	2	10	14	3	15	36	10	5	6
BCF	5	47	20	74	31	27	3	5	2	3	4	11	3	11	30	12	2	10

Germany--Japan Model

Germany

Percentage of forecast error due to:

Months Ahead	German Industrial			Japaneseese			German Inflation			German--Japanese			German Interest			German--Japanese		
	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	96	92	95	2	4	2	1	1	0	0	2	0	0	1	0	0	0	2
6	91	87	84	3	7	1	1	1	4	1	3	1	4	1	3	0	1	7
12	89	72	67	5	12	6	1	1	3	1	3	5	3	3	5	1	9	14
24	81	51	39	13	9	30	1	3	2	1	3	13	3	20	3	1	13	14
36	66	52	40	17	7	30	1	4	2	2	2	13	5	26	3	9	9	12
60	46	55	36	15	10	31	1	3	1	7	2	15	6	21	3	25	9	14
BCF	64	60	37	8	7	33	1	3	1	4	2	14	5	17	3	19	10	12

Japan

Percentage of forecast error due to:

Months Ahead	German Industrial			Japaneseese			German Inflation			German--Japanese			German Interest			German--Japanese		
	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	1	2	2	97	93	93	1	0	2	0	1	2	1	1	1	1	2	0
6	1	4	4	93	85	88	2	1	2	0	1	3	3	1	1	1	9	1
12	1	2	4	83	70	76	2	1	1	1	1	11	1	1	1	12	26	6
24	3	16	9	44	44	60	1	1	1	7	1	18	6	7	1	39	31	12
36	3	30	15	30	34	55	1	1	1	12	1	17	8	11	2	46	24	11
60	2	39	14	27	31	55	1	1	1	13	0	17	7	9	2	50	20	11
BCF	3	31	13	31	28	51	2	3	1	12	1	20	11	13	2	41	24	15

Germany--UK Model

Germany

Percentage of forecast error due to:

Months Ahead	German Industrial			UK Industrial			German Inflation			German--UK			German Interest			German--UK Interest		
	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	80	89	96	3	4	0	0	5	0	12	0	0	4	1	1	1	1	3
6	57	87	86	24	3	1	1	5	1	9	1	5	3	0	1	7	4	6
12	37	82	79	34	2	2	1	6	2	4	1	10	10	3	0	13	6	7
24	18	57	75	37	1	4	3	16	2	12	1	10	16	20	0	13	4	9
36	11	37	74	31	5	5	4	21	2	25	1	10	17	32	0	11	4	9
60	9	24	72	26	11	5	4	23	2	38	2	10	15	37	1	9	4	10
BCF	19	50	75	26	8	3	3	10	2	29	3	11	13	20	0	9	8	9

UK

Percentage of forecast error due to:

Months Ahead	German Industrial			UK Industrial			German Inflation			German--UK			German Interest			German--UK Interest		
	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	4	5	4	74	86	83	0	3	5	12	4	1	6	3	3	4	0	4
6	8	10	4	54	77	80	2	3	4	23	5	1	8	4	5	6	1	6
12	6	20	4	41	57	78	2	7	4	24	4	6	15	10	4	11	1	5
24	3	15	8	32	33	60	4	19	7	35	2	11	16	28	5	10	3	10
36	2	10	7	27	27	49	4	23	9	43	2	11	15	35	5	8	4	20
60	3	7	23	23	25	38	4	23	7	50	2	7	14	39	3	7	4	21
BCF	7	23	35	28	30	28	4	16	4	32	5	7	17	24	2	12	3	23

Table 5

Forecast error decompostion for industrial production of G7 countries across exchange rate regimes

Japan--U.S. Model

Japan

Percentage of forecast error due to:

Months	Japaneseese Industrial Production			U.S. Industrial Production			Japaneseese Inflation			Japanese--U.S. Inflation Differential			Japaneseese Interest Rate			Japanese--U.S. Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	88	88	94	1	8	2	3	2	1	0	1	2	7	0	0	0	0	2
6	72	78	91	2	11	4	3	6	1	0	1	1	19	3	1	5	1	1
12	39	52	84	1	6	7	3	24	1	0	0	1	49	17	2	8	0	4
24	17	21	80	3	2	8	3	42	2	1	2	1	72	31	3	4	1	7
36	11	16	71	6	2	7	3	47	2	1	2	1	76	30	5	3	2	13
60	7	14	64	9	2	7	2	49	3	3	2	3	76	30	10	3	3	14
BCF	17	20	64	7	5	4	2	40	3	2	4	2	64	29	7	8	2	19

U.S.

Percentage of forecast error due to:

Months	Japaneseese Industrial Production			U.S. Industrial Production			Japaneseese Inflation			Japanese--U.S. Inflation Differential			Japaneseese Interest Rate			Japanese--U.S. Interest Rate Differential		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	0	5	0	97	93	89	0	1	2	0	0	2	0	0	0	2	0	6
6	0	9	1	91	83	87	2	4	3	0	0	2	2	3	1	4	1	5
12	1	16	6	80	53	78	1	15	2	0	3	2	12	6	3	5	7	9
24	4	9	25	48	25	44	1	33	2	7	3	3	17	14	16	23	17	10
36	4	6	38	41	22	25	1	36	1	9	2	4	21	15	16	24	20	16
60	3	5	47	35	20	13	1	39	0	9	2	3	33	17	10	20	17	26
BCF	5	9	15	39	43	42	2	22	1	7	2	4	18	10	12	29	13	26

Japan-Germany Model

Japan

Percentage of forecast error due to:

Months	Japaneseese			German Industrial			Japaneseese			Japanese--German			Japaneseese			Japanese--German		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	93	92	95	1	0	1	3	4	1	1	2	2	0	1	0	1	1	1
6	88	81	91	3	1	2	4	9	1	1	1	4	0	5	1	3	4	1
12	77	53	79	5	3	2	4	24	1	1	1	11	12	16	6	2	3	1
24	39	24	62	4	17	6	3	31	1	4	1	19	48	21	13	2	7	1
36	26	16	57	3	27	11	2	28	0	7	1	18	59	16	12	2	13	1
60	23	13	56	2	36	11	2	26	0	8	0	19	63	13	12	2	11	1
BCF	28	20	50	3	22	10	2	22	0	9	1	22	55	17	17	3	18	1

Germany

Percentage of forecast error due to:

Months	Japaneseese			German Industrial			Japaneseese			Japanese--German			Japaneseese			Japanese--German		
Ahead	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM	BW	PBW	ERM
3	7	8	3	90	88	95	1	0	0	2	3	1	0	0	0	0	1	0
6	11	12	3	80	81	88	1	0	1	2	4	4	0	1	2	5	2	2
12	16	15	6	72	69	72	2	3	1	3	4	8	1	6	9	6	2	4
24	26	10	26	62	47	41	2	8	0	3	4	16	2	11	14	6	21	3
36	23	7	27	52	45	40	2	6	0	3	3	16	13	8	13	7	32	3
60	18	6	28	37	49	37	2	8	0	5	2	18	34	7	15	5	27	2
BCF	11	11	29	55	49	37	2	6	0	2	3	16	22	8	15	8	24	3

Table 6

Estimated percentage standard deviation of structural disturbances

U.S.-Canada model

	Structural Disturbance					
Period	U.S. Industrial Production	Canadian Industrial Production	U.S. Inflation	U.S.--Canadian Inflation Differential	U.S. Interest Rate	U.S.--Canadian Interest Rate Differential
BW	0.83	1.05	1.89	7.87	0.25	0.27
PBW	0.65	1.29	2.85	13.59	0.65	0.50
ERM	0.38	0.61	1.64	12.33	0.12	0.39
Ratio						
BW/PBW	1.27	0.82	0.66	0.58	0.39	0.54
ERM/PBW	0.59	0.48	0.58	0.91	0.18	0.78

U.S.--France model

	Structural Disturbance					
Period	U.S. Industrial Production	French Industrial Production	U.S. Inflation	U.S.--French Inflation Differential	U.S. Interest Rate	U.S.--French Interest Rate Differential
BW	0.64	3.61	1.67	10.70	0.25	0.32
PBW	0.66	1.36	2.83	33.35	0.68	0.48
ERM	0.39	0.83	1.71	28.78	0.12	0.44
Ratio						
BW/PBW	0.97	2.67	0.59	0.32	0.36	0.67
ERM/PBW	0.59	0.61	0.60	0.86	0.17	0.92

U.S.--Germany model

	Structural Disturbance					
Period	U.S. Industrial Production	German Industrial Production	U.S. Inflation	U.S.--German Inflation Differential	U.S. Interest Rate	U.S.--German Interest Rate Differential
BW	0.65	1.55	1.69	6.81	0.23	0.61
PBW	0.66	1.53	2.85	35.17	0.66	1.02
ERM	0.41	1.18	1.69	30.69	0.12	0.16
Ratio						
BW/PBW	0.98	1.01	0.59	0.19	0.35	0.59
ERM/PBW	0.61	0.77	0.59	0.87	0.18	0.15

U.S.--Italy model

	Structural Disturbance					
Period	U.S. Industrial Production	Italian Industrial Production	U.S. Inflation	U.S.--Italian Inflation Differential	U.S. Interest Rate	U.S.--Italian Interest Rate Differential
BW	0.63	1.83	1.66	4.22	0.24	0.14
PBW	0.66	2.35	2.88	29.66	0.66	0.27
ERM	0.41	1.29	1.71	31.40	0.11	0.31
Ratio						
BW/PBW	0.95	0.78	0.57	0.14	0.36	0.53
ERM/PBW	0.62	0.55	0.59	1.06	0.17	1.14

U.S.--Japan model

	Structural Disturbance					
Period	U.S. Industrial Production	Japanese Industrial Production	U.S. Inflation	U.S.--Japanese Inflation Differential	U.S. Interest Rate	U.S.--Japanese Interest Rate Differential
BW	0.87	1.05	1.71	8.04	0.25	0.93
PBW	0.63	1.00	2.71	34.92	0.67	0.35
ERM	0.39	1.02	1.61	35.46	0.12	0.14
Ratio						
BW/PBW	1.39	1.05	0.63	0.23	0.38	2.64
ERM/PBW	0.61	1.02	0.59	1.02	0.18	0.39

U.S.--UK model

	Structural Disturbance					
Period	U.S. Industrial Production	UK Industrial Production	U.S. Inflation	U.S.--UK Inflation Differential	U.S. Interest Rate	U.S.--UK Interest Rate Differential
BW	0.58	0.70	1.38	14.98	0.20	0.19
PBW	0.64	1.47	2.89	32.35	0.66	0.53
ERM	0.35	0.58	1.62	29.20	0.12	0.22
Ratio						
BW/PBW	0.90	0.48	0.48	0.46	0.30	0.36
ERM/PBW	0.54	0.39	0.56	0.90	0.18	0.41

Table 7

Estimated percentage standard deviation of structural disturbances

Germany--Canada model

	Structural Disturbance					
Period	German Industrial Production	Canadian Industrial Production	German Inflation	German--Canadian Inflation Differential	German Interest Rate	German--Canadian Interest Rate Differential
BW	1.57	0.92	2.91	9.52	0.61	0.31
PBW	1.50	1.27	2.80	35.18	0.96	0.74
ERM	1.25	0.67	3.44	32.47	0.16	0.41
Ratio						
BW/PBW	1.05	0.72	1.04	0.27	0.64	0.41
ERM/PBW	0.84	0.52	1.23	0.92	0.17	0.56

Germany--France model

	Structural Disturbance					
Period	German Industrial Production	French Industrial Production	German Inflation	German--French Inflation Differential	German Interest Rate	German--French Interest Rate Differential
BW	1.56	3.43	3.11	13.02	0.62	0.34
PBW	1.56	1.21	2.82	16.72	0.98	0.51
ERM	1.12	0.84	3.52	6.18	0.17	0.43
Ratio						
BW/PBW	1.01	2.83	1.10	0.78	0.63	0.66
ERM/PBW	0.72	0.69	1.25	0.37	0.17	0.84

Germany--U.S. model

	Structural Disturbance					
Period	German Industrial Production	U.S. Industrial Production	German Inflation	German--U.S. Inflation Differential	German Interest Rate	German--U.S. Interest Rate Differential
BW	1.54	0.64	2.88	6.32	0.61	0.23
PBW	1.55	0.67	2.76	35.30	0.98	0.68
ERM	1.22	0.41	3.51	28.08	0.16	0.12
Ratio						
BW/PBW	0.99	0.94	1.04	0.18	0.63	0.35
ERM/PBW	0.78	0.62	1.27	0.80	0.16	0.17

