Global Financial Conditions, Country Spreads and Macroeconomic Fluctuations in Emerging Countries: A Panel VAR Approach

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May 1, 2012

Abstract

This paper investigates the extent to which global financial conditions contribute to the macroeconomic fluctuations in emerging economies using a panel structural VAR analysis. The main findings are: (1) Global risk shocks explain about 20 percent of movements in aggregate activity in emerging economies. (2) The contribution of U.S. Interest Rate shocks to emerging market business cycle fluctuations is nil. Therefore, the role of U.S. interest rate shocks in driving the business cycle fluctuations in emerging economies, as emphasized in the previous literature, is taken up by the global risk shocks. (3) Sovereign spread shocks explain about 15 percent of business cycles in emerging economies. (4) The feedback from domestic fundamentals to country borrowing rate, even after a measure of global risk is included in the analysis, play a important role in transmitting the external shocks to domestic economy. (5) There is strong positive co-movement between sovereign risk and banking sector risk in emerging economies. Higher sovereign risk leads to higher bank lending spreads and lower economic activity. (6) The feedback between sovereign risk and domestic banking sector risk add to higher domestic macroeconomic volatility in emerging economies.

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1 Introduction

Understanding the driving forces behind the fluctuations in the country interest rate premium and its impact on the macroeconomic fluctuations in emerging economies has been at the center of academic and policy research. The traditional literature has identified the U.S. risk-free interest rate as the main global financial factor affecting country spreads and hence the aggregate fluctuations in emerging markets. The underlying assumption of such studies is that international lenders are risk neutral and the changes in the U.S. real interest rate will affect the country interest rate in international markets through the usual arbitrage relation plus the higher risk premium required for probability of default. However, international lenders are indeed risk averse and the actual interest rate that sovereign faces in the international markets includes not only a base premium that compensates the lenders for the probability of default (as in the risk neutral case) but also an excess premium that compensates them for taking the risk of default. In particular, as lenders become wealthier or less risk averse, the emerging economy becomes less credit constrained. Quantifying the relative contributions of U.S. real interest rate shocks and global risk shocks to aggregate fluctuations in emerging countries is perplexed by the fact that country interest rates do not respond one to one to movements in the global financial conditions. Country spreads serve as a transmission mechanism of global financial conditions, capable of amplifying or dampening the effect of external shocks on the domestic economy as they also respond to domestic fundamentals.[1]

The objective of this paper is to investigate the extent to which international factors contribute to the variability of country spreads and macroeconomic fundamentals in emerging economies. This work attempts to investigate the endogeneity of country spreads, and to relate them to the degree of risk in the international financial markets, as well as to domestic macroeconomic variables in a Panel VAR Framework. I consider six emerging market economies in the baseline analysis: four emerging markets in Latin America (Argentina, Brazil, Mexico, Peru), and two from other regions (South Africa and Turkey).[2]

The results of the analysis can be discussed under four sections. First, I present some facts about the relation between the external financing conditions, country spreads, and the cyclical component

[1] In this paper, I use the term global risk to refer to worldwide measures of investors' "appetite" for risk.

[2] In the robustness analysis, four more countries (Chile, Colombia, Malaysia, and Philippines) are included in to the estimation. Details of the data used in this study are presented in Appendix 7.1.

of output. There is high level of commonality in country spreads. In particular, the first principal component of country spreads explains 87 percent of the variation in country spreads during the 1998-2011 sample period. Figure 1 shows that the first principal component of country spreads has a correlation of 52 percent with the implied U.S. stock market volatility index; 30 percent with the U.S. BAA Corporate spread, 43 percent with the U.S. High yield corporate spread. However, its correlation with the U.S. real interest rate is 18 percent. Therefore, country risk appears to be more related to global risk factors than they are to the U.S. real interest rate. The negative co-movement between the country spreads and the real economic activity is also depicted in Figure 2.[3]

Second, I estimate a Panel Structural VAR model with country specific factors, a measure of global risk, US real interest rates and country spreads. In general, all variables have significant explanatory power for country spreads. I find that the country spread is driven more by global risk factors than the US real interest rate. The contribution of country-specific fundamentals to the fluctuations in the country spread is slightly lower than the contribution of global risk. On average, 20%percent of fluctuations in country spreads is explained by global risk shocks; 5% of fluctuations by the US real rate; and 15% of the fluctuations is explained by domestic factors.

Third, I investigate the extent to which the global risk, the U.S. interest rate and the country interest rate premium contribute to macroeconomic fluctuations in emerging economies. I find that global risk shocks explain about 20 percent of movements in aggregate activity in emerging economies. The contribution of the U.S. Interest Rate shock to emerging market business cycle fluctuations is negligible. Therefore, the role of U.S. interest rate shocks in driving the business cycle fluctuations in emerging economies, as emphasized in the previous literature (see for example Uribe and Yue (2006)), is replaced by global risk shocks. Country spread shocks explain about 15 percent of the business cycles in emerging economies. The feedback from domestic fundamentals to the country borrowing rate, even after a measure of global risk is included in the analysis, plays an important role in transmitting external shocks to the domestic economy. Moreover, the global risk shock affects domestic macroeconomic variables mostly through their effects on country spreads. When the country spread is assumed not to respond directly to variations in the global risk, the variance of output, investment, and the trade balance-to-output ratio explained by global risk shocks is about two thirds smaller.

[3] Some of these facts are also documented in previous studies which are referenced below.

Fourth, I extent the Panel VAR model by incorporating a measure of domestic banking sector risk into the analysis. The purpose is to investigate whether the domestic banking sector risk has any impact on country spreads, after external factors and the state of the macroeconomy are taken into consideration. As shown in Figure 4, there is a negative comovement between the bank lending spread and the output in emerging economies. As depicted in Figure 3, there is a positive co-movement between the country interest rate premium and the domestic banking sector spread. I find that bank lending spreads explain about 10% of the fluctuations in country spreads while 50% of the fluctuations in the country spreads is explained by its own shock. The country interest premium also have significant impact on the private sector borrowing cost in emerging economies. Higher sovereign risk leads to higher bank lending spreads and lower economic activity. The feedback between the country risk and the domestic banking sector risk results in higher domestic macroeconomic volatility in emerging economies.[4]

In summary, I show that the global risk, which is measured by the U.S. corporate credit spread and the U.S. Stock market volatility index, plays an important role in deriving macroeconomic fluctuations in emerging economies. The global risk shock affects domestic macroeconomic variables mostly through their effects on the country interest rate premium. Moreover, global risk shocks replaces the role of the risk free U.S. interest rate identified in the traditional literature as an important external driving force of macroeconomic fluctuations in emerging economies.

This paper is related to growing body of empirical and theoretical research in emerging economy business cycle fluctuations. In a number of papers, Calvo (Calvo et al. (1993), Calvo (2002)) has observed that emerging market risk premia are correlated with international factors, in particular worldwide measures of investors' "appetite" for risk, such as, for instance, the spread between the yield on U.S. corporate bonds and that on U.S. Treasuries. In fact, Calvo suggests further that once one accounts for the international financial shocks, domestic factors in emerging markets have a limited role in explaining country spreads. The work by Garca-Herrero et al. (2006) contributed to the literature by analyzing how investors' attitude toward risks affects Latin American sovereign spreads, by treating the default risk in emerging economies as purely an exogenous process. In other words, they do not take the state of the macroeconomy in emerging economies into consideration. In

[4]The results are not directly comparable to the baseline model because in the extended model sample size is different is shorter for two countries in the panel even if the number of countries is same. But, in the baseline model I report that around 60 percent of fluctuations in country spread is due to country spread shock itself.

an influential paper, Uribe and Yue (2006) investigated the relationship between the country interest premium, the U.S. interest rate and business conditions in emerging markets. Their structural VAR analysis, using data for a panel of emerging market economies between 1994:Q1 and 2001:Q4, pointed out the importance of the U.S. interest rates shock in deriving the macroeconomic fluctuations in emerging markets. However, they identified external shocks by only risk free U.S. interest rates. Agenor et al. (2008) also studied the effects of external shocks on bank lending spreads and output fluctuations in Argentina during the early 1990s. They did not incorporate any global financial variables into the estimation. An external shock is modeled as a shock in the country interest rate.[5]

The present paper is also related to a large body of existing theoretical literature on emerging-market business cycles. Most models in this literature build on the canonical small open economy real business cycle model presented in Mendoza (1991) and Schmitt-Grohe and Uribe (2003). Neumeyer and Perri (2005) augmented the canonical model with financial friction. However, they treat country risk premium in a reduced form without explicitly incorporating a microfounded default mechanism. In a more recent paper, Aguiar and Gopinath (2007) argue that introducing shocks to trend output in an otherwise standard small open economy real business cycle model (with frictionless international financial markets) can account for the key features of economic fluctuations in emerging market economies. García-Cicco, Pancrazi, and Uribe (2010) developed and estimated an encompassing model for an emerging economy with both trend shocks and financial frictions. Financial market imperfections introduced in this paper are also in a reduced form fashion. Therefore, in the earlier theoretical models, the dependence of the country premium on variables such as output were not microfounded. There has been progress in the recent theoretical work to address the concerns about the microfoundations of the country spread behavior (see Mendoza and Yue (2011) and Akinci (2012)). However, all these models assume that international lenders are risk neutral. An exception is the work by Lizarazo (2011) who develops a quantitative model of debt and default for small open economies that interact with risk averse international investors.This model does not take endogenous nature of the spreads into consideration.

After recent financial crises, there has been a renewed interest in understanding the role of global factors in explaining the variation in the country spreads. According toBlanchard et al. (2010), an

[5]The theoretical models of an emerging economy with explicit intermediation sector (see among others, Edwards and Vegh (1997) and Oviedo (2005)) predict that sovereign risk and/or global shocks systematically affects private-sector borrowing conditions in emerging economies.

increase in the global risk was an important channel through which the crisis was propagated to emerging economies. The empirical evidence in Longstaff et al. (2011)) also suggests that global factors explain a large fraction of the variation in the international interest rate. These studies concentrate mainly on the role of global factors in deriving country spreads; nothing is said about the implications of higher global risk on business cycle fluctuations in emerging economies.

The remainder of the paper is organized in five sections. In Section 2, I present the empirical model and discuss the identification of the country spread shocks, the U.S. risk free interest rate shocks, and the global risk shocks. In section 3, I analyze the business cycles implied by these three sources of aggregate uncertainty with the help of impulse responses and variance decompositions. Section 4 discusses the role of bank lending spreads in the transmission of external shocks and the country spread shocks in emerging economies. Section 5 discusses the robustness of the results. The last section concludes the paper.

2 The Empirical Model

The goal of this section is to identify shocks and to determine the lag length. The empirical model follows closely the model specification in Uribe and Yue (2006):

$$Ay_{i,t} = \sum_{k=1}^{p} B_k y_{i,t-k} + \eta_i + \epsilon_{i,t} \tag{1}$$

where η_i is a fixed effect and

$$\begin{aligned} y_{i,t} &= \left[\hat{gdp}_{i,t}, \hat{inv}_{i,t}, tby_{i,t}, \hat{R}_t^{US}, \hat{GR}_t, \hat{R}_{i,t}\right] \\ \epsilon_{i,t} &= \left[\epsilon_{i,t}^{gdp}, \epsilon_{i,t}^{inv}, \epsilon_{i,t}^{tby}, \epsilon_t^{R,US}, \epsilon_t^{GR}, \epsilon_{i,t}^{R}\right] \end{aligned}$$

$gdp_{i,t}$ denotes the real gross domestic output, $inv_{i,t}$ denotes the real gross domestic investment, $tby_{i,t}$ denotes the trade balance to output ratio, R_t^{US} denotes the gross real U.S. interest rate, GR_t is an indicator for global risk (proxied by three variables: the U.S. BAA Corporate Spread, $\hat{S}_t^{BAA,US}$; the U.S. Stock Market Volatility Index, $\hat{Vol}_t^{US}$; and the U.S.High Yield Corporate Spread, $\hat{S}_t^{HYI,US}$), and $R_{i,t}$ denotes the country specific interest rate. A hat on $gdp_{i,t}$ and $inv_{i,t}$ denotes log deviations from a log-linear trend. A hat on R_t^{US}, $S_t^{BAA,US}$, Vol_t^{US}, $S_t^{HYI,US}$, and $R_{i,t}$ denotes the log. The trade balance-to output ratio, $tby_{i,t}$ is expressed in percentage points. I measure R_t^{US} as the 3-month gross U.S. Treasury Bill rate deflated using a measure of expected U.S. inflation (see Schmitt-Grohe and Uribe (2011) for details of the calculation of the expected U.S. Inflation). In the calculation of the expected inflation I use two lags of CPI inflation. The results are robust to using higher order lags of inflation. I measure $S_t^{BAA,US}$ as the difference between the U.S. BAA corporate borrowing rate calculated by Moody's and long term (20 years, constant maturity) U.S. Treasury bond rate. $R_{i,t}$ is measured as the sum of the J. P. Morgan's EMBI+ sovereign spread and the US real interest rate. Output, investment, and the trade balance are seasonally adjusted. Finally, the subscript i denotes that corresponding variable is country specific. For example, $\hat{gdp}_{i,t}$ has TN observations where T represents time series dimension and N diplays the number of countries included in the sample. The variables, $\hat{R}_t^{US}$ and $G\hat{R}A_t$, are common across coutries included in the sample.[6]

[6]More details on the data are provided in the Appendix 7.1.

2.1 Identification

The domestic macroeconomic variables are included in the model to capture the impact of local variables on sovereign spreads. Moreover, once I estimate the VAR system 1, I will be able to quantify the importance of the country risk premium on business cycle fluctuations in emerging economies. I place country spreads last in the ordering of the VAR model, in order to capture primarily the exogenous component of the country spread shock when calculating variance decompositions and impulse response functions. This ordering also allows me to account for the fact that movements in country spreads may respond subsequently to changes in domestic variables after the initial exogenous shock.

Sovereigns included in the study typically have extensive economic relationships with other countries. Thus, the ability of one of these sovereigns to repay its debt may depend not only on local variables, but also on the state of the global economy. To capture broad changes in the state of the global economy, I include some measures from the U.S. financial markets. There are several reasons for choosing financial variables related the US economy as the global macroeconomic forces external to small open economies in the sample. First, the U.S. is not one of the sovereigns included in our sample. Second, there is an extensive evidence that shocks to the U.S. financial markets are transmitted globally. Finally, as the largest economy in the world, the U.S. has direct effect on the economies and financial markets of many other sovereigns; but, emerging economies are too small to have an impact on the financial system in the U.S.

In particular, I identify the empirical model by imposing the restriction that the matrix A be lower triangular with unit diagonal elements. An additional restriction I impose in estimating the VAR system is that $\hat{R}_t^{US}$ and a measure of Global Risk ($\hat{GR_t}$) follows a two-variable VAR process (i.e., I impose the restriction $B_{k,4,j} = B_{k,5,j} = 0$, for all $j \neq 4$ and $j \neq 5$ and $k = 1, 2, .., p$. I also impose the restriction on A matrix, $A_{4,j} = 0$, for all $j \neq 4$ and $A_{5,j} = 0$ for all $j \neq 4$ and $j \neq 5$). I adopt this restriction because it is reasonable to assume that disturbances in a particular (small) emerging country will not affect either the corporate borrowing rate (and the tock market volatility) or the real interest rate of a large country like the U.S. I however, let the real interest rates and a measure of Global Risk affecting each other. The restriction on A matrix imply that U.S. corporate spreads (or the U.S. Stock Market volatility) respond contemporaneously to the U.S.

risk-free interest rate while U.S. risk free rate responds to the lagged values of U.S. Corporate spreads (or the U.S. Stock market volatility).

I note that the country-interest-rate shock can equivalently be interpreted as a country spread shock in the VAR system 1. As I mentioned before, $R_{i,t}$ is measured as the sum of the J. P. Morgan's EMBI+ sovereign spread and the US real interest rate. Because $R_{i,t}$ appears as a regressor in the bottom equation of the VAR system, the estimated residual $\epsilon_{i,t}^{R}$ would be identical to a country spread shock. Therefore, throughout the paper I refer to $\epsilon_{i,t}^{R}$ as a country spread shock.

The identification strategy employed in this paper presupposes that innovations in global financial conditions and innovations in country interest rates affect domestic real variables with a one-period lag; while real domestic shocks affect financial markets contemporaneously. The identification strategy is a natural in order to capture primarily the exogenous component of the country spread shock. It is also reasonable to assume that financial markets are able to react quickly to news about the state of the business cycle in emerging economies.[7]

2.2 Estimation Method

I estimate the structural VAR given in Equation 1 by pooling quarterly data from Argentina, Brazil, Mexico, Peru, South Africa and Turkey. The sample begins in the first quarter of 1994 and ends in the third quarter of 2011. The choice of countries is guided by my desire to limit attention to emerging countries, and by the availability of reliable quarterly data on macroeconomic aggregates and the country borrowing rate in the international markets. The rationale for pooling data is to gain efficiency. I estimate the Output, Investment, Trade Balance-to-Output Ratio and the Country Interest rate equations of the VAR system in Equation 1 by OLS including country dummies and constant term. I define the first country in the sample to be the reference category so that the estimated constant is its intercept, and then treated the estimated coefficients of the dummies for the other countries as the shifts in the intercept for the particular country included in the sample. The exogenous block (U.S. real interest rate and Global Risk Equations) of the VAR system in Equation1 is estimated by OLS including only constant for the longer time span from 1987:3 to 2011:4.

