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Assessing the Importance of Global Shocks versus Country-specific Shocks

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Abstract

A common assumption is that global shocks have little influence on current accounts, relative output levels, and real exchange rates. We use a four-variable structural VAR of the Sims-Bernanke type that allows us to obtain a global shock and three country-specific shocks. We find that global shocks explain sizable portions real rate movements and bilateral current account balances. Our decomposition also allows us to measure the extent to which "third-country effects" are important in explaining bilateral real exchange rates and relative output levels.

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Assessing the Importance of Global Shocks versus Country-specific Shocks

1. Introduction

A common assumption in the open-economy macroeconomics literature is that global shocks have little influence on current account balances, relative output levels, and real exchange rates. The notion underlying this assumption is that global shocks affect all nations equally; in a sense, global shocks are like the tides that "cause all boats to rise and fall together." For example, Glick and Rogoff (1995), state "if all countries have identical preferences, technology, and initial capital stocks, then the change in a country's current account depends on its country-specific shock, but not on the global shock, since the latter impacts on all countries equally." In their empirical work, Glick and Rogoff (1995) construct a global shock as a weighted average of the productivity levels in the G7 countries. The individual country-specific shocks are then constructed as the deviations from this global average. They find that the global shocks have small effects, compared to country-specific shocks, in a regression of the current account.

The notion that global shocks affect all countries equally is so well embedded in the literature that it is often employed as a non-testable identifying restriction in open-economy macroeconometric models. For example, in their structural vector autoregressions, Kwark (1999), Hoffmann (2001), and Nason and Rogers (2002) invoke the assumption that global shocks have no effect on the current account in order to identify global and country-specific shocks. Similarly, Ng (2003) defines a global shock such that it has no contemporaneous effect on the real exchange rate. The idea is that global shocks have no effects on relative national price levels once they are converted into a common currency unit. Another line of research uses a dynamic factor model to identify global and country-specific shocks. For example, Gregory and

Head (1999) use a Kalman filter such that the global shock is identified as the component of the error term that causes all of the variables to move together.

The main aim of this paper is to identify global and country-specific shocks in a model that allows for the possibility that global events affect countries asymmetrically. As implied by the aforementioned quote from Glick and Rogoff (1995), global shocks will have differential effects on relative prices and the current account if countries have different tastes, technology, or initial capital stocks. Clearly, the effects of a sharp increase in the world's price of oil might be expected to affect oil-poor Japan more profoundly than it affects the United States. As such, we develop a structural vector autoregression (SVAR) such that global shocks *and* country-specific shocks are allowed to affect relative prices and relative output levels.

A secondary aim of the paper is to examine the importance of "third-country effects." Many papers abstract from such effects in that they assume that economic relations between countries 1 and 2 are not affected by events in country 3. Even though the assumption may not be explicit, any two-country model implicitly assumes that the influence of third-countries can be ignored. Moreover, in applied work, it is typical to employ a two-country model such that relative prices and output levels of two countries are not affected by events in a third country. Our SVAR allows us to measure the extent to which "third-country effects" are important in explaining bilateral real exchange rates and relative output levels. Furthermore, we use the structural shocks identified through our SVAR as explanatory variables in autoregressive (AR) models of the bilateral current accounts between the three countries analyzed to assess their relative importance.

To be a bit more specific, we develop a four-variable SVAR of the Sims-Bernanke type. The four variables of the model are the DM/Dollar and Yen/Dollar real exchange rates, and the

Germany/US and Japanese/US industrial production ratios. (Note that the DM/Yen real exchange rate and the German/Japanese industrial production ratio can be computed as ratios of the other variables in the system.) We decompose the four regression residuals into three country-specific shocks and one global shock. The global shock is unrestricted in the sense that it can affect all countries contemporaneously and in the long run. The country-specific shock is restricted to affect other countries with a lag of at least one period. Since the global shock is unrestricted, our decomposition allows us to measure the importance of global versus country-specific (i.e., idiosyncratic) shocks in explaining the variation in real exchange rates and relative output levels.

To preview our results, we find little evidence that third-country effects are important. The maximal impact is that the US-shock explains 12% of the forecast-error variance of the Japanese/German industrial production ratio. Moreover, we find that global shocks have little effect on relative output levels. As such, our findings seem to support the conventional view of global and country-specific shocks. However, we do find that global shocks explain almost all of the movements in the German/US real exchange rate and sizable portions of the movements in the other two real rates. We also find that global shocks are significant in explaining the changes in the bilateral current accounts between the three countries considered.

