Aggregate Shocks and the Two Sides of Credit Reallocation*

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Abstract

We construct two sides of quarterly gross credit reallocation for the U.S. economy: *business borrowing* gross flows of publicly traded companies and *bank lending* gross flows of commercial banks from the mid-to-late 1970s to 2012. We study the responses of credit creation, destruction, and reallocation for these two sides of credit relationships to a set of macroeconomic shocks—embodied and neutral technological shocks, monetary policy shocks, and excess bond premium shocks—in a structural vector autoregressive framework. Together, these shocks explain at most 20% of credit reallocation. Embodied technology shocks and excess bond premium shocks explain the largest portion of credit reallocation in lending but play a more limited role in explaining borrowing flows. We then study the different roles of allocative and aggregate shocks in driving cyclical movements in credit reallocation and find a sizably larger role for idiosyncratic shocks than for aggregate shocks. These results call for an important role for cross-sectional firm-level and bank-level heterogeneity in theoretical models with credit frictions.

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1 Introduction

Reallocation of resources across firms is a significant force in shaping aggregate productivity as well as capital and labor market dynamics. An extensive literature on the reallocation of workers and jobs across establishments and firms has anchored our understanding of the relationship between labor market dynamics and the business cycle (Davis, Haltiwanger, and Schuh, 1996). A similarly important role has been established for physical capital reallocation (Eisfeldt and Rampini, 2006). More recently, and in part because of the 2007-09 financial crisis, credit has received renewed interest as a channel that may slow factor reallocation even in what is perceived as a relatively frictionless economy such as the United States. Financial frictions can be amplified via working capital and external finance dependency channels, for example.

Studies such as Wasmer and Weil (2004) and Petrosky-Nadeau and Wasmer (2013) have shown in a general equilibrium framework that Diamond (1990)-type endogenous search frictions in both credit and labor markets amplify macroeconomic volatility through a financial accelerator mechanism that is quantitatively as important as fluctuations in the value of collateral studied in Kiyotaki and Moore (1997) and Bernanke, Gertler, and Gilchrist (1999). Search frictions in credit markets are also being incorporated in dynamic general equilibrium models with or without sticky prices (Reza, 2013; Beaubrun-Diant and Tripier, 2010). Yet, the empirical evidence on credit reallocation in the aggregate economy is currently limited to partial views both in terms of the side of the credit transactions and the period of analysis. Most notably, little is known about credit reallocation since the incipit of the recent global financial crisis.[1]

In this paper, we provide a comprehensive view of credit reallocation for the United States at a business cycle frequency between the 1970s and 2012, focusing on the following questions: What is the contribution of various shocks to credit market fluctuations? How different are credit market responses to allocative versus aggregate shocks?

[1]Dell'Ariccia and Garibaldi (2005) analyze bank lending flows from 1979 to 1999. Herrera, Kolar, and Minetti (2011) study firms' borrowing flows from 1952 to 2007 period. Other studies focusing on credit flows include Craig and Haubrich (2013), Contessi and Francis (2013), Herrera, Kolar, and Minetti (2014), and Hyun and Minetti (2014).

We approach these questions focusing on what we call the "two sides" of credit reallocation, that is we contrast bank lending and corporate borrowing. Aggregate data show clearly that over the past decades banks have lent progressively more to other agents than to corporate and noncorporate firms, and firms borrowed massively from sources other than depository institutions (see the next section). Therefore, we study credit reallocation on the bank side and on the corporate borrowers side to understand whether and how aggregate and allocative shocks affect credit growth and reallocation differently on the two sides of the credit relationships. This information is important form two perspectives. First, it permits the empirical evaluation of the effects of a set of identified typical aggregate shocks, which are generally embedded in general equilibrium models. Second, it offers a more complete view of the transmission of monetary and financial shocks through banks, and eventually to corporate borrowers. More precisely, what may appear as an important impact on bank lending may have little or no impact on firms' borrowing.(see also Ippolito, Perez, and Ozdagli, 2013).

Moreover, the literature tends to focus on one type of lending or another (see, for example Devrim Demirel, 2013). We contrast total lending with different types of bank lending (real estate, individual loans, and commercial and industrial loans [C&I]), as well all total borrowing with its short-term and long-term components.

By "credit reallocation" we primarily refer to the movement of credit between firms as well as between banks. In a given quarter, one bank may be increasing lending while another bank is decreasing lending. The sum of these increases and decreases across banks is one measure of inter-bank credit reallocation. Similarly, some firms may be increasing their debt finance and others decreasing it; The sum of such increases and decreases is a measure of inter-firm debt reallocation. Net credit growth, by contrast, considers only the *net* change in credit use by firms or lending by banks and therefore does not capture the broader scope of reallocation which can occur even if net credit (or debt) growth is zero.

We approach this problem using two methodologies. The first utilizes a structural vector autoregression (SVAR), identified using long-run and contemporaneous restrictions as proposed by Fisher (2006). Technology shocks are identified using long-run restrictions. Only investment-specific technology shocks produce long-run effects on the relative price of investment goods. Only neutral and investment-specific technology shocks affect average labor productivity in the long run.[2] Monetary shocks are identified in the standard manner(see Christiano, Eichenbaum, and Evans, 1999): Variables ordered before the federal funds rate in the VAR do not respond to a monetary shock within the same quarter. We also identify financial shocks as in Gilchrist and Zakrajšek (2012): We assume that variables ordered before the excess bond premium (EBP) in the VAR do not respond contemporaneously to financial shocks. We find that–together–these 4 shocks explain at most 20% of credit reallocation. Embodied technological shocks and EBP (financial) shocks explain the largest portion of credit reallocation in lending, but they play a much more limited role in explaining borrowing flows.

The second approach relies on a bivariate SVAR in the spirit of Davis and Haltiwanger (1999). We restrict short-run credit flows responses and cumulative reallocation responses to only allocative and aggregate shocks following an identification approach suggested by Davis and Haltiwanger (1999). We find a more sizable role for allocative shocks than for aggregate shocks essentially for all types of lending and borrowing flows.

Together, these results indicate an important role for cross-sectional firm- and/or bank-level heterogeneity in theoretical models with credit frictions.

The paper is composed of five sections. In Section 2, we present the data and methodology used for our analysis; Sections 3 and 4 discuss the methodology, identification, and results. We discuss the relationship between our work and the existing literature, and we conclude in section 5.

[2]These restrictions are motivated by the two-sector neoclassical growth model with investment neutral and embodied technology shocks, but also apply to models with additional endogenous variables and propagation mechanisms — for example, models with nominal rigidities.

2 Lending and Borrowing Credit Flows, and Other Data

We focus on two sides of credit reallocation constructed from micro data: bank lending reconstructed from the regulatory Call Reports, and nonfinancial corporation borrowing from Compustat.

Aggregate data from the Flows of Funds show that lending relationships by depository institutions are established not only with firms in the form of C&I loans but also with households in the form of individual loans and both households and firms in the form or real estate loans. Table 1 shows that the vast majority of aggregate bank loans are real estate loans (RE, 57.5 percent of total loans [TL] in 2012), followed by C&I loans (24.2 percent), and individual loans (IND, 18.3 percent). Understanding the effect of aggregate shocks on lending, therefore, also depends on understanding their effect of different types of loans. Table 1 also shows the sources of non-financial sector borrowing: The leading source in aggregate data are corporate bonds, followed by other instruments and bank loans only represent 13.2 percent of total borrowing by non-financial corporations. The "end-users" of credit, therefore, are affected by aggregate shocks through several channels other than direct bank lending.

Table 1 also shows that these flows have different cyclical properties. The last columns in this table are constructed using by detrending the stock of main types of loans from banks and loans to the nonfinancial corporate sector using the Hodrick-Prescott filter (HP) and then using the cyclical components of these levels. For each type of loans and debt we computed the standard deviation (σ/σ^{GDP}) and correlation with nominal GDP ($\rho(., GDP)$); we report relative standard deviations and correlations with real GDP in Appendix A. For consistency with the entity-level data discussed later we compute standard deviations and correlations between 1974:Q1 and the end of our firm- or bank-level sample, i.e. 2012:Q4.

The aggregate data match the bank-level data on the lending side relatively well but do not provide a good match on the borrowing side. In particular, bank lending data are available as quarterly outstanding non-mortgage loans to individuals (IND) and businesses

(C&I), as well as mortgage loans to individual and businesses (RE) from the Call Reports; their sum (excluding agricultural loans which account for a very small fraction of lending) is total loans, TL, as reported in the Flows of Funds data.

On the financing side, however, in our micro-data we cannot distinguish between types of debt. We have data available for total debt (TD) of large businesses decomposed into short-term (STD) and long term debt (LTD) components.[3] At the aggregate level, firm borrowing can be decomposed into bond and bank finance.

The publicly available Reports of Condition and Income database (Call Report Files) are the most accurate and complete bank-level lending data for the United States. The sum of IND, RE, and C&I loans—total loans—represents a complete measure of aggregate quarterly bank lending by the regulated banking system.[4] These files contain quarterly bank-level balance-sheet information for all banks regulated by the Federal Reserve System, Federal Deposit Insurance Corporation, and the Comptroller of the Currency. Banks report their individual-entity lending activities on a consolidated basis for the entire group of banks owned by the reporting entity. We used the data available at the time of this writing covering the quarters between 1978:Q1 and 2012:Q4 and encompassing several recessions. The number of banks filing Call Reports fell from more than 15,000 in 1978 to about 7,000 entities in 2012 due to mergers, acquisitions, and failures. In order to take into account consolidation, entry, and exit we match the Call Report data with the National Information Center's transformation table from the Board of Governors of the Federal Reserve System.

We create measures of gross flows, following Dell'Ariccia and Garibaldi (2005)—credit expansion and contraction—but using the Davis and Haltiwanger (1992) definition of loan growth.

For each bank i and period t, $tl_{i,t}$ is the value of nominal loans in one quarter and $\Delta tl_{i,t} = tl_{i,t} - tl_{i,t-1}$ is the change in total loans. From this baseline definition, we make adjustments to take into account mergers and acquisitions as well as failures.

[3]We refer to the Covas and Den Haan (2012) analysis of the cyclical property of debt and equity financing, though we do not consider equity here.

[4]http://www.chicagofed.org/economic_research_and_data/commercial_bank_data.cfm.

We define "loan creation" as the sum of the change in bank loans at all banks that increased their loans since the previous quarter. We define "loan destruction" as the absolute value of the decrease in loans at all banks that decreased their loans since the previous quarter. In other words, a bank expands credit in a given period if its credit growth is positive and contracts credit in a given period if its credit growth is negative. Then "gross flows" is the sum of creation and destruction, whereas "net flows" is the difference between the two. In order to aggregate our data from individual bank Call Reports and avoid double-counting, we correct loan flows for mergers and acquisitions as follows.

If bank i (the surviving bank) acquires bank j (the non-surviving bank) in period t, then the loan portfolio for bank j is zero or $tl_{j,t} = 0$, while the loan portfolio for the surviving bank includes the previous balances of the acquired bank plus its net loan changes, or $\Delta tl_{i,t} = tl_{i,t-1} + \Delta tl_{i,t} + tl_{j,t-1} + \Delta tl_{j,t-1}$. Thus, we adjust the change in bank $i's$ loans by subtracting the loans of bank j in $t-1$ from the change in bank i's loans and add them to the difference for bank j. The adjusted change in the loan portfolios should then be $\Delta \tilde{tl}_{i,t} = \Delta tl_{i,t} - \sum_{k=1}^{N} \phi_{ik}(t) tl_{k,t-1} - \psi_i(t) \Delta tl_{i,t}$, where $\phi_{ik}(t)$ is an indicator function that takes a value of 1 if bank i acquires bank k at some s between $t-1$ and t and the value 0 otherwise. Thus, if bank k is acquired by bank i, its loans from the previous period are subtracted from the raw change in bank i's loan portfolio. Similarly, $\psi_i(t)$ is an indicator function that is equal to 1 if bank i is itself acquired (by some other bank) between period $t-1$ and t. Thus, we keep the changes in an acquired bank's loan portfolio with the acquired bank for the period of acquisition and remove them from the acquiring bank. There are two exceptions to this rule: If the non-surviving bank was divided among several banks, unless we could otherwise determine what share of the loans the acquiring banks received, we divide the changes in lending of the acquired bank by the number of acquiring banks and remove part of the new credit from each of the acquiring banks. The other exception is if the original bank survives the merger or acquisition (keeps its own charter); in that case, we leave all the changes in credit with the original bank and none with the newly formed banks.

We used data from the National Information Center to identify when banks experienced a transformation—for example, a merger or acquisition (either as the acquirer or acquiree)—with discontinuation of one of the involved bank's charter, a split, sale of assets, or merger without a charter discontinuation or a failure. These data are matched with Call Report data on bank balance sheets and used to adjust loan totals (and subcategories of loans) as in Contessi and Francis (2013).[5]

We reconstruct the gross flows using the following procedure. We first compute *adjusted credit growth rates* $\tilde{g}_{it}$, defined as $\tilde{g}_{it} = \Delta\tilde{tl}_{it}/[0.5 * (tl_{it-1} + tl_{it})]$ (i.e., the ratio between the adjusted change in total loans between t and $t-1$), $\Delta\tilde{tl}_{it}$, and the average value of loans between t and $t-1$, a variable that bounds the adjusted credit growth rate between -2 and +2. Naturally $\tilde{g}_{it}$ is positive for the generic bank i if it has expanded loans between t and $t-1$ and is negative in the opposite case.

We then aggregate individual adjusted growth rates over the share of the population of banks for which $\tilde{g}_{it}$ is positive, as follows:

$$POS_t = \sum_{i|\tilde{g}_{it}\geq 0}^{N} \tilde{g}_{it} \left[\frac{0.5(tl_{it-1} + tl_{it})}{\sum_{i=1}^{N} 0.5(l_{it} + l_{it-1})} \right]$$

We calculate a similar measure for banks that are decreasing loans between consecutive periods, $\tilde{g}_{it} < 0$:

$$NEG_t = \sum_{i|\tilde{g}_{it}< 0}^{N} |\tilde{g}_{it}| \left[\frac{0.5(tl_{it-1} + tl_{it})}{\sum_{i=1}^{N} 0.5(l_{it} + l_{it-1})} \right]$$

With these two measures of credit expansion (POS_t) and credit contraction (NEG_t), we can define the net growth rate of credit as their difference

$$NET_t = POS_t - NEG_t$$

and a measure of reallocation in excess of the net credit change

$$EXC_t = POS_t + NEG_t - |NET_t|.$$

[5] We cannot distinguish between two different events that can cause credit to contract: loan write-offs for failed and defaulted loans or loans that are not rolled over upon expiry. To the extent that different mechanisms are involved in these two types of credit contraction, our analysis is unable to distinguish between them.

This procedure is followed for all four groups of loans (IND, RE, C&I, and TL). The flows are available in an online appendix and are plotted in Figure 1.

2.1 Firms Borrowing Flows in Nonfinancial Corporate Business Data

The Call Reports are not necessarily a good measure of firm and household borrowing for a variety of reasons. First, these are outstanding loans, and they do not necessarily measure "new loans" because their level can vary from quarter to quarter for a variety of reasons (Contessi and Francis, 2013). Second, the rise of securitization in the later 1990s and 2000s suggests that Call Reports loans may no longer be an appropriate measure of the full extent of bank lending. When a loan is securitized, it is effectively moved off the balance sheet, and loans surviving in bank assets are potentially just a fraction of the overall outstanding amount lent. A particularly evident proof of the importance of this process is the implementation of FAS 166 and FAS 167 in early 2010 that induced many large banks to bring back a large amount of previously securitized consumer loans on their balance sheets thereby inducing an apparent but illusionary increase of consumer lending in aggregate data.

We construct borrowing flows using Standard and Poor's Full-Coverage Compustat data in a quarterly format.[6] These data refer to all publicly traded U.S. firms and are therefore a subsample of corporate borrowers that excludes small firms. As discussed in other studies these firms represent a sizable portion of the U.S. GDP ranging between 40 and 50 percent of U.S. GDP (see Covas and Den Haan 2012; Gabaix 2011).

