GLOBAL LIQUIDITY, DOMESTIC CREDIT, AND CAPITAL FLOWS

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Abstract. The link between economic and financial conditions in emerging markets and global liquidity is controversial. First, there is disagreement about the relative importance of public liquidity shocks (created by central banks) and private liquidity shocks (created by financial institutions and variations in risk) in determining overall global liquidity conditions. A second area of disagreement is the relative importance of global liquidity shocks in comparison to domestic shocks. Using a structural vector autoregressive model, we assesses how private and public global liquidity shocks affect financial and macroeconomic conditions in Brazil and compare the effects of the global shocks to equivalent domestic shocks. Private liquidity shocks have a substantially larger effect on key financial and macroeconomic variables. When comparing global and domestic liquidity shocks, local shocks are more important at short horizon, whereas global shock are more important at the medium horizon.

1. Introduction

Many emerging markets experience volatile capital flows and credit conditions. Some scholars and policy makers consider global liquidity conditions - and monetary policy in advanced countries in particular - to be an important contributor. Brazil's finance minister Mantega (2012), for example, recently stated at the annual IMF meeting on the behalf of its constituency that "[s]ome economies are paying a high price for the ultra-loose monetary policies in advanced economies. The increase in global liquidity very quickly finds its way into emerging market economies, especially the ones with stronger economic fundamentals, such

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as Brazil." Similarly, Taylor (2012) warns that monetary policy in advanced economies has important effects on global capital flows and has contributed to the global financial crisis by encouraging the growth in cross-border lending. Officials from advanced countries on the other hand tend to argue that global liquidity conditions are mainly determined by private financial intermediaries and their risk appetite. In addition, they are of the view that appropriate domestic policy choices in emerging countries can attenuate the consequences of global liquidity fluctuations to a large extent. In this vein, Federal Reserve Board Chairman Bernanke (2012) recently stated that "the linkage between advanced-economy monetary policies and international capital flows is looser than is sometimes asserted. [...] swings in investor sentiment between "risk-on" and "risk-off," [...], have led to corresponding swings in capital flows" and that further "the effects of capital inflows, whatever their cause, on emerging market economies are not predetermined, but instead depend greatly on the choices made by policymakers in those economies."

Overall, we identify two areas of disagreement from the statements: The first disagreement is whether global liquidity (as relevant for emerging markets) is mainly determined by the global monetary stance (public liquidity) or variations in the risk appetite of investors (private liquidity).[1] The second area of disagreement is the importance of global liquidity shocks in comparison to domestic shocks in emerging markets.

The present paper contributes to the debate by investigating how global public and global private liquidity shocks affect economic and financial conditions in an emerging market economy, using a structural vector-autoregressive (VAR) model for Brazil. To address the first issue, we identify public and private global liquidity shocks using sign restrictions (Canova and De Nicolo, 2002; Uhlig, 2005) and assess the contributions of the shocks for fluctuations of financial variables, such as cross-border banking flows and domestic credit, and of standard macroeconomic variables, such as the exchange rate and inflation. To address the second issue, we identify equivalent domestic public and private liquidity shocks and compare their effects to those of the global shocks.

[1]The distinction between private and public global liquidity follows a recent report by the Bank for International Settlements (BIS) CGFS (2011). Public liquidity is created through central banks' operations, whereas private liquidity is created endogenously by financial intermediaries, driven by risk appetite and overall financial market conditions.

As one of the largest emerging market economies and with a long history of volatile capital flows and credit conditions, Brazil is well suited for a such study. Rapid changes in financial conditions have been attributed both to domestic reasons (for example the retreat of capital during and after the election of President Lula da Silva in 2003) and global developments (variations in risk appetite and global monetary policy in the aftermath of the crisis). But a systematic assessment of the overall importance of the various factors is to our knowledge still missing.

The identification of private liquidity shocks relies on variations in risk. Bruno and Shin (2012b) show in a theoretical model that risk can be an important determinant of private liquidity. Global banks are subject to a value-at-risk constraint and the size of their balance sheet depends on the amount of risk in the financial system. A reduction in uncertainty reduces default risk, allowing banks to expand their balance sheet and to fund a larger amount of credit with a given net worth. The role of risk as a determinant of private liquidity is also emphasized in CGFS (2011) and Domanski et al. (2011). Bruno and Shin (2012a) model the interaction between private liquidity and public liquidity by considering the international dimension of the "‘risk taking channel of monetary policy"’ (Borio and Zhu, 2012). Expansionary US monetary policy encourages risk taking of global banks and cross-border lending. The present study will assess both the role of monetary policy and risk, accounting for simultaneity between the two variables. Public liquidity shocks relate to surprises in interest rate movement, following a large literature on monetary policy shocks.

To preview our results, we find that domestic credit and, in particular, cross-border credit is primarily affected by private liquidity shocks: both global and domestic private liquidity shocks have a significant impact on cross-border banking flows and explain about 23% and 12% of the overall variation at the two year horizon. Similarly, private liquidity shocks also have a significant effect on domestic credit and explain about a third of the variation at the two year horizon. In contrast to this, we find only a limited role for monetary policy. The contribution of global and domestic public liquidity shocks is substantially smaller and in most cases not statistically different from zero. public liquidity shocks on macroeconomic variables, such as the Brazilian exchange rate and inflation.

Overall, our results indicate that mainly private liquidity shocks matter for fluctuations in credit variables and therefore financial stability concerns. For the nominal exchange rate and inflation, the picture is more nuanced. Both private and public shocks have a significant effects and their relative importance varies with the horizon considered. Aggregating over the origin of the shock, global shocks are clearly more important at longer horizons, while domestic shocks tend to be more important. In that sense, part of the disagreement over the importance of push and pull factors for emerging countries, may therefore stem from a neglect to differentiate across the relevant horizon.

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The concept of global liquidity has been used in different contexts (Domanski et al., 2011). There is both interest in its implications for price stability (see, for example, D'Agostino and Surico, 2009) and financial stability (CGFS, 2011; Chen et al., 2012). By including both financial variables and nominal macroeconomic variables in our model, the present paper considers the implications of global liquidity for price and for financial stability. As a result of the increased interest in financial stability aspects of global liquidity since the cris , there are a number of proposal to improve traditional indicators for global liquidity such as monetary aggregates and policy rates in major currencies by including further financial variables (CGFS, 2011; Chen et al., 2012; Eickmeier et al., 2013). Different from these studies, the present paper does not propose improvements in the measurement of global liquidity. Rather it identifies shocks to variables that are identified as potentially important drivers (i.e. monetary policy and risk appetite) and assesses their impact on outcome variables considered important in the policy debate (credit, cross-border lending, inflation, and exchange rate fluctuations).

Our paper is related to the economic literature that studies the effects of global monetary policy and changes in risk appetite in emerging markets. Using univariate regressions, Bruno and Shin (2012b) find that a decline in the implicit volatility of the US stock market (VIX index) predicts larger US cross border lending in the future. Fostel and Kaminsky (2008) find that gross issuance on international capital markets is both influenced by domestic fundamentals and global liquidity conditions. Fratzscher et al. (2012) focus on the effects of US unconventional monteary poliy on capital flows to emerging markets during the financial crisis, finding a significant, but relatively small. Forbes and Warnock (2012) find that risk is the most important global determinant of extreme capital flows episodes, while Ghosh et al. (2012) find a role for both global interest rates and global risk. A disadvantage of univariate regression approach is that it does not look at the response to a true, unexpected, shock and its transmission, but at the sensitivity of output to contemporaneous values of a specific exogenous variable and therefore a reduced form relationship. This complicates the interpretation of results if the exogenous variables are interdependent, for example if monetary policy responds to risk and vice versa.

Among the studies that use a VAR framework, Bruno and Shin (2012a) find that a positive Fed Fund rate shock increases the VIX and leads to a decline in global cross-border loans. Their specification is different from ours as they focus on global conditions and do not analyze the transmission of global shocks to a specific country or the importance of domestic liquidity shocks. Furthermore, their identification relies on a recursive ordering of interest rate policy and risk. If there is a two way simultaneous relationship between risk and monetary policy, any recursive identification scheme (irrespective of the ordering) is problematic. Similarly, Matsumoto (2011) focuses on global aggregates and does not attempt to disentangle public and private liquidity shocks in a single framework. There are also several studies that analyze the effects of US interest rate shocks on emerging countries (Canova, 2005; Mackowiak, 2007). Different from the present paper they focus mainly on real conditions and do not consider credit conditions and banking flows.

