The risk-taking channel of international financial flows

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Abstract

From the second half of the 1990s, the higher propensity to save in emerging economies triggered a global saving glut, consisting of massive inflows towards safe assets in the United States; then, from the early 2000s, rising dollar funding by global banks coincided with increasing inflows – a global banking glut – towards private-label US securities. We investigate to what extent the *global saving glut* and the *global banking glut* have stimulated risk taking in US financial markets, and find significant effects on credit spreads, market volatility and banking leverage ratios, which are independent of US monetary policy. By identifying saving and banking glut shocks in a VAR framework, we also detect linkages with household indebtedness and the housing market, further suggesting a substantial risk-taking channel. Our evidence provides a new perspective on the autonomous role of foreign financial inflows on the US economy during the run-up to the global financial crisis.

JEL classification: F32, F33, F34

Keywords: savings glut, banking glut, capital flows, banking leverage, risk-taking channel

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1 Introduction

One of the main causes of the housing and financial bubble in the United States that preceded the global financial crisis has been identified as the availability of easy credit in the early 2000s. Between 1996 and 2003, following financial market crises in East Asia, Latin America and Russia, many developing and oil-producing economies decided to accumulate foreign reserves as a buffer against potential capital outflows. This increased propensity to save, coupled with a preference for low-risk assets, triggered substantial inflows to the US government bond market putting, according to one prominent view, downward pressure on real interest rates and upward pressure on asset prices (the *Global Savings Glut* or GSG; see Bernanke, 2005 and Warnock and Warnock, 2009). Another strand of the literature emphasizes the role of the international banking sector, arguing that a key driver of the last financial crisis was the excess elasticity of banks' intermediation, expanding in times of favorable regulation or expansionary monetary policy and allowing for the build-up of unsustainable credit (the *Global Banking Glut* or GBG; see Borio and Disyatat, 2011, Shin, 2011, Brender and Pisani, 2010 and Bernanke et al., 2011). The latter is related to the activity of global banks, mostly European, which participated in international risk-taking chains by raising dollar funding via their US branches (Bruno and Shin, 2015b) and buying private-label US securities (Bertaut et al., 2012).

The two hypotheses have been separately tested by a number of authors. Concerning the effects on financial markets, the literature focused on US long-term interest rates in order to find plausible explanations to the Greenspan conundrum:[1] for example, Bertaut et al. (2012) find that foreign inflows to US bonds have significantly compressed bond yields. In the run-up to the 2007-2008 financial crisis, the long-term rates conundrum was accompanied at the same time by a sharp increase in investors' risk-taking behavior, reflected in decreasing credit spreads, shrinking market volatility and increasing bank leverage (see Figure 1.1). The linkages between these latter facts and foreign financial flows have received much less attention in the literature compared to the effects of foreign inflows on US safe assets returns (Bernanke et al., 2011).

Our paper proposes a joint test of the GSG and GBG hypotheses. We find that the increased foreign demand for US securities has also stimulated the risk-taking behavior in the US markets, above and beyond its effects on long-term yields, and that this channel has propagated to the credit and housing markets during the run-up to the crisis.

[1] In 2005, the Federal Reserve Chairman Greenspan observed that long-term rates trended lower despite the 150-basis point rise in the Federal Funds rate.

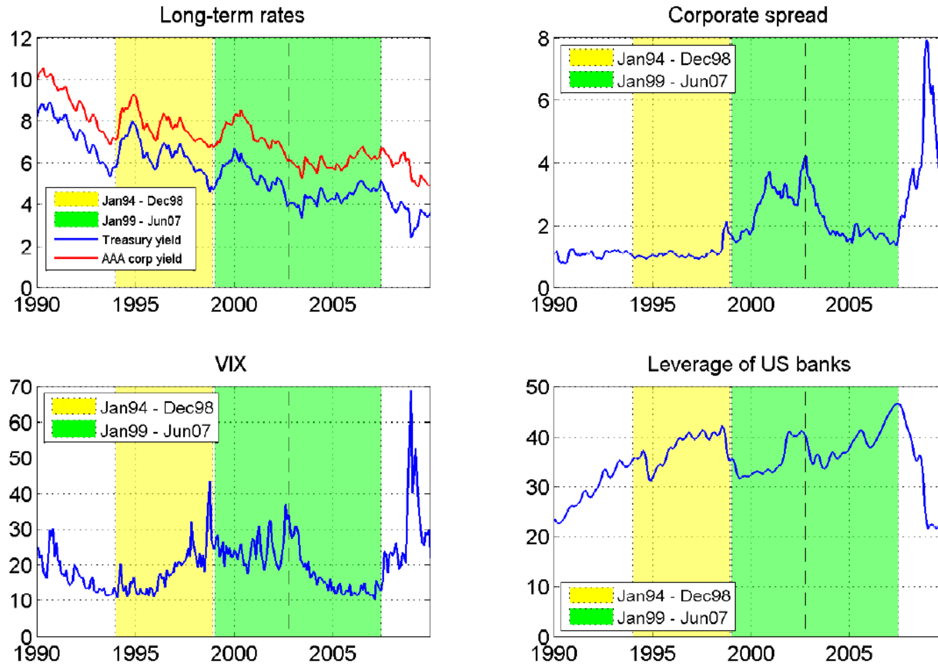

Figure 1.1: Long-term interest rates, credit spread, VIX and US bank leverage during the run-up to the crisis. The vertical dashed line in August 2002 marks the beginning of the credit spread's and VIX's decreasing phases; the yellow area marks the phase in which GSG inflows where predominant, while the green one the period when both GSG and and GBG inflows were present.

Importantly, we show that these "risk-on" effects of foreign financial inflows are independent of the US monetary policy stance. In this sense our results contribute to achieve a better understanding of the connections between international capital flows, monetary policy and the buildup of financial risks, which have not yet been sufficiently explored as emphasized by Bernanke (2017). To our knowldge, while the international risk-taking channel of US monetary policy on foreign countries has been extensively investigated in the literature, the joint and independent effects of the savings and banking gluts *on* the US economy, as well as the connections between the two types of flows, have never been extensively explored from an empirical point of view.

To this end, we first analyze the effects of foreign (net) purchases of public and private US bonds (our measures of GSG and GBG, respectively) on a battery of US financial market variables proxying the degree of risk-aversion using a reduced-form regression analysis and Granger causality tests.[2] We then rely on a Bayesian VAR (BVAR) framework in order to (1) identify two distinct exogenous portfolio preference shocks from our two foreign flows measures, and (2) investigate the direct effects of these two shocks

[2]Relating GSG to purchases of safe assets and GBG to purchases of risky assets is coherent on the one hand with the flight-to-safety behavior of public institutions in emerging countries and on the other hand with the search-for-yield behavior of global banks.

on the leverage of US banks – the linchpin of global credit expansion according to Shin (2011)[3] – as well as on households' indebtedness and the housing market.[4]

Our results show that both types of inflows had autonomous roles in affecting US financial and macroeconomic conditions. In particular, GBG flows were a relevant driver behind the compression of the credit spread and the VIX, whereas both types of flows contributed to the rise in bank leverage and household indebtedness. Furthermore, a decomposition of the credit spread and the VIX in their expectations and risk premia components suggests that the effect of GBG was channeled via lower risk premia both in bond and equity markets. Last, we also find evidence that GBG flows stimulated further GSG flows. These results suggest an autonomous – i.e. independent of US monetary policy conditions – risk-taking channel of foreign financial flows, which according to our knowledge is new in the literature.

Compared to the most recent literature on the global financial cycle, which points to the role of US monetary policy as a driver of synchronized capital flows (see Rey, 2015 and Miranda-Agrippino and Rey, 2015, among others), we document an episode in which foreign shocks induced by incoming financial flows had independent effects on the US financial conditions. Moreover, we also find that both GSG and GBG flows were self-reinforcing and that their risk-on effects also affected the broader US economy. Finally, from a more methodological and practical point of view, our work proposes a simple strategy to identify two types of (almost concomitant) capital flows shocks using data on bilateral portfolio flows among countries from which these two flows originated. This allows us to address the potential endogeneity affecting GBG flows, which could arise from the fact that, especially during the pre-crisis period, GBG flows may have been partly "recycled" from GSG flows targeting Europe, as suggested by Bertaut et al. (2012).[5]

The rest of the paper is organized as follows. Section 2 describes in detail the evolution of financial inflows into the US markets during the run-up to the crisis, the way we compute monthly GSG and GBG flows and the empirical strategy followed in the rest of the

[3]Bruno and Shin (2015b) propose a model of the international banking system focusing on the leverage cycle of global banks and on the global and local factors affecting their balance sheets.

[4]Specifically, one could think of GSG and GBG flows as encompassing two distinct porfolio preference shocks: first, a preference shock towards low risk US assets that originated in a number of countries previously hit, directly or indirectly, by financial crises; second, a search-for-yield shock due to the diffusion of more permissive risk management practices implied by Basel II regulation which induced a gradual reassessment of portfolio risk at bank level (a search-for-yield behavior, as emphasized by Shin, 2011 and Danielsson et al., 2011).

[5]We further test for the exogeneity of the identified capital flows shocks with respect to US monetary policy, using the high-frequency US monetary policy surprises estimated by Gertler and Karadi (2015).

paper. Section 3 and Section 4 focus, respectively, on the results from monthly regressions and on the impulse responses of quarterly BVAR models. Section 5 concludes.

2 Data and empirical strategy

In this section we describe the main features of our analysis. First, we present the data sets that are commonly used in the literature (Section 2.1) and compare foreign inflows coming from different countries and regions (Section 2.2). Then, we compute our measures of inflows into the US public and private bond markets and comment on their evolution between the 90s and the early 2000s (Section 2.3); finally, Section 2.4 describes and motivates our empirical approach.

2.1 Data sources

Following Warnock and Warnock (2009) and Bertaut et al. (2012), we construct monthly foreign inflows into US securities by using data coming from two data sets published by the US Treasury. The first one is the "US Transactions with Foreigners in Long-term Domestic and Foreign Securities" (UST henceforth) that collects monthly gross purchases and sales made by foreign residents of domestic (US-issued) securities from January 1977; fixed-income securities are split into Treasury, Agency and corporate bonds. The second source is the survey named "Foreign portfolio holdings of US securities" (FPH henceforth), reporting holdings of foreign-owned US bonds for the same three categories; it has been conducted six times since 1974 (in 1974, 1978, 1984, 1989, 1994 and 2000), then on a yearly basis since 2002.

To obtain monthly holdings within each survey, one first needs to adjust the monthly net purchases (i.e., gross purchases less sales of US bonds by foreigners) computed from UST in order to be coherent with FPH. The method proposed by Warnock and Warnock (2009) has been refined and updated by Bertaut and Tryon (2007) and Bertaut and Judson (2014).[6] Monthly data (*benchmark-consistent holdings*, henceforth) are available from March 1994 to December 2014.[7]

To construct our indicators, we rely on flows (i.e., first differences of monthly holdings) into government bonds – Treasuries and Agencies – and private fixed-income secu-

[6]The estimation procedure involves (i) minimizing the gap between the holdings from the FPH data and the cumulated monthly net purchases from the UST and (ii) spread the needed adjustment evenly between two survey dates.