[7] In section 5.2, I explore an identification scheme that allows for real domestic variables to react contemporaneously to innovations in financial variables.

A potential concern with the panel VAR is the inconsistency of the least squares parameter estimates due to the combination of fixed effects and lagged dependent variables (e.g., Nickell (1981)). However, because the time series dimension of our data is large, the inconsistency problem is likely not to be a major concern. I calculate the bias following the methodology in Hahn and Kuersteiner (2002). The estimated impulse response function with the bias corrected least square dummy variable method is close to those obtained with simple least square estimation method.[8]

Our estimation procedure imposes that the matrices A and B are the same across the six countries from which we pool information. This simplifying assumption seems appropriate in light of the fact that estimations using individual country data yield similar results for the dynamic effects of external shocks on country spreads and the macroeconomic aggregates.[9]

2.3 Lag Length Selection

Table 1 presents results for lag length selection test. Guided by the LR, FPE and AIC, the panel SVAR specification allows for two lags. Lag exclusion test result also show that Joint(p-value) for Lag 3 is 0.1241, implying that 3rd lag can be excluded from the equation while Joint (p-value) for Lag 2 is 0.0078, implying that lag 2 is significant and should be included.

3 Estimation Results

In this section I discuss the consequences of incorporating a measure of global risk into the VAR system in Equation 1 in accounting for the fluctuations in country spreads and real domestic variables such as output, investment, and the trade balance. I also investigate how and by how much do country spreads move in response to innovations in emerging-country fundamentals, after including a measure of global risk in the estimation. Calvo (2002) suggest that once one accounts for international financial shocks, domestic factors in emerging markets have a limited role in explaining variables such as sovereign borrowing spreads. With an estimate of the VAR system 1 at hand, I can decompose the relative importance of domestic macroeconomic variables and international factors in

[8]The bias corrected least square dummy variables method is argued to be more efficient than the GMM estimator, based on monte-carlo simulation exercises. Section 5.1 compares the estimated impulse response functions from different estimation methods and provides more in depth discussion about the robustness of the results presented in this section to different estimation methods.

[9]Individual country estimates are available upon request

accounting for movements in country spreads. I will also address additional questions, such as, the importance of the US real interest rate for the movements of country spreads and domestic variables in emerging economies and how important country spread shocks are in explaining movements in aggregate activity in emerging economies.

3.1 Impulse Responses

The impulse responses following one standard deviation increase in a measure of Global Risk is shown in Figure 5. Dark-grey shaded area depicts 95% confidence bands while light-grey shaded area show 68% confidence interval. In the baseline model, the U.S. BAA Corporate Spread; i.e., the spread between the yield on U.S. BAA rated corporate bonds and that on U.S. Treasuries of the same maturity, is used as a proxy for the global risk. Country spreads respond strongly to innovations in the global risk. In response to an unanticipated one standard deviation shock to U.S. BAA corporate spreads (0.3 percent), the country spread increases by 0.4 percentage point on impact and stays high for two quarters after the shock. The response of the country spread to global risk shock is higher than the response of the global risk to the global risk itself. Output, investment, and the trade balance-to-output ratio are unchanged in the period of impact because of our maintained assumption that external financial shocks take one quarter to affect production and absorption. In the two periods following the global risk shock, output and investment fall, and subsequently recover gradually until they reach their preshock level. The trade balance improves in the two periods following the shock. One might argue that the persistence of the country spread response to global risk shock is resulting to some extend from the fact that output decrease feeds back on to the higher country spreads following the global risk shock. Setting the estimated coefficient for the response of country spread to domestic macroeconomic variables to zero confirms the intuition: the country spread shock (not shown in the figure) dies out much quicker. The US real interest rate is unchanged on impact and increases by 0.6 percentage point in the two periods following the shock. But the impact of global risk shock on US interest rate dies out very quickly.[10]

Figure 6 displays the response of the variables included in the VAR system to one standard deviation increase in the U.S. real interest rate. The US real interest rate is used in the earlier literature to identify the impact of external shocks on country spreads and domestic variables. Under our

[10] The estimated impulse response functions for other measures of the global risk are presented in section 3.3.

maintained assumption that global risk responds to US real interest rate shock contemporaneously, global risk decreases on impact and continues to decline two periods after the shock. This result is not in line with what one would expect. Theoretical models would predict that an increase in the risk free real interest rate leads to an increase in the U.S. credit spreads. This counterfactual result is mainly driven by the financial crises period and the period after that during which US nominal interest rates hit the zero lower pound. As it is depicted in Figure 7, once I restrict the sample period to pre-crises period (sample ends in 2007Q4), global risk initially falls following an increase in the US real interest rates and after a couple of quarters it increases.[11]

The response of country spreads to innovations in the US interest rate is qualitatively same both in the restricted sample and in the baseline model: Country spreads increase in response to US real interest rates shocks but with a short delay. Output and investment improves after a positive shock to US real interest rates, but, as I argued before, it is mainly because output and investment respond strongly to changes in global risk. If the sample is restricted to pre-crises period, output and investment decreases following a shock but again with a short delay. Overall, I argue that the responses of macroeconomic variables are in line with what one would expect but quantitatively the impact of the shock is not big. Moreover, all the impulse responses due to an innovation in U.S. real interest rate are measured with significant error. Both 68% and 95% errors bands are very wide and the responses of variables in the VAR system 1 are not statistically significant. These results combined with impulse responses to the global risk show that the role of US real interest rate is replaced by the global risk as the main global macroeconomic force external to the country.

Figure 8 displays the response of the variables included in the VAR system 1 to one standard deviation increase in the country spread shock. In response to an unanticipated country-spread shock, the country spread itself increases and then quickly falls toward its steady-state level. The half life of the country spread response is about one and half year. Output, investment, and the trade balanceto-output ratio respond as one would expect. They are unchanged in the period of impact. In the two periods following the country-spread shock, output and investment fall, and subsequently recover gradually until they reach their preshock level. The trade balance improves in the two periods following the shock. The trough in the output response with a country spread shock is about the same in magnitude under a global risk shock.

[11]The robustness of my results to different sample periods is discussed in detail in section 5.3.

3.2 Variance Decomposition

Figure 9 displays the variance decomposition of the variables contained in the VAR system at different horizons. Solid lines in the first row depict the fraction of the variance of the k-quarter ahead forecasting error explained by the US real interest rate shock at different horizons. The fraction of the variance of the k-quarter ahead forecasting error explained by the global risk shock is shown in the second row and by the country spread shocks is shown in the last row. For the purpose of the present discussion, I associate business-cycle fluctuations with the variance of the forecasting error at a horizon of about five years (20 quarters).

According to my estimate of the VAR system given in equation 1, innovations in the global risk explain 18 percent of movements in aggregate activity and the US real interest rate account for about 6 percent in emerging countries at business cycle frequency. But the impact of US real interest rates on macroeconomic variables is driven mainly by the response of the global risk to US real interest rates on impact. If one eliminated only the impact effect of the US real interest rate on the global risk, the variance of output explained by the US real interest rate decreases significant (from 6 percent to 2 percent). Therefore, I argue that the impact of US real interest rates on business cycle fluctuations is negligible. Country-spread shocks account for about 18 percent of aggregate fluctuations in these countries. Thus, around 40 percent of business cycles in emerging economies is explained by disturbances in external financial variables. These disturbances play smaller role in explaining movements in trade balance-to-output ratio. In effect, global risk shock and country-spread shocks are responsible for about 15 percent of movements in the trade balance-to-output ratio in the countries included in our panel. The majority of variance of the international transaction is explained by the shock to trade balance-to-output ratio itself and shocks to the real investment. This result suggest the investment specific shocks could be the primary sources of the fluctuations in the trade balance-to-output ratio. Variations in country spreads are largely explained by innovations in the global risk, country specific variables and and innovations in country-spreads themselves. The contribution of domestic macroeconomic variables to fluctuation in sovereign spreads (15%) is slightly lower than the contribution of global risk (18%). These two sources of uncertainty jointly account for about 35% of the fluctuations in sovereign spreads.

The second largest shock contributing to the fluctuation in country spreads is global risk shock.

The natural question to ask in this context is to what extent the responsiveness of country spreads to global shocks contributes to aggregate fluctuations in emerging countries. I address this question by means of a counterfactual exercises. In particular, I assume (without re-estimating the VAR system 1) that the country spread does not directly depend on the global financial conditions (both U.S. real interest rates and U.S. credit spreads). The variance decomposition of the country specific variables contained in the VAR system 1 under counterfactual exercise is shown in Figure 10. When I shut off the response of the country spread to global financial conditions, the variance of domestic macroeconomic variables explained by global financial shocks is about two thirds smaller than in the baseline scenario. This result is robust to different measures of the global risk used in the estimation of the VAR system 1, which is discussed in the next section. Therefore, I conclude that external shocks affect domestic variables mostly through their effects on country spreads.[12]

3.3 Estimation Results with Alternative Measures of Global Risk

I estimate the baseline model with U.S. investment-grade corporate bond spreads (U.S. BAA Corporate spreads) as a measure of global risk. In this section, I discuss the estimation results of the VAR system 1 for different measures of the global risk (U.S. high-yield corporate bond spreads and the U.S. Stock Market Volatility index) and compare them with the baseline estimation.

The impulse responses following one standard deviation increase in different measures of global risk variables are shown in Figure 11. Solid lines with diamond show point estimates of impulse responses when the U.S. High Yield Spread is used as a proxy for the global risk; dashed lines depict point estimate when the U.S. Stock Market Volatility Index is used as a proxy for the global risk; and solid lines show point estimates of impulse responses when the U.S. BAA Corporate spread (as in the baseline model) is used as a proxy for the global risk. 68% and 95% confidence bands associated with estimates with the U.S. High Yield spread are depicted with dark-grey and light-grey shaded areas respectively. Qualitatively, the response of the country spread and domestic variables to different measures of global risk are very similar: an increase in the global risk leads to a significant and persistent increase in the country spread on impact. Under the maintained assumption that global financial markets affect emerging economy macroeconomic variables with

[12] I am aware that this counterfactual exercise is subject to Lucas (1976) critique. This more satisfactory approach involves the use of a theoretical model economy where private decisions change in response to alterations in the country spread process.

one period lag, output, investment and the trade balance-to-output ratio do not change on impact but output and investment decrease and the trade balance-to-output ratio improves one period after the shock.

The quantitative effect of different measures of the global risk shock on country specific variables slightly varies across different proxies used as global risk. The largest response is due to changes in the U.S. High Yield index. This result is partly coming from the fact that the U.S. High Yield Corporate Bond spread has more persistent process compared to other two measures of the global risk. There is deep recession in emerging economies after a shock to global risk. After one standard deviation increase in the U.S. High Yield Corporate Bond spread (1 percentage point, annually), country spread increases by 0.6 percentage point (annually) on impact and it stays as high one period after the shock. Output decrease by around 0.8 percent three periods period after the shock and recovers back to its steady state level gradually. The response of investment is about three times as large as that of output. At the same time, the trade balance improves for two periods by about 0.2 percent and then converges gradually to its steady-state level. The U.S. real interest rate is also affected with one period lag to changes in the global risk (under our identification assumption). One period after the shock, the U.S. real interest rate by 0.4 percent.

One standard deviation shock to the U.S. Stock Market Volatility Index (1 percentage point, annually) leads to 0.4 percentage point (annually) increase on country spreads. The shock to the U.S. Stock Market volatility dies out pretty quickly. The half life of the U.S. Stock Market Volatility response after the U.S. Stock Market Volatility shock is only two quarters while the the half life of the U.S. High Yield Spread after a shock to U.S. High Yield spread is about a year. The decrease in output and investment are lower with stock market volatility shock compared to high yield spread shock. Output decreases by around 0.6 percent three periods period after a shock to U.S. stock market volatility. The response of investment is about three times as large as that of output. The trade balance improves for two periods by about 0.1 percent and then converges gradually to its steady-state level.

Figure 12 displays the variance decomposition of the variables contained in the VAR system at different horizons. Solid lines with circles depict the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk and country spread shocks. Solid lines shows the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate and the global risk. Broken lines depict the fraction of the variance of the forecasting error explained the US interest rate shock. The first row shows the forecast error variance decomposition at different horizons when the US BAA Corporate spread is used as a proxy for the global risk. The second row shows the forecast error variance decomposition at different horizons when the US stock market volatility index is used as a proxy for the global risk. The third row shows the forecast error variance decomposition at different horizons when the U.S. High Yield spread is used as a proxy for the global risk.

According to our estimate of the VAR system given in equation 1, innovations in the U.S. high yield spreads explain slightly more than 20 percent of movements in aggregate activity while the U.S. stock market volatility and the U.S. BAA Corporate spreads explain slightly less than 20 percent of aggregate fluctuations in emerging economies. The robust finding across different measures of the global risk is that the US real interest rate account for negligible portion of the variance of domestic variables in emerging countries at business cycle frequency. Country-spread shocks account for about 20 percent of aggregate fluctuations when the U.S. BAA Corporate spread and the U.S. Stock Market volatility are used while it account for 15 percent when U.S. high yield corporate spreads is used. Therefore, around 40 percent of business cycles in emerging economies is explained by disturbances in external financial variables. These disturbances play smaller role in explaining movements in trade balance-to-output ratio.

4 Sovereign Risk, Banking Sector Risk and Business Cycle Fluctuations

In this section, I investigate the impact of the global financial conditions and sovereign risk on domestic bank lending spreads and macroeconomic fluctuations in emerging economies. Sovereign distress has often gone hand in hand with banking crises in emerging market economies. As it was briefly discussed before, there is strong positive comovement between bank lending spreads (as a proxy for banking sector risk) and country spreads in emerging economies (see Figure 3).

4.1 Extended Model

I extend the model given in Equation 1 to incorporate a measure of banking sector risk as the following.

$$Ay_{i,t} = \sum_{k=1}^{p} B_k y_{i,t-k} + \eta_i + \epsilon_{i,t} \tag{2}$$

where η_i is a fixed effect and

$$\begin{aligned} y_{i,t} &= \left[\hat{gdp}_{i,t}, \hat{inv}_{i,t}, tby_{i,t}, \hat{R}^{US}_t, \hat{GR}_t, \hat{DS}_{i,t}, \hat{R}_{i,t} \right] \\ \epsilon_{i,t} &= \left[\epsilon^{gdp}_{i,t}, \epsilon^{inv}_{i,t}, \epsilon^{tby}_{i,t}, \epsilon^{RUS}_{t}, \epsilon^{GR}_{t}, \epsilon^{DS}_{i,t}, \epsilon^{R}_{i,t} \right] \end{aligned}$$

$DS_{i,t}$ denotes the domestic bank intermediation spread.

Movements in the domestic bank intermediation spread depend on changes in the risk premium that banks charge to their borrowers; this premium, in turn, reflects changes in the (perceived) risk of default. To the extent that default risk tends to vary with the state of the business cycleduring recessions, default rates tend to increase, and vice versathe ordering of bank lending spread after local variables in the VAR model 2 allows me to capture the endogeneity of bank lending spreads. I acknowledge that there might be other reasons for the observed co-movement between the domestic bank lending spread and the country spread. In the context of the present paper; however, I interpret the comovement as caused by banking sector developments is immediately picked by international investor to charge higher premium; however, changes in sovereign risk (after all domestic variables and global financial conditions are taken into account), affect domestic bank lending spreads with one period lag. I maintain the assumption that it takes one period for the developments in the financial markets to be effective in real economic activity.

I estimate the structural VAR pooling quarterly data from the same group of countries as in the baseline model: Argentina, Brazil, Mexico, Peru, South Africa and Turkey. However, the sample period for some of the countries is shorter than the baseline model based on the availability of the bank lending spread data. The sample also begins in the first quarter of 1994 and ends in the third quarter of 2011.The only difference is that the sample for Brazil starts from 1999Q3 instead of 1995Q1; and for Turkey from 2003Q1 instead of 1999Q3. I estimate the Bank Lending Spread, Output, Investment, Trade Balance-to-Output Ratio and Country Interest rate equations of the VAR system in Equation 2 by OLS including country dummies and constant term. The exogenous block (U.S. real interest rate and Global Risk Aversion Equations) of the VAR system in Equation2 is estimated by OLS including only constant for the longer time span from 1987:3 to 2011:4.