Of course, in the international economy, there are probably as many shocks as there are variables. Clearly, no single time-series decomposition from a small VAR such as ours can capture all varieties of shocks. Nevertheless, our findings should serve as a warning that the standard decompositions relying on the assumption that global shocks affect all countries equally can be seriously misleading.

2. Analytical Exposition of Country-specific and Global Shocks

A standard assumption in the international finance literature is that a country-specific shock in *i* affects economic variables only in *i*. In contrast, a global shock is one that affects several countries. In our view, the distinction between country-specific and global shocks should also be made with reference to the timing, and not just the effects, of the shocks. For example, a country-specific shock occurring in a large country, such as the US or Japan, can have lagged effects on other countries. Hence, if we use the standard definition, shocks to US or Japanese aggregate supply or demand that are ultimately transmitted to other countries would be classified as global shocks. In this paper we develop an identification scheme such that a country-specific shock in *i* has no *contemporaneous* effect on other countries. As such, it is possible for a country-specific shock in a large country to have world-wide effects, but only with a lag. In contrast, global shocks can affect several countries simultaneously.

To better explain the nature of our decomposition, consider a three-country world in which the value of some key economic variable—such as the price level or the income level—in country *i* is given by

$$x_{it} = \alpha_{i1}\varepsilon_{wt} + \alpha_{i2}\varepsilon_{it} \qquad i = 1, 2, 3$$

where: x_{it} is the natural logarithm of the variable of interest for country *i* in time period *t*, ε_{wt} is the global (or worldwide) shock in period *t*, ε_{it} is the country-specific shock for *i* in period *t*, and the α_{ij} are coefficients.

We classify the shocks by their consequences, not by their source. After all, almost any shock emanates from some particular country. In our classification system, shocks--such as 9/11 or an important announcement from a company such as Microsoft--with immediate worldwide consequences are global, not country-specific, shocks. Similarly, the sharp rise in the price of oil resulting from the hostilities between Israel and Hezbollah in July 2006 is classified as a global shock rather than an Iranian, Lebanese, or an Israeli shock. The shock is global because of its negative worldwide consequences, not because of its source. The sharp fall in the price of oil due to the August 2006 cease-fire is a positive global shock. In order to ensure that country-specific shocks do not have any immediate worldwide consequences, it is necessary to assume that country-specific shocks are orthogonal to each other and to the global shock. Formally, we assume that $E\varepsilon_{wt}\varepsilon_{it} = 0$ and that $E\varepsilon_{it}\varepsilon_{jt} = 0$ $(i \neq j)$.

The impact of the global shock on country i is given by α_{i1}. Since the variables are in logs, if $\alpha_{11} = \alpha_{21} = \alpha_{31}$, the global shock will have no effect on the ratios of the variables ($x_{it} - x_{jt}$). Since one of our aims is to determine whether global shocks can affect real exchange rates, relative output levels, and the current account, we do not want to impose $\alpha_{11} = \alpha_{21} = \alpha_{31}$ as an identifying restriction in our SVAR.

2.1 An Empirical Identification Scheme

In order to empirically identify four distinct shocks, it is necessary to use a four-equation model. Consider a three-country model represented by the appropriately differenced four-variable VAR:

$$\begin{bmatrix} \Delta rgus_t \\ \Delta rjus_t \\ \Delta ygus_t \\ \Delta yjus_t \end{bmatrix} = \begin{bmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) & A_{14}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) & A_{24}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & A_{34}(L) \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) \end{bmatrix} \begin{bmatrix} \Delta rgus_{t-1} \\ \Delta rjus_{t-1} \\ \Delta ygus_{t-1} \\ \Delta yjus_{t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{bmatrix} \quad (1)$$

where: $rgus_t$ is the log of the real exchange rate between Germany and the US, $rjus_t$ is the log of the real exchange rate between Japan and the US, $ygus_t$ is the log of German/US output, $yjus_t$ is the log of Japanese/US output, Δ is the difference operator, the $A_{ij}(L)$ are polynomials in the lag operator L, and the e_{it} are the regression residuals.