Finally, our paper is related to studies that investigate the effect of monetary policy on uncertainty and risk aversion and the effect of uncertainty shocks using structural VARs (Bekaert et al., 2010; Bloom, 2009). Different from the present paper, the studies are conducted in a closed economy set up that do not consider international spill overs.

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In the remainder, Section 2 discusses the data and the econometric methodology. Section 3 presents the results and Section 4 discusses several extensions. Finally, Section 5 concludes.

2. Data and Model

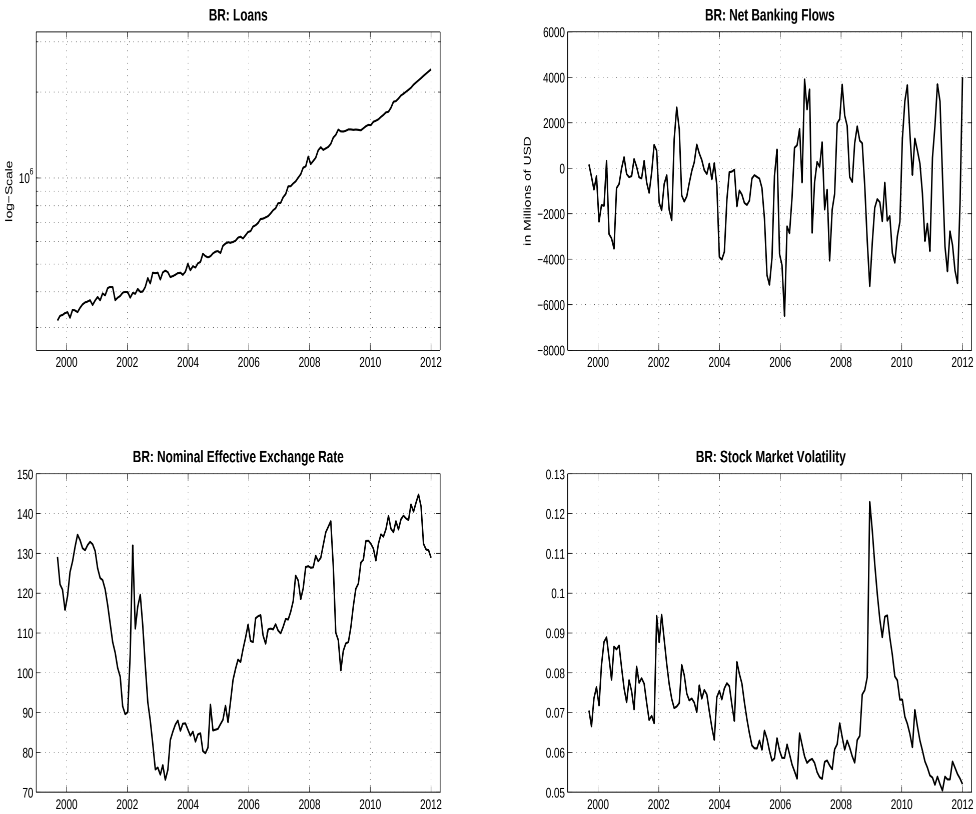
We consider the following block-exogenous Bayesian vector-autoregressive (BVAR) model

$$\begin{bmatrix} I_G & 0 \\ A^0_{C,G} & I_C \end{bmatrix} \begin{bmatrix} y_G(t) \\ y_C(t) \end{bmatrix} = \sum_{k=1}^{L} \begin{bmatrix} A^k_{G,G} & 0 \\ A^k_{C,G} & A^k_{C,C} \end{bmatrix} \begin{bmatrix} y_G(t-k) \\ y_C(t-k) \end{bmatrix} + \begin{bmatrix} \Xi_G \\ \Xi_C \end{bmatrix} x(t) + \begin{bmatrix} e_G(t) \\ e_C(t) \end{bmatrix} \tag{1}$$

where $y_G(t)$ is a vector of global macroeconomic variables, $y_C(t)$ is a vector of domestic variables and $x(t)$ is a vector of exogenous variables. A^k_{ij}, Ξ_i are coefficient matrices and L is the number of lags in the model. I_C and I_G are conformable identity matrices. $e_C(t)$ is a Gaussian random vector of reduced form disturbances of domestic origin with mean zero and covariance matrix Σ_C and the vector $e_G(t)$ is the global counterpart with covariance matrix Σ_G. Due to the block exogenous structure of the VAR model and the block triangularity of the impact matrix, forecast errors $e_C(t)$ and $e_G(t)$ are mutually uncorrelated by construction and the joint error vector $e(t) = [e_G(t)', e_C(t)']'$ has a block-diagonal covariance matrix Σ with elements Σ_G and Σ_C.

As the United States issues the main international currency, global conditions are approximated by US variables in our baseline specification. In an extension, we also include European variables. The main specification includes as global variables the federal funds rate, the log of the VIX index, the year on year CPI-inflation rate, and commodity price index. All three variables are necessary to identify the global private and the global public liquidity shock. The VIX index serves as a measure of global risk. The VIX is a measure of the implied volatility of S&P500 index options. It represents a measure of financial markets' expectations

Figure 1. Macroeconomic Overview



Remarks: The figure reports key macroeconomic variables used in the analysis. The first panel reports the log of loans granted to the private sector. The second panel reports net banking flows (in millions of US Dollars). Following standard balance-of-payments accounting, an outflow is expressed as a negative value.
Finally, the third panel shows the nominal effective exchange rate and the fourth panel captures the realized volatility of the Bovespa index. The realized Bovespa volatility is estimated by means of a GJR-GARCH process (Glosten et al., 1993).
Further information concerning the data and the sources can be found in Table 3 in the appendix.

of stock market volatility over the next 30 days. [2] The commodity price index is included as it has been show to contain important information about the state of the economy.

The domestic variables in the main specification are the realized volatility of the Brazilian stock market index (Bovespa - Bolsa de Valores de São Paulo) as depicted in Figure 1, the Brazilian policy interest rate, the annual inflation

[2]As Bekaert et al. (2010) point out, the implicit (risk-neutral) volatility varies because of two components: expected uncertainty and investor's risk aversion, that is, their willingness to bear the uncertainty. Both components should be relevant in determining the size of the balance sheet of global financial intermediaries and we make no attempt to disentangle the two components. In the Bruno and Shin (2012b) model, uncertainty measures how much leverage risk neutral banks can take without violating their value-at-risk constraint. Variations in investors' risk preferences will also influence the amount of credit extended.

rate based on the CPI, net banking inflows over nominal GDP, log of nominal domestic credit and the log of the nominal effective exchange rate. The first three variables are in analogy to the global part. Since there is no sufficiently long time series for the implicit volatility of the Brazilian stock market derived from option prices, we estimate the stock market volatility by means of a GJR-GARCH model (Glosten et al., 1993) based on the first difference of the log of the Bovespa index. The monetary stance is measured by the overnight rate (SELIC rate - *Sistema Especial de Liquidação de Custódia*), which is the policy rate. These three variables are important for the identification of the domestic liquidity shocks. The last three variables appear only in the domestic part. They are the main variables of interest. Net banking inflows from foreign investors measure the extent to which liquidity is provided from abroad. As alternatives we also report results for other balance of payment items, including gross flows, portfolio flows, and foreign exchange reserves. The vector of exogenous variables further includes as deterministic variables a quadratic time trend, a level dummy from 2008:1 onwards to control for the financial market turbulence associated with the financial crisis, and a constant term. Detailed data sources are documented in Table 3.

We choose a lag lengths of two[3] and estimate the parameter matrices of the BVAR model in equation (1) with Bayesian techniques as motivated in Uhlig (1994), using an uninformative Normal-Wishart prior density for the coefficient matrices and the variance-covariance matrix. Since $e_C(t)$ and $e_G(t)$ are uncorrelated, the two blocks can be simulated separately.

Our sample comprises monthly data that cover the period from 1999:7 to 2011:12. We choose the implementation of the inflation targeting regime as the starting date in order to ensure a homogeneous monetary policy framework.