4.2 Estimation Results for the Extended Model

This section focuses on the role domestic interest rates in the transmission process of external shocks to output. Figure 13 displays the response of the variables included in the VAR system 2 to one standard deviation increase in the domestic bank lending spread shock. In response to an unanticipated one standard deviation shock to domestic lending spread (1.3 percentage points), the country spread increases by about 0.5 percentage point and then quickly falls toward its steady-state level. Output, investment, and the trade balance to-output ratio respond as one would expect. The output and investment fall significantly one period after the shock and recover pretty quickly to their steady state level. The trade balance improves significantly in the year following the shock. The impact of a bank lending spread shock on domestic macroeconomic aggregates is vert short-lived. The effect of the shock dies out very quickly and its impact is statistically insignificant about a year after the shock. Based on the variance decomposition analysis (not shown in the figure), 10 percent of the fluctuations in country spreads is explained by bank lending spreads, which is also robust to alternative orderings (not shown in figure).[13].

Figure 14 displays the response of the variables included in the VAR system to one standard deviation increase in the country spread shock. In response to an unanticipated country-spread shock, the country spread itself increases on impact, stays high one period after the shock and then falls toward its steady-state level. Output and investment fall, and the trade balance improves significantly in the three periods following the shock. The impact of heightened country risk on the domestic bank lending spreads is statistically significant. 0.8 percentage point increase in the country risk premium leads to 0.4 percentage point increase in the bank-lending spread in emerging

[13]The results in this are not directly comparable to the baseline model because in the extended model sample size is different even if the number of countries is same. In the baseline model I report that around 60 percent of fluctuations in country spread is due to country spread shock itself. In the model with bank lending spreads, 50 percent of fluctuations in country spread is explained by the country spread shock itself

economies. The effect of the shock on bank lending spreads dies out quickly. The half life of bank lending spread is about a year.

The impulse responses following one standard deviation increase in a measure of Global Risk is shown in Figure 15. The interesting result is that the effect of the global risk on domestic bank lending spreads is negligible. Most of the impact of the global risk still transmitted to the domestic economy through its impact on country spreads.

5 Robustness Analysis

5.1 Robustness of Results to Different Estimation Methods

The purpose of this section is to apply different econometric estimation methods and compare the estimated impulse response function. Judson and Owen (1999) and Juessen and Linnemann (2010) compare the performance of widely applied techniques to estimate panel VARs from macroeconomic (large T) data with the help of Monte Carlo simulations. In this section I briefly discuss estimation methods implemented in this paper (Least square dummy variable method (LSDV), Bias corrected Least square dummy variable method (LSDVBC) following Hahn and Kuersteiner (2002) and GMM method following Arellano and Bond (1991)) and then compare the estimated impulse response functions across different methods.

The panel VAR model given in equation 1 has additive individual time invariant intercepts (fixed effects) along with a parameter common to every country used in the sample. LSDV method eliminates the fixed effects. A potential concern with LSDV estimation of the panel VAR models is the inconsistency of the least squares parameter estimates due to the combination of fixed effects and lagged dependent variables, but, the associated bias decreases in T; see e.g. Nickell (1981). I use the bias-corrected fixed effects estimator developed by Hahn and Kuersteiner (2002). Their method is suitable for panel VAR models with large times series dimension which is the case in this study. The estimator I implement is given by equations (3) and (4) in Hahn and Kuersteiner (2002). GMM estimator takes first differences of the dynamic system to eliminate the fixed effects. This introduces a correlation between lagged dependent variables and differenced errors. Arellano and Bond (1991) have developed GMM estimators that use all linear moment restrictions specified by the model, as more lagged instruments become available for the differenced equation. Since the number of moment restrictions increases at the order T^2; I do not use all available moment restrictions but use a maximum of five lagged levels as instruments.

Figure 16 shows the estimated impulse responses to one standard deviation shock to country spreads. The dashed lines are the impulse response functions that are implied by the LSDV estimates and the solid lines with stars show impulse response functions from the bias-corrected fixed effects estimator, LSDVBC. Only the former impulse responses are accompanied by 95% and 68% bootstrapped confidence bands (shown by the dark-gery and light-grey shaded areas respectively). All responses are estimated to be in line with one would expect. The bias-corrected estimates show more persistence than the LSDV estimates. This observation reflects the negative bias of the LSDV estimator in samples of this size. Output and Investment responses are still substantial and they stay as low as a period after shock after about a year, i.e. at a time when the exogenous persistence of country spending itself has reduced the decrease in output and investment to about half its impact value. Other than with respect to persistence, the impulse responses from the LSDV and LSDVBC estimates turn out to be fairly similar (with the LSDVBC responses lying within the confidence bands of the LSDV based ones).

Figure 17 shows impulse response functions to one standard deviation shock to country spreads. The estimated impulse responses with GMM method are shown with circled lines. The results are in general in line with the monte carlo evidence presented in Juessen and Linnemann (2010) . The substantial negative bias in this type of estimator translates into impulse response functions dying out very quickly. This problem is most remarkable for Investment equation. Investment decreases one period after the shock. The decrease in the investment is substantially lower than the decline predicted by the LSDV estimator and the effect of the shock on domestic macroeconomic variables dies out very quickly.

Overall, I argue that estimated impulse response functions following country spread shocks obtained using widely applied simple fixed effects LSDV estimator are still reasonably close to the bias-corrected ones, though they tend to understate the persistence of shock effect. Since the time series dimension of my data is very large (significantly larger than cross section dimension), LSDV method produces estimates with small bias; and when converted into impulse responses and variance decompositions, the results obtained with LSDVBC method are fairly close to the results predicted by simple LSDV.

5.2 An Alternative Identification Scheme for Global Financial and Sovereign Spread Shocks

In this section I present an an alternative strategy for identifying country-spread shocks. Namely, I assume that innovations to the US interest rate, to the global risk and to country spreads can affect real domestic variables contemporaneously and that innovations to domestic variables affect country spreads with a lag. Formally, the empirical system takes the form where the matrix A is assumed to be lower triangular. I continue to assume that the US interest rate and a measure of global risk follows a VAR(2) process.

$$Ay_{i,t} = \sum_{k=1}^{p} B_k y_{i,t-k} + \eta_i + \epsilon_{i,t} \tag{3}$$

where η_i is a fixed effect and

$$\begin{aligned} y_{i,t} &= \left[\hat{R}_t^{US}, \hat{GR}_t, \hat{R}_{i,t}, \hat{gdp}_{i,t}, \hat{inv}_{i,t}, tby_{i,t}\right] \\ \epsilon_{i,t} &= \left[\epsilon_t^{RUS}, \epsilon_t^{GR}, \epsilon_{i,t}^{R}, \epsilon_{i,t}^{gdp}, \epsilon_{i,t}^{inv}, \epsilon_{i,t}^{tby}\right] \end{aligned}$$

The impulse responses following one standard deviation shock to the country spread and to the global risk is shown in Figure 18. The shape of the impulse responses is very similar to the one obtained under baseline model. Figure 19 displays the variance decomposition of the variables contained in the VAR system at different horizons. Surprisingly, the difference in the contribution to external financial conditions to domestic variables in this identification scheme is very small compared to the baseline model. International financial factors jointly accounts for about 45 percent of the fluctuations in domestic activity. The contribution of the U.S. interest rate shock is still negligible.

5.3 Sub-sample Analysis - Pre-crises period

One natural question in this context is whether the results presented in this study are driven by the crises in 2008. There is a tendency for comovements in financial markets indicators to increase during crisis periods. In light of this, I re-run the baseline VAR system 1 for the time period between 1994Q1-2007Q3.

Figure 20 displays the variance decomposition of the variables contained in the VAR 1 system at different horizons between 1994Q1-2007Q4 period. Solid lines show the fraction of the variance of the forecasting error explained jointly by US-interest-rate shocks and country-spread shocks. Broken lines depict the fraction of the variance of the forecasting error explained by US-interest rate shocks. The results show that global risk is still important in deriving sovereign spreads and macroeconomic fluctuations in emerging economies. The percent of forecast error variance explained by global risk for output and investment decreases only slightly. The role of US real interest rate on business cycle fluctuations of the countries included in the sample is still small. The role of country spreads in accounting for the fluctuations in output and investment is unchanged.

5.4 Different country coverage

To study the robustness of the results presented in the baseline model, I augment the sample by adding 4 more emerging economies. Namely, Chile, Colombia, Malaysia, and Philippines. I also deepen the sample in the temporal dimension by enlarging the Argentine sample to the period 1983:1 to 2001:3. The variance decomposition results of estimating the VAR system 1 using the expanded sample are shown in Figure 21. External shocks still account for an important fraction of the variance explained in emerging economies. Around 30% of the fluctuations in economic activity is explained jointly by external financial conditions and sovereign spreads.

6 Conclusion

After recent financial crises, there has been a renewed interest in understanding the role of global factors in explaining the variation in the country spreads and in the business cycle fluctuations in emerging economies. This paper has explored the role of global shocks in accounting for the volatility of macroeconomic aggregates in emerging economies. Impulse responses and variance decomposition exercise show that global risk shocks explain about 20 percent of movements in aggregate activity in emerging economies while the contribution of U.S. Interest Rate shocks to emerging market business cycle fluctuations is negligible. Therefore, the role of U.S. interest rate shocks in driving the business cycle fluctuations in emerging economies, as emphasized in the previous literature, is taken up by the global risk shocks. Sovereign spread shocks, after the role of external factors and state of the macroeconomy is taken into account, explain about 15 percent of business cycles in emerging economies. But, more importantly, country spreads play a significant role in propagating shocks. For instance, I find that global risk shocks explain about 20 percent of movements in output. This is a large number. But most of the contribution of global risk to business cycles in emerging markets is due to the fact that country spreads respond systematically to variations in this variable. Specifically, if country spreads were independent of the global risk, then the variance of emerging countries output explained by global risk would fall by about two thirds.

7 Appendix

7.1 Appendix A: Data Description

The dataset includes quarterly data for Argentina, Brazil, Mexico, Peru, South Africa and Turkey. The sample periods vary across countries. They are : Argentina 1994Q1-2001Q3, Brazil 1995Q1-2011Q3, Mexico 1994Q1-2011Q3, Peru 1997Q1-2011Q3, South Africa: 1994Q4-2011Q3, and Turkey: 1999Q3-2011Q3. The default period in Argentina is excluded from the analysis as the country interest rate in that period was not allocative. In total, the dataset contains 345 observations. My choice of countries and sample period is guided by data availability. The countries I consider belong to the set of countries included in J. P. Morgans EMBI+ data set for emerging-country spreads. In the EMBI+database, time series for country spreads begin in 1994:1 or later.

Quarterly series for GDP, investment and net exports are from the IMFs International Financial Statistics. All of these variables are deflated using the GDP deflator. The country spread is measured using data on spreads from J.P.Morgans Emerging Markets Bond Index Plus (EMBI+). The U.S. real interest rate is measured by the interest rate on three-month US treasury bill minus a measure of US expected inflation. EMBI+ is a composite index of different US dollar-denominated bonds on four markets: Brady bonds, Eurobonds, U.S. dollar local markets and loans. The spreads are computed as an arithmetic, market-capitalization-weighted average of bond spreads over US treasury bonds of comparable duration. Domestic bank borrowing lending spread in emerging economies is the difference between domestic lending rate by banks to corporate sector and the deposit rate, as reported in the International Financial Statistics of the International Monetary Fund. The data for Turkey is from the Central bank of the Republic of Turkey.

U.S. Stock Market Volatility is the monthly (averages of daily values) U.S. Implied Stock Market Volatility (VXO index: Chicago Board of Options Exchange VXO index of percentage implied volatility, on a hypothetical at the money S&P500 option 30 days to expiration). U.S. High Yield Corporate Spread is the spread between the yield of the Merrill Lynch High Yield Master II Index (YTM) and U.S. 20 Year Government Bond Yields. U.S. BAA Corporate Spread is calculated as the difference between U.S. BAA Corporate Rate and U.S. 20 Year Government Bond Yields. U.S. Real Interest Rate is measured as the 3-month gross U.S. Treasury Bill rate deflated using a measure of expected U.S. inflation (see Schmitt-Grohe and Uribe (2011) for details of the calculation of expected U.S. Inflation). I use 2 lags of inflation when calculating expected U.S. inflation. The results are not sensitive to using higher lags of inflation in calculating real interest rates. Sovereign spreads (EMBI+) are downloaded from Global Financial Data and Bloomberg. The U.S. 3M TBILL Rate, the U.S. CPI, the U.S. BAA Corporate Rate and 20Y Government Bond Yield are obtained from St. Louis Fed. FRED Database. The Merrill Lynch High Yield Master II Index (YTM) is from Bloomberg.

References

Agenor, Pierre-Richard, Joshua Aizenman, and Alexander W. Hoffmaister, "External Shocks, Bank Lending Spreads, and Output Fluctuations," *Review of International Economics, Vol. 16, No. 1, pp. 1-20, February 2008*, 2008. 1

Aguiar, Mark and Gita Gopinath, "Emerging Market Business Cycles: The Cycle Is the Trend," *Journal of Political Economy*, 2007, *115*, 69–102. 1

Akinci, Ozge, "Financial Frictions and macroeconomic Fluctuations in Emerging Economies," 2012. 1

Arellano, Manuel and Stephen Bond, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, April 1991, *58* (2), 277–97. 5.1

Blanchard, Olivier J., Mitali Das, and Hamid Faruqee, "The Initial Impact of the Crisis on Emerging Market Countries," *Brookings Papers on Economic Activity*, 2010, *41* (1 (Spring), 263–323. 1

Bloom, Nicholas, "The Impact of Uncertainty Shocks," *Econometrica*, 05 2009, *77* (3), 623–685. 1

Calvo, Guillermo A., "Globalization Hazard and Delayed Reform in Emerging Markets," 2002. 1, 3

_ , Leonardo Leiderman, and Carmen M. Reinhart, "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," *Staff Papers - International Monetary Fund*, 1993, *40* (1), pp. 108–151. 1

Edwards, Sebastian and Carlos A. Vegh, "Banks and macroeconomic disturbances under predetermined exchange rates," *Journal of Monetary Economics*, October 1997, *40* (2), 239–278. 5

Garca-Herrero, Alicia, Alvaro Ortz, and Kevin Cowan, "The Role of Global Risk Aversion in Explaining Sovereign Spreads [with Comments]," *Economa*, 2006, *7* (1), pp. 125–155. 1

Hahn, Jinyong and Guido Kuersteiner, "Asymptotically Unbiased Inference for a Dynamic Panel Model with Fixed Effects when Both n and T Are Large," *Econometrica*, July 2002, *70* (4), 1639–1657. 2.2, 5.1

Judson, Ruth A. and Ann L. Owen, "Estimating dynamic panel data models: a guide for macroeconomists," *Economics Letters*, October 1999, *65* (1), 9–15. 5.1

Juessen, Falko and Ludger Linnemann, "Estimating panel VARs from macroeconomic data: Some Monte Carlo evidence and an application to OECD public spending shocks," Working Paper SFB 823, TU Dortmund University 2010. 5.1

Lizarazo, Sandra, "Default risk and risk averse international investors," MPRA Paper 20794, University Library of Munich, Germany August 2011. 1

Longstaff, Francis A., Jun Pan, Lasse H. Pedersen, and Kenneth J. Singleton, "How Sovereign Is Sovereign Credit Risk?," *American Economic Journal: Macroeconomics*, April 2011, *3* (2), 75–103. 1

Mendoza, Enrique G., "Real Business Cycles in a Small Open Economy," *The American Economic Review*, 1991, *81* (4), pp. 797–818. 1

_ **and Vivian Z. Yue**, "A General Equilibrium Model of Sovereign Default and Business Cycles," Working Paper 17151, National Bureau of Economic Research June 2011. 1

Neumeyer, Pablo A. and Fabrizio Perri, "Business cycles in emerging economies: the role of interest rates," *Journal of Monetary Economics*, March 2005, *52* (2), 345–380. 1

Nickell, Stephen J, "Biases in Dynamic Models with Fixed Effects," *Econometrica*, November 1981, *49* (6), 1417–26. 2.2, 5.1

Oviedo, P. Marcelo, "World Interest Rate, Business Cycles, and Financial Intermediation in Small Open Economies," Staff General Research Papers 12360, Iowa State University, Department of Economics May 2005. 5

Schmitt-Grohe, Stephanie and Martin Uribe, "Closing small open economy models," *Journal of International Economics*, October 2003, *61* (1), 163–185. 1

_ **and** _ , "Pegs and Pain," Working Paper 16847, National Bureau of Economic Research March 2011. 2, 7.1, 1