Short-term debt, which includes long-term loans with residual maturity shorter than one year, is primarily used during the time period that runs between financing of current business activity such as paying wages and for materials or inventories and the cashing of revenues. Long-term financing is used typically to finance long-term activity (such as capital spending, growth of productive capacity, or acquisitions). The inclusion of debt with one year of remaining maturity in short-term debt makes the distinction between the two types of debt less clear, but there is no mechanism to remove debt with less than one year maturity

[6] Annual flows are available in an online appendix.

from the short-term account.

Total debt is the sum of short- and long-term debt. As is customary in the literature, we exclude accounts payable to suppliers (trade credit), which is normally unrelated to a firm's financing strategy but more connected to its commercial and marketing policy.

While we are able to distinguish between short-term and long-term debt, and equity, these data do not allow the distinction between different sources of financing in the corporate debt structure—for example, bonds and bank loans. This is an important consideration because there is considerable evidence (for example, Becker and Ivashina 2011) that firms substitute corporate bonds for bank loans during episodes of credit tightening.

Borrowing flows are constructed analogously to lending flows except that the information we use to control for mergers and acquisitions is not as detailed as it is for banks.

We adopt the same strategy as in Herrera, Kolar, and Minetti (2011) to deal with mergers, and acquisitions, and exits, inspired by Ramey and Shapiro (1998), to whom we refer for details. We focus on quarterly data for the period between 1974:Q1 to 2012:Q4.[7] First, we drop firms that appear as new entries in the data and also have a ratio between the end-of-period gross capital and end-of-period net capital larger than 120%. In addition, we categorize exits from the Compustat dataset due to mergers and acquisitions, bankruptcy, or liquidation as credit reductions, similar to Ramey and Shapiro (1998). Other exits are not counted as credit contraction (e.g., firms exiting Compustat because they became private). We use the fiscal year quarters as reported in Compustat and do not need to correct for inflation as this variable appears in our SVAR analysis. We double check the results using calendar year quarters. Like (Herrera, Kolar, and Minetti, 2011), we also exclude firms in the industrial classification covering "finance, insurance, and real estate firms" (SIC codes 6000-6999).

For borrowing flows (short and long-term debt and total debt), we follow Herrera, Kolar, and Minetti (2011) and define γ_{it} as the symmetric growth rate between $t-1$ and t, M as the number of Compustat firms in a given year, and TD as $TD_{it} = \sum_{i=1}^{M} 0.5 \times (td_{it-1} + td_{it})$;

[7]Quarterly data are available since 1968:Q1 but they are incomplete prior to 1974:Q1.

aggregate LTD and STD are defined analogously. Similar to the lending flows, we aggregate individual growth rates over the share of the population of firms for which γ_{it} is positive, as follows:

$$POS_t = \sum_{i|\gamma_{it}\geq 0}^{M} \gamma_{it} \frac{0.5 \times (td_{it-1} + td_{it})}{TD_{it}}.$$

For firms who decrease their debt (short-, long-, or total-debt) we have a similar expression ($\gamma_{it} < 0$):

$$NEG_t = \sum_{i|\gamma_{it}<0}^{M} |\gamma_{it}| \frac{0.5 \times (td_{it-1} + td_{it})}{TD_{it}}$$

With these two measures of borrowing expansion (POS_t) and borrowing contraction (NEG_t), we can define the net growth rate of borrowing as their difference (NET_t), debt reallocation (SUM_t) as the sum of debt creation and destruction, and a measure of reallocation in excess of the net borrowing change (EXC_t) as $SUM_t - |NET_t|$. We provide a detailed description of the variables and data source in the Appendix.

2.2 Comparison of Lending and Borrowing Flows

Figures 1 and 2 plot the four-quarter moving averages for the eight credit variables we study. We plot credit expansion and contraction, as well as net flows and excess reallocation. Summary statistics are reported in Table 2.

Figure 1 shows the time series patterns of total loans and each component of total loan flows: C&I (commerical & industrial loans), IND (loans to individuals) and RE (real estate loans). We depict the series of credit creation (POS) and destruction (NEG), as well as excess reallocation (EXC) and net reallocation (NET) for each lending type separately. Considering first the patterns in credit creation and destruction, there are three notable features of the data.

First, the POS series of total lending as well as of each component is strongly procyclical (confirmed in Table 2), while the NEG series for each flow type displays varying degrees of countercyclicality with real GDP.

Second, particularly for total loans, credit creation—though dampened—remains above credit destruction during recessions. However, during the Great Recession, net total flows turned negative and remained so for more than two quarters, a unique event in the post-Volcker era. A similar pattern is observed for real estate loans. The other components of loan flows, notably commercial and industrial lending, also exhibited negative net flows during the Great Recession, but this is a typical feature during or, more commonly, after a recession for these flows.

The third feature we observe is that excess credit reallocation, defined as the sum of credit creation and destruction minus the absolute value of the net, typically rises during recessions. The Great Recession was also different in this respect. Net reallocation for each of the components of flows was flat throughout the recession and declined moderately afterward. This fact could is related to the evidence presented by Foster and Haltiwanger (2013) that the intensity of input and output reallocation across producers declined during the Great Recession. They conjecture that the decline in productivity enhancing reallocation could be due to credit constraints that prevent resources from flowing to more productive firms.

In Table 2, we document stylized facts regarding the first and second moments of credit flows, as well as their correlation with real GDP. We first confirm that credit creation is procyclical with respect to GDP, while credit destruction is countercyclical (a fact also noted by Herrera, Kolar, and Minetti, 2011) for all types of loans we consider. Second, on the lending side, we find both credit creation and destruction are highly volatile, with respective coefficients of variation of 34 and 46. The relative volatility of credit creation with respect to output volatility is 1.61 and it is 2.30 for credit destruction. Credit flows volatility is significantly larger than, for example, job flow volatility: The credit creation series is 3 times more volatile than job creation (relative to output volatility) and credit destruction is twice as volatile as job destruction relative to output volatility: 0.49 and 1.10, respectively.

On the borrowing side, credit creation and destruction are significantly more volatile than lending flows, with coefficients of variation of 307 and 337, respectively, which are largely driven by the volatility of short term debt. On the firm borrowing side, the positive component of credit flows has similar volatility to that of POS for lending, but credit destruction for borrowing flows is less countercyclical than NEG for lending (-0.36 versus -0.45). This latter result may be due to the fact that borrowing for firms includes bonds and other commercial paper in addition to loans, potentially altering the counter-cyclicality of borrowing. We also find that short term debt is much more countercyclical than total firm borrowing and equity is nearly acyclical. Debt flows are more volatile than real GDP but less volatile than lending flows relative to GDP.

Figure 3 depicts the correlations between total debt in period t and total lending in periods $t+i$ for five leads and five lags ($i=[-5,+5]$) for each of the following measures of credit: net expansion, excess reallocation, credit creation, and credit destruction. We find that net lending flows are positively correlated with net debt flows and lead net debt flows by three quarters. Thus, net increases in lending behavior occur before we observe increases in debt holdings on firm balance sheets; the same holds true for net decreases. This relationship likely reflects the fact that the majority of bank lending consists of real estate and consumer loans and firms have several sources of debt other than banks. The correlation between excess reallocation of total debt and lending reaches a maximum at a lag of one quarter, implying that lending excess reallocation leads debt reallocation. These correlations are relatively weak and are zero at a lag of one quarter, suggesting that (i) excess reallocation across borrowers primarily affects consumer lending and (ii) the reshuffling of bank lending is not strongly correlated to the reallocation of debt across firms. The bottom two panels of figure 3 show correlations between credit creation for lending and borrowing and of credit destruction for lending and borrowing, from left to right. Credit creation is roughly symmetric around zero, with the peak correlation (positive) at zero, so that adjustments in credit creation by banks and creation of debt by firms occur contemporaneously. The negative component of credit allocation flows adjusts differentially: declines in total lending lead declines in debt by three quarters. Again, this likely reflects multiple sources of credit for firms and bank credit primarily being directed toward households.

Figure 4 depicts the correlations between total firm borrowing (debt) in period t and C&I lending in periods $t+i$ for five leads and five lags ($i = [-5, +5]$) for the same measures. The top left graph shows that the absolute value of the maximum correlation of the net movements of total debt with C& I occurs at one lag, suggesting net changes in C&I lending occur *before* net changes in debt. This implies that banks reduce overall C&I lending before firms reduce debt. The top-right graph suggests that movements in excess reallocation of debt and C&I lending are contemporaneous. The two bottom panels depict the correlation between the positive component (left) of debt flows and C&I lending and the negative component (right), respectively. In both cases, the correlations are largest at a one-quarter lag, implying that changes in credit flows occur first in C&I lending and then are later reflected in debt flows for firms. However, movements in C&I lending are more closely related to changes in firms' debt flows than are movements in total bank lending. Since there is some adjustment in C&I lending prior to changes in total debt, firms could potentially adjust bonds, commercial paper, or other debt initially.

2.3 Other Data

We summarize the variables used in the VAR analysis in Table 3, as well as their source, and whether they are available in the online appendix.

The majority of our other data (see Table 3) are from public sources, namely the output (Y) deflator, P_Y (GDP deflator), the measure of hours per capita $h = \log(H/N)$, where H is hours of all workers (non-farm business sector), average labor productivity $ALP = \log(Y/H)$, the civilian non-institutional population 16 years of age and older L, the unemployment rate u, and the federal funds rate $FFED$ are all from FRED of the Federal Reserve Bank of St. Louis.

In addition, we also construct or obtain the following series that are not publicly available:

- The investment (I) deflator (P_I) is constructed following Fisher (2006) and is available in an online appendix. The 2013 comprehensive BEA revision does not allow us to reconstruct this series for 2012, so the VAR analysis will be limited to use 2011:Q4 as the end of the sample.

- The EBP is from Gilchrist and Zakrajšek (2012). It is constructed from the credit spread of U.S. nonfinancial corporate bonds over Treasury securities. The index is decomposed into two parts: a component that captures the systematic movements in default risk of individual firms measured using Merton (1974)'s distance to default model and a residual component, the excess bond premium, EBP, which is the variation in the average price of bearing exposure to U.S. corporate credit risk not otherwise compensated for by the premium for expected default.

- The last time is the shadow federal funds rate constructed by Krippner (2013) for the period from October 2008 onwards which is characterized by near a zero federal funds rate.

3 Medium-size SVARs

In this section, we detail our structural VAR exercises, first discussing the methodology and identification and then the results.

3.1 Methodology

Consider the following reduced-form VAR representation of the $(n \times 1)$ vector, Z_t[8]:

$$\begin{aligned} Z_t &= A(L) Z_{t-1} + \upsilon_t, \; E(\upsilon_t \upsilon_t') = V, \\ A(L) &= A_1 + A_2 L + ... + A_p L^p, \; p < \infty \end{aligned}$$

The reduced-form residuals, υ_t, are related to the structural shocks, ϵ_t, by the structural matrix A_0: $\epsilon_t = A_0 \upsilon_t$. The structural shocks are orthogonal to each other (i.e., $E(\epsilon_t \epsilon_t') = I$).

[8] In the estimation, two lags (i.e., $p = 1$) and a constant were included. For ease of exposition, the constant is omitted hereafter.

Following Fisher (2006), technology shocks are identified using long-run restrictions. Investment-specific technology shocks are the only shocks that have a long-run effect on the relative price of investment. Neutral technology shocks and investment-specific technology shocks are the only shocks that affect average labor productivity in the long run. The long-run effects of the structural shocks are given by $Z_\infty = \Theta\epsilon_t$, where $\Theta \equiv \left[I - A\left(1\right)\right]^{-1} A_0^{-1}$. Assuming that the growth rate of the relative price of investment goods and the growth rate of labor productivity are the first two elements of the vector Z, the identifying assumptions reduce to the first two rows of the matrix Θ with the following structure:

$$\Theta\left(1:2,:\right) = \begin{bmatrix} \theta_{11} & 0 & 0_{1\times(n-2)} \\ \theta_{21} & \theta_{22} & 0_{1\times(n-2)} \end{bmatrix}.$$

Monetary policy shocks are identified as in Christiano, Eichenbaum, and Evans (1999) by assuming that the variables ordered before the interest rate in the VAR do not respond contemporaneously to monetary shocks. Financial shocks are identified as in Gilchrist and Zakrajšek (2012): Variables ordered before the EBP in the VAR do not respond contemporaneously to financial shocks.

Notice that the VAR is overidentified. Two rows of A_0 are identified by imposing the long-run restrictions. The identification of additional shocks with contemporaneous restrictions poses additional zero restrictions on the columns of A_0.

The data used in the analysis are summarized in Table 3. The vector Z_t includes the growth rate of the relative price of investment goods (Δp_I), the growth rate of labor productivity (ΔALP), hours per capita (h), inflation (π), the excess bond premium (EBP), the shadow federal funds rate constructed by Krippner (2013) ($FFED^S$), gross credit creation (POS), and gross credit destruction (NEG):[9]

$$Z = \left[\Delta p_I, \Delta ALP, h, \pi, EBP, FFED^s, POS, NEG\right]'.$$

[9]As in Craig and Haubrich (2013), gross credit flows are ordered last. Our results are robust to ordering gross credit flows before the EBP.

Other variables of interest can be constructed from the variables included in Z_t. Net credit growth is given by the difference of the credit creation and destruction rates, $NET = POS - NEG$. Gross credit reallocation is the sum of credit creation and destruction, $SUM = POS + NEG$. Excess credit reallocation is the credit reallocation in excess of credit growth, $EXC = GCR - |NET|$. The relative price of investment goods, productivity, and output per capita are derived in the obvious way:

$$\begin{aligned} p_I &= (1-L)^{-1}\Delta p_I, \\ ALP &= (1-L)^{-1}\Delta ALP, \\ \frac{Y}{N} &= ALP + h, \end{aligned}$$

where L is the lag operator.

3.2 Results

Figures 6 through 8 plot the impulse response functions of both sides (borrowing and lending) of credit flows to the four shocks we identify. The size of the shocks is 1 standard deviation; we consider expansionary shocks. Impulse Response Functions (IRFs) to a monetary shocks(M-shock) are shown in blue, to a financial shock (F-shock) in red, to an embodied technology shock (E-shock) in green, and to a neutral technology shock (N-shock) in purple. The sign of the shocks is chosen so that it eventually has an expansionary effect on output: The shock is positive for a neutral technology shock and negative for other shocks. Notice that monetary shocks and EBP shocks have a zero impact response on output by construction. In the case of the monetary policy shock, a negative innovation amounts to a monetary easing (i.e., a reduction in the fed funds rate).

For comparison, the relevant papers are those by Fisher (2006), DiCecio (2009), and Altig, Christiano, Eichenbaum, and Lindé (2011), who identify embodied, neutral technology, and monetary shocks in a SVAR framework. Also related is the work of Canova, Lopez-Salido, and Michelacci (2013), which studies technology shocks and job flows. See also Bernanke, Gertler, and Gilchrist (1999), Adrian and Shin (2010), and Gertler and Kiyotaki (2010).

IRFs to a monetary shock. The IRFs to a monetary shock are conventional. The point estimates for output and hours are positive, and inflation increases and remains persistently above its equilibrium value. This is consistent with the literature (see Christiano, Eichenbaum, and Evans, 1999), which typically finds long-lasting hump-shaped expansionary effects of a monetary shock that lowers the federal funds rate. The inclusion of credit flows appears to weaken the real effects of monetary policy. A standard monetary VAR using the credit flows data from Dell'Ariccia and Garibaldi (2005) returns standard-looking IRFs; the IRFs using our credit flows data on the same sample (1979:Q2-1999:Q2) are similar. Extending the sample from 1999:Q2 to 2011:Q4 makes the effect of a monetary shock even weaker.

IRFs to technology shocks. The IRFs for technology shocks, are consistent with Fisher (2006), though with the inclusion of either total lending or total debt, they are less pronounced.

