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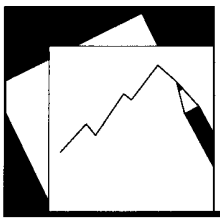

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Information Rigidity in Growth Forecasts: Some Cross-Country Evidence

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Information Rigidity in Growth Forecasts: Some Cross-Country Evidence

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Abstract

We document information rigidity in forecasts for real GDP growth in 46 countries over the past two decades. We investigate: (i) if rigidities are lower around turning points in the economy, such as in times of recessions and crises; (ii) if rigidities differ across countries, particularly between advanced countries and emerging markets; and (iii) how quickly forecasters incorporate news about growth in other countries into their growth forecasts, with a focus on how advanced countries' growth forecasts incorporate news about emerging market growth and vice versa.

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I. Introduction

This paper studies the properties of forecasts of real GDP growth for 46 economies over the past two decades. The source of the data is *Consensus Forecasts*, which covers both advanced economies (the label used by the IMF's *World Economic Outlook* to refer to high-income economies) and major emerging market economies. The structure of the data—forecasters provide monthly or bimonthly updates of their forecasts of a fixed event (viz. annual real GDP growth)—allows for a simple way to document the sluggishness with which news is absorbed into growth forecasts. And the wide country coverage allows us to look at differences in information rigidities between advanced and emerging market groups, and at linkages between forecast revisions in advanced countries and emerging market economies.

Our main findings are as follows. First, there is considerable sluggishness in revisions of growth forecasts. This is consistent with the sticky information models of Mankiw and Reis (2002), the imperfect information models of Woodford (2002) and Sims (2003), and behavioral explanations for forecast smoothing (Nordhaus 1987, Nordhaus and Durlauf, 1984, Fildes and Stekler, 2002).

Second, the sluggishness in forecast revisions declines during recessions and banking crises. We find that forecasts in the year preceding a year of recession start to depart from the unconditional mean, and the pace of revision picks over the course of the year of the recession. A similar pattern holds for banking crises. These finding supports models with state-dependent acquisition of information (e.g. Gorodnichenko 2008).

Third, we confirm the finding of sluggish adjustment in a multivariate setting, by estimating a seven-country VAR model for forecast revisions. The seven economies are the so-called G-3 (U.S., Germany, Japan) and the BRICs (Brazil, Russia, India, China) Forecasters are somewhat slower in absorbing news from other countries than own-country (or domestic) news. Forecasts for non-U.S countries, particularly those for Germany and Japan, are generally slow to absorb news from the U.S. There is also a tendency to absorb news from China at a very sluggish pace.

The rest of the paper is organized as follows. The next section describes the structure of the *Consensus Forecasts* dataset. Section III presents our basic evidence on the extent of information rigidity. Section IV documents how this rigidity is attenuated during recessions and banking crises. Section V looks linkages across countries in forecast revisions. The last section concludes.

II. DATA ON CONSENSUS FORECASTS

The data set consists of the consensus (the simple average) of analysts' monthly forecasts of output growth for the current and next year for the period from October 1989 to December 2008. Forty six countries are represented in the sample, of which 15 are advanced economies (henceforth referred to as AE) and 31 are emerging market economies (EM).[2] The sample is geographically diverse, covering countries in Africa, Asia, Europe, Middle East and Western Hemisphere. The full list of countries and regional classifications are shown in Table 1 of the Appendix.

The forecast data have been collected and published on a monthly basis by Consensus Economics, Inc. since October 1989 for major advanced economies under the title of *Consensus Forecasts*. Over time the data set was expanded to include many emerging and developing economies, initially on a bi-monthly basis, in a series of related publications.[3] The frequency of forecasts for many emerging economies increased over the years from bi-monthly to monthly.

[2] Some of the economies are better classified as „developing" but for convenience we refer to the entire group as emerging market economies.

[3] *Latin American Consensus Forecasts* have been published on a bi-monthly basis since 1993, *Asia Pacific Consensus Forecasts* on a monthly basis since 1995, and *Eastern Europe Consensus Forecasts* on a bi-monthly basis since 1998.

The event being forecast is annual average real GDP growth. Every month a new forecast is made of the event.[4] For each year, the sequence of forecasts is the 24 forecasts made between January of the previous year and December of the year in question. We index the sequence of forecasts by h, with the January previous year forecast being 24 and the forecast in December of the current year being 1, In addition to consensus forecasts, the data set includes actual real GDP growth from the International Monetary Fund's *International Financial Statistics*.

Using quarterly GDP series, recession episodes are identified based on the classical definition of a business cycle using quarterly changes in the level of real GDP (Burns and Mitchell, 1946).[5] Economies are classified as being in a recession in a given month if they were in a recession in the respective quarter of the year. Note that, on average, actual growth is not negative during recessions in advanced economies because the dating of recession episodes is based on the quarterly data and annual growth tends to remains positive during many recessions. In all, the data set includes 45 recession episodes in advanced economies and 61 in emerging and developing economies. See Appendix Table 1 for the list of recession episodes. The dates of banking crises are taken from the Laeven and Valencia (2008) database, extended to 2010.[6] The sample includes 7 banking crises in advanced economies and 22 banking crises in emerging markets. These episodes are listed in Appendix Table 1.

Table 1 presents the basic statistics on growth forecasts.[7] Forecast errors are defined as actual minus forecast, so a negative number indicates overprediction of the growth

[4] For some emerging markets, only bi-monthly data are available over some time periods. In these cases we use the preceding months forecasts to fill in the missing values. See Appendix Table 2 for the list of countries with monthly and bi-monthly forecasts.

[5] See Claessens, Kose and Terrones (2008) for a discussion of business cycle dating in advanced economies.

[6] A systemic banking crisis is defined as an event when a country's corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, nonperforming loans increase sharply and all or most of the aggregate banking system capital is exhausted.

[7] The actual values in this paper are defined as the latest available data (as of June 2009). Use of first published or real-time data would be a useful cross-check, but such data are not always available or easy to collect for a

(continued…)

outcome. Averaged over all countries and all forecast horizons, the mean forecast error is essentially zero; this is also the case for the AE and EM groups separately. The mean absolute forecast error is 1.7 percentage points. While absolute forecast errors are higher in the EM than in the AE group, the higher mean and volatility of the EM group must be kept in mind when judging this performance. The remainder of the table presents similar statistics for recession and banking crises episodes. Not surprisingly, forecast errors are higher during these episodes; growth is overpredicted about by 2½ percentage points in recessions and about 4½ percentage points during banking crises. The overprediction is much larger for the EM group than for the AE group. The same holds for the absolute forecast errors.

Table 2 shows regressions of the absolute forecast errors on the recession (or bank crises) dummies and on a variable indexing the horizon. In both groups of economies, absolute forecast errors become smaller as the forecasting horizon draws to a close. The table also shows that, as suggested by Table 1, that errors are higher for recession and banking crises episodes than for other years.

III. Two Tests Of Information Rigidity

We conduct two statistical tests to document the extent of informational rigidity. The first, following Coibion and Gorodnichenko (2010), is to regress the forecast error, $A_{t,h} - F_{t,h}$, on the forecast revision, $r_{t,h+k}$:

$$A_{t,h} - F_{t,h} = \alpha_0 + \alpha_1 * r_{t,h+k} + e_{t,h} \qquad (1)$$

where *t* is the target year, *h* the forecast horizon and $k \geq 1$. Coibion and Gorodnichenko show that the coefficient on the forecast revision is zero under the null of full information rational expectations, whereas a positive value indicates information rigidities. One feature of this test is that it requires the use of the growth outcomes and hence requires a view on whether to use the latest data or an earlier vintage. Our test uses the latest data, but it would be useful to use earlier vintages as a check on the results.

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large group of countries. As noted later, many of our statistical tests do not require use of the growth outcomes and hence are able to sidestep the issue of which vintage of the actual data to use.

Tables 3 and 4 present the results of this test; in the former table, the revisions are over a six-month horizon and in the latter over a three-month horizon. Each table reports five regressions, each corresponding to the forecast for the selected month, viz., September of the previous year, and March, June, September and December of the current year. So, for example, the first column shows a regression of the forecast error made in September of the previous year on the revision between March and September of the previous year, while the last column shows a regression of the forecast error in December of the current year on the revision between June and December of the current year.

The results in Table 3 can be summarized as follows. First, the coefficient estimates are almost all positive and significantly different from zero. Hence the null of full information rational expectations can be rejected, and the rejection goes in the direction consistent with models with information rigidity. The estimated coefficients in the first column imply that, in the context of sticky information models, agents update their information sets every 5 ½ to 7 months. Second, the magnitude of the coefficients declines monotonically in going from column 1 to column 5. Hence, while the evidence in favor of information rigidities remains strong, there is somewhat quicker updating of information as the forecasting horizon draws to the a close. This is particularly the case for advanced economies; in the regression in the fifth column for example, the null of full information rational expectation cannot be rejected for this group. Third, with the exception just noted, there is not much difference between the coefficients for the advanced and emerging country groups. The coefficients for the latter tend to be higher than for the former, suggesting greater information rigidities in emerging markets; but in economic terms (i.e. in the implied estimate of how it takes agents to update their information sets), the differences do not seem very significant—the updating of information takes about 1 to 2 months longer in emerging markets group.

Table 4 presents a similar set of regressions, except that the horizon over which the revisions are made is now three months. Compared with the corresponding regressions in Table 2, the coefficients estimates are larger, though again in most cases the difference in economic terms in not very significant. For the case of advanced countries, the decline in

coefficient estimates as the forecasting horizon draws to a close is again monotonic, with the estimate in the fifth column consistent with full information rational expectations. In the case of emerging economies, the pattern is choppier; and, as in Table 2, for this group there is evidence in favor of information rigidities persisting even at the end of the forecasting horizon.

The second test of information rigidity exploits the fact that we have a sequence of forecasts of forecast for the same fixed event, viz., annual real GDP growth. Under the null of full information rational expectations, this sequence of forecasts must follow a martingale (Nordhaus, 1987). To implement the test, we run regressions of the forecast revision, $r_{i,t,h}$, on past forecast revisions:

$$r_{t,h} = \beta_0 + \beta_1 * r_{t,h+k} + u_{t,h} \qquad (2)$$

As before, *t* the target year, *h* the forecast horizon and $k \geq 1$. If $\beta_1 = 0$, there is no informational rigidity in forecasts. Note that the implementation of the test does involve use of the actual growth outcomes and hence side-steps the issue of what vintage of the actual data to use (revised data vs. preliminary release of the data).

In Table 4 we again present results for a variety of different forecast horizons as a way of testing the robustness of our results. In the first column, the dependent variable is the revision in the forecast between September and March of the current year. The independent variables are the revision between March of the current year and September of the previous year (~~l~~ag 1") and the revision between September and March of the previous year (~~l~~ag 2"). As shown, there is a strong positive correlation between the current forecast revision and its first lag (as defined here), suggesting considerable sluggishness in forecasts.

In the remaining columns of the table, the variables are changed to correspond to different horizons, with a focus on revisions made during the current year. In each case, the estimated coefficient on the lagged revision points to the presence of informational rigidities.

IV. Information Rigidity In Recessions And Crises

a. Descriptive Evidence

Figure 1 shows that distributions of actual and forecasted real GDP growth at three different horizons, April of the previous year, April of the current year and October of the current year. The distributions for advanced economies are shown in the left panels. The April year-ahead forecasts are tilted to the right; there are no forecasts of recessions that are made that far in advance. Current-year forecasts for April start to show some forecasts of recessions but the number is vastly underestimated. By October, however, the forecasts tend to converge to the distribution of actual values.