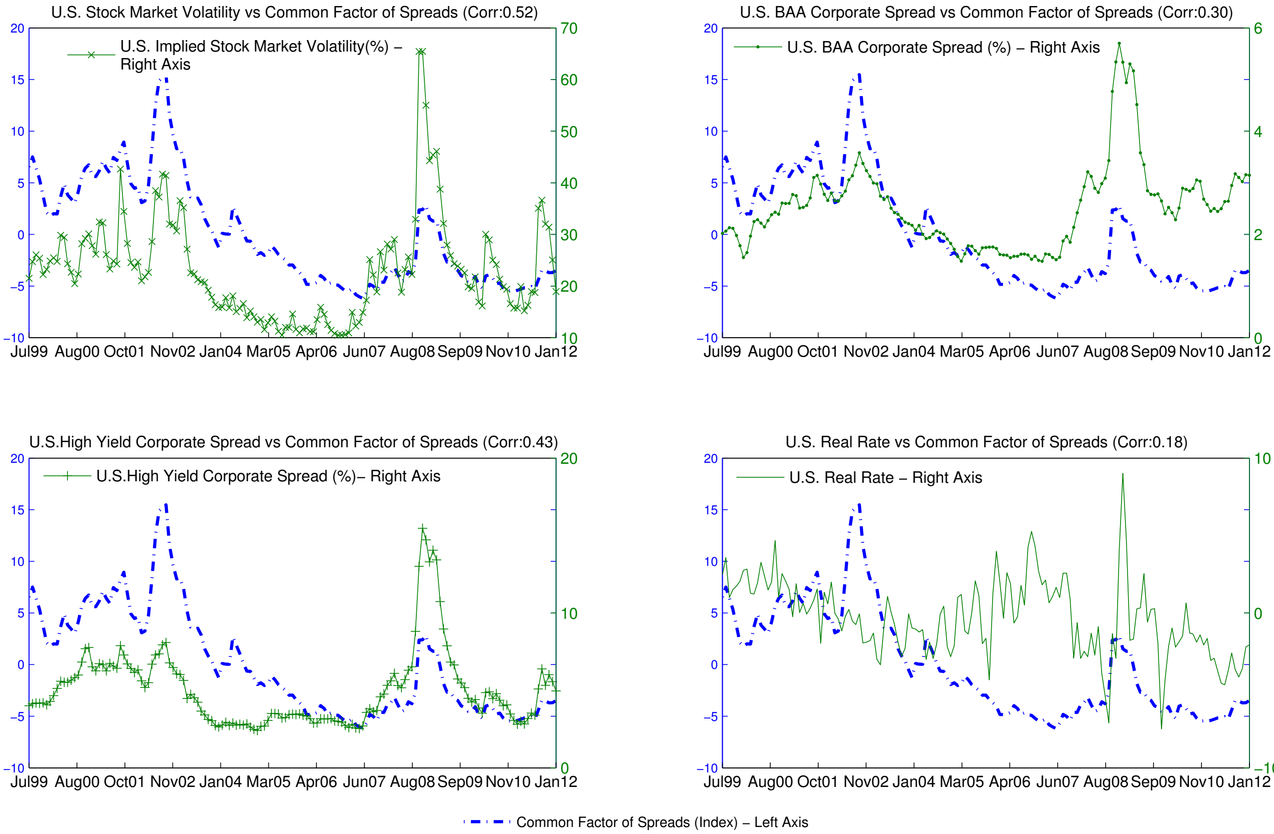
Uribe, Martin and Vivian Z. Yue, "Country spreads and emerging countries: Who drives whom?," *Journal of International Economics*, June 2006, *69* (1), 6–36. 1, 2

Table 1: Lag Length Selection Criteria (6 country Panel with country specific dummy and constant)

Lags	LR	FPE	AIC	SC	HQ
0	NA	1.95e-13	-17.92	-17.44	-17.73
1	2018.44	6.76e-16	-23.57	**-22.93***	**-23.32***
2	**40.16***	**6.57e-16***	**-23.60***	-22.79	-23.28
3	19.27	6.78e-16	-23.57	-22.59	-23.18
4	23.48	6.91e-16	-23.55	-22.40	-23.10

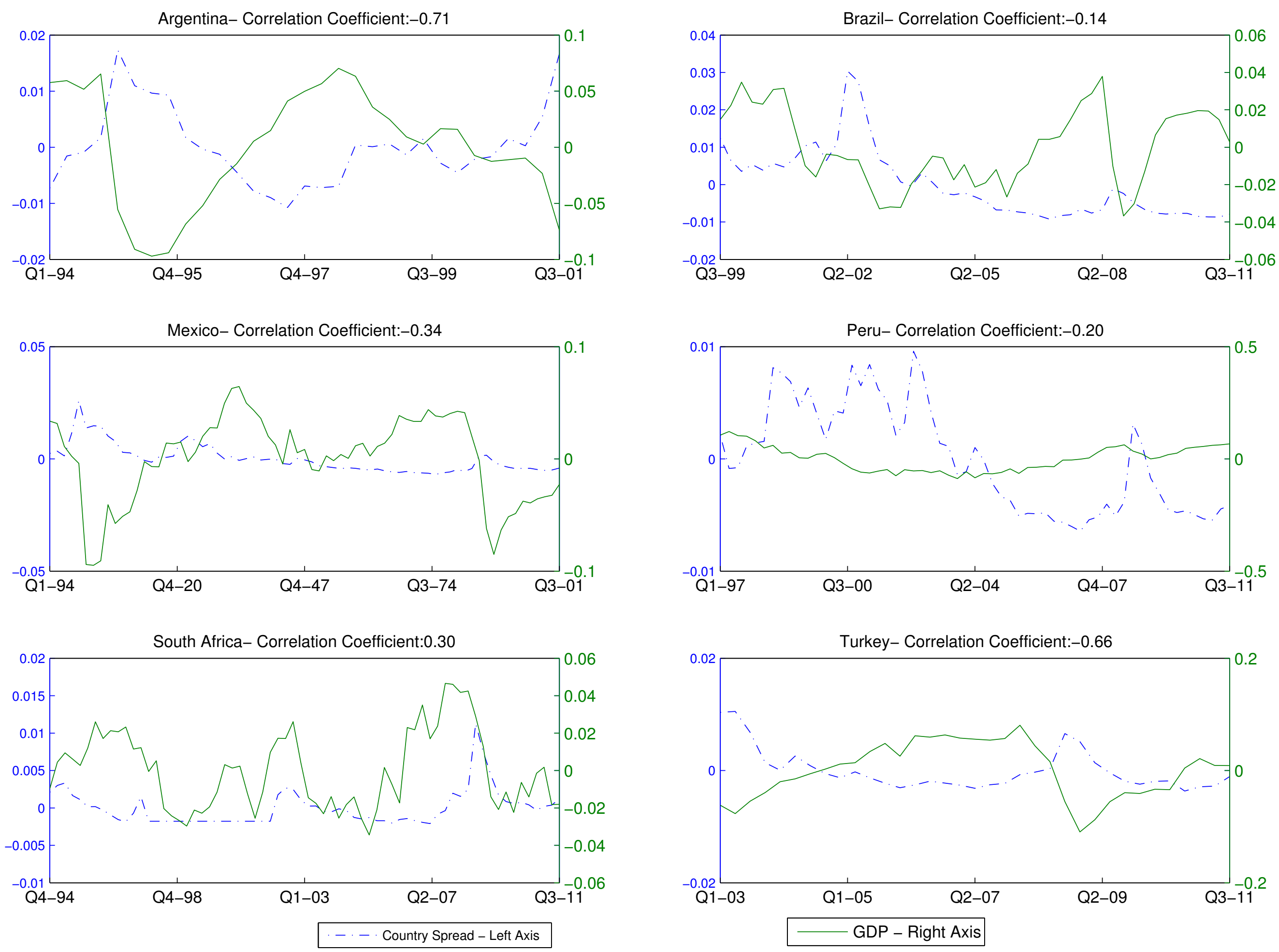
Notes: * indicates lag order selected by the criterion (at 5% level). LR: sequential modified LR test statistics; FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Figure 1: The Global Risk, The U.S. Real Rate and the Country Spread



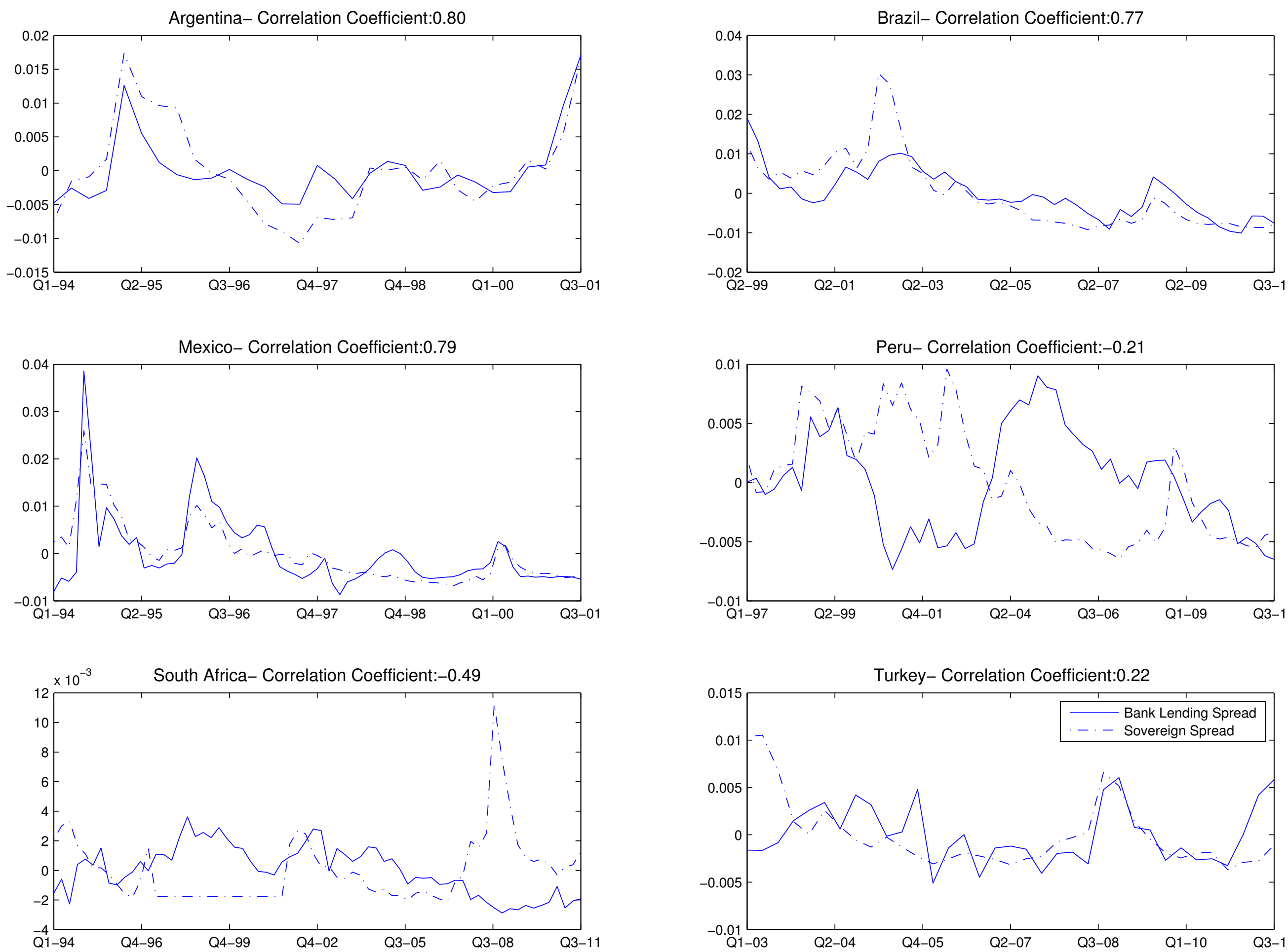
Notes: The common factor of spreads is the first principal component based on sovereign spreads of Brazil, Chile, Colombia, Malaysia, Mexico, Peru, Philippines, South Africa and Turkey. Argentina is excluded from the group of countries because of sovereign default in 2001. U.S. Stock Market Volatility is the monthly (averages of daily values) U.S. Implied Stock Market Volatility (VXO index: Chicago Board of Options Exchange VXO index of percentage implied volatility, on a hypothetical at the money S&P500 option 30 days to expiration). U.S. High Yield Corporate Spread is the spread between the yield of the Merrill Lynch High Yield Master II Index (YTM) and U.S. 20 Year Government Bond Yields. U.S. BAA Corporate Spread is calculated as the difference between U.S. BAA Corporate Rate and U.S. 20 Year Government Bond Yields. U.S. Real Interest Rate is measured as the 3-month gross U.S. Treasury Bill rate deflated using a measure of expected U.S. inflation (see Schmitt-Grohe and Uribe (2011) for details of the calculation of expected U.S. Inflation). I use 13 lags of inflation when calculating expected U.S. inflation. Data Source: Sovereign spreads (EMBI+), Global Financial Data and Bloomberg; U.S. 3M TBILL Rate and U.S. CPI, U.S. BAA Corporate Rate and 20Y Government Bond Yield, St. Louis Fed. FRED Database; U.S. Stock Market Volatility, Bloom (2009). Merrill Lynch High Yield Master II Index (YTM), Bloomberg. The common factor is measured on the left axis. Restricting the sample to those countries included in the baseline analysis in (Brazil, Mexico, Peru, South Africa and Turkey) yields very similar correlation coefficients with U.S. financial market variables.

Figure 2: Country Spread vs GDP



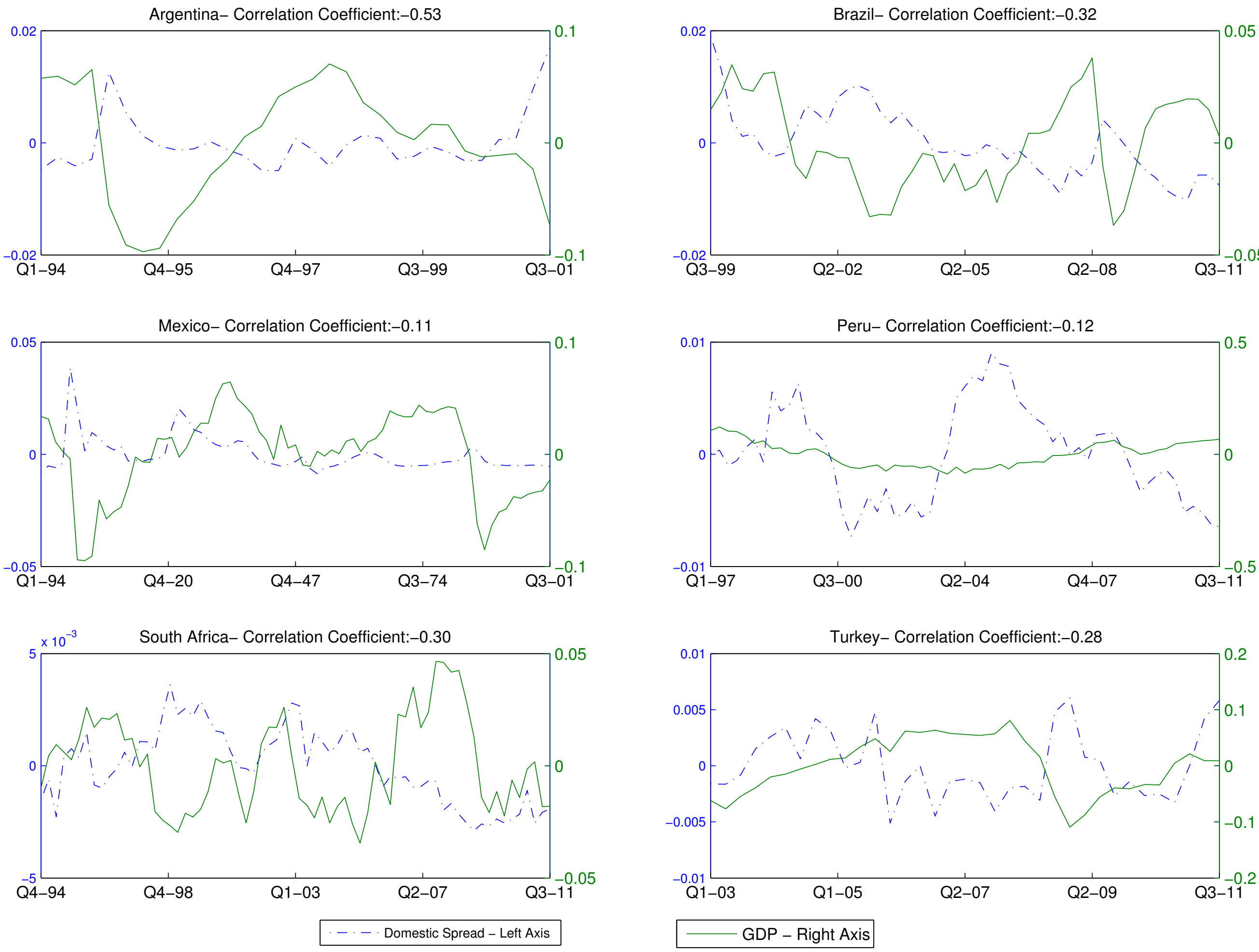
Notes: Output is seasonally adjusted and detrended using a log-linear trend. EMBI+ is an index of country interest rates which are real yields on dollar-denominated bonds of emerging countries issued in international financial markets. Data source: Output, IFS; EMBI+,Global Financial Data.

