Global Research Unit

Global Research Unit Working Paper #2017-005

International Financial Flows and the Risk-taking Channel

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Abstract

During the 1990s, the increased propensity to save in emerging market economies triggered massive inflows towards safe assets in the US; a few years later, rising dollar funding by global banks was concurrent to increasing inflows to high-yield US securities. While it is well documented that foreign financial flows have eased financing conditions in the US through the compression of long-term yields, in this paper we also find significant negative effects on the credit spread and the VIX, suggesting a relevant risk appetite channel. Moreover, flows into the US corporate bond market, partly linked to the previous "saving glut" in emerging economies, also directly affected bank leverage, household indebtedness and the housing market. This evidence provides a new perspective on the "global banking glut", complementary to the role of banks in the risk-taking channel of monetary policy.

JEL classification: F32, F33, F34

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

*Bank of Italy, Directorate General for Economics, Statistics and Research. We would like to thank Piergiorgio Alessandri, Fabio Busetti, Pietro Catte, Ambrogio Cesa-Bianchi, Paolo Del Giovane, Andrea Finicelli, Alberto Locarno, Massimo Sbracia, Fabrizio Venditti, the participants to the 2016 conference of the European Economic Association, the participants to the 10th International Workshop of the Methods for International Finance Analysis Network (MIFN) and two anonymous referees for their helpful comments and suggestions. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy. All the remaining errors are ours. E-mail: pietro.cova@bancaditalia.it, filippo.natoli@bancaditalia.it.

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. In the years 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 the desire of low-risk investment, triggered substantial inflows to the US Government bond market. According to one prominent view, this has put downward pressure on real interest rates in the US, contributing along with other factors to a generalized asset bubble (the *Global Savings Glut* (GSG); see Bernanke (2005) and Warnock and Warnock (2009)).

More recently, the focus of the analysis concerning the overheating of US financial market conditions has shifted towards the role of the international banking sector, disregarded in previous studies. Many authors argue that the key driver of the ensuing financial crisis was not an excess of savings but the excess elasticity of the global financial system to expansionary monetary policy regimes, that allowed the build-up of unsustainable credit and asset price booms (the *Global Banking Glut* (GBG); see Borio and Disyatat (2011), Shin (2011), Brender and Pisani (2010) and Bernanke et al. (2011)). This evidence is both related to the activity of global banks, mostly European, which by raising dollar funding via their US branches participated in international "risk-taking chains" (Bruno and Shin, 2015b), both to the steady increase in foreign inflows to US high-yield securities, mostly from European countries (Bertaut et al., 2012).

Testing the effect of foreign inflows on US long-term yields, Bertaut et al. (2012) find that, as inflows to public bonds (GSG flows henceforth) compressed their yields, so did flows targeting corporate bonds (GBG flows henceforth) with respect to AAA and ABS yields. Beyond this first step there is no investigation, as far as we know, of how this increased foreign demand has stimulated the risk-taking behavior in the US markets, and whether this has propagated to the credit and housing markets. Moreover, the possible connection between GSG (that preceded GBG and partly targeted Europe) and GBG flows has never been empirically explored.

This paper addresses these issues by investigating the linkages between foreign demand pressures on US public and private bonds and the evolution of US financial market conditions during the periods in which GSG and GBG flows increased the most; notably, we focus on the phase in which the spread between private and public bond yields, as well as the VIX,

steadily declined.[1] Focusing on this risk-taking phase that preceded the financial crisis, we then test possible direct effects of these flows on the leverage of US banks – the linchpin of global credit expansion in Shins theory – as well as, by means of a Bayesian VAR (BVAR), the possible macroeconomic effects on households indebtedness and the housing market.[2]

Throughout the analysis we show that foreign inflows had an autonomous role, with respect to US monetary policy, in affecting US financial and macroeconomic conditions. Indeed, we find that GBG flows were a relevant driver of the corporate spreads and VIXs compression, as well as a driver of the rise in banking leverage and household indebtedness, results that to our knowledge are completely new in the literature. Moreover, an analysis of the subcomponents of the corporate spread and the VIX (i.e., expectations and risk premia) suggests that the effect of GBG was channeled by lower risk premia in bond and equity markets, uncovering a previously disregarded risk appetite channel.[3] We also find evidence that GSG has a short-term effect on GBG and not vice versa. This empirically supports the "triangular trade" in financial assets view first proposed by Bertaut et al. (2012), according to which GSG flows to Europe may have been partly "recycled" to the US via the European banking system.

While GSG is widely seen as an exogenous preference shock originated from a shift in saving propensities, GBG is obviously not only connected to GSG but also to US monetary policy – the increase in dollar funding by European banks has been stimulated by low real interest rates in the US (Bruno and Shin, 2015b). However, the decision of re-investing those funds in high-yield US instruments may in part have been shaped by a regime change in the European regulatory environment inducing overseas diversification and higher risk-taking.[4] Significant effects of GBG on US markets only since 1999 seem to confirm this claim.

Our results are complementary to those of Bertaut et al. (2012), who find effects of GBG flows on long-term rates. Moreover, our evidence also provides a new perspective on the GBG, complementary to the role of banks in the risk-taking channel of monetary policy highlighted by Bruno and Shin (2015a).

[1] The marked decrease in the corporate credit spread between 2002 and 2007 has received much less attention in the literature than the so called Greenspan conundrum of long-term yields (Bernanke et al., 2011)

[2] 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 that affect their balance sheets. Following Geneakoplos (2009), leverage is a collateral rate, distinct from the interest rate, which is given by the value of collateral that must be pledged to guarantee one dollar of loan. Huge moves in collateral rates define "leverage cycles".

[3] The expectations and risk premia components of the corporate credit spread and the VIX used in our analysis are taken from Gilchrist and Zakrajsek (2012) and Bekaert and Hoerova (2014), respectively.

[4] We refer in particular to the advent of the euro, inducing currency diversification of investment decisions and the diffusion of more permissive risk management practices implied by the Basel II regulatory regime (see in particular (Shin, 2011) and Danielsson et al. (2011) for a discussion on this point of view).

The rest of the paper is organized as follows. Section 2 describes financial inflows into the US markets during the run-up to the crisis by their geographic origin, our procedure for the computation of monthly GSG and GBG flows and the empirical strategy followed in the rest of the paper. Section 3 and Section 4 focus respectively on our empirical results from monthly regressions and the impulse responses of a quarterly BVAR model. Section 5 concludes.

2. Data and empirical strategy

In this section we describe the main features of our analysis. Specifically, we present the data sets that are commonly used in the literature to measure GSG and GBG flows (Section 2.1). We then compare foreign inflows coming from different countries and regions in order to understand how these should be reflected in our benchmark measures for GSG and GBG flows (Section 2.2). Using these data, we compute our measures of GSG and GBG flows and we comment on their evolution between the 90s and the early 2000s (Section 2.3); finally, Section 2.4 describes and motivates the empirical approach adopted in the subsequent two sections.

2.1. Data sources

Following Warnock and Warnock (2009) and Bertaut et al. (2012), we construct monthly GSG and GBG flows by using data that merge information 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 computed from the UST in order to be coherent with the FPH. The method proposed by Warnock and Warnock (2009) has been refined and updated by Bertaut and Tryon (2007) and Bertaut and Judson (2014).[5] Monthly data (*benchmark-consistent holdings*,

[5]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.

henceforth) are available from March 1994 to December 2014.[6]

We use these data to construct our indicators of GSG and GBG, relying respectively on flows (i.e., first differences of monthly holdings) into government bonds – Treasuries and Agencies – and private fixed-income securities – corporate bonds.[7] Before describing the computation of actual GSG and GBG flows, we first have a look at the evolution over time of foreign holdings during our period of interest, going from the 1990s to the early 2000s.

2.2. Capital inflows by region and country of origin

For each security, the benchmark-consistent holdings dataset reports the country and regional breakdown of foreign holders, as available in the original UST and FPH. While the GSG and GBG hypotheses refers 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 markets, 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 in 2000, China's holdings were about a third of Japanese ones; in the 2000s, 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

[6] See Bertaut and Judson (2014).

[7] 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.

results for European and Asian countries; holdings by region are reported in Table 3. 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 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 4).

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 5 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.

This initial look at the data allows us to identify the key actors in our story. Indeed, 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. GSG and GBG flows

We now move on to the construction of our proxies for GSG and GBG flows, by extending the original formulation of Warnock and Warnock (2009) to private besides public bonds.

While the definition of GSG flows as foreign net purchases of US government securities is common in the literature, GBG flows have been measured in different ways, depending on the aspect of the phenomenon one needs to focus on. During the run-up to the crisis, global banks expanded their balance sheets by leveraging their funding in US dollars and increasing both investment in risky US assets (see Bernanke et al. (2011) and Bertaut et al. (2012)) and cross-border loans to regional banks (Bruno and Shin (2015b)). While investment in risky assets may have had direct effects on the US markets – via lower long-term rates and a compression of credit spreads –, cross border loans may have spilled back to the US markets only indirectly; for this reason, and in order to have flows that are comparable to GSG ones, we only focus on the first aspect and proxy GBG with net purchases of corporate US bonds.[8]

GSG and GBG are computed as the 12-month cumulated benchmark-consistent *flows* in 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)). GSG flows are defined as:

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

and GBG ones as

$$GBG_t = \frac{1}{12 * GDP_{t-12}} \sum_{j=1}^{n} \sum_{i=1}^{12} \Delta C_{j,t-i+1} \tag{2}$$

The evolution of GSG and GBG flows over time is reported in Figure 1. The upper panel reports GSG and GBG as total inflows into Treasury plus Agency bonds and corporate bonds, respectively; on the lower panel, the two series are constructed using inflows into US bonds coming from specific geographic regions, i.e. flows into US Treasuries and Agencies from all Asian countries for the GSG variable and those into corporate bonds from Europe and the Caribbean banking centers for the GBG measure. Capital inflows from abroad are substantial in two distinct phases (Figure 1, panel (a)): (i) during the early 90s, when inflows on private label securities were low and almost flat while purchases of public bonds increased

[8] The indirect effect on US markets of an increase in cross border lending to regional banks (the *bank-to-bank* lending) is explained in Bruno and Shin (2015b).