The right-hand panels of Figure 1 provide analogous evidence for emerging market economies. The April year-ahead forecasts are again tilted to the right, though compared with the AE group, there are already a few forecasts of recessions. By April of the current-year, the forecasts start to mirror the actual distribution much better than was the case with the AE group. By October, the correspondence between the actual and forecasted distributions is quite good. Overall, the suggestion from this graphical evidence is that a revision of forecasts, particularly recognition of the possibility recessions, appears to be somewhat faster for the EM than for the AE group.

Figure 2 provides a more detailed look at the time profile of forecasts in recession and non-recession years. Each panel provides three pieces of the information: the solid line shows actual growth in recession years, the dashed line is the unconditional forecast (i.e., the average forecast for all years) and the bars show the evolution of forecasts in recession years. Unlike Figure 1, which provided snapshots at different points, Figure 2 shown the evolution of forecasts over the entire horizon, starting at January of the previous year and ending at December of the current year?

Consider the evidence for recessions, shown in the top panels of the figure. For the AE group, the forecasts in recession years start out very close to the unconditional averages. They start to depart from it slightly around the middle of the previous year, suggesting that

forecasters are starting to be aware that the year to come is likely to be a departure from the norm. Major departures of the forecasts from the unconditional average, however, only start to occur over the course of the current year and occur in a very smooth fashion. By the end of the forecasting horizon in December, forecasts are only slightly above the outcome. For the EM group the deviation of the recession year forecast from the unconditional average appears from the very start of the forecasting horizon and continues over the course of the previous year. The biggest revision in forecasts however occurs at the start of the current year. Revisions continue over the course of the year but the terminal forecast nevertheless underestimates the decline in real GDP.

The evidence for recessions associated with banking crises is shown in Figure 3. For advanced economies, the departure from the unconditional forecast starts earlier than it does for other recessions. This is followed by a smooth pattern of revisions as in the case of all recession years. However, one difference is that even the terminal forecast vastly underestimates the actual decline. For the EM group, the recognition starts a bit later than for the AE group but the extent of the decline is more accurately forecast.

b. Statistical Tests

In Table 6, the regressions reported in Table 5 are augmented by (i) a dummy variable for recession episodes; and (ii) the interaction between the recession dummy variable and the lagged forecast revision. The signs of the coefficient estimates on the dummy variable are negative and significant; not surprisingly, forecast revisions tend to be larger in recession years than in other years. The interaction terms are also negative, indicating that information acquisition speeds up during a recession. For both AE and EM groups we cannot reject the hypothesis that the sum of coefficients on the revision and the interaction is zero. That is, for recession years, we cannot reject the null of full information rational expectations.

Table 7 presents a similar set of results for recessions associated with banking crises. Once again, we find that information acquisition speeds up during such recessions. However, as the results for the two country groups indicate, this result is driven by the emerging markets group. For this group we cannot reject the null of full information rational

expectations. For the AE group, the results are weaker: the coefficient on the interaction term is negative but not significant in one case and actually positive in the other. We suspect that this result reflects the small number of episodes of banking crises in our AE sample rather than any systematic differences in information acquisition across the two country groups during banking crises.

V. Cross-country Linkages in Forecast Revisions

a. Statistical Framework

In this section, we examine cross-country linkages in forecast revisions using the framework developed by Isiklar, Lahiri and Loungani (2006). We again exploit the fact that we have a sequence of revised forecasts of the same event to shed light on how quickly forecasters absorb new information into their forecasts and how responsive they are to news from other countries. In the previous section, we considered regressions on forecast revisions on lagged forecast revisions for the same country to gauge the speed with which information is absorbed. By the same logic, studying the correlations between the forecast revisions for one country and the forecasts revisions for other countries tells us to what extent, and how speedily, news from other countries is absorbed into a country's forecasts.

Under the null of full information rational expectations, forecast revisions will reflect all new information:

$$r_{t,h} = E(y_t \mid \Phi_{t,h}) - E(y_t \mid \Phi_{t,h+1}) \qquad (3)$$

where $E(y_t \mid \Phi_{t,h})$ is the forecast of growth made at horizon h based on the information set $\Phi_{t,h}$ and $r_{t,h}$ represents the forecast revision between horizon h and h+1. Denoting the new information, $E(y_t \mid \Phi_{t,h}) - E(y_t \mid \Phi_{t,h+1})$, as $\varepsilon_{t,h}$, one can think of the forecast revision as the accumulation of past news components so that

$$r_{t,h} = \beta_0 \varepsilon_{t,h} + \beta_1 \varepsilon_{t,h+1} + \beta_2 \varepsilon_{t,h+2} + \beta_3 \varepsilon_{t,h+3} + \ldots \qquad (4)$$

where β_s represents the use in today's revision of the new information that has been available *s* periods ago ($\varepsilon_{i,t,h+s}$). If forecasters are fully efficient, then $\beta_j = 0$ for all j>0 should be satisfied. That is, all the information that becomes available should be reflected immediately in today's revision and no information components should be left over to be utilized in later revisions. Re-writing equation (1) in autoregressive form,

$$r_{t,h} = c + B_1 r_{t,h+1} + B_2 r_{t,h+2} + \cdots + B_p r_{t,h+p} + \varepsilon_{t,h} \qquad (5)$$

under the null of full information rational expectations all the B coefficients should be zero. In a multi-country context, $r_{t,h}$ in the equation above is a (J $\times$ 1) vector containing the forecast revisions of the J countries and B_k is the (J $\times$ J) matrix of coefficients of $r_{t,h+k}$. The diagonal elements of the matrix tell us how quickly forecasters absorb news from their own country and the off-diagonal elements how quickly they absorb news from other countries.

Note that equation (2) is in the form of a vector autoregressive model (VAR), where the variables are the forecast revisions of the 7 countries; hence one can use the standard output from an estimated VAR to describe the results. In particular, the estimated impulse responses can be used to trace out the effect of a one standard deviation shock to forecast revisions for country *i* on the forecast revisions for country *j*.

The orthogonalized impulse responses and the associated variance decomposition are sensitive to the ordering of the countries in the VAR. Because of this, we uses generalized impulse responses and variance decompositions which are ordering-free. Pesaran and Shin (1998) proposed the method for an ordering free solution in the VAR analysis, and they show that $n \times 1$ vector of *k* period ahead generalized impulse response of the effect of a one-standard deviation shock in the *j*-th country forecast revision equation is given by

$$\psi_j(k) = \sigma_{jj}^{-1/2} M_k \Omega e_j \qquad (6)$$

where e_j is the *j*-th column of an identity matrix and $\Omega = E(\varepsilon_{t,h}\varepsilon_{t,h}') = \{\sigma_{ij}, i, j = 1,2,...,n\}$. M_k have been defined before. Note that, Ω has a sample estimate of $\hat{\Omega} = (1/TH)\Sigma_t \Sigma_h \hat{\varepsilon}_{t,h}\hat{\varepsilon}_{t,h}'$ where $\hat{\varepsilon}_{t,h}$ is (7×1) residual vector from the estimated VAR model.

To compute the speed with which forecasters absorb news over time, we decompose the variation in forecast revisions into the part accounted for by current innovations and the part accounted for by past innovations. Specifically, using equation (2), for country *k* the percentage of revision variation due to the immediate use of current information is

$$\theta_{k,0} = \frac{e_k' M_0 \Omega M_0' e_k}{\sum_{i=0}^{\infty} e_k' M_i \Omega M_i' e_k} \tag{7}$$

where e_k is the k-th vector of the identity matrix. The numerator of equation (4) is the i-th diagonal element of the total forecast error variance at horizon zero and $\sum_{i=0}^{\infty} e_i' M_i \Omega M_i' e_i$ is the variance of *k-th* element of $r_{t,h}$. Hence $\theta_{k,0}$ gives the percentage of the variation in revisions accounted for by contemporaneous innovations. Similarly the cumulative percentage of the variation of the revisions within *m- periods* is

$$\theta_{k,m} = \frac{\sum_{i=0}^{m} e_k' M_i \Omega M_i' e_k}{\sum_{i=0}^{\infty} e_k' M_i \Omega M_i' e_k}. \tag{8}$$

b. Evidence

To estimate equation (2), we use data on forecast revisions for 7 major economies, the so-called „G-3" economies (the United States, Japan, Germany) and the BRICs (Brazil, Russia, India and China). A VAR is estimated, with the lag length set at 3, using the AIC.

In general, the impulse responses show a significant dependence of forecast revisions on both own-country and cross-country lagged revisions. To quantify the relative importance of own-country shocks and cross-country shocks, in Table 8 we present the generalized forecast error variance decompositions.[8] The contribution of own-shocks ranges from about

[8] Notice that, in general, generalized variance decompositions do not add up to 100 percent due to non-zero covariances between the original country shocks, see Pesaran and Shin (1998). The numbers presented here are normalized so that the total adds up to 100.

50% (Brazil) to close to 95% (U.S., Russia). The off-diagonal terms shows the considerable dependence of Japan and Germany forecast revisions on U.S. revisions, and also the importance of China—there is substantial dependence of revisions in Japan, Germany and India on Chinese revisions.

The full set of estimated generalized impulse responses with 2 standard error bands are given in Appendix III (Figures 1A-G). In the main text we focus on some on some of the key results from the impulse responses. First, consider the impulse responses to own-country shocks, shown in Figure 4. Consistent with the evidence from the previous section, in all seven cases there is sluggishness in the absorption of information. The number of months it takes to absorb information fully ranges from about 4-5 months (US, Brazil) to about 10 months (Germany, China).

Next, consider the ‗off-diagonal' elements—the panels that show the responses of the forecast revision of one country to the forecast revisions in other countries. First, countries where there is sluggishness in absorption of own-country information also tend to be sluggish in absorbing foreign information. Second, most countries show sluggish responses to news emanating from the US and China, implying that departures from full information rational expectations arise partly from sufficient attention to news from these countries. As an illustration, Figure 5 shows the impulse responses of four of the countries to Chinese news.

In Figure 6 we show the speed of absorption of news. As shown, there is quite a bit of variation across countries in the immediate absorption of news, ranging from 50% to 90%. However, catch-up is fairly rapid so that by 6 months, in all countries 90% of the news has been absorbed into forecasts.

VI. CONCLUSIONS

This paper has documented information rigidity in growth forecasts. A novel feature of our work is that it includes not just forecasts for advanced economies but for all the major emerging markets. In all we use forecasts for 46 economies over the period 1989 to 2008.

Using a test suggested by Coibion and Gorodnichenko (2010), we find that the null of full information rational expectations is rejected in favor of models with sluggish incorporation of information. We also exploit the unique structure of our data set—we have repeated updates of forecasts of a fixed event (viz. annual real GDP growth—to corroborate the finding of information rigidity using a test based on departures of forecast revisions from a martingale process.

Putting together the results from the two tests, the preponderance of evidence points to 4 to 6 months as being the duration it takes forecasters to update their forecasts to fully reflect new information. This is broadly consistent with the evidence of previous studies for advanced economies. We find that patterns of information rigidity are similar across advanced economies and emerging markets, though there is some evidence of somewhat faster incorporation of information in advanced economies.