Figure 3: Domestic Borrowing Lending Spreads vs Sovereign Risk



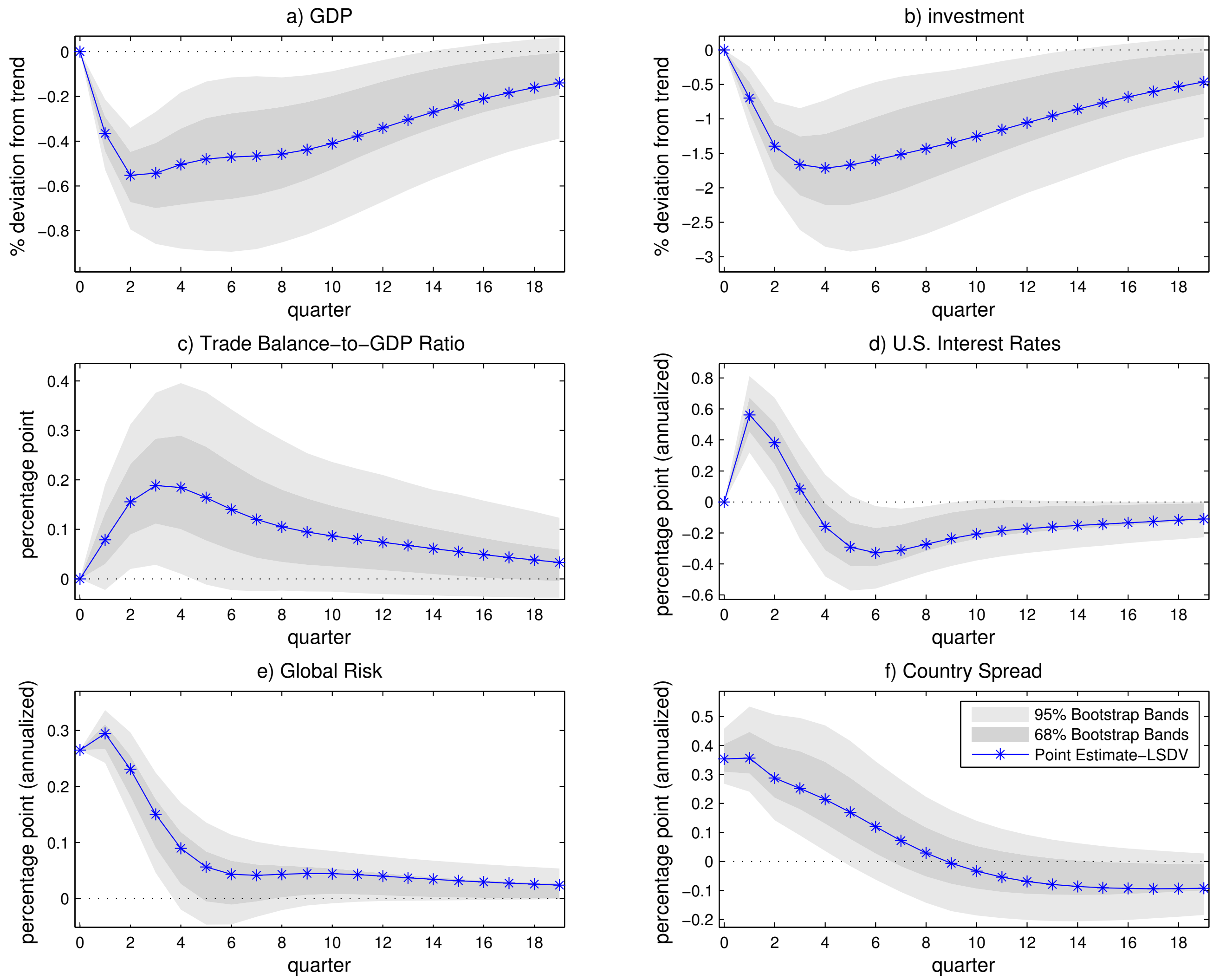
Notes: EMBI+ is an index of country interest rates which are real yields on dollar-denominated bonds of emerging countries in international financial markets. Borrowing lending spread is the difference between domestic lending rate by banks to corporate sector and the deposit rate. Data source: Domestic bank lending spreads, IFS; EMBI+,Global Financial Data.

Figure 4: Domestic Borrowing Lending Spreads vs GDP



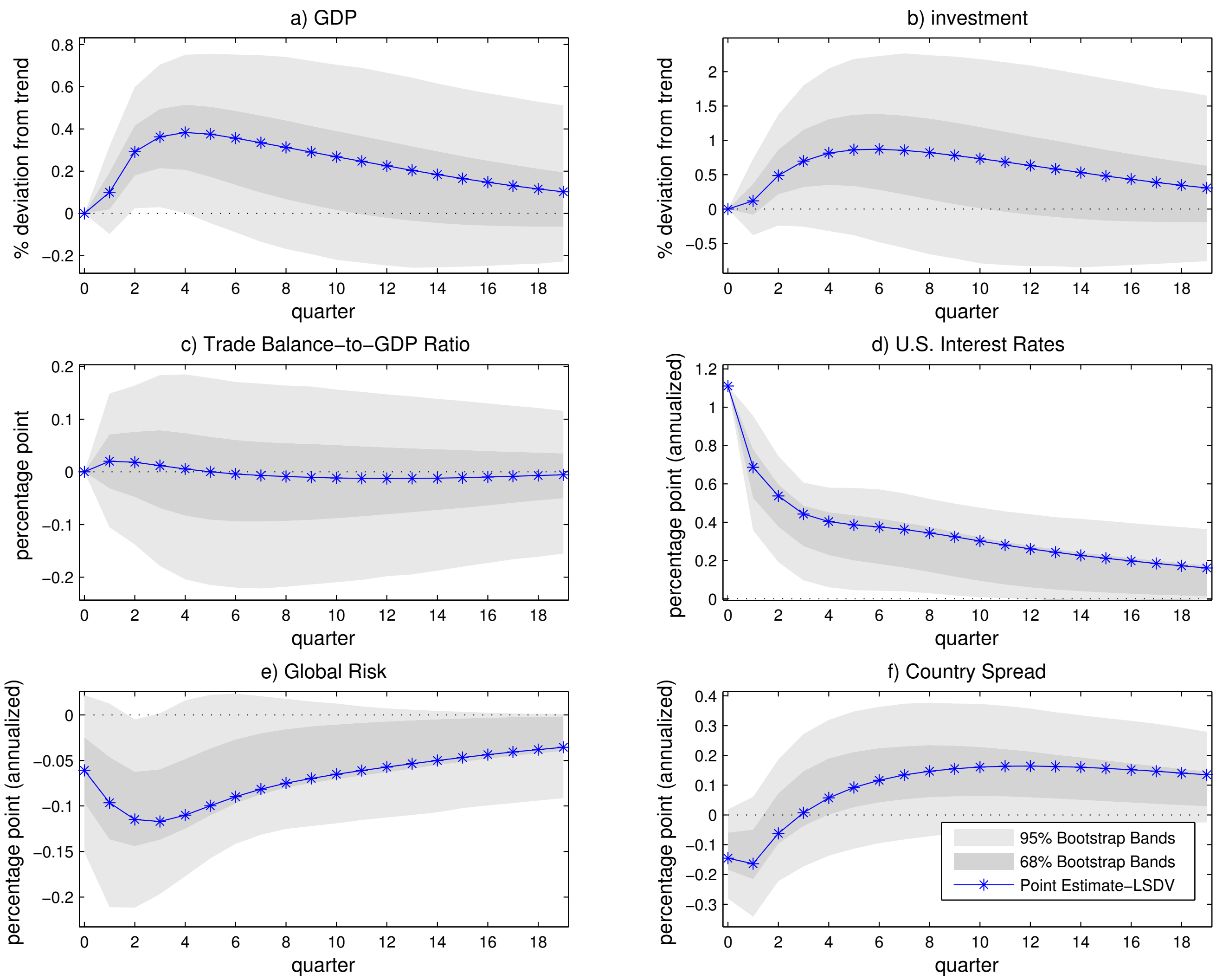
Notes: Borrowing lending spread is the difference between domestic lending rate by banks to corporate sector and the deposit rate. Output is seasonally adjusted and detrended using a log-linear trend. Data source: Output and domestic bank lending spreads, IFS.

Figure 5: Impulse Response to a one standard deviation shock to the Global Risk: The U.S. BAA Corporate spread



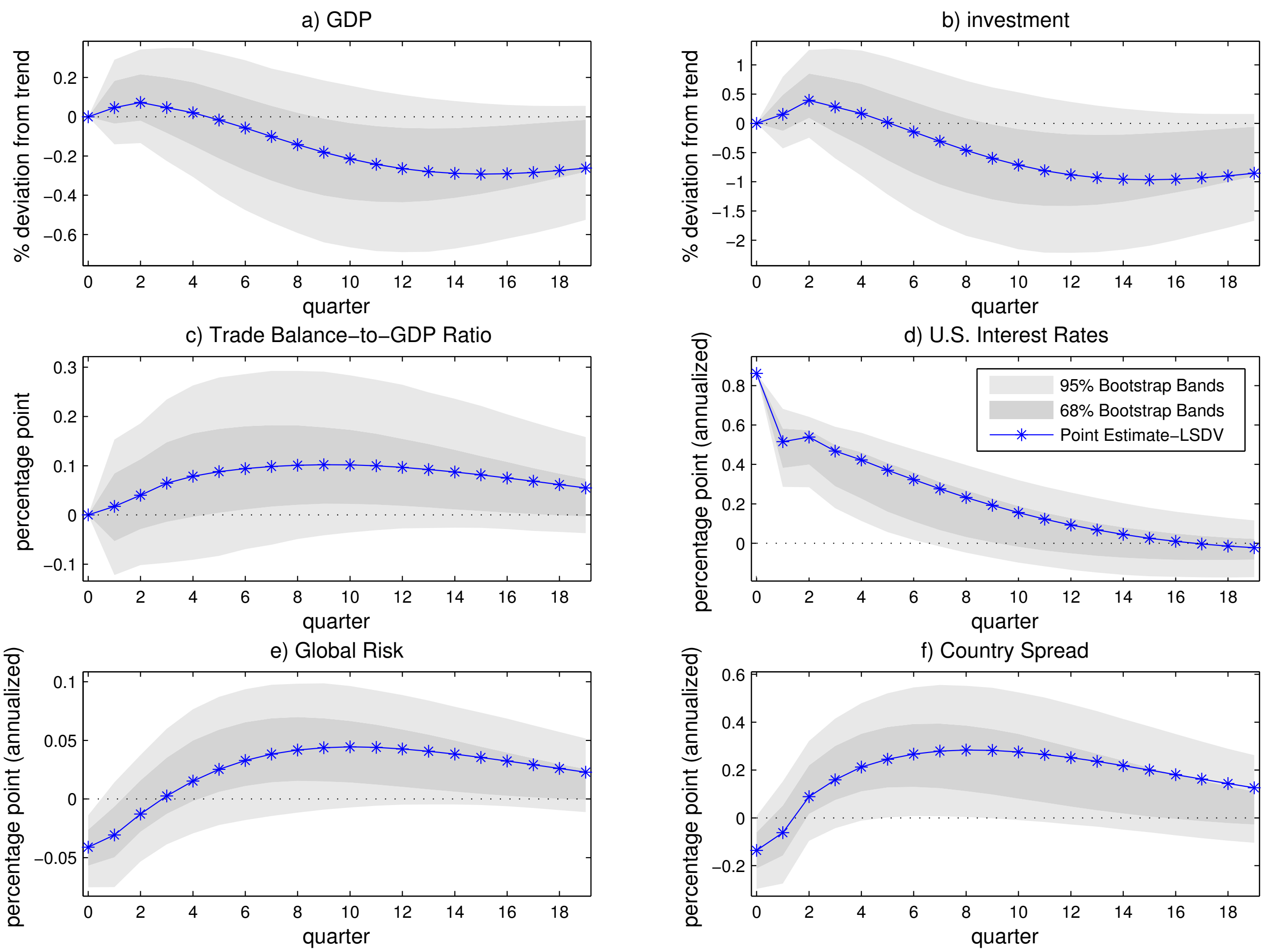
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 6: Impulse Response to a one standard deviation shock to the U.S. Real Interest Rate



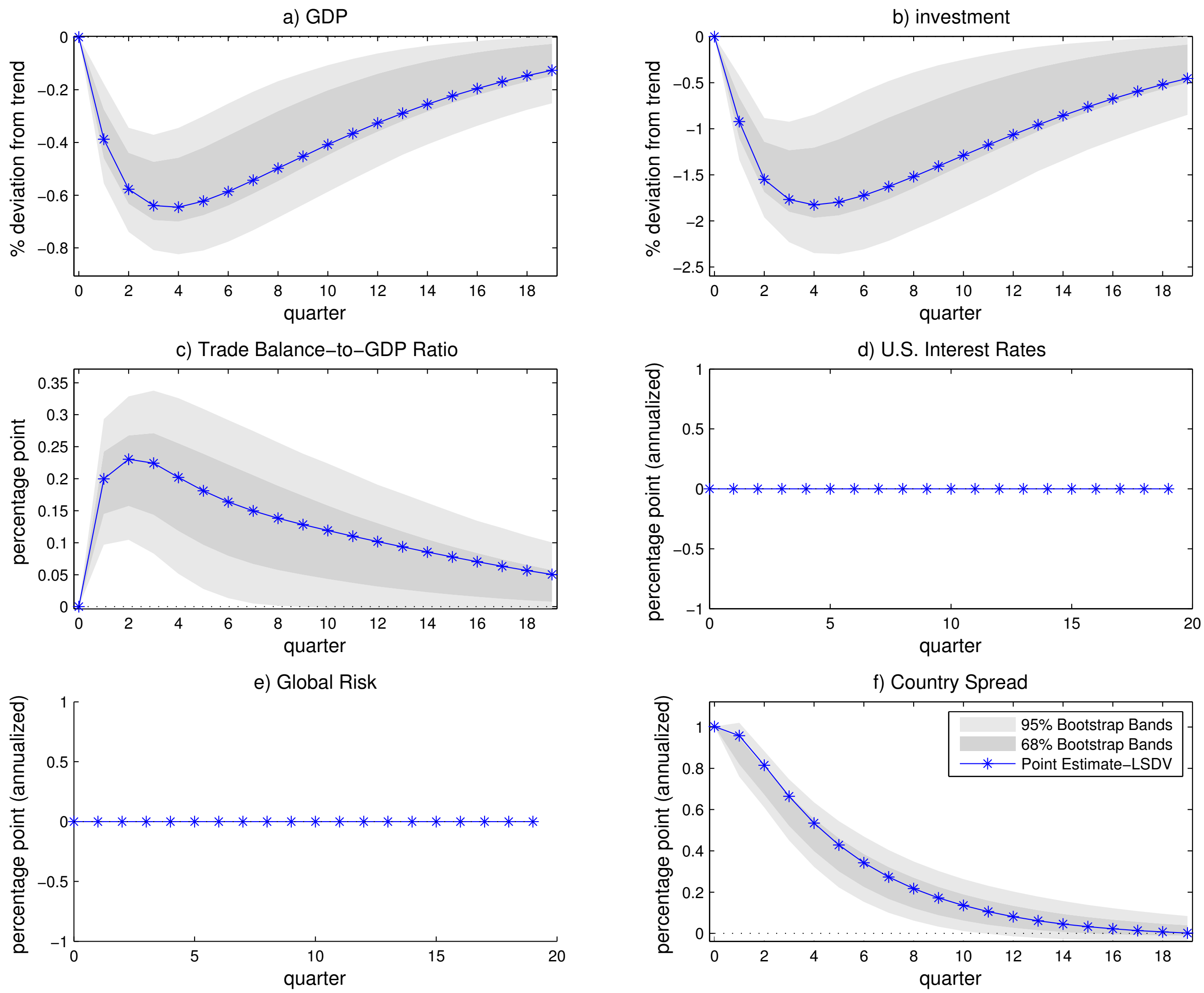
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 7: Impulse Response to a one standard deviation shock to the U.S. Real Interest Rate in the Pre-Crises Period