[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.

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.

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 between the end of the 90s and the beginning of the 2000s, while GSG overtake GBG flows later on in the 2000s; finally, corporate bond flows accelerate in 2005, and from there onwards, during the years running up to the 2008 crisis, exhibit a much more rapid pace than GSG flows. Instead, the series constructed using subsets of countries show a more comparable evolution during the entire period of interest (Figure 1, panel (b)), except during the later years of the sample period, when GBG flows rose much more rapidly. In the following, given that our empirical analysis will focus on the overall impact on the financing conditions in the US more than on the effects of specific regional inflows, we will use total inflows to identify GSG and GBG flows. Note, however, that all our results are robust to using the more geographically restricted measures of GSG and GBG flows.[10]

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; we then start by performing, in the next section, a reduced form analysis that aims at testing the main results and claims in the literature. First of all, we explore the impact of GSG and GBG on long-term interest rates in the US, considering both 10-year Treasury yields and returns on AAA corporate bonds issued by the US non-financial sector. The latter can be considered as a reasonable proxy for private-label MBS: 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 (see Figure 2).

During the run-up to the crisis, an increasing demand for high-yield MBS with respect to the safe Treasuries has progressively compressed the yield spread between the two securities. To investigate the possible contribution of GSG and GBG to this yield contraction, we regress this spread on our two financial flows measures: a negative impact of either type of flow on the credit spread, and in particular on its risk premium component, could signal foreign inflows as being partly responsible for eased financing conditions for consumers and investors.

A second effect we would like to investigate is the excess elasticity of the global financial system claimed by Borio and Disyatat (2011) and at the heart of Bruno and Shin (2015b), according to which in periods of low risk aversion banks' leverage increases via an expansion

[10]Results using the GSG and GBG flows restricted only to Asian countries and to European countries and Caribbean banking centers respectively are available from the authors upon request.

of banks' balance sheets (i.e. higher lending). From this perspective, we regress separately a proxy for banking leverage and the VIX index on foreign inflows, with the aim of disentangle a possible direct effect on leverage – banks increase their leverage when funding is abundant and rates are low. At the same time, the idea is also to verify whether GSG and GBG exert some procyclical effects on risk aversion and countercyclical effects on market uncertainty, proxied by the two components of the VIX estimated by Bekaert and Hoerova (2014).

In order to validate the results of the regression analysis, we investigate possible endogeneities between capital inflows and variations in financial prices. Instead of driving changes in the US markets, GBG and GSG could have themselves been driven by variations in market expectations and in risk aversion due to the accommodative policy stance. This is especially plausible for GBG inflows, that depend, at least in part, to the cheap funding available in US markets; on the other hand, while GSG inflows have been triggered by a preference shock in emerging countries, eased financing conditions may have attracted subsequent inflows. These issues are clarified by running appropriate tests of Granger causality.

The analysis is then further expanded by focusing on lower frequency data and estimating a BVAR that includes both financial and macroeconomic variables. The idea is to investigate whether, besides affecting banking leverage, GSG and GBG flows might also influence lending to households, housing prices and residential investment.

Moreover, the BVAR setup also allows us to take on the question of how GSG and GBG flows might be interrelated, even if originating from different sources and underlying motivations; this is motivated by the fact that part of the GBG flows may be related to previous financial investments in Europe by GSG countries (the *triangular trade* in financial assets discussed by Bertaut et al. (2012)). A reverse causality between the two (GBG flows inducing more GSG inflows) is hardly plausible in the short-term, provided that the need of investing abroad by official investors in emerging economies is independent from big banks' strategies; for this reason, we consider GSG as more exogenous than GBG in the ordering of the variables. In the medium-term, however, we do not exclude that new GSG inflows could have been attracted by the availability of new and apparently safe products.

In the BVAR we also account for possible interactions between GBG flows, US monetary policy and dollar exchange rate changes. For example, if foreign flows were following carry trade strategies during the expansion phase of the financial cycle one would expect to see GBG changes leading to a US dollar (the target currency) appreciation. On the contrary, expectations of persistent dollar appreciations – say due to shifts in the expected monetary policy rate path – would suggest an opposite relationship.[11]

[11] In the first case (carry trade) the uncovered interest rate parity condition (UIP) would be violated, whereas in the second case the UIP would hold.

We further investigate the effect of capital flows on private debt-to-income ratios and the US housing sector. The aim is to understand which foreign 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: has the expansion of the housing sector 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

Figure 3 shows the evolution of four risk taking indicators (long-term interest rates, corporate spread, VIX and bank leverage) for the US markets during the run-up to the 2008 financial crisis. The yellow area marks the phase in which GSG inflows where predominant, while the green one identifies the rise in GBG inflows in addition to GSGs; a vertical dashed line marks the beginning of the synchronous decrease in the corporate spread and the VIX from August 2002 inwards.

Long-term interest rates, on a downward trend since the early 1980s, showed substantial fluctuations during the whole 1994 – 2007 period (upper left panel); on the contrary, the corporate spread, quite flat around 1% during the 90s, quadrupled between 1998 and 2002 before declining back to values just below two percent (upper right panel). Volatility in equity markets, as captured by the VIX, started to increase before the widening of the corporate spread, staying at relatively high levels before declining, also from 2002 onwards (lower left panel); the leverage of US banks, on an upward trend since late 80s, exhibits relevant upswings during both the 90s and the 2000s and, again, in particular during the 2002-2007 sub-period (lower right panel).

In this section we present the results of our regression analysis: Section 3.1 focuses on the effects of GSG and GBG on long-term rates; Section 3.2 on their implications for credit spreads; Section 3.3 on their impact on the VIX and its two components; finally, Section 3.4 on the relationship between both types of flows and banking leverage.

3.1. Long-term interest rates

During the 90's and early 2000's, interest rates and inflation in the US drifted lower. The analysis of longer time spans suggested by this co-movement points, as documented by many authors, to the existence of a cointegration relationship between long-term interest

rates, the short-rate, and inflation (see Warnock and Warnock (2009), among others). To verify the existence of this cointegration relationship both for the 10-year Treasury yield and for Moody's AAA long-term corporate bond yield, we separately have run Johansen tests, finding that in both cases one cointegration relationship holds.[12]

To estimate the effects of foreign flows on long-term rates, we thus estimate Vector Error Correction Models (VECM) with the following variables: long-term interest rates (10-year Treasury rate or the AAA corporate yield), the Federal Funds target rate, 10-year inflation expectations (taken from the US Survey of Professional Forecasters), GSG and GBG. GSG and GBG are included both one at a time and together.[13]

Results are reported in table 6. Denoting $z = \{FF\ target,\ 10y\ exp\ infl\}$, for each VECM we only comment results relative to the following equations in Panel A:

$$\Delta treas_t = \alpha + \beta_1 \Delta GSG_t + \beta_2 \Delta z_t + \delta(treas_{t-1} - \gamma_1 GSG_{t-1} - \gamma_2 z_{t-1}) + \epsilon_t \tag{3}$$

$$\Delta treas_t = \alpha + \beta_1 \Delta GBG_t + \beta_2 \Delta z_t + \delta(treas_{t-1} - \gamma_1 GBG_{t-1} - \gamma_2 z_{t-1}) + \epsilon_t \tag{4}$$

$$\Delta treas_t = \alpha + \beta_1 \Delta GSG_t + \beta_2 \Delta GBG_t + \beta_3 \Delta z_t + \delta(treas_{t-1} - \gamma_1 GSG_{t-1} - \gamma_2 GBG_{t-1} - \gamma_3 z_{t-1}) + \epsilon_t \tag{5}$$

and relative to the folowing ones in Panel B:

$$\Delta corp_t = \alpha + \beta_1 \Delta GSG_t + \beta_2 \Delta z_t + \delta(corp_{t-1} - \gamma_1 GSG_{t-1} - \gamma_2 z_{t-1}) + \epsilon_t \tag{6}$$

$$\Delta corp_t = \alpha + \beta_1 \Delta GBG_t + \beta_2 \Delta z_t + \delta(corp_{t-1} - \gamma_1 GBG_{t-1} - \gamma_2 z_{t-1}) + \epsilon_t \tag{7}$$

$$\Delta corp_t = \alpha + \beta_1 \Delta GSG_t + \beta_2 \Delta GBG_t + \beta_3 \Delta z_t + \delta(corp_{t-1} - \gamma_1 GSG_{t-1} - \gamma_2 GBG_{t-1} - \gamma_3 z_{t-1}) + \epsilon_t \tag{8}$$

Both GBG and GSG flows have a significant and negative impact on the 10-year Treasury rate and these effects turn out to be statistically significant both during the sample period and during our subsample – the time span, as highlighted by Bruno and Shin (2015b), characterized by the upswing of the global liquidity cycle.

Including GSG and GBG flows once at a time, we find that the size of the coefficients in the Treasury and AAA corporate regressions, while close to each other for each type of flow, are slightly stronger when the dependent variables are 10-year Treasury rates (cf. cols. 1,2 and 4,5). For GSG, this result is intuitive, to the extent that it mostly reflects purchases of Treasuries and Agency debt.

[12] Results of the Johansen tests are available upon request.

[13] Alternatively and equivalently to the VECM specification, we could have estimated a simple OLS after imposing, as in Warnock and Warnock (2009), that the coefficients of the short rate and inflation expectations sum to one.

Once both types of flows are included, their effects remain significant and of the expected signs, though the magnitude of the coefficients is somewhat lower compared to when they are individually accounted for as explanatory variables (Table 6, cols. 3 and 6).

3.2. Credit spreads

The difference between the AAA and the10-year yields is not a reliable measure of the credit spread, one of the reason being the duration mismatch. We thus choose a different measure of the credit spread and claim that its underlying components might be affected by increases in foreign inflows in different ways.