[7]See Bertaut and Judson (2014).

rities – corporate bonds.[8]

2.2 Inflows by region and country of origin

For each security, the benchmark-consistent holdings dataset reports the breakdown of foreign holders by country, as available in the original UST and FPH. While the GSG and GBG hypotheses refer to flows coming from emerging economies and from Europe through banks, respectively, an analysis of the evolution of net inflows to the US by security and country has never been reported, as far as we know. We analyze the time variation of net positions in public and private bonds separately: for both asset types, we consider the level of foreign holdings on three survey dates (December 1994, March 2000 and June 2007) and we rank each source of flows (aggregated by region) by net change in holdings between 1994 and 2007. Then, we make a second ranking by country and pick the first ten countries which increased their portfolio holdings the most between these dates.

Table 1 displays the regional ranking for Treasury and Agency bonds. The block of Asian countries is, on aggregate, not only the top foreign holder in 1994 (col. 1), but also the one that has increased its holdings the most between 1994 and 2007 (col. 4). Looking closer, while the pace of increase is close to the one of European countries during the '90s (i.e. between 1994 and 2000), in the first seven years of the 2000s Asia more than tripled its holdings, increasing its share of US public bonds owned by foreigners to up to two thirds (col. 3). Within Asia, Japan was the first holder of US bonds during the '90s – according to the survey, China's holdings in 2000 were about a third of the Japanese ones; since then, China increased its holdings more than any other country, replacing Japan as the first holder with 843 bn of US dollars as of June 2007 (Table 2). Following China and Japan, major buyers of public bonds are the group of Caribbean banking centers, Belgium plus Luxembourg, Russia, Brazil and Korea.

The investigation conducted above is repeated for US corporate bonds, leading to opposite results for European and Asian countries; holdings by region are reported in Table 4. In the overall market of private US bonds, Europe is by far the region with the strongest increase in total holdings during our sample period: since 1994, when European

[8] According to Bertaut et al. (2012), the majority of inflows into the broad category of corporate bonds between the late '90s and 2007 involved the purchase of asset-backed securities and other notes and structured products that were much less "safe" than conventional nonfinancial corporate bonds; we consider flows into this broader category because foreign holdings of ABS are only available since 2002. We have in mind the purchase of these types of fixed income securities by global banks when constructing our GBG indicator.

and Asian economies had a portfolio of US corporate bonds of similar size (55 and 43 bn USD, respectively), European countries started to accumulate private US securities reaching USD 250 billion in the year 2000; the pace of purchases increased substantially during the 2000s and total holdings reached more than 1600 bn in 2007 (11 percent of US GDP). The United Kingdom and some euro area countries, in particular Belgium plus Luxembourg, Ireland and Germany, are among the leading buyers (see Table 5).

The Caribbean banking centers have played a relevant role in both markets (third position in the ranking of net purchasers for both public and private bonds). Cayman Islands and Bermuda are two important business centers in the area: Cayman Islands are the main offshore centers for banking, hosting foreign branches of global banks, while Bermuda mainly hosts branches of insurance companies. According to the 2005 country report made by the International Monetary Fund (IMF), in 2003 Cayman Islands had 349 banks with total assets amounting to over one trillion dollars (see Table 3 for details). Almost one-third of these banks were foreign branches of European banks, holding 56 percent of the total assets. We thus speculate that a big portion of the purchases of US corporate bonds coming from the Cayman Islands might be traced back to European global banks.

To sum up, we confirm that capital flows into the US markets originated mostly from Asian countries with high excess savings and from the cross-border lending activity of European global banks investing in US corporate bonds; however, the analysis also highlights the active role of Luxembourg in accumulating US public bonds and that of the Caribbean Banking centers as a source of inflows into private securities, usually disregarded in this literature. The data also shows that the bulk of inflows is concentrated between the 2000 and 2007. This is almost concurrent with the widening of the US current account deficit, which occurred between 1996 and 2003, as highlighted in Bernanke (2005); for the case of GBG flows, the strong increase since the early 2000s is in line with the hypothesis that the implementation of Basel II and the advent of the euro have put significant pressure on European banks to diversify their investments out of domestic markets (Shin, 2011).

2.3 Indicators of financial inflows

We now move on to the construction of our indicators of foreign financial inflows, by extending the original formulation of Warnock and Warnock (2009) to private as well as to public bonds; those indicators will be used, in Section 3, to identify the effects of GSG and GBG flows on US financial conditions. Foreign financial inflows are computed as the

#	Region	1994	2000	2007	1994–2007	2000–2007
1	Total Asia	302.2	596.1	2144.0	1841.8	1547.9
	of which:					
	China	*17.7*	*90.7*	*842.9*	*825.1*	*752.2*
	Japan	*166.4*	*263.9*	*781.4*	*615.0*	*517.5*
	Middle Eastern Oil Exporters	*19.9*	*24.4*	*108.3*	*88.4*	*83.9*
2	Total Europe	188.5	390.3	656.8	468.2	266.4
	of which:					
	Euro Area Countries	*105.5*	*191.0*	*325.8*	*220.3*	*134.8*
	United Kingdom	*58.1*	*112.0*	*73.5*	*15.4*	*-38.5*
3	Total Latin America	12.6	44.0	196.6	184.0	152.6
4	Total Caribbean	33.8	64.2	163.9	130.1	99.7
5	Australia and New Zealand	2.9	8.0	44.8	40.1	36.8
6	Total Africa	1.2	5.4	14.6	13.3	9.1
	Total	570.7	1145.6	3268.2	2697.6	2122.7

Table 1: Foreign portfolio holdings of US Treasury and Agency bonds by region on three surveyed dates (December 1994, March 2000 and June 2007) and changes in holdings between two surveys (Jun2007-Dec1994 and Jun2007-Mar2000), in bn USD. Regions are sorted by net change in holdings between 2007 and 1994 (col. 4). Net positions for the United Kingdom also comprises Channel Islands and the Isle of Man.

#	Country	1994	2000	2007	1994–2007	2000–2007
1	China	17.7	90.7	842.9	825.1	752.2
2	Japan	166.4	263.9	781.4	615.0	517.5
3	Caribbean Banking Centers	33.2	56.0	157.8	124.6	101.8
4	Belgium and Luxembourg	14.5	28.9	131.5	117.0	102.6
5	Russia	0.1	6.8	108.8	108.6	102.0
6	Brazil	0.2	7.6	102.0	101.9	94.5
7	Korea	5.4	38.4	105.9	100.5	67.5
8	Middle Eastern Oil Exporters	19.9	24.4	108.3	88.4	83.9
9	Taiwan	33.3	45.1	97.9	64.6	52.9
10	Hong Kong	13.9	55.9	76.2	62.3	20.3
	Total	570.7	1145.6	3268.2	2697.6	2122.7

Table 2: Top 10 portfolio holdings of US Treasury and Agency bonds by foreign country on three surveyed dates (December 1994, March 2000 and June 2007) and changes in holdings between two surveys (Jun2007-Dec1994 and Jun2007-Mar2000), in bn USD. Countries are sorted by net change in holdings between 2007 and 1994 (col. 4).

Country	2002 #	2002 Tot. assets	2003 #	2003 Tot. assets	2003 % of assets
Africa	1	0.1	1	0.2	0
Asia	41	38.2	34	29.7	3
Caribbean	14	5.7	12	11.4	1
Canada	10	29.2	8	21.2	2
Cayman Islands	5	1.0	5	1.2	0
Central and South America	82	59.1	73	67.1	6
Europe	110	501.0	101	580.1	56
Middle East	17	3.2	13	2.8	0
United Kingdom	16	12.8	16	10.5	1
United States	87	317.2	86	321.0	31
Total	383	967.5	349	1045.2	

Table 3: Cayman Islands - Geographical distribution of banks in 2002 and 2003 (total assets are in bn USD).

12-month cumulated benchmark-consistent flows into Treasury and Agency bonds and corporate bonds respectively, both as a share of the (estimated) previous month's US GDP in annual terms.[9] Considering foreign investors from n countries and denoting by $\{T_{j,t}\}$, $\{A_{j,t}\}$ and $\{C_{j,t}\}$ the monthly series of benchmark-consistent holdings of country j of US Treasury, Agency and Corporate bonds, respectively. Let $\{\Delta T_{j,t}\}$, $\{\Delta A_{j,t}\}$ and $\{\Delta C_{j,t}\}$ be the benchmark-consistent flows obtained as first differences of holdings and $\{GDP_t\}$ the series of estimated monthly US GDP from quarterly data using the Chow-Lin algorithm (see Chow and Lin (1971)). Inflows in Treasury and Agency bonds are defined as:

$$\text{TAinflows}_t = \frac{1}{12 * GDP_{t-12}} \sum_{j=1}^{n} \sum_{i=1}^{12} \left(\Delta T_{j,t-i+1} + \Delta A_{j,t-i+1} \right) \tag{2.1}$$

and those in corporate bonds as

$$\text{Cinflows}_t = \frac{1}{12 * GDP_{t-12}} \sum_{j=1}^{n} \sum_{i=1}^{12} \Delta C_{j,t-i+1} \tag{2.2}$$

The evolution of those inflows over time is reported in Figure 2.1. The left panel reports total inflows into Treasury plus Agency bonds (red line) and corporate bonds (blue line); the right panel shows inflows into US Treasuries and Agencies from all Asian coun-

[9] Focusing on flows rather than holdings is in line with the literature on the savings and banking glut. Intuitively, flow effects are considered to be more likely to have shaped the swings in financial variables than liquidity and portfolio effects induced by the increasing size of the stock of assets held abroad.

#	Region	1994	2000	2007	1994–2007	2000–2007
1	Total Europe	55.0	250.6	1677.0	1622.0	1426.5
	of which:					
	Euro Area Countries	*23.0*	*115.3*	*1062.9*	*1040.0*	*947.6*
	United Kingdom	*24.2*	*114.1*	*460.8*	*436.5*	*346.6*
2	Total Caribbean	21.8	114.2	454.5	432.7	340.3
3	Total Asia	42.7	37.8	239.3	196.6	201.6
	of which:					
	China	*0.3*	*0.2*	*27.6*	*27.3*	*27.5*
	Japan	*29.9*	*22.2*	*119.2*	*89.2*	*96.9*
	Middle Eastern Oil Exporters	*5.8*	*4.4*	*16.7*	*10.9*	*12.3*
4	Total Latin America	2.9	4.2	30.9	28.0	26.7
5	Australia and New Zealand	0.5	2.4	28.5	26.4	26.0
6	Total Africa	0.8	1.0	1.5	0.7	0.4
	Total	275.5	703.5	2737.6	2462.1	2034.1

Table 4: Foreign portfolio holdings of US Corporate bonds by region on three surveyed dates (December 1994, March 2000 and June 2007) and changes in holdings between two surveys (Jun2007-Dec1994 and Jun2007-Mar2000), in bn USD. Regions are sorted by net change in holdings between 2007 and 1994 (col. 4). Net positions for the United Kingdom also comprises Channel Islands and the Isle of Man.

#	Country	1994	2000	2007	1994–2007	2000–2007
1	Belgium and Luxembourg	6.6	43.0	661.7	655.1	618.7
2	United Kingdom	24.2	114.1	460.8	436.5	346.6
3	Caribbean Banking Centers	22.4	109.0	451.0	428.6	342.0
4	Ireland	0.9	8.9	136.0	135.1	127.1
5	Germany	4.5	34.6	98.5	93.9	63.8
6	Japan	29.9	22.2	119.2	89.2	96.9
7	Switzerland	7.0	17.3	89.2	82.2	71.9
8	Netherlands	3.8	11.0	84.2	80.3	73.2
9	Canada	3.6	12.9	83.6	80.1	70.7
10	France	3.8	10.1	58.5	54.7	48.4
	Total	570.7	1145.6	3268.2	2697.6	2122.7

Table 5: Top 10 portfolio holdings of US Corporate bonds by foreign country on three surveyed dates (December 1994, March 2000 and June 2007) and changes in holdings between two surveys (Jun2007-Dec1994 and Jun2007-Mar2000), in bn USD. Countries are sorted by net change in holdings between 2007 and 1994 (col. 4). Net positions for the United Kingdom also comprises Channel Islands and the Isle of Man.

tries (red line) and into corporate bonds from Europe and the Caribbean banking centers (blue line). Financial inflows from abroad are substantial in two distinct phases (Figure 2.1, left panel): (i) during the early 90s, when inflows on private label securities were low and almost flat while purchases of public bonds increased a lot, then retrenching around the end of the decade during the Asian and Russian financial crises; (ii) between the end of the 90s and 2007, when both types of inflows rose substantially.