IRFs by type of flows. Figures 7-8 contrast the IRFs from our benchmark VAR with IRFs of VARs that include gross credit flows by type; (short-term and long-term debt) instead of the overall flows included in the benchmark.

Variance decompositions. Figures 9 and 10 plot the corresponding forecast error variance decompositions (FEVDs). By construction, at long horizons output is driven by the two technology shocks, and the price of investment is driven by the embodied technology shock. When other shocks are identified, the role of financial shocks in explaining the forecast error variance (FEV) of output and inflation is diminished with respect to Gilchrist and Zakrajšek (2012); Financial shocks still play an important role for the FEV of the Fed Funds rate and, especially, of hours. Monetary shocks appear to be unimportant, except for the short-horizon FEV of the Fed Funds rate. The fraction of the FEV of the credit flows, credit growth, and credit reallocation explained by the four shocks we identify is below 30 percent; financial shocks are the most important, followed by embodied technology shocks.

Tables 4 and 5 report the FEVD at business cycle frequencies, computed as described in Altig, Christiano, Eichenbaum, and Lindé (2011, pp. 235-36). More of the cyclical variance of credit flows is accounted for by the shocks we identify when the cyclical variation is extracted with a band-pass filter rather than an HP filter. The four shocks we identify explain up to 40 percent of the cyclical variance of credit destruction and credit growth from the lending side (see Table 4). For borrowing flows (see Table 5), less than 20 percent of the cyclical variance of credit creation, destruction, growth, and reallocation is accounted for by the four structural shocks. Financial shocks are the most important both for lending and borrowing flows.

Historical decompositions. Figures A.1 and A.2, in the appendix, plot the historical decomposition for TD and TL. While the identified shocks do not account for the high-frequency movements of credit flows, financial shocks account for most of the sharp increase in credit destruction and for about half of the fall in credit creation associated with the Great Recession. Thus, the financial shock explains most of the negative credit growth that occurred from 2008:Q2 to the end of the sample.

4 Bivariate SVARs

In this section, we describe the methodology used determine the importance of allocative versus aggregate shocks. Second, we describe the identification and results.

4.1 Specification

In the context of a bivariate model, consider a vector gathering credit creation and destruction rates and a vector containing i innovations to the structural disturbances ($i = AGG, ALL$; i.e. aggregate and allocative) that drive the observed rates of creation and destruction. These two vectors are described as $Y_t = [POS_t, NEG_t]^{'}$ and $\varepsilon_t = [\varepsilon_{AGGt}, \varepsilon_{ALLt}]'$.

We assume that the structural innovations ε_t and the observed outcomes Y_t have a moving average representation:

$$Y_t = B(L)\varepsilon_t \text{ with } B(0) = B_0, \tag{1}$$

where $B(L)$ is an infinite-order matrix lag polynomial and B_0, the diagonal elements, are normalized to unity.

From the reduced-form VAR estimates we obtain

$$Y_t = D(L)\eta_t \text{ with D(0)=I,} \tag{2}$$

where $D(L)$ is also an infinite-order matrix lag polynominal, implied by coefficients in the VAR representation of Y_t, and $\eta_t = [POS_t, NEG_t]'$ is the vector of reduced-form innovations. Then, from expressions (1) and (2) we obtain $\eta_t = B_0\varepsilon_t$ and $B(L) = D(L)B_0$.

Thus, a full knowledge of B_0 will solve $B(L)$ and η_t, and further on $\varepsilon_t = [\varepsilon_{AGGt}, \varepsilon_{ALLt}]'$. Since the knowledge of B_0 is not provided by the time series data on Y_t, we need a priori information to identify the role played by structural disturbances.

4.2 Weak Restrictions on Range of the Structural Parameters

Let b_{ij} denote the element in the ith row and jth column of B_0. Let $B_{ij}(l)$ and $D_{ij}(l)$ denote the elements in the ith row and jth column of the matrices describing responses at lag l to the structural innovations and the reduced-form innovations, respectively. Let $\rho(x, y)$ denote the correlation between x and y.

Conditions (i) through (iii) provide the first set of identifying assumptions. In practice, we combine the weak restrictions on contemporaneous shock responses with a restriction on the covariance of the structural innovations:

(i) $b_{NEG,AGG} < 0$,

(ii) $b_{POS,ALL} > 0$,

(iii) $\rho(\varepsilon_{AGGt}, \varepsilon_{ALLt}) = 0$.

Conditions (i) and (ii) reflect the qualitative character of the effects of aggregate and allocative disturbances on the response of credit creation and destruction rates.

- Aggregate disturbances → creation and destruction move in opposite directions

- Allocative disturbances → creation and destruction move in the same direction.

Condition (iii) imposes a zero covariance between aggregate and allocative innovations. The system $\eta_t = B_0 \varepsilon_t$ then becomes

$$\eta_{POSt} = \varepsilon_{AGGt} + b_{POS,ALL} \varepsilon_{ALL_t} \eta_{NEGt} = b_{NEG,AGG} \varepsilon_{AGG_t} + \varepsilon_{ALL_t}. \tag{3}$$

Using restriction (iii), we obtain the following second-moment conditions:

$$\sigma^2_{POS} = \sigma^2_{AGG} + b^2_{POS,ALL} \sigma^2_{ALL} \tag{4}$$

$$\sigma^2_{NEG} = b^2_{NEG,AGG} \sigma^2_{AGG} + \sigma^2_{ALL} \tag{5}$$

$$\sigma_{POS,NEG} = b_{NEG,AGG} \sigma^2_{AGG} + b_{POS,ALL} \sigma^2_{ALL} \tag{6}$$

where σ^2_{POS}, σ^2_{NEG}, and $\sigma_{POS,NEG}$ include the elements of the reduced-form covariance matrix.

Because there are four unknowns on the right side of these moment conditions, (iii) implies a one-dimensional under-identification of the VAR system. In fact, combining the moment conditions yields a one-to-one mapping between $b_{NEG,AGG}$ and $b_{POS,ALL}$:

$$b_{POS,ALL} = \frac{\sigma_{POS,NEG} - b_{NEG,AGG} \sigma^2_{POS}}{\sigma^2_{NEG} - b_{NEG,AGG} \sigma_{POS,NEG}}. \tag{7}$$

4.3 Tighter Restrictions on the Structural Parameter Range

Because conditions (i)-(iii) only limit the permissible combinations on $b_{NEG,AGG}$ and $b_{POS,ALL}$, we place the following tighter qualitative restrictions:

(i)' $b_{POS,ALL} \leq -1$, which implies that the contemporaneous credit destruction response to an aggregate innovation must be at least as large as the contemporaneous creation response.

(ii.a)' $|b_{POS,ALL}| \leq 1$, which implies that the contemporaneous credit creation response to an allocative innovation must be smaller than the contemporaneous destruction response.

(ii.b)' $\sum_{l=1}^{m} B_{11}(l) > 0$ for all m such that $2 \leq m \leq M$ requires that an allocative shock must have a positive cumulative effect on credit creation at every horizon from 1 to $M-1$ periods after the initial impulse.

A standard representative agent model would have $b_{NEG,AGG} = -1$ and $b_{POS,ALL} = 1$ as natural references. If $b_{NEG,AGG} = 1$, then creation and destruction respond symmetrically to aggregate shocks. If $b_{POS,ALL} = 1$, then creation and destruction respond symmetrically to an allocative shock; in other words, aggregate credit would not be affected by an allocative shock.

4.4 Graphical Representation of the Restrictions

Given this mapping between parameters, the inequality restrictions (i) and (ii) determine a locus of pairs, $\{b_{NEG,AGG}, b_{POS,ALL}\}$; these pairs satisfy all three identifying assumptions once the VAR is estimated. The relationships are plotted in Figure 11, A.4, and A.3 for the estimated VARs. These graphs should be interpreted as follows:

In each group of charts—for example, Figure 11—the first row represents the permissible values of parameters that satisfy the imposed conditions, the second row represents the corresponding variance, and the third row represents the FEVD of allocative shocks for credit growth and credit reallocation.

Equation (7) can be rewritten as

$$b_{NEG,AGG} = \frac{\rho_{POS,NEG} - b_{POS,ALL}\sigma^2_{NEG}}{\sigma^2_{POS} - b_{POS,ALL}\rho_{POS,NEG}}.$$

Notice that Eq. (7) has vertical and horizontal asymptotes:

$$\begin{aligned}
\lim_{b_{NEG,AGG} \to \left(\sigma^2_{NEG}/\rho_{POS,NEG}\right)^{\pm}} b_{POS,ALL} &= \pm\infty, \\
\lim_{b_{POS,ALL} \to \left(\sigma^2_{POS}/\rho_{POS,NEG}\right)^{\pm}} b_{NEG,AGG} &= \pm\infty.
\end{aligned}$$

For any value of $b_{NEG,AGG}$ that satisfies the equation above, σ^2_{AGG} and σ^2_{ALL} are uniquely determined as follows:

$$\sigma^2_{AGG} = \frac{\sigma^2_{NEG}\sigma^2_{POS} - \left(\rho_{POS,NEG}\right)^2}{\sigma^2_{NEG} - 2b_{NEG,AGG}\rho_{POS,NEG} + \left(b_{NEG,AGG}\right)^2 \sigma^2_{POS}}, \tag{8}$$

$$\sigma^2_{ALL} = \frac{\left(b_{NEG,AGG}\right)^2 \left(\rho_{POS,NEG}\right)^2 + \left(\sigma^2_{NEG}\right)^2 - 2\left(b_{NEG,AGG}\right)^2 \sigma^2_{NEG}\rho_{POS,NEG}}{\sigma^2_{NEG} - 2b_{NEG,AGG}\rho_{POS,NEG} + \left(b_{NEG,AGG}\right)^2 \sigma^2_{POS}}. \tag{9}$$

These two equations also show that for each value of $b_{NEG,AGG}$ we can obtain a unique value of σ^2_{AGG} and σ^2_{ALL}

These restrictions are represented in Figures 11, A.3, and A.4. The top graph in each figure shows the combination of $b_{POS,ALL}$ and $b_{NEG,AGG}$ allowed by the restrictions. The middle row maps the relationship between $b_{NEG,AGG}$ and that of σ_{AGG} and σ_{ALL} as a function of $b_{NEG,AGG}$, obtained using Eq. (4.4).

Under (i) every negative value of $b_{NEG,AGG}$ and corresponding value of $b_{POS,ALL}$ are permissible, but under (ii) only values of $b_{NEG,AGG}$ such that $b_{POS,ALL}$ is positive are permissible. The restrictions imposed by these assumptions are represented by the vertical lines in each of the top charts of Figures Figures 11, A.3, and A.4. The vertical lines are obtained as follows:

- Right green line. In order to respect condition (ii) $b_{POS,ALL} > 0$, $b_{NEG,AGG}$ must equal $\frac{\rho_{POS,NEG}}{\sigma^2_{POS}}$, which determines the right green vertical line.
- Left green line. As long as the condition above is satisfied, $b_{POS,ALL}$ is positive to the

right of the vertical asymptote denoted as a left green line at this value: $b_{NEG,AGG} = \frac{\sigma^2_{NEG}}{\rho_{POS,NEG}}$.

- Left red line. Notice that with $\rho_{POS,NEG} < 0$, restriction (ii) is not binding, so the first condition listed here is tighter. This observation delivers restriction (i'): $b_{NEG,AGG} \leq -1$ and the left red line at $b_{NEG,AGG} = -1$

- Right red line: From restriction (ii.a)': $0 < b_{POS,ALL} \leq 1$, $b_{POS,ALL} = 1$ implies that $b_{NEG,AGG} = \frac{\rho_{POS,NEG} - \sigma^2_{NEG}}{\sigma^2_{POS} - \rho_{POS,NEG}}$, which defines the red vertical line to the right.

The green lines correspond to the looser restrictions implied by conditions (i)-(iii); when these are tightened with restrictions (i)' and (ii/a)', we obtain the red vertical lines contained within the green vertical lines (i.e. by the wider permissible range of $b_{NEG,AGG}$).

4.5 Long-Run Restrictions

Finally, we follow Davis and Haltiwanger (1999) in considering restrictions on the cumulative response behavior of creation and destruction to achieve just-identification.

The first restriction is that aggregate shocks have no effect on cumulative credit reallocation in the long run:

$$\text{(iv)} \quad \begin{aligned} &\sum_{l=0}^{\infty}[B_{11}(l) + B_{21}(l)] = \mathbf{0} \\ \Longrightarrow &\sum_{l=0}^{\infty}[D_{11}(l) + D_{21}(l)] + b_{NEG,AGG}[D_{12}(l) + D_{22}(l)] = 0. \end{aligned}$$

Additionally, consider the case in which aggregate shocks have neutral effects on cumulative excess reallocation:

$$\text{(iv)'} \quad \begin{aligned} &\sum_{l=0}^{\infty} B_{11}(l) + B_{21}(l) - |B_{11}(l) - B_{21}(l)| = 0 \\ \Longrightarrow &\sum_{l=0}^{\infty} D_{11}(l) + D_{21}(l) + b_{NEG,AGG}\left[D_{12}(l) + D_{22}(l)\right] - \\ &- |D_{11}(l) + D_{21}(l) - [b_{NEG,AGG}(D_{12}(l) + D_{22}(l))]| = 0. \end{aligned}$$

The long-run neutral impact of allocative shocks on credit translates into a joint restriction on the dynamic response functions of credit creation and destruction:

$$\text{(v)} \quad \begin{aligned} &\sum_{l=0}^{\infty} [B_{12}(l) - B_{22}(l)] = 0 \\ \implies &\sum_{l=0}^{\infty} b_{POS,ALL} [D_{11}(l) - D_{21}(l)] + [D_{12}(l) - D_{22}(l)] = 0. \end{aligned}$$

4.6 Results

Figures 11, A.3, and A.4 are grouped in three plots for credit creation and credit destruction as modeled in Section 4 and for the periods defined by the data availability defined in Section 2.

The top graphs all describe a more or less convex relationship between $b_{NEG,AGG}$ and $b_{POS,ALL}$ obtained from the estimation. Any value of $b_{NEG,AGG}$ for which $b_{POS,ALL}$ is negative is not admissible. For $b_{NEG,AGG}$ lower than the value marked by the left green line, $b_{POS,ALL}$ is negative and therefore inadmissible under the less restrictive constraints. For TL and TD, the minimal restrictions impose $b_{NEG,AGG} \in (-4.45, 0.1)$ and a much tighter $b_{NEG,AGG} \in (-2.4, 0.15)$.

The middle row of graphs in each triplet represents the relationship between the $b_{NEG,AGG}$ and the standard deviations of the structural innovation. The permissible ranges are identified by the same vertical graphs as in the top plots. The solid line is the standard deviation of the allocative shock, and the dashed line is the standard deviation of the aggregate shock. Over the range determined by the restrictions the standard deviation of the aggregate shock is larger than that of the allocative shock for all types of flows considered, though it is particularly larger for total lending, short-term debt and real estate flows. The lower the values of permissible $b_{NEG,AGG}$, the lower both standard deviations, though that of the allocative shock trends to zero faster than the standard deviation of aggregate shocks do.

The bottom row of each graph is a plot of FEVD for credit growth rates and credit reallocation rates. They allow us to discuss the percentage of the 4- or 16-step-ahead FEV of credit growth and credit reallocation explained by allocative and aggregate shocks for each individual flow. The 4- and 16-step-ahead FEVDs are similar for all flows except perhaps total borrowing. Allocative shocks account for about 25 percent of the FEV of borrowing and lending flows for low values of $b_{NEG,AGG}$. These percentages fall to 10 percent for borrowing and close to zero for lending when $b_{NEG,AGG}$ is close to -0.5. For the lowest values of $b_{NEG,AGG}$ permitted by the laxest restrictions, allocative shocks account for larger shares, up to about 70 percent and 55 percent for total borrowing and total lending, respectively. This pattern is similar for other flows as well, starting in the 20-30 percent range for low values, falling to close to zero, when $b_{NEG,AGG}$ is close to -0.5, then increasing to percentages ranging from 50 to 80 percent for the lowest permitted values of $b_{NEG,AGG}$. Commercial and industrial loans and loans to individuals follow a somewhat different pattern.