Another important result is that the acquisition of information speeds up during recessions. Not only is the size of forecast revisions larger in recession years than in others, but the serial correlation in forecast revisions is much lower in recession years than in other years. In fact, for both advanced and emerging market groups, we cannot reject the null of full information rational expectations for recession years. We find a similar speeding up of information acquisition during banking crises, but here the evidence is stronger for emerging market economies (for which we have many more episodes of banking crises in our sample) than for advanced economies. These findings support models with state-dependent acquisition of information (Gorodnichenko 2008).

For a smaller group of seven systemically important economies (the ‗G3‘—U.S., Japan, Germany—and the BRICs) we also look at linkages among forecast revisions in a multivariate VAR model. In addition to corroborating the findings of information rigidity from the previous univariate tests, this allows us to present evidence on the speed of absorption of news from other countries in the forecast of a country‘s own growth. One finding here is that departures from full information rational expectations occur because of

slow absorption of news from the U.S. and China into the forecasts of other countries. In general, the results point to the continued importance of U.S. growth for the ‗G-3' and growing importance of Chinese growth for many countries. The overall speed with which news is immediately absorbed into forecasts also differs quite a bit across countries. However, by 6 months, 90% of information is absorbed into forecasts for all seven countries. Hence, the evidence from this more detailed look at the forecast formation process supports the tenor of the results from the univariate tests on the speed of updating of information sets.

One limitation of our work is that it relies on the use of *consensus* forecasts, viz. the mean across several individual forecasters. In addition to introducing, potentially, some aggregation bias, the use of the consensus also throws away rich data on forecast formation at the individual level and the potential for testing interesting behavior such as herding and group-think. In a companion paper, we study the individual level forecasts to document information rigidity, state-dependent acquisition of information, and herding behavior in growth forecasts.

Table 1. Descriptive Statistics

	Forecast errors	Absolute forecast errors	Forecast errors	Absolute forecast errors	Forecast errors	Absolute forecast errors
			Unconditional			
	All Countries		Advanced Economies		Emerging economies	
Number of observations	16,120	16,120	6,824	6,824	9,296	9,296
Mean	-0.3	1.7	-0.3	1.0	-0.3	2.2
Standard deviation	2.9	2.3	1.4	1.0	3.6	2.8
			Recessions			
	All Countries		Advanced Economies		Emerging economies	
Number of observations	2,978	2,978	1,689	1,689	1,289	1,289
Mean	-2.7	3.1	-1.4	1.5	-4.5	5.1
Standard deviation	3.8	3.5	1.5	1.5	5.0	4.3
			Recessions following banking crises			
	All Countries		Advanced Economies		Emerging economies	
Number of observations	387	387	117	117	270	270
Mean	-4.6	5.0	-2.6	2.6	-5.5	6.1
Standard deviation	5.2	4.8	1.8	1.8	5.9	5.3

Table 2. Absolute Forecast Errors

	All Countries		Advanced Economies		Emerging economies	
	Coefficient	Standard errors	Coefficient	Standard errors	Coefficient	Standard errors
Recessions	**2.09**	0.07 ***	**0.83**	0.04 ***	**2.95**	0.10 ***
Horizon	**0.09**	0.00 ***	**0.05**	0.00 ***	**0.12**	0.00 ***
Constant	**0.28**	0.03 ***	**0.21**	0.02 ***	**0.32**	0.04 ***
Observations	16,120		6,824		9,296	
R-squared	0.18		0.20		0.23	
Recessions following banking crises	**3.40**	0.23 ***	**1.54**	0.15 ***	**4.03**	0.29 ***
Horizon	**0.09**	0.00 ***	**0.05**	0.00 ***	**0.11**	0.00 ***
Constant	**0.53**	0.03 ***	**0.31**	0.02 ***	**0.69**	0.04 ***
Observations	16,120		6,824		9,296	
R-squared	0.12		0.16		0.14	

Table 3. Informational Rigidities: Tests Based on Forecast Errors (6-month horizon)

	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error
					All Countries					
Lag 1	**0.886**	0.308 ***	**0.548**	0.208 ***	**0.362**	0.126 ***	**0.324**	0.069 ***	**0.233**	0.043 ***
Constant	**-0.375**	0.115 ***	**0.349**	0.082 ***	**0.260**	0.063 ***	**0.265**	0.044 ***	**0.232**	0.035 ***
Number of observations		757		716		741		757		755
R-squared		0.048		0.109		0.078		0.119		0.092
					Advanced Economies					
Lag 1	**1.443**	0.272 ***	**0.468**	0.088 ***	**0.309**	0.086 ***	**0.159**	0.064 **	**-0.005**	0.062
Constant	**-0.279**	0.085 ***	**0.143**	0.063 **	**0.043**	0.049	**0.051**	0.039	**0.060**	0.034 *
Number of observations		281		267		280		281		282
R-squared		0.138		0.099		0.061		0.026		0.000
					Emerging Economies					
Lag 1	**0.827**	0.334 **	**0.557**	0.230 **	**0.372**	0.137 ***	**0.340**	0.075 ***	**0.254**	0.047 ***
Constant	**-0.391**	0.175 **	**0.461**	0.115 ***	**0.391**	0.096 ***	**0.388**	0.065 ***	**0.327**	0.052 ***
Number of observations		476		449		461		476		473
R-squared		0.041		0.111		0.082		0.135		0.114
Dependent variable [1]	Actual-Sep. py		Actual-Mar. cy		Actual-Jun. cy		Actual-Sep. cy		Actual-Dec. cy	
Lag 1 [1]	Sep. py-Mar.py		Mar. cy-Sep. py		Jun. cy-Dec. py		Sep. cy-Mar. cy		Dec. cy-Jun. cy	

Notes: [1] cy refers to current year, and py refers to previous year.

Table 4. Informational Rigidities: Tests Based on Forecast Errors (3-month horizon)

	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error
					All Countries					
Lag 1	**0.9091**	0.4681 *	**0.653**	0.378 *	**1.197**	0.212 ***	**0.520**	0.115 ***	**0.563**	0.077 ***
Constant	**-0.5637**	0.1244 ***	**0.182**	0.078 **	**0.211**	0.063 ***	**0.192**	0.048 ***	**0.221**	0.034 ***
Number of observations		755		743		757		755		755
R-squared		0.022		0.079		0.164		0.114		0.137
					Advanced Economies					
Lag 1	**2.2697**	0.4092 ***	**0.896**	0.152 ***	**0.511**	0.128 ***	**0.334**	0.108 ***	**0.061**	0.111
Constant	**-0.2747**	0.0841 ***	**0.077**	0.057	**0.022**	0.048	**0.048**	0.039	**0.062**	0.033 *
Number of observations		282		280		281		282		282
R-squared		0.150		0.120		0.064		0.039		0.002
					Emerging Economies					
Lag 1	**0.7638**	0.4954	**0.641**	0.396	**1.317**	0.249 ***	**0.532**	0.123 ***	**0.619**	0.084 ***
Constant	**-0.6677**	0.1898 ***	**0.257**	0.118 **	**0.320**	0.096 ***	**0.274**	0.073 ***	**0.311**	0.051 ***
Number of observations		473		463		476		473		473
R-squared		0.015		0.077		0.183		0.123		0.169
Dependent variable [1]	Actual-sep py		Actual-Mar. cy		Actual-Jun. cy		Actual-Sep. cy		Actual-Dec. cy	
Lag 1 [1]	Sep. py-Jun. py		Mar. cy-Dec. py		Jun. cy-Mar. cy		Sep. cy-Jun. cy		Dec. cy-Sep. cy	

Notes: [1] cy refers to current year, and py refers to previous year.

Table 5. Informational Rigidities in Forecast Revisions

	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error	Coeff.	St. Error
				All Countries				
Lag 1	**0.528**	0.163 ***	**0.278**	0.054 ***	**0.342**	0.056 ***	**0.372**	0.093 ***
Lag 2	**-0.181**	0.110	**0.178**	0.082 **				
Constant	**0.071**	0.045	**-0.010**	0.020	**-0.019**	0.021	**0.038**	0.043
Number of observations		711		750		755		741
R-squared		0.233		0.247		0.220		0.165
				Advanced Economies				
Lag 1	**0.484**	0.059 ***	**0.372**	0.060 ***	**0.395**	0.056 ***	**0.379**	0.060 ***
Lag 2	**-0.294**	0.104 ***	**0.051**	0.063				
Constant	**0.050**	0.036	**-0.009**	0.019	**-0.010**	0.019	**-0.014**	0.034
Number of observations		266		281		282		280
R-squared		0.195		0.199		0.197		0.158
				Emerging Economies				
Lag 1	**0.534**	0.181 ***	**0.266**	0.058 ***	**0.339**	0.060 ***	**0.372**	0.101 ***
Lag 2	**-0.170**	0.119	**0.204**	0.097 **				
Constant	**0.071**	0.062	**-0.010**	0.031	**-0.023**	0.033	**0.071**	0.065
Number of observations		445		469		473		461
R-squared		0.238		0.255		0.223		0.167
Dependent variable [1]	Sep. cy-Mar. cy		Dec. cy-Sep. cy		Dec. cy-Sep. cy		Dec. cy-Jun. cy	
Lag 1 [1]	Mar. cy-Sep. py		Sep. cy-Jun. cy		Sep. cy-Jun. cy		Jun. cy-Dec. py	
Lag 2 [1]	Sep. py-Mar.py		Jun. cy-Mar. cy					

Notes: [1] cy refers to current year, and py refers to previous year.

Table 6. Informational Rigidities during Recessions

	Coeff.	St. Error	Coeff.	St. Error
		All Countries		
Lag 1	**0.382**	0.052 ***	**0.445**	0.090 ***
Recessions	**-0.858**	0.137 ***	**-2.175**	0.268 ***
Lag 1 * recessions	**-0.310**	0.097 ***	**-0.458**	0.117 ***
Constant	**0.068**	0.018 ***	**0.261**	0.038 ***
Number of observations		755		741
R-squared		0.336		0.358
P-values for Wald tests				
Lag 1 * recessions		0.371		0.899
		Advanced Economies		
Lag 1	**0.339**	0.063 ***	**0.273**	0.067 ***
Recessions	**-0.491**	0.077 ***	**-0.899**	0.127 ***
Lag 1 * recessions	**-0.304**	0.184	**-0.177**	0.227
Constant	**0.046**	0.019 **	**0.088**	0.036 **
Number of observations		282		280
R-squared		0.306		0.275
P-values for Wald tests				
Lag 1 * recessions		0.831		0.637
		Emerging Economies		
Lag 1	**0.390**	0.059 ***	**0.485**	0.111 ***
Recessions	**-1.118**	0.216 ***	**-2.999**	0.386 ***
Lag 1 * recessions	**-0.375**	0.107 ***	**-0.595**	0.140 ***
Constant	**0.076**	0.026 ***	**0.347**	0.056 ***
Number of observations		473		461
R-squared		0.359		0.418
P-values for Wald tests				
Lag 1 * recessions		0.864		0.317
Dependent variable [1]	Dec. cy-Sep. cy		Dec. cy-Jun. cy	
Lag 1 [1]	Sep. cy-Jun. cy		Jun. cy-Dec. py	

Notes: [1] cy refers to current year, and py refers to previous year.