The regression residuals are composed of the three country-specific shocks and the global shock such that

$$\begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{bmatrix} = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} & \alpha_{24} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} & \alpha_{34} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_{gt} \\ \varepsilon_{jt} \\ \varepsilon_{ut} \\ \varepsilon_{wt} \end{bmatrix} \tag{2}$$

or $e_t = \alpha\varepsilon_t$

where: ε_{gt}, ε_{jt}, and ε_{ut} are the German, Japanese and US shocks, and ε_{wt} is the global, or worldwide, shock.

The nature of the four ε_{it} shocks is that they are all *i.i.d.* zero-mean random variables that are mutually uncorrelated in the sense that $E_{t-1}\varepsilon_{it}\varepsilon_{kt} = 0$ for $i \neq k$. Moreover, we normalize units so that the variance of each structural shock is unity. It is well-known that in this type of four-variable VAR, it is necessary to impose 6 additional restrictions to obtain an exactly identified system.[1] Intuitively, the estimated VAR yields 10 distinct elements of the variance/covariance matrix Ee_te_t'. Since α contains 16 elements, is necessary to impose 6 additional restrictions to exactly identify the α matrix. Consider the following six restrictions: $\alpha_{12} = \alpha_{21} = \alpha_{32} = \alpha_{41} = 0$, $\alpha_{13} = \alpha_{23}$, and $\alpha_{33} = \alpha_{34}$ so that

$$\begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{bmatrix} = \begin{bmatrix} \alpha_{11} & 0 & \alpha_{13} & \alpha_{14} \\ 0 & \alpha_{22} & \alpha_{13} & \alpha_{24} \\ \alpha_{31} & 0 & \alpha_{33} & \alpha_{34} \\ 0 & \alpha_{42} & \alpha_{33} & \alpha_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_{gt} \\ \varepsilon_{jt} \\ \varepsilon_{ut} \\ \varepsilon_{wt} \end{bmatrix}. \tag{3}$$

The first four restrictions have a straightforward interpretation. An ε_{jt} shock has no contemporaneous effect on $\Delta rgus_t$ if $\alpha_{12} = 0$ and has no contemporaneous effect on $\Delta ygus_t$ if $\alpha_{32} = 0$. In the same way, an ε_{gt} shock has no contemporaneous effect on $\Delta rjus_t$ if $\alpha_{21} = 0$ and has no

[1] Enders (2004) discusses the number of restrictions required for the identification of a structural VAR.

contemporaneous effect on $\Delta yjus_t$ if $\alpha_{41} = 0$. To explain the last two restrictions, notice that the log of the real exchange rate between Japan and Germany is $rgus_t - rjus_t$ and the log German/Japanese output is $ygus_t - yjus_t$. Hence, if $\alpha_{13} = \alpha_{23}$, the US shock will have no contemporaneous effect on the German/Japanese real exchange rate and if $\alpha_{33} = \alpha_{34}$, the US shock will have no contemporaneous effect on the German/Japanese output.

Since we do not restrict α_{14}, α_{24}, α_{34} or α_{44} to equal zero, our identification scheme allows global shocks to change relative output levels and real exchange rates. Nevertheless, we do not *force* global shocks to have asymmetric effects. If the standard assumption is correct (so that global shocks have only symmetric effects), we should find that all values of α_{i4} are equal to zero. Moreover, the lag structure should be such that global shocks explain none of the forecast error variance of real exchange rates and relative outputs. Hence, any findings that our identified global shocks affect relative output levels and/or real exchange rates are necessarily due to non-proportional effects of global shocks.

3. Results of the Decomposition

We obtained the quarterly values of the DM/Dollar and the Yen /Dollar nominal exchange rates, the consumer price index and the seasonally adjusted industrial production of the United States, Germany and Japan from March 1973 to June 2004 from the CD-ROM version of *International Financial Statistics*.[2] The real exchange rates were constructed as the nominal exchange rate multiplied by the price ratio between the relevant countries, and all the variables are expressed in logarithms. As a first-step, we performed unit-root tests on the log levels and on the logarithmic first-differences of the variables. As shown in Table 1, all six variables contain a

[2] The series for the DM/Dollar exchange rate is replaced by the Euro/Dollar exchange rate in January 1999. We used the DM/Euro fixed exchange rate to complete the series for the DM/Dollar exchange rate to 2004. All the variables are expressed as indexes using 2000 as the base year.

unit root but are stationary in first-differences. Moreover, as shown in Table 2, the Johansen test indicated that none of the variables are cointegrated using the 5% critical values.