The results for credit reallocation however are starkly different: In this case, allocative shocks play the lion's share in the FEVD for all flows, particularly at estimated values of $b_{NEG,AGG}$ below 1, but also a sizable share (and growing as $b_{NEG,AGG}$ decreases) for values between zero and 1.

Considering parameter combinations within the ranges allowed by weaker restrictions, we observe that allocative shocks play a substantially larger role than aggregate shocks in explaining credit reallocation but a much smaller role in explaining credit growth. This result is consistent with the existing evidence on job flows.

If we focus on FEVD for $b_{NEG,AGG} = -1$ (i.e. a value we would expect if we thought of symmetric responses of creation and destruction to aggregate shocks), allocative shocks explain more than 90 percent of FEV of total lending and total borrowing, the two types of debt and the three types of lending.

Similar to results for job flow models that attribute a large role to aggregate shocks in explaining credit expansion, if $b_{NEG,AGG}\ -1$, the estimation attributes an even larger role for allocative shocks in driving not only credit growth but also reallocation on both sides of the credit relationship.

We now analyze the role of the additional restrictions that bound the coefficient pairs between the red vertical lines in Figures 11 through A.3. We refer to Table 7 for borrowing flows and Table 6 for lending flows that correspond to the set of tighter restrictions including (i)' and (ii)'. There are two sets of qualitative restrictions and three sets of long-run or neutrality restrictions for each of the flows (depicted in the columns).

We include 4 forecast horizons (1 quarter, 4 quarters, 8 quarters, and 16 quarters ahead) for the FEVD of the credit growth rate and the credit reallocation rate. Standard errors are reported in parentheses and are bootstrapped by Monte Carlo simulations with 1,000 draws. Taking total lending as an example, the permissible range for $b_{NEG,AGG}$ corresponds to the tighter restrictions and is between -1 and -0.43 which implies two limit values for $b_{POS,ALL}$ of 4.20 and 1. Corresponding to these boundaries, we observe a standard deviation of allocative shocks of about 0.2 at $b_{NEG,AGG} = -1$ and 0.55 at $b_{NEG,AGG} = -0.43$. In both cases, the standard deviation of allocative shocks is about half that of aggregate shocks.

The results are similar for borrowing shocks, though the standard deviations shift somewhat. Considering the two extreme values and credit growth, the 4-step FEV of credit growth is explained by allocative disturbances–about 22.5 percent at $b_{NEG,AGG} = -1$–but explains less than 1 percent at $b_{NEG,AGG} = -0.43$. At 16 quarters ahead, these percentages are approximately 21 and 2.7 percent. Results for credit reallocation display a range between 97.51 percent and 77.85 percent at 4-quarter-ahead horizons and between 93.87 percent and 72.52 percent at the 16-quarter horizon. These figures are quantitatively comparable for total debt as shown in Table 7, although the percentages are higher for credit growth in the case of total debt relative to total lending.

The most striking result is that allocative shocks account for a very large share of the FEV of credit reallocation and a much smaller share of the FEV of credit growth.

In these tables, columns 3-5 show results constructed under the long-run neutrality restrictions— that is, imposing that aggregate shocks do not affect credit growth and reallocation in the long run. With restriction (iv), we obtain $b_{NEG,AGG}$ and $b_{POS,ALL}$ pairs equal to -1.57 and 11.79, respectively, for total lending and -0.54 and 1.44 for total borrowing, corresponding to a standard deviation of allocative shocks of less than 10 percent and close to 60 percent for total lending and total debt, respectively.

When we impose restriction (iv)' (last column), we obtain a pair equal to -2.94 and 4.01

for total loans and -0.03 and -0.15 for total debt, respectively. In both cases, these values contradict the weaker qualitative restrictions (i) and (ii).

Under these long-run restrictions, allocative shocks continue to play a larger role in both sides of credit reallocation but gain traction in explaining credit growth, especially on the lending side and particularly for real estate loans. At a minimum, they explain 80 percent of credit reallocation but closer to 95 percent for lending reallocation.

Column 3 is relevant because it shows results obtained under the assumption that allocative shocks have no long-run effect on the level of credit—imposing restriction (v)—and delivers ($b_{NEG,AGG}$, $b_{POS,ALL}$) = (0.02, -0.27) for total debt and (-0.56 and 1.58) for total loans. This restriction violates looser conditions for debt but not for loans. Allocative shocks here play an even smaller role for lending growth but continue to be important for credit reallocation, both lending and borrowing. They do not contribute much to accounting for credit reallocation of real estate loans but they are important for loans to individuals and C&I loans. Under this restriction, they account for a sizable share of the variance of long-term debt but not of short-term debt.

To summarize, we find that long-run neutrality restrictions drive fluctuations in reallocation but are somewhat less important for credit growth.

5 Conclusions

In this paper we constructed and studied two sides of gross credit reallocation for the U.S. economy contrasting *business borrowing* with *bank lending* from the mid- to late 1970s to 2012. A set of macroeconomic shocks—embodied technological shocks, total factor productivity shocks, monetary policy shocks, and excess bond premium shocks—studied in a structural vector autoregressive framework, explains at most 20% of credit reallocation, and little of credit creation and destruction with the majority explained by embodied technological shocks and excess bond premium (or financial) shocks.

By disentangling allocative and aggregate shocks in a bivariate VAR inspired by Davis and Haltiwanger (1999), we show that idiosyncratic shocks play the most important role in explaining cyclical movements of credit reallocation.

These results suggest an important role for cross-sectional firm-level and bank-level heterogeneity in theoretical models with credit frictions.

We leave for future research (i) the combination of idiosyncratic and diverse aggregate shocks in a unique VAR model and (ii) a cross-country comparison of the analysis of credit flows.

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Table 1: Relevance of Different Types of Debt and Loans and Key Business Cycle Statistics

	1974		2007		2012		1974Q1-2012Q4	
Credit Market Instruments	as a % of total debt	as a % of GDP	as a % of total debt	as a % of GDP	as a % of total debt	as a % of GDP	σ/σ^{GDP}	$\rho(.,GDP)$
Commercial Paper	1.5	0.8	1.1	0.9	1.0	0.8	13.6	0.64
Corporate Bonds	27.7	14.6	34.0	25.8	45.5	35.7	27.6	-0.29
Bank Loans	25.3	13.4	15.0	11.3	13.2	10.3	47.0	0.42
Other Instruments	45.5	24.0	49.9	37.8	40.3	31.6	83.8	0.28
Total	100	52.8	100	75.8	100	78.4	132.1	0.33
Types of Loans	as a % of total loans	as a % of GDP	as a % of total loans	as a % of GDP	as a % of total loans	as a % of GDP	σ/σ^{GDP}	$\rho(.,GDP)$
C&I Loans	45.3	12.4	24.6	9.9	24.2	9.2	43.1	0.44
Real Estate Loans	30.6	8.4	61.7	24.8	57.5	21.9	38.4	0.15
Individual Loans	24.2	6.6	13.7	5.5	18.3	7.0	19.0	-0.06
Total	100	27.5	100	40.3	100	38.1	70.0	0.33
GDP ($ Bil)	1,549		1,4480		6,245			

Note: Standard deviations and correlations are calculated using on the cyclical component of the HP-filtered level of the variable.

Table 2: Descriptive Statistics for Gross Credit Flows.

v	Rate						Level				
	POS	NEG	NET	SUM	EXC		POS	NEG	Level	SUM	EXC
					Total loans						
Mean	3.82	1.82	2	5.63	3.37	$\rho(., rGDP)$	0.26	-0.45	0.17	-0.04	-0.36
σ	1.31	0.85	1.71	1.41	1.4	σ/σ^{rGDP}	16.37	19.7	2.25	8.55	15.7
					Individual loans						
Mean	4.25	2.56	1.68	6.81	4.45	$\rho(., rGDP)$	0.1	-0.32	0.26	-0.04	-0.28
σ	1.81	1.37	2.38	2.16	2.17	σ/σ^{rGDP}	20.69	23.69	3.23	14.35	23.87
					Commercial loans						
Mean	4.61	2.95	1.66	7.56	5.1	$\rho(., rGDP)$	0.34	-0.22	-0.04	0.13	-0.18
σ	1.62	1.42	2.46	1.8	2.2	σ/σ^{rGDP}	21.6	29.28	5.75	17.16	24.02
					Real estate loans						
Mean	3.96	1.39	2.57	5.36	2.64	$\rho(., rGDP)$	0.41	-0.53	0.07	-0.05	-0.26
σ	1.84	0.6	2.08	1.78	1.07	σ/σ^{rGDP}	23.33	24.87	2.16	11.73	19.15

	Rate						Level				
	POS	NEG	NET	SUM	EXC		POS	NEG	Level	SUM	EXC
					Total debt						
Mean	4.64	2.76	1.88	7.39	5.35	$\rho(., rGDP)$	0.35	-0.36	-0.22	0.14	-0.42
σ	1.51	0.82	1.71	1.72	1.36	σ/σ^{rGDP}	13.73	13.3	2.3	8.68	11.58
					Short-term debt						
Mean	14.08	11.78	2.3	25.86	22.17	$\rho(., rGDP)$	0.38	-0.5	0.04	-0.04	-0.29
σ	3.42	2.54	4.28	4.24	4.19	σ/σ^{rGDP}	11.87	11.59	5.16	7.35	9.05
					Long-term debt						
Mean	5.17	3.2	1.97	8.36	6.18	$\rho(., rGDP)$	0.15	-0.17	-0.32	0.02	-0.19
σ	1.64	1.41	1.62	2.59	2.5	σ/σ^{rGDP}	12.21	13.04	2.13	8.35	10.76
					Equity						
Mean	3.1	1.13	1.97	4.23	2.12	$\rho(., rGDP)$	-0.15	0.01	-0.31	-0.12	-0.04
σ	1.89	0.71	1.98	2.06	1.2	σ/σ^{rGDP}	56.78	68.16	24.89	31.03	79.29

Note: This table represents key moments of the gross flows. The left columns identified by "Rate" refer to the mean and the standard deviation (σ) of the flowsrates. The right columns identified by "Levels" refer to the correlation with real GDP and the ratio of each variable's relative standard with respect to GDP of the cyclical components of each variable's level, detrended using the HP filter.

Table 3: Data Description

Variable	Description	Source/FRED code	Sample
P_I	Investment deflator	Fisher (2006)	1947:Q1-2011:Q4
P_Y	Output deflator	GDPDEF	1947:Q1-2013:Q1
H	Hours of all persons (non-farm business sector)	HOANBS	1947:Q1-2013:Q1
N	Civilian non-institutional population 16 and over	CNP16OV	1948:Q1-2013:Q1
u	Unemployment	UNRATE	1948:Q1-2013:Q1
EBP	Excess bond premium	Gilchrist and Zakrajšek (2012)	1973:Q1-2012:Q3
$FFED$	Federal Funds rate	FEDFUNDS	1954:Q3-2013:Q1
$FFED^s$	$FFED$ up to 2008Q3; then Krippner (2013) shadow rate	-	1954Q3-2012Q4
$p_I = \log\left(\frac{P_I}{P_Y}\right)$	Relative price of investment goods	-	1947:Q1-2011:Q4
$h = \log\left(\frac{H}{N}\right)$	Hours per capita	-	1948:Q1-2013:Q1
$ALP = \log\left(\frac{Y}{H}\right)$	Average labor productivity	-	1947:Q1-2013:Q1

Table 4: Lending Flows: FEVD for Net and Gross Flows Rates.

	Embodied tech. Shock	Neutral tech. Shock	Financial Shock	Monetary Shock	All 4 Shocks
			Total loans		
Investment price	31.77	4.81	15.16	0.67	52.41
Output	2.91	20.17	36.92	0.62	60.61
Hours	21.13	5.61	30.24	0.47	57.45
Inflation	19.91	7.64	5.00	2.67	35.22
Excess bond premium	6.28	2.42	77.74	0.66	87.10
Fed Funds	4.15	4.10	11.91	30.46	50.62
Credit creation	4.70	1.71	12.78	1.39	20.59
Credit destruction	1.60	1.59	21.46	0.41	25.07
Credit growth	3.50	1.47	21.28	1.27	27.51
Credit reallocation	4.33	2.02	5.54	0.86	12.75
			Individual loans		
Investment price	29.75	6.50	15.53	0.88	52.67
Output	3.75	17.79	36.57	0.67	58.78
Hours	19.00	8.99	29.06	0.52	57.57
Inflation	18.19	8.71	4.71	2.60	34.21
Excess bond premium	6.88	2.68	75.51	0.77	85.84
Fed Funds	4.77	5.08	12.08	30.93	52.87
Credit creation	9.18	8.63	6.60	0.22	24.62
Credit destruction	3.11	1.38	5.09	0.50	10.09
Credit growth	8.97	4.89	7.64	0.30	21.80
Credit reallocation	3.85	8.21	3.41	0.34	15.80
			C&I loans		
Investment price	32.29	15.51	13.14	0.92	61.86
Output	5.22	13.80	37.51	0.77	57.30
Hours	24.61	6.42	27.29	0.54	58.86
Inflation	14.24	15.95	4.91	2.74	37.84
Excess bond premium	8.22	0.49	76.11	0.62	85.44
Fed Funds	5.54	2.74	11.53	30.95	50.76
Credit creation	2.09	5.59	15.92	0.44	24.04
Credit destruction	5.48	1.19	22.32	0.36	29.34
Credit growth	2.77	2.96	26.28	0.54	32.54
Credit reallocation	5.49	4.86	3.25	0.11	13.71
			Real estate loans		
Investment price	52.22	1.27	6.44	0.30	60.23
Output	2.40	24.74	35.37	0.36	62.87
Hours	6.49	5.56	39.36	0.17	51.58
Inflation	17.45	6.68	3.22	2.94	30.29
Excess bond premium	4.21	3.07	78.10	0.55	85.93
Fed Funds	3.31	5.01	13.73	29.52	51.58
Credit creation	3.14	8.07	1.49	0.32	13.02
Credit destruction	0.83	2.95	19.53	0.78	24.09
Credit growth	2.49	6.25	4.44	0.41	13.59
Credit reallocation	3.46	9.33	1.94	0.32	15.05

Note: Fraction of the variance in the cyclical frequencies accounted for by structural shocks. The cyclical frequencies are identified by an HP1600 filter (results obtained by band-pass filter between 8 and 32 quarters reported in the online appendix). See Altig, Christiano, Eichenbaum, and Linde (2011, pp. 235-6) for details.

Table 5: Borrowing Flows: FEVD for Net and Gross Flows Rates.

	Embodied tech. Shock	Neutral tech. Shock	Financial Shock	Monetary Shock	All 4 Shocks
			Total debt		
Investment price	55.06	1.76	5.58	1.41	63.81
Output	5.44	20.26	28.34	1.00	55.04
Hours	26.55	6.10	23.91	0.33	56.88
Inflation	12.86	2.66	5.50	6.65	27.67
Excess bond premium	6.83	3.29	73.97	0.42	84.51
Fed Funds	12.85	4.87	12.09	39.14	68.95
Credit creation	2.96	0.65	3.09	1.81	8.52
Credit destruction	1.84	0.49	2.16	2.88	7.37
Credit growth	3.09	0.40	1.34	2.76	7.58
Credit reallocation	2.24	0.88	4.71	1.22	9.05
			Short-term debt		
Investment price	52.17	0.17	4.20	0.73	57.28
Output	3.18	32.71	27.11	0.41	63.41
Hours	15.80	1.47	32.10	0.40	49.78
Inflation	25.24	0.71	3.81	5.52	35.28
Excess bond premium	4.78	2.77	77.66	0.68	85.90
Fed Funds	7.85	0.32	12.70	40.67	61.54
Credit creation	3.96	1.11	2.51	1.29	8.87
Credit destruction	4.49	1.80	9.23	1.26	16.77
Credit growth	5.33	0.73	6.57	1.34	13.98
Credit reallocation	2.02	2.44	1.76	1.18	7.40
			Long-term debt		
Investment price	50.29	1.83	6.56	1.67	60.35
Output	5.59	18.33	33.09	0.82	57.83
Hours	27.51	7.02	26.64	0.29	61.46
Inflation	16.36	2.56	5.84	5.30	30.06
Excess bond premium	7.12	3.43	75.67	0.41	86.63
Fed Funds	11.94	4.58	13.86	39.04	69.41
Credit creation	5.69	1.38	3.67	1.58	12.33
Credit destruction	2.80	1.60	2.60	2.98	9.98
Credit growth	3.48	2.26	2.58	3.55	11.88
Credit reallocation	5.51	0.63	3.90	0.70	10.74

Note: Fraction of the variance in the cyclical frequencies accounted for by structural shocks. The cyclical frequencies are identified by an HP1600 filter (results obtained by band-pass filter between 8 and 32 quarters reported in the online appendix). See Altig, Christiano, Eichenbaum, and Linde (2011, pp. 235-6) for details.