Table 7. Informational Rigidities during Banking Crises

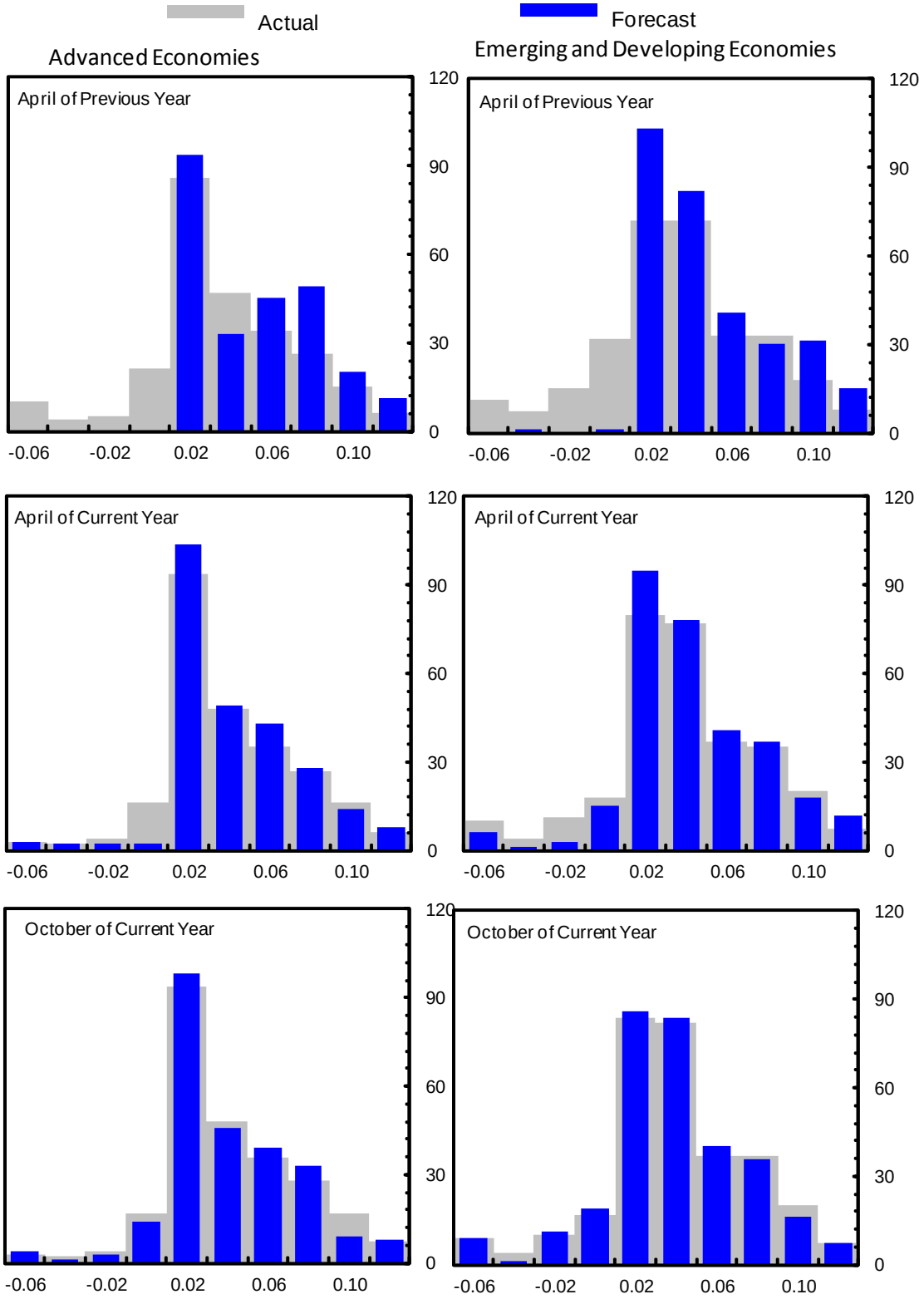
	Coeff.	St. Error		Coeff.	St. Error	
All Countries						
Lag 1	**0.410**	0.042	***	**0.466**	0.144	***
Recessions following banking crises	**-0.997**	0.437	**	**-1.348**	0.513	***
Lag 1 * recessions following banking crises	**-0.568**	0.113	***	**-0.385**	0.170	**
Constant	**-0.014**	0.020		**0.049**	0.042	
Number of observations		755			741	
R-squared		0.284			0.192	
P-values for Wald tests						
Lag 1 * recessions following banking crises		0.130			0.378	
Advanced Economies						
Lag 1	**0.382**	0.057	***	**0.354**	0.057	***
Recessions following banking crises	**-0.612**	0.072	***	**-0.325**	0.387	
Lag 1 * recessions following banking crises	**-0.218**	0.065	***	**0.760**	0.276	***
Constant	**-0.004**	0.019		**-0.005**	0.034	
Number of observations		282			280	
R-squared		0.224			0.190	
P-values for Wald tests						
Lag 1 * recessions following banking crises		0.00			0.00	
Emerging Economies						
Lag 1	**0.413**	0.046	***	**0.482**	0.169	***
Recessions following banking crises	**-1.096**	0.606	*	**-1.492**	0.794	*
Lag 1 * recessions following banking crises	**-0.593**	0.133	***	**-0.415**	0.198	**
Constant	**-0.020**	0.030		**0.077**	0.065	
Number of observations		473			461	
R-squared		0.292			0.195	
P-values for Wald tests						
Lag 1 * recessions following banking crises		0.150			0.539	
Dependent variable [1]	Dec. cy-Sep. cy			Dec. cy-Jun. cy		
Lag 1 [1]	Sep. cy-Jun. cy			Jun. cy-Dec. py		

Notes: [1] cy refers to current year, and py refers to previous year.

Table 8. Variance Decompositions

	Explained by						
	USA	JAPAN	GERMANY	BRAZIL	RUSSIA	INDIA	CHINA
USA	**81%**	3%	10%	1%	1%	2%	2%
JAPAN	10%	**54%**	3%	3%	16%	3%	10%
GERMANY	15%	3%	**64%**	11%	0%	1%	6%
BRAZIL	3%	1%	3%	**50%**	39%	0%	5%
RUSSIA	1%	1%	0%	0%	**93%**	1%	2%
INDIA	4%	2%	2%	3%	3%	**80%**	7%
CHINA	3%	4%	1%	8%	1%	3%	**79%**

Figure 1. Distributions of Actual and Forecasted Real GDP Growth, 1989–2008



Source: Authors' estimates.