Indeed, Gilchrist and Zakrajsek (2012) (GZ henceforth) show that credit spreads may not accurately reflect cyclical movements in investors' risk appetite because they also capture a component linked to expected default rates of the riskier bond: while the latter is related to the financial health of the issuers, it is not as strongly related to investors' moods. To capture the intended effect of GSG and GBG, it is therefore necessary to consider only the so-called "excess bond premium" part of the spread, which better captures the procyclicality of investors' risk appetite.[14].

To test this hypothesis, we use the GZ measure (and its two subcomponents) to proxy the credit spread; while the credit spread is stationary, we can assess the short-term impact of GSG and GBG flows on its level by including flows in first differences.

We find that the effect of GSG flows on the excess bond premium component of the spread – the GZ spread for short – is positive, whereas GBG flows exert a downward pressure; the effects on the GZ spread are preserved even when GSG and GBG are included jointly (Table 7, Panel C).[15] 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 markedly accelerated (Figure 1).[16]

[14]In the words of GZ, this excess bond premium measures "deviations in the pricing of corporate bonds relative to the measured default risk of the issuer", which according to our interpretation should capture the procyclical subjective beliefs of investors not necessarily reflecting the underlying health of the corporate sector. The excess bond premium is obtained as the residual after subtracting from the credit spread its predicted component, 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.

[15]Interestingly, GBG and GSG have significant effects only when included in first differences (i.e., one-month flows instead of 12-month ones). This suggests that risk appetite in the bond market is highly sensible to new inflows, more than to the cumulated increase in foreign positions.

[16]The third phase of the Economic and Monetary Union (EMU) started formally on January 1, 1999, with

Substituting the excess bond premium with the expected default component as dependent variable, we do not find any statistical significance spanning the entire sample period chosen, neither for GSG nor for GBG except for the negative effect of the latter during the 2002-2007 subperiod (Panel B). This further confirms our prior that the effects ofGSG and GBG flows on overall credit spreads (Panel A) mostly reflect 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. Our results also highlight that these effects are concentrated in 1999-2007.

3.3. Risk aversion and uncertainty

The compression of rates on riskier bonds due to GBG and GSG flows, also reflected in the excess bond premium contraction, suggests a broader "risk-on" type of influence of foreign inflows on the US financial markets. Differently from Bernanke (2015) who defines risk-on periods as periods of increasing capital inflows motivated by low market volatility and low risk premiums, we are interested in assessing whether causality runs also in the opposite direction. To investigate this issue more deeply, we now turn to the analysis of the US equity market, checking for the possible effects of GSG and GBG flows on expected future equity price fluctuations (proxied by the VIX): a VIX index significantly reacting to GSG and GBG could be interpreted as international financial flows having effect on investors' uncertainty or risk aversion in equity markets as well as in bond markets.

Results for regressions of GBG and GSG flows on the VIX are shown in Table 8. During our sample period (1994-2007), the coefficients of both GBG and GSG flows are negative and significant (Panel A, first three columns), meaning that an increase in these flows drove the VIX index down. Controlling for the US effective Federal Funds' target rate in real terms does not invalidate this result. Note also that, while both GBG and GSG flows are significant if included one at a time, only the effect of GBG flows remains statistically significant once both variables are included together.

Being the VIX 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 identify the effect of our flows on the two components, we re-run the last set of regressions by substituting 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 – to the VIX index. Results show that the impact, again mostly from GBG flows, is stronger in terms of reducing investors' risk aversion than in terms

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 implementation of a single monetary policy under the responsibility of the European Central Bank (ECB) within the Eurosystem.

of shrinking uncertainty (Table 8, Panels B and C). This evidence is coherent with the one found in the previous subsection for long-term bond rates, according to which international financial flows mainly affect the risk premium component of corporate bond rates.Finally note that the effects of GBG flows on equity investors risk aversion are strongest in the 1999-2007 subperiod.

3.4. Bank leverage

Our results so far suggest that both GBG and GSG flows acted as a push factor on US financial markets, ultimately leading to lower US long term interest rates and a reduction in risk aversion both in bond and equity markets. Do these flows, at the same time, also directly account for an increase in banks' lending, i.e. do they also positively affect the credit supply? Provided that they lead to a generally higher risk appetite, this should be the case. We take up this question in Table 9 where we test for the possible determinants underlying changes in banks' leverage, proxied, as in Bruno and Shin (2015b), with the ratio of US broker-dealers' total liabilities including equity, over equity.[17]

The results suggest some interesting linkages between foreign inflows and banks' leverage ratios. First, only GBG flows are statistically significant in explaining observed increases in banking leverage, even after controlling for the monetary policy rate in real terms and the lagged effect of changing risk aversion.

Second, the effects of GBG are stronger from 2002 onwards: the regression coefficients markedly increasefor this latter subperiod, confirming Shin (2011)'s claim that European global banks were relevant drivers of the GBG flows and, hence, also in influencing financial conditions in the US, particularly after the introduction of euro coins and banknotes in 2002. Third, this increased linkage between GBG flows and banks' leverage after 2002 is also consistent with the balance sheet capacity channel advocated by Shin and co-authors (see, Danielsson et al. (2011)).[18] According to this view, for a given equity base, leverage mainly builds up thanks to additional debt piled up by banks to finance additional assets during good times, i.e. during periods of low measured risks. Such a period of markedly low

[17] 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.

[18] According to the balance sheet capacity channel view then; for a given equity base, leverage fluctuates with risk aversion, so that the balance sheet constraint binds at all times, consistent with a Value at Risk (VaR) approach to risk management.

volatility was indeed observed in 2002-2007 (see Figure 3).

Fourth, Table 9 (col.1) also highlights that the (lagged) VIX index affects changes in banking leverage in an economically meaningful and statistically significant way: banks' leverage decreases when the VIX rises, i.e. when the expected stock market volatility measured by the index increases.[19] The first to highlight this important result have been Bruno and Shin (2015a), who also find evidence that the decrease in the VIX may be induced by changes in monetary policy, thereby supporting the view of a so-called "risk-taking channel" of monetary policy. According to our results, the impact of GBG flows on banking leverageis independent from the corresponding effect of the VIX regressor.[20] We will return to this result in the next section when presenting the BVAR analysis, which is better suited to capture the complex interactions between US monetary policy, international financial flows, and financial markets conditions.

All in all the results reported in Table 9 point to the fact that GBG flows act as a rather different and stand-alone conduit of the leverage cycle than the VIX index. Thus, beyond the explanatory power of foreign capital flows on the VIX index (Table 8) – a result that has been emphasized by a number of authors[21] – GBG flows exert an autonomous pro-cyclical effect on banking leverage (both on the credit demand and supply side). Concerning GBG, the introduction of the euro seems to define a structural break in terms of investment decisions, both in terms of geographic destination of funds and of size of financial investments (i.e., triggering a marked acceleration of GBG inflows, cf. Figure 1). To our knowledge, these results have not been emphasized in the literature so far.

4. BVAR analysis

4.1. Motivation

The empirical estimates presented and discussed so far have highlighted sound linkages between GBG, GSG flows and US financial variables – looking both at asset prices and quantities. Overall, the analysis indicates an autonomous role of these flows in affecting the US financial markets during the run-up to the crisis: this suggests that, while the accommodative policy stance in the US may have stimulated new inflows over time, GSG and GBG were not

[19] 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.

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

[21] Bruno and Shin (2015b) confirm this important linkage, highlighted also by Adrian and Shin (2010) and Forbes and Warnock (2012).

in principle triggered by specific monetary events.

We now use our GBG and GSG measures to identify two distinct shocks in a BVAR framework. The two shocks can be viewed as external preference shocks, i.e. preference shocks which concern non-US agents. The principal aim of this analysis is to evaluate the timing and persistence of the responses in US financial variables to these shocks in a richer setup. Moreover, the BVAR framework should also help us to study the connections between foreign financial flows and broader US macroeconomic conditions, while at the same time also taking into account potential international spillovers via exchange rate effects.

To this end, we first of all investigate the possible linkages between GSG and GBG. While GSG flows are the outcome of deliberate policy decisions undertaken since the first half of the nineties, GBG flows have assumed particular significance later in that decade, possibly also in reaction to GSG flows, as highlighted in Bertaut et al. (2012). In particular if, as suggested by these authors, GBG flows have been substantially driven by the part of GSG flows previously invested in European assets (the "triangular trade" in financial assets view), then we should find that the effects of GBG on US markets may not hold in the BVAR; this fact might challenge the view according to which GBG flows contributed per se to an easing of financial conditions in the US, which is at least as important as that attributable to GSG ones (Shin, 2011).

Secondly, we wish to make a broader investigation into the role of risk aversion. Our previous results have highlighted the relevance of both GBG and GSG in bringing about a *risk-on* investment environment of low credit spreads and volatility. The BVAR framework should help us further to clarify 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, forcefully documented by Bruno and Shin (2015b)) or, as we have shown in the previous section, if it also reflects the autonomous transmission mechanism of GBG and GSG flows.

Third, by including in the BVAR both the US real effective exchange rate and the real Fed Funds target rate, we want to investigate the possible direct effects induced by GSG and GBG flows on the dollar, while at the same time controlling for the US monetary policy stance. In other words we look at whether international financial inflows exert appreciation pressures on the US dollar, thus conforming to the view exposed by Hofmann et al. (2016) according to which a currency appreciation may be the outcome of more permissive financial conditions.[22]

[22] According to this "risk-taking channel" view, exchange rate appreciations are not necessarily contractionary as in the standard Mundell-Fleming model, where an appreciation is associated with lower net exports and output. A similar argument has been recently advanced also by Blanchard et al. (2015), who argue that capital inflows by reducing financial intermediation costs may offset the contractionary impact of apprecia-

Finally, we exploit the BVAR setup to extend our analysis beyond the effects on US financial markets. As affirmed by Justiniano et al. (2014), only a few papers have addressed quantitatively the impact of GSG and GBG on the US economy in general, and on the credit and house-price boom of the 2000s more specifically. To investigate this issue we thus include in our BVAR two alternative measures, one for credit (household debt) and one for housing expenditures (house prices).