Table 6: Lending Flows: FEVD for Net and Gross Flows Rates in the Bivariate VAR.

	TOTAL LOANS					C&I LOANS				
	Qualitative restrictions		Long-Run Restrictions			Qualitative restrictions		Long-Run Restrictions		
$b_{NEG,AGG}$	-1.00	-0.43	-0.56	-1.57	2.94	-1	-0.78	-0.86	-1.13	31.35
$b_{POS,ALL}$	4.20	1.00	1.58	11.79	-4.01	1.58	1.00	1.20	2.01	-3.64
Forecast Horizon										
	A. FEVD of Credit Growth Rate					A. FEVD of Credit Growth Rate				
1q	24.57	0.00	2.86	44.19	92.35	2.73	0.00	0.44	6.07	72.67
	(8.8)	-	(10.4)	(22.1)	(12.8)	(4.2)	-	(9.6)	(13.5)	(20.9)
4q	22.57	0.66	2.58	41.57	90.34	3.42	0.47	1.00	6.84	73.11
	(8.6)	(2.3)	(8.8)	(20.3)	(11.9)	(4.9)	(1.9)	(8.3)	(13.2)	(18.8)
8q	21.52	1.30	2.65	40.05	88.95	3.27	0.59	1.01	6.57	72.36
	(8.5)	(3.6)	(8.6)	(19.0)	(10.8)	(5.4)	(3.1)	(8.3)	(12.5)	(17.4)
16q	21.39	1.43	2.69	39.85	88.73	3.30	0.66	1.07	6.57	72.21
	(8.5)	(4.0)	(8.8)	(18.8)	(10.5)	(5.7)	(3.8)	(8.5)	(12.5)	(17.1)
	B. FEVD of Credit Reallocation Rate					B. FEVD of Credit Reallocation Rate				
1q	100.00	75.43	88.33	95.71	51.35	100.00	97.27	99.01	99.31	0.00
	-	(8.9)	(16.8)	(9.7)	(21.9)	-	(3.8)	(11.1)	(8.3)	0.0
4q	97.51	77.85	89.17	91.71	47.00	98.75	97.32	98.53	97.46	0.00
	(3.2)	(8.5)	(14.2)	(9.0)	(19.5)	(2.7)	(3.9)	(10.2)	(7.7)	0.0
8q	95.32	73.99	85.44	90.99	50.14	98.33	96.16	97.66	97.43	0.00
	(4.3)	(9.1)	(14.1)	(8.8)	(18.2)	(3.4)	(5.1)	(10.3)	(7.4)	0.0
16q	93.87	72.52	83.79	90.02	50.94	97.96	95.56	97.14	97.19	0.00
	(5.1)	(9.3)	(14.2)	(9.1)	(17.9)	(4.1)	(5.7)	(10.5)	(7.6)	0.0

	INDIVIDUAL LOANS					REAL ESTATE LOANS				
	Qualitative restrictions		Long-Run Restrictions			Qualitative restrictions		Long-Run Restrictions		
$b_{NEG,AGG}$	-1.00	-0.61	-0.70	-1.19	-0.36	-1	4.51	11.11	15.92	8.28
$b_{POS,ALL}$	2.25	1.00	1.24	3.05	0.39	47.82	1.00	0.17	16.13	-1.88
Forecast Horizon										
	A. FEVD of Credit Growth Rate					A. FEVD of Credit Growth Rate				
1q	9.28	0.00	0.71	15.95	61.64	70.31	0.00	4.69	58.76	82.32
	(6.0)	-	(12.2)	(17.5)	(21.9)	(8.5)	-	(11.3)	(24.2)	-19.71
4q	12.38	2.19	3.25	19.10	63.33	67.61	0.60	6.37	56.01	79.89
	(6.8)	(2.8)	(10.7)	(16.9)	(19.9)	(9.8)	(2.2)	(10.4)	(22.7)	-18.37
8q	12.43	2.77	3.71	18.97	62.50	70.84	1.71	5.67	59.78	82.24
	(6.6)	(3.5)	(10.6)	(15.8)	(18.4)	(9.7)	(3.7)	(9.4)	(21.1)	-16.36
16q	12.53	2.96	3.87	19.03	62.37	72.29	3.08	5.99	61.70	83.03
	(6.7)	(3.9)	(10.9)	(15.6)	(17.9)	(9.7)	(5.4)	(9.5)	(20.5)	-15.83
	B. FEVD of Credit Reallocation Rate					B. FEVD of Credit Reallocation Rate				
1q	100.00	90.72	95.02	98.98	68.73	100.00	29.69	12.28	98.54	97.99
	-	(6.0)	(16.1)	(7.6)	(22.2)	-	(8.5)	(19.0)	(10.4)	-11.29
4q	97.53	91.25	94.70	95.67	63.74	98.58	31.33	14.11	97.44	96.30
	(3.0)	(5.7)	(14.0)	(6.6)	(19.9)	(2.5)	(9.4)	(17.5)	(9.1)	-10.33
8q	96.96	88.77	92.67	95.82	66.77	98.35	33.31	15.64	97.71	95.50
	(3.5)	(7.4)	(14.3)	(6.0)	(18.5)	(3.7)	(10.5)	(16.4)	(8.2)	-9.42
16q	96.52	87.44	91.54	95.73	68.16	98.22	34.06	16.24	97.76	95.16
	(4.4)	(8.3)	(14.6)	(6.1)	(18.3)	(4.5)	(11.1)	(15.9)	(8.3)	-9.12

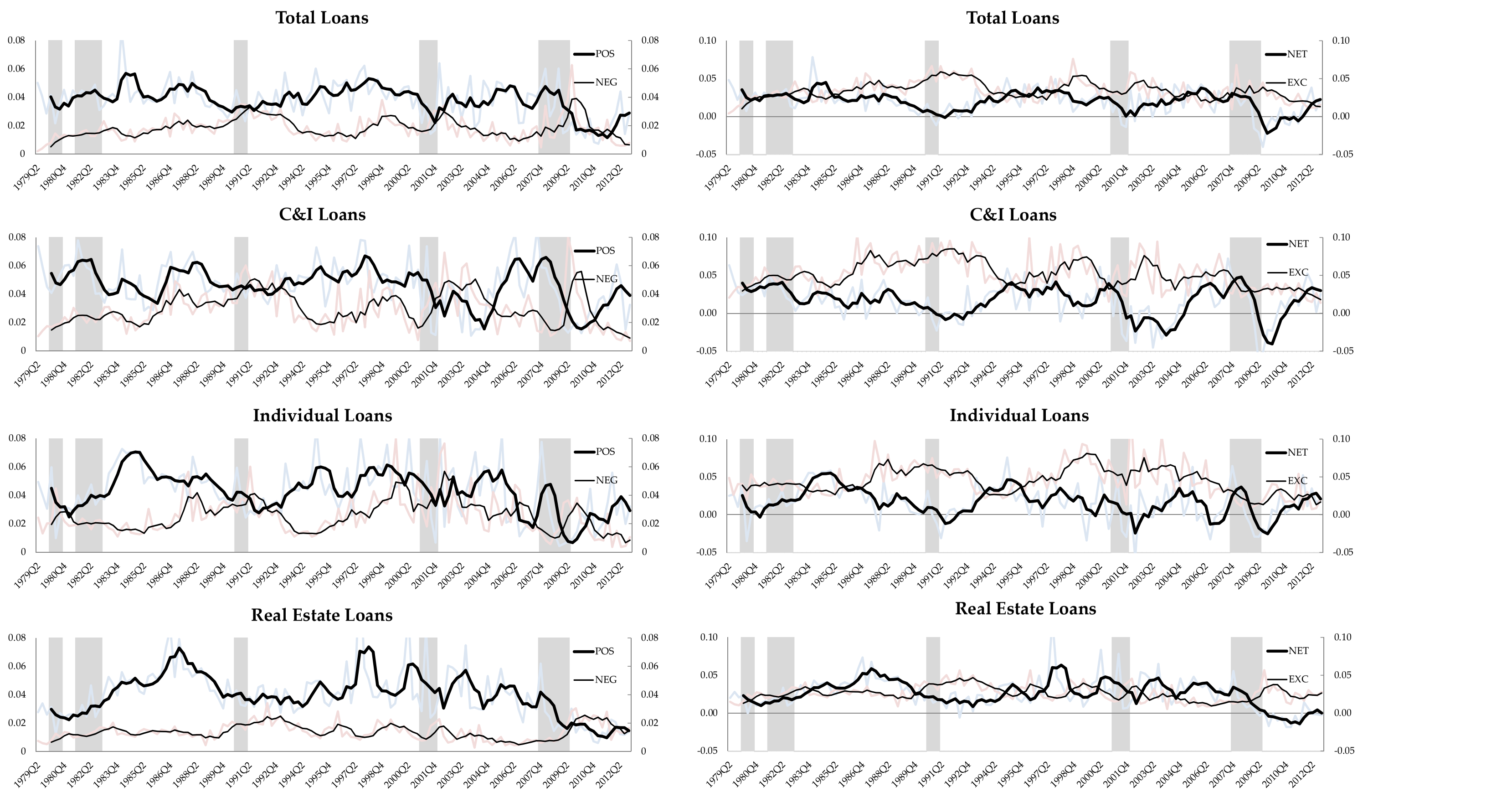
Note: Standard errors are reported in parenthesis. The values of $b_{NEG,ALL}$ represent the lower and upper bounds of the range of values satisfying restrictions (i)' and (ii)'.

Table 7: Borrowing Flows: FEVD for Net and Gross Flows Rates in the Bivariate VAR.

	TOTAL DEBT					SHORT-TERM DEBT				
	Qualitative restrictions		Long-Run Restrictions			Qualitative restrictions		Long-Run Restrictions		
$b_{NEG,AGG}$	-1.00	-0.41	0.02	-0.54	-0.03	-1	-0.58	-0.14	-0.66	-0.40
$b_{POS,ALL}$	3.25	1.00	-0.27	1.44	-0.15	2.96	1.00	-0.19	1.26	0.43
Forecast Horizon										
	A. FEVD of Credit Growth Rate					A. FEVD of Credit Growth Rate				
1q	22.03	0.00	38.34	2.28	19.14	12.97	0.00	34.16	0.63	8.09
	(15.4)	-	(24.6)	(14.5)	(22.9)	(9.9)	-	(25.5)	(7.6)	(16.8)
4q	29.79	3.68	32.51	7.84	26.82	12.47	0.12	35.02	0.61	7.71
	(15.6)	(3.2)	(21.1)	(14.8)	(22.1)	(9.8)	(1.4)	(24.5)	(7.5)	(15.9)
8q	34.17	7.52	30.80	12.31	31.30	13.40	1.64	35.77	2.07	8.83
	(15.1)	(5.6)	(19.2)	(14.7)	(20.8)	(9.3)	(2.8)	(24.1)	(7.4)	(15.2)
16q	36.28	11.06	31.47	15.74	33.61	14.39	3.13	36.40	3.51	9.99
	(14.7)	(7.4)	(18.6)	(14.7)	(20.0)	(9.2)	(3.9)	(23.6)	(7.6)	(14.8)
	B. FEVD of Credit Reallocation Rate					B. FEVD of Credit Reallocation Rate				
1q	100.00	77.97	16.22	89.06	99.87	100.00	87.04	29.88	91.90	0.00
		(15.0)	(22.0)	(12.7)	(7.5)		(10.1)	(30.1)	(9.5)	0.0
4q	97.76	80.21	20.85	89.94	97.94	95.15	90.62	41.61	93.67	0.00
	(2.6)	(13.7)	(20.9)	(10.1)	(6.6)	(3.9)	(7.7)	(26.3)	(6.7)	0.0
8q	95.30	83.16	26.36	91.28	95.85	93.37	92.94	47.28	95.12	0.00
	(4.9)	(12.4)	(20.0)	(8.6)	(6.2)	(5.9)	(7.1)	(25.0)	(5.4)	0.0
16q	93.15	84.54	30.11	91.55	93.93	93.00	94.29	49.65	96.14	0.00
	(6.7)	(11.9)	(19.3)	(8.4)	(6.3)	(6.8)	(7.1)	(24.9)	(4.9)	0.0