Figure 2. Actual and Forecasted Real GDP Growth during Recessions

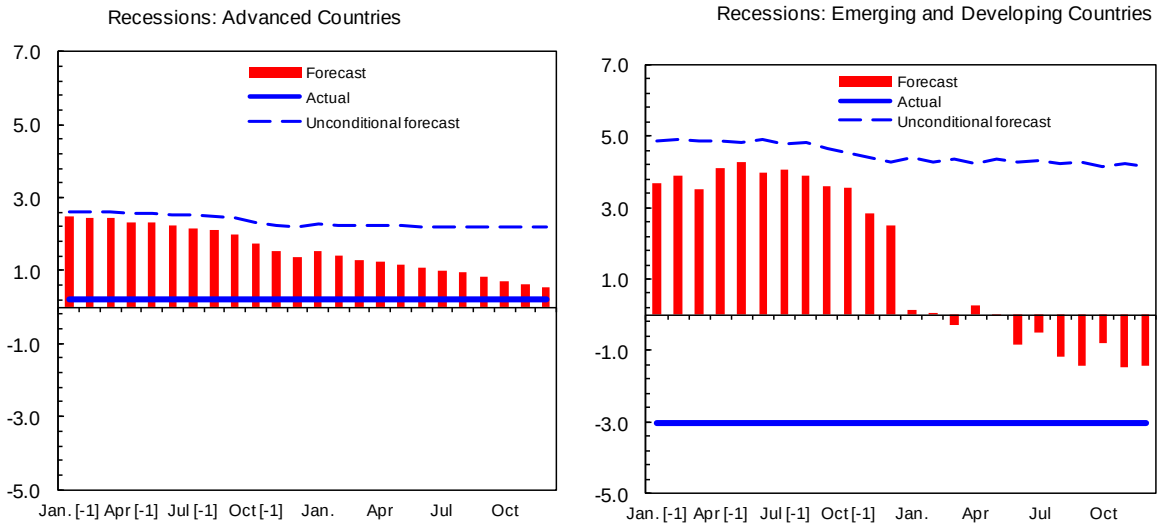


Figure 3. Actual and Forecasted Real GDP Growth during Banking Crises

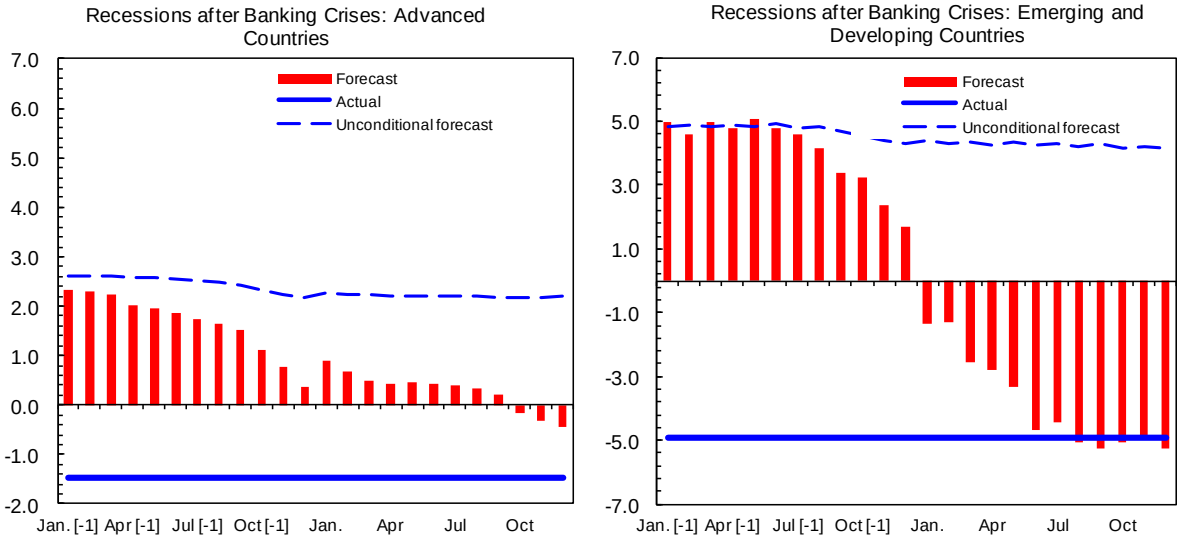
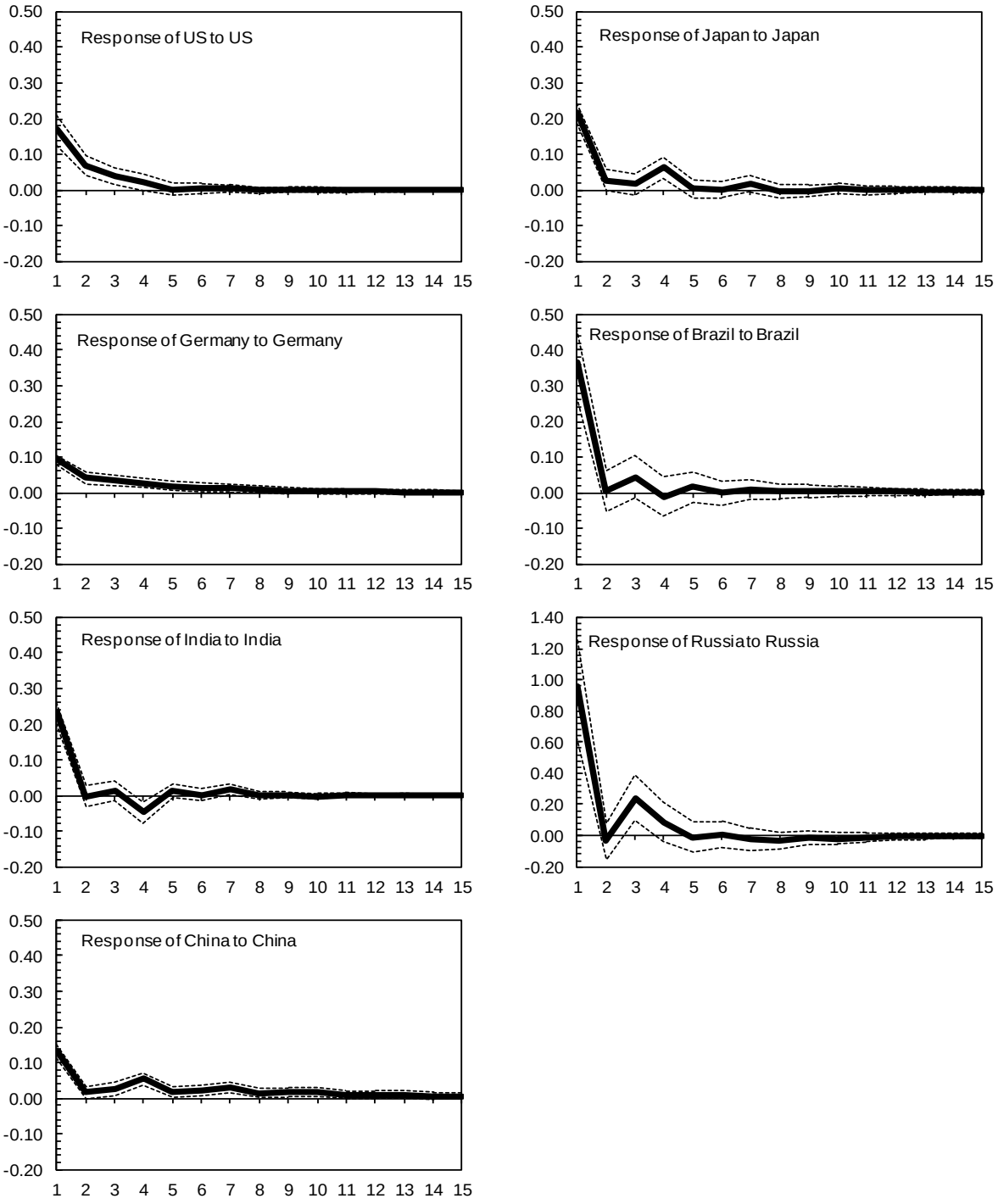
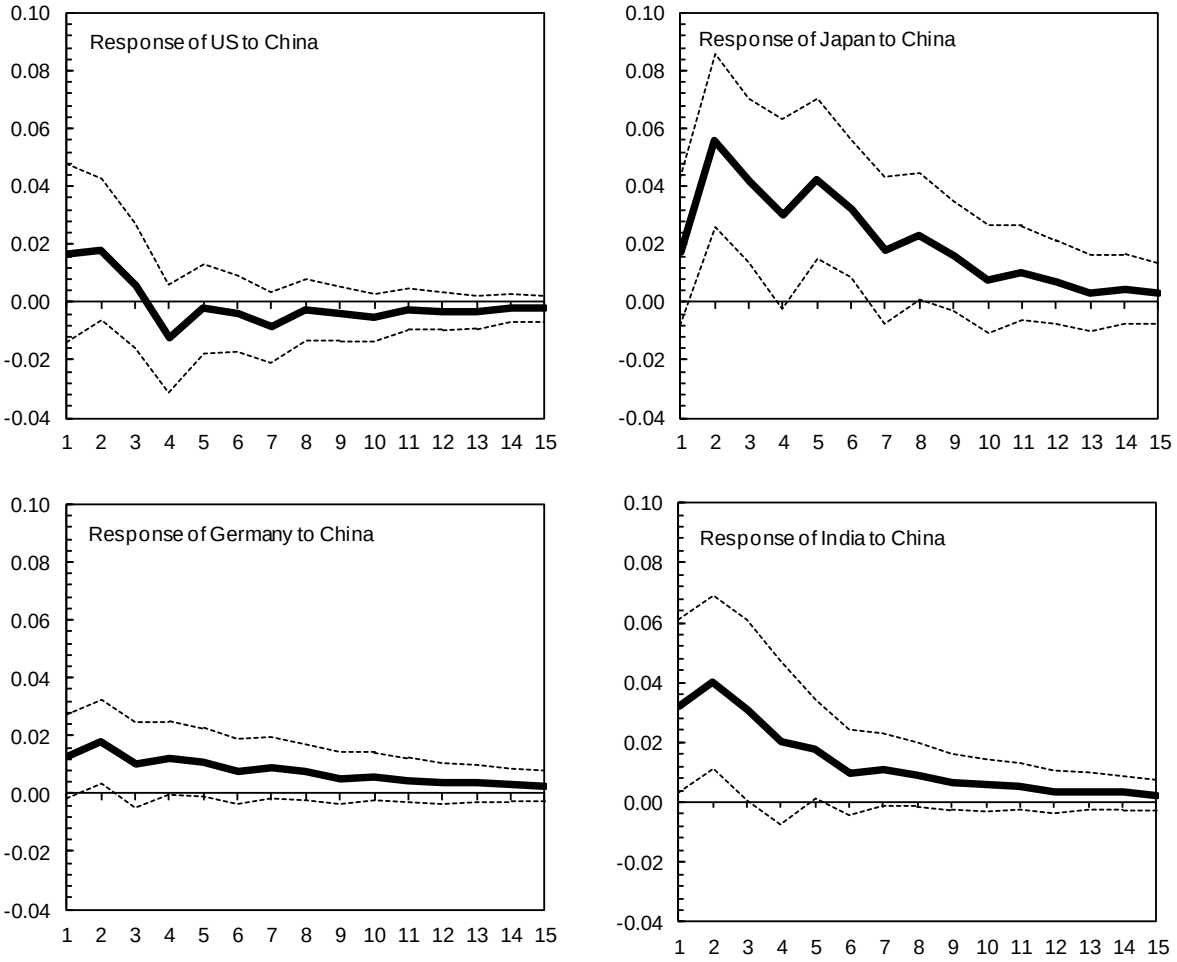


Figure 4. Generalized Impulse Responses of Forecast Revisions (Own-country responses; in percentage points)



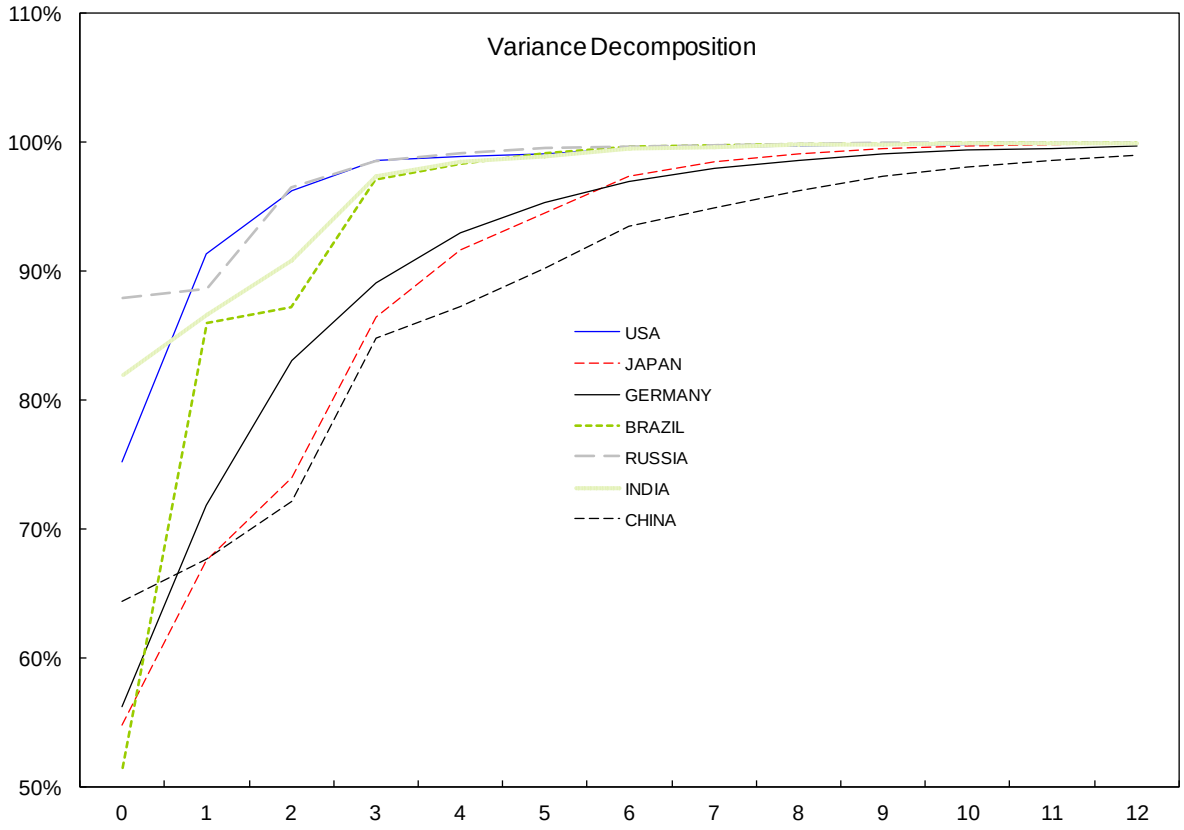
Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 5. Generalized Impulse Responses of Forecast Revisions (Response to Chinese revisions; in percentage points)



Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 6. Speed of Absorption of News



APPENDIX I. DESCRIPTION OF SAMPLE

Appendix Table 1. List of Countries, Recessions and Crisis Episodes

Country name	Region	Starting date	Banking crisis	Recession
		Advanced economies		
AUSTRALIA*	Asia	Jan-90		1990Q2-91Q2
CANADA*	Western Hemisphere	Oct-89		1990Q2-91Q1, 2008Q4-09Q2
FRANCE*	Europe	Oct-89		1992Q2-93Q3, 2002Q4-03Q2, 2008Q2-09Q1
GERMANY*	Europe	Oct-89		1992Q2-93Q1, 1995Q4-96Q1, 2002Q4-04Q3, 2008Q2-09Q1
GREECE*	Europe	Jun-93		1990Q2-90Q3,1992Q2-93Q1,1994Q4-95Q2, 2008Q4-09Q3
ITALY*	Europe	Oct-89		1992Q2-93Q3, 1996Q2-96Q4, 2001Q2-01Q4, 2003Q1-03Q2, 2004Q4-05Q1, 2008Q2-09Q2
JAPAN*	Asia	Oct-89	1997	1993Q2-93Q4, 1997Q2-99Q1, 2001Q2-01Q4, 2008Q2-09Q1
NETHERLANDS*	Europe	Nov-89	2008	2008Q2-09Q2
NEW ZEALAND*	Asia	Nov-89		1991Q1-91Q2, 1997Q4-98Q1, 2008Q1-09Q1
NORWAY*	Europe	Nov-89		2002Q3-03Q1, 2008Q3-09Q2
SPAIN*	Europe	Nov-89		1992Q2-93Q2, 2008Q2-09Q3
SWEDEN*	Europe	Nov-89	1991	1990Q2-93Q1, 2008Q2-09Q1
SWITZERLAND*	Europe	Nov-89		1990Q3-93Q1, 1996Q2-96Q3, 1998Q4-99Q1, 2001Q2-03Q1, 2008Q3-09Q2
UNITED STATES*	Western Hemisphere	Oct-89	2007, 2008	1990Q4-91Q1, 2001Q1-01Q3, 2008Q1-09Q2
UNITED KINGDOM*	Europe	Oct-89	2007, 2008	1990Q3-91Q3, 2008Q2-09Q3
Number of countries or episodes			7	45

Sources: International Financial Statistics; Claessens, Kose and Terrones (2008); Laeven and Valencia (2008).
Notes: The classification of countries into advanced, emerging and developing is aligned with Consensus Forecasts publications. Countries for which the dating of recession and recovery episodes is based on quarterly data are marked with an asterisk. Only crises during the time period for which consensus forecasts are available are reported.