[Insert Table 1 about here]

[Insert Table 2 about here]

The estimated VAR includes a constant and four lags of the first-difference of each variable (the lag length selection is based on a likelihood ratio test). The contemporaneous restrictions defined above allow us to derive the structural shocks from the VAR residuals using the restricted α matrix, and consequently to analyze their effects on the system from the variance decompositions. Notice that the responses of the German/Japanese real exchange rate and relative income levels can be obtained from $\Delta rgus_t - \Delta rjus_t$ and $\Delta ygus_t - \Delta yjus_t$, respectively.

3.1 Variance Decompositions

The variance decompositions shown in Table 3 were obtained by inverting the structural VAR.[3] Notice that the country-specific shock to Japan is the main determinant of the variability of both the Yen/Dollar and the DM/Yen real exchange rates (respectively $\Delta rjus_t$ and Δrgj_t). Specifically, the ε_{jt} series explains 73% in the first quarter and 64% after 8 quarters of the movements in the Yen/Dollar real exchange rate, and contributes to more than 72% of the forecast error variance of the DM/Yen real exchange rate. The remaining variability in the Yen/Dollar and the DM/Yen real exchange rates is due to the global shock (around 27% and 15%, respectively).

[Insert Table 2 about here]

[3] In standard form, our four-variable VAR can be expressed as $x_t = A(L)x_{t-1} + e_t$ where x_t contains the first-difference of the real exchange rates and bilateral outputs. Since $e_t = \alpha\varepsilon_t$, it follows that the structural VAR is $x_t = A(L)x_{t-1} + \alpha\varepsilon_t$. Solving for x_t, the structural vector moving average is $x_t = [I - A(L)L]^{-1}\alpha\varepsilon_t$. As such, each real exchange rate and bilateral output level can be expressed as a function of the current and lagged values of the four structural shocks ε_{gt}, ε_{jt}, ε_{ut} and ε_{wt}.

The DM/Dollar real exchange rate exhibits a different pattern; its variance is almost completely explained by the global shock (90% on average). The country specific shock to the US has almost no effect on $\Delta rgus_t$, $\Delta rjus_t$ and Δrgj_t at any forecast horizon (Note: By construction, it has no contemporaneous effect on Δrgj_t).

Although it does not seem to affect the real exchange rates, the US shock strongly influences the industrial production ratios fluctuations, especially between Japan and the US. We observe in Table 3 that more than 91% of the forecast error variance of this variable is due to the country specific shock to the US. Note that ε_{ut} shocks also explain around 33% of the forecast error variance of the industrial production ratio between Germany and US, while the German country specific shock is responsible for the remaining variability. Finally, the country-specific shock to Germany contributes to almost all the variance (99% in the first quarter and 87% after 8 quarters) of the change in the production ratio between Germany and Japan. It is worth noting that the global shock has only a minor impact on the industrial production ratios, which could mean that it affects all countries' industrial production levels proportionately.

For the structural vector moving average (VMA) representation of each variable, we also used F-tests to determine whether the coefficients on the current and lagged values of each structural shock were jointly equal to zero.[4] All were significant at the 0.001 level except for the effect of the global shock on the bilateral output level between Germany and the US. In this one case, the *prob*-value was 0.126. Hence, even though the magnitudes of the effects of the shocks can be small, the influence of the shocks is almost always statistically significant.

[4] We thank an anonymous referee for making this suggestion. Note that the structural VMA for any variable x_{it} can be written in the form $x_{it} = \Sigma\beta_{1k}\varepsilon_{gt-k} + \Sigma\beta_{2k}\varepsilon_{jt-k} + \Sigma\beta_{3k}\varepsilon_{ut-k} + \Sigma\beta_{4k}\varepsilon_{wt-k}$ where the index of summation, *k,* begins at zero. Since country-specific shocks to country *i* affect only *i*-variables contemporaneously, one of the values of β_{10}, β_{20}, or β_{30} is necessarily equal to zero. The *prob*-values are for the null hypothesis that $\beta_{i0} = \beta_{i1} = \beta_{i2} = \ldots = 0$.