The block-exogeneity structure is a testable restriction. It implies that $y_G(t)$ is Granger causally prior with respect to $y_C(t)$ and Granger causal priority is a testable assumption. Following Mackowiak (2007), the hypothesis that $y_G(t)$ is Granger causally prior with respect to $y_C(t)$ was evaluated using the Schwarz-criterion. The test results indeed favored the assumption of the block-exogeneity structure in the BVAR model.

[3]The lag length is chosen by means of the Schwartz Information Criterion. A Ljung-Box test cannot reject the null of no autocorrelation in the residuals.

Table 1. Identification Restrictions

	Global Liquidity		**Domestic Liquidity**	
	Private	**Public**	**Private**	**Public**
Country Block				
BVol			≥ 0	
NEER				
BF				
Loans				
SELIC			≤ 0	≥ 0
CPI			≤ 0	≤ 0
Global Block				
VIX	≥ 0			
MP rate	≤ 0	≥ 0		
CPI	≤ 0	≤ 0		
GComdPI				

Notes: The sign restrictions apply to the rst quarter. The variables are: (1) for Brazil: realized Bovespa stock market volatility (BVol), nominal effective exchange rate (NEER), cross border banking flows (BF), total aggregate credit (Loans), the SELIC rate and the CPI inflation rate (2) for the global economy: the implicit S&P500 stock market volatility (VIX), the US Fend Funds rate (MP rate), the US CPI inflation rate and a global commodity price index (GComPI). Additional information concerning the data can be found in table 3.

2.1. **Identification.** We identify the structural shocks using a combination of zero and sign restrictions (Uhlig, 2005; Canova and De Nicolo, 2002). The zero restrictions follow from the block exogeneity restriction. We impose that domestic liquidity shocks only have an effect on Brazilian variables, while global liquidity shocks can affect both global and domestic variables. For both global and domestic shocks, we disentangle private and public liquidity shocks using sign restrictions.

A negative global private liquidity shock leads to an increase in risk that coincides with a reduction in the policy rate and a fall in inflation. In line with Bruno and Shin (2012b), an increase in risk allows banks to extend less credit for a given amount of equity, as the value-at-risk increases. The reduction in credit leads to a fall in aggregate demand. Lower demand in turn leads to a decrease in prices. The central bank counteracts the deflationary pressures, by reducing the policy rate.

A negative global public shock leads to an increase in the policy rate and decrease in prices. The restriction that tighter monetary policy dampens inflation is consistent with standard monetary theory and is used in a number of other structural VAR models that rely on sign restrictions (Uhlig, 2005; Canova and De Nicolo, 2002). We leave the effect of monetary policy on global risk unrestricted.

Domestic public and private liquidity shocks are identified in an analogous fashion. A negative domestic public liquidity shock leads to a decrease in domestic prices and an increase in the domestic policy rate. A negative domestic private liquidity shock leads to an increase in domestic risk, a decrease in the interest rate, and a fall in domestic prices. We leave the response of the nominal exchange rate, cross-border banking flows, and private domestic credit unrestricted.

Different from other studies that identify risk shocks (Bekaert et al., 2010; Bruno and Shin, 2012a), our identification scheme does not impose the restriction that the central bank reacts to changes in risk only with a temporal lag, but allows for a contemporaneous monetary accommodation of risk shocks. The restriction that monetary policy responds to changes in risk only with a lag can be quite restrictive. For example, in 2008 the Federal reserve board has cut interest rate at several unscheduled emergency meetings in response to deteriorating financial conditions, which suggests that central banks often respond quickly to changes in risk and private liquidity. In order to disentangle private and public liquidity shocks, it maybe important to allow for a contemporaneous monetary policy feedback and refrain from imposing a temporal ordering.

2.2. **Computational Implementation.** We sample the regression coefficients $A^k_{i,j}$ and covariance matrix blocks Σ_i with $i = G, C$ and $i = G, C$ from the posterior distribution.[4]

Given the draws, we implement the identification based on sign restrictions. We can think of the one step ahead prediction error e_t as a linear combination of orthonormal structural shocks $e_t = B \cdot v_t$, with $E(v_t' v_t) = I$ where the matrix B describes the contemporaneous response of the endogenous variables to structural shocks, $\Sigma = E(e_t e_t') = E(B v_t v_t' B') = BB'$. To sample candidate matrices B, we compute the Cholesky factorization V of the draws of the two covariance matrix Σ. We then multiply V with a random orthonormal matrix Q ($B = VQ$). In

[4] Σ_i is drawn from an Inverted-Wishart Distribution $IW(\Sigma_{i,OLS}, T)$, and coefficient matrices $A^k_{i,j}$ from a Normal Distribution $N(A^k_{i,j,OLS}, \Sigma_{i,OLS})$, where T is the number of observations and subscript OLS stands for the OLS estimates.

analogy to Σ, Q is block diagonal, where the two elements Q_G and Q_C are sampled as in Rubio-Ramirez et al. (2010):

$$Q = \begin{bmatrix} \underset{n_G \times n_G}{Q_G} & \underset{n_G \times n_C}{0} \\ \underset{n_C \times n_G}{0} & \underset{n_C \times n_C}{Q_C} \end{bmatrix} \tag{2}$$

The Q_i matrices, $i \in G, C$, are orthonormal random matrices, as a consequence Q is an orthonormal matrix too. Given the matrix Q and the impact matrix B, we compute candidate impulse responses. If the impulse response functions implied by B are consistent with the sign restrictions for all shocks, we keep the draw and proceed with the next parameter draw until we have 10,000 accepted draws. Otherwise, we draw a new Q_i matrix until the sign restrictions are fulfilled. We report as coverage bands the point wise 16% and 84% percentile of the posterior distribution.

3. Main Results

3.1. **Impulse Response Functions.** The global private liquidity shock has significant effects on Brazilian financial and economic variables (Figure 2). Consider first the effect on global variables. A one standard deviation private liquidity shock is associated with a rise in the VIX index by about 8%. Yearly inflation falls by more than 0.7 % at the median, consistent with a weaker aggregate demand that follows from tighter credit conditions. US monetary policy responds to the tighter financial market conditions and deflationary pressures by cutting interests by about 20 basis points on impact, lowering them by a further 10 basis points over the course of the next year, before slowly reversing its stance.Finally, the decline in global risk appetite also triggers significant contractionary effects on the world raw materials index. Commodity prices decline by around 1% at impact and stay subdued throughout.

The rise in global risk spills over to domestic risk, as evidenced by the increase in the realized volatility of the Brazilian stock market index, which peaks after about four months. The increase in uncertainty leads to a retreat of foreign net banking inflows, which fall by about 0.25% of GDP within a year. The effect is persistent and dissipates after about three years. There is also a statistically significant and persistent effect on the volume of domestic credit. Domestic credit falls by a bit less than 0.3% on impact and reaches its trough after 12 months. The outflow of foreign capital is also reflected in the behavior of the Brazilian exchange rate: the currency depreciates persistently by about 2 %, reaching its trough after roughly two and a half years. Monetary policy does not attempt to counter the depreciation. The cut of the interest rate by more that 50 basis points is consistent with an accommodative response to financial stress and low inflation.

Global public liquidity shocks have no effect on Brazilian credit variables, but do influence nominal macro variables (Figure 3). In the United States, a one standard deviation negative global public liquidity shock is associated with a 10 basis points rise in the federal funds rate and a fall in inflation by 0.2 %. There is no significant response of global risk: the median path of the VIX index remains close to zero. This is in contrast to Bruno and Shin (2012a); Bekaert et al. (2010) who find that expansionary monetary policy shocks lead to a reduction in risk. Their identification scheme relies on the temporal ordering of the policy rate and the VIX index. The difference in the path of the VIX suggests that their assumption of monetary policy reacting only with a lag to changes in risk may be important for the result obtained. In analogy to the zero response of global risk, there is also no significant change in domestic risk. The response of foreign banking inflows and domestic credit is weak and error bands include zero. As expected, tighter global monetary policy leads to a depreciation of the Brazilian currency. Prices also respond, but with the opposite sign of the US response: a surprise increase in the Federal Funds rate leads to an increase in inflation. Canova (2005) obtains a similar price response in Latin American countries. A potential explanation for the response is that the depreciation of the currency leads to a higher inflation rate in the traded goods sector, as goods are priced in foreign currency. There is only a weak response of domestic monetary policy. After a year, the SELIC rate rises at the median, which is consistent with a response to higher inflation. Error bands are, however, wide and include zero.