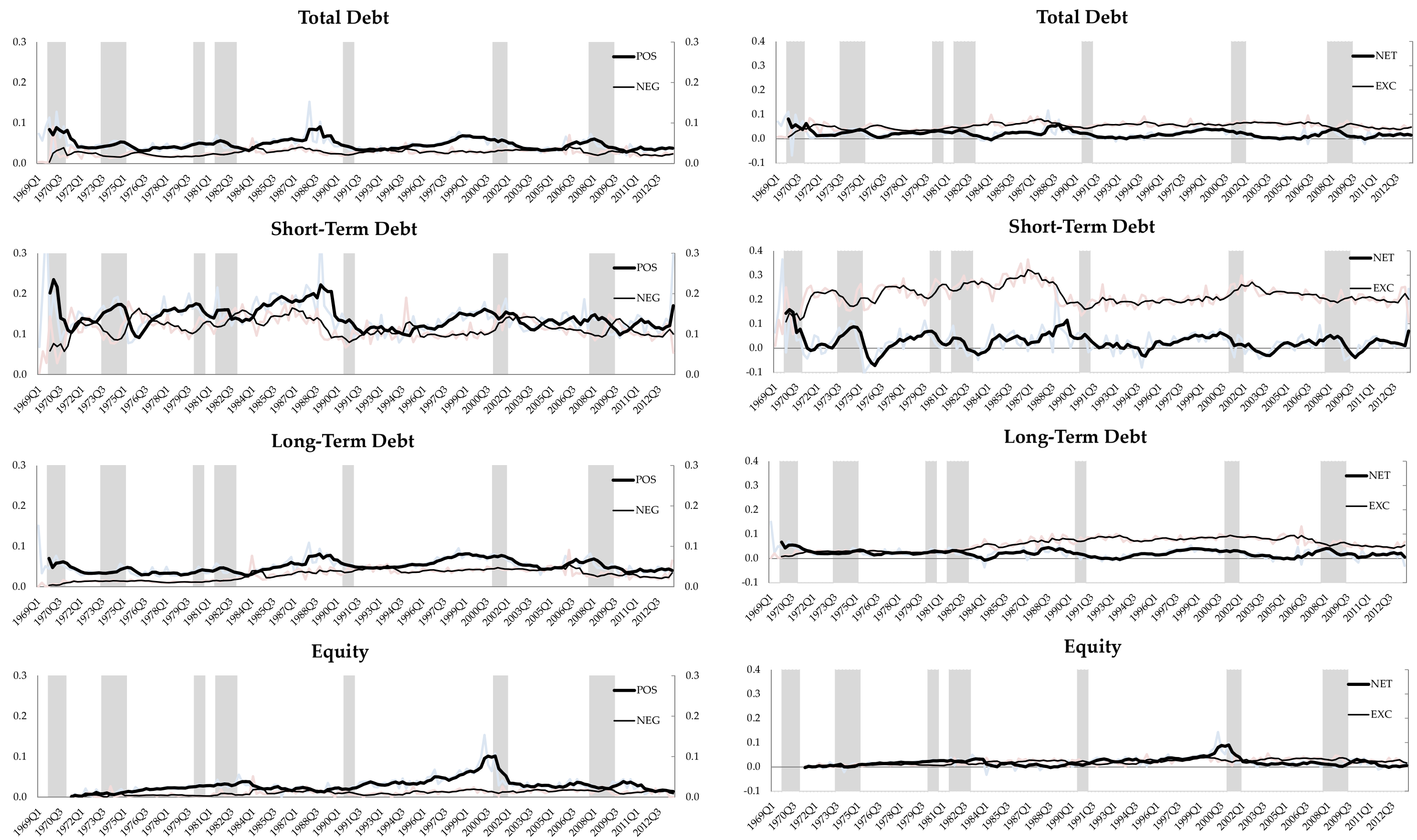
	LONG-TERM DEBT					TRADE CREDIT				
	Qualitative restrictions		Long-Run Restrictions			Qualitative restrictions		Long-Run Restrictions		
$b_{NEG,AGG}$	-1.00	-0.76	-0.30	-0.57	-0.33	0	0.00	0.00	0.00	0.00
$b_{POS,ALL}$	1.39	1.00	0.33	0.72	0.37	0.00	0.00	0.00	0.00	0.00
Forecast Horizon										
	A. FEVD of Credit Growth Rate					A. FEVD of Credit Growth Rate				
1q	2.24	0.00	15.80	2.09	0.37	0.00	0.00	0.00	0.00	0.00
	(6.9)	-	(26.3)	(13.4)	(17.6)	0.0	0.0	0.0	0.0	0.0
4q	7.64	3.63	13.52	3.70	4.75	0.00	0.00	0.00	0.00	0.00
	(8.4)	(3.2)	(22.3)	(11.9)	(18.1)	0.0	0.0	0.0	0.0	0.0
8q	8.41	3.98	12.70	3.62	5.28	0.00	0.00	0.00	0.00	0.00
	(8.7)	(3.6)	(21.3)	(11.7)	(17.9)	0.0	0.0	0.0	0.0	0.0
16q	8.89	4.31	12.53	3.78	5.68	0.00	0.00	0.00	0.00	0.00
	(9.1)	(4.4)	(20.6)	(11.7)	(17.5)	0.0	0.0	0.0	0.0	0.0
	B. FEVD of Credit Reallocation Rate					B. FEVD of Credit Reallocation Rate				
1q	100.00	97.76	71.86	91.52	99.19	0.00	0.00	0.00	0.00	0.00
	-	(6.4)	(30.5)	(13.7)	(11.3)	0.0	0.0	0.0	0.0	0.0
4q	96.75	95.08	71.72	89.61	96.25	0.00	0.00	0.00	0.00	0.00
	(2.4)	(6.4)	(27.3)	(11.3)	(9.5)	0.0	0.0	0.0	0.0	0.0
8q	96.27	96.24	76.44	92.27	96.76	0.00	0.00	0.00	0.00	0.00
	(4.1)	(6.2)	(25.4)	(8.9)	(8.9)	0.0	0.0	0.0	0.0	0.0
16q	94.63	96.47	81.19	94.29	96.23	0.00	0.00	0.00	0.00	0.00
	(6.9)	(7.2)	(23.8)	(7.3)	(8.9)	0.0	0.0	0.0	0.0	0.0

Figure 1: Lending Flows: Expansion, Contraction, Net Flows, and Excess Reallocation (1978:Q2-2012:Q4).



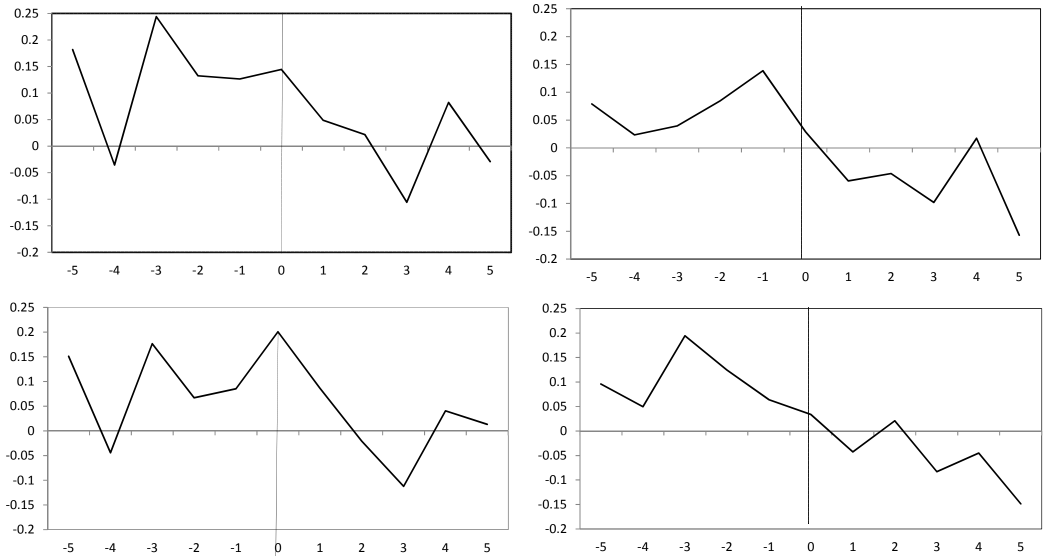
Source: Authors calculations based on Call Report data. Note: These line represents four-quarters moving averages; gray areas represent NBER recessions.

Figure 2: Borrowing Flows: Total Debt, Short-Term Debt, Long-Term Debt, and Book Value of Equity, 1970:Q2-2012:Q4.



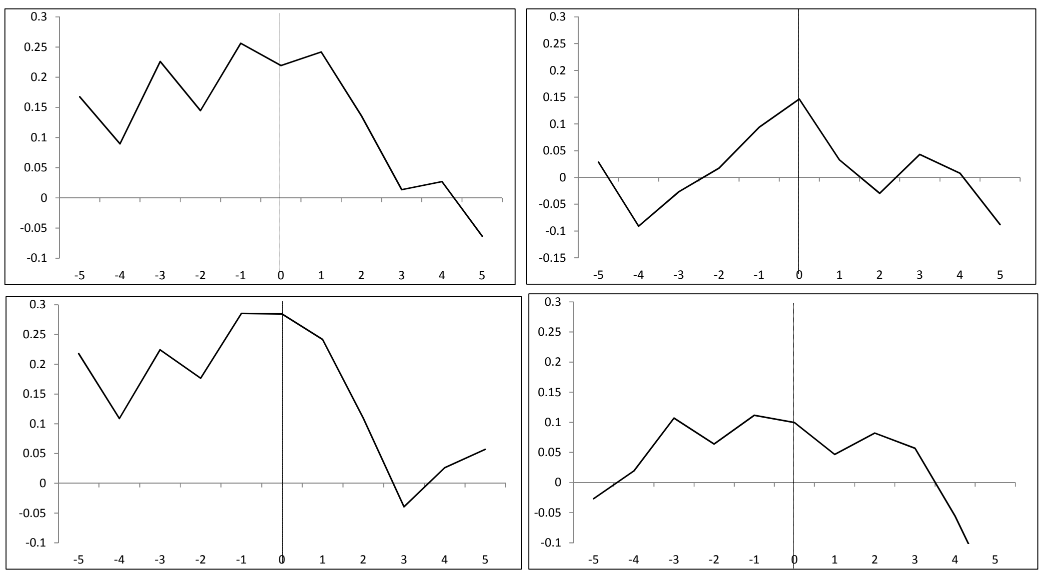
Source: Authors' calculations based on Compustat data. Note: These line represents four-quarters moving averages; gray areas represent NBER recessions.

Figure 3: Cross-correlations of total firm debt and total bank lending



Note: Top left graph depicts the correlation of net total debt in period t with net total lending in periods $t+i$, top right graph shows the correlation of the excess reallocation of total debt in period t with the excess reallocation of total lending in periods $t+i$, bottom left graph is the correlation of the positive component of total debt in period t with the positive component total lending in $t+i$, the bottom right graph is the correlation of the negative component of total debt in period t with the negative component total lending in $t+i$. In all four graphs, $i=[-5,+5]$. Source: Authors' calculations based on Reports of Income and Condition and Compustat data.

Figure 4: Cross-correlations of total firm debt and commercial & industrial lending



Note: Top left graph depicts the correlation of net total debt in period t with net C&I lending in periods $t+i$, top right graph shows the correlation of excess reallocation total debt in period t with excess reallocation of C&I lending in periods $t+i$, bottom left graph is the correlation of the positive component of total debt in period t with the positive component of C&I lending in $t+i$, the bottom right graph is the correlation of the negative component of total debt in period t with the negative component of C&I lending in $t+i$. In all four graphs, $i=[-5,+5]$. Source: Authors' calculations based on Reports of Income and Condition and Compustat data.

Figure 5: Total Loans: IRFs to an Embodied Technology Shock (green), a Neutral Technology Shock (purple), a Monetary Shock (in blue), and a Financial Shock (in red)

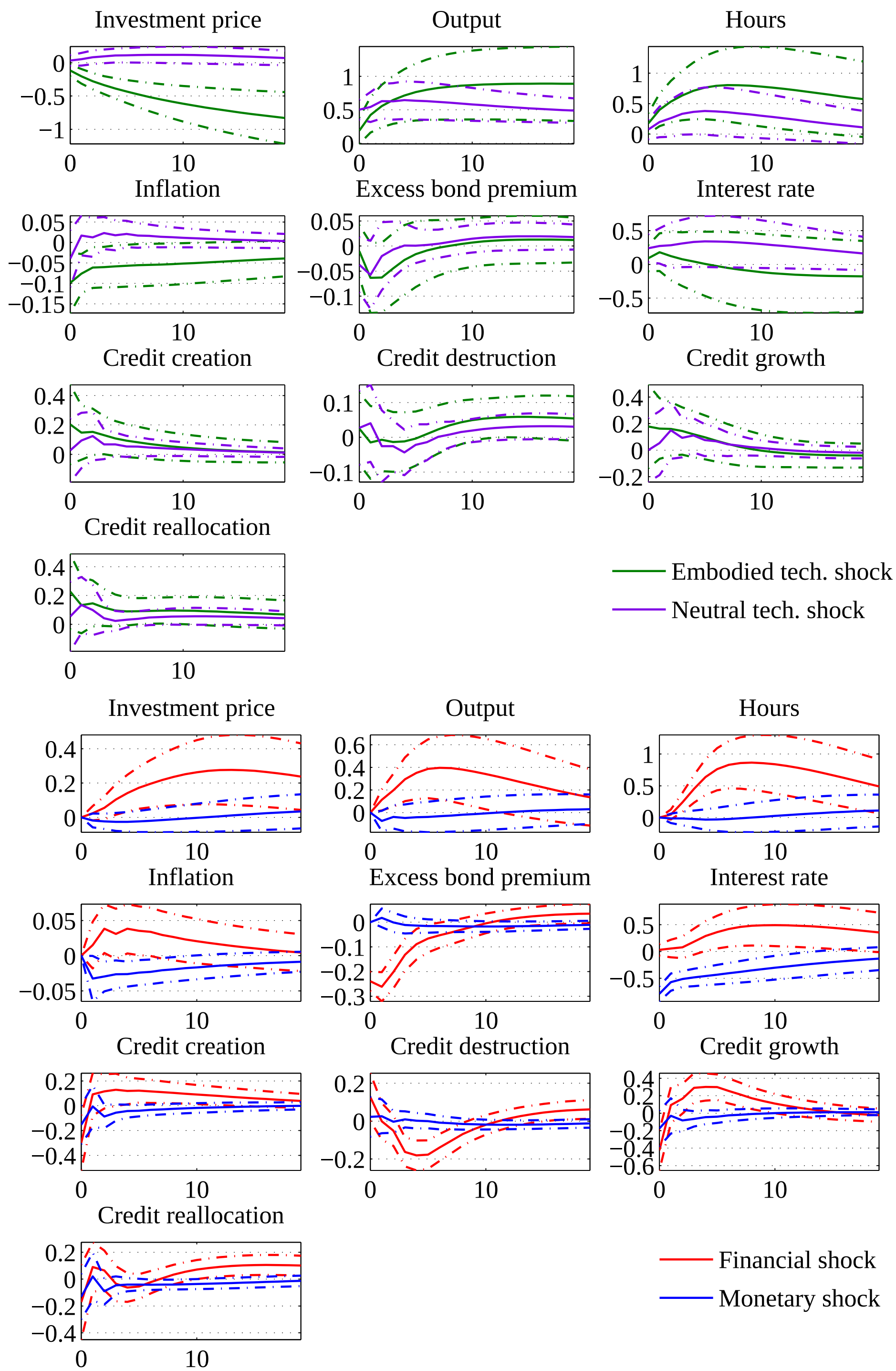


Figure 6: Total Debt: IRFs to an Embodied Technology Shock (green), a Neutral Technology Shock (purple), a Monetary Shock (in blue), and a Financial Shock (in red)

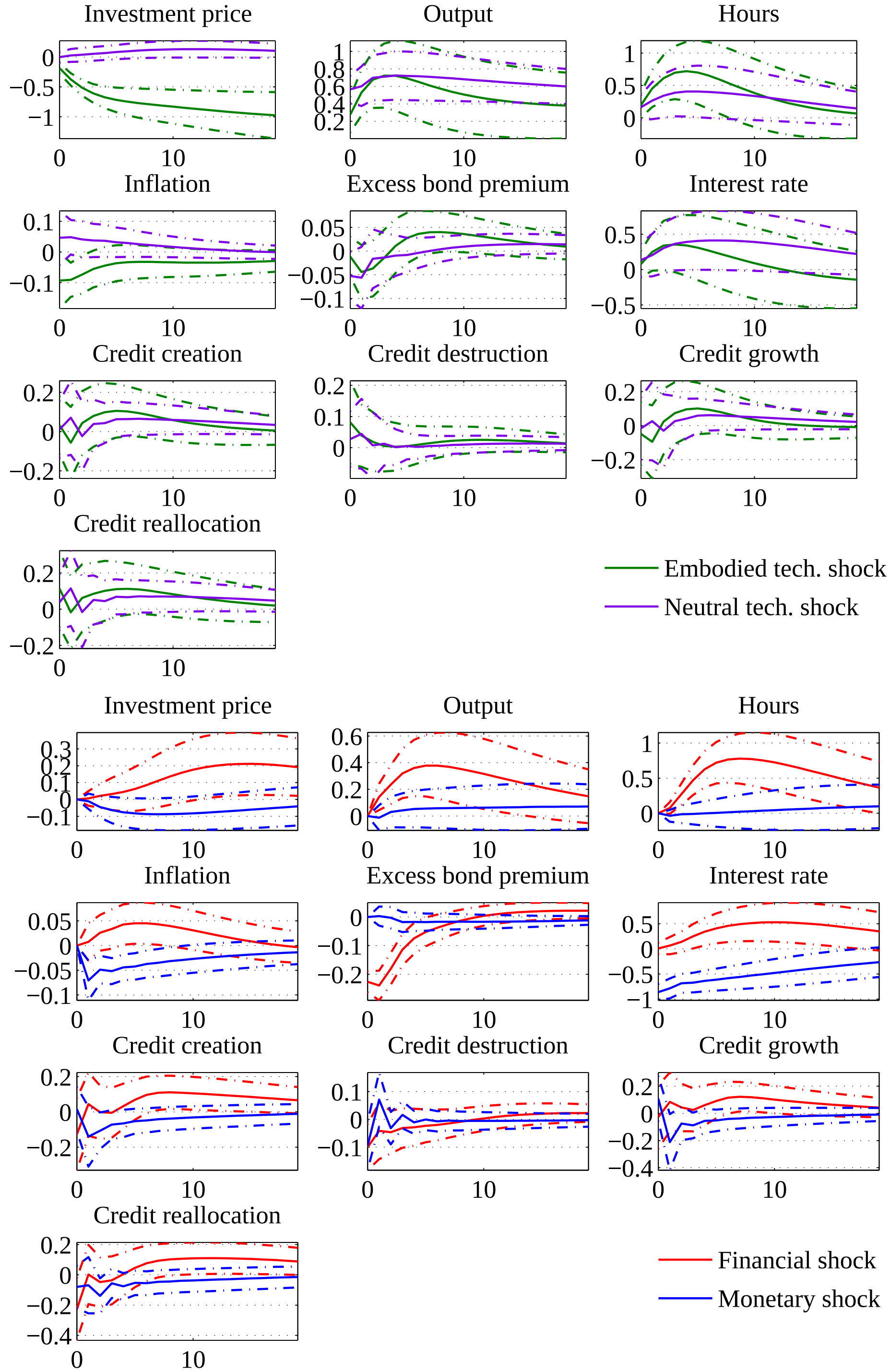


Figure 7: Total Loans, C&I Loans, RE Loans, Individual Loans: IRFs to an Embodied Technology Shock (green), a Neutral Technology Shock (purple), a Monetary Shock (in blue), and a Financial Shock (in red)