Germany--Italy model

	Structural Disturbance					
Period	German Industrial Production	Italian Industrial Production	German Inflation	German--Italian Inflation Differential	German Interest Rate	German--Italian Interest Rate Differential
BW	1.58	1.77	2.85	6.81	0.63	0.15
PBW	1.53	2.20	2.70	23.39	0.94	0.26
ERM	1.20	1.35	3.39	21.32	0.17	0.31
Ratio						
BW/PBW	1.04	0.80	1.06	0.29	0.68	0.55
ERM/PBW	0.78	0.61	1.26	0.91	0.18	1.16

Germany--Japan model

	Structural Disturbance					
Period	German Industrial Production	Japanese Industrial Production	German Inflation	German--Japanese Inflation Differential	German Interest Rate	German--Japanese Interest Rate Differential
BW	1.52	0.92	2.93	9.56	0.64	0.84
PBW	1.54	1.06	2.67	32.67	1.01	0.34
ERM	1.20	1.05	3.46	32.37	0.15	0.13
Ratio						
BW/PBW	0.99	0.87	1.10	0.29	0.63	2.47
ERM/PBW	0.78	0.99	1.30	0.99	0.15	0.38

Germany--UK model

	Structural Disturbance					
Period	German Industrial Production	UK Industrial Production	German Inflation	German--UK Inflation Differential	German Interest Rate	German--UK Interest Rate Differential
BW	0.98	0.70	2.41	16.06	0.64	0.20
PBW	1.52	1.47	2.69	31.57	1.00	0.55
ERM	1.21	0.58	3.53	22.92	0.14	0.21
Ratio						
BW/PBW	0.64	0.48	0.90	0.51	0.64	0.37
ERM/PBW	0.80	0.39	1.31	0.73	0.14	0.39

Table 8

Estimated percentage standard deviation of structural disturbances

Japan--U.S. model

Period	Structural Disturbance: Japanese Industrial Production	U.S. Industrial Production	Japanese Inflation	Japanese--U.S. Inflation Differential	Japanese Interest Rate	Japanese--U.S. Interest Rate Differential
BW	1.07	0.88	8.08	2.92	0.92	0.27
PBW	0.99	0.62	7.89	35.22	0.35	0.66
ERM	1.03	0.39	3.93	33.62	0.14	0.12
Ratio						
BW/PBW	1.08	1.42	1.02	0.08	2.62	0.41
ERM/PBW	1.04	0.63	0.50	0.95	0.39	0.19

Japan--Germany model

Period	Structural Disturbance: Japanese Industrial Production	German Industrial Production	Japanese Inflation	Japanese--German Inflation Differential	Japanese Interest Rate	Japanese--German Interest Rate Differential
BW	0.94	1.48	7.07	7.57	0.81	0.62
PBW	1.01	1.53	7.86	33.04	0.35	1.04
ERM	1.06	1.21	3.73	31.37	0.13	0.15
Ratio						
BW/PBW	0.93	0.96	0.90	0.23	2.30	0.60
ERM/PBW	1.05	0.79	0.47	0.95	0.36	0.14

Table 9

Simulated International Business Cycle Comovement

Correlation of Industrial production with US

	Post-Bretton Woods	Bretton Woods			Exchange Rate Mechanism		
	(PBW,PBW)	(BW,BW)	(BW,PBW)	(PBW,BW)	(ERM,ERM)	(ERM,PBW)	(PBW,ERM)
Canada	0.86	0.90	0.91	0.84	0.83	0.82	0.82
France	0.86	0.02	-0.38	0.81	0.31	0.22	0.86
Germany	0.87	-0.20	0.03	0.84	0.02	-0.11	0.82
Italy	0.68	0.29	0.13	0.67	0.42	0.42	0.65
Japan	0.81	0.29	-0.04	0.84	-0.13	-0.13	0.77
UK	0.70	0.49	0.56	0.59	0.82	0.87	0.68
US	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Correlation of Industrial production with Germany

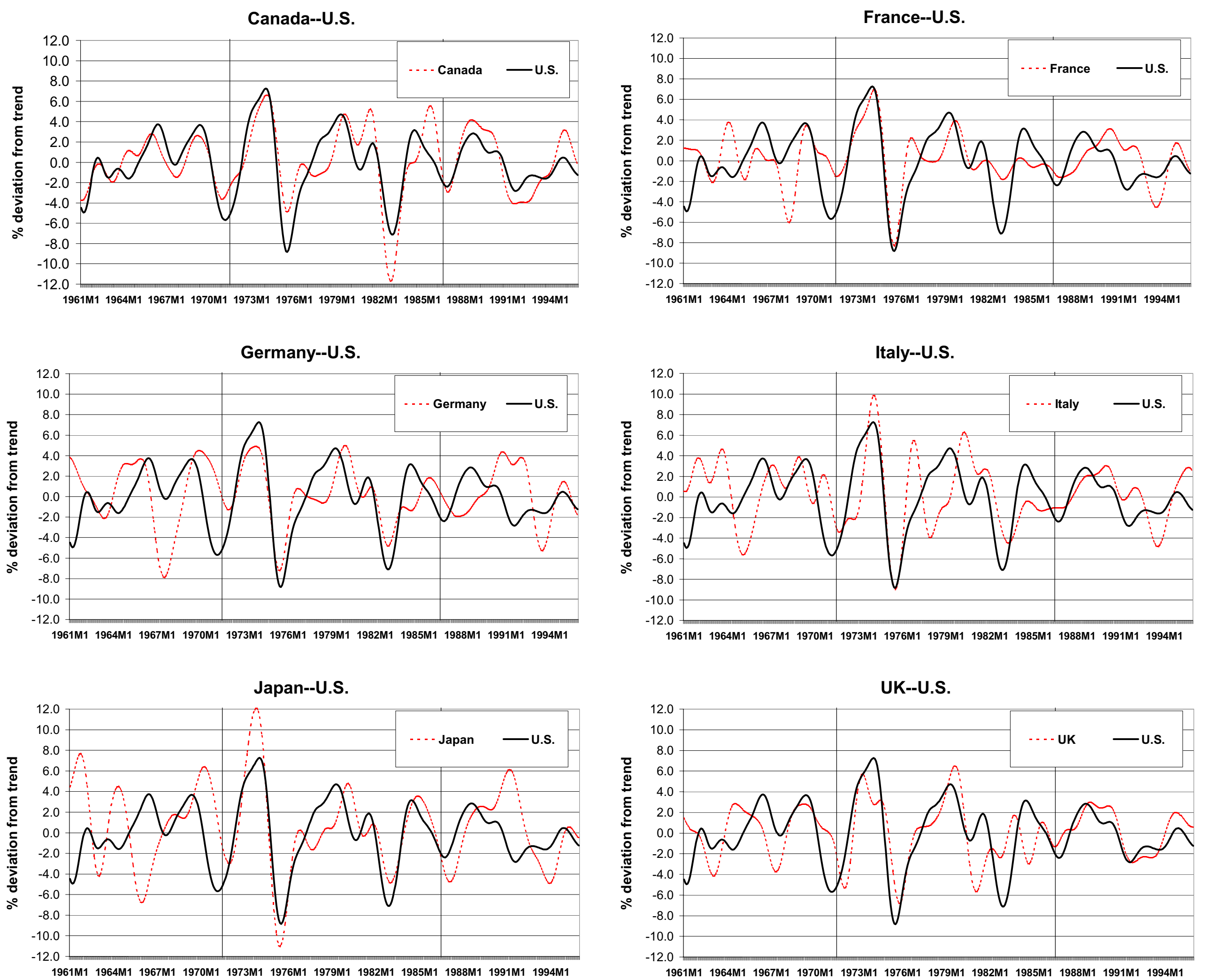
	Post-Bretton Woods	Bretton Woods			Exchange Rate Mechanism		
	(PBW,PBW)	(BW,BW)	(BW,PBW)	(PBW,BW)	(ERM,ERM)	(ERM,PBW)	(PBW,ERM)
Canada	0.85	0.08	0.06	0.79	0.15	0.34	0.83
France	0.89	0.77	0.93	0.74	0.83	0.88	0.91
Germany	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Italy	0.81	0.04	-0.16	0.83	0.66	0.59	0.81
Japan	0.83	0.32	0.43	0.86	0.59	0.74	0.80
UK	0.74	0.76	0.77	0.83	0.14	0.20	0.86
US	0.87	-0.37	-0.34	0.84	0.06	-0.09	0.85

Correlation of Industrial production with Japan

	Post-Bretton Woods	Bretton Woods			Exchange Rate Mechanism		
	(PBW,PBW)	(BW,BW)	(BW,PBW)	(PBW,BW)	(ERM,ERM)	(ERM,PBW)	(PBW,ERM)
Canada	0.68	0.26	-0.11	0.74	-0.20	-0.06	0.74
France	0.79	0.68	0.80	0.67	0.51	0.54	0.78
Germany	0.81	0.32	0.31	0.85	0.59	0.77	0.79
Italy	0.74	0.52	0.60	0.85	0.04	-0.03	0.75
Japan	1.00	1.00	1.00	1.00	1.00	1.00	1.00
UK	0.61	0.36	0.40	0.53	0.00	-0.15	0.23
US	0.79	0.28	0.32	0.82	-0.07	0.00	0.79

Figure 1

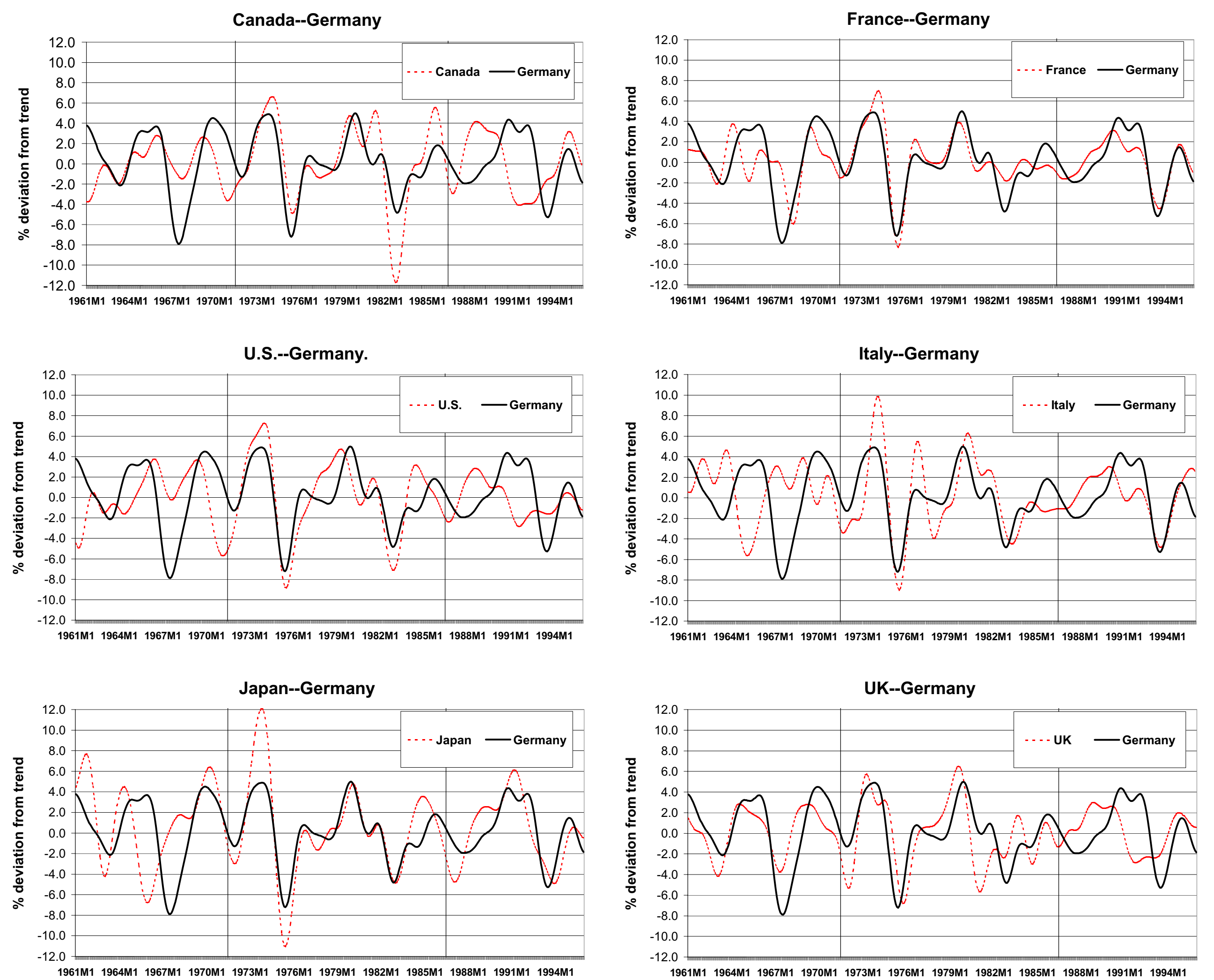
Cyclical Movements of U.S. and G7 Industrial Production



Source: Author's calculations using International Monetary Fund monthly industrial production data from International Financial Statistics on CD-ROM.
Notes: All reported data are filtered using Baxter/King band pass filter using a moving average of 36 months, designed to capture frequencies of 18 months to 96 months (8 years).