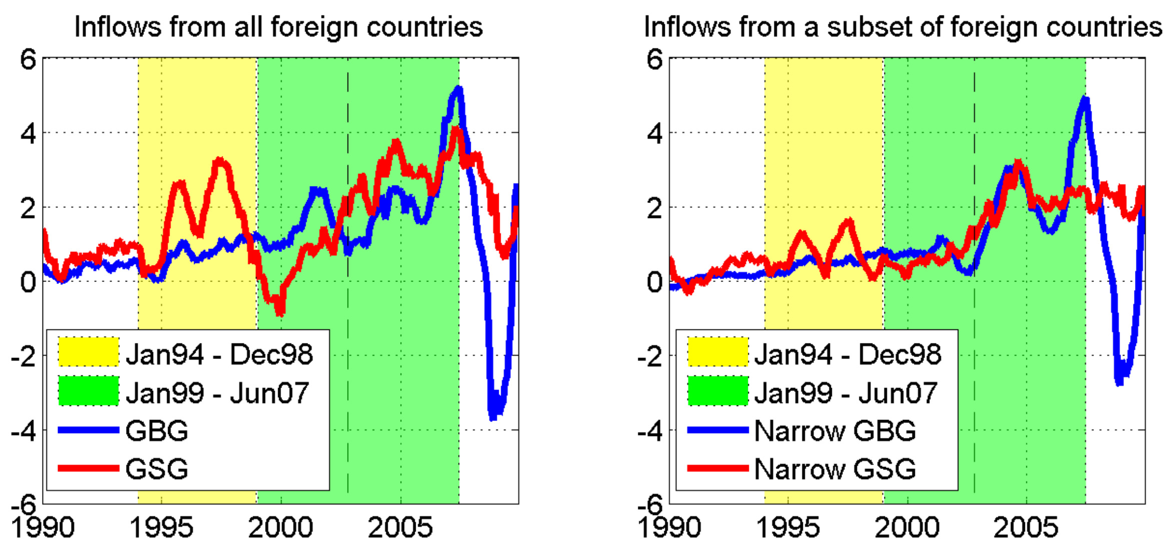

Figure 2.1: Monthly public bond inflows (red line) and corporate bond inflows (blue line) computed for all foreign countries (left panel) and for a restricted sample of countries (right panel), in % of US GDP. The restricted sample is formed by European countries plus Caribbean banking centers (for corporate inflows) and by the group of Asian countries (for public bond inflows). Values for month t are computed as the sum of the 12 month flows ending in month t, standardized by the monthly value of US GDP for month $t-12$, as in Warnock and Warnock (2009). The yellow area marks the phase in which the global savings glut started to spill over the US markets (Jan94-Dec98), while the green one displays the concomitant phase of savings and banking glut inflows (Jan99-Jun07); a vertical dashed line marks the beginning of the synchronous decrease in the credit spread and the VIX from August 2002 onwards. The temporal disaggregation of US quarterly GDP is done using a Chow-Lin type algorithm. Data are from January 1990 to January 2008.

The dominance of one or the other type of flows during the second phase can be observed during the different subperiods: net purchases of corporate bonds are stronger than those of public bonds between the end of the 90s and the beginning of the 2000s, while the evidence is reversed later on in the 2000s; finally, between 2005 and 2008, private bond inflows exhibit again a much more rapid pace. Instead, the series constructed using subsets of countries show a more comparable evolution during the entire period of interest (Figure 2.1, right panel), except during the later years of the sample period, when foreign banking flows accumulation clearly dominates.

2.4 Empirical strategy

The objective of this paper is to investigate the effects of foreign inflows on the US financial and economic conditions during the run-up to the financial crisis. Figure 2.2 summarizes the expected transmission channels, that we explore first with a reduced form analysis targeting long-term yields and measures for both the quantity and price of risk, and then with the identification of GSG and GBG shocks in a BVAR model.

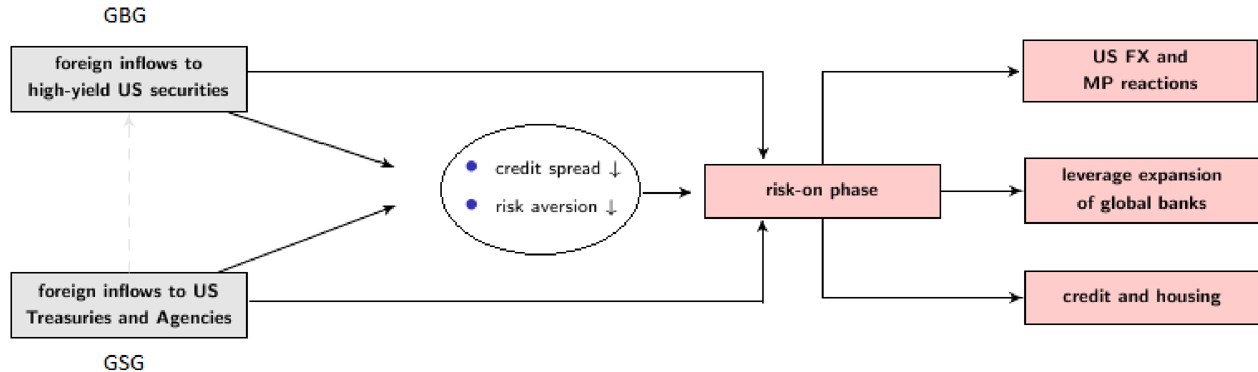

Figure 2.2: Diagram of the effects of foreign inflows on the US financial and macroeconomic conditions.

The reduced form analysis is conducted as follows. We start out by exploring the impact of foreign inflows on US long-term rates, namely 10-year Treasury yields and returns on AAA corporate bonds issued by the US non-financial sector (a proxy for private-label MBS).[10] Then, we focus more closely on the credit spread, i.e. the premium assigned by investors to corporate with respect to government bonds which, during the run-up to the crisis, steadily decreased over time. In particular, we employ both the measure of the credit spread and of its two subcomponents – i.e., expectations and risk premium – computed by Gilchrist and Zakrajsek (2012): a negative impact of either type of flows on the credit spread, and in particular on its risk premium component, should signal foreign inflows as being partly responsible for increased risk-taking behavior.

We further investigate whether the reduction in riskiness which stimulates an expansion in banks' balance sheets is only the outcome of an underlying transmission channel of monetary policy – the "risk-taking channel of monetary policy" view documented by Bruno and Shin (2015b) – or whether both the reduction in riskiness and the expansion in banks' balance sheets also reflect the autonomous transmission mechanism of GBG and GSG flows. For this purpose, while controlling for the monetary policy stance, we regress

[10] As shown by Bertaut et al. (2012), Jumbo MBS yields provided by JP Morgan and Bloomberg show a path that is very similar to that of AAA yields during the available sample.

separately a proxy for banking leverage and the VIX index on foreign inflows. The aim is to capture a possible direct effect of international financial flows on US leverage, and also to test whether inflows exert pro- or counter-cyclical effects on risk aversion and market uncertainty, proxied by the two components of the VIX estimated by Bekaert and Hoerova (2014).

The structural analysis is implemented in a BVAR framework including both financial and macroeconomic variables. The GSG variable included in the BVAR is computed by retaining only inflows to US public bonds coming from emerging Asian economies only, in line with the original claim by Bernanke (2005); the GBG one is instead computed using corporate bond flows from those European economies in which portfolio investments from emerging Asia *decreased* during the same years, to exclude inflows to the US which could have been recycled from the Asian saving glut (see Section 4). The shocks are recovered through a recursive procedure, after their exogeneity with respect to US monetary shocks has been established by assessing their correlation with the monetary policy shocks identified by Gertler and Karadi (2015). These GSG and GBG preference shocks are then used to investigate whether GSG and GBG flows have effects not only on financial conditions, but also on bank lending, house prices and residential investment.

The BVAR setup allows us to further explore the impact of foreign financial flows. First, the autonomous role of GBG flows, in particular, is still debated. While saving glut flows are the outcome of deliberate policy decisions undertaken since the first half of the nineties, the global banking glut assumed particular relevance later in that decade, possibly also in reaction to GSG flows. If, as suggested among others by Bertaut et al. (2012), GBG flows have been largely driven by the global savings glut (the so-called "triangular trade-in-financial assets view"), then we should find no autonomous role on US markets. Second, the two types of flows might be interrelated. For example, a saving glut shock might have induced an increase in the supply of financial instruments in the US, therefore spurring new search-for-yield banking inflows to the US markets. Third, the BVAR also allows us to detect possible links between GSG (and GBG) flows and the dollar exchange rate. By including both the US real effective exchange rate and the real Fed Funds target rate, we thus investigate possible direct effects of inflow shocks on the dollar, while at the same time controlling for the US monetary stance.[11] Finally, the BVAR allows us

[11] For example, if foreign flows were following only carry trade strategies during the expansion phase of the financial cycle, then GBG increases would simply determine a US dollar (the target currency) appreciation. On the other hand, according to Hofmann et al. (2016) and Blanchard et al. (2015), currency appreciations may reflect, for a given monetary policy rate, the outcome of capital inflows which are ultimately driven by overall more expansionary financial and macroeconomic conditions. Differently than in the standard Mundell-Fleming model, where an appreciation is associated with lower net exports and

to explore the transmission between GBG/GSG flows and the broader macroeconomy. We restrict our focus on private debt and house prices. The aim is to understand which type of flows, if any, may have contributed the most to the build-up of the housing bubble in the United States; moreover, we want to clarify the direction of causation between banking flows and house price developments, in order to investigate wether the expansion of the housing sector has been predetermined with respect to the increase of foreign investments into ABS and other private-label securities. According to this view, GBG flows would have followed, in the medium-term, internal developments in the US, with housing acting as a catalyst of foreign capital inflows.

3 Foreign inflows into US financial markets

In this section we present the results of our regression analysis: Section 3.1 focuses on the effects of public and private bond inflows on long-term interest rates; Section 3.2 on their impact on the credit spread and on its subcomponents (the expected default component and excess bond premium); Section 3.3 on their effects on the VIX and on its expectation and premium components; finally, Section 3.4 looks at the relationship between inflows and banking leverage.

3.1 Long-term interest rates

To estimate the effects of foreign flows on long-term rates, we run univariate regressions of foreign financial inflows on the 10-year Treasury rate and the AAA corporate yield, controlling for variations in the Federal Funds target rate, 10-year inflation expectations (taken from the US Survey of Professional Forecasters), and the log of the US real effective exchange rate. Inflows in Treasury and Agency bonds ($TA\ inflows$) and those on US corporate bonds ($C\ inflows$) are included both one at a time and together. All variables are taken in first differences, with the aim of capturing short-term effects on bond yields.[12]

Results are reported in Table 6. Both flow variables have a significant and negative impact on the 10-year Treasury rate and the AAA yield, with comparable magnitudes for the two yields. This is evident both when they are included one at a time (cf. cols. 1,2 and

output, according to this "risk-taking channel" view exchange rate appreciations are not necessarily contractionary.