The essential point is that there is only weak evidence supporting the conventional view that global shocks influence all nations proportionately. It is true that global shocks explain relatively small amounts of the movements in relative output levels. However, global shocks explain almost all of the movements in the DM/Dollar real exchange rate and sizable portions of the movements in the other two real rates. As such, our identified global shocks alter relative prices but not relative outputs. As Glick and Rogoff (1995) imply, global shocks can affect countries asymmetrically if nations have different preferences, technologies and/or capital stocks.

3.2 Historical Effects of the Shocks

Figures 1 and 2 show what the real exchange rates would look like if they were subject to only one type of structural shock. These historical decompositions are another way to assess the relative importance of each shock on the variables in the system. It appears from the graphs that the information contained in the historical decomposition is similar to that deduced from the variance decomposition.

[Insert Figure 1 about here]

[Insert Figure 2 about here]

Historically, the evolution of the DM/Dollar real exchange rate appears to be largely the result of the global shock since the actual sequence follows closely what the sequence would have been if there was only the global shock (Figure 1, Panel d). The country-specific shocks to the US and to Japan do not seem to exert any effect on the DM/Dollar real exchange rate (Panels b and c respectively) while the country-specific shock to Germany, at best, may have been the source of some of the trends in the series (Panel a).

It is also very clear from Figure 2 that the global shock is responsible for the shape of the Yen/Dollar real exchange rate along with the country specific shock to Japan (Panels d and c respectively). The influence of the country-specific shocks to Germany and to the US on the evolution of the Yen/Dollar real exchange rate is insignificant (Panels a and b respectively).

Since the global shock is central in explaining real exchange rate movements, it should also influence current account balances. We investigate this assumption in the following section by performing tests of the effects of the global and country-specific shocks on the bilateral current accounts between Germany, Japan and the US.

4. Effects of the Structural Shocks on the Bilateral Current Accounts

Since the aggregate value of a nation's current account may be affected by each of its trading partners, we measure the influence of our identified structural shocks on bilateral current account balances. Also contrary to previous studies, we focus on the real value of the current account (instead of the nominal value) since it is more relevant to compare variables expressed in terms of goods than variables expressed in units of money across time.

We use quarterly data for the bilateral real current accounts between Germany, Japan and the US over the period 1974:2-2004:2. The data for the bilateral current accounts involving Germany (Germany/ US and Germany/Japan), and for the German producer price index are obtained from the *Deutsche Bundesbank* (Central Bank of Germany) website; the sources of the data for the bilateral current account between the US and Japan, and for the US producer price index are respectively the *Bureau of Economic Analysis* (U.S. Department of Commerce) and the CD-ROM version of *International Financial Statistics.*

The bilateral real current accounts are obtained by deflating the nominal current accounts by the relevant producer price indexes. All three bilateral current accounts contain a unit root but are stationary in first differences.[5] As such, we estimate autoregressive models (AR) of the change in the bilateral real current accounts including the structural shocks identified in the previous section as regressors. We introduce lags of the dependent variable in the AR model so as to correct for autocorrelation in the residuals and for potential seasonal effects.[6]

The current accounts are regressed on the contemporaneous and lagged values of the shocks to account for the impact effect of the shocks and for potential persistence effects.[7] The estimated models have the form:

$$\Delta ca_t = \sum_{i=1}^{k} \lambda_i \Delta ca_{t-i} + \sum_{i=0}^{k1} \beta_{1i}\varepsilon_{gt-i} + \sum_{i=0}^{k2} \beta_{2i}\varepsilon_{jt-i} + \sum_{i=0}^{k3} \beta_{3i}\varepsilon_{ut-i} + \sum_{i=0}^{k4} \beta_{4i}\varepsilon_{wt-i} + v_t \quad (4)$$

where Δca_t represents the change in the bilateral real current account, ε_g, ε_j, ε_u and ε_w are the country-specific shocks to Germany, Japan, the US and the global shock, the λ_i and β_{ji} are constants, and v_t is a white-noise error-term.

F-tests are used to determine the joint significance of each shock and its lagged values (if significant) on the bilateral current accounts. The main results are presented in Table 4.[8] For the bilateral German/US current account, the global shock is significant at the 1% level, the US shock is significant at the 5% level, and the German shock is significant at the 10% level. The global shock is also highly significant in the regression of the bilateral current account between Germany and Japan, and its effects on the bilateral current account between the US and Japan cannot be rejected at the 5% level.

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[5] The results of the unit root tests are given in an unpublished Appendix available from the authors.