Figure 2

Cyclical Movements of German and G7 Industrial Production

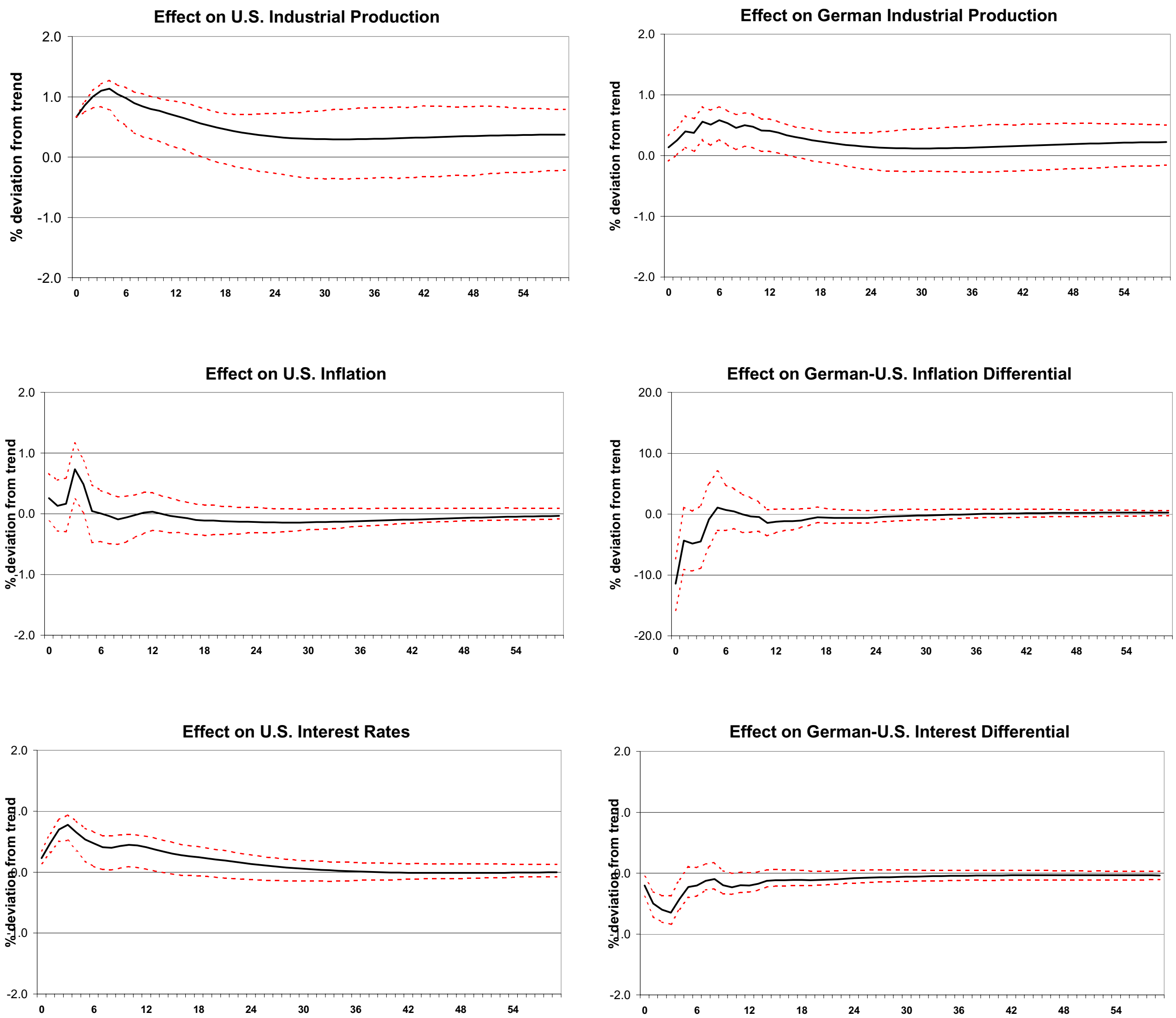


Source: Author's calculations using International Monetary Fund monthly industrial production data from International Financial Statistics on CD-ROM.

Notes: All reported data are filtered using Baxter/King band pass filter using a moving average of 36 months, designed to capture frequencies of 18 months to 96 months (8 years).

Figure 3

Impulse response functions: Shock to U.S. Industrial Production



Notes: Solid line is the point estimate of the impulse response from the bilateral VAR for the U.S. and Germany estimated over the PBW era. The dashed lines are 90 percent confidence intervals computed using standard bootstrap Monte Carlo procedures.