Appendix Table 1. List of Countries, Recessions and Crisis Episodes, continued

Country name		Starting date	Banking crisis	Recession
		Emerging economies		
ARGENTINA*	Western Hemisphere	Mar-93	1995, 2001	1995Q2-96Q1, 1998Q4-02Q4
BRAZIL*	Western Hemisphere	Nov-89	1990, 1994	1990Q2-91Q1, 1992Q2-92Q4, 1995Q4-96Q1, 1998Q4-99Q3, 2001Q4-02Q1, 2008Q4-09Q1
BULGARIA	Europe	Jan-95	1996	1996-97, 2008Q4-09Q1
CHILE*	Western Hemisphere	Mar-93		1998Q4-99Q3, 2008Q3-09Q2
CHINA*	Asia	Dec-94	1998	
COLOMBIA*	Western Hemisphere	Mar-93	1998	1998Q3-99Q4, 2008Q3-08Q4
CROATIA*	Europe	May-98	1998	1998Q3-99Q4, 2008Q2-09Q2
CZECH REPUBLIC*	Europe	Jan-95	1996	1997Q3-98Q4, 2008Q4-09Q1
ESTONIA*	Europe	May-98		1999Q1-99Q3, 2008Q1-09Q3
HONG KONG*	Asia	Nov-90		1997Q4-98Q4, 2001Q1-03Q4, 2008Q2-09Q1
HUNGARY*	Europe	Nov-90	1991	1990-93, 2008Q2-09Q2
INDIA*	Asia	Dec-94	1993	
INDONESIA*	Asia	Nov-90	1997	1998Q1-99Q1
LATVIA*	Europe	May-98		1993Q1-94Q1, 1996Q4-97Q1, 2008Q4-09Q2
LITHUANIA*	Europe	May-98		1999Q2-99Q4, 2008Q3-09Q2
MALAYSIA*	Asia	Nov-90	1997	1998Q1-99Q1, 2008Q4-09Q1
MEXICO*	Western Hemisphere	Nov-89	1994	1995Q1-95Q4, 2001Q3-02Q1, 2008Q2-09Q2
PERU*	Western Hemisphere	Mar-93		1998Q2-99Q3, 2000Q4-01Q2, 2008Q4-09Q1
PHILIPPINES*	Asia	Dec-94	1997	1998Q2-98Q4
POLAND*	Europe	Nov-90	1992	1990Q1-92Q1, 2008Q4-09Q1
ROMANIA	Europe	Jan-95		1997-1998, 2008Q3-09Q3
REPUBLIC OF KOREA*	Asia	Nov-89	1997	1998Q1-98Q4
SINGAPORE*	Asia	Nov-90		2001, 2008
SLOVAK REPUBLIC*	Europe	Jan-95	1998	1999Q3-00Q1, 2008Q4-09Q1
SLOVENIA*	Europe	Jan-95		
SOUTH AFRICA*	Africa	Jun-93		2008Q4-09Q2
TAIWAN*	Asia	Nov-89		2001Q2-01Q4, 2008Q2-09Q1
THAILAND*	Asia	Nov-90	1997	1997Q2-99Q1, 2008Q2-09Q1
TURKEY*	Europe	Jan-95	2000	1999Q1-99Q4, 2001Q1-02Q1, 2008Q2-09Q1
UKRAINE	Europe	Jan-95	1998	2008Q3-09Q1
VENEZUELA*	Western Hemisphere	Mar-93	1994	1993Q1-94Q4, 1996Q2-96Q3, 1998Q3-99Q4,
Number of countries or episodes			22	61

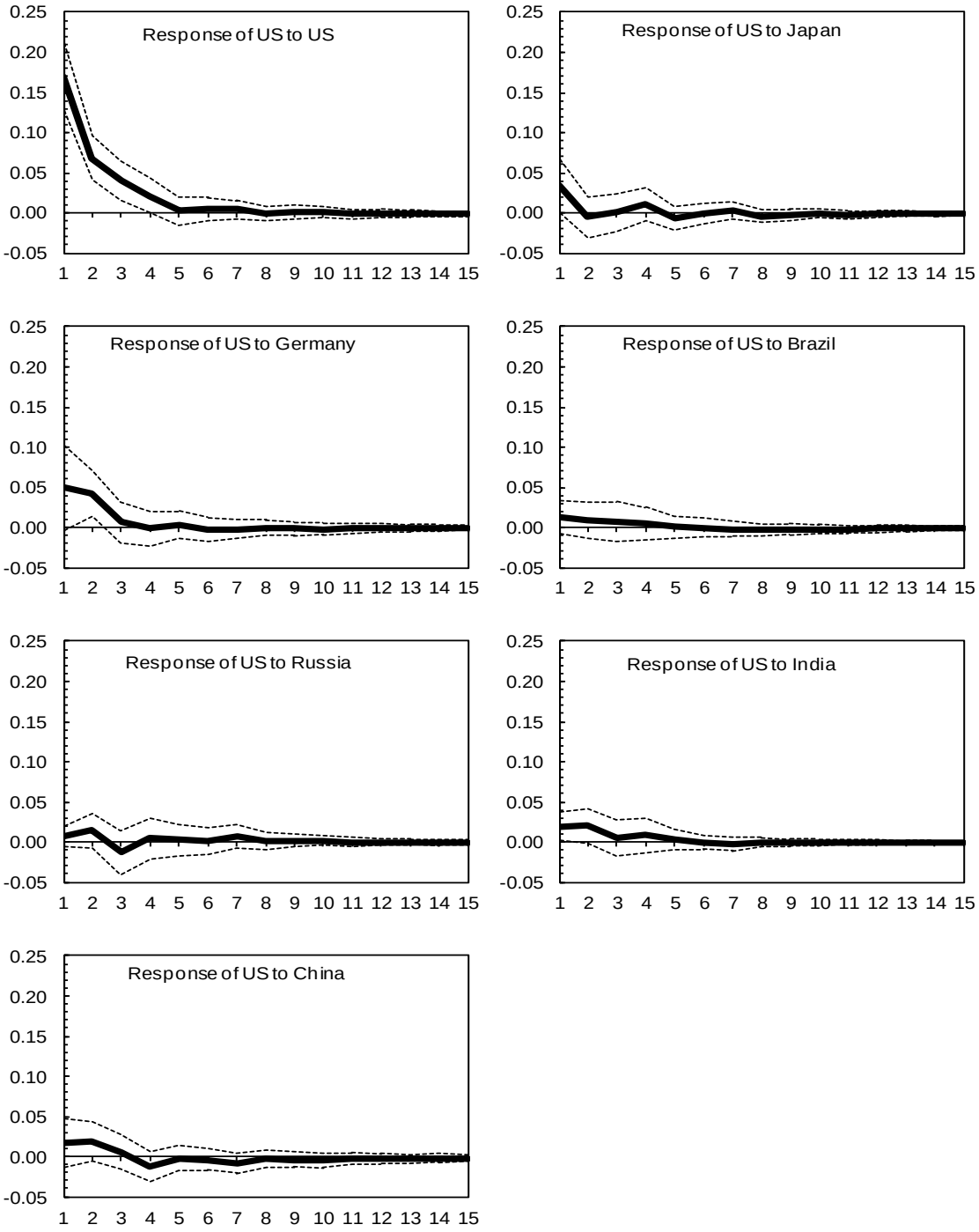
Sources: International Financial Statistics; Claessens, Kose and Terrones (2008); Laeven and Valencia (2008).
Notes: The classification of countries into advanced, emerging and developing is aligned with Consensus Forecasts publications. Countries for which the dating of recession and recovery episodes is based on quarterly data are marked with an asterisk. Only crises during the time period for which consensus forecasts are available are reported.

APPENDIX II. FREQUENCY OF DATA

Country	Start Date of Bi-monthly Data	Start Date of Monthly Data	Second Start of Monthly Data If Data Frequency Was Changed From Monthly to Bi-monthly to Monthly
ARGENTINA	1993m3	2001m8	.
AUSTRALIA	.	1990m1	.
BRAZIL	1993m6	1989m11	2001m8
BULGARIA	1998m6	1995m1	2007m5
CANADA	.	1989m10	.
CHILE	1993m3	2001m8	.
CHINA	.	1994m12	.
COLOMBIA	1993m3	2001m8	.
CROATIA	1998m5	2007m5	.
CZECH REPUBLIC	1998m6	1995m1	2007m5
ESTONIA	1998m5	2007m5	.
FRANCE	.	1989m10	.
GERMANY	.	1989m10	.
GREECE	.	1993m6	.
HONG KONG	.	1990m11	.
HUNGARY	1998m6	1990m11	2007m5
INDIA	.	1994m12	.
INDONESIA	.	1990m11	.
ITALY	.	1989m10	.
JAPAN	.	1989m10	.
LATVIA	1998m5	2007m5	.
LITHUANIA	1998m5	2007m5	.
MALAYSIA	.	1990m11	.
MEXICO	1993m6	1989m11	2001m8
NETHERLANDS	.	1989m11	.
NEW ZEALAND	.	1989m11	.
NORWAY	.	1989m11	.
PERU	1993m3	2001m8	.
PHILIPPINES	.	1994m12	.
POLAND	1998m6	1990m11	2007m5
ROMANIA	1998m6	1995m1	2007m5
RUSSIA	.	1995m1	.
SINGAPORE	1998m6	1995m1	2007m5
SLOVAKIA	1998m6	1995m1	2007m5
SLOVENIA	.	1993m6	.
SOUTH AFRICA	.	1989m11	.
SPAIN	.	1989m11	.
SWEDEN	.	1989m11	.
SWITZERLAND	.	1989m11	.
TAIWAN	.	1989m11	.
THAILAND	.	1990m11	.
TURKEY	1998m6	1995m1	2007m5
U.S.A.	.	1989m10	.
UKRAINE	1998m6	1995m1	2007m5
UNITED KINGDOM	.	1989m10	.
VENEZUELA	1993m3	2001m8	.