[12]Other papers investigate the effect on the level (instead of the first difference) of bond yields by running constrained regressions in which it is assumed that real interest rates are stationary (see Warnock and Warnock (2009), among others). We choose not to make this assumption and work with first differences.

4,5) and when they are included together (cf. cols. 3 and 6), although in this latter case the magnitude of the coefficients is somewhat lower. In both cases, the effect of corporate bond inflows on long-term yields is stronger than that of public bond flows.

	D.10-year	D.10-year	D.10-year	D.AAAyield	D.AAAyield	D.AAAyield
D.FFtarget	0.37***	0.37***	0.37***	0.20**	0.20**	0.20**
	(0.10)	(0.09)	(0.09)	(0.08)	(0.08)	(0.08)
D.exp infl	−0.09	−0.11	−0.12	−0.02	−0.03	−0.04
	(0.08)	(0.09)	(0.08)	(0.06)	(0.06)	(0.06)
D.logREER	−0.73	−0.24	−0.98	−1.12	−0.61	−1.28
	(1.47)	(1.52)	(1.47)	(1.07)	(1.12)	(1.10)
D.Cinflows	−0.40***		−0.28***	−0.33***		−0.25***
	(0.09)		(0.10)	(0.07)		(0.08)
D.TAinflows		−0.29***	−0.23***		−0.21***	−0.15**
		(0.07)	(0.08)		(0.06)	(0.06)
Constant	0.00	−0.00	0.00	−0.00	−0.01	0.00
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	162	162	162	162	162	162
Adjusted R^2	0.15	0.17	0.20	0.12	0.11	0.15

Standard errors in parentheses. Sample: Jan 1994 – Jun 2007.
* $p < 0.01$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Regressions on US long rates (10-year Treasury yield) and Moody's AAA corporate bond yield. Regressors are: nominal Fed Funds target rate (*FFtarget*), expected inflation proxied by lagged core US CPI inflation (*exp infl*), US real effective exchange rate in natural logs (*logREER*), Cinflows and TAinflows. Sample is January 1994 – June 2007 (162 obs.). The *D.* indicates that variables are in first differences.

3.2 Credit spreads

As shown by Gilchrist and Zakrajsek (2012) (GZ henceforth), credit spreads capture both the expected default rate of corporate bonds and cyclical movements in investors' risk appetite. The authors compute measures of these two components, i.e. the expected default component and the excess bond premium.[13] While the former is related to the financial health of the issuers, it is not as strongly related to investors' moods. To investigate the effect of foreign flows on the credit spread, we run univariate regressions on the aggregate GZ measure – that, differently than the AAA-minus-10year spread, is free from duration and liquidity mismatches – and, separately, on its two subcomponents. The credit spread series is stationary, so we can assess the short-term impact of inflows on its level; as in the previous estimation, regressors are all in first differences.

[13] In Gilchrist and Zakrajsek (2012), the excess bond premium is obtained as the residual after subtracting from the credit spread the expected default component; the latter is in turn obtained in a separate regression by regressing the credit spread on firm-specific measures of expected default and a vector of bond-specific characteristics.

Results are reported in Table 7. Panel A, in which the GZ spread is the dependent variable, shows that corporate flows have a negative effect on the credit spread, while public bond inflows are almost never significant throughout the sample. Estimates in Panel B and Panel C (in which the dependent variables are the expected default component and the excess default premium, respectively) confirm that, as expected, the fall in the credit spread induced by corporate bond flows is driven by a compression in the excess bond premium, and not in the default component. Concerning the expected default component, we do not find any statistical significance spanning the entire sample period chosen, neither for corporate nor for public inflows (Panel B); for the excess bond premium, we find negative effects of corporate inflows, that are preserved even when both flow variables are included jointly (Panel C).

Interestingly, contrary to corporate inflows, flows on public US securities have a positive effect on the excess bond premium. This joint, and distinct in sign, effect of the two types of flows is consistent with a standard portfolio balance model with imperfect substitution across safer (Treasuries and Agency debt) and riskier (corporate bonds) assets. Note that the effects on the excess bond premium become even stronger from 1999 onwards (Panel C, results for subperiod 1999-2007), after the formal introduction of the euro when, as argued by Shin (2011), the expansion of global banking flows markedly accelerated (Figure 2.1).[14] Overall, results on credit spreads confirm our prior that financial inflows induced variations in the subjective investor-led pricing of default risk rather than variations in the risk of default of the underlying bond issuer per se; also, they highlight that these effects are concentrated in 1999-2007.

3.3 Risk aversion and uncertainty

We next turn to the analysis of the US equity market, investigating possible effects of foreign flows on expected equity price fluctuations proxied by the VIX. A VIX index significantly reacting to GSG and GBG flows could be interpreted as international financial flows having effect on investors' uncertainty or risk aversion in equity markets, complementing the evidence found for the bond market.

Results are shown in Table 8. During the entire sample period (1994-2007), the coefficients of both types of foreign inflows are negative and significant (Panel A, first three

[14] The third phase of the Economic and Monetary Union (EMU) started formally on January 1, 1999, with the gradual introduction of the euro – first as a scriptural money at fixed conversion rates, and from January 1, 2002, with the introduction of euro coins and banknotes – and the implementation of a single monetary policy under the responsibility of the European Central Bank (ECB) within the Eurosystem.

Panel A: Credit spread

	1994 – 2007			1999 – 2007		
D.FFtarget	-2.18^{***}	-2.14^{***}	-2.16^{***}	-2.34^{***}	-2.27^{***}	-2.28^{***}
	(0.26)	(0.26)	(0.26)	(0.24)	(0.25)	(0.24)
D.exp infl	0.65	0.54	0.54	0.42	0.20	0.21
	(0.49)	(0.50)	(0.48)	(0.49)	(0.53)	(0.51)
D.logreer	−6.88	−5.05	−6.45	−1.81	1.66	−1.65
	(5.22)	(5.26)	(5.29)	(5.37)	(5.50)	(5.37)
D.Cinflows	−0.36		−0.53	-0.55^{**}		-0.82^{***}
	(0.34)		(0.37)	(0.28)		(0.29)
D.TAinflows		0.20	0.34		0.37	0.63^{**}
		(0.23)	(0.26)		(0.25)	(0.27)
Constant	1.87^{***}	1.86^{***}	1.87^{***}	2.28^{***}	2.25^{***}	2.27^{***}
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Adjusted R^2	0.19	0.19	0.20	0.33	0.32	0.36

Panel B: Expected default component

	1994 – 2007			1999 – 2007		
D.FFtarget	-0.71^{***}	-0.71^{***}	-0.72^{***}	-0.48^{***}	-0.48^{***}	-0.49^{***}
	(0.19)	(0.19)	(0.19)	(0.16)	(0.16)	(0.16)
D.exp infl	0.27	0.30	0.30	−0.02	−0.02	−0.01
	(0.25)	(0.26)	(0.26)	(0.22)	(0.24)	(0.24)
D.logreer	-6.22^{*}	-6.16^{*}	-6.31^{*}	−3.31	−2.38	−3.31
	(3.71)	(3.61)	(3.67)	(3.28)	(3.14)	(3.27)
D.Cinflows	−0.09		−0.06	−0.23		−0.23
	(0.23)		(0.25)	(0.15)		(0.16)
D.TAinflows		−0.08	−0.07		−0.08	−0.00
		(0.20)	(0.22)		(0.22)	(0.24)
Constant	2.01^{***}	2.01^{***}	2.01^{***}	2.34^{***}	2.33^{***}	2.34^{***}
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Adjusted R^2	0.04	0.04	0.04	0.04	0.03	0.03

Panel C: Excess bond premium

	1994 – 2007			1999 – 2007		
D.FFtarget	-1.47^{***}	-1.43^{***}	-1.44^{***}	-1.85^{***}	-1.79^{***}	-1.80^{***}
	(0.19)	(0.19)	(0.19)	(0.21)	(0.20)	(0.20)
D.exp infl	0.37	0.24	0.24	0.44	0.21	0.22
	(0.29)	(0.30)	(0.28)	(0.33)	(0.35)	(0.34)
D.logREER	−0.66	1.10	−0.14	1.49	4.05	1.66
	(2.98)	(2.98)	(2.92)	(5.14)	(4.97)	(4.85)
D.Cinflows	−0.27		-0.48^{*}	−0.32		-0.59^{**}
	(0.23)		(0.24)	(0.25)		(0.26)
D.TAinflows		0.28^{*}	0.40^{**}		0.45^{*}	0.63^{**}
		(0.15)	(0.17)		(0.25)	(0.27)
Constant	-0.14^{***}	-0.16^{***}	-0.14^{***}	−0.05	−0.08	−0.06
	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)
Adjusted R^2	0.22	0.23	0.24	0.27	0.29	0.32

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Regressions on the US credit spread and on its two subcomponents estimated in Gilchrist and Zakrajsek (2012). Regressors are: nominal Fed Funds target rate (*FFtarget*), expected inflation proxied by lagged core US CPI inflation (*exp infl*), US real effective exchange rate in natural logs (*logREER*), Cinflows and TAinflows. Samples are January 1994 – June 2007 (162 obs.), January 1999 – June 2007 (102 obs.). The *D.* symbol indicates that variables are taken in first differences.

columns), meaning that their increase is negatively correlated to the VIX index. Controlling for the US effective Federal Funds' target rate in real terms does not invalidate this result. Note also that, while inflows are significant if included one at a time, only flows into corporate bonds remain statistically significant once both variables are included together.

The VIX being a risk-neutral measure, variations could reflect changes in the expected volatility (i.e., uncertainty about future prices) or variations in the price attached by investors to future fluctuations (i.e., risk aversion). In order to disentangle the effects on the two components, we re-run the last set of regressions by substituting the VIX with the conditional variance of the stock market and the variance premium estimated by Bekaert and Hoerova (2014) – which sum up to the square of the VIX. Results show that, differently than in the case of the credit spread, there is also a significant effect of inflows on uncertainty; however, in line with the previous results, the effect of corporate bond inflows is stronger in terms of reducing equity investors' risk aversion (Table 8, Panels B and C). Finally, note that the effects are strongest in the 1999-2007 subperiod, which is consistent with the large increase in GBG flows observed during those years (Figure 2.1).

3.4 Bank leverage

Results in Sections 3.2 and 3.3 suggest that both types of flows acted as push factors on US financial markets, leading to lower US long-term rates and a reduction in risk aversion in both bond and equity markets. Do these flows also directly account for an increase in banks' lending, i.e. do they also positively affect credit supply? We take up this question by testing the effect of foreign inflows on banks' leverage, proxied, as in Bruno and Shin (2015b), with the ratio of US broker-dealers' total liabilities including equity, over equity.[15]

Our results, reported in Table 9, suggest two interesting facts. First, flows into US corporate bonds (and not those into public securities) are significant in explaining the observed variations in bank leverage during the entire sample period (1994 –2007). While the significance vanishes in the 1999 – 2007 subperiod, the all-sample result is confirmed in the narrower 2002–2007 sample, that is the focus of our analysis. This evidence con-

[15] Shin (2011) shows that a large fraction of the US dollar intermediation activity that takes place outside the United States is accounted for by European global banks. Moreover, as explained in Bruno and Shin (2015b), proxying the leverage of European global banks with the one of US broker-dealers is based on two considerations: (i) first of all, the only available balance sheet data for European global banks are consolidated, so it is impossible to separate between commercial banking and wholesale investment banking activities, which are the only ones that matter for measuring banking leverage ratios; (ii) secondly, US broker dealers' behavior is most likely aligned to that of their European counterparts.