Figure 4

Impulse response functions: Shock to German Industrial Production

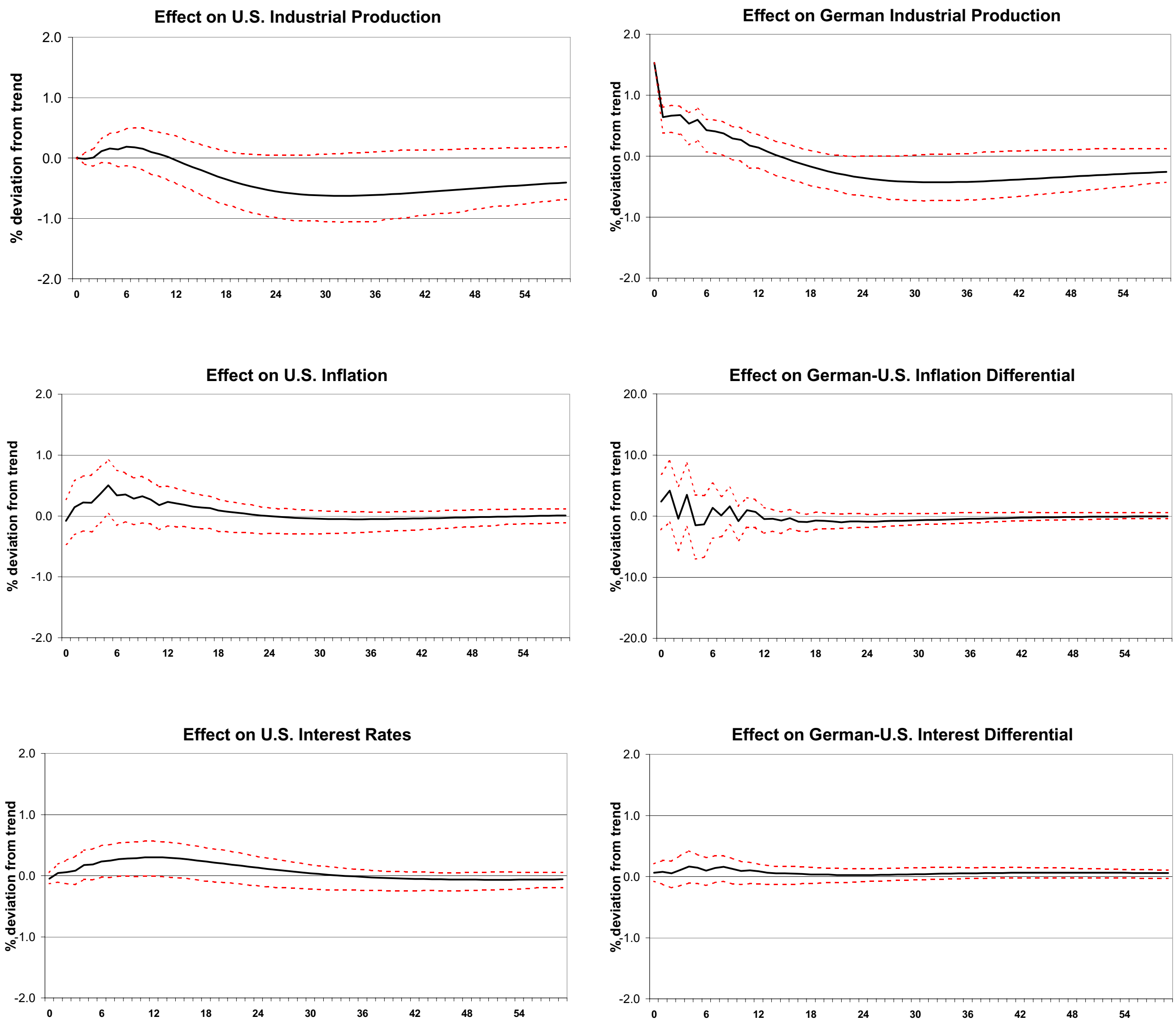


Figure 5

Impulse response functions: Shock to U.S. Inflation

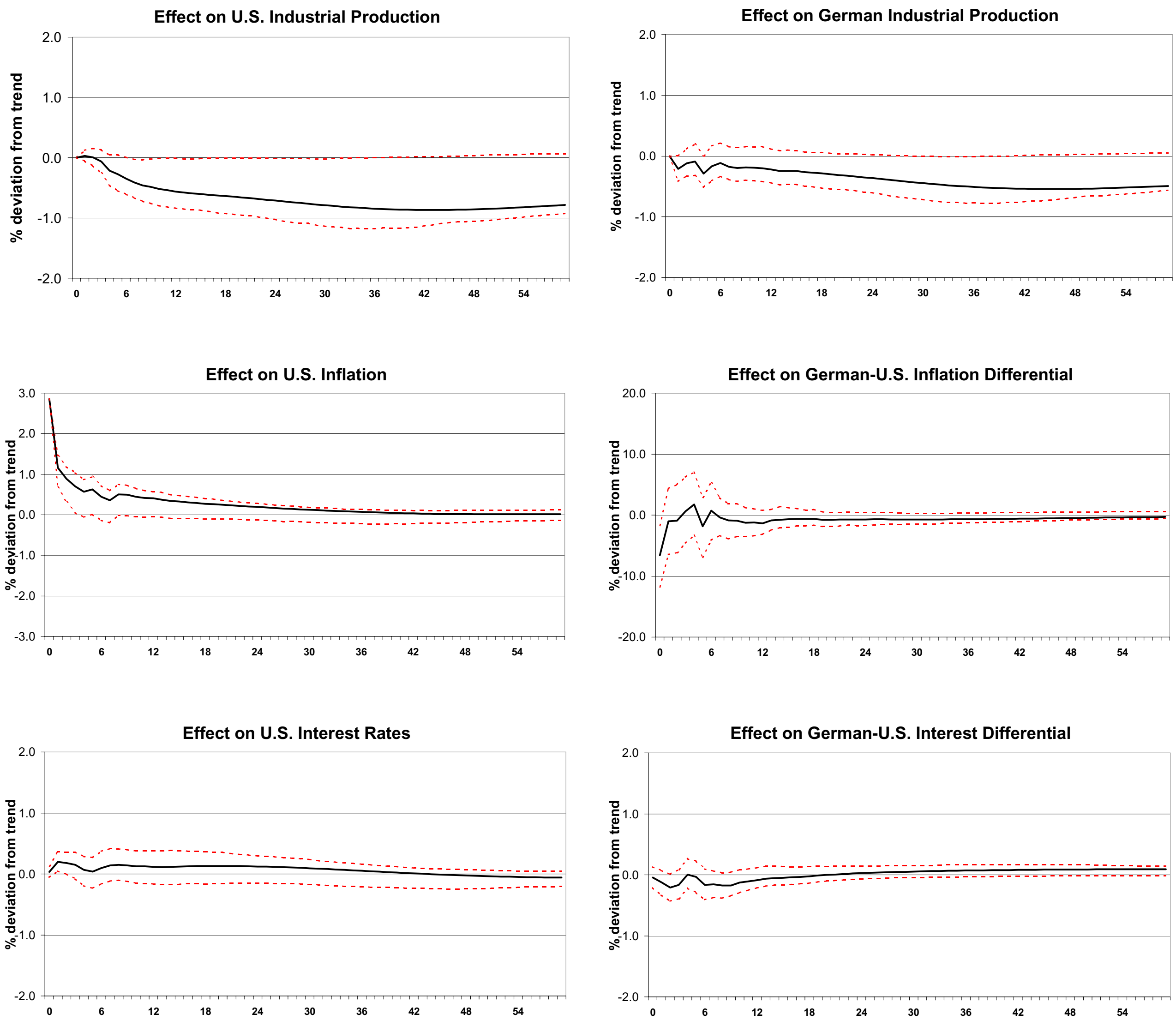


Figure 6

Impulse response functions: Shock to German-U.S. Inflation Differential

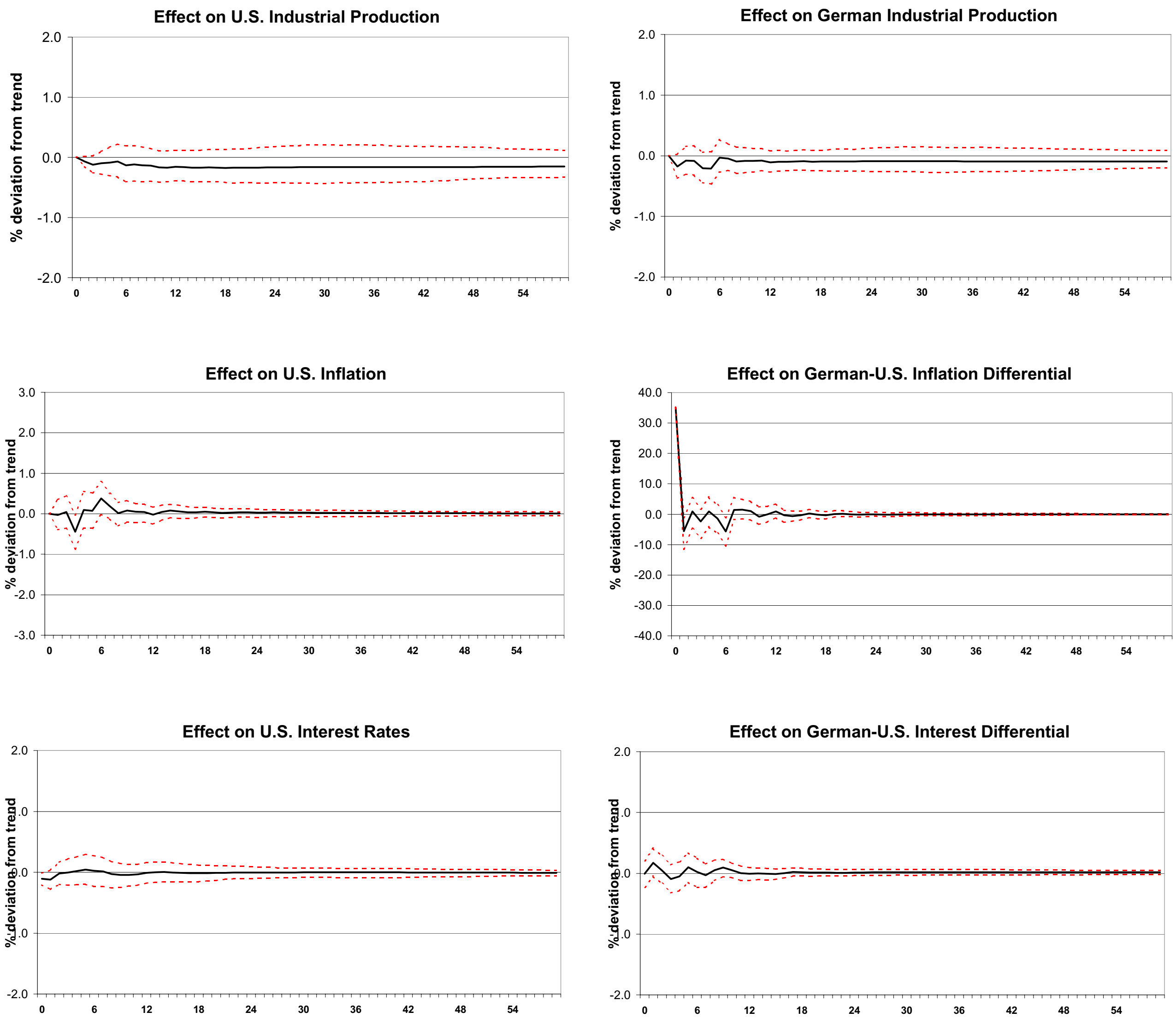


Figure 7

Impulse response functions: Shock to U.S. Interest Rates

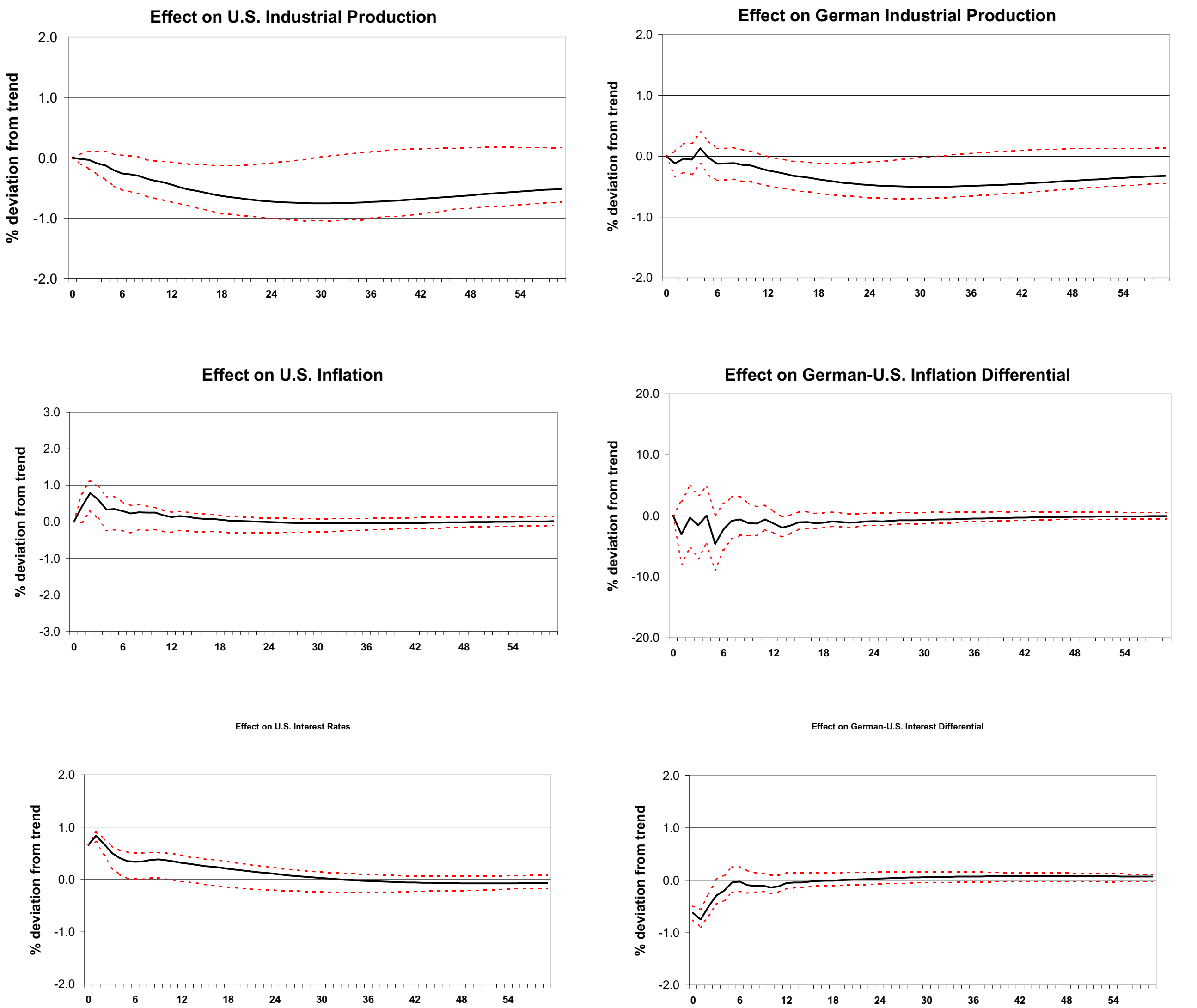


Figure 8