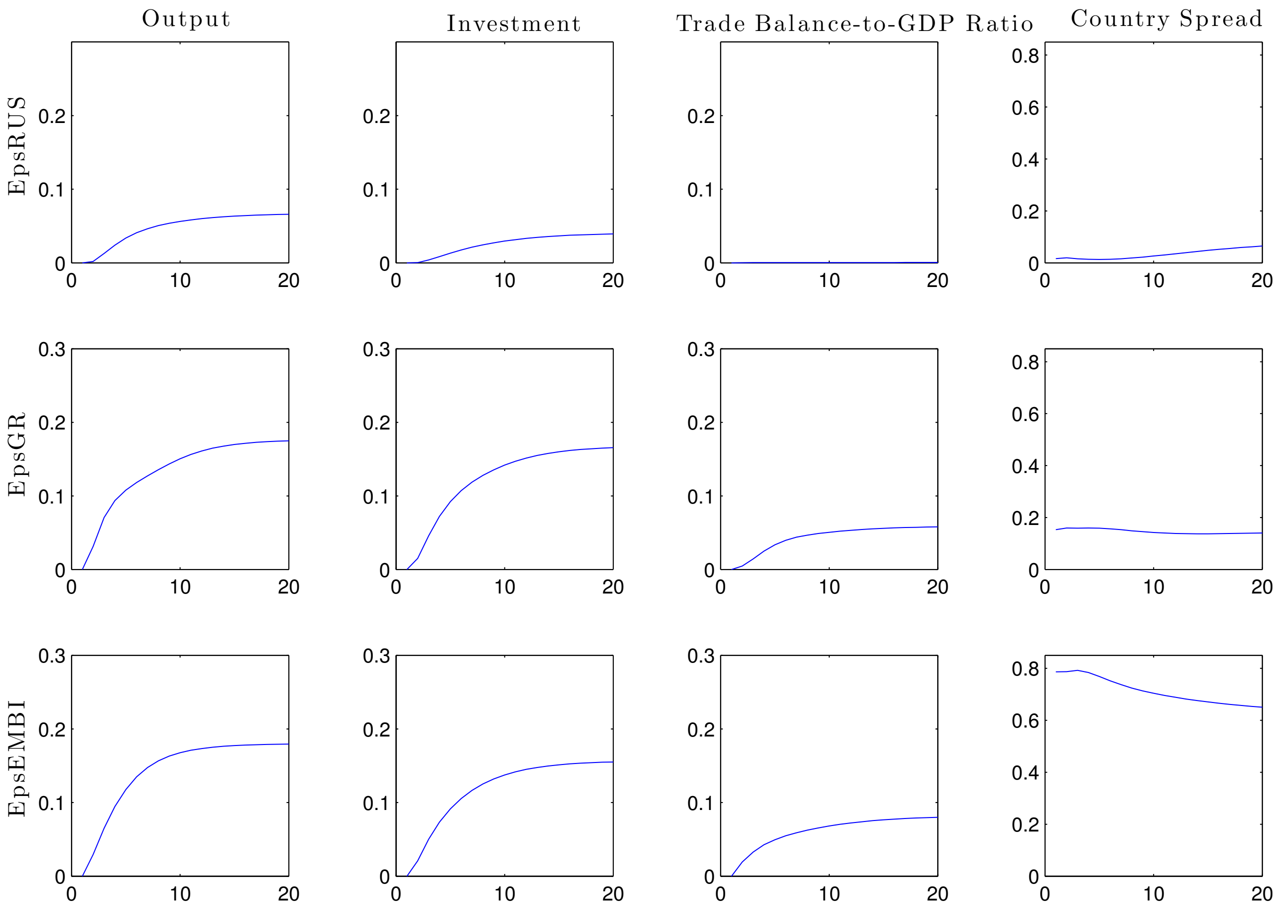
Notes: The estimated impulse responses are for pre-crises period (sample end in 2007Q4). Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 8: Impulse Response to a one standard deviation shock to the country spread



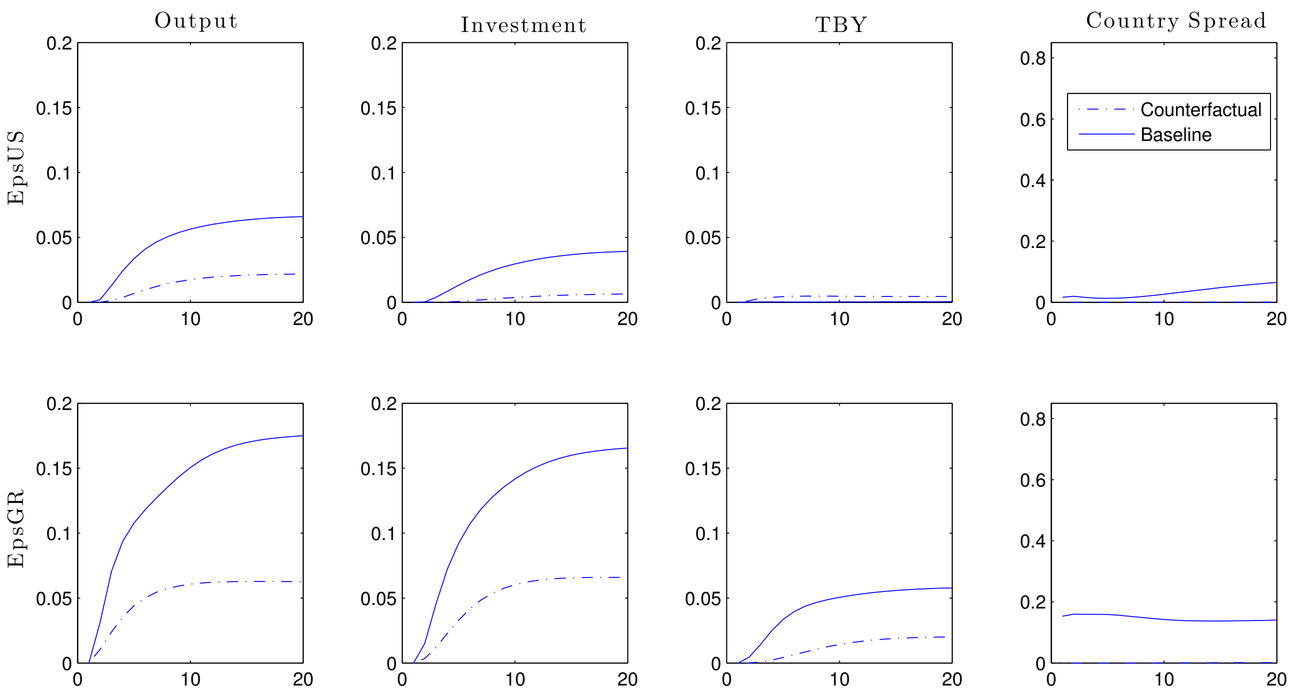
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 9: Forecast Error Variance Decomposition at Different Horizons



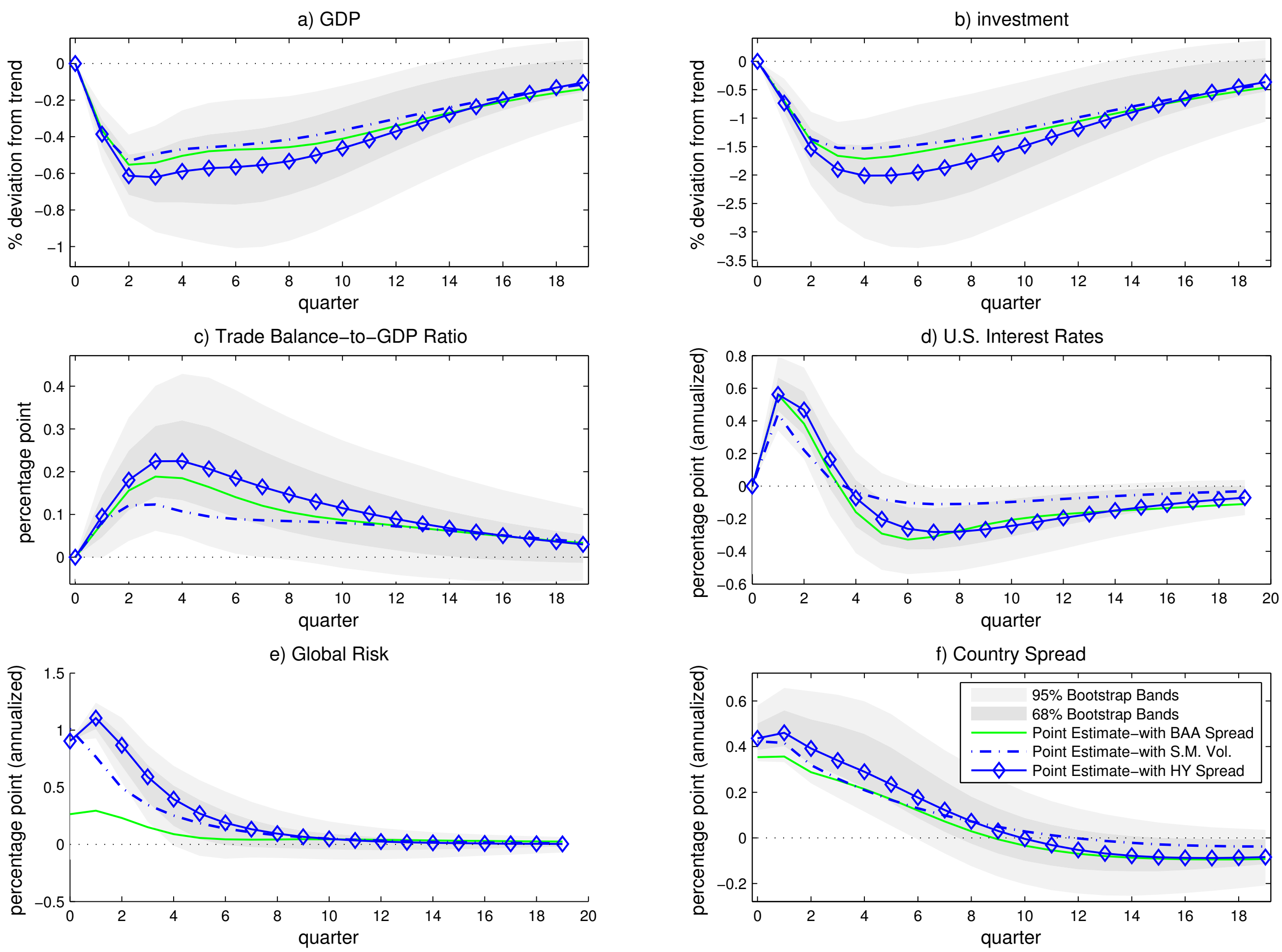
Notes: Solid lines depict the fraction of the variance of the k-quarter ahead forecasting error explained by the US real interest rate shocks (shown in the first row), the Global Risk shocks (shown in the second row); and the Country Spread shocks (shown in the last row) at different horizons. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 10: Forecast Error Variance Decomposition at Different Horizons–Counterfactual



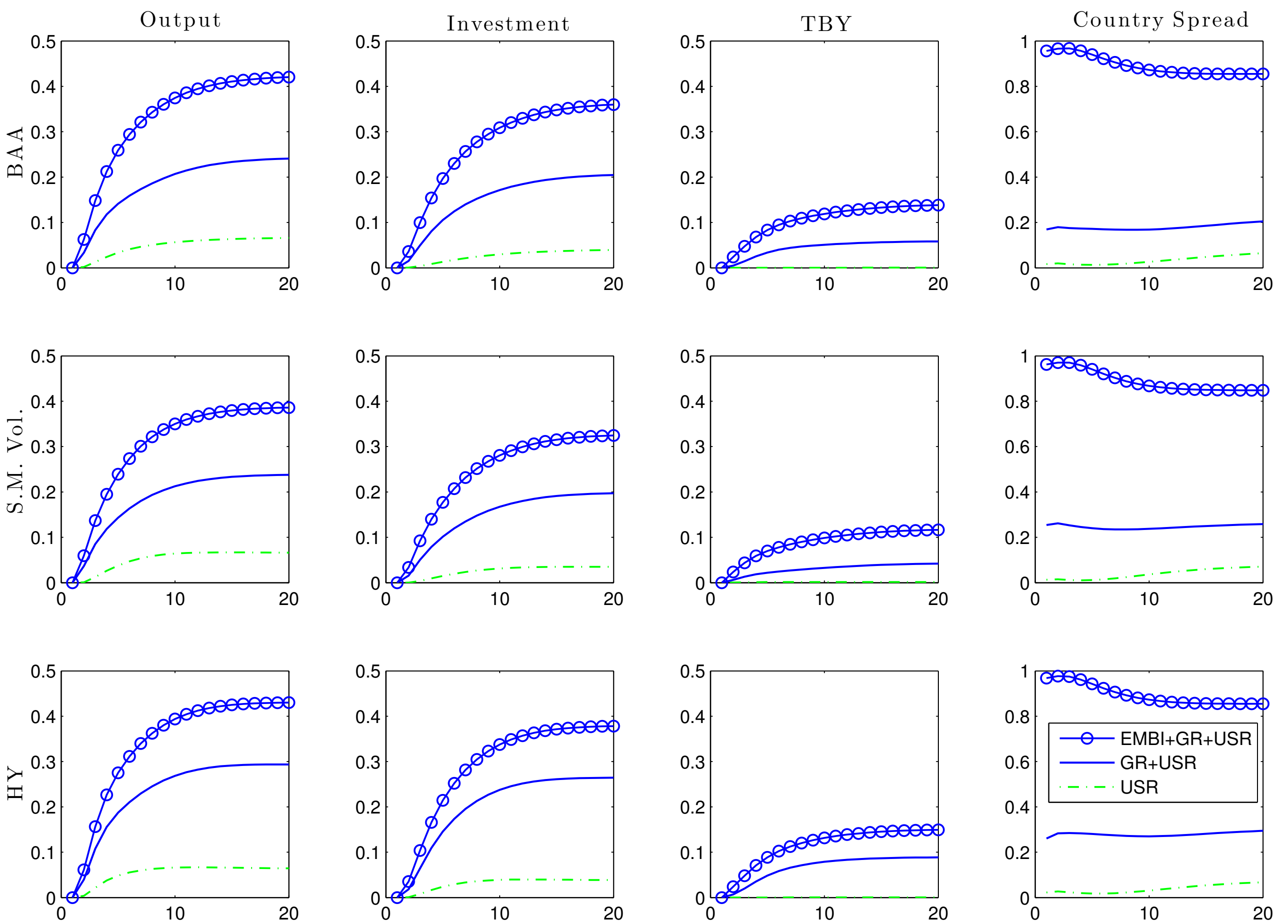
Notes: Solid lines depict the fraction of the variance of the k-quarter ahead forecasting error explained by the US real interest rate shocks (shown in the first row), the Global Risk shocks (shown in the second row). Dashed lines show the fraction of the variance of the k-quarter ahead forecasting error explained by the US real interest rate shocks (shown in the first row), the Global Risk shocks (shown in the second row), when the country spread is assumed not to respond directly to variations in US financial variables. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 11: Impulse Response to a one standard deviation shock to the Global Risk: the U.S. BAA Corporate spread, the U.S. HY Corporate Spread, and the U.S. Stock Market Volatility Index



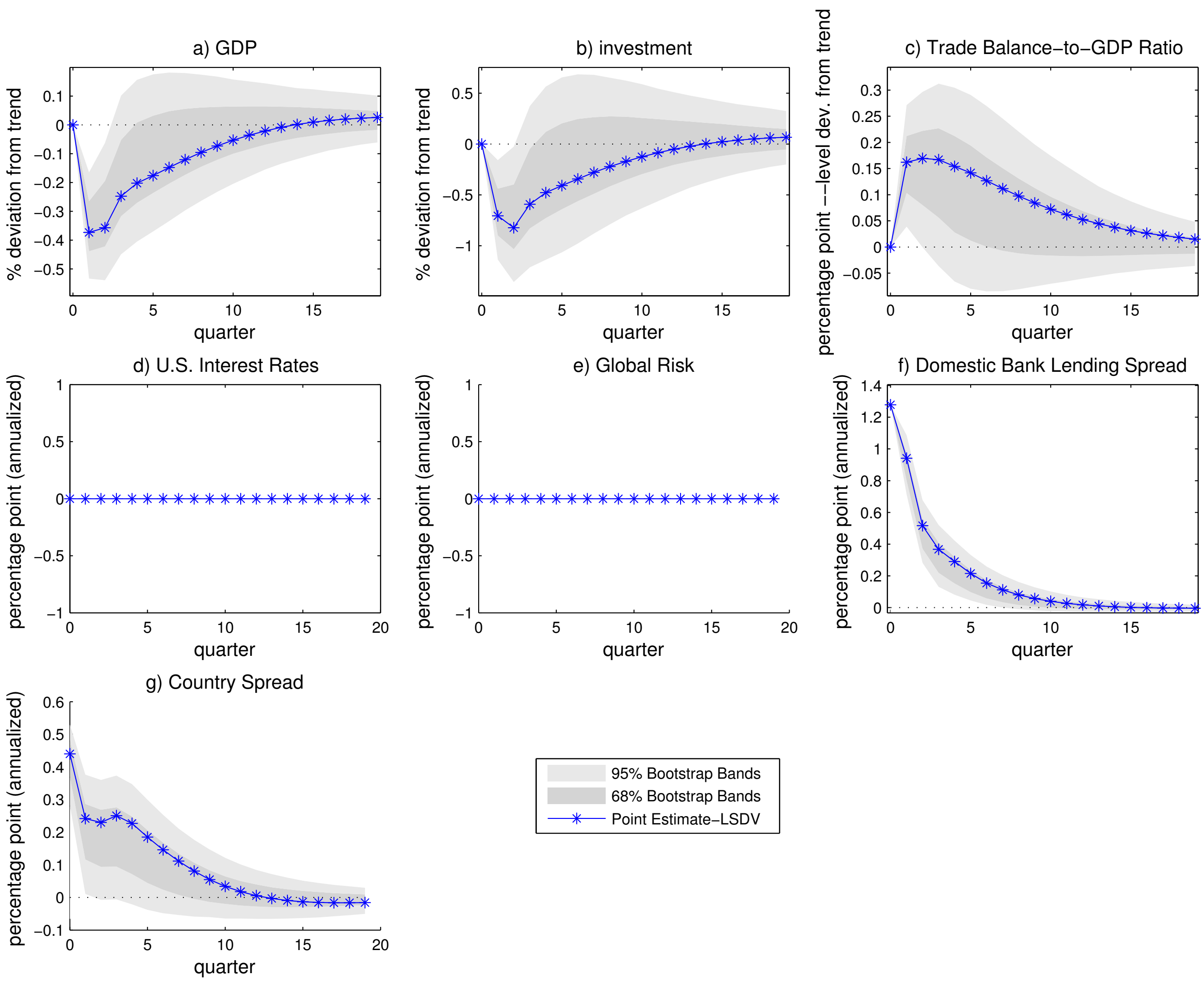
Notes: Solid lines with diamond show point estimates of impulse responses when High Yield Spread is used as a proxy for the global risk; dashed lines depict point estimate when U.S. Stock Market Volatility Index is used as a proxy for the global risk; and solid lines show point estimates of impulse responses when U.S. corporate BAA spread (as in the baseline model) is used as a proxy for the global risk. 68% and 95% Confidence Bands associated with estimates with high yield index are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions.