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 variance premium, (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 to explore the possible role of inflows on the housing bubble (BVAR #2 and #3).[23]

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 any financial misalignment that arises and that poses a threat to its target. Considering that the frequency of the BVAR setup is quarterly, this ability of monetary policy to respond immediately to financial shocks does not appear to be inappropriate.[24]

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, i.e. stopping our sample period due to data availability.[25]

tions.

[23]Rising trends in household indebtedness and housing are visible in Figure 4

[24]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.

[25]GZ spreads are only available until 2010 Q3. The estimation periods are extended backwards compared

4.3. Structural shocks testing

Results coming from the analysis carried out in Section 3 do not a priori rule out the possibility that foreign inflows were endogenous to the accommodative monetary policy stance in the US. Before discussing the impulse responses we test whether, under our identification assumptions, GSG and GBG shocks are correlated to US monetary policy shocks.

Shocks from our identified BVAR are computed as follows. From the reduced-form representation

$$x_t = Fx_{t-1} + u_t \tag{9}$$

where x_t and u_t are $[N * T]$ matrices, the structural form is

$$Ax_t = Bx_{t-1} + e_t \tag{10}$$

where $F = A^{-1}B$ and $B = AF$. Structural shocks are

$$e_t = Au_t \tag{11}$$

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 11. This procedure is repeated for our three BVAR specifications.

As proxies for monetary policy shocks, we consider the set of instruments used in 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 monetary shocks by simply averaging these monthly measures.[26]

Results of linear correlations with bootstrapped confidence intervals are reported in Table 10, and the dynamics of GSG and GBG shocks along with that of the FF4 proxy (the preferred instrument in Gertler and Karadi (2015)) are shown in Figure 11. Correlations are not significant for any of the five proxies of monetary policy shocks, for both GSG and GBG shocks; same outcomes show up when extracting structural GSG and GBG shocks from the other BVAR specifications.

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 1). Second, the VIX Index is not available prior to 1990.

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

The above results confirm, under our identification assumptions, the absence of endogeneity between foreign flows and US monetary policy, adding evidence to our original claim of an autonomous role of GSG and GBG flows. This result supports the discussion of the impulse response functions in the next subsection.

4.4. Impulse responses

Figures 6 and 7 present the main impulse response functions of the benchmark specification; Figure 8 and 9 present selected impulse responses from BVAR #2 and #3, respectively. Each panel in the figure graphs 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, we find that both GSG and GBG flows lead to a significant increase in banking leverage: a positive shock to GSG leads, on impact, to an increase in leverage that lasts about three quarters, while the reaction to a GBG shock is more persistent – lasting up to five quarters – and, at its peak, almost double in size (Figure 6 rows 1 and 2, col. 1). This result confirms that both types of capital flows have an autonomous impact on US banks' leverage ratios, even when accounting for the possible interactions with monetary policy and broader financial market conditions.

Second, positive GSG and GSG shocks lead to a significant compression in excess bond premia, whereas only GBG shocks significantly reduce the VIX variance premium.[27] Thus, GSG flows only exert a significant and very persistent impact on risk aversion in corporate bond markets (rows 1 and 2, cols. 2 and 3), while increases in GBG flows lead to a generalized but shorter-lived (approximately around 3 quarters) reduction in risk-aversion both on corporate bond and equity markets. This latter result is consistent with the findings in Section 3.2. To the contrary the reduction of the GZ excess bond premium in response to a positive GSG shock contrasts with our earlier findings.

Third, the US dollar real effective exchange rate depreciates persistently in response to a positive GBG shock and for approximately two years in response to an unexpected increase in GSG flows (rows 1 and 2, col. 4). This result is consistent with capital inflows being associated not only with overall more expansionary financial conditions, but also with easier monetary conditions. This can be clearly seen from the fact that GBG shocks exert a negative impact of the Federal funds real rate. This is a slightly different result than the

[27] Results are identical if using the VIX index instead

findings in Hofmann et al. (2016) and Blanchard et al. (2015) according to which 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. Also according to our findings capital inflows are conducive to more expansionary financial conditions, but in addition to that they also lead to easier monetary conditions and an exchange rate depreciation as opposed to an appreciation.

Fourth, both types of flows seem to affect each other over the first year (rows 1 and 2, col. 5). The effect of GSG flows on GBG ones speaks in favor of the view advanced by Bertaut et al. (2012) according to which part of the GBG flows may have been "recylced" from previous financial investments in Europe by GSG countries. Alternatively, the impact of GSG shocks on GBG flows could simply reflect the degree of substitutability between safer (Treasuries and Agency debt) and riskier (corporate bonds) assets.

All in all, our results confirm that GSG and, in particular, GBG 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.[28] Moreover, both types of flows are conducive to international spillover effects, as they lead to a persistent real effective depreciation of the US dollar vis--vis its trading partners.

The risk-taking channel of monetary policy Our 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, whereby monetary policy by affecting measured risk, changes banks lending risk-capacity. Briefly, as in Bruno and Shin (2015b), we do find that a positive shock to the real Fed funds target rate induces after some time a persistent rise in the VIX variance premium (Figure 7 row 2, cols. 2 and 3) and a decline in banking leverage after a fairly long lag of around 10 quarters; we also confirm that this pro-cyclical effect of monetary policy on risk-taking holds also with respect to the GZ excess bond premium measure (row 2, col.1);[29] furthermore, an increase in the VIX variance premium lowers banks leverage (row 3, col. 2).

In addition, we also find significant negative effects of a monetary tightening on GSG and especially GBG flows (row 1, cols. 1 and 2), from the second half of year two onwards.

[28] See for example, by Miranda-Agrippino and Rey (2015).

[29] Bruno and Shin include the VIX index as opposed to the VIX variance premium – our preferred proxy for risk-taking in equity markets – in their specification. Using the VIX in our specification yields essentially identical impulse responses to the ones obtained with the variance premium.

However, both the responses of GBG flows and banking leverage to a monetary policy shock are positive during the first year, suggesting that a turning in financial conditions, i.e. a reduction in GBG flows and banking leverage, in response to a monetary tightening is not immediate.[30]

The effects of GSG and GBG on US macroeconomic conditions We may now explore whether GSG and GBG flows have also any *direct* macroeconomic consequences on household debt and housing market developments. In the following, we will run other two BVAR estimates (named BVAR #2 and #3) by alternatively including 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).

Given that we are considering the ratio of households debt to disposable income, any effects of GSG and GBG flows on this variable are likely to signal an increase in households indebtedness above their potential long-term rates of growth.[31] 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. As expected, GBG flows positively affect households' debt dynamics in a very persistent way (Figure 8, row 2 col 1); on the contrary, GSG do not have significant effect on it (row 1 col 1).[32]

To analyze the interaction between international financial flows and the housing market, we augment our baseline specification by introducing real house prices (BVAR #3).[33] The results obtained support the view according to which positive shocks to both GBG and, after a fairly long lag, GSG flows significantly affect the US housing market by contributing to a rise in real house prices (Figure 9, row 1, cols 1 and 2). This finding is in line with the results of Punzi and Kauko (2015).

The above figures point also to another interesting evidence. As can be seen, we also find that expansions in households debt-to-income ratios and appreciations in house prices, are

[30] Contrary to Bruno and Shin, in our benchmark BVAR we are not able to find that a positive Fed Funds target rate shock leads after half a year to a protracted real appreciation of the US dollar (7, row 2 and col.3).

[31] This is obviously true if one believes that households debt levels cannot grow unbounded compared to the rest of the economy. It may however well be the case that this variable deviates for long periods of time from its longer term values.

[32] Normalizing household debt with GDP instead of income yields identical results.

[33] The ordering of 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, (7) the real house price index and (8) the real Federal Funds target rate.

conducive to higher GBG flows (Figure 9, row 2 col. 2). Thus, according to our BVAR, there is evidence of households debts and housing market developments acting also as a catalyst for GBG flows. On the 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 been important determinants in attracting GBG flows towards U.S. financial markets.

5. Conclusions

The present paper has explored the effects of ocial and private international financial flows – our GSG and GBG measures – on US financial conditions. We have further focused on the nexus between GSG and GBG flows and the broader US economy, in particular the dynamics of households debt and of the 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 expansion (1990-2007) both types of flows are complementary in that they tend to positively affect each other. Finally, both GSG, and to a greater extent, GBG flows exert a positive impact on households debt-to-income ratios, and housing market developments. However it is also the case that ebullient macroeconomic conditions, in terms of higher house prices and more leveraged households, have significant effects on GBG flows.

The above findings thus 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 on 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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#	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 ad 1994 (col. 4). Net positions for the United Kingdom also comprises Channels 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 ad 1994 (col. 4).

#	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 3: 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 ad 1994 (col. 4). Net positions for the United Kingdom also comprises Channels 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 4: 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 ad 1994 (col. 4). Net positions for the United Kingdom also comprises Channels Islands and the Isle of Man.

	2002		2003		
Country	#	tot asset	#	tot asset	% 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 5: Cayman Islands - Geographical distribution of banks in 2002 and 2003 (total assets are in bn USD).

	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.GBG	−0.40***		−0.28***	−0.33***		−0.25***
	(0.09)		(0.10)	(0.07)		(0.08)
d.GSG		−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. Sample is January 1994 – June 2007 (162 obs.).