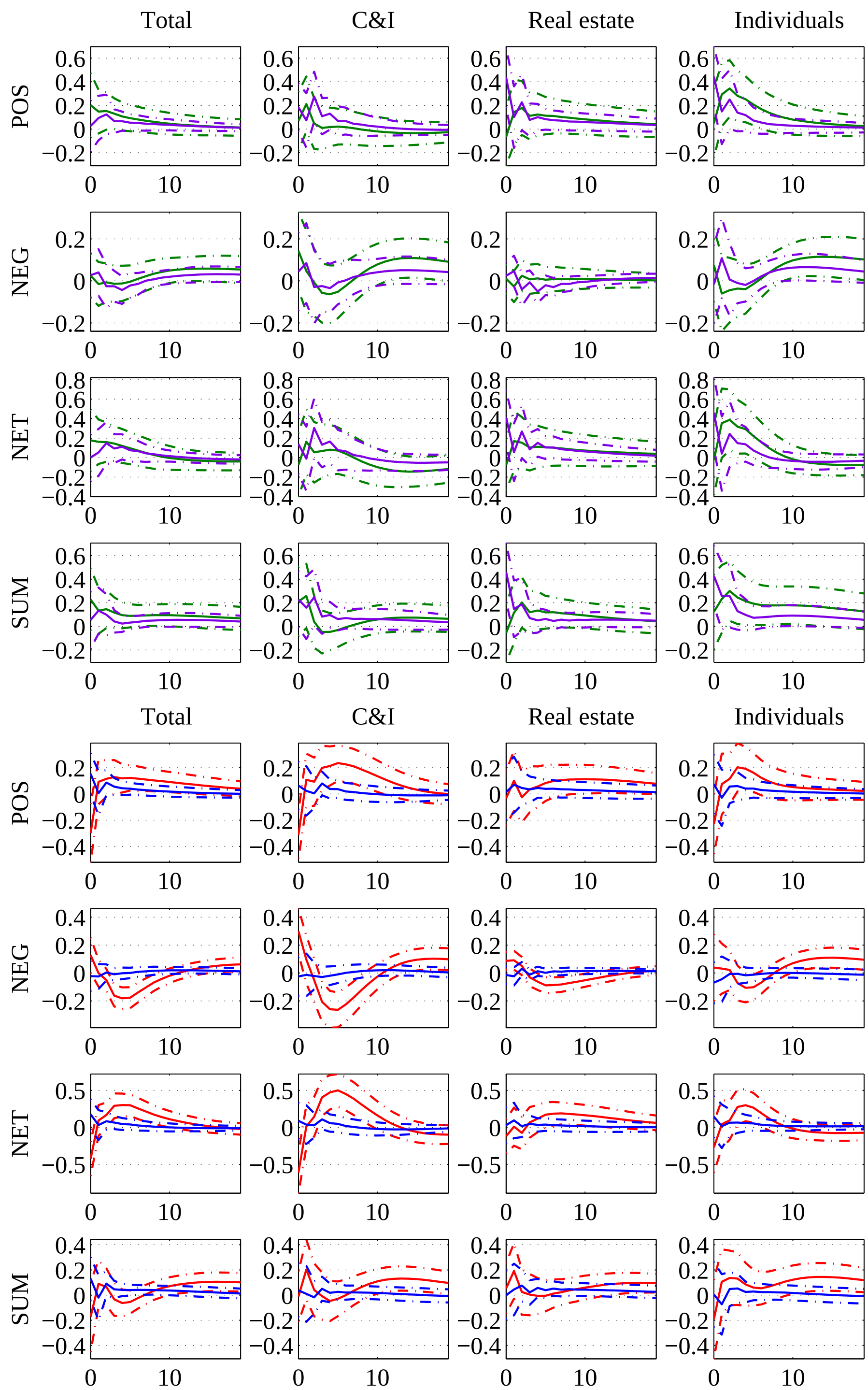


Figure 8: Total Debt, Short-Term Debt, and Long-Term Debt: IRFs to an Embodied Technology Shock (green), to a Neutral Technology Shock (purple), to a Monetary Shock (in blue), and to a Financial Shock (in red)

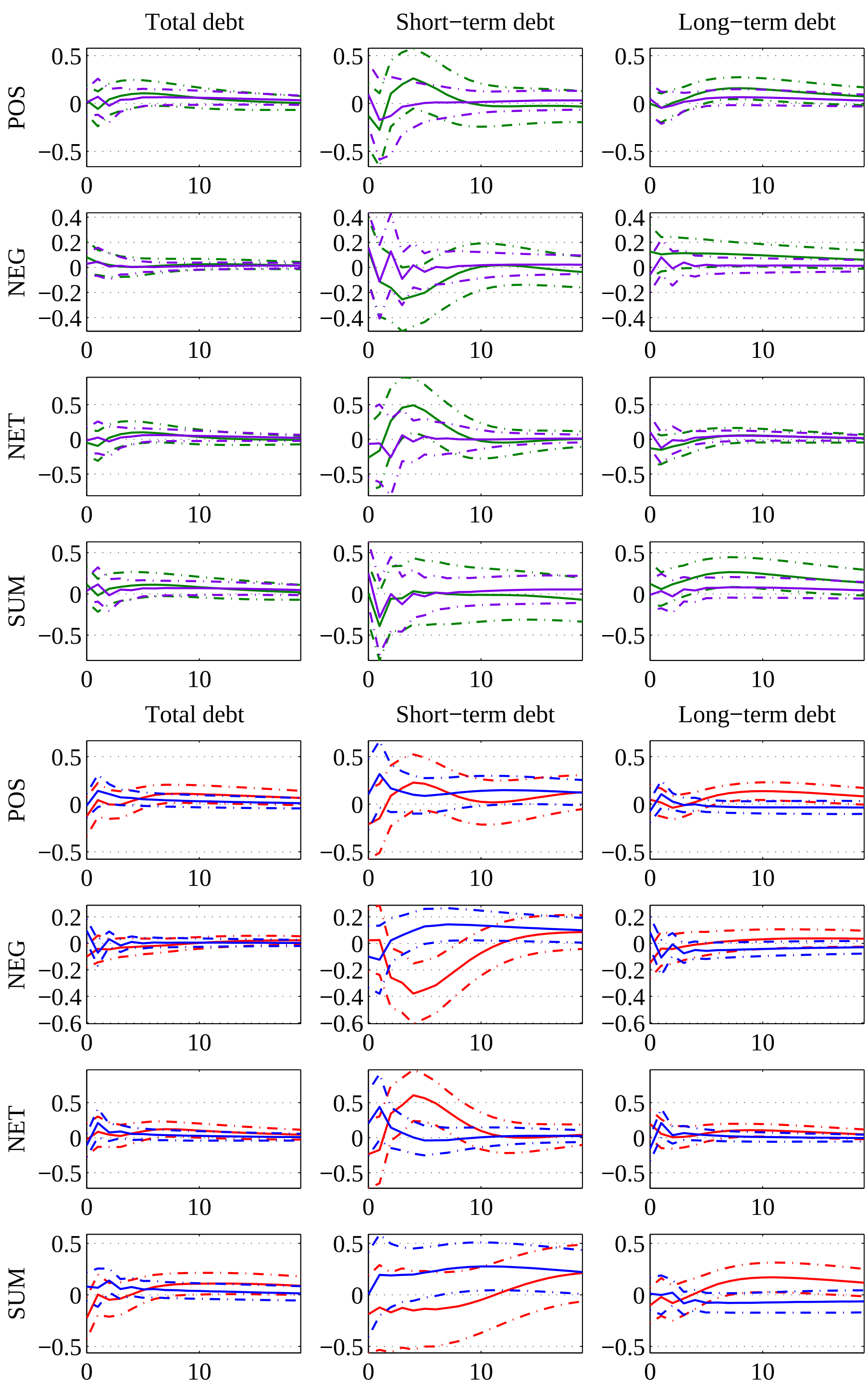
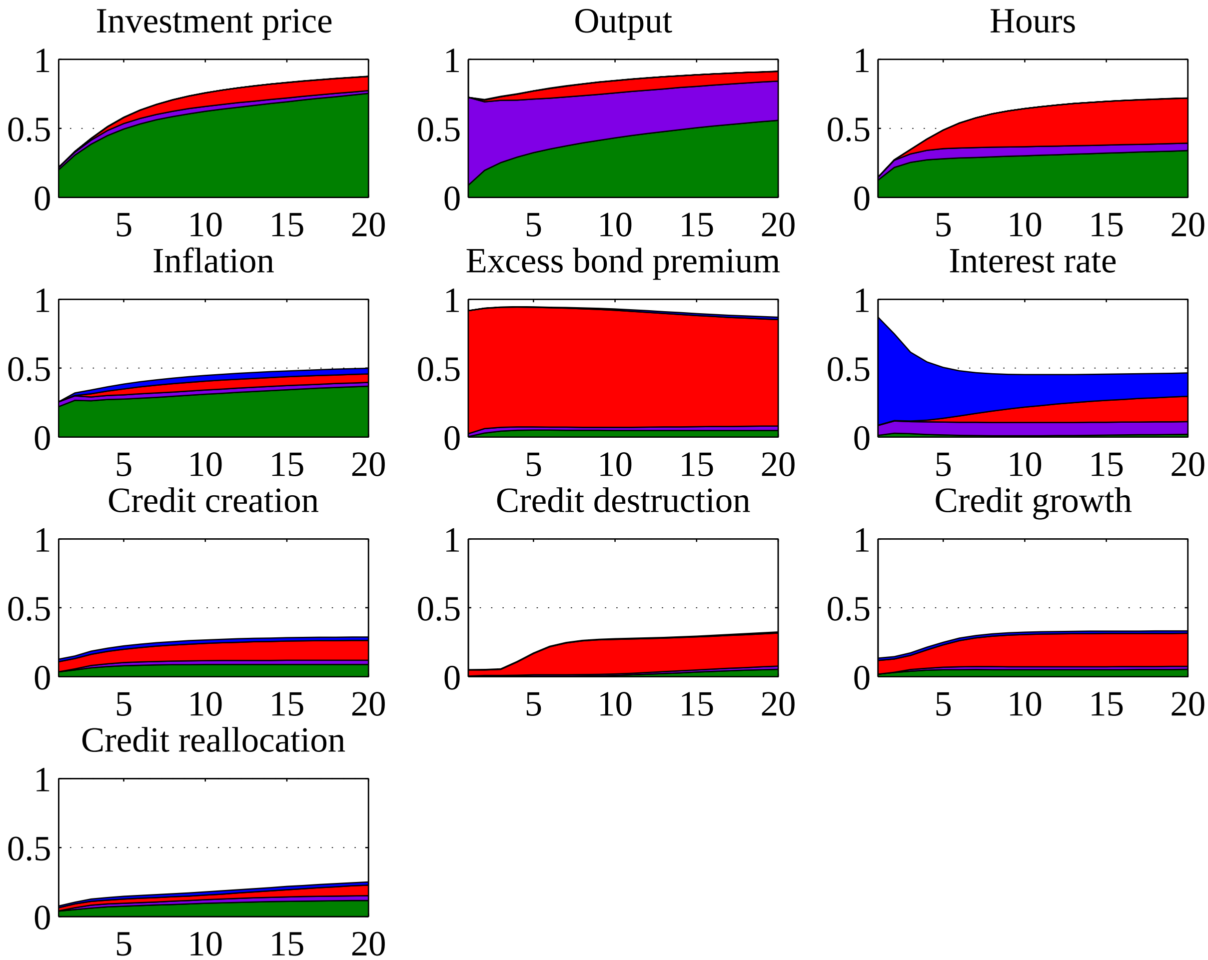
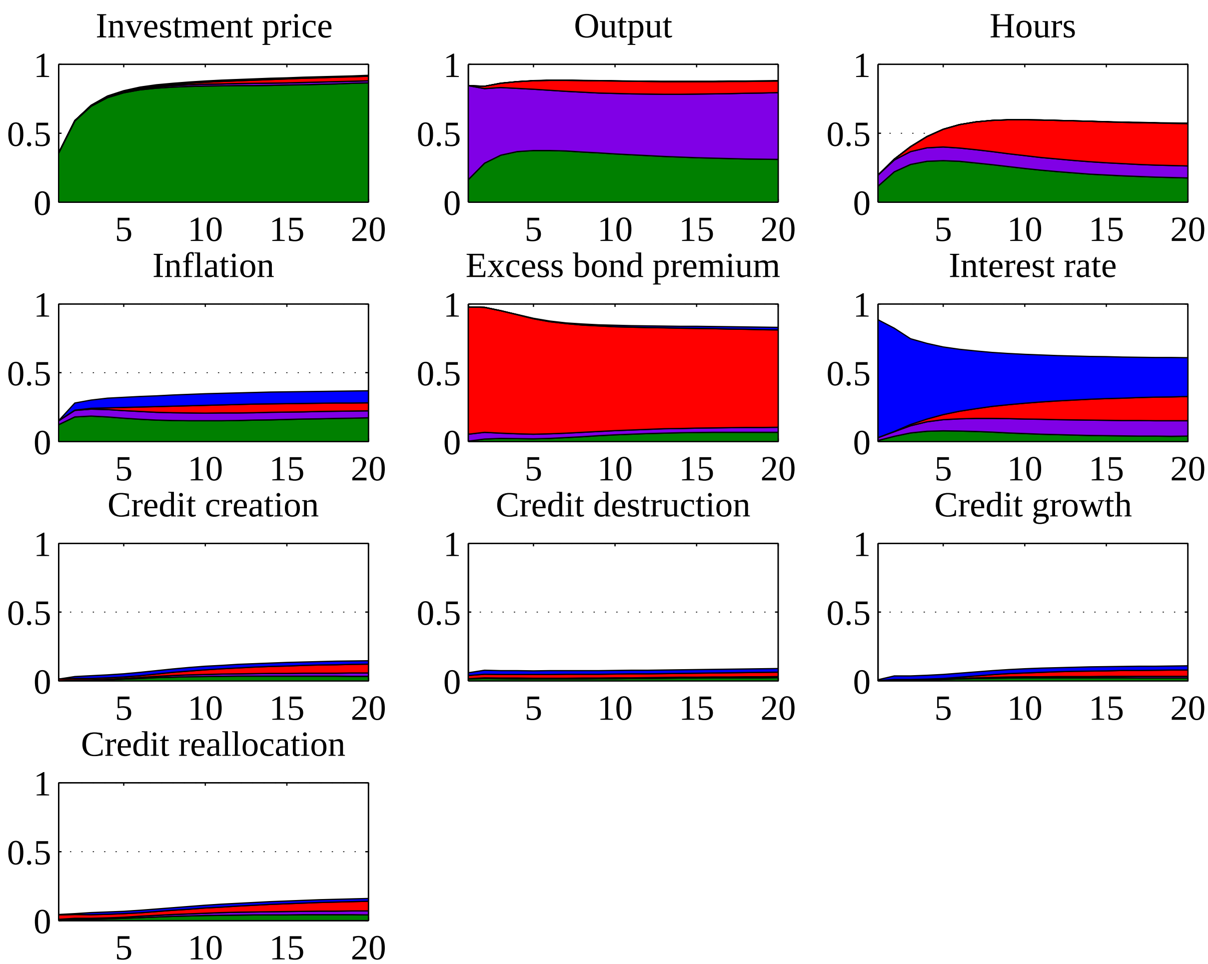


Figure 9: Total Loans: Forecast Error Variance Decomposition.