Panel A: logVIX

	1994 – 2007			1999 – 2007		
D.real FF target	−0.53***	−0.55***	−0.55***	−0.61***	−0.60***	−0.60***
	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)
D.logREER	0.31	0.81	0.14	−1.32	0.35	−1.32
	(2.52)	(2.41)	(2.44)	(3.16)	(3.24)	(3.18)
D.Cinflows	−0.33**		−0.25*	−0.40***		−0.42***
	(0.15)		(0.15)	(0.15)		(0.16)
D.TAinflows		−0.21*	−0.15		−0.10	0.03
		(0.11)	(0.11)		(0.12)	(0.12)
Constant	2.92***	2.92***	2.93***	2.95***	2.94***	2.95***
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Adjusted R^2	0.13	0.12	0.13	0.19	0.14	0.18

Panel B: Conditional variance (in logs)

	1994 – 2007			1999 – 2007		
D.real FF target	−0.99***	−0.99***	−1.00***	−0.93***	−0.88***	−0.88***
	(0.18)	(0.19)	(0.19)	(0.21)	(0.22)	(0.23)
D.logREER	−0.49	1.04	−0.59	1.19	4.54	1.21
	(4.51)	(4.62)	(4.55)	(5.92)	(6.31)	(5.99)
D.Cinflows	−0.66**		−0.62**	−0.72**		−0.83***
	(0.27)		(0.29)	(0.29)		(0.31)
D.TAinflows		−0.24	−0.08		−0.03	0.23
		(0.20)	(0.20)		(0.25)	(0.24)
Constant	2.79***	2.77***	2.79***	2.91***	2.88***	2.90***
	(0.05)	(0.04)	(0.05)	(0.06)	(0.05)	(0.06)
Adjusted R^2	0.15	0.12	0.14	0.17	0.11	0.17

Panel C: Variance premium (in logs)

	1994 – 2007			1999 – 2007		
D.real FF target	−1.40***	−1.44***	−1.45***	−1.68***	−1.65***	−1.66***
	(0.25)	(0.26)	(0.26)	(0.30)	(0.31)	(0.30)
D.logREER	1.20	2.78	0.82	−5.89	−1.48	−5.88
	(6.09)	(5.78)	(5.89)	(7.41)	(7.44)	(7.48)
D.Cinflows	−0.91**		−0.75*	−1.04**		−1.09**
	(0.40)		(0.45)	(0.42)		(0.47)
D.TAinflows		−0.51**	−0.32		−0.22	0.12
		(0.25)	(0.28)		(0.34)	(0.36)
Constant	2.51***	2.49***	2.51***	2.47***	2.44***	2.47***
	(0.07)	(0.06)	(0.06)	(0.09)	(0.09)	(0.09)
Adjusted R^2	0.13	0.12	0.13	0.18	0.13	0.17

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Regressions on logVIX and on its subcomponents taken from Bekaert and Hoerova (2014). Samples are January 1994 – June 2007 (162 obs.), January 1999 – June 2007 (102 obs.). Regressors are: real Fed Funds target rate proxied by nominal Fed Funds target rate minus expected inflation (*real FFtarget*), US real effective exchange rate in natural logs (*logREER*), Cinflows and TAinflows. The *D.* indicates that variables are taken in first differences.

firms Shin (2011)'s claim that European global banks were relevant drivers of the global banking glut flows and, hence, also in influencing financial conditions in the US, particularly after the euro changeover in 2002.[16] Second, the lagged VIX index also significantly affects banking leverage: banks' leverage decreases when expected stock market volatility increases.[17] The first paper that highlights this important result is Bruno and Shin (2015a), which also finds evidence that the change in the VIX may be induced by variations in the monetary policy stance, thereby supporting the view of a so-called "risk-taking channel" of monetary policy. According to our results, the impact of corporate inflows on banking leverage is *independent* from the corresponding effect of the VIX regressor.[18] We will return to this result in the next section.

All in all the results reported in Table 9 point to the fact that flows into private fixed-income securities act as a rather different and stand-alone conduit of the leverage cycle than the VIX index. Corporate inflows exert an autonomous pro-cyclical effect on banking leverage, a result that, to our knowledge, has not been emphasized in the literature so far.

3.5 Tests of Granger causality

The previous results suggest that foreign flows have exerted a significant impact on US financial variables and risk-taking behavior. In this section, we briefly address the possible reverse causality between financial inflows and the target variables (i.e., regressors) considered in the previous regressions by running a series of Granger causality tests.[19] Granger causality is estimated by means of Wald tests computed on estimated VAR models. We consider VARs with three variables, i.e. $Cinflows$, $TAinflows$ and one of the previous dependent variables (credit spread, VIX and bank leverage) at a time.

Results are reported in Table 10. Overall, Granger causality runs from foreign inflows

[16] This increased linkage between GBG flows and banks' leverage after 2002 is consistent with the balance sheet capacity channel advocated by Shin and co-authors (see, Danielsson et al. (2011)): according to this view, in periods of low perceived risk, leverage builds up thanks to additional debt piled up by banks to finance asset purchases. Such a period of markedly low volatility was indeed observed in 2002-2007 (see Figure 1.1).

[17] Note that, in line with many other authors, we are considering the lagged VIX index, as the VIX captures the one-month expected volatility. As such, an increase in today's uncertainty about the future should affect a bank's investment decisions - and hence its leverage - in due time.

[18] Including an interaction between the VIX and either type of international financial flows does not alter this finding.

[19] A variable x is said to Granger-cause a variable y if, given the past values of y, past values of x are useful for predicting y. A common method for testing Granger causality is to run a VAR with x and y and, alternatively, make Wald tests on the lagged values of the two variables. Failure to reject the null hypotheses is equivalent to failing to reject the hypothesis that the tested variable does not Granger-cause the dependent variable in each equation.

Bank leverage (first difference)

	1994 – 2007				1999 – 2007				2002 – 2007			
D.real FF target	-0.63	-0.50	-0.51	-0.44	-0.76^{*}	-0.67	-0.66	-0.61	-0.09	0.06	0.20	0.20
	(0.40)	(0.42)	(0.42)	(0.44)	(0.44)	(0.48)	(0.45)	(0.49)	(0.49)	(0.48)	(0.45)	(0.44)
L(3).logVIX	-0.61^{***}	-0.52^{***}	-0.56^{***}	-0.50^{**}	-0.76^{***}	-0.65^{**}	-0.72^{***}	-0.64^{**}	-0.96^{***}	-0.81^{**}	-0.94^{**}	-0.80^{**}
	(0.18)	(0.20)	(0.20)	(0.20)	(0.22)	(0.26)	(0.24)	(0.27)	(0.36)	(0.38)	(0.37)	(0.39)
L.D.Cinflows		0.55^{*}		0.52^{*}		0.39		0.44		0.69^{**}		0.87^{***}
		(0.29)		(0.29)		(0.33)		(0.31)		(0.31)		(0.31)
D.Cinflows		0.55^{*}		0.40		0.31		0.16		0.62^{**}		0.42
		(0.31)		(0.29)		(0.30)		(0.32)		(0.30)		(0.33)
L.D.TAinflows			0.18	0.06			0.06	-0.07			-0.04	-0.35
			(0.22)	(0.22)			(0.25)	(0.23)			(0.30)	(0.30)
D.TAinflows			0.42	0.30			0.37	0.32			0.59^{*}	0.35
			(0.29)	(0.30)			(0.26)	(0.27)			(0.35)	(0.39)
Constant	1.86^{***}	1.55^{***}	1.69^{***}	1.50^{**}	2.37^{***}	2.01^{**}	2.23^{***}	1.98^{**}	2.78^{***}	2.26^{**}	2.68^{**}	2.23^{**}
	(0.53)	(0.58)	(0.57)	(0.60)	(0.66)	(0.78)	(0.70)	(0.81)	(0.98)	(1.07)	(1.03)	(1.08)
Adjusted R^2	0.07	0.09	0.08	0.09	0.14	0.14	0.14	0.14	0.17	0.25	0.18	0.24

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Regressions on bank leverage, proxied, as in Bruno and Shin (2015b), with the ratio of US broker-dealers' total liabilities including equity, over equity. Regressors are: real Fed Funds target rate proxied by nominal Fed Funds target rate minus expected inflation (*real FFtarget*), the VIX index in natural logs (*logVIX*), Cinflows and TAinflows. Samples are January 1994 – June 2007 (162 obs.), January 1999 – June 2007 (102 obs.), September 2002 – June 2007 (58 obs.). The *D.* symbol indicates that variables are taken in first differences; the *L.* symbol indicates one-period lag, and *L(3).* symbol indicates a 3-period lag.

to the target variables and not the other way around. Note that the null hypothesis of the tests is mainly rejected in the 2002 - 2007 subsample, that is exactly the period in which the credit spread and the VIX fell substantially. While the credit spread and the VIX are Granger caused by corporate flows only, both types of flows Granger cause bank leverage.

4 BVAR analysis

The empirical estimates presented so far have highlighted interesting linkages between financial inflows and US financial variables. We now construct specific measures of GBG and GSG flows in order to identify two distinct shocks in a BVAR framework. The identified shocks can be viewed as external portfolio preference shocks, i.e. preference shocks of non-US agents. The aim of this analysis is to evaluate the timing and persistence of the response of US financial variables to those shocks and to extend the investigation to other macroeconomic aggregates, which so far have been left out of the analysis.

4.1 Identification of GSG and GBG shocks

Inflow shocks are identified recursively. This is justified by the way we construct our GSG and GBG variables, and in particular by the fact that the selection of countries from which those flows originated minimizes endogeneity issues between the two types of flows. To construct GSG shocks, we simply retain net purchases of US Treasury and Agency bonds by investors from Asian emerging economies. These inflows started before international banking-related purchases and were basically due to preference shifts which followed previous local financial crisis episodes; for this reason, they reasonably can be considered *ex-ante* as exogeneous to US monetary policy and to other factors (like global financial regulation). We thus place GSG flows as first in our recursive identification scheme.