We turn now to domestic shocks: Figure 4 shows the effect of domestic private liquidity shocks are qualitatively comparable to those of global private liquidity shocks, but more short lived. A domestic private liquidity shock is associated with a 6 % increase in stock market volatility and 0.1 % fall in inflation on impact. The central bank immediately lowers the Brazilian policy rate by around 15 basis points. Bank lending retreats, as net banking inflows decrease by almost 0.3 % of GDP on impact. The effect disappears after less than a year. Domestic credit declines initially by about 0.15 %, but again reverses quickly to zero. The exchange rate depreciates, in line with accommodative monetary policy and capital outflows. The depreciation amounts to about 0.6 % on impact and and gradually dies out within a year.

Domestic liquidity have the expected effects on nominal macro variables and little impact on foreign bank lending. The bottom panel in Figure 4 shows the reaction to a one standard deviation domestic public liquidity shock. It is characterized by a 15 basis points tightening of the Selic rate. Inflation falls and reaches its trough at minus 0.15 % after five months. The path of the exchange rate shows a pattern consistent with Dornbusch's overshooting model (Dornbusch, 1976): the currency appreciates immediately by about 0.8 % and reverts slowly back to zero. As in the case of the global public liquidity shock, there is no significant effect on risk . Similarly, there is also no significant response of foreign banking inflows. Not surprisingly, however, overall domestic credit is affected by surprise changes in monetary policy. If falls on impact by about 0.5 % and reverts to zero within a year. This is line line with the notion that a tighter monetary policy stance increases the cost of borrowing throughout the economy, and lowers credit demand.

3.2. **Variance Decomposition .** Table 2 shows the relative contribution of the four identified shocks for fluctuations in net banking inflows, domestic credit, the nominal exchange rate and inflation at short (four months) and medium term horizons (two years). In addition to the individual contribution of each shock, we also aggregate over origin (global versus domestic) and sector (public or private liquidity shock).[5]

Private liquidity shocks - that is, domestic and global considered jointly - are more important than public shocks for fluctuations in domestic credit banking

[5]The reported aggregate values do not exactly correspond to the sum of the contributions of the components. The reason is that we compute the sum for each draw separately and then take the median

inflows, and particularly at longer horizons. At the median, private shocks contribute at two year horizon to 37 % of all fluctuations in net banking inflows and 34% in credit, compared to 9% for public shocks. The differences are significant. Private shocks are more important are also more important for fluctuations in exchange rates at the medium horizon. They explain about 36% of the fluctuations, compared to 24% for public shocks. The difference is again significant. At short horizons, the two shock groups are of about equal importance. For inflation, by contrast, private shocks are again important more important at short horizons, but of about equal importance at the medium horizon.

Aggregating over the origin of the shock, we find that overall global shocks dominate at domestic shocks in the medium run. For all four variables, the aggregate contribution of global shock ist 15% to 20% larger. In the short horizon, domestic shocks tend to be more important. Their contribution to fluctuations in the exchange, inflation, and banking is significantly larger, while respective importance for for credit fluctuations is comparable. Overall, our results therefore indicate the private liquidity shocks are more important for fluctuations in the considered variables inflows and that the importance global and domestic sources varies with horizon considered.

4. Extensions and Robustness Analysis

4.1. **Alternative Capital Flow Measures.** The previous analysis has focused on net banking inflows as the main capital flows measure. Figure 5 presents alternative measures. We report only the response of the new capital flows measure, as the responses of the other variables are very similar. Furthermore, we do not report the results for public liquidity shocks, as the responses have remained insignificant in all cases. Again, all measures are scaled by nominal GDP.

In a first step we split net banking inflows into gross banking inflows (transactions by foreign investors) and gross banking outflows (transactions by domestic investors).[6] Several recent studies have emphasized the importance of gross flows (Obstfeld, 2012) and a sole focus net flows may neglect differences in dynamics of

[6]We follow the literature and use the standard terminology of gross inflows, gross outflows, and net inflows (Forbes and Warnock, 2012, see, for example). Gross inflows are the net of foreign purchases of domestic assets and foreign sales of domestic assets, while gross outflows are the net of domestic residents' purchases of foreign assets and domestic residents' sales of foreign assets. Net inflows are the net of the two.

TABLE 2. Forecast Error Variance Decomposition

Horizon	4	24	4	24	4	24	4	24
	Global				**Domestic**			
	Private		**Public**		**Private**		**Public**	
NEER	8	21	9	18	10	14	14	6
BF	7	23	3	8	12	13	15	2
Loans	12	23	3	7	6	11	10	3
CPI	13	24	1	17	14	10	8	14
Aggregating over the Shocks								
	Type				**Origin**			
	Private		**Public**		**Global**		**Domestic**	
NEER	21	36	21	24	18	40	24	19
BF	19	37	16	9	9	31	26	14
Loans	20	34	11	9	15	29	14	14
CPI	26	33	9	32	15	39	21	25

Difference of the aggregated Shocks

	Type (Private - Public)		**Origin** (Global - Domestic)	
Horizon	4	24	4	24
NEER	0	12*	-7*	21*
BF	2	28*	-18*	17*
Loans	9*	25*	0	16*
CPI	17*	1	-6*	15*

Notes: The numbers are in Percent. The variables are: nominal effective exchange rate (NEER), net bank lending (BF), total aggregate credit (Loans), and finally the Consumer Price Index CPI. The upper block shows the individual contribution of each of the four shocks.
In the bottom panel of the table, an asterix (*) indicates if the difference is significant at the 10 % level.

gross in- and outflows (Forbes and Warnock, 2012). In the present case, negative inflows in response to the global private liquidity shocks are primarily driven by gross inflows , i.e. foreign investors shifting their funds out of Brazil domestic investors that transfer their investments abroad. The median response of gross outflows is also significant, but the response is substantially smaller and error bands include zero. For the domestic private liquidity shock, both gross outflows and gross inflows respond significantly.

In a second step, we consider other short term capital flows and find similar results as for banking inflows. Global private liquidity shocks also lead to persistent declines in net portfolio equity inflows and net portfolio debt inflows. The response of equity flows is les persistent than the response of portfolio debt and equity flows. For domestic private liquidity shocks, we also find evidence for a decline in portfolio flows, but the effect is more short lived than in the case of global shocks.

Lastly, we investigate whether the central bank has responded to shocks through accumulation or decumulation of international reserves. International reserves fall substantially (about 2% of GDP) in response to variations in global risk, suggesting that official provision of international liquidity partially compensates for the loss of private liquidity. The response to the domestic shock, on the other hand is weak and the error bands include zero for most of the time. The contrast between global and domestic shocks can be explained by the fact, the central bank can absorb domestic liquidity shocks by issuing more money and does not necessarily need foreign reserves. There are no significant response to global or domestic monetary policy shocks (not reported).

4.2. **The Financial Crisis and Unconventional Monetary Policy.** In the baseline results we have accounted for the financial crisis by including a level dummy from 2008:1 onwards. We thereby account for a level effect of the financial crisis, for example that US monetary policy is tighter than usual given economic fundamentals, because of the zero lower bound. The specification, however, does not account for changes in dynamic relations between the variables (i.e. the slope coefficients) or unconventional monetary policy.

In order to investigate whether our results are driven by the strong variations in risk and policy rates during the crisis, we estimate the model with data only up to 2007:12. The main results are not affected. Figure 7 shows the no crisis specification (solid line) in comparison to the baseline (dashed) for the nominal exchange rate, net banking inflows for the private liquidity shock. Results are qualitatively similar, but there are quantitative differences.The inflation response is more muted and error bands include zero. The response of net banking inflows is substantially stronger and the exchange rate response is less persistent. Results for the global monetary shock also confirm the baseline results. The exchange rate is response is a bit weaker. Inflation also responds less, consistent with an interpretation that attributes the inflationary effect mainly to the exchange rate depreciation. Results for domestic shocks are unchanged (not reported).