Figure 12: Forecast Error Variance Decomposition at Different Horizons–Alternative measures of the Global Risk



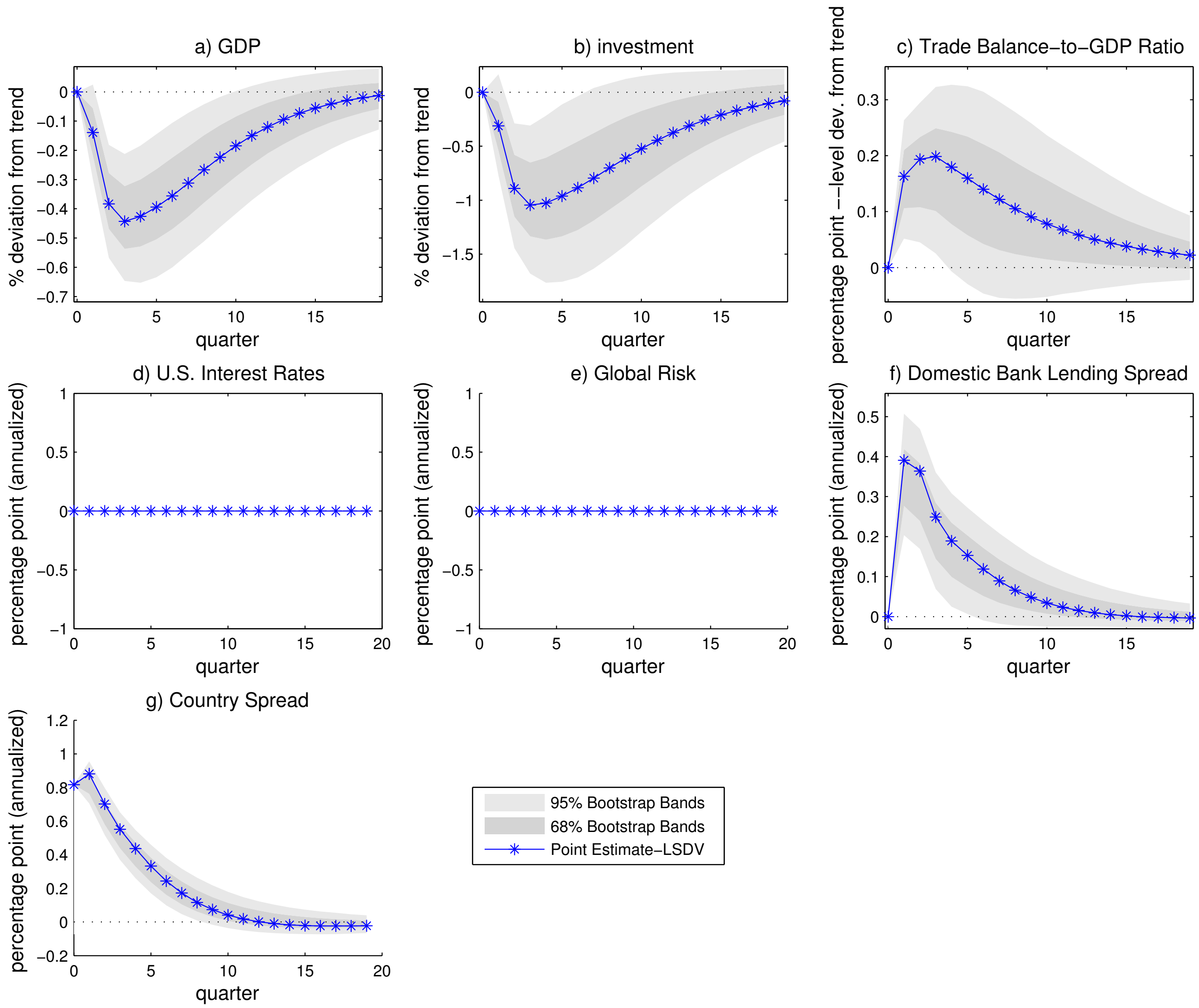
Notes: Note: Solid lines with circles depict the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk and country spread shocks. Solid lines shows the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate and the global risk. Broken lines depict the fraction of the variance of the forecasting error explained the US interest rate shock. The first row shows the forecast error variance decomposition at different horizons when US BAA Corporate spread is used as a proxy for the global risk. The second row shows the forecast error variance decomposition at different horizons when US stock market volatility index is used as a proxy for the global risk. The third row shows the forecast error variance decomposition at different horizons when High Yield spread is used as a proxy for the global risk.

Figure 13: Impulse Response to a one standard deviation shock to the Bank Lending Spread in the Extended Model



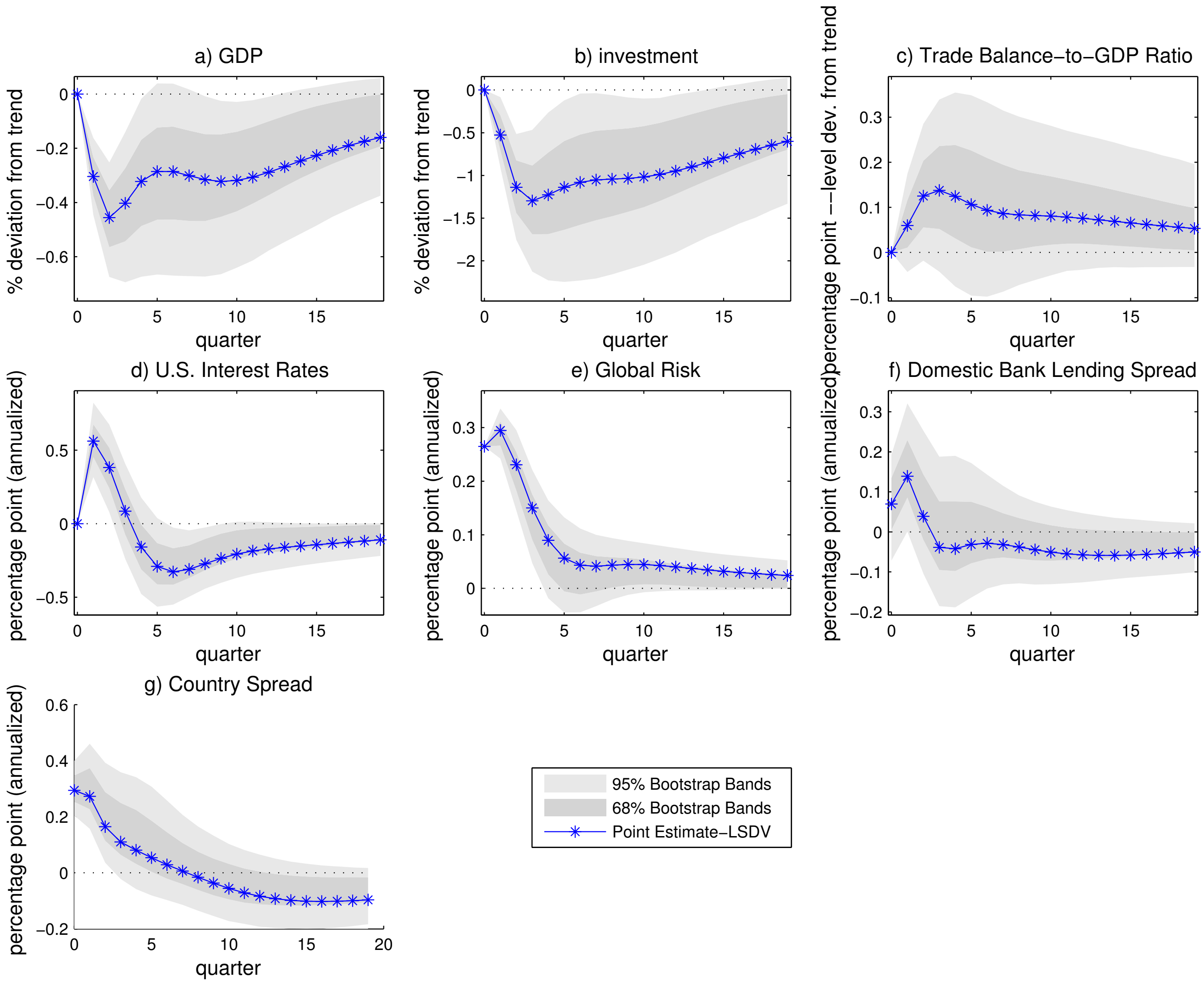
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate, domestic borrowing-lending spread and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 14: Impulse Response to a one standard deviation shock to the country spread in the Extended Model



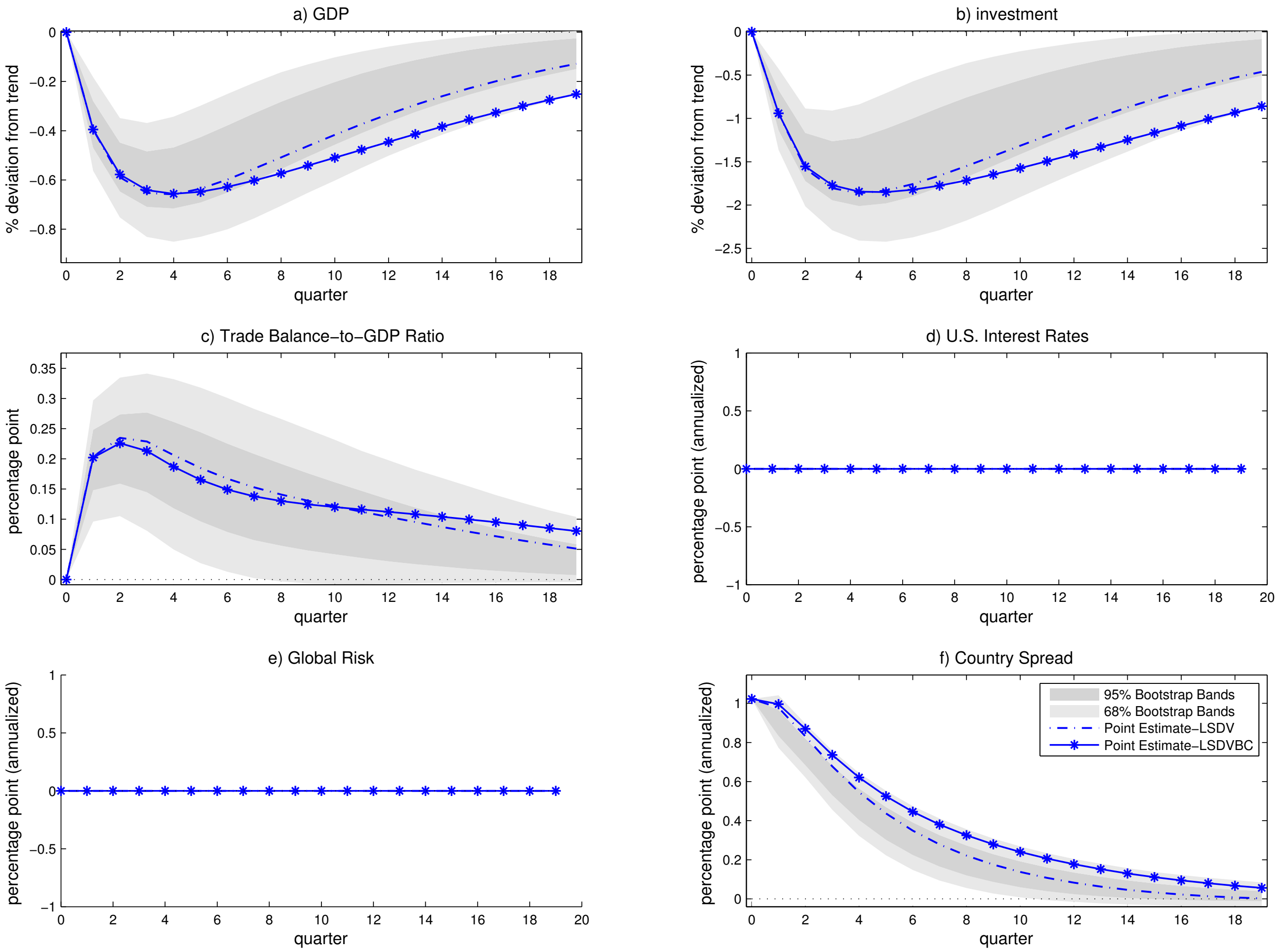
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate, domestic borrowing-lending spread and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 15: Impulse Response to a one standard deviation shock to the Global Risk: U.S. BAA Corporate spread in the Extended Model



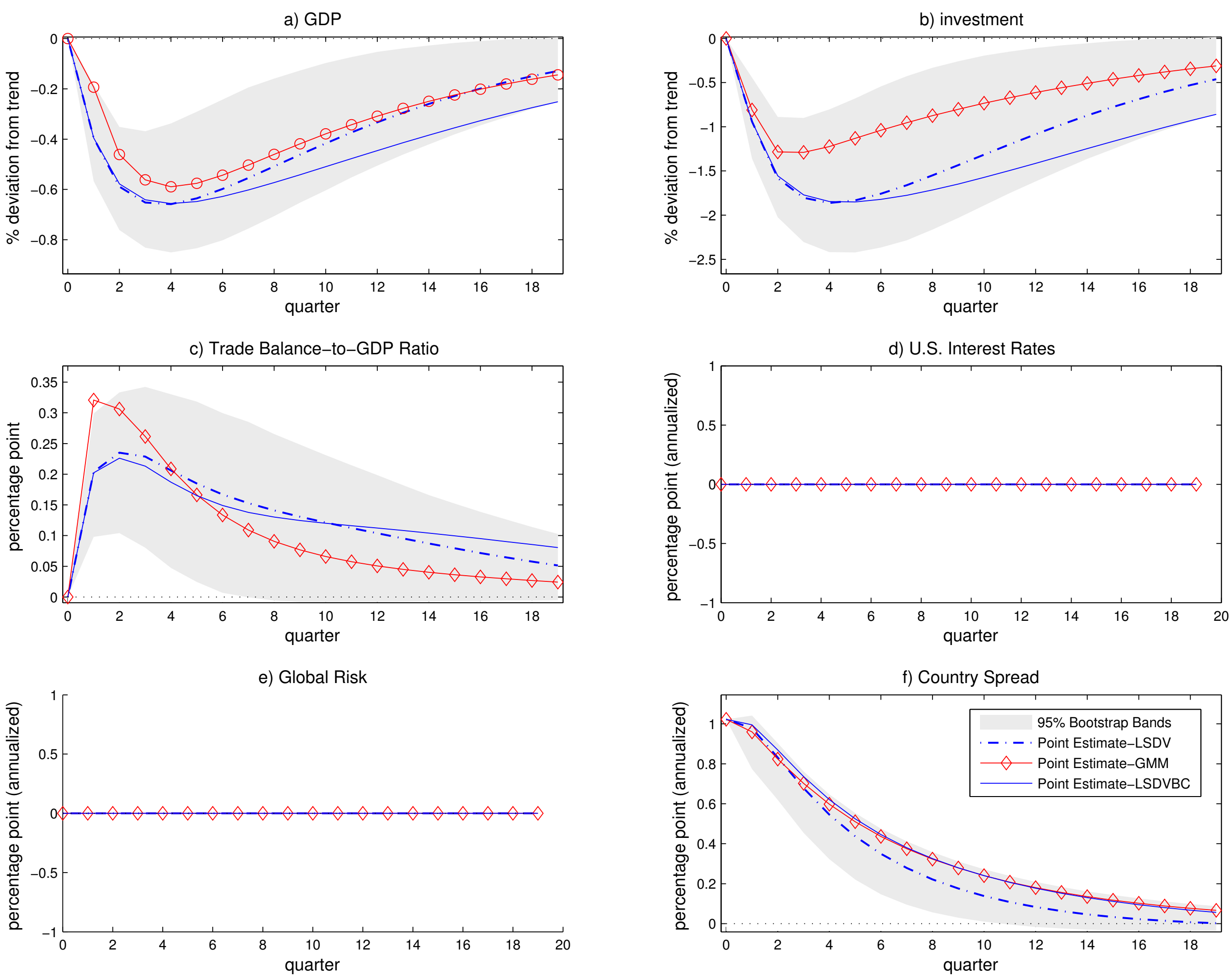
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate, domestic borrowing-lending spread and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 16: Impulse Response to a one standard deviation shock to the country spread – Bias Corrected LSDV (LSDVBC)