Concerning the GBG variable, we ideally look for banking inflows from Europe spurred by bank-related preference shocks, including regulatory shocks (like the advent of the euro and Basel II regulation) which, according to Shin (2011), induced overseas diversification and risk-taking by global banks. In order to avoid endogeneity with respect to GSG flows, we select European countries as follows: we compare financial inflows into the US corporate bond market with portfolio inflows (on equity and debt securities) *targeting* European countries. For each European country, if portfolio flows from Asian (saving glut) countries were negative (i.e., outflows were greater than inflows) during the core of the banking glut phase, then concomitant flows from these countries to the US are considered as exogenous with respect to the global saving glut phenomenon, and as such

Jan 1999 – Jun 2007	
h0: x does not GC y	Prob > chi2
Cinflows → GZspread	0.154
TAinflows → GZspread	0.395
ALL → GZspread	0.392
GZspread → Cinflows	0.807
TAinflows → Cinflows	0.847
ALL → Cinflows	0.899
GZspread → TAinflows	0.868
Cinflows → TAinflows	0.538
ALL → TAinflows	0.790

Sep 2002 – Jun 2007	
h0: x does not GC y	Prob > chi2
Cinflows → GZspread	0.018
TAinflows → GZspread	0.345
ALL → GZspread	0.073
GZspread → Cinflows	0.485
TAinflows → Cinflows	0.787
ALL → Cinflows	0.668
GZspread → TAinflows	0.256
Cinflows → TAinflows	0.234
ALL → TAinflows	0.296

Jan 1999 – Jun 2007	
h0: x does not GC y	Prob > chi2
Cinflows → log VIX	0.198
TAinflows → log VIX	0.313
ALL → log VIX	0.360
log VIX → Cinflows	0.067
TAinflows → Cinflows	0.682
ALL → Cinflows	0.194
log VIX → TAinflows	0.305
Cinflows → TAinflows	0.373
ALL → TAinflows	0.429

Sep 2002 – Jun 2007	
h0: x does not GC y	Prob > chi2
Cinflows → log VIX	0.113
TAinflows → log VIX	0.995
ALL → log VIX	0.284
log VIX → Cinflows	0.279
TAinflows → Cinflows	0.655
ALL → Cinflows	0.479
log VIX → TAinflows	0.225
Cinflows → TAinflows	0.196
ALL → TAinflows	0.269

Jan 1999 – Jun 2007	
h0: x does not GC y	Prob > chi2
Cinflows → bank leverage	0.175
TAinflows → bank leverage	0.245
ALL → bank leverage	0.315
bank leverage → Cinflows	0.850
TAinflows → Cinflows	0.690
ALL → Cinflows	0.915
bank leverage → TAinflows	0.061
Cinflows → TAinflows	0.291
ALL → TAinflows	0.131

Sep 2002 – Jun 2007	
h0: x does not GC y	Prob > chi2
Cinflows → bank leverage	0.049
TAinflows → bank leverage	0.012
ALL → bank leverage	0.026
bank leverage → Cinflows	0.642
TAinflows → Cinflows	0.609
ALL → Cinflows	0.773
bank leverage → TAinflows	0.078
Cinflows → TAinflows	0.155
ALL → TAinflows	0.117

Table 10: Tests of Granger causality between foreign inflows and credit spread (upper panels), VIX (medium panels) and bank leverage (lower panel). $Cinflows$ and $TAinflows$ are in first difference. The null hypothesis of the tests is that variable x does not Granger cause variable y. Longer sample: January 1999 – December 2007 (108 obs., *left panels*); shorter sample: September 2002 – December 2007 (58 obs., *right panels*).

are included in the computation of the GBG variable used in the BVAR. Thus only this subcomponent of our original GBG flow variable is retained in the BVAR framework.

Portfolio flows to European countries are provided by Hobza and Zeugner (2014), who constructed a database of bilateral financial flows on a global scale. Data are computed by aggregating information from national and international sources and, differently from previous datasets, are based on adjusted stock data (to fix mismatches between stocks reported in the two countries) and avoid model-based estimates (as is commonly done to obtain historical observations). Table 11 compares flows from European countries to US corporate bonds (upper panel) with flows from non-EU, non-OECD emerging countries to Europe between 2002 and 2006, the period in which banking glut flows are at their peak.[20] The table shows that, between 2002 and 2006, Belgium and Luxembourg, Ireland, Italy, Switzerland, Denmark, Sweden and the UK experienced cumulated *outflows* from emerging economies, in a period when they were at the same time heavily investing in US securities (especially in the case of Belgium and Luxembourg, UK, Ireland and Switzerland). This entails that those countries, and in particular their resident banks, did not recycle concomitant saving glut inflows. As such only these countries are retained to construct the GBG variable used in the BVAR analysis. Given the above selection procedures, we finally proceed to compute GSG and GBG flows as before by using equations 2.1 and 2.2.

4.2 Setup

We define a BVAR specification that we take as a benchmark and which includes variables in the following order (from the most exogenous to the most endogenous): (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate, and (7) the real Federal Funds target rate. We then augment this benchmark specification by adding, alternatively, a measure of household debt and house prices (BVAR #2 and #3 respectively).

Following Bruno and Shin (2015b), fast moving financial variables are ordered after variables involving slower decision processes – such as foreign inflows and banking leverage. As discussed in the previous subsection we order GSG before GBG flows. With respect to the five variables that follow GSG and GBG, the main identifying assumption implied by this ordering is that only the policy rate can react contemporaneously to financial disturbances (the recursiveness assumption made by Christiano et al. (1999), among others). This is consistent with the view that monetary policy can respond immediately to

[20] Pre-2002 bilateral portfolio flow data, which would have allowed to identify Europan countries which received substantial saving glut flows also before the peak phase of the global banking glut, are unfortunately not available for most of Asian emerging economies.

Europe → US corporate bonds

billion USD	2002	2003	2004	2005	2006	**total 2002-2006**
EA:						
Austria	0.2	1.2	0.8	- 0.1	2.4	**4.5**
Belgium and Luxembourg	143.1	229.5	207.4	65.1	245.9	**891.0**
Germany	- 2.5	10.5	19.1	8.0	19.7	**54.8**
Spain	- 0.6	0.6	3.2	2.9	1.2	**7.4**
Finland	- 0.0	0.2	0.4	- 0.1	0.4	**0.9**
France	3.2	5.5	2.1	3.9	24.4	**39.0**
Greece	- 0.1	0.1	0.0	- 0.1	0.1	**0.0**
Ireland	8.0	10.8	9.3	10.1	45.8	**83.9**
Italy	- 0.3	1.7	- 0.8	0.1	1.4	**2.1**
Nederlands	2.5	9.2	20.8	21.8	16.1	**70.4**
Portugal	- 0.0	- 0.0	0.2	0.7	0.4	**1.3**
non EA:						
Switzerland	1.4	16.1	18.7	6.6	22.5	**65.4**
Denmark	0.5	1.0	2.5	- 0.6	- 0.5	**2.9**
Norway	3.5	5.5	4.1	3.5	12.3	**28.9**
Sweden	0.2	1.2	4.9	2.2	2.5	**11.1**
UK	- 24.1	61.7	54.2	27.4	97.2	**216.4**

Portfolio flows from RoW→ Europe

billion EUR	2002	2003	2004	2005	2006	**total 2002-2006**
EA:						
Austria	- 2.4	1.1	3.6	- 0.4	2.2	**4.2**
Belgium and Luxembourg	- 528.9	104.6	- 9.6	109.8	- 20.1	**- 344.1**
Germany	2.4	154.4	- 23.0	- 1.5	7.3	**139.6**
Spain	27.1	- 2.2	6.9	- 19.5	51.2	**63.5**
Finland	- 2.2	2.9	- 4.8	5.4	9.6	**10.8**
France	1.0	3.9	45.8	61.3	- 60.3	**51.6**
Greece	- 3.9	13.3	1.0	- 0.1	1.2	**11.6**
Ireland	- 58.0	44.8	29.3	66.8	- 88.4	**- 5.5**
Italy	- 70.2	1.9	- 15.0	- 22.1	68.5	**- 36.8**
Nederlands	169.5	11.4	0.9	66.6	83.2	**331.6**
Portugal	4.7	2.7	9.1	3.2	- 18.4	**1.4**
non EA:						
Switzerland	- 11.6	- 5.3	0.0	18.0	- 21.4	**- 20.3**
Denmark	- 11.4	- 5.0	2.9	- 13.3	9.0	**- 17.8**
Norway	- 1.2	- 0.2	1.6	5.6	5.5	**11.3**
Sweden	- 24.4	2.5	- 2.0	- 8.7	5.1	**- 27.3**
UK	- 66.6	- 19.6	1.6	8.5	- 20.4	**- 96.5**

Table 11: Comparison between flows from Europe to the US and flows targeting Europe, 2002 – 2006, billion of US dollars (upper panel) and billions of euros (lower panel). Upper panel: Inflows from European countries to US corporate bonds taken from Bertaut and Judson (2014). Lower panel: portfolio flows (debt and equity) from Rest-Of-The-World (ROW) economies to European countries, where ROW economies are all economies but EU-27 countries, OECD countries, Hong Kong, Singapore and offshore countries (Bahamas, Bahrain, Barbados, Bermuda, Cayman Islands, Gibraltar, Guernsey, Isle Of Man, Jersey, Lebanon, Macao, Mauritius, Netherlands Antilles, Panama, Samoa, British West Indies, Andorra, Liechtenstein); data are taken from Hobza and Zeugner (2014).

any financial misalignment that arises and that poses a threat to its target.[21] The BVARs are estimated with four lags using a Gibbs sampling algorithm with 1000 replications and identified recursively, with Minnesota priors calibrated as in Banbura et al. (2010). Quarterly variables are averages of daily (for financial variables) or monthly (for GBG, GSG and bank leverage) values. The estimation is done from 1990 Q1 to 2010 Q3 due to data availability, well past the onset of the financial crisis that led to an abrupt retrenchment in foreign financial flows.[22]

4.3 Structural shocks testing

Results coming from the analysis carried out in Section 3 do not a priori completely rule out the possibility that foreign inflows were endogenous to the accommodative monetary policy stance in the US. Thus, before discussing the impulse responses we test whether, under our identification assumptions, GSG and GBG shocks are correlated to US monetary policy shocks. The shocks from our identified BVAR are computed as follows. From the reduced-form representation

$$x_t = Fx_{t-1} + u_t \tag{4.1}$$

where x_t and u_t are $[N * T]$ matrices, one can identify the parameters of the structural form

$$Ax_t = Bx_{t-1} + e_t \tag{4.2}$$

where $F = A^{-1}B$ and $B = AF$. Structural shocks can be computed as

$$e_t = Au_t \tag{4.3}$$

Provided that the Gibbs sampling procedure identifies one A^{-1} matrix at each iteration, we retain the one yielding median impulse responses and construct structural shocks according to Equation 4.3. This procedure is repeated for our three BVAR specifications.

As proxies for monetary policy shocks, we consider the set of instruments used in

[21]This assumption has been adopted, for example, in Gilchrist and Zakrajsek (2012). Alternatively, one could assume that monetary policy does only respond with some lags to shocks channeled by the VIX and the real exchange rate, which are faster moving variables, as in Bruno and Shin (2015b). Our results are robust to this alternative ordering assumption.

[22]The estimation period is also extended backwards compared to the regression analysis in Section 3 given the fairly large number of variables entering our BVARs. Our main constraints in extending the length of the estimation period further backwards are twofold. First, it is widely accepted that both types of flows have started to play a major quantitative role no earlier than in the 1990s (see Figure 2.1). Second, the VIX Index is not available prior to 1990.

Gertler and Karadi (2015) to assess the effect of monetary shocks on interest rates: (1) the surprise in the current month's Fed Funds futures (FF1); (2) the surprise in the three-month ahead Fed Funds futures (FF4); and (3) in the six-month, (4) nine-month and (5) one-year ahead futures on three-month Eurodollar deposits (ED2, ED3, ED4), as in Gurkaynak et al. (2005). We compute quarterly measures of these instruments by averaging monthly values.[23] Results of linear correlations with bootstrapped confidence intervals are reported in Table 12, and the dynamics of GSG and GBG shocks identified with our benchmark specification, along with that of the FF4 proxy (the preferred instrument in Gertler and Karadi (2015)) are shown in Figure 4.1. Correlations are low and not significant for any of the five instruments with respect to GBG shocks, and for most of them in the case of GSG shocks; similar outcomes show up when extracting structural GSG and GBG shocks from the other two BVAR specifications.