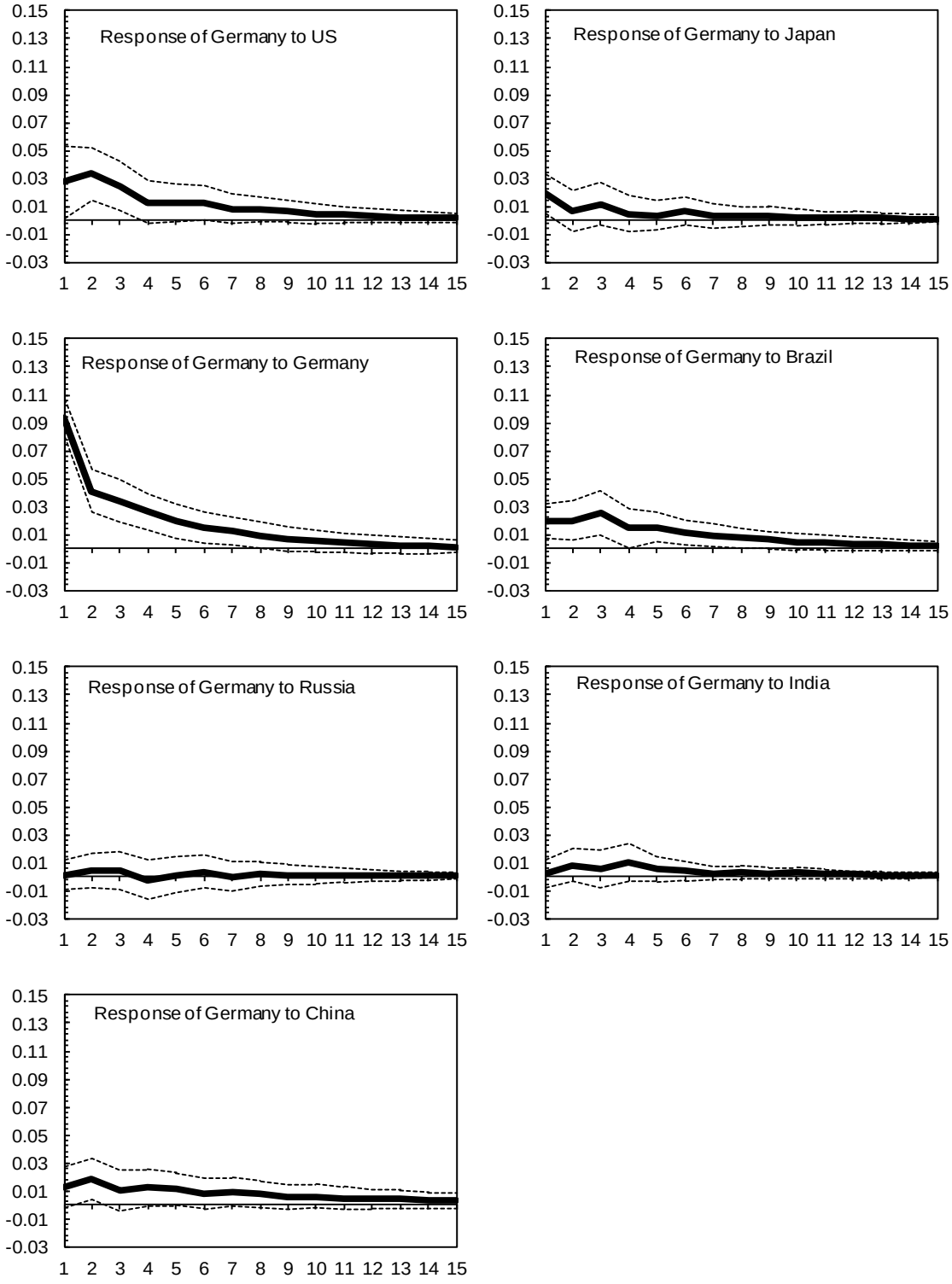
APPENDIX III. Generalized Impulse Responses of Forecast Revisions

Figure 1A. Generalized Impulse Responses of U.S. Forecast Revisions
(In percentage points)



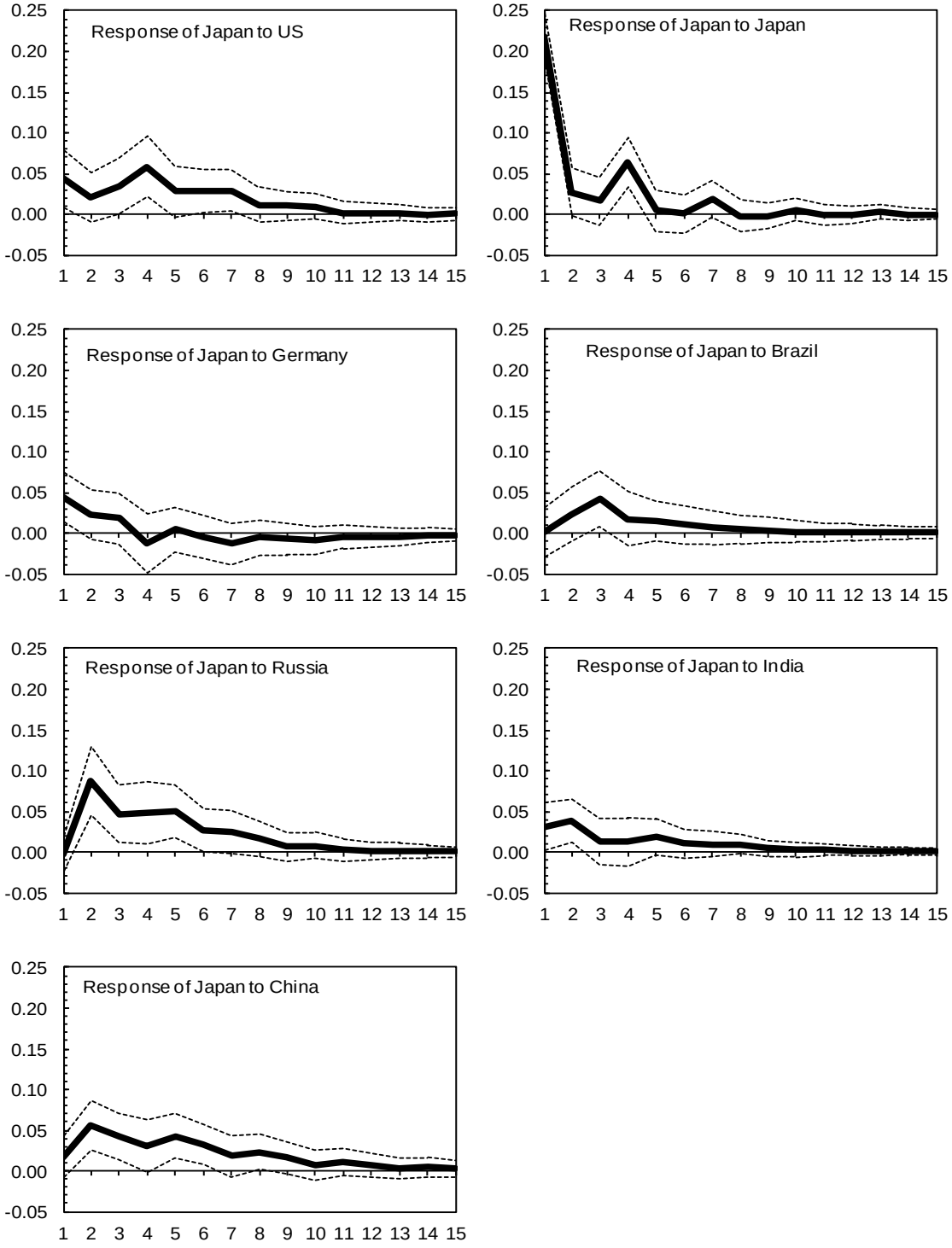
Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 1B. Generalized Impulse Responses of Germany's Forecast Revisions



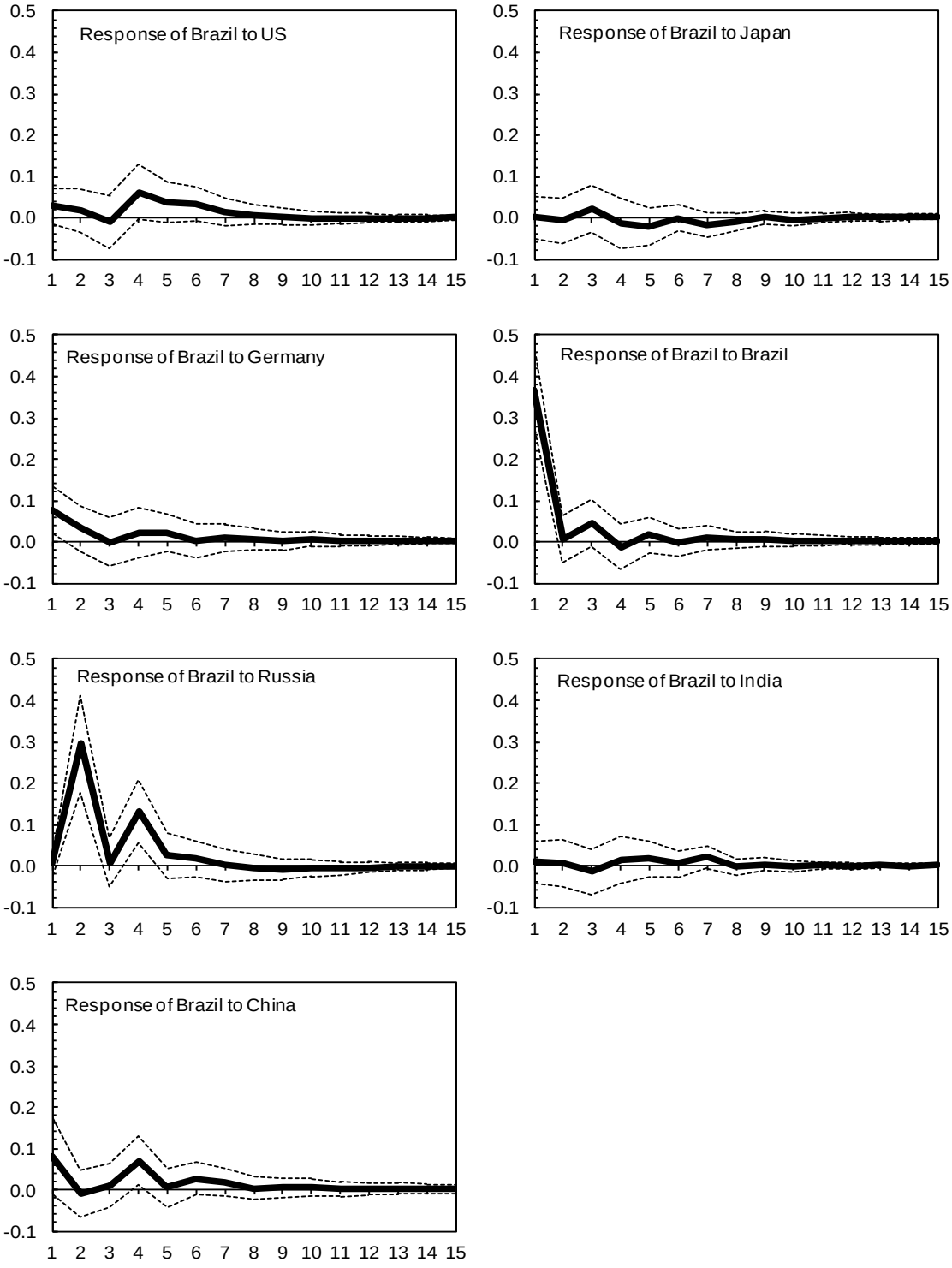
Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 1C. Generalized Impulse Responses of Japan's Forecast Revisions (In percentage points)