Impulse response functions: Shock to German-U.S. Interest Rate Differential

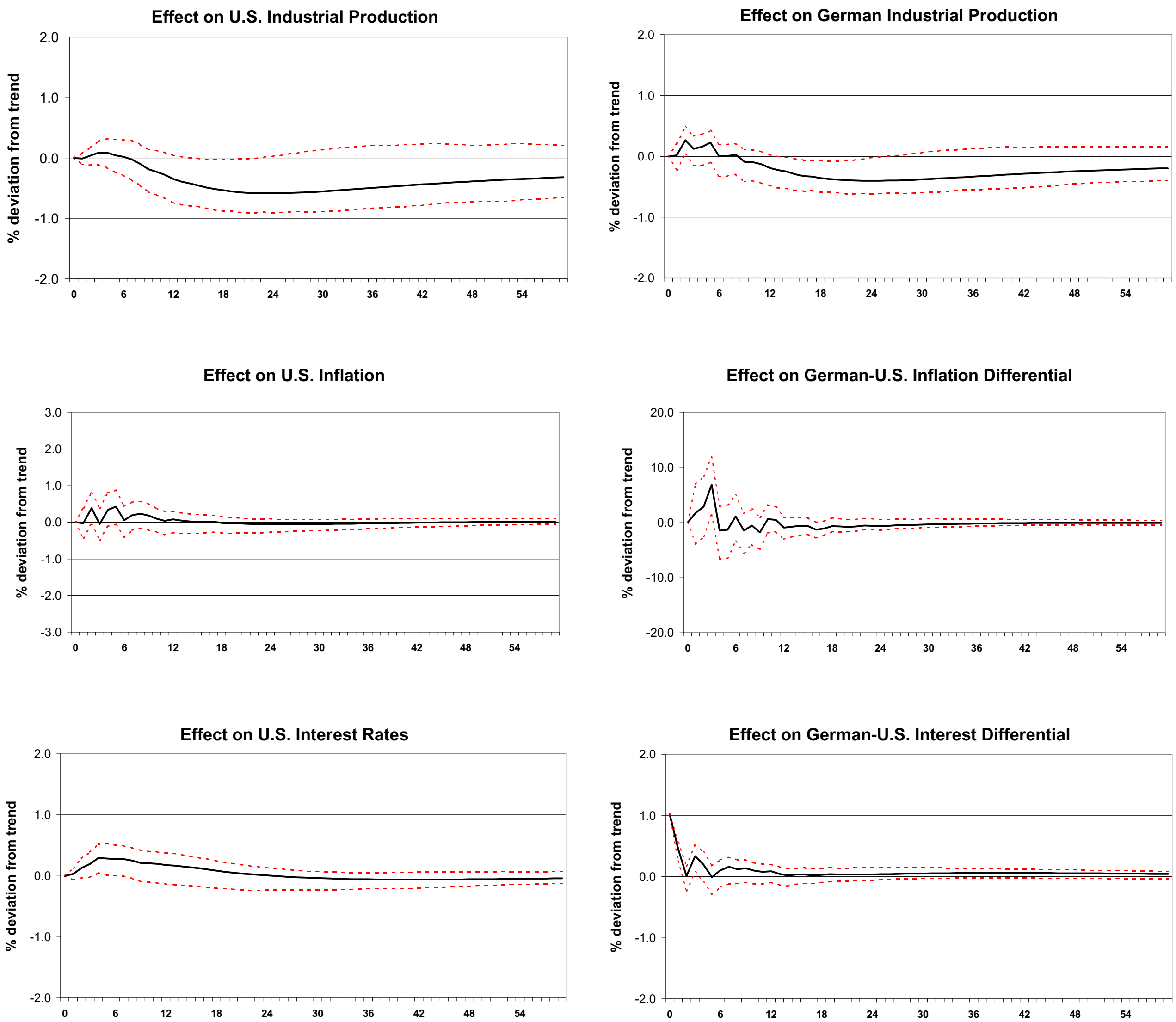


Figure 9

Impulse response functions: U.S. vs. Canadian Industrial Production

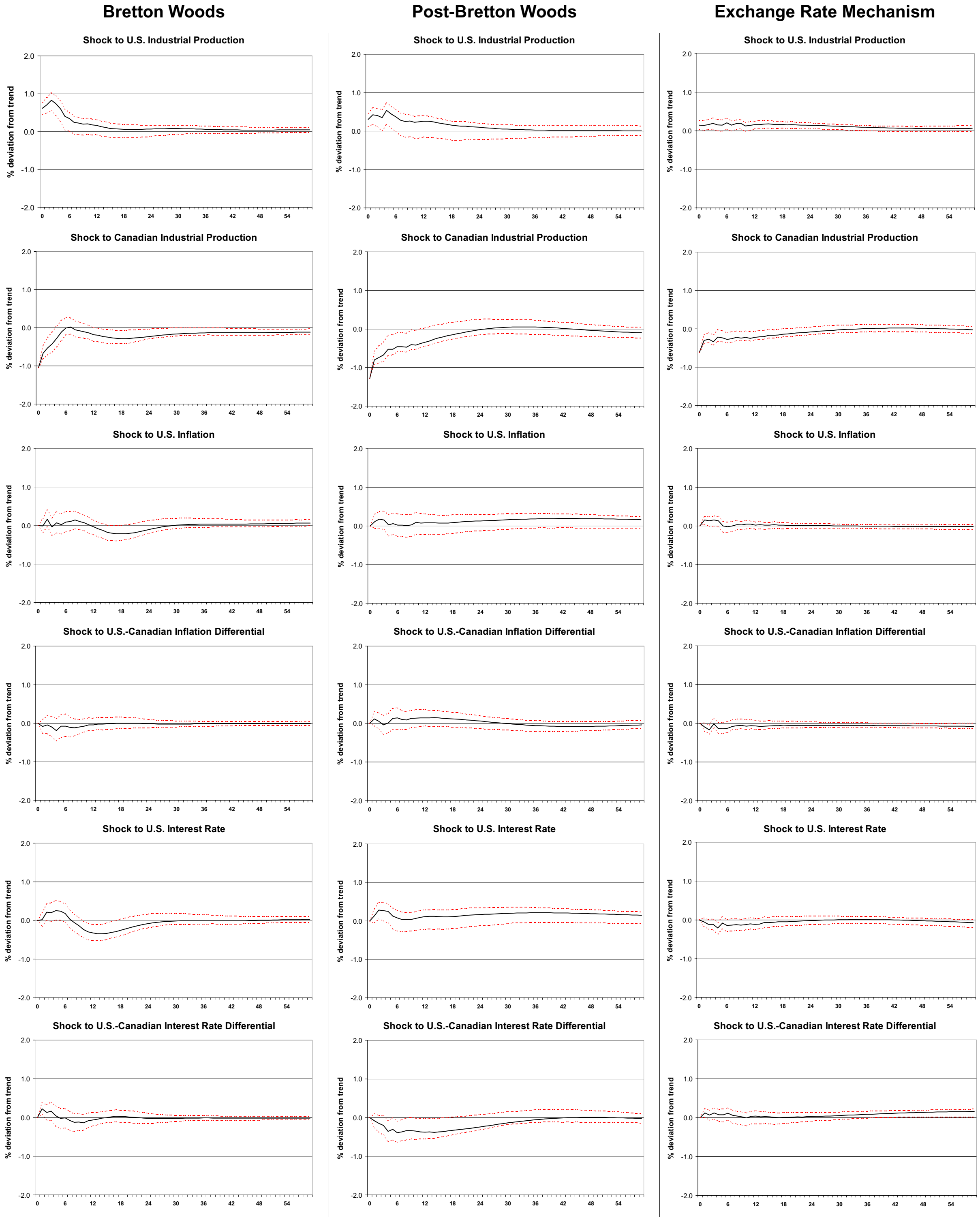


Figure 10

Impulse response functions: U.S. vs. French Industrial Production

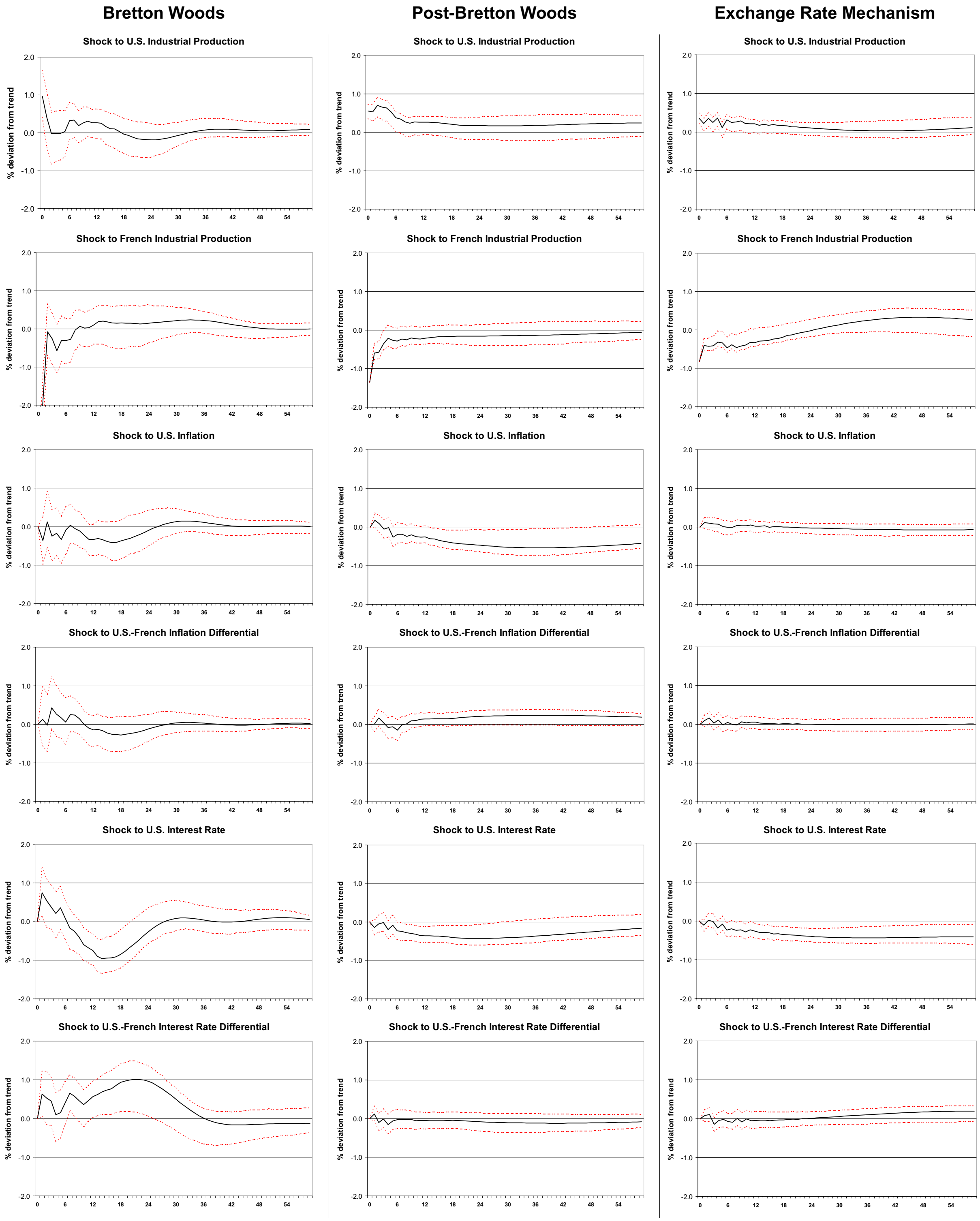


Figure 11

Impulse response functions: U.S. vs. German Industrial Production

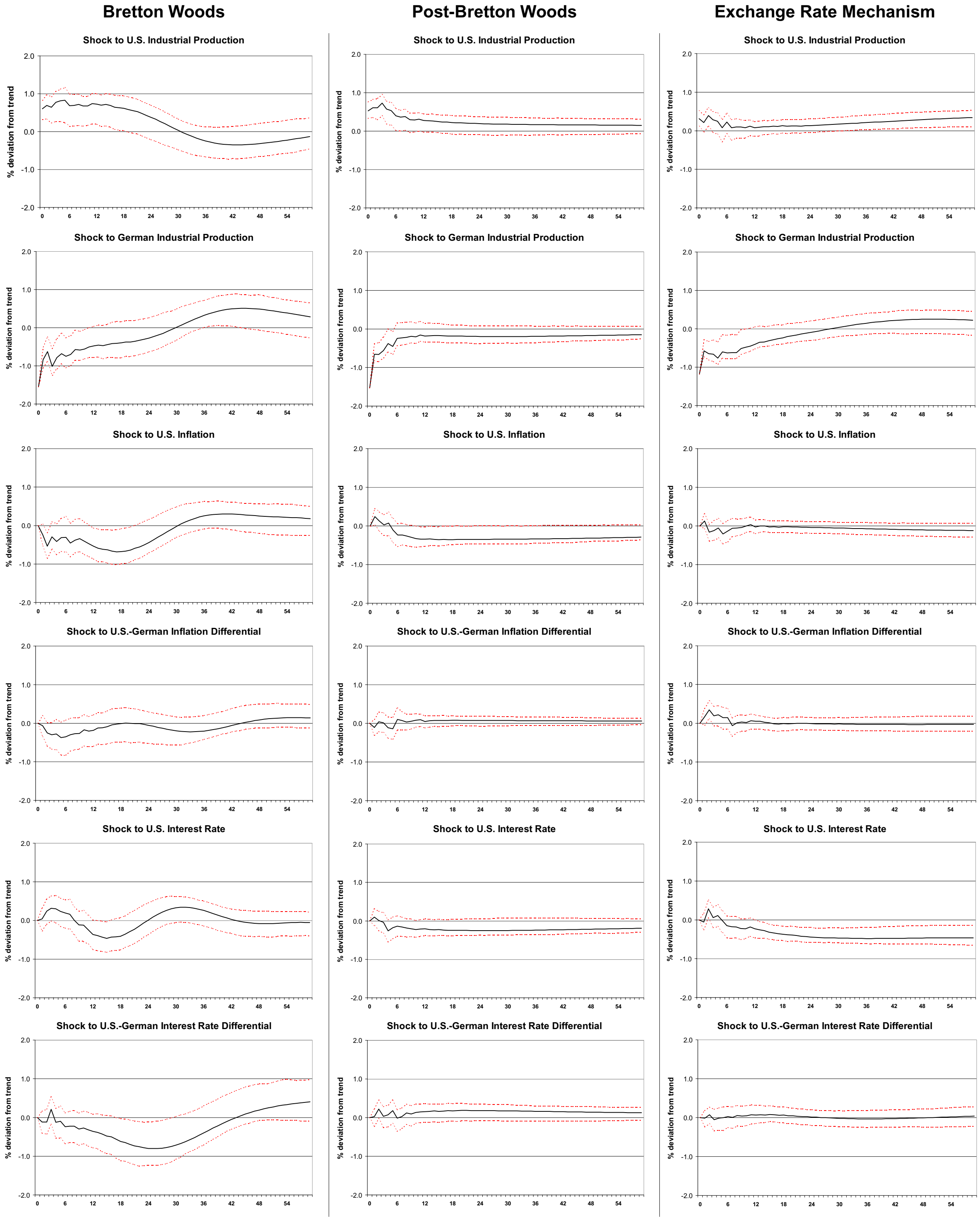


Figure 12