[6] The results are slightly sensitive to the way we correct for seasonality, and we based our choice on a residuals analysis. If we use deterministic seasonal dummies, the global shock remains highly significant in the majority of the cases and the effects of the country-specific shocks are similar, particularly for the US shock.

[7] The lag lengths for the shocks are determined as a function of their significance. We use F-tests on the lagged coefficients and include the lags as long as they are significant below the 10% level.

[8] The details of the regressions are given in the unpublished Appendix.

[Insert Table 4 about here]

The movements in the bilateral current account between the US and Japan are also significantly influenced by the US country-specific shock (at the 1% level), while the country-specific shock to Japan has a *prob*-value of 0.055 in the equation for the bilateral real current account between Germany and Japan. The key result is that the global shock matters as much as the country-specific shocks (or more) in explaining the variations in the bilateral current accounts. These results seem to contradict the main belief that global shocks do not exert any effect on relative variables and on the current account. Also notice that the results reported in Table 4 support our previous finding that third-country effects do not matter for the three large countries considered in our analysis.

5. Conclusion

In contrast to the standard assumptions of open-economy macroeconomics, we allow global shocks to affect all variables contemporaneously as well as in the long run. Our identifying assumption is that country-specific shocks have no contemporaneous effects on other countries. When we impose the implied set of identifying restrictions on a 4-variable VAR, we find that the main source of fluctuations in the DM/Yen and the Yen/Dollar real exchange rates is the country-specific shock to Japan (and to a lesser extent the global shock). The DM/Dollar real exchange rate is mainly driven by the global shock. The US shock explains much of the variability in the Japanese/US and the German/US industrial production ratios. The German shock is the major determinant of the German/Japanese and the Germany/US (the latter is also affected to a lesser extent by the US shock).

Since the global shock is important only for real exchange rate behavior, it is possible that global shocks exert a proportionate impact on the industrial production ratios. In the face of differing demand patterns, such global shocks would alter real exchange rates. As a consequence, the global shock is also expected to affect the bilateral current accounts between the countries considered. We find evidence in favor of this presumption since the global shock is significant in explaining movements in all three bilateral real current accounts between Germany, Japan and the US. A second important finding is that third-country shocks do not matter in the analysis of the evolution and variability of bilateral variables like real exchange rates and industrial production ratios. This provides support to the standard practice of ignoring events in third-countries when analyzing relative prices and output levels in two-country models.

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Figure Headings, and Legends

Note that each figure has four panels *a* through *d*. Each panel has its own header and legend.

Figure 1: Historical effects of shocks on the DM/Dollar real exchange rate

a: Effects of German shock

____ Effect of German Shock _ _ _ Actual Rate

b: Effects of US shock

____ Effect of US Shock _ _ _ Actual Rate

c: Effects of Japanese shock

____ Effect of Japanese Shock _ _ _ Actual Rate

d: Effects of global shock

____ Effect of Global Shock _ _ _ Actual Rate

Figure 2: Historical effects of shocks on the Yen/Dollar exchange rate

a: Effects of German shock

____ Effect of German Shock _ _ _ Actual Rate

b: Effects of US shock

____ Effect of US Shock _ _ _ Actual Rate

c: Effects of Japanese shock

____ Effect of Japanese Shock _ _ _ Actual Rate

d: Effects of global shock

____ Effect of Global Shock _ _ _ Actual Rate

Table 1: Unit root tests (Augmented Dickey-Fuller tests)

Variables in log-levels	Φ_3-statistic	τ_μ	First differences	τ_μ
rgus	3.97	-2.73	$\Delta rgus$	-4.43
rjus	3.62	-2.35	$\Delta rjus$	-4.92
rgj	3.77	-2.04	Δrgj	-6.35
ygus	3.35	-0.37	$\Delta ygus$	-3.85
yjus	1.10	-0.86	$\Delta yjus$	-4.20
ygj	2.18	-1.12	$\Delta ypgj$	-5.01

The Dickey-Fuller Φ_3 and τ_μ tests are discussed in Enders (2004). The critical values for Φ_3 are 6.49 and 8.73, respectively at the 5% and 1% significance level, while the critical values for τ_μ are –2.89 and –3.51, respectively at the 5% and 1% significance level.