	GSG			GBG		
	correlation	conf int lowb	conf int ub	correlation	conf int lowb	conf int ub
BVAR # 1:						
FF1	- 0.16	- 0.32	- 0.02	0.09	- 0.09	0.29
FF4	- 0.17	- 0.35	- 0.00	0.05	- 0.15	0.28
ED2	- 0.09	- 0.26	0.09	0.05	- 0.17	0.28
ED3	- 0.09	- 0.27	0.09	0.08	- 0.16	0.33
ED4	- 0.07	- 0.25	0.11	0.09	- 0.16	0.34
BVAR # 2:						
FF1	- 0.14	- 0.30	0.00	0.14	- 0.03	0.34
FF4	- 0.15	- 0.32	0.02	0.11	- 0.05	0.37
ED2	- 0.07	- 0.24	0.12	0.10	- 0.11	0.34
ED3	- 0.07	- 0.27	0.10	0.13	- 0.12	0.37
ED4	- 0.06	- 0.24	0.13	0.13	- 0.13	0.39
BVAR # 3:						
FF1	- 0.18	- 0.33	- 0.03	0.07	- 0.10	0.24
FF4	- 0.21	- 0.39	- 0.03	0.04	- 0.16	0.24
ED2	- 0.11	- 0.30	0.06	0.06	- 0.12	0.27
ED3	- 0.12	- 0.30	0.06	0.08	- 0.13	0.32
ED4	- 0.10	- 0.28	0.08	0.08	- 0.14	0.34

Table 12: Correlations between the structural GSG/GBG shocks (left/right block) extracted from the three BVAR specifications and the five instruments for monetary policy shocks taken from Gertler and Karadi (2015). For each block, column 1 reports Pearson's correlations coefficients and columns 2 and 3 the confidence interval's lower and upper bound, respectively. Bootstrapped confidence intervals are computed with 1000 replications.

The above results confirm, under our identification assumptions, the absence of endogeneity between foreign flows and US monetary policy, adding evidence to our claim of

[23]This is coherent with monthly surprises constructed in Gertler and Karadi (2015) by averaging daily surprises.

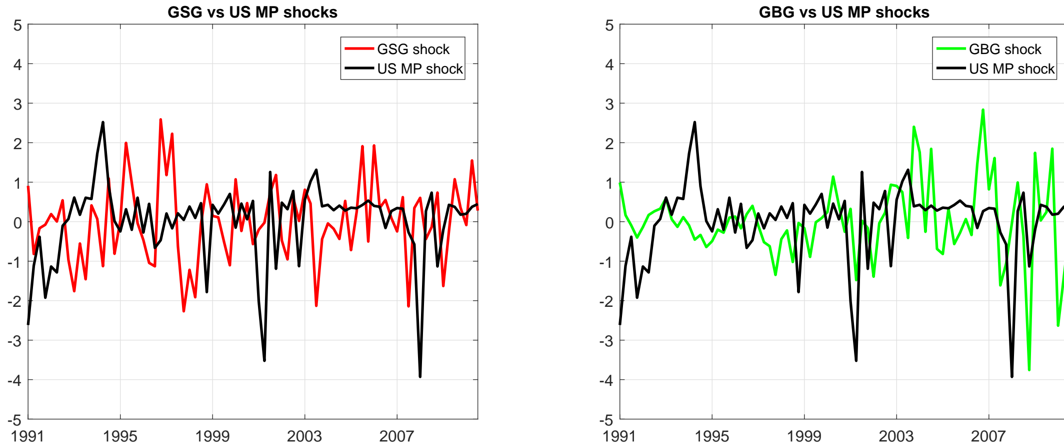

Figure 4.1: Comparison between BVAR-estimated structural shocks and US monetary policy shocks. Structural GSG and GBG shocks are computed from the benchmark BVAR. The proxy for the monetary policy shock is the three-month ahead funds rate surprise (FF4), chosen by Gertler and Karadi (2015) for their baseline estimation. Shocks are standardized in mean and variance.

an autonomous role of GSG and GBG flows on US financial conditions.

4.4 Impulse response analysis

Figures 4.2, 4.3 and 4.4 present the main impulse response functions of the benchmark specification; Figure 4.5 and 4.6 present selected impulse responses from BVAR #2 and #3, respectively. Each panel in the figure shows the impulse responses over 20 quarters (five years) to a one-standard-deviation shock.

The effects of GSG and GBG on US financial variables The main results on the effects of GSG and GBG flows on US financial conditions can be summarized as follows. First, while both GSG and GBG flows lead to a significant increase in banking leverage (BLEV panels of Figures 4.2 and 4.3), their effects on bond and equity markets are quite differentiated. Both shocks compress the excess bond premium, even though the effect of GBG is stronger and more persistent (EBP panels); similarly, GBG shocks significantly reduce the VIX, while the GSG shocks are not significant (VIX panels). This result confirms the important role of GBG flows in inducing higher risk appetite in US financial markets.
Second, the US real effective exchange rate depreciates persistently in response to a positive GBG shock and does not respond significantly in case of GSG shocks (USREER panels of the same figures). This result is consistent with the fact that GBG shocks exert a negative impact on the Federal funds real rate. Our evidence points to a different result than the findings in Hofmann et al. (2016) and Blanchard et al. (2015) according to which

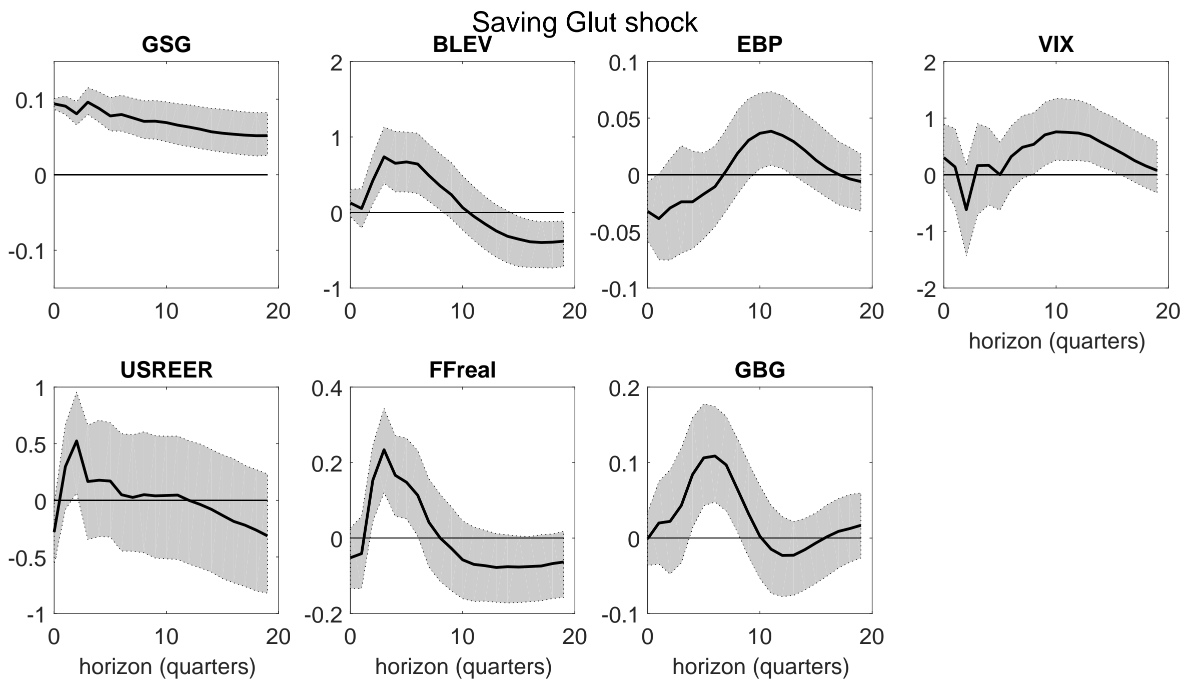

Figure 4.2: Impulse response functions from selected shocks, taken from the benchmark BVAR. The ordering of the variables is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), and (7) the real Federal Funds target rate. The bootstrapped 68% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.

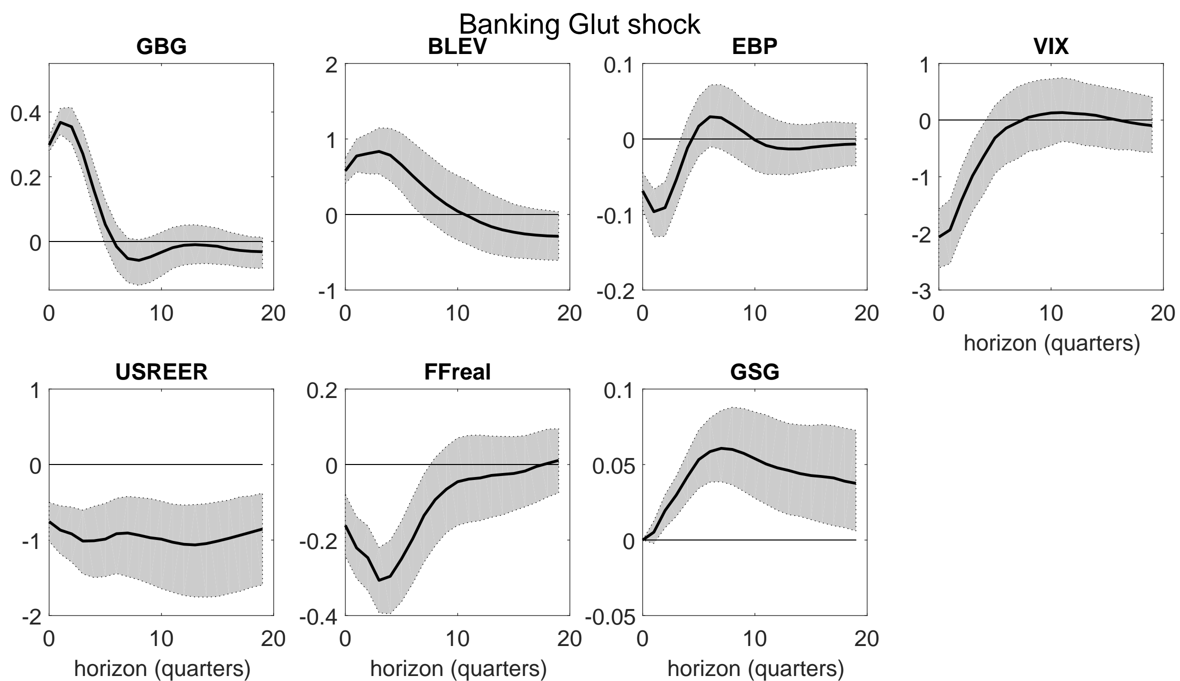

Figure 4.3: Impulse response functions from selected shocks, taken from the benchmark BVAR. The ordering of the variables is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), and (7) the real Federal Funds target rate. The bootstrapped 68% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.

currency appreciations may reflect, for a given monetary policy rate, the outcome of capital inflows, such as GBG ones, associated to overall more expansionary financial and macroeconomic conditions. According to our findings capital inflows are conducive to more expansionary financial conditions, easier monetary conditions (a fall in the Federal Funds rate target as shown in Figure 4.3), and an exchange rate depreciation as opposed to an appreciation. The responses of interest rates and real exchange rates to a GBG shock speak in favor of the existence of substantial market incompleteness in exchange rate risk trading, a result that has been initially highlighted in Hau and Rey (2006).[24] These results seem further consistent with a standard "unconvered interest parity condition". Third, both types of flows seem to positively affect each other (GBG panel of Figure Figures 4.2 and GSG panel of Figure 4.3), reflecting the mutually reinforcing effects of these two flows during the run-up to the crisis.