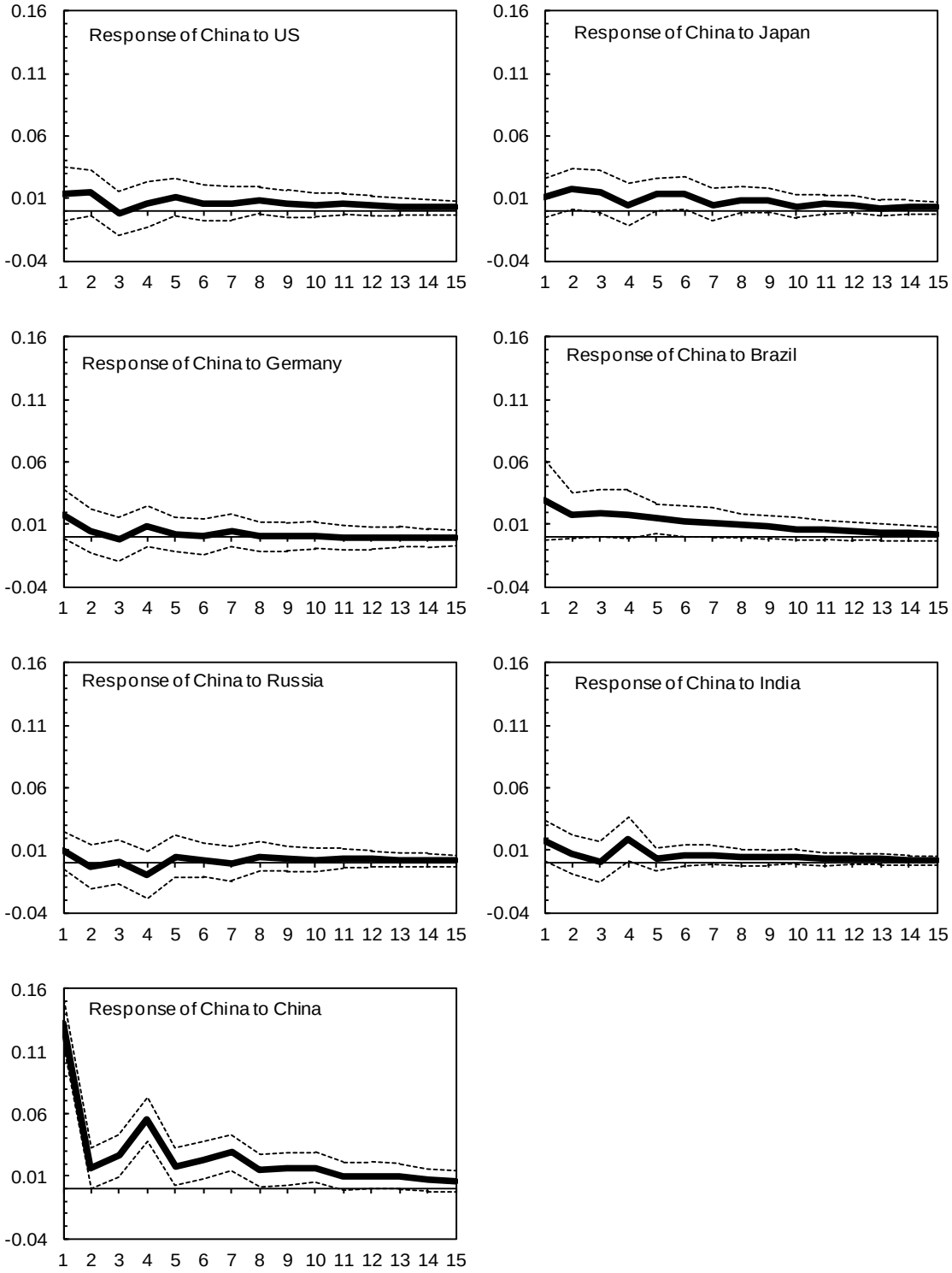
Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 1D. Generalized Impulse Responses of Brazil's Forecast Revisions (In percentage points)



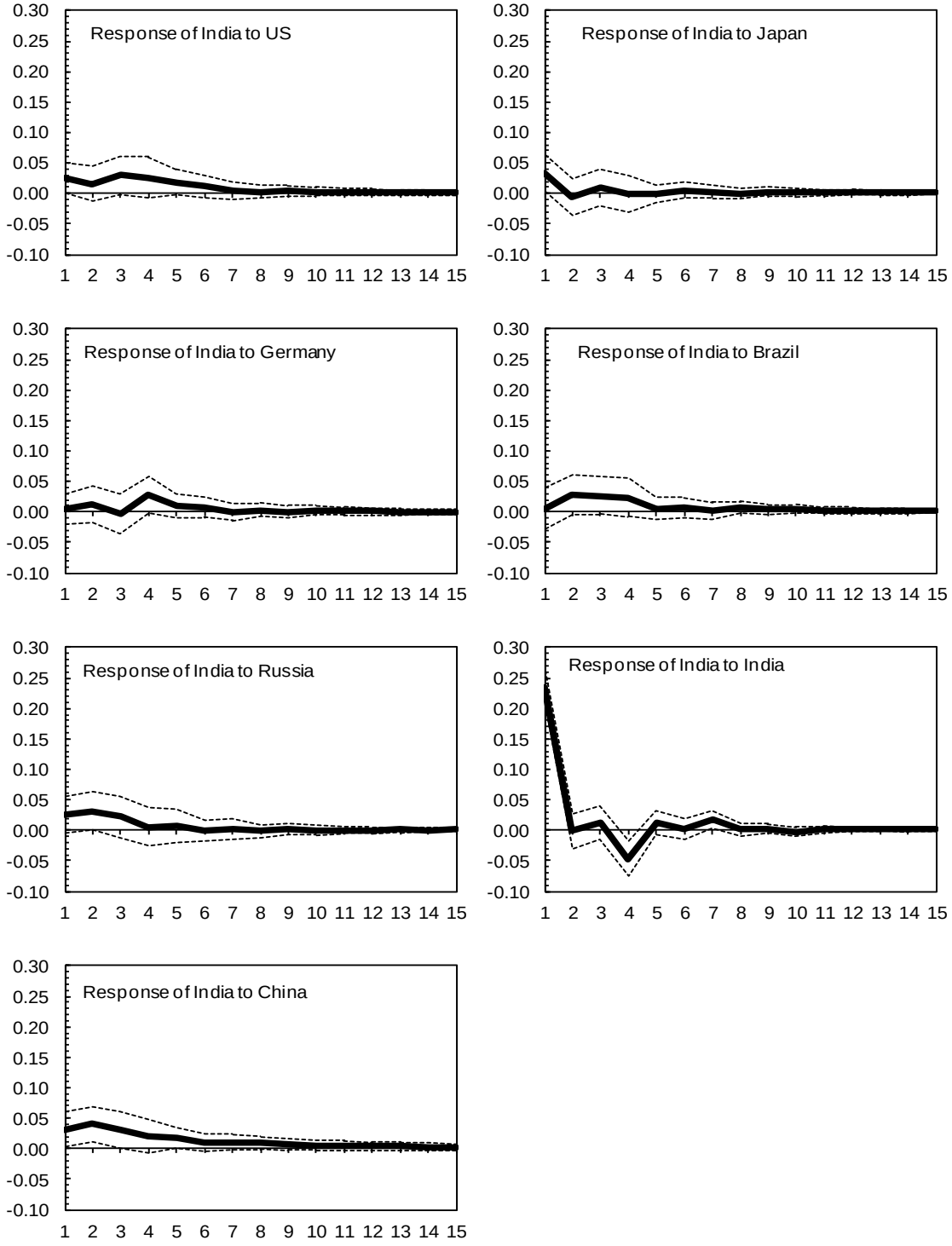
Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 1E. Generalized Impulse Responses of China's Forecast Revisions (In percentage points)



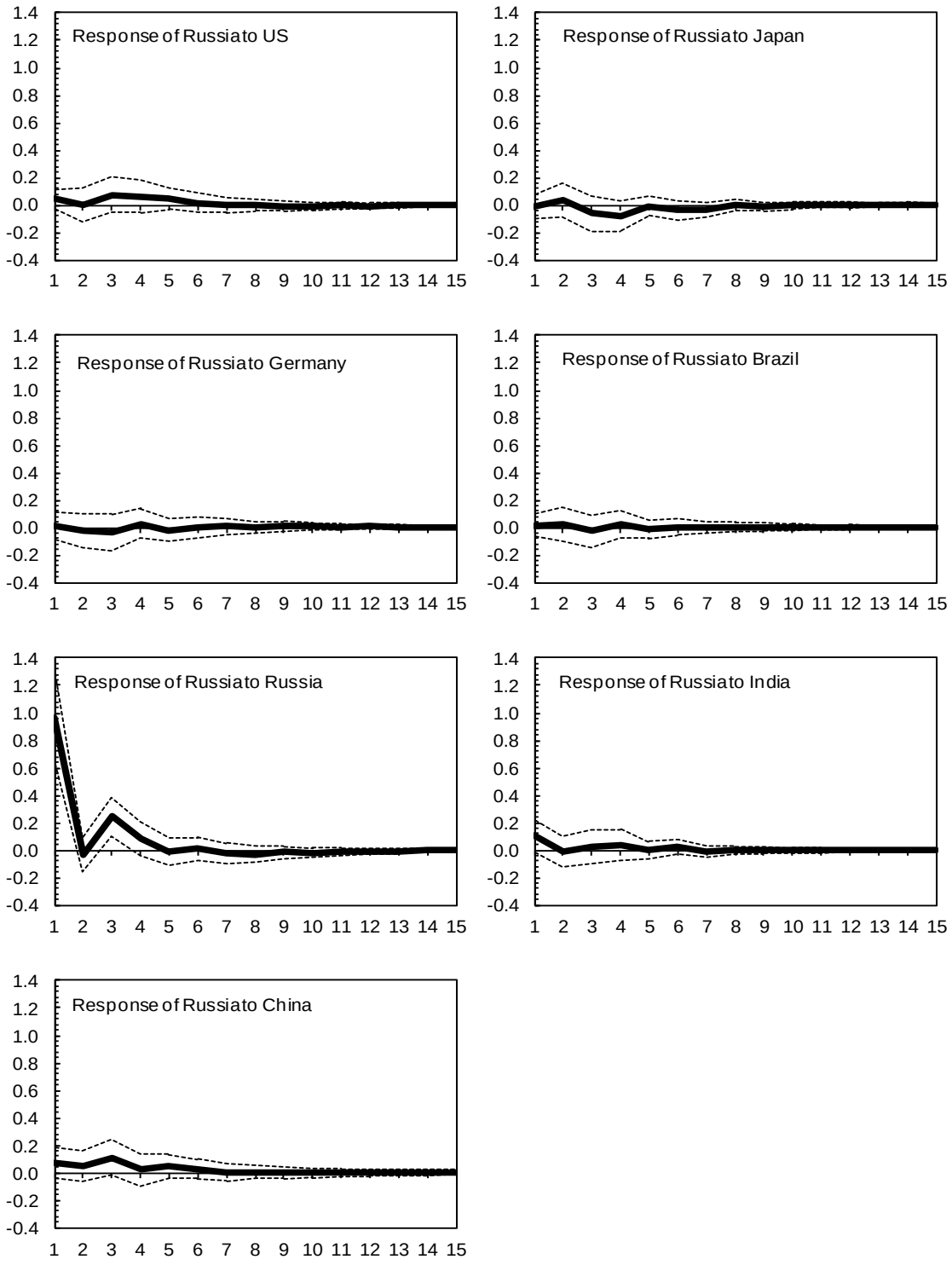
Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 1F. Generalized Impulse Responses of India's Forecast Revisions (In percentage points)



Note: The Figure shows confidence intervals for 2 standard deviations.

Figure 1G. Generalized Impulse Responses of Russia's Forecast Revisions (In percentage points)



Note: The Figure shows confidence intervals for 2 standard deviations.

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