Impulse response functions: U.S. vs. Italian Industrial Production

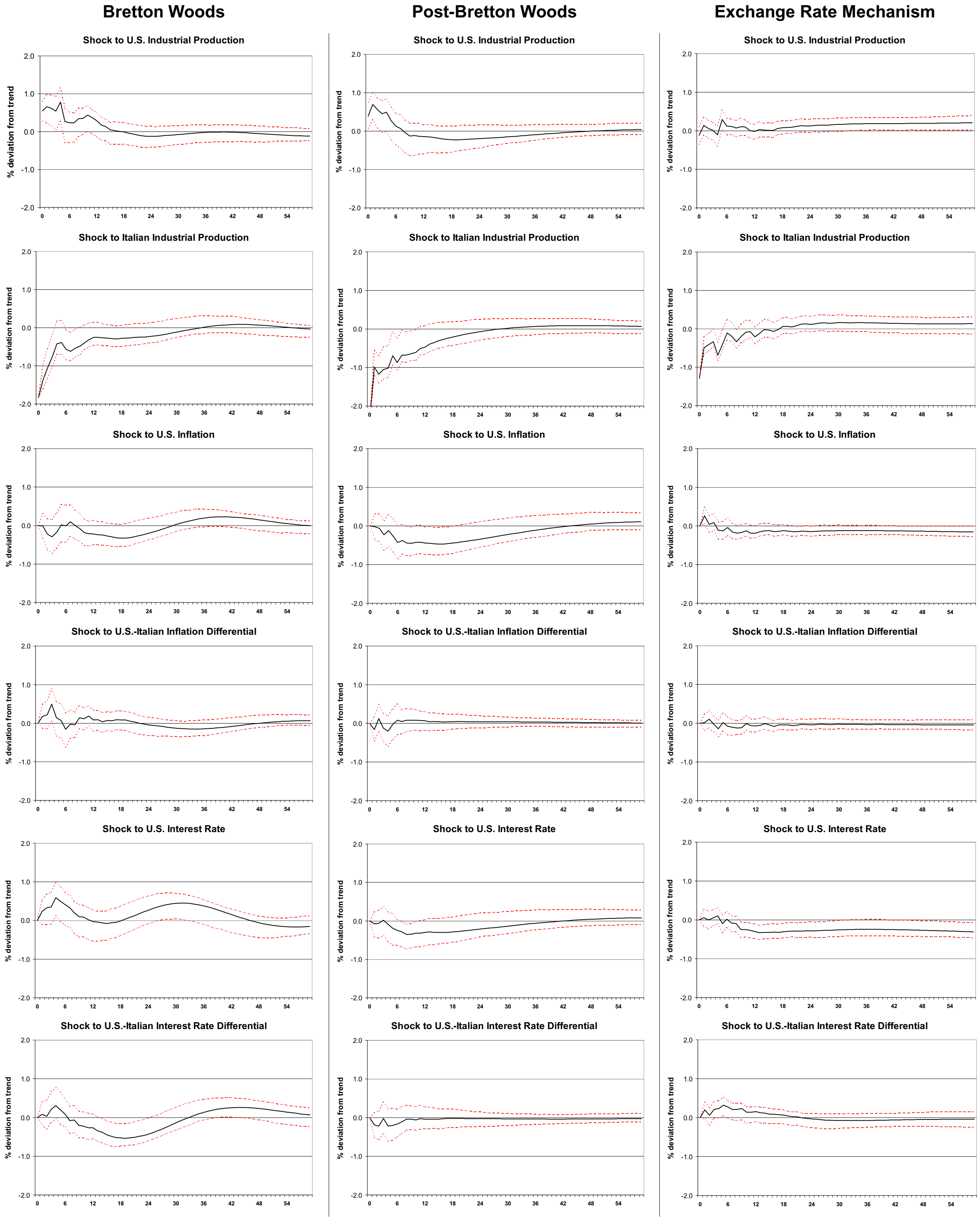


Figure 13

Impulse response functions: U.S. vs. Japanese Industrial Production

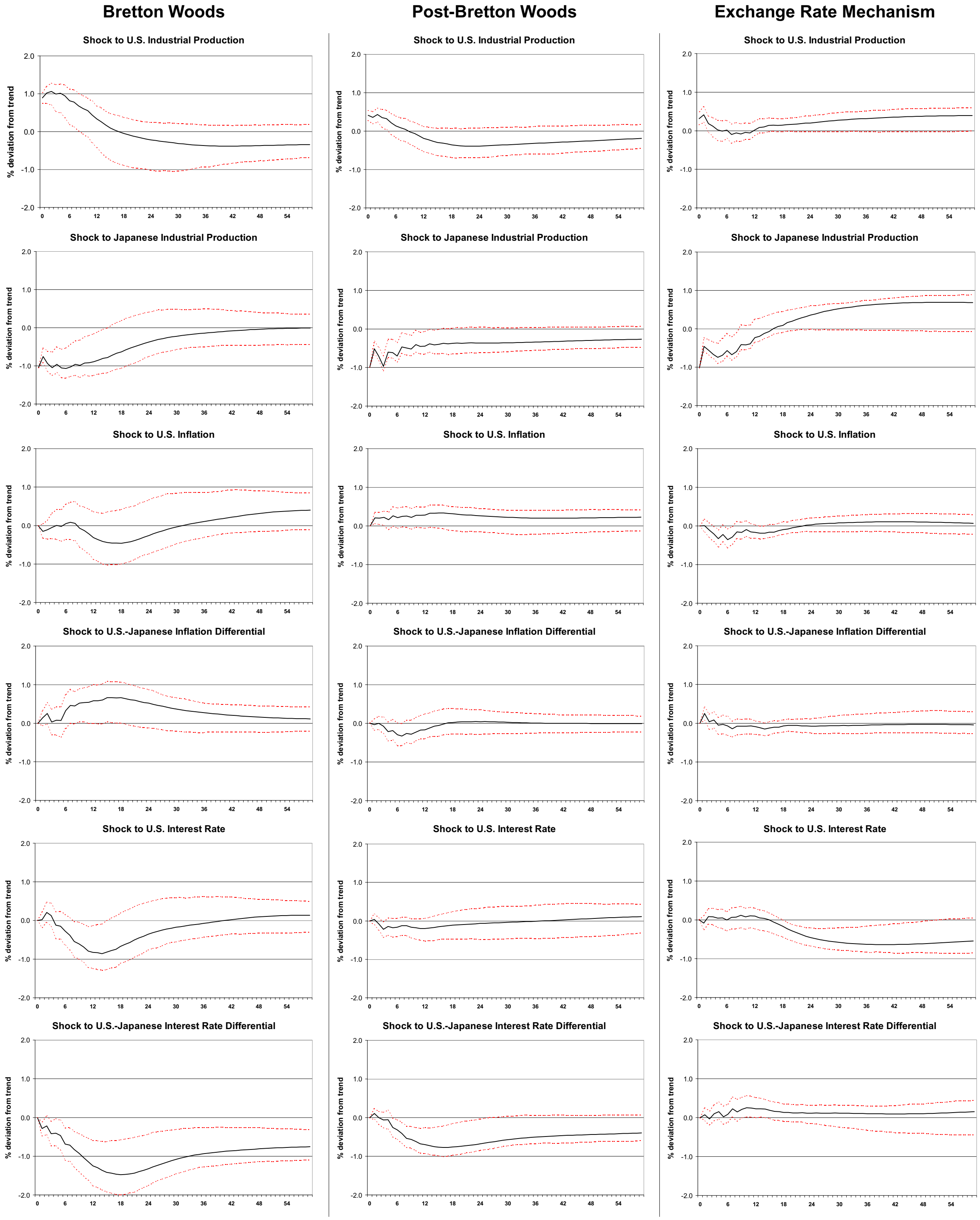


Figure 14

Impulse response functions: U.S. vs. U.K. Industrial Production

Bretton Woods | **Post-Bretton Woods** | **Exchange Rate Mechanism**

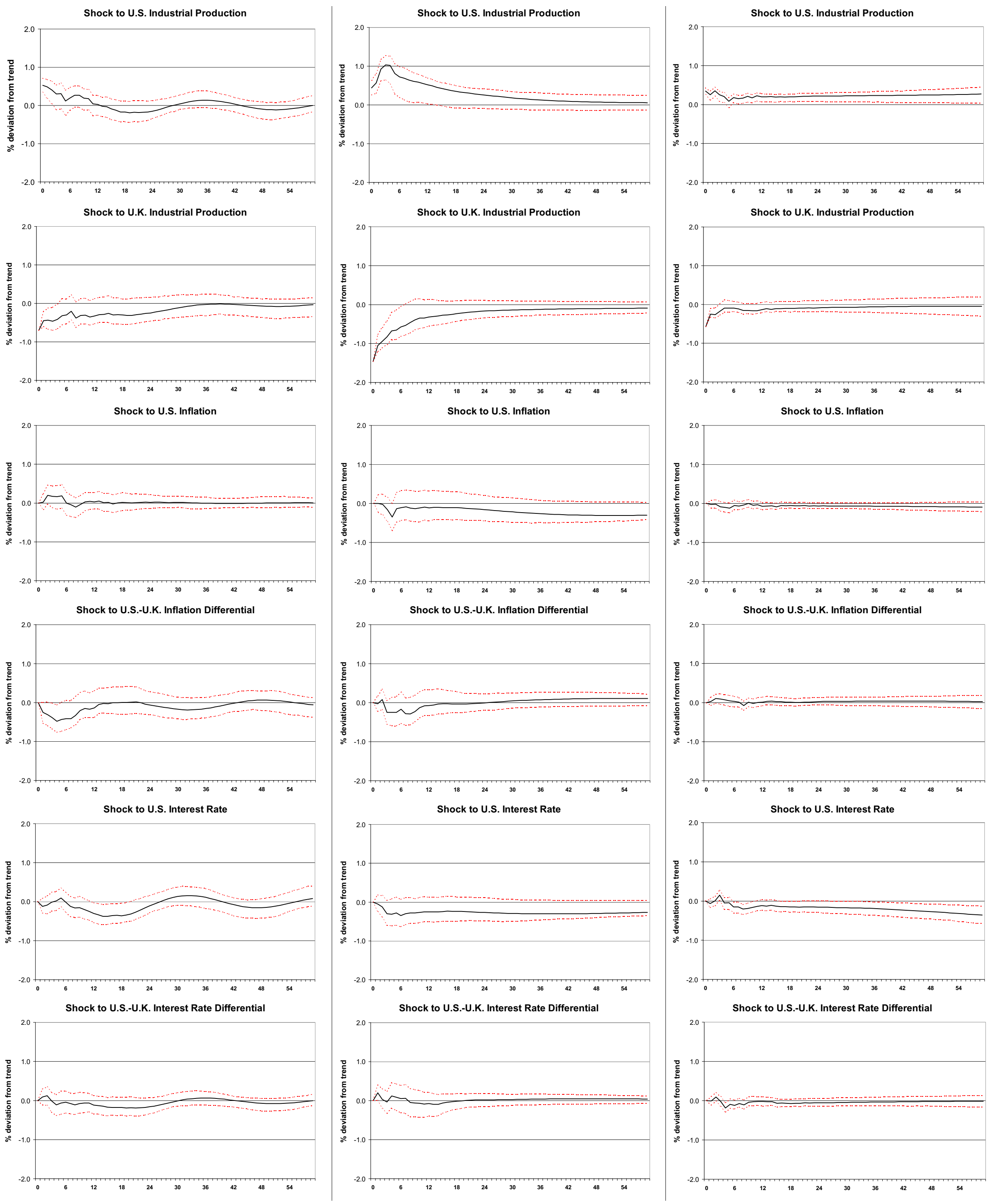


Figure 15

Impulse response functions: German vs. French Industrial Production