All in all, our results confirm that GSG and, in particular, GBG flows are conducive to generally looser financial conditions via higher banking leverage, with both types of flows tending to reinforce each other. According to our findings both GSG and GBG flows are conduits for risk-on/risk-off periods: inflows (outflows) are not simply driven by risk-on (risk-off) periods, as usually documented for emerging market economies, but they actively concur to the determination of these periods. Moreover, GBG flows are conducive to international spillover effects, as they lead to a persistent real effective depreciation of the US dollar vis-à-vis its trading partners.

The risk-taking channel of monetary policy Figure 4.4 reports the impulse responses to a monetary policy shock resulting from our benchmark BVAR model specification. Impulse responses are in line with the results documented by Bruno and Shin (2015b) and Rey (2015) on the so-called risk-taking channel of monetary policy. In particular, as in Bruno and Shin (2015b), we do find that : (1) a positive shock to the real Fed funds target rate induces after some time an increase in the VIX index and a decline in banking leverage after a fairly long lag (around 10 quarters); (2) the pro-cyclical effect of monetary policy on risk-taking holds also with respect to the GZ excess bond premium measure (the excess bond premum increases due to monetary policy tightening). We also find significant negative effects of a monetary tightening on both GSG and GBG, where the effect on GBG is lagged but stronger.

[24] For example, these two authors find that higher returns in the home equity markets (in local currency) relative to the foreign equity market are associated with a home currency depreciation.

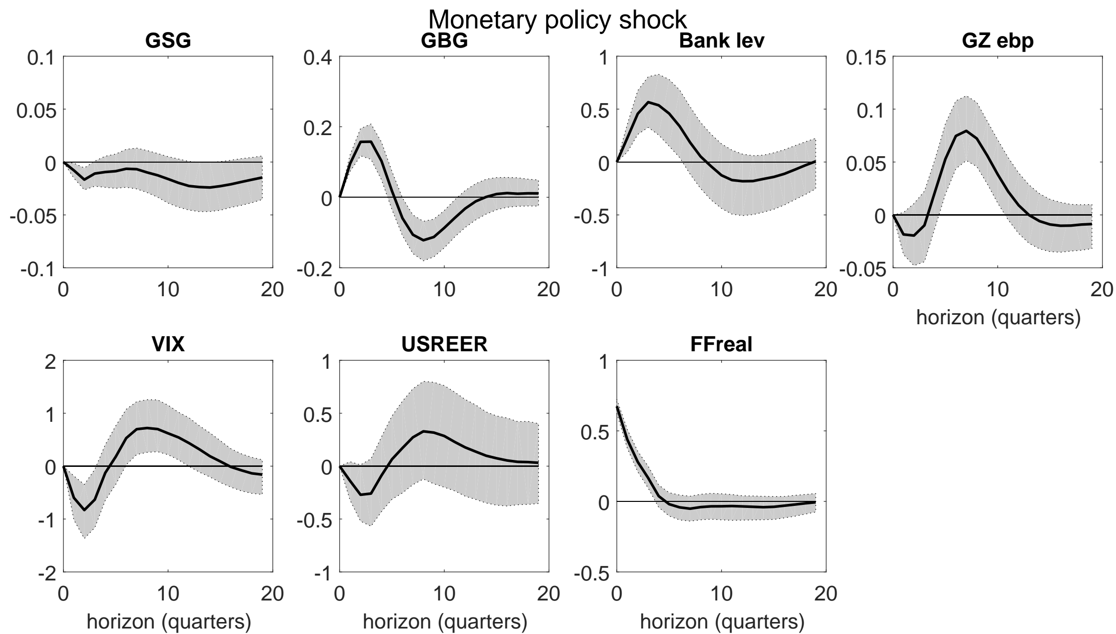

Figure 4.4: Impulse response functions from selected shocks, taken from the benchmark BVAR. The ordering of the variables is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), and (7) the real Federal Funds target rate. The bootstrapped 68% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.

The effects of GSG and GBG on US macroeconomic conditions We now explore whether GSG and GBG flows have also any direct macroeconomic effects on household debt and housing market developments. BVAR #2 and BVAR #3 include the following variables: (i) the US households' debt-to-disposable-income ratio, taken from the FRED database (BVAR #2), and (ii) the S&P/Case-Shiller 10-City Composite Home Price Index (average price for 10 cities in the United States), deflated by the CPI (BVAR #3).

In BVAR #2, households' debt as a percentage of disposable income is assumed to respond to changes in banks' lending decisions with a lag, so it is placed between GBG and bank leverage. The variable ordering becomes: (1) GSG, (2) GBG, (3) household debt-to-income, (4) banking leverage, (5) the GZ excess bond premium, (6) the VIX index, (7) the US dollar real effective exchange rate, and (8) the real Federal Funds target rate. Results are shown in Figure 4.5. As expected, both GSG and GBG shocks have positive effects on households' indebtedness, with the effect of GBG shocks being much more persistent.[25]

The ordering of BVAR #3 is the following: (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate, (7) the real house price index and (8) the real Federal Funds target

[25]Including household debt-to-GDP instead of debt-to-disposable-income yields identical results.

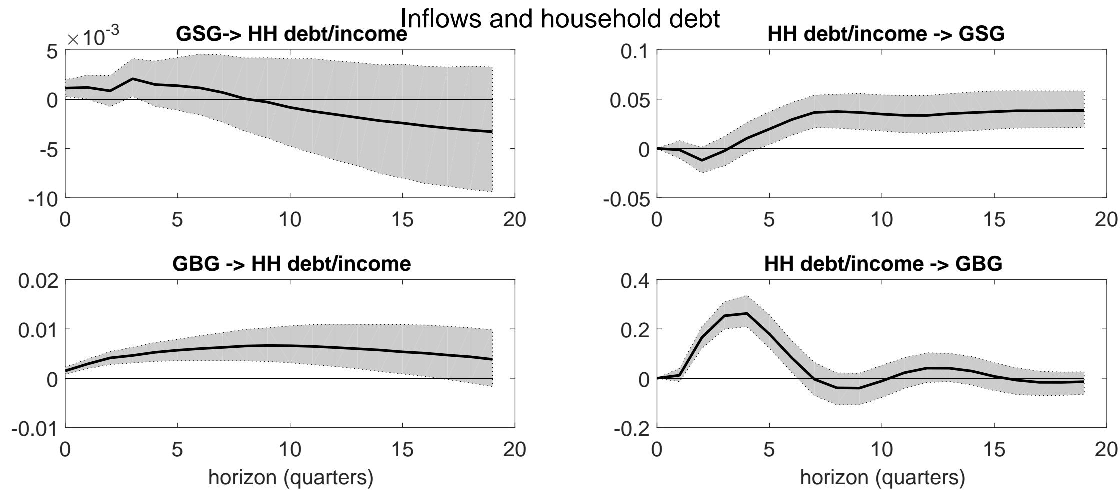

Figure 4.5: Impulse response functions from selected shocks, taken from BVAR #2. BVAR #2 is (1) GSG flows, (2) GBG flows, (3) household debt, (4) banking leverage, (5) the GZ excess bond premium, (6) the VIX index, (7) the US dollar real effective exchange rate (REER), and (8) the real Federal Funds target rate. Bootstrapped 68% confidence bands computed with 1000 replications; sample period is 1990Q1-2010Q3.

rate. Results (in Figure 4.6) supports the view according to which positive shocks to both GBG and GSG flows significantly affect the US housing market by contributing to a rise in real house prices. This finding is in line with the results of Punzi and Kauko (2015).

The above figures point also to another interesting evidence: expansions in households' debt-to-income ratios and increases in house prices are conducive to higher GBG flows. Thus, according to our BVAR, there is evidence of households' indebtedness and housing market developments acting also as a catalyst for GBG flows. Overall, while both GSG and, especially, GBG flows may have contributed significantly to U.S. macroeconomic imbalances prior to the onset of the Great Recession it appears from our results that increasingly favorable developments in the U.S. economy have also been important determinants in attracting GBG flows towards U.S. financial markets.

5 Conclusions

This paper has explored the effects of public and private international financial flows coming from different economic areas – our GSG and GBG measures – on US financial conditions. We have further focused on the nexus between GSG and GBG flows and the dynamics of US households' debt and of the US housing market. Our results confirm the existence of an autonomous channel whereby both types of flows have contributed to looser financial market conditions in the United States through lowered risk aversion and higher banking leverage. Moreover, during the period of strongest global financial

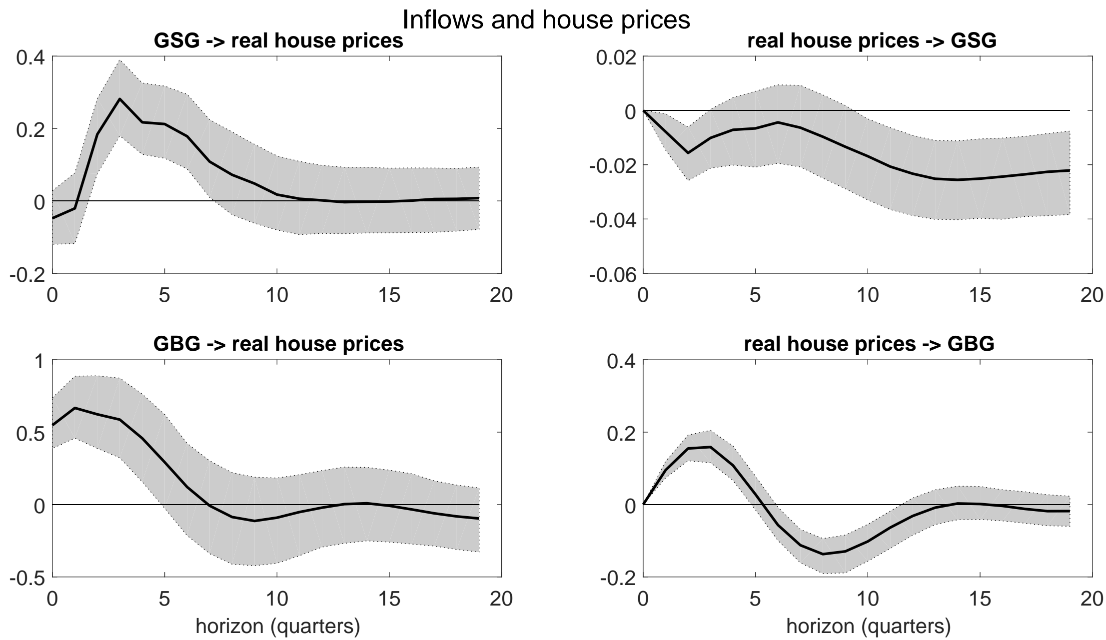

Figure 4.6: Impulse response functions from selected shocks, taken from BVAR #3. BVAR #3 is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), (7) the real house price index and (8) the real Federal Funds target rate. Bootstrapped 68% confidence bands computed with 1000 replications; sample period is 1990Q1-2010Q3.

expansion, both types of flows have been complementary in that they tended to reinforce each other. Finally, both GSG, and to a greater extent, GBG flows have exerted a positive impact on households' debt-to-income ratios, and housing market developments. However it has also been the case that ebullient US macroeconomic conditions, in terms of higher house prices and more leveraged households, had significant pull effects on GBG flows.

The above findings suggest that international capital inflows can have significant autonomous effects on financial and macroeconomic stability in the US. Relying on this important evidence, our results could inform the development of more general quantitative open economy models, in the spirit of Justiniano et al. (2014): this can help to further investigate the broader macroeconomic consequences of foreign inflows on the US economy, to assess whether particular counter-cyclical policy measures targeting international financial flows are desirable in terms of welfare outcomes both for the recipient and the originator countries. We leave these very interesting extensions for future research.

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