Panel A: Corporate spread

	1994 – 2007			1999 – 2007			2002 – 2007		
D.FFtarget	-2.18^{***}	-2.14^{***}	-2.16^{***}	-2.34^{***}	-2.27^{***}	-2.28^{***}	-3.06^{***}	-3.15^{***}	-3.04^{***}
	(0.26)	(0.26)	(0.26)	(0.24)	(0.25)	(0.24)	(0.82)	(0.88)	(0.84)
D.exp infl	0.65	0.54	0.54	0.42	0.20	0.21	0.72	0.75	0.67
	(0.49)	(0.50)	(0.48)	(0.49)	(0.53)	(0.51)	(1.01)	(1.05)	(1.07)
D.logreer	−6.88	−5.05	−6.45	−1.81	1.66	−1.65	-9.18^{*}	−7.17	-9.16^{*}
	(5.22)	(5.26)	(5.29)	(5.37)	(5.50)	(5.37)	(5.02)	(4.83)	(5.08)
dbg	−0.36		−0.53	-0.55^{**}		-0.82^{***}	-0.49^{*}		-0.53^{*}
	(0.34)		(0.37)	(0.28)		(0.29)	(0.27)		(0.27)
dsg		0.20	0.34		0.37	0.63^{**}		−0.13	0.09
		(0.23)	(0.26)		(0.25)	(0.27)		(0.31)	(0.33)
Constant	1.87^{***}	1.86^{***}	1.87^{***}	2.28^{***}	2.25^{***}	2.27^{***}	2.18^{***}	2.16^{***}	2.18^{***}
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.11)	(0.11)
Adjusted R^2	0.19	0.19	0.20	0.33	0.32	0.36	0.27	0.24	0.25

Panel B: Expected default component

	1994 – 2007			1999 – 2007			2002 – 2007		
D.FFtarget	-0.71^{***}	-0.71^{***}	-0.72^{***}	-0.48^{***}	-0.48^{***}	-0.49^{***}	-1.43^{***}	-1.55^{***}	-1.50^{***}
	(0.19)	(0.19)	(0.19)	(0.16)	(0.16)	(0.16)	(0.34)	(0.35)	(0.36)
D.exp infl	0.27	0.30	0.30	−0.02	−0.02	−0.01	0.15	0.32	0.29
	(0.25)	(0.26)	(0.26)	(0.22)	(0.24)	(0.24)	(0.27)	(0.32)	(0.34)
D.logreer	-6.22^{*}	-6.16^{*}	-6.31^{*}	−3.31	−2.38	−3.31	−0.07	0.62	−0.13
	(3.71)	(3.61)	(3.67)	(3.28)	(3.14)	(3.27)	(4.59)	(4.13)	(4.36)
dbg	−0.09		−0.06	−0.23		−0.23	-0.31^{**}		−0.20
	(0.23)		(0.25)	(0.15)		(0.16)	(0.15)		(0.20)
dsg		−0.08	−0.07		−0.08	−0.00		−0.32	−0.24
		(0.20)	(0.22)		(0.22)	(0.24)		(0.31)	(0.36)
Constant	2.01^{***}	2.01^{***}	2.01^{***}	2.34^{***}	2.33^{***}	2.34^{***}	2.53^{***}	2.53^{***}	2.53^{***}
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.07)	(0.07)	(0.07)
Adjusted R^2	0.04	0.04	0.04	0.04	0.03	0.03	0.15	0.16	0.15

Panel C: Excess bond premium

	1994 – 2007			1999 – 2007			2002 – 2007		
D.FFtarget	-1.47^{***}	-1.43^{***}	-1.44^{***}	-1.85^{***}	-1.79^{***}	-1.80^{***}	-1.63^{**}	-1.60^{**}	-1.53^{**}
	(0.19)	(0.19)	(0.19)	(0.21)	(0.20)	(0.20)	(0.67)	(0.75)	(0.71)
D.ei	0.37	0.24	0.24	0.44	0.21	0.22	0.57	0.44	0.38
	(0.29)	(0.30)	(0.28)	(0.33)	(0.35)	(0.34)	(0.81)	(0.86)	(0.88)
D.logreer	−0.66	1.10	−0.14	1.49	4.05	1.66	-9.11^{**}	-7.79^{*}	-9.03^{**}
	(2.98)	(2.98)	(2.92)	(5.14)	(4.97)	(4.85)	(4.20)	(3.90)	(3.96)
dbg	−0.27		-0.48^{*}	−0.32		-0.59^{**}	−0.18		−0.33
	(0.23)		(0.24)	(0.25)		(0.26)	(0.22)		(0.24)
dsg		0.28^{*}	0.40^{**}		0.45^{*}	0.63^{**}		0.19	0.33
		(0.15)	(0.17)		(0.25)	(0.27)		(0.28)	(0.30)
Constant	-0.14^{***}	-0.16^{***}	-0.14^{***}	−0.05	−0.08	−0.06	-0.35^{***}	-0.37^{***}	-0.36^{***}
	(0.04)	(0.04)	(0.04)	(0.06)	(0.05)	(0.05)	(0.09)	(0.09)	(0.09)
Adjusted R^2	0.22	0.23	0.24	0.27	0.29	0.32	0.14	0.15	0.15

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

Table 7: Regressions on the US corporate spread and on its two subcomponents estimated in Gilchrist and Zakrajsek (2012). Samples are January 1994 – June 2007 (162 obs.), January 1999 – June 2007 (102 obs.), September 2002 – June 2007 (58 obs.).

Panel A: logVIX

	1994 – 2007			1999 – 2007			2002 – 2007		
D.real FF target	-0.53^{***}	-0.55^{***}	-0.55^{***}	-0.61^{***}	-0.60^{***}	-0.60^{***}	-0.81^{***}	-0.85^{***}	-0.79^{***}
	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)	(0.21)	(0.21)	(0.23)
D.logreer	0.31	0.81	0.14	-1.32	0.35	-1.32	-8.95^{**}	-7.62^{**}	-8.96^{**}
	(2.52)	(2.41)	(2.44)	(3.16)	(3.24)	(3.18)	(3.49)	(3.41)	(3.57)
dbg	-0.33^{**}		-0.25^{*}	-0.40^{***}		-0.42^{***}	-0.34^{*}		-0.36^{**}
	(0.15)		(0.15)	(0.15)		(0.16)	(0.17)		(0.18)
dsg		-0.21^{*}	-0.15		-0.10	0.03		-0.10	0.05
		(0.11)	(0.11)		(0.12)	(0.12)		(0.18)	(0.17)
Constant	2.92^{***}	2.92^{***}	2.93^{***}	2.95^{***}	2.94^{***}	2.95^{***}	2.80^{***}	2.79^{***}	2.80^{***}
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Adjusted R^2	0.13	0.12	0.13	0.19	0.14	0.18	0.22	0.16	0.20

Panel B: Conditional variance (in logs)

	1994 – 2007			1999 – 2007			2002 – 2007		
D.real FF target	-0.99^{***}	-0.99^{***}	-1.00^{***}	-0.93^{***}	-0.88^{***}	-0.88^{***}	-1.17^{***}	-1.29^{***}	-1.19^{***}
	(0.18)	(0.19)	(0.19)	(0.21)	(0.22)	(0.23)	(0.43)	(0.42)	(0.44)
D.logreer	-0.49	1.04	-0.59	1.19	4.54	1.21	-12.50^{**}	-10.31^{**}	-12.49^{**}
	(4.51)	(4.62)	(4.55)	(5.92)	(6.31)	(5.99)	(5.48)	(5.08)	(5.51)
dbg	-0.66^{**}		-0.62^{**}	-0.72^{**}		-0.83^{***}	-0.60^{*}		-0.59^{*}
	(0.27)		(0.29)	(0.29)		(0.31)	(0.34)		(0.30)
dsg		-0.24	-0.08		-0.03	0.23		-0.27	-0.03
		(0.20)	(0.20)		(0.25)	(0.24)		(0.32)	(0.25)
Constant	2.79^{***}	2.77^{***}	2.79^{***}	2.91^{***}	2.88^{***}	2.90^{***}	2.64^{***}	2.63^{***}	2.64^{***}
	(0.05)	(0.04)	(0.05)	(0.06)	(0.05)	(0.06)	(0.07)	(0.07)	(0.07)
Adjusted R^2	0.15	0.12	0.14	0.17	0.11	0.17	0.20	0.14	0.18

Panel C: Variance premium (in logs)

	1994 – 2007			1999 – 2007			2002 – 2007		
D.real FF target	-1.40^{***}	-1.44^{***}	-1.45^{***}	-1.68^{***}	-1.65^{***}	-1.66^{***}	-2.39^{***}	-2.40^{***}	-2.25^{***}
	(0.25)	(0.26)	(0.26)	(0.30)	(0.31)	(0.30)	(0.74)	(0.76)	(0.81)
D.logreer	1.20	2.78	0.82	-5.89	-1.48	-5.88	-20.76^{**}	-17.75^{**}	-20.82^{**}
	(6.09)	(5.78)	(5.89)	(7.41)	(7.44)	(7.48)	(8.39)	(8.22)	(8.60)
dbg	-0.91^{**}		-0.75^{*}	-1.04^{**}		-1.09^{**}	-0.69		-0.83
	(0.40)		(0.45)	(0.42)		(0.47)	(0.51)		(0.58)
dsg		-0.51^{**}	-0.32		-0.22	0.12		-0.05	0.29
		(0.25)	(0.28)		(0.34)	(0.36)		(0.48)	(0.51)
Constant	2.51^{***}	2.49^{***}	2.51^{***}	2.47^{***}	2.44^{***}	2.47^{***}	2.08^{***}	2.04^{***}	2.07^{***}
	(0.07)	(0.06)	(0.06)	(0.09)	(0.09)	(0.09)	(0.13)	(0.13)	(0.13)
Adjusted R^2	0.13	0.12	0.13	0.18	0.13	0.17	0.17	0.14	0.16

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.), September 2002 – June 2007 (58 obs.).

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)
L3.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.dbg		0.55*		0.52*		0.39		0.44		0.69**		0.87***
		(0.29)		(0.29)		(0.33)		(0.31)		(0.31)		(0.31)
dbg		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.dsg			0.18	0.06			0.06	−0.07			−0.04	−0.35
			(0.22)	(0.22)			(0.25)	(0.23)			(0.30)	(0.30)
dsg			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. Samples are January 1994 – June 2007 (162 obs.), January 1999 – June 2007 (102 obs.), September 2002 – June 2007 (58 obs.).