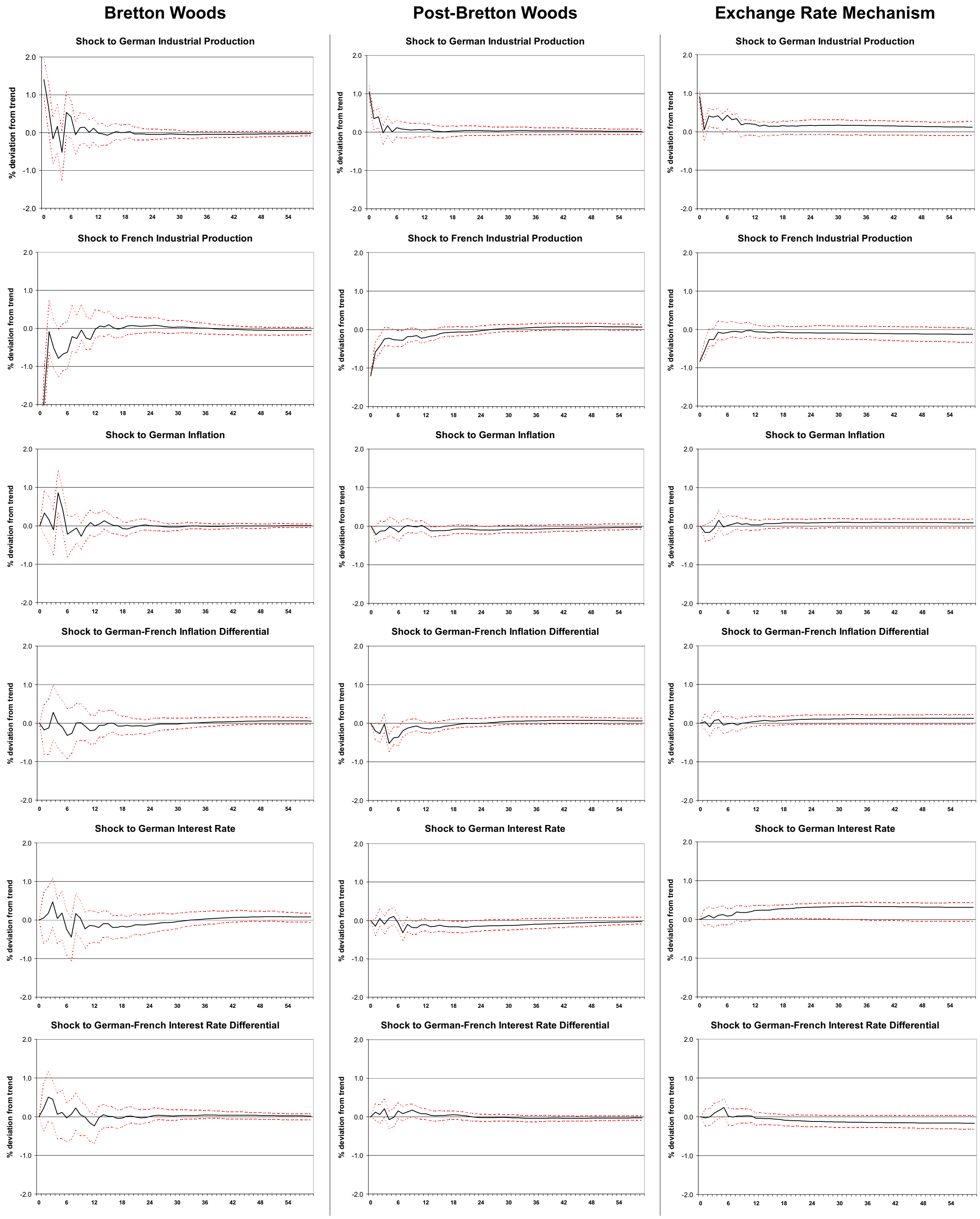


Figure 16

Impulse response functions: German vs. Italian Industrial Production

Bretton Woods | **Post-Bretton Woods** | **Exchange Rate Mechanism**

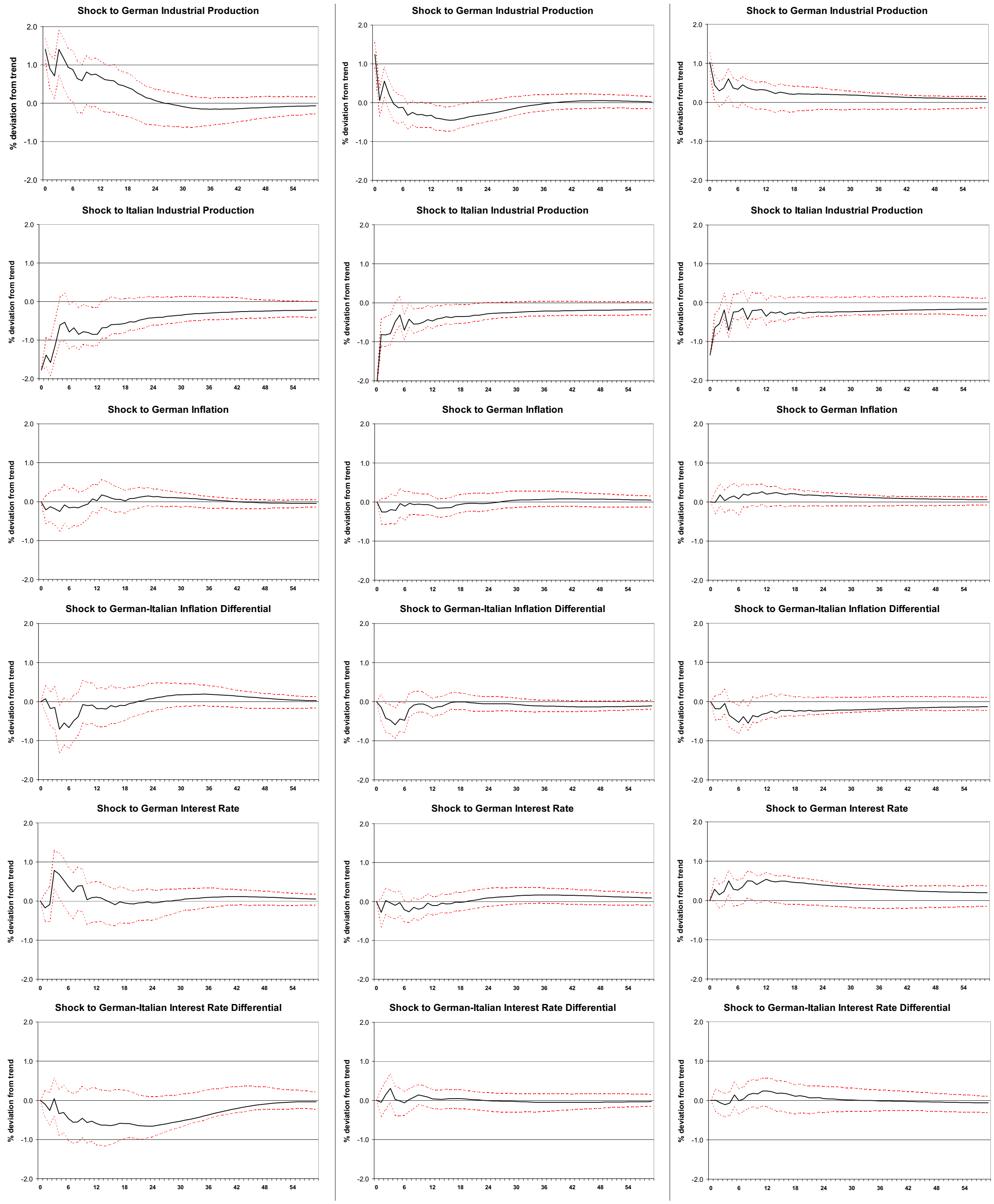


Figure 17

Impulse response functions: German vs. Japanese Industrial Production

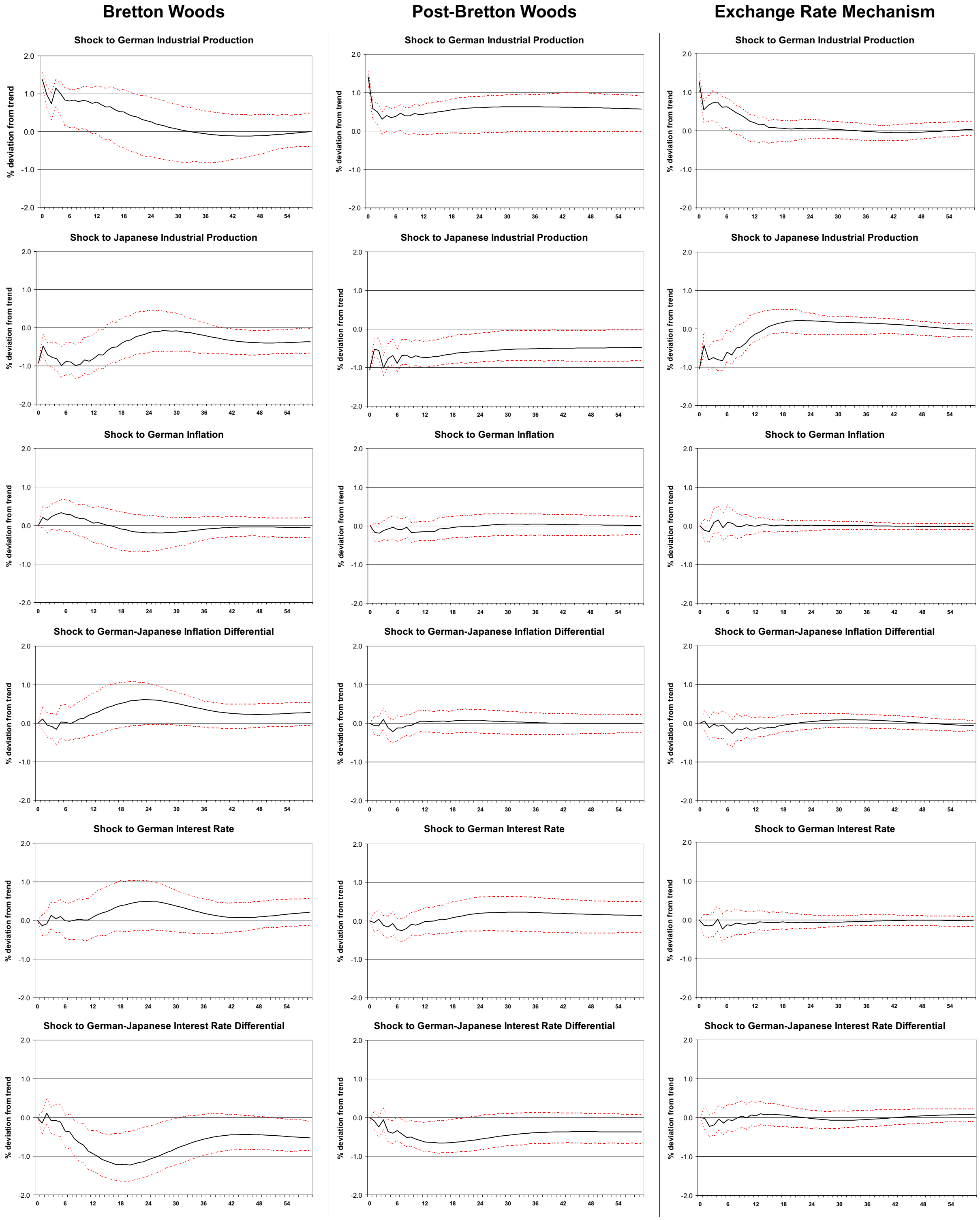


Figure 18

Impulse response functions: German vs. U.K. Industrial Production

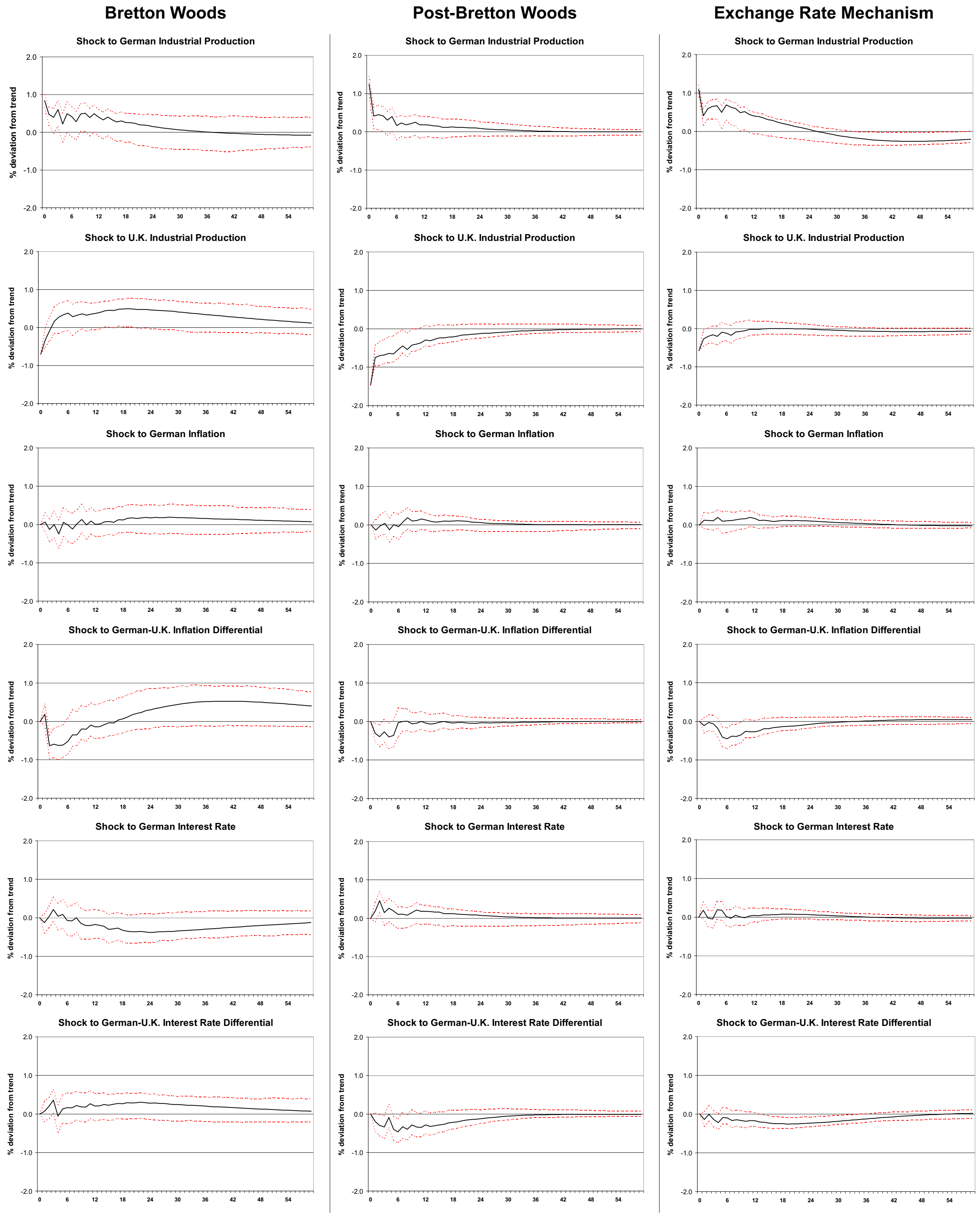