Table 2: Cointegration Tests

Variables[1]	Eigenvalues	Null Hypothesis[2]	Trace Statistic[3]	5% Critical Value	Deterministic Regressors[4]
rgus, rgus	0.0768	$r = 0$	14.43	15.41	Constant in the
	0.0386	$r = 1$	4.76	3.76	cointegrating vector
ipgus, ipjus	0.1419	$r = 0$	20.55	25.32	Trend in the
	0.0166	$r = 1$	2.03	12.25	cointegrating vector
rgus, rgus,	0.1424	$r = 0$	34.37	47.21	Trend in the
ipgus, ipjus	0.0999	$r = 1$	15.78	29.68	cointegrating vector
	0.0226	$r = 2$	3.04	15.41	
	0.0023	$r = 3$	0.28	3.76	

[1] Since all variables are in logs, the results using a base country other than the U.S. are redundant.

[2] Using the Johansen trace statistic, the alternative hypothesis is that the number of cointegrating vectors, r, exceeds that specified in the null.

[3] The λ-max version of the Johansen test never allowed us to reject the null hypothesis of $r = 0$ against the specific alternative hypothesis of $r = 1$.

[4] Cointegration tests were carried out for the real exchange rate pairs, industrial production pairs, and for all four of the variables. When testing for cointegration between the various real exchange rates, we allowed for a constant in the cointegration vector. When testing for cointegration using the industrial production series, we allowed for a constant and a trend in the cointegration vector.

Table 3: Variance Decompositions[1]

Percentage contribution of ε_g to

Horizon	$\Delta rgus$	$\Delta rjus$	Δrgj	$\Delta ygus$	$\Delta yjus$	Δygj
1-quarter	1.977	0.000	1.002	63.495	0.000	99.486
4-quarter	4.427	0.630	7.459	61.496	0.589	90.711
8-quarter	5.287	4.851	9.742	63.795	1.563	87.010
12-quarter	5.686	6.039	10.421	64.710	1.740	86.384
16-quarter	5.830	6.496	10.663	65.081	1.818	86.187

Percentage contribution of ε_j to

Horizon	$\Delta rgus$	$\Delta rjus$	Δrgj	$\Delta ygus$	$\Delta yjus$	Δygj
1-quarter	0.000	72.366	81.365	0.000	1.483	0.420
4-quarter	2.648	68.731	75.597	2.125	4.539	0.473
8-quarter	3.875	64.193	73.175	2.196	4.603	0.833
12-quarter	3.884	63.231	72.519	2.199	4.605	0.869
16-quarter	3.882	62.832	72.267	2.205	4.604	0.886

Percentage contribution of ε_u to

Horizon	$\Delta rgus$	$\Delta rjus$	Δrgj	$\Delta ygus$	$\Delta yjus$	Δygj
1-quarter	1.948	1.645	0.000	35.600	95.024	0.000
4-quarter	2.713	2.588	2.029	34.709	92.028	7.711
8-quarter	2.782	3.294	2.741	32.388	90.914	11.161
12-quarter	2.851	3.503	2.842	31.541	90.726	11.807
16-quarter	2.886	3.621	2.901	31.196	90.651	12.009

Percentage contribution of ε_w to

Horizon	$\Delta rgus$	$\Delta rjus$	Δrgj	$\Delta ygus$	$\Delta yjus$	Δygj
1-quarter	96.076	25.990	17.633	0.905	3.492	0.094
4-quarter	90.212	28.052	14.915	1.669	2.844	1.106
8-quarter	88.056	27.661	14.342	1.621	2.920	0.996
12-quarter	87.579	27.227	14.218	1.549	2.929	0.941
16-quarter	87.402	27.051	14.169	1.518	2.928	0.917

[1] For every horizon, the percentage contribution of ε_g, ε_j, ε_u and ε_w to each of the variables should sum to 100%.

Table 4: Effects of the country-specific and global shocks on the (change in the) real bilateral current accounts

	Germany/US bilateral real CA	US/Japan bilateral real CA	Germany/Japan bilateral real CA
German shock	2.59*	0.63	2.57
	(0.057)	(0.430)	(0.111)
Japanese shock	1.65	0.53	3.77*
	(0.168)	(0.470)	(0.055)
US shock	2.89**	10.09***	1.73
	(0.04)	(0.0019)	(0.135)
Global shock	5.57***	2.86**	4.61***
	(0.005)	(0.040)	(0.005)

The values in the table are F-statistics for the joint hypothesis that the coefficients of the contemporaneous and lagged values (if any) of each shock are zero and the numbers in parenthesis are *prob*-values. The symbols *, **, and *** indicate that the coefficients are significant at the 10%, 5% and 1% significance levels, respectively.