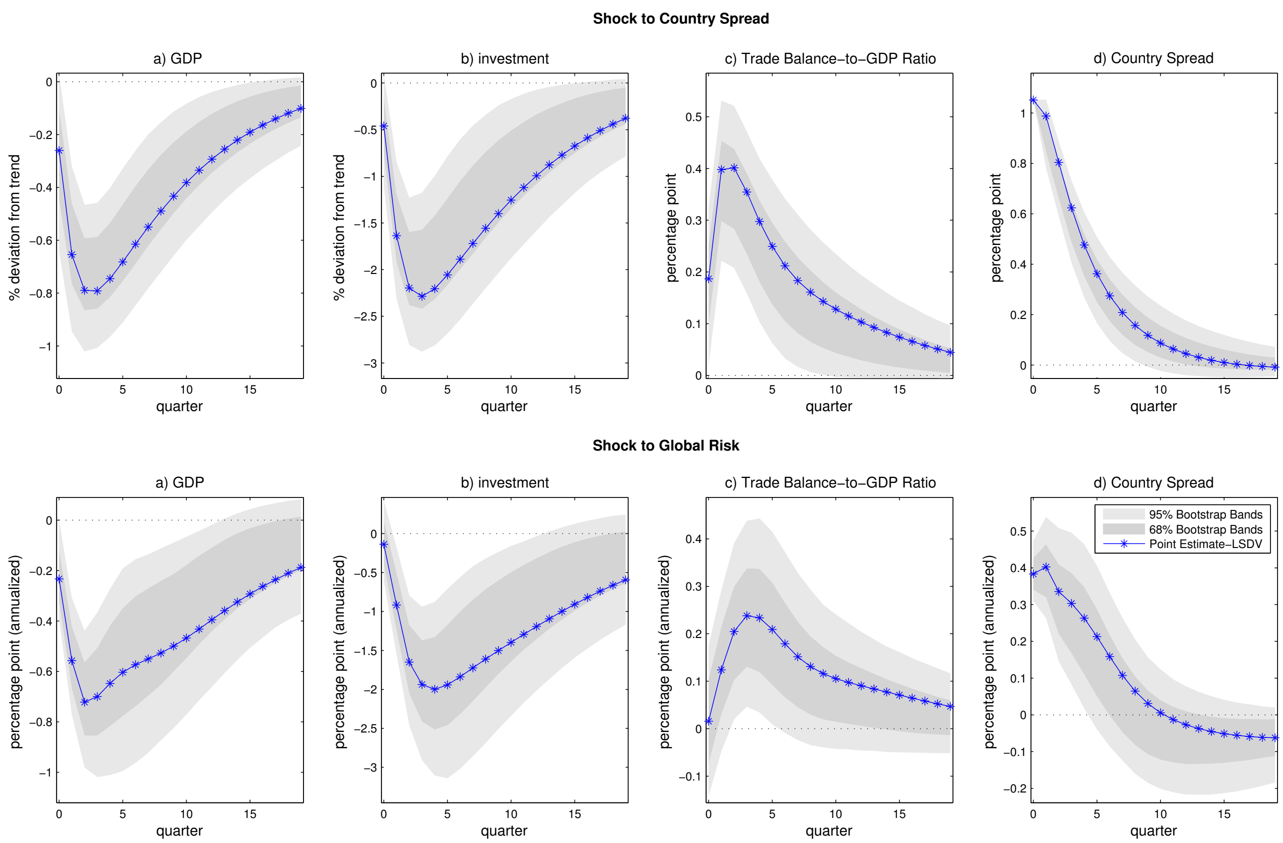
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate, domestic borrowing-lending spread and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 17: Impulse Response to a one standard deviation shock to the country spread – GMM



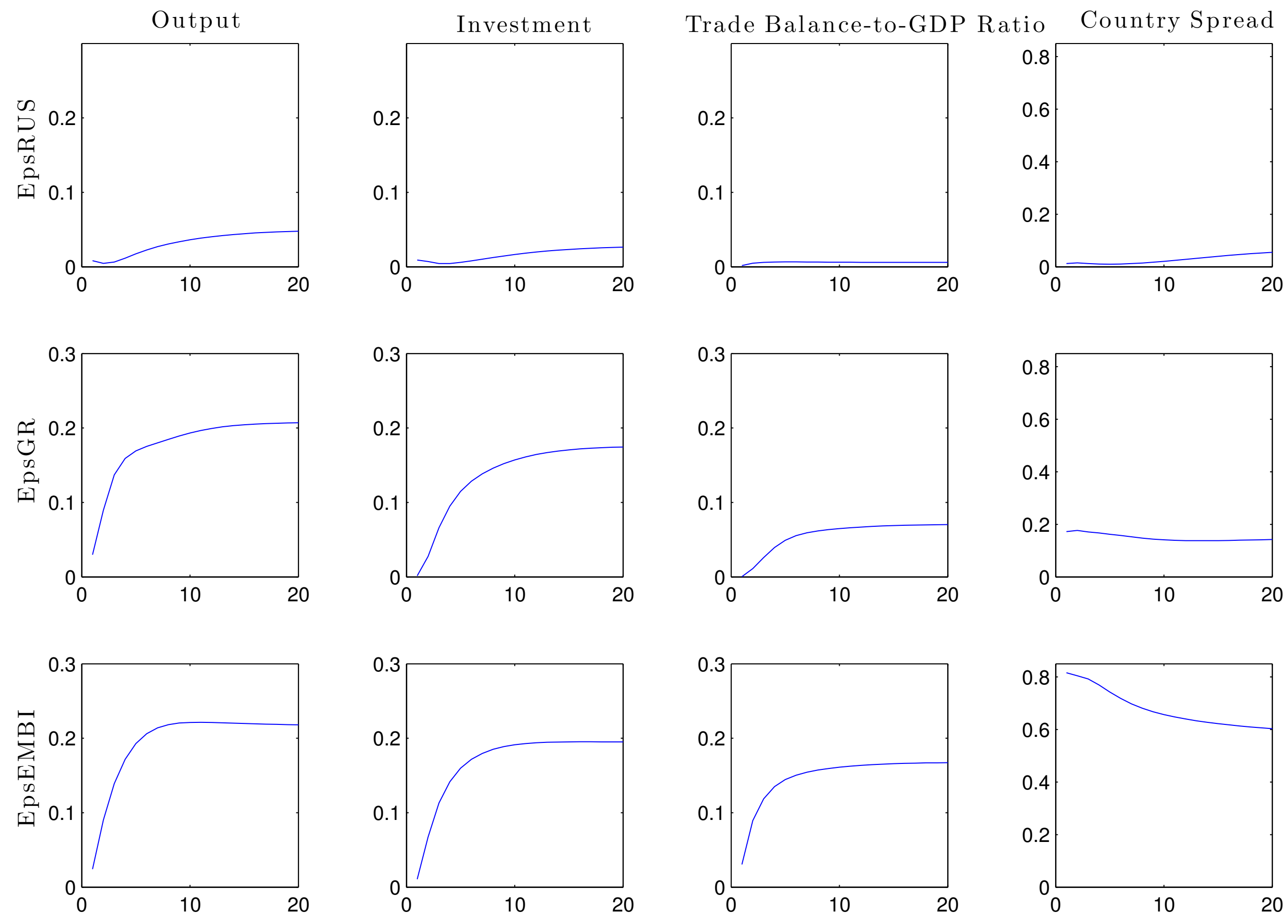
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate, domestic borrowing-lending spread and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 18: Impulse Response to a one standard deviation shock to the country spread (Upper panel) and to the Global Risk (Lower panel)



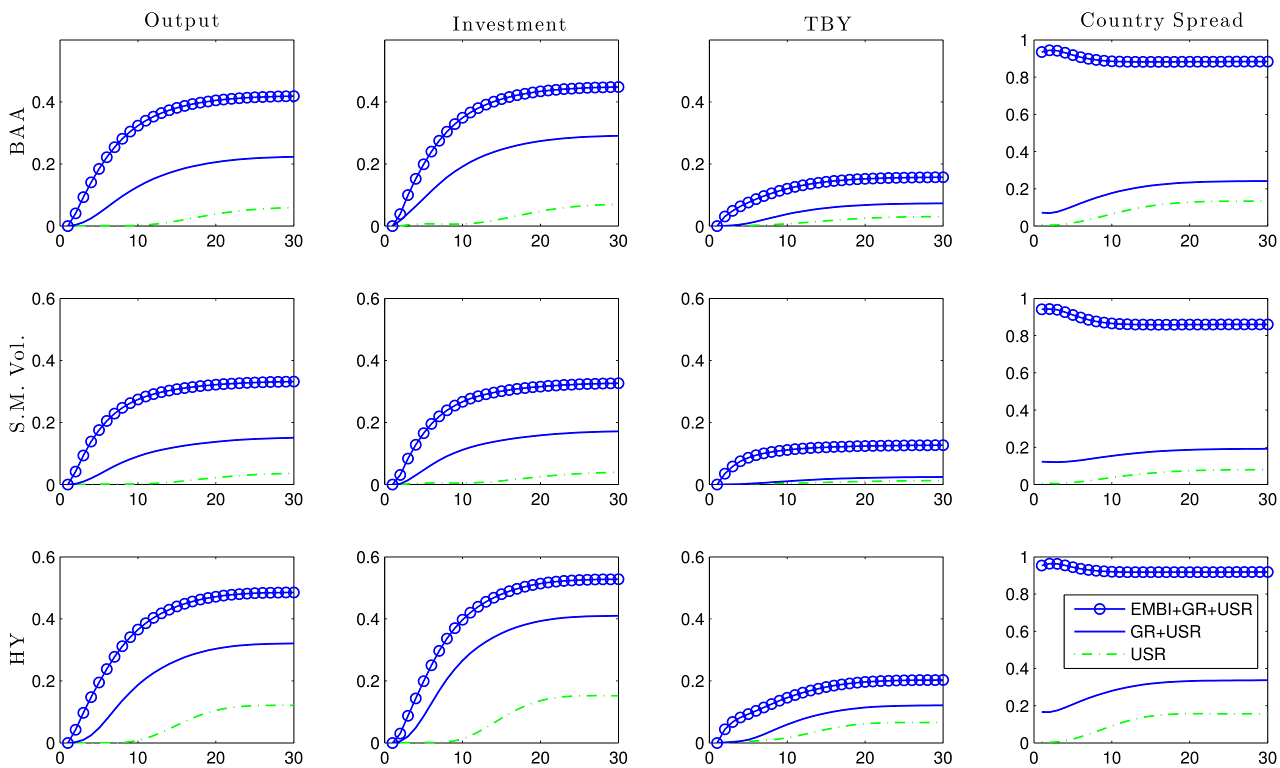
Notes: Solid lines with stars show point estimates of impulse responses; and 68% and 95% Confidence Bands are depicted with dark-grey and light-grey shaded areas respectively. The responses of Output and Investment are expressed in percent deviation from their respective log-linear trends. The response of Trade Balance-to-GDP ratio, the country spread, the U.S. Interest rate, domestic borrowing-lending spread and the global risk are expressed (**annualized**) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. U.S. BAA Corporate Spreads are used as a proxy for the global risk.

Figure 19: Forecast Error Variance Decomposition at Different Horizons– Alternative Identification



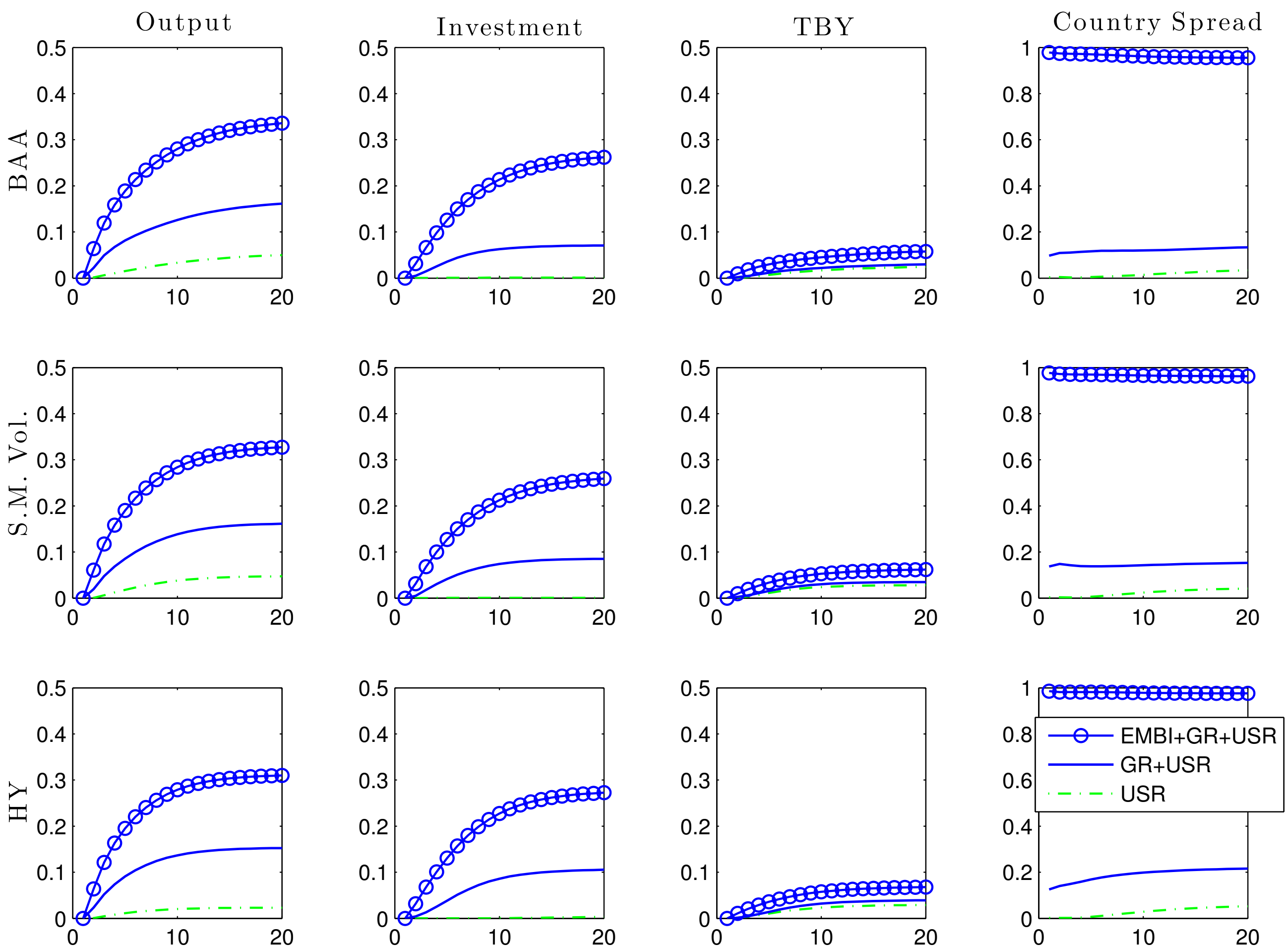
Notes: Solid lines with circles depict the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk and country spread shocks. Solid lines shows the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk. Broken lines depict the fraction of the variance of the forecasting error explained the US interest rate shock. The first row shows the forecast error variance decomposition at different horizons when the US BAA Corporate spread is used as a proxy for the global risk. The second row shows the forecast error variance decomposition at different horizons when the US stock market volatility index is used as a proxy for the global risk. The third row shows the forecast error variance decomposition at different horizons when the U.S. High Yield spread is used as a proxy for the global risk.

Figure 20: Forecast Error Variance Decomposition at Different Horizons– PreCrises Period



Notes: Solid lines with circles depict the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk and country spread shocks. Solid lines shows the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk. Broken lines depict the fraction of the variance of the forecasting error explained the US interest rate shock. The first row shows the forecast error variance decomposition at different horizons when the US BAA Corporate spread is used as a proxy for the global risk. The second row shows the forecast error variance decomposition at different horizons when the US stock market volatility index is used as a proxy for the global risk. The third row shows the forecast error variance decomposition at different horizons when the U.S. High Yield spread is used as a proxy for the global risk.

Figure 21: Forecast Error Variance Decomposition at Different Horizons– 10 Country Case



Notes: Solid lines with circles depict the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk and country spread shocks. Solid lines shows the fraction of the variance of the k-quarter ahead forecasting error explained jointly by the US real interest rate, the global risk. Broken lines depict the fraction of the variance of the forecasting error explained the US interest rate shock. The first row shows the forecast error variance decomposition at different horizons when the US BAA Corporate spread is used as a proxy for the global risk. The second row shows the forecast error variance decomposition at different horizons when the US stock market volatility index is used as a proxy for the global risk. The third row shows the forecast error variance decomposition at different horizons when the U.S. High Yield spread is used as a proxy for the global risk.