Figure 19

Impulse response functions: German vs. U.S. Industrial Production

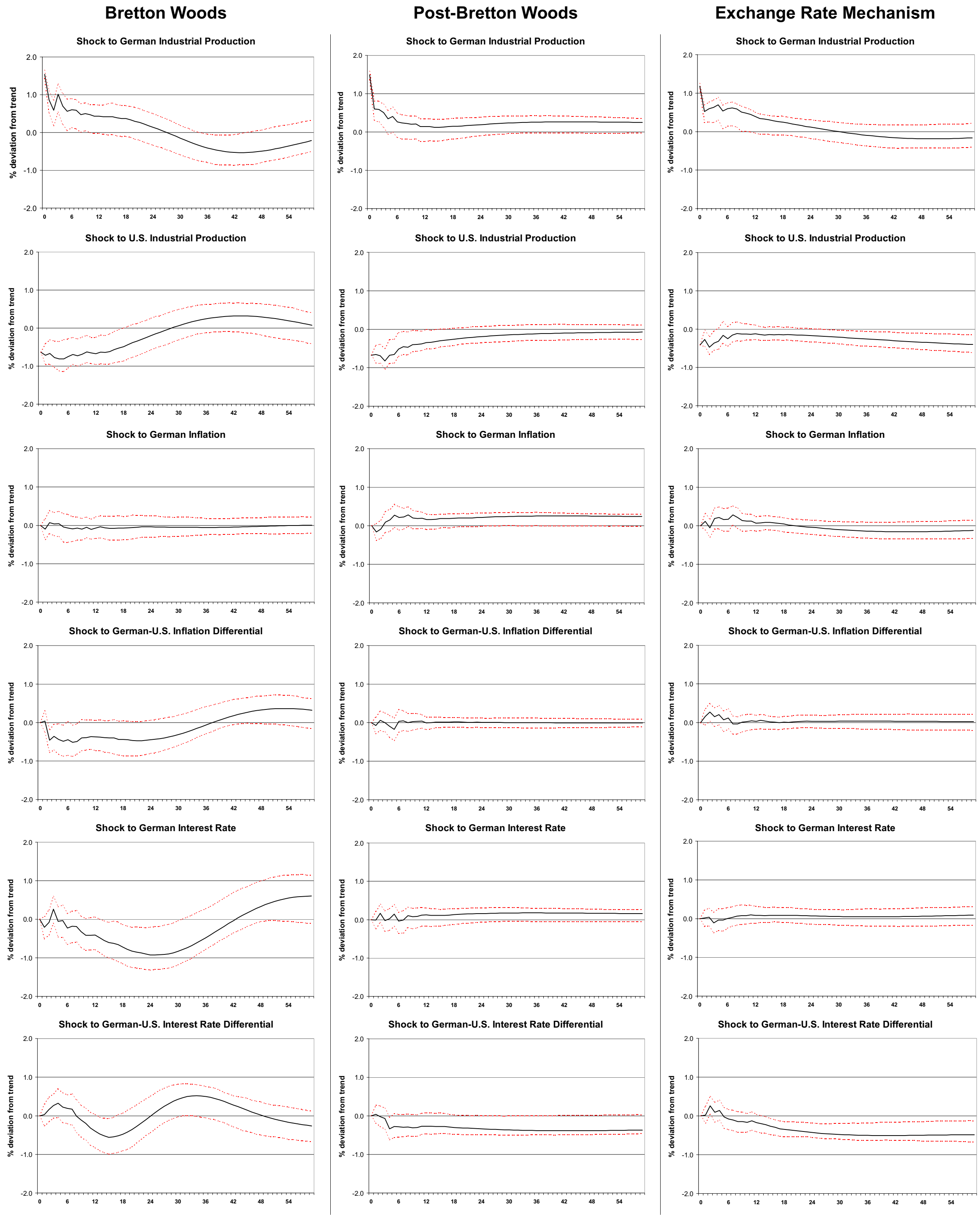


Figure 20

Impulse response functions: Japanese vs. German Industrial Production

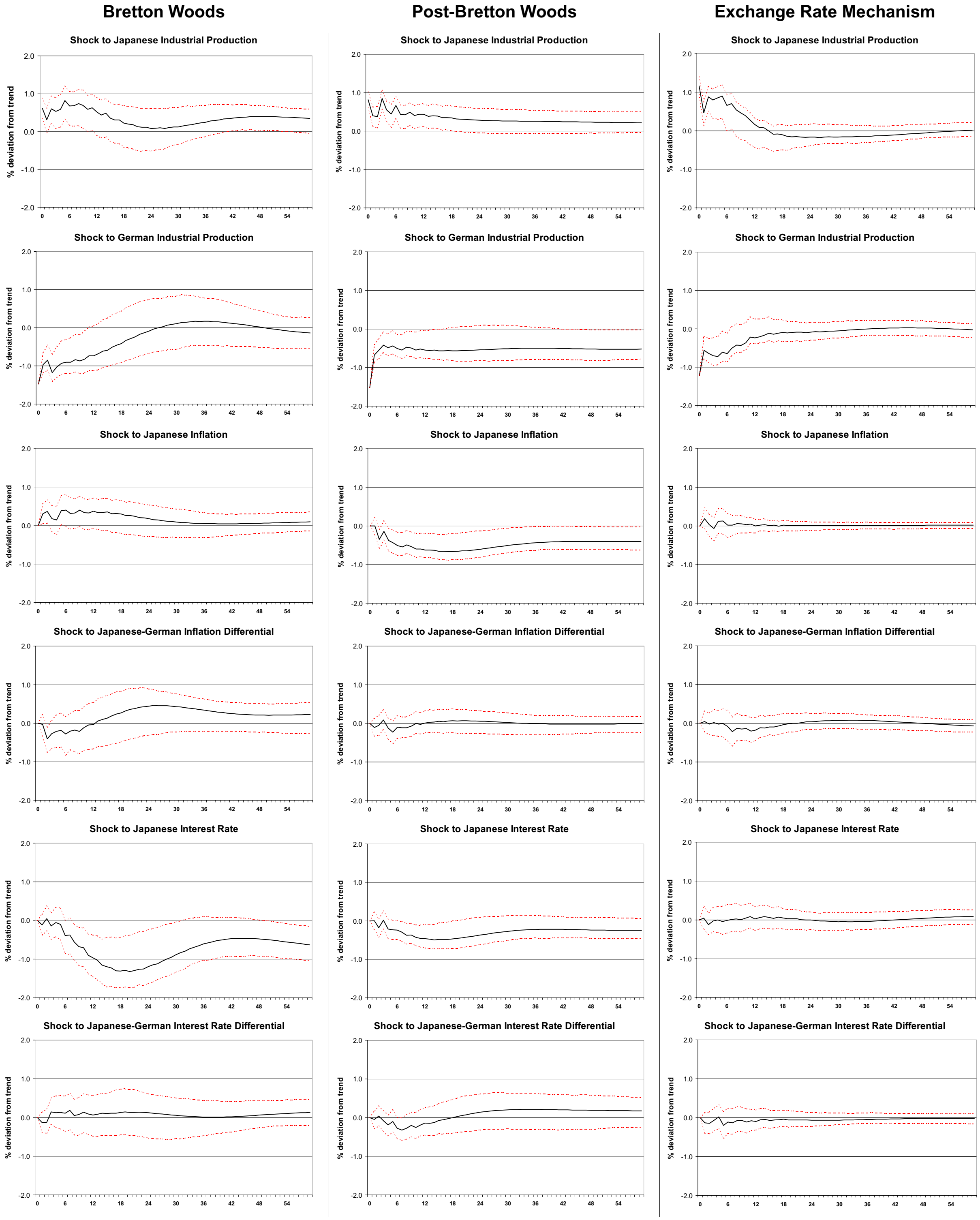
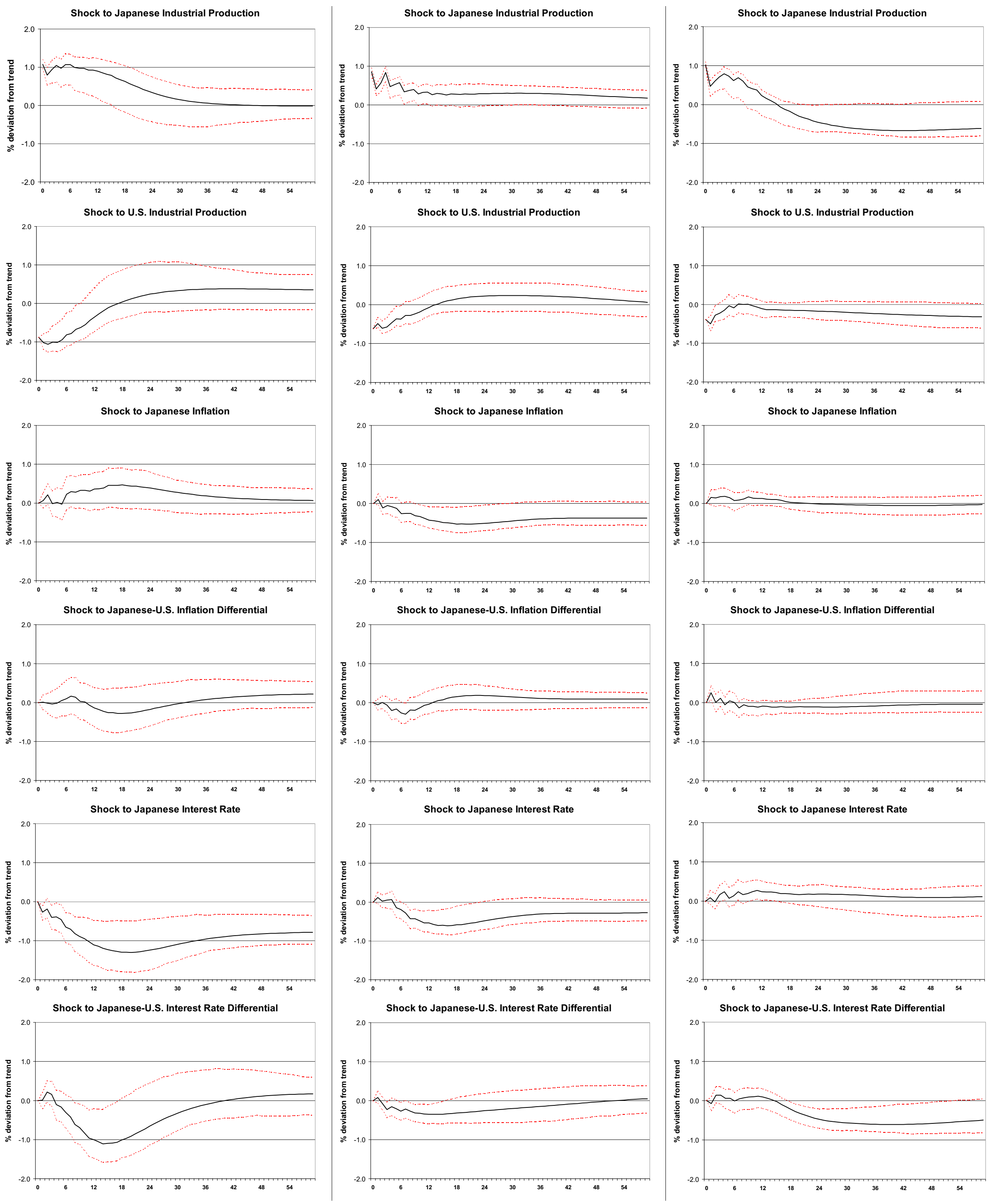


Figure 21

Impulse response functions: Japanese vs. U.S. Industrial Production

Bretton Woods | Post-Bretton Woods | Exchange Rate Mechanism



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