		GSG			GBG		
		correlation	conf int lowb	conf int ub	correlation	conf int lowb	conf int ub
BVAR #1	FF1	- 0.090	- 0.308	0.112	- 0.077	- 0.279	0.107
	FF4	- 0.120	- 0.308	0.076	- 0.010	- 0.239	0.174
	ED2	- 0.038	- 0.239	0.154	- 0.007	- 0.245	0.213
	ED3	- 0.021	- 0.234	0.183	0.012	- 0.248	0.239
	ED4	- 0.001	- 0.217	0.231	0.021	- 0.224	0.247
BVAR #2	FF1	- 0.080	- 0.294	0.121	- 0.010	- 0.250	0.186
	FF4	- 0.118	- 0.298	0.072	0.033	- 0.251	0.221
	ED2	- 0.037	- 0.242	0.152	0.048	- 0.221	0.251
	ED3	- 0.025	- 0.248	0.197	0.047	- 0.232	0.256
	ED4	- 0.006	- 0.231	0.240	0.048	- 0.220	0.256
BVAR #3	FF1	- 0.071	- 0.299	0.144	- 0.048	- 0.242	0.130
	FF4	- 0.109	- 0.314	0.115	- 0.012	- 0.219	0.170
	ED2	- 0.020	- 0.239	0.179	0.015	- 0.214	0.212
	ED3	- 0.003	- 0.239	0.211	0.034	- 0.204	0.235
	ED4	0.017	- 0.218	0.251	0.048	- 0.186	0.244

Table 10: Correlations between the structural GSG flow shocks (left block) and structural GBG shock (right block) extracted from the three BVAR specifications and the five proxies of monetary policy shocks taken from Gertler and Karadi (2015). For each block, column 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.

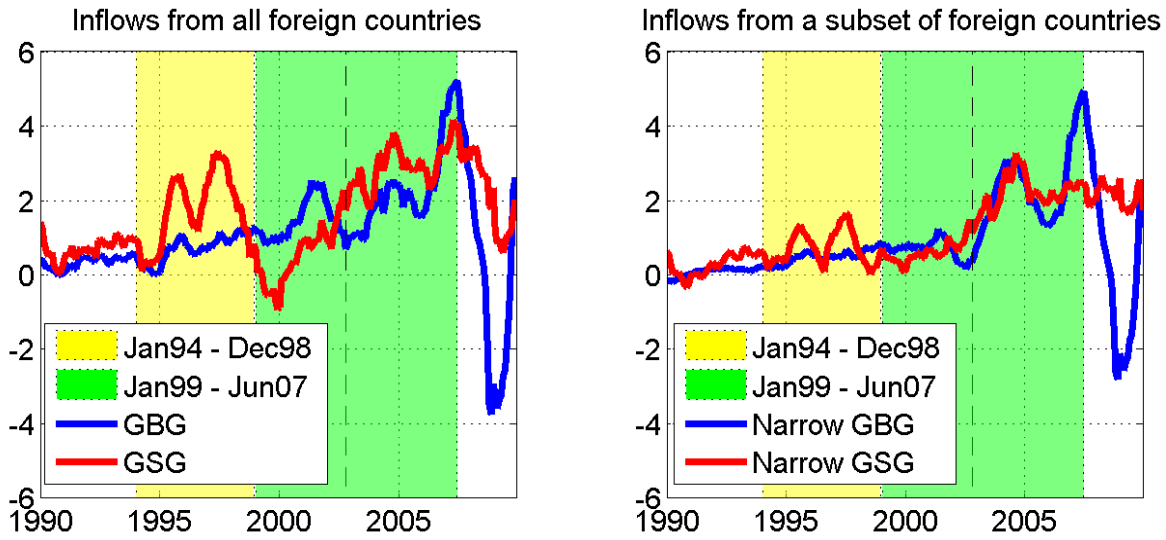

Figure 1. Monthly GSG (red line) and GBG (blue line) computed for total foreign countries (Panel (a)) and for a restricted sample of countries (Panel (b)), in % of US GDP. The restricted sample is formed by European countries plus Caribbean banking centers (banking glut) and by the group of Asian countries (savings glut). 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 Warnock and Warnock (2009). The vertical dashed line in August 2002 marks the beginning of the corporate spread's and VIX's decreasing phases; the yellow area (Jan94-Dec98) marks the phase in which, according to the literature, GSG inflows where predominant; the green area (Jan99-Jun07) marks the rise in GBG inflows. The temporal disaggregation of US quarterly GDP is done using a Chow-Lin type algorithm. Data are from January 1990 to January 2008.

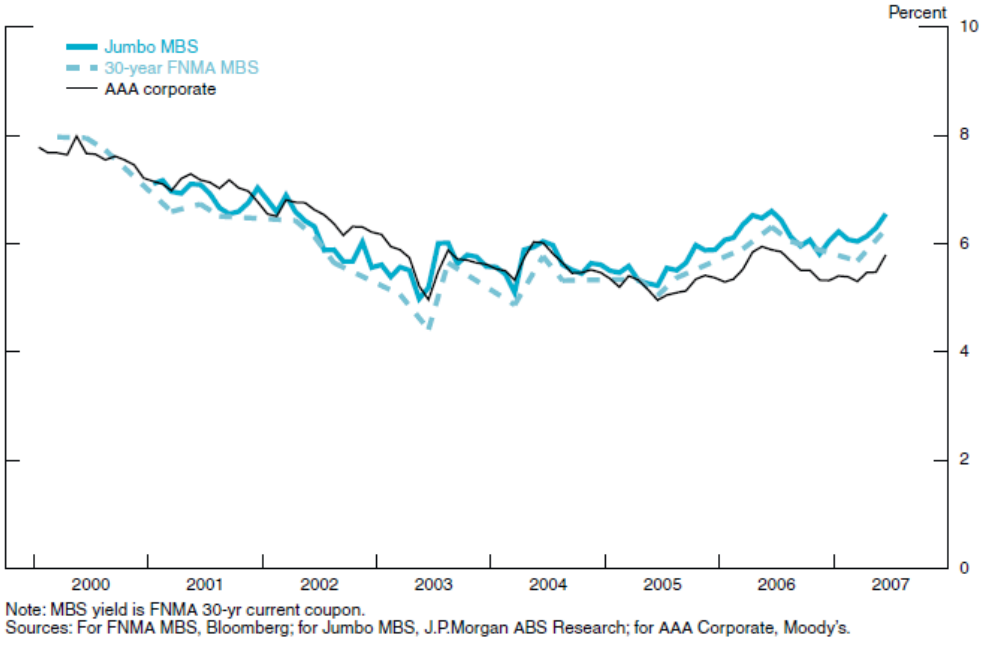

Figure 2. Yields on selected MBS and on AAA corporate bonds, taken from Bertaut et al. (2012).

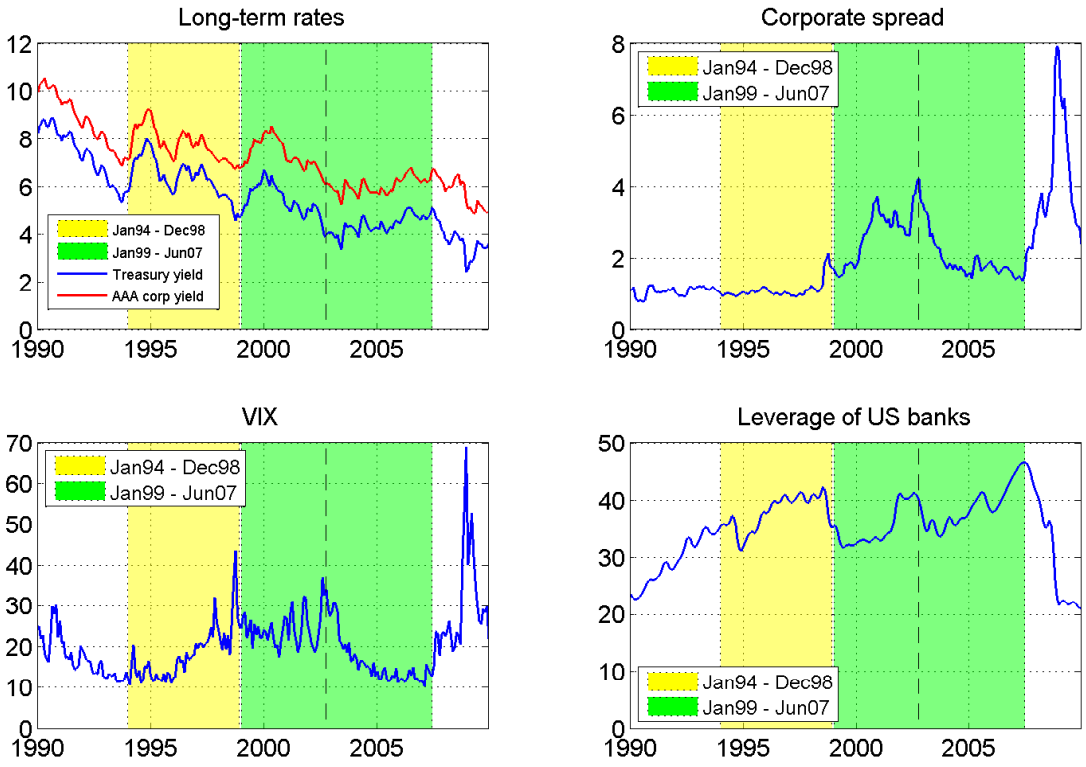

Figure 3. Long-term rates, corporate spread by Gilchrist and Zakrajsek (2012), VIX and US bank leverage during the run up to the crisis. The vertical dashed line in August 2002 marks the beginning of the corporate spread's and VIX's decreasing phases; the yellow area marks the phase in which GSG inflows where predominant, while the green one marks the rise in GBG inflows..