The baseline specification also does not account for the various unconventional measures by the Federal Reserve, such as large scale asset purchases (quantitative easing) and the implementation of forward guidance. Providing an estimate of the effects of the various unconventional measures is beyond the scope of this paper. Instead, we rely on a feature that is common to conventional interest rate policy, asset purchases and forward guidance. Expansionary action in either form should lower long term rates. We therefore replace the Federal Funds Rate by the 3 year Treasury rate. Results are again unchanged (Figure 7 and 8). Only the inflation response is more muted for both shocks.

4.3. **Including Further Global Variables.** So far, we have associated global shocks with US monetary policy shocks and risk shocks. In extension we replace the US variables by the corresponding Euro zone variables (the ECB main financing rate as policy rate, Euro area inflation and the implied volatility of the European stock index VSTOXX). Qualitative results are not affected, but the magnitude of the responses to to one standard deviation global private liquidity shocks differs for some variables. In particular, the response of loans becomes weaker and the response of the exchange rate stronger, but less persistent. For public liquidity shock responses are very similar. Figure 6 shows the results when we include as further global variables total US foreign banking claims from the Treasury International Capital database (TIC) or the term spread between the 3 month treasury bill and the 10 year treasury bond. The term spread is known to contain important information about economic activity. If including it as an additional variables changes our results materially, it would indicate that our specification has omitted important information about the state of the economy. We find that our results are not affected (not reported) and the response of the term spread makes economic sense. In response to the the private liquidity shock, the term increases, as short rates due to expansionary monetary policy fall by more than long rates. A surprise increase in the federal funds rate, by contrast, leads to a decline in the the term spread. Including US foreign banking claims allows us another angle to assess how shocks are transmitted from US banks to Brazil. We find that a negative private liquidity shock leads to a decrease in foreign claims after about six month, mirroring the gradual response of net banking inflows in Brazil. US foreign banking claims also respond significantly to public liquidity shocks, the effect on inflows in Brazil remains, however, insignificant. This suggests that while US monetary policy affects foreign lending of US bank, this effect can be compensated through other channels, for example by lending from other sources.

5. Conclusion

The link between global liquidity and economic conditions in emerging markets is controversial. First, there is disagreement about the relative importance of public liquidity shocks and private liquidity shocks in determining global liquidity conditions. A second area of disagreement is the relative importance of global liquidity shocks in comparison to domestic shocks. In the present study we have used a structural vector autoregressive model for Brazil to assesses how private and public global liquidity shocks affect financial and macroeconomic conditions in Brazil and compared the effects of the global liquidity shocks to equivalent domestic liquidity shocks.

Our findings indicate that private liquidity shocks in the form of risk shocks have a substantially larger effect on credit aggregates and cross border lending than public liquidity shocks. To reduce the volatility of domestic credit and cross-border lending, macroprudential policies and improved financial regulation in general appear to us more promising avenues than coordiniation of monetary policies.

References

Bekaert, Geert, Marie Hoerova, and Marco Lo Duca (2010) 'Risk, uncertainty and monetary policy.' NBER Working Papers 16397, National Bureau of Economic Research, Inc, September

Bernanke, Ben (2012) 'U.S. monetary policy and international implications–speech, october 14, 2012.' http://www.federalreserve.gov/newsevents/speech/bernanke20121014a.htm

Bloom, Nicholas (2009) 'The impact of uncertainty shocks.' *Econometrica* 77(3), 623–685

Borio, Claudio, and Haibin Zhu (2012) 'Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism?' *Journal of Financial Stability* 8(4), 236–251

Bruno, Valentina Giulia, and Hyun Song Shin (2012a) 'Capital flows and the risk taking channel of monetary policy'

______ (2012b) 'Capital flows, cross-border banking and global liquidity'

Canova, Fabio (2005) 'The transmission of us shocks to latin america.' *Journal of Applied Econometrics* 20(2), 229–251

Canova, Fabio, and Gianni De Nicolo (2002) 'Monetary disturbances matter for business fluctuations in the g-7.' *Journal of Monetary Economics* 49(6), 1131–1159

CGFS (2011) 'Global liquidity - concept, measurement and policy implications.' Technical Report, Committee on the Global Financial System, Bank for International Settlements

Chen, M.S., M.P. Liu, A.M. Maechler, C. Marsh, M.S. Saksonovs, and M.H.S. Shin (2012) 'Exploring the dynamics of global liquidity.' Technical Report

D'Agostino, Antonello, and Paolo Surico (2009) 'Does global liquidity help to forecast U.S. inflation?' *Journal of Money, Credit and Banking* 41(2-3), 479–489

Domanski, Dietrich, Ingo Fender, and Patrick McGuire (2011) 'Assessing global liquidity.' *BIS Quarterly Review*

Dornbusch, Rudiger (1976) 'Expectations and exchange rate dynamics.' *Journal of Political Economy* 84(6), 1161–76

Eickmeier, Sandra, Leonardo Gambacorta, and Boris Hoffmann (2013) 'Understanding global liquidity.' BIS Working Papers 402, Bank for International Settlements, February

Forbes, Kristin J., and Francis E. Warnock (2012) 'Capital flow waves: Surges, stops, flight, and retrenchment.' *Journal of International Economics* 88(2), 235–251

Fostel, Ana, and Graciela Laura Kaminsky (2008) 'Latin americas access to international capital markets: Good behavior or global liquidity?' In *Current*

Account and External Financing, ed. Kevin Cowan, Sebastian Edwards, Rodrigo O. Valdes, Norman Loayza (Series Editor), and Klaus Schmid, vol. 12 of *Central Banking, Analysis, and Economic Policies Book Series* (Central Bank of Chile) chapter 4, pp. 117–158

Fratzscher, Marcel, Marco Lo Duca, and Roland Straub (2012) 'A global monetary tsunami? on the spillovers of us quantitative easing.' CEPR Discussion Papers 9195, C.E.P.R. Discussion Papers, October

Ghosh, Atish R., Mahvash Saeed Qureshi, Juan Zalduendo, and Jun Il Kim (2012) 'Surges.' IMF Working Papers 12/22, International Monetary Fund, January

Glosten, Lawrence R, Ravi Jagannathan, and David E Runkle (1993) 'On the relation between the expected value and the volatility of the nominal excess return on stocks.' *Journal of Finance* 48(5), 1779–1801

Mackowiak, Bartosz (2007) 'External shocks, u.s. monetary policy and macroeconomic fluctuations in emerging markets.' *Journal of Monetary Economics* 54(8), 2512–2520

Mantega, Guido (2012) 'Statement at twenty-fifth meeting of the international monetary and financial comitee, april 21, 2012.' http://www.imf.org/External/spring/2012/imfc/statement/eng/bra.pdf

Matsumoto, Akito (2011) 'Global liquidity: Availability of funds for safe and risky assets.' IMF Working Papers 11/136, International Monetary Fund, June

Obstfeld, Maurice (2012) 'Does the current account still matter?' Working Paper 17877, National Bureau of Economic Research, March

Rubio-Ramirez, Juan F., Daniel F. Waggoner, and Tao Zha (2010) 'Structural vector autoregressions: Theory of identification and algorithms for inference.' *Review of Economic Studies* 77(2), 665–696

Taylor, John B. (2012) 'Monetary policy and the next crisis.' *Wall Street Journal*

Uhlig, Harald (2005) 'What are the effects of monetary policy on output? results from an agnostic identification procedure.' *Journal of Monetary Economics* 52(2), 381–419

Appendix A. Data

The data being used are monthly Brazilian data over the period 1999M7:2010M12. The series were taken from the OECD database, from the IFS (International Financial Statistics) database, from Datastream (DS), from the World Bank (WB), from the Fundação Getulio Vargas (FGV) and from the Banco Central do Brasil (BCdB). Table 3 specifies the details.