Figure 1: Historical effects of shocks on the DM/Dollar real exchange rate

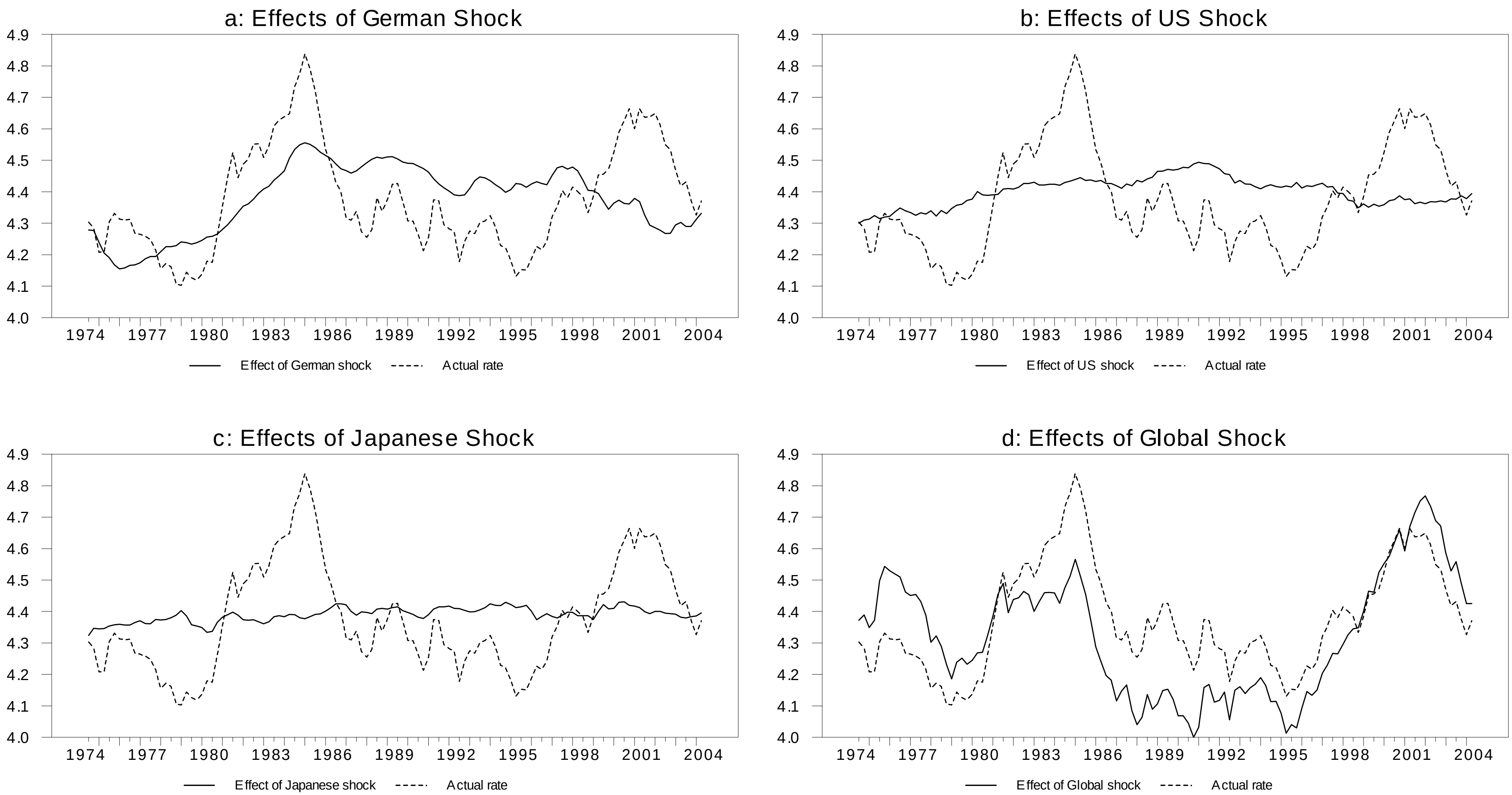

Figure 2: Historical effects of shocks on the Yen/Dollar real exchange rate