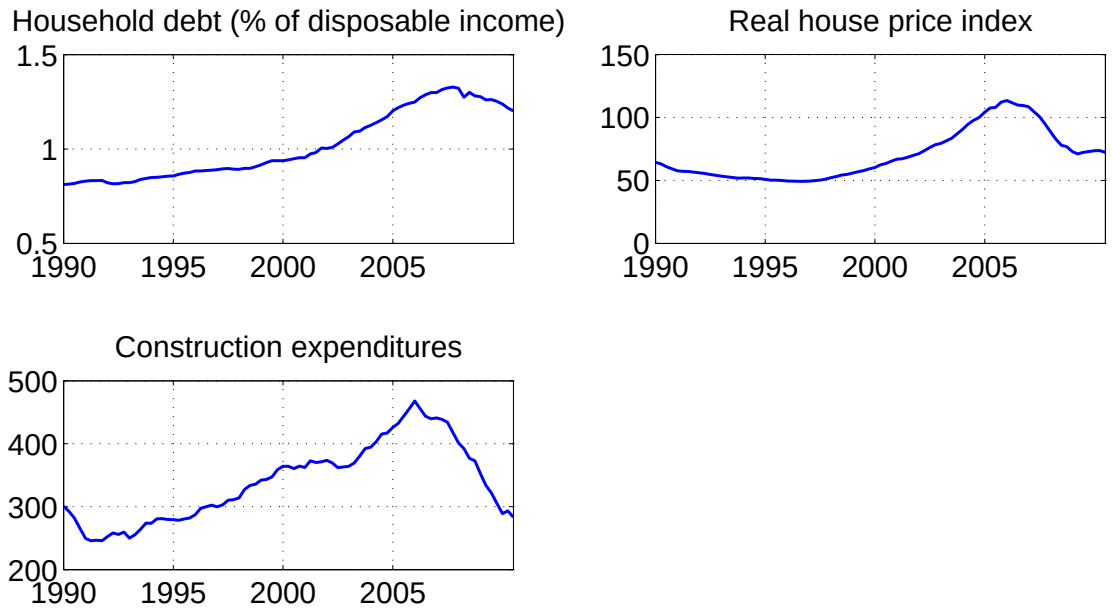

Figure 4. US household debt as a percentage of disposable income, construction expenditures in the US and the real US house price index, constructed as the CPI-deflated S& P Case-Shiller.

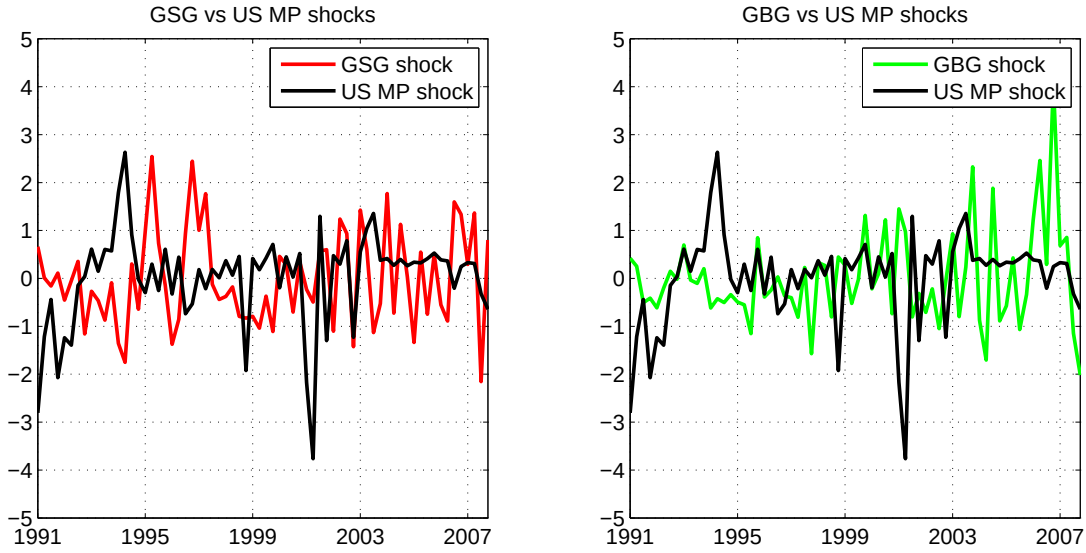

Figure 5. Comparison between BVAR-estimated structural shocks and US monetary policy shocks. Structural GSG and GBG shocks are computed from the benchmark BVAR. The proxy for monetary policy shock is the three-month ahead funds rate surprise (FF4), chosen by Gertler and Karadi (2015) for their baseline estimation. Shocks are standardized in mean and variance..

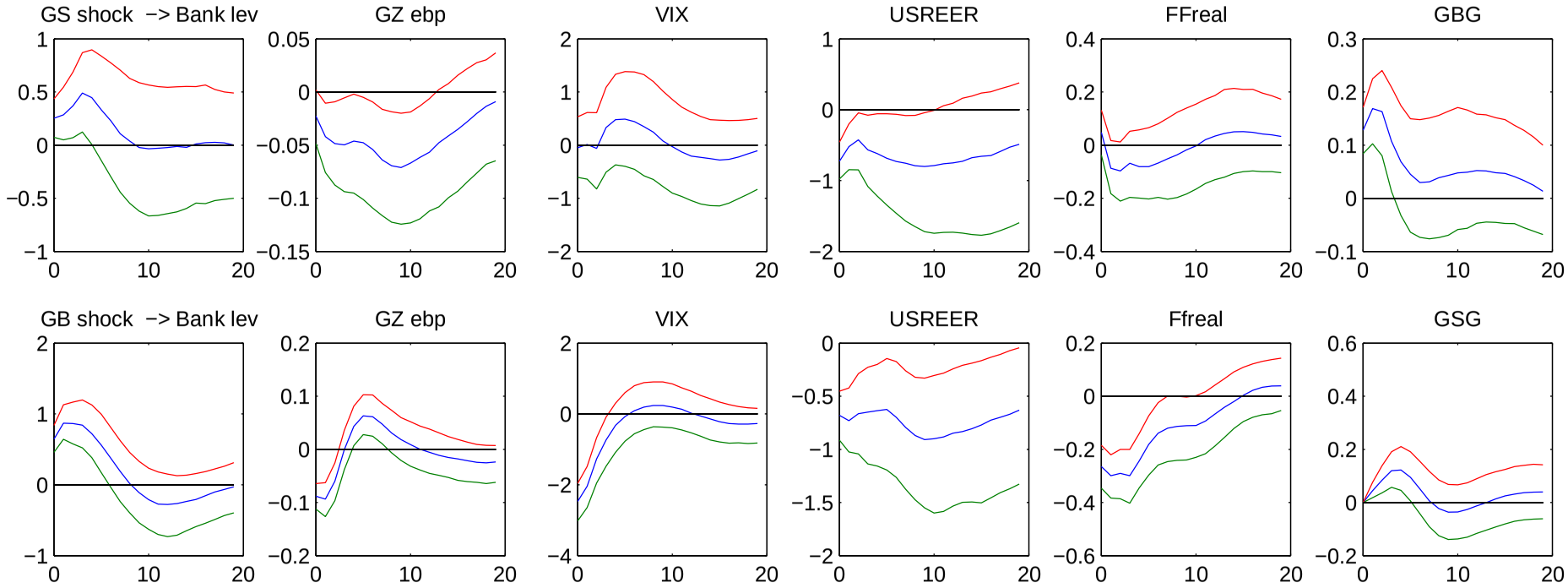

Figure 6. Impulse response functions from GSG and GBG shocks, taken from the benchmark BVAR. The order of the variables is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), and (7) the real Federal Funds target rate. The bootstrapped 90% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.