Table 3. Data: Definitions and Sources

		Description	Source	Coding
1	CPI	National Consumer Price Index	IFS	223"64"M
2	NEER	Nominal Effective Exchange Rate	IFS	223"__NEC
3	SELIC	BRA Federal funds rate	BCdB	SELIC
4	RMP	World Raw Materials Price Index	WB	RMPIdx
5	BOVESPA	Share Prices (end of month)	IFS	223"62_EP
6	L	Domestic Credit	IFS	223"32"M
7	FX	Change in Reserves	BCdB	...
8	PI	Portfolio Investments Brazil	BCdB	...
9	PI-A	Portfolio Investments Brazil - Assets: net	BCdB	...
10	PI-AE	Portfolio Investments Brazil - Assets: Equity	BCdB	...
11	PI-AD	Portfolio Investments Brazil - Assets: Debt	BCdB	...
12	PI-NL	Portfolio Investments Brazil - Liabilites: net	BCdB	...
13	PI-LE	Portfolio Investments Brazil - Liabilites: Equity	BCdB	...
14	PI-LD	Portfolio Investments Brazil - Liabilites: Debt	BCdB	...
15	OI-LF	Other Investments - Loan & Financing	BCdB	...
16	OI-CD	Other Investments - Currency & Deposits	BCdB	...
17	OI-TC	Other Investments - Trade Credit	BCdB	...
18	OI-L	Other Investments - Loans	BCdB	...
19	OI	Other Investments	BCdB	...
20	OI-BI	Other Investments - other brazilian investments	BCdB	...
21	OI-FI	Other Investments - other foreign investments	BCdB	...
22	FFR	USA Federal funds rate	OECD	USA"IRSTF
23	CPI	USA CPI inflation rate (yoy)	IFS	111"64__X
24	VIX	USA VIX index	Datastream	...
25	USFC	Total claims of US banks on foreigners (excluding long term securities)	US Treasury	...
26	3YBR	US Treasury yield yield adjusted to constant maturity - 3 Year	US Treasury	...
27	EMRR	ECB main refinancing rate	ECB	...
28	CPI_EA	Euro Area inflation rate based on the HCPI (yoy)	ECB	111"64__X
29	VSTOXX	EURO STOXX 50 implied volatility index	Datastream	...

FIGURE 2. Global Private Liquidity Shock

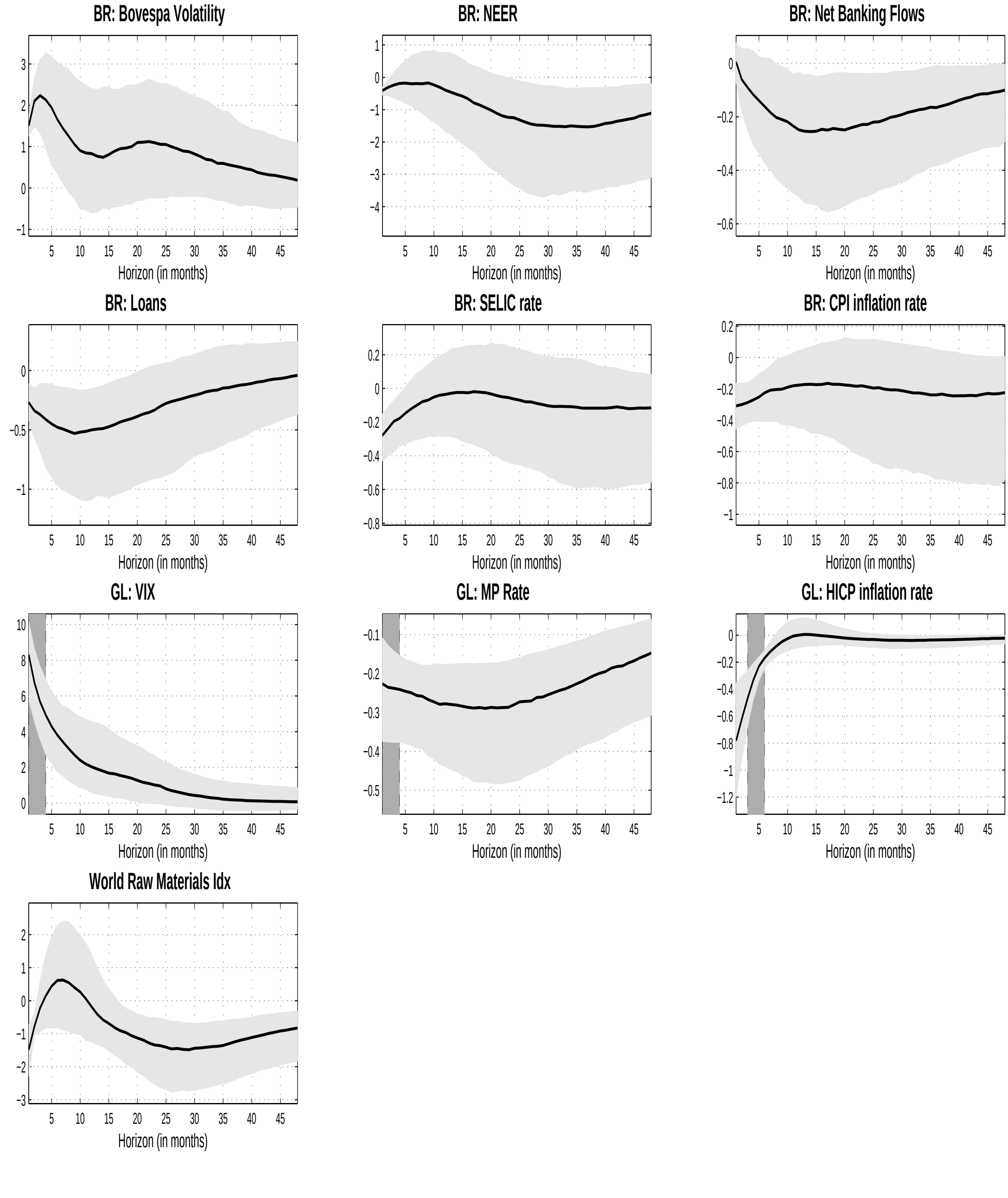


Figure 3. Global Public Liquidity Shock

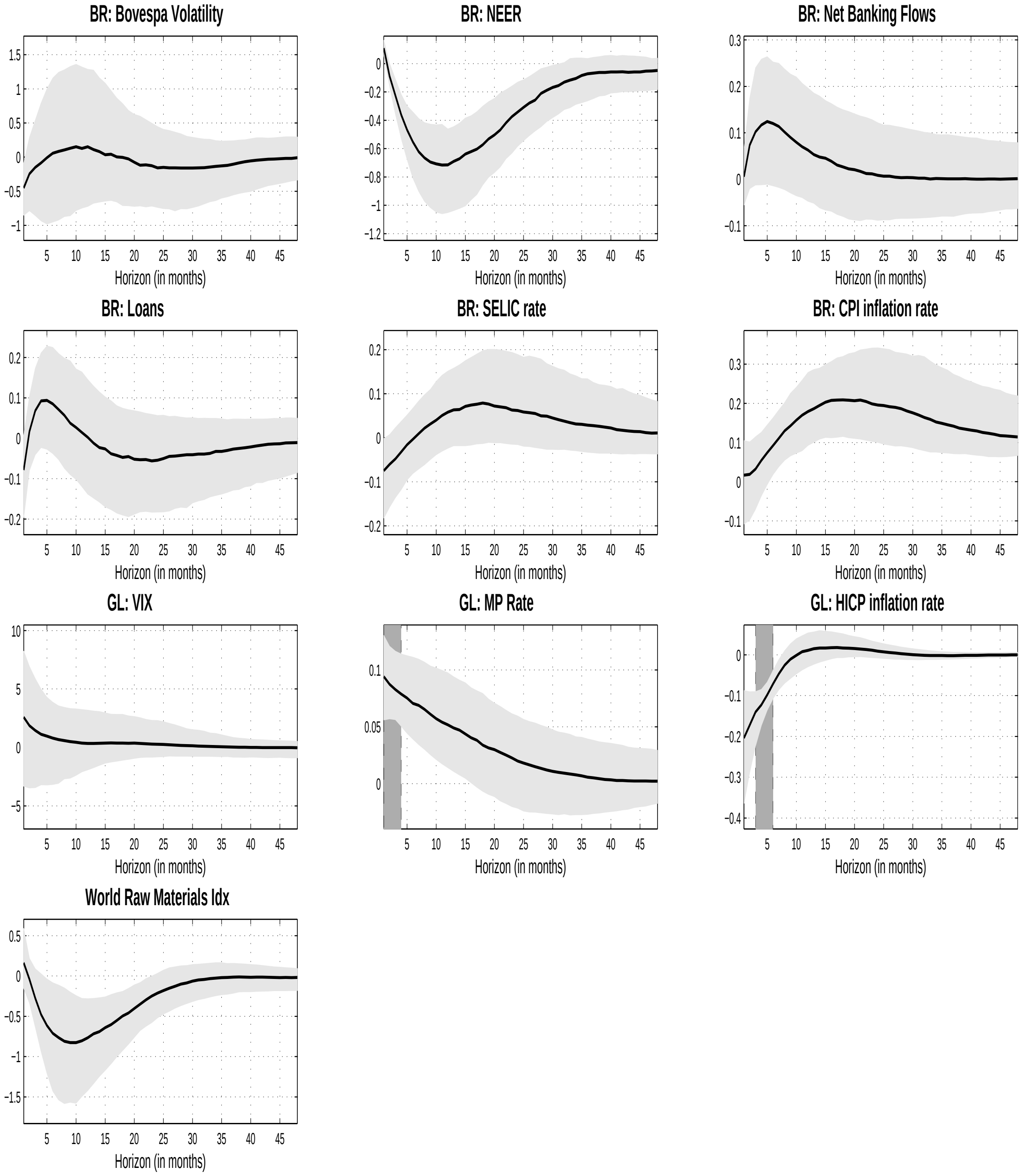
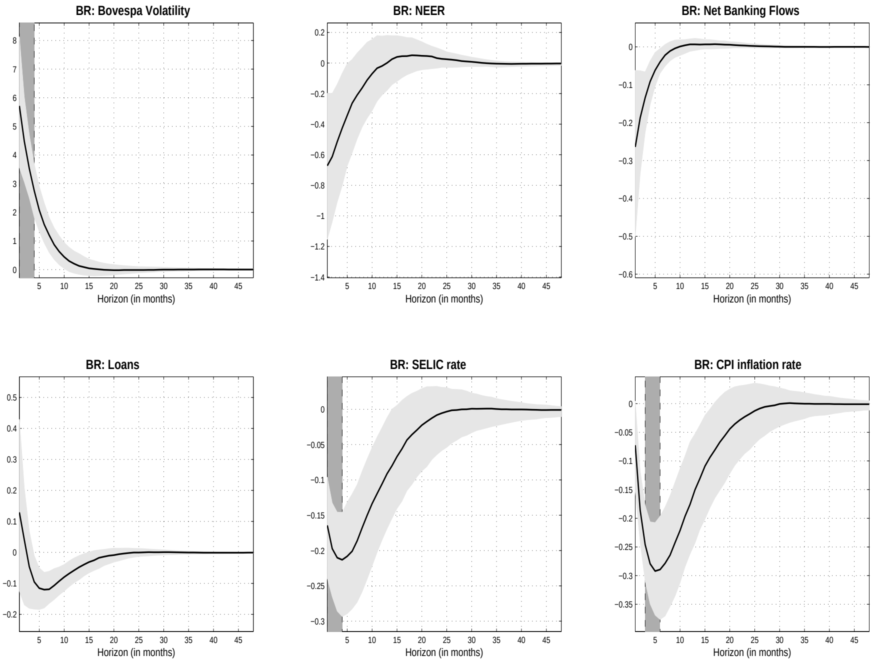


Figure 4. Domestic Liquidity Shocks

Domestic Private Liquidity Shock



Domestic Public Liquidity Shock

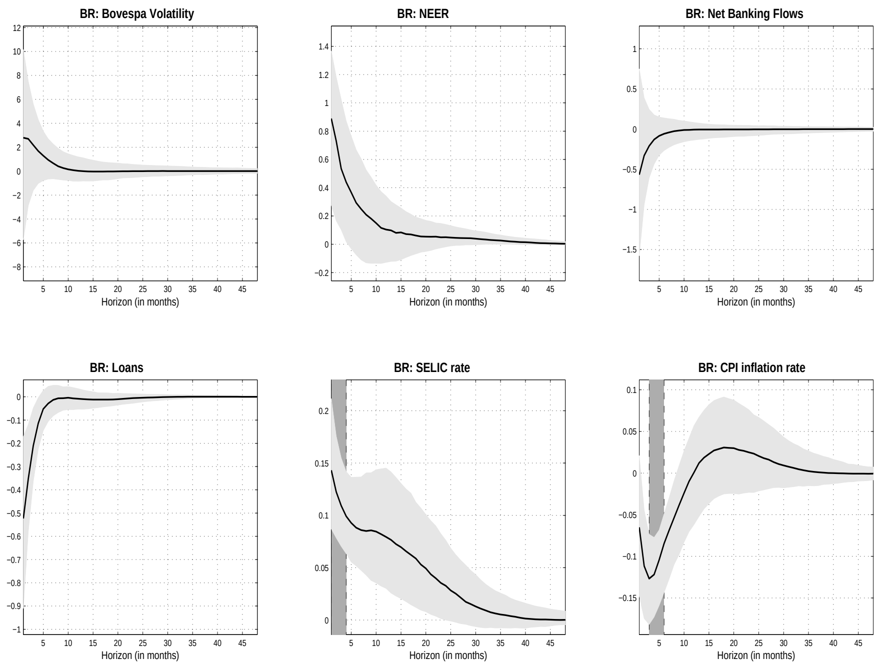
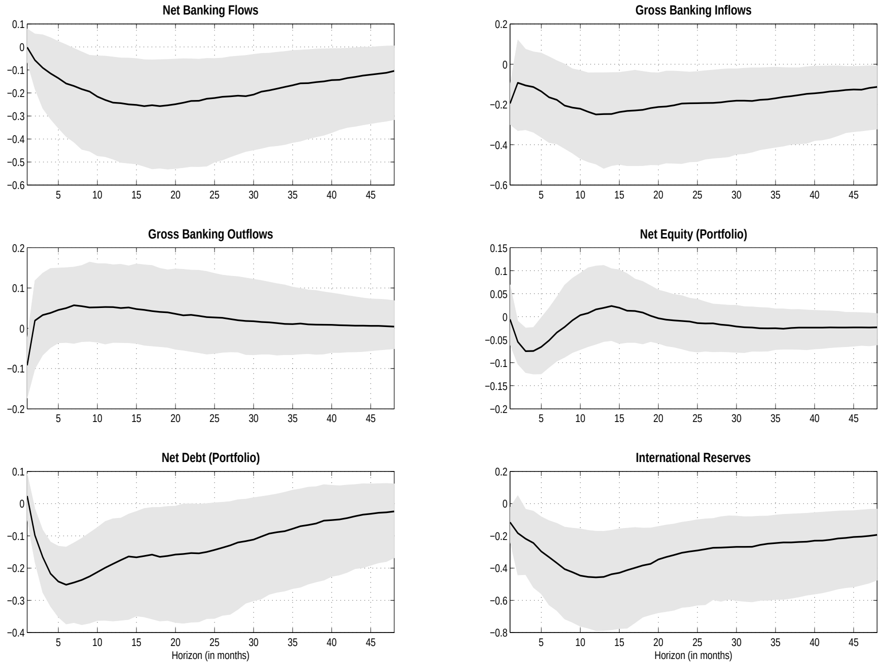