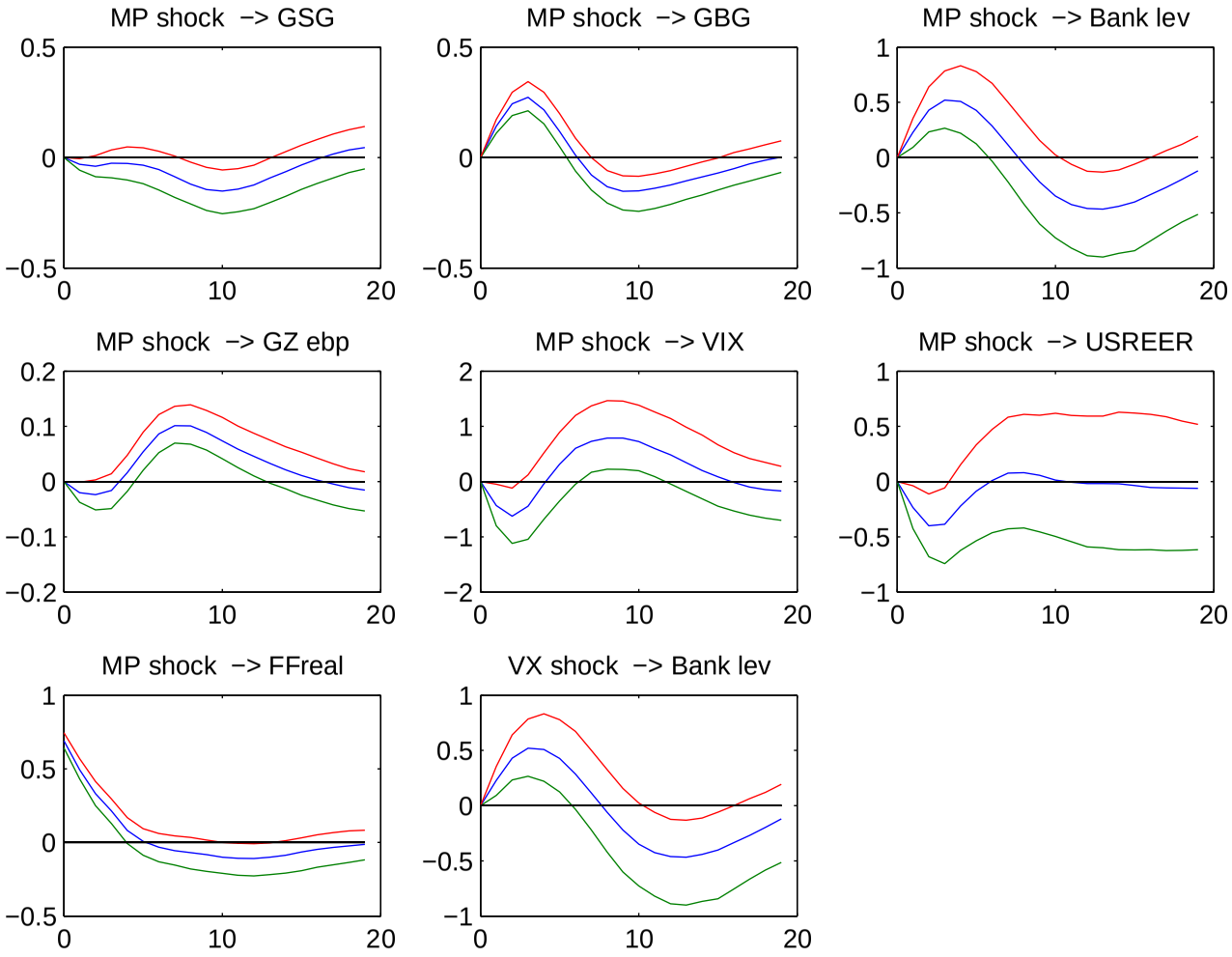

Figure 7. Impulse response functions from selected shocks, taken from the benchmark BVAR. The order of the variables is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), and (7) the real Federal Funds target rate. The bootstrapped 90% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.

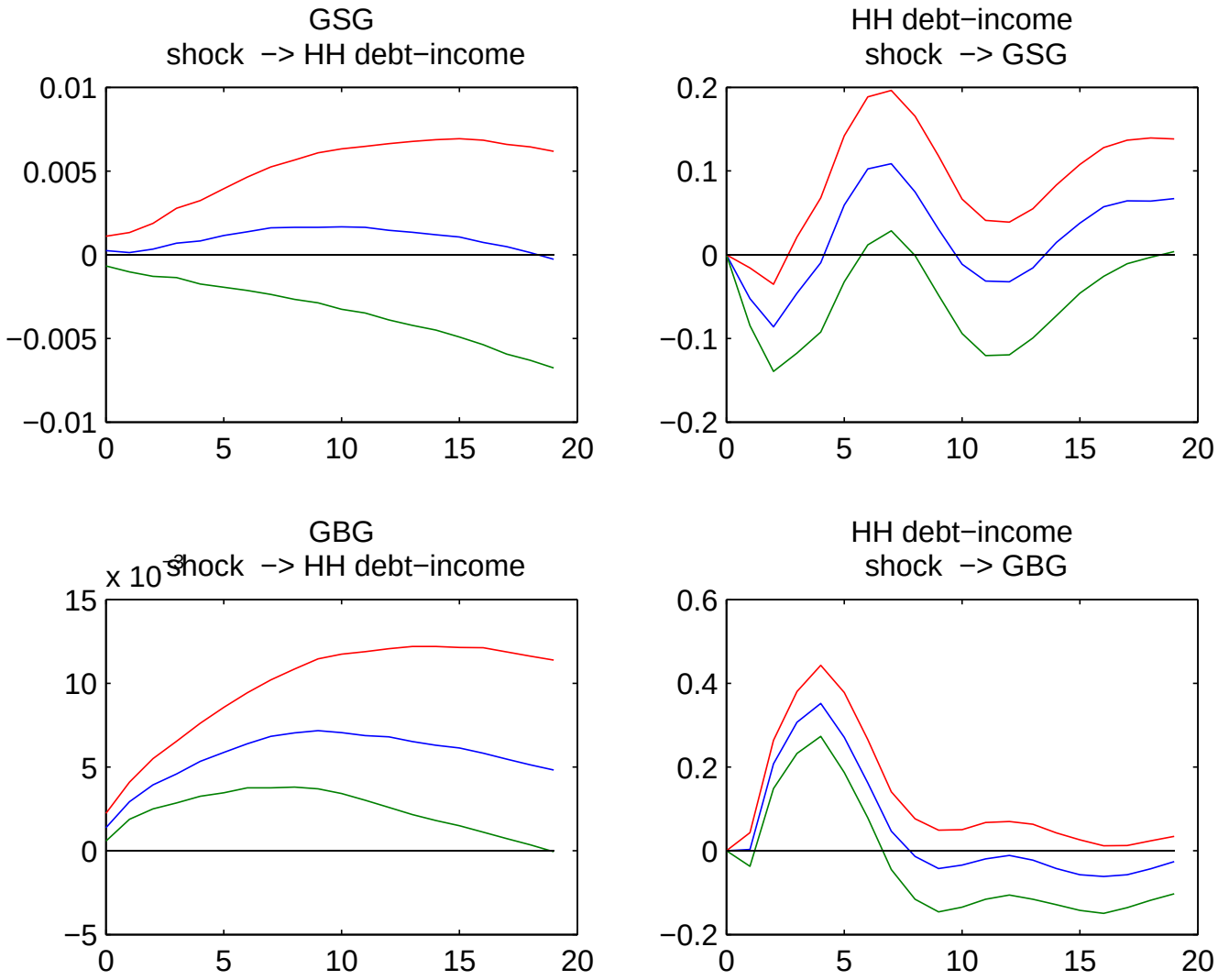

Figure 8. Impulse response functions from selected shocks, taken from BVAR #2. BVAR #2 is (1) GSG flows, (2) GBG flows, (3) household debt, (4) banking leverage, (5) the GZ excess bond premium, (6) the VIX index, (7) the US dollar real effective exchange rate (REER), and (8) the real Federal Funds target rate. The bootstrapped 90% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.

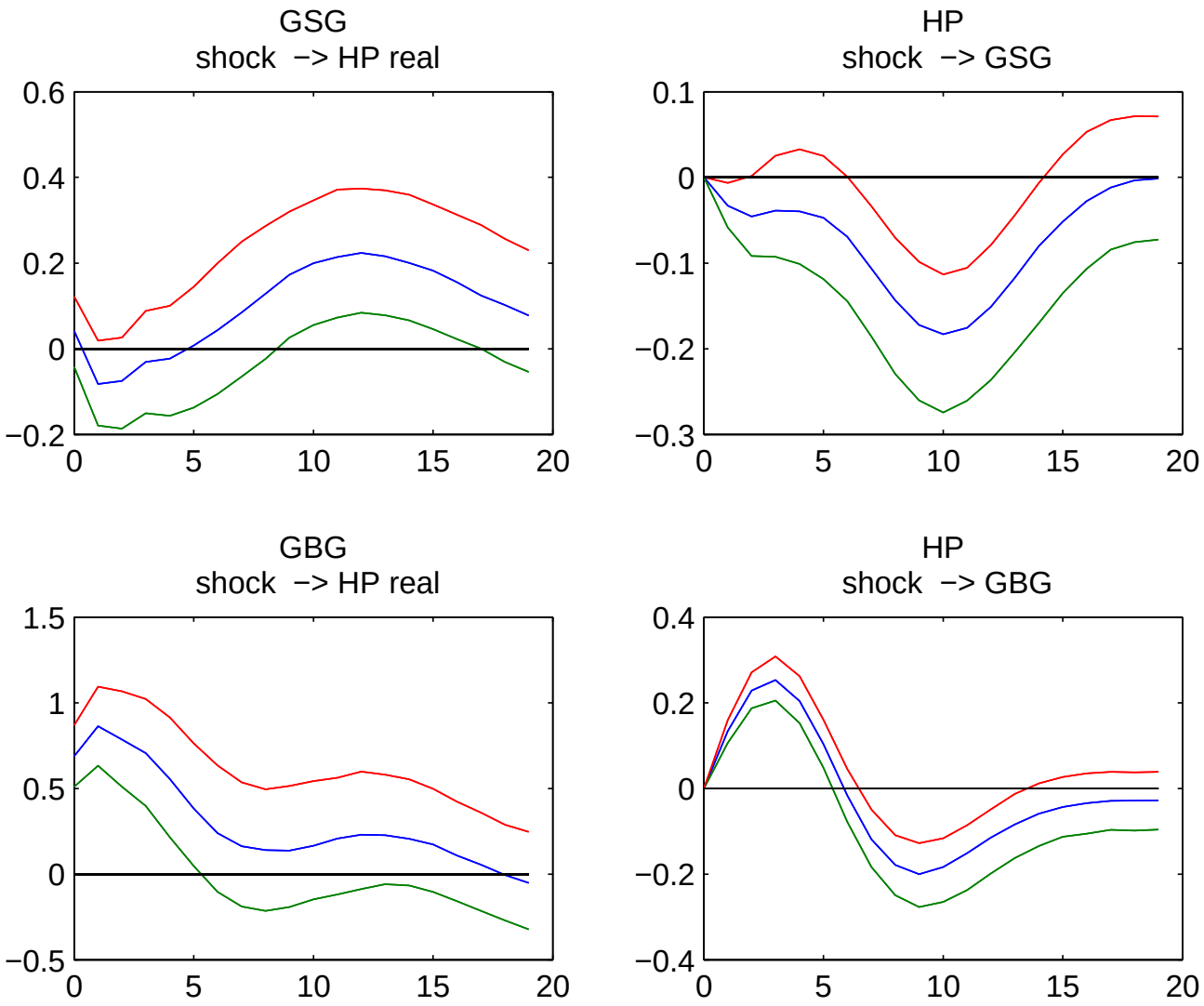

Figure 9. Impulse response functions from selected shocks, taken from BVAR #3. BVAR #3 is (1) GSG flows, (2) GBG flows, (3) banking leverage, (4) the GZ excess bond premium, (5) the VIX index, (6) the US dollar real effective exchange rate (REER), (7) the real house price index and (8) the real Federal Funds target rate. The bootstrapped 90% confidence bands are computed with 1000 replications; the sample period is 1990Q1-2010Q3.