Figure 5. Alternative Capital Flow Measures

Global Private Liquidity Shock



Domestic Private Liquidity Shock

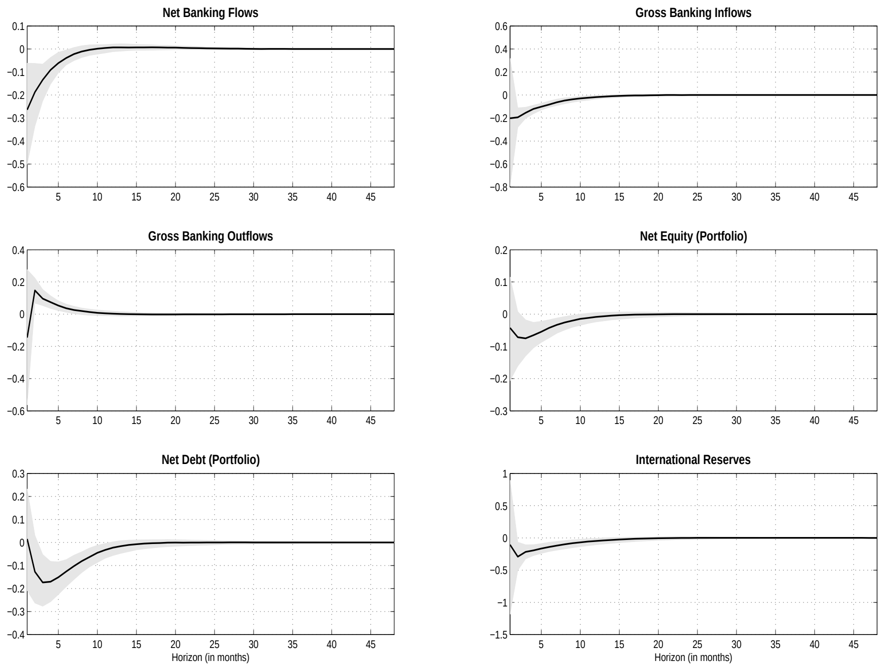


FIGURE 6. Responses of Further Global Variables

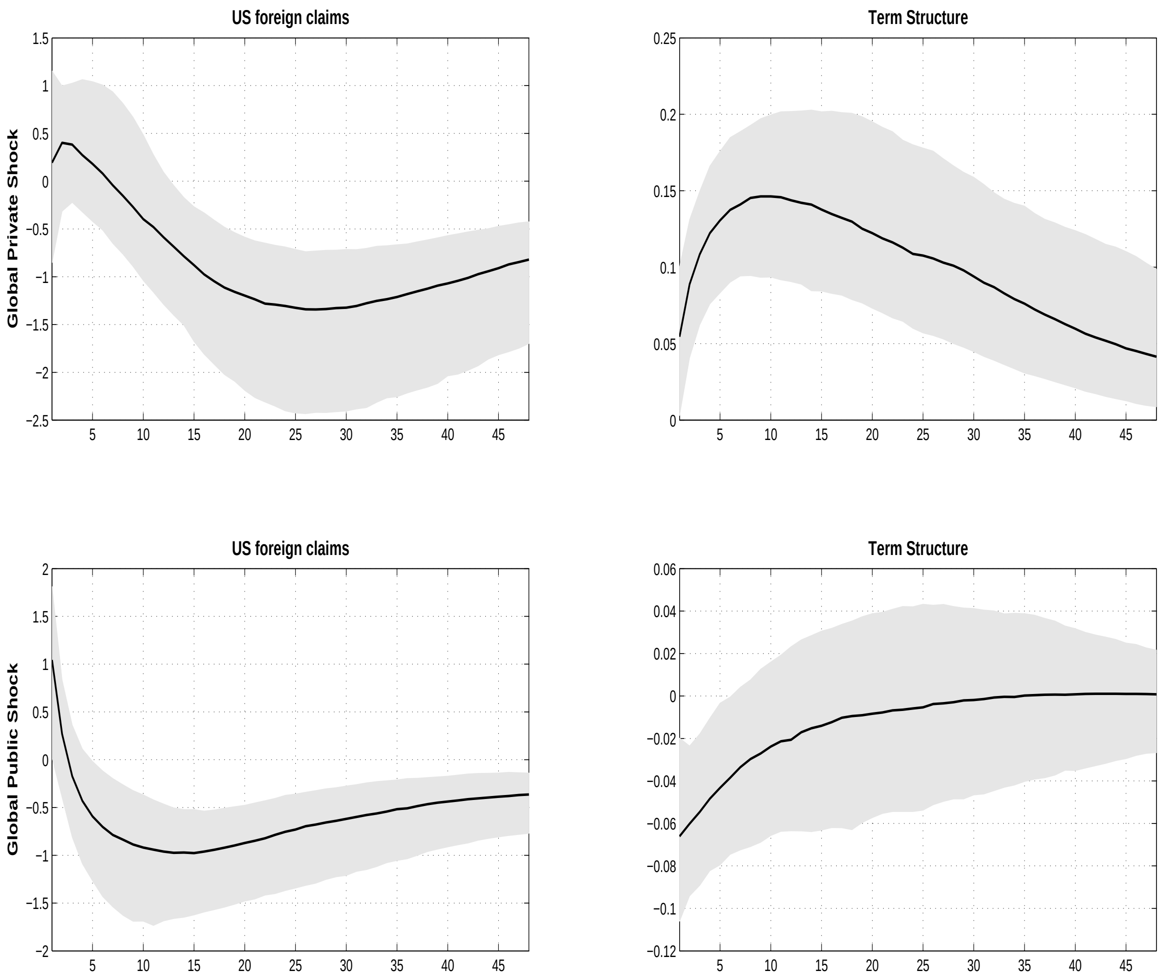


FIGURE 7. Private Global Liquidity Shock

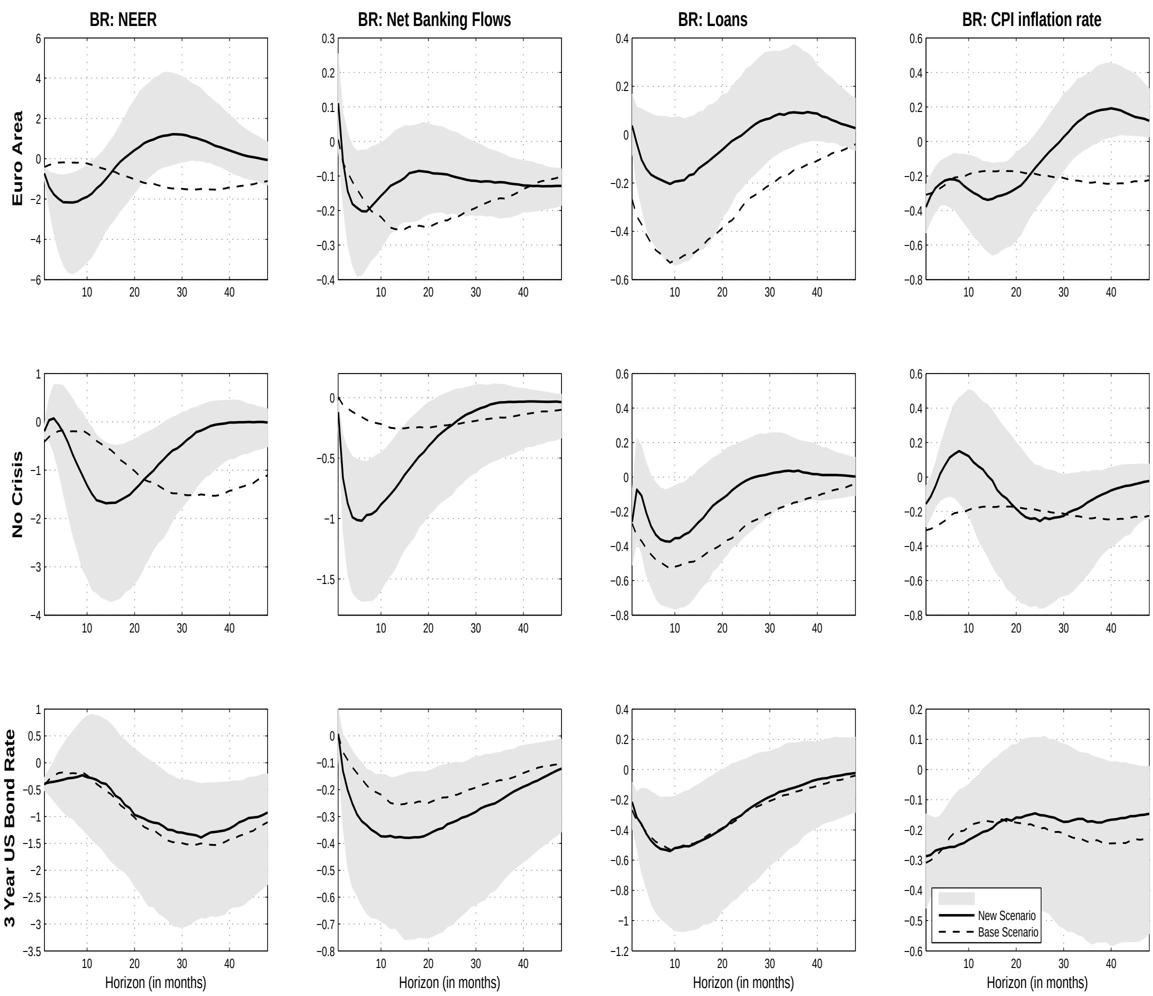


FIGURE 8. Public Global Liquidity Shock