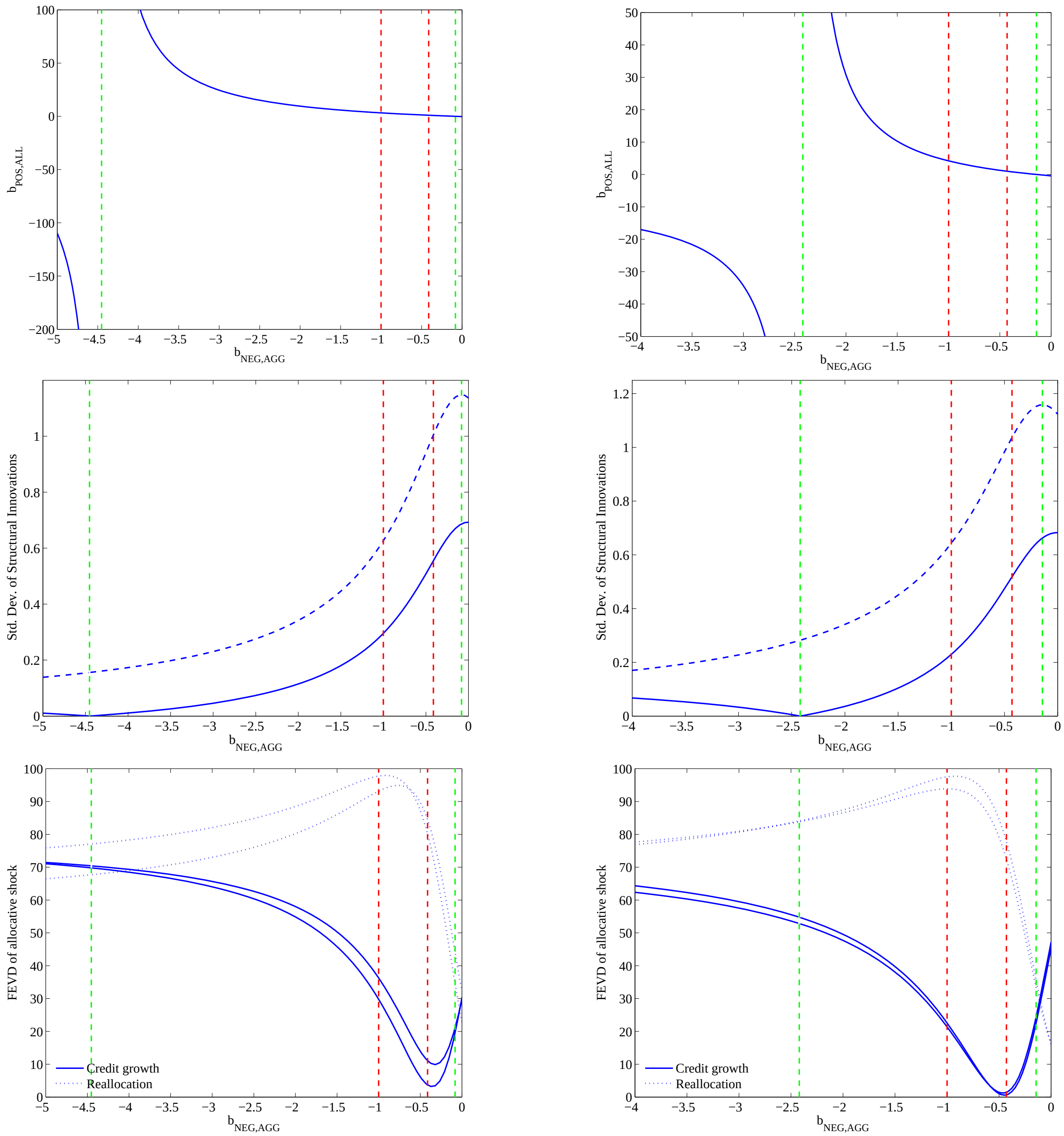
Monetary shocks are in plotted in blue, financial shocks in red, embodied technology shocks in green, neutral technology shocks in purple, and demeaned data in black.

Figure 10: Total Debt: Forecast Error Variance Decomposition.



Monetary shocks are in plotted in blue, financial shocks in red, embodied technology shocks in green, neutral technology shocks in purple, and demeaned data in black.

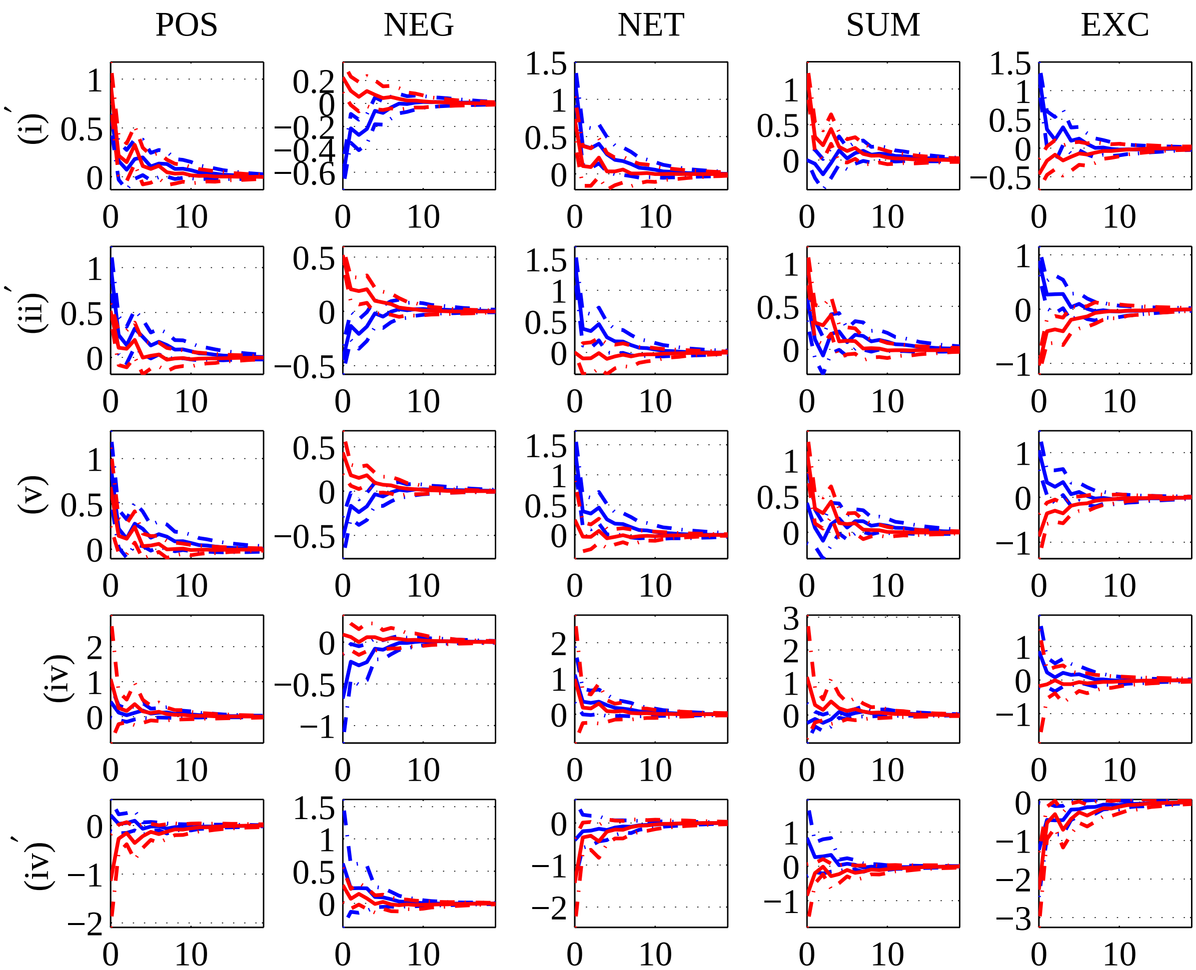
Figure 11: Implications of Identification for Key Parameters for Total Lending and Borrowing.



(a) Total Debt

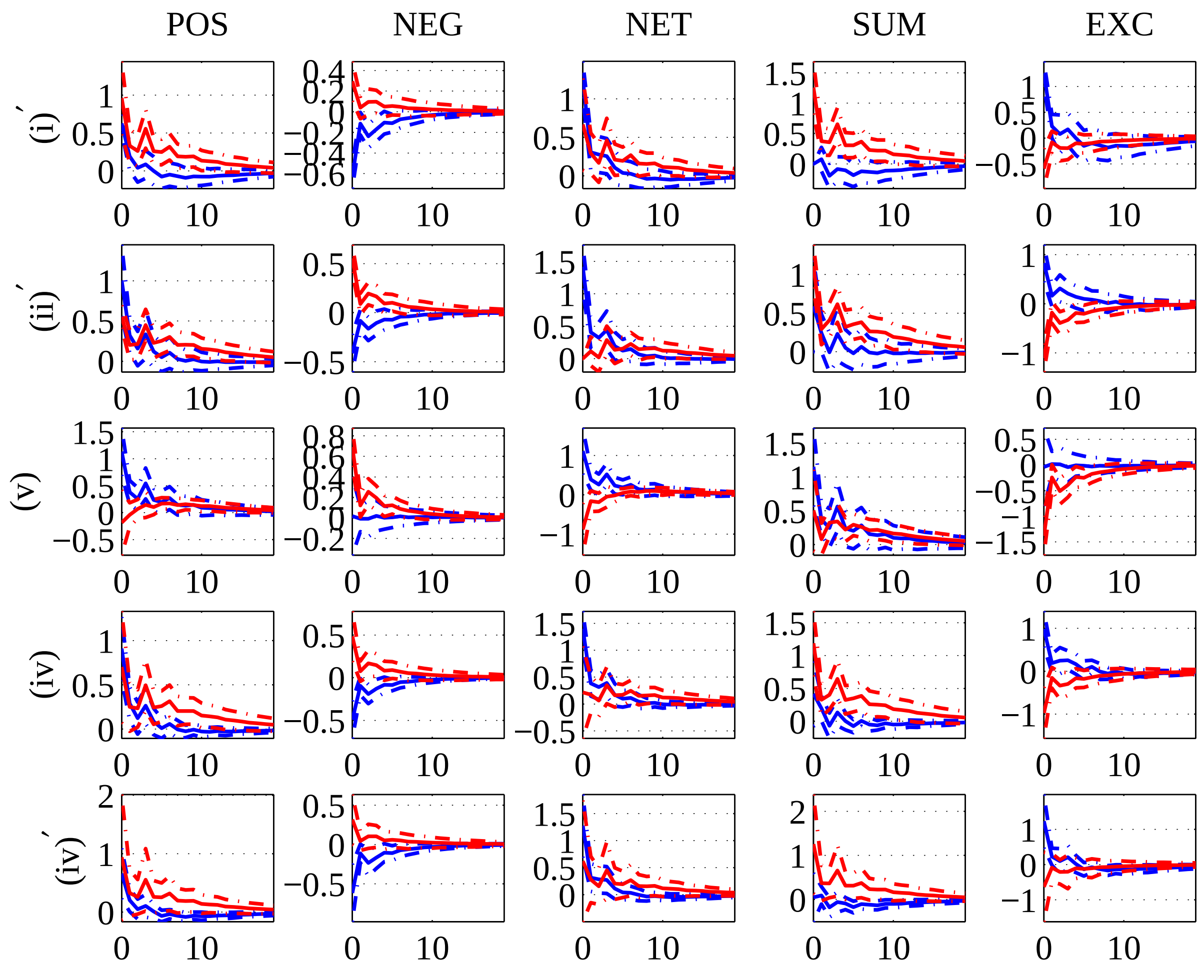
(b) Total Loans

Figure 12: Total Loans: IRFs from the the bivariate VAR.



Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1..

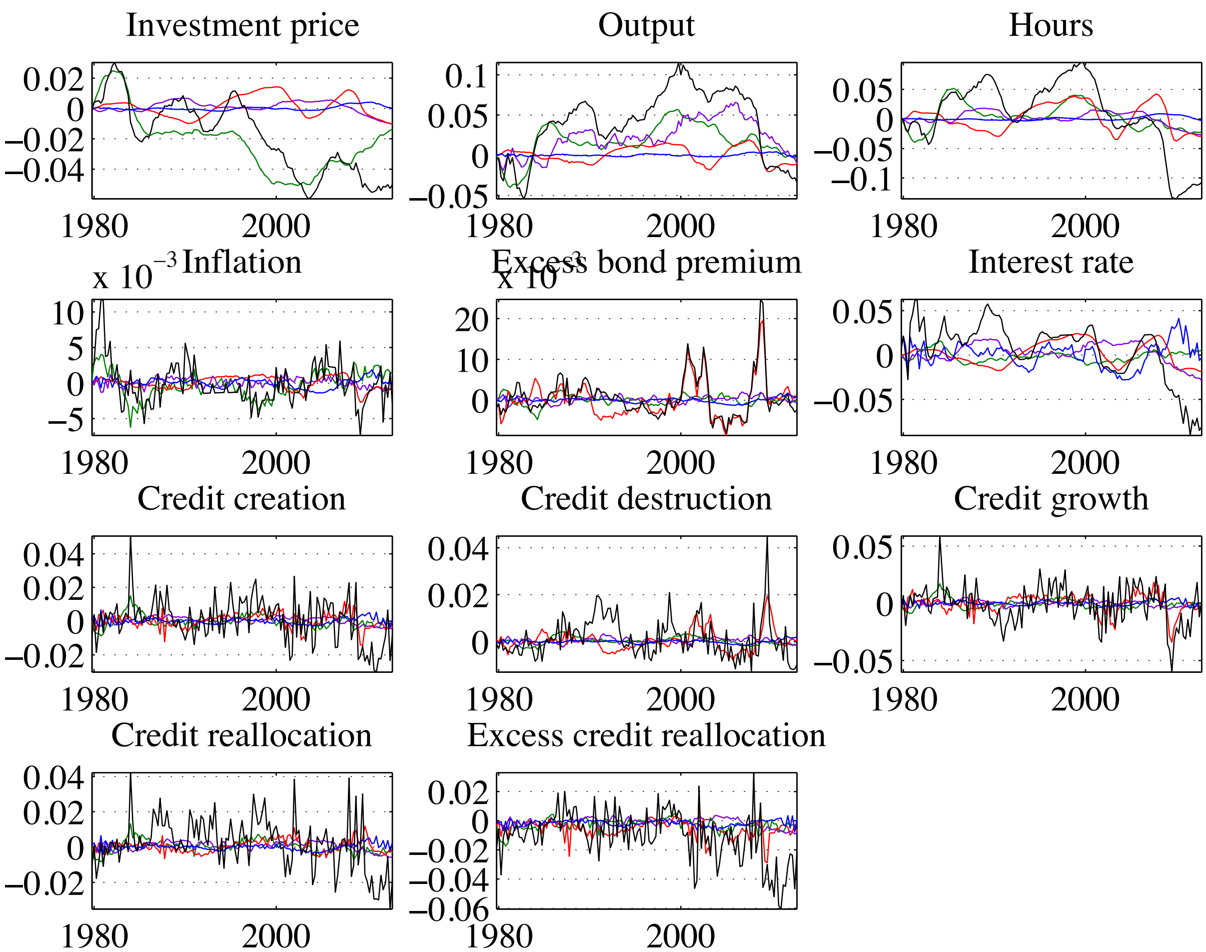
Figure 13: Total Debt: IRFs from the the bivariate VAR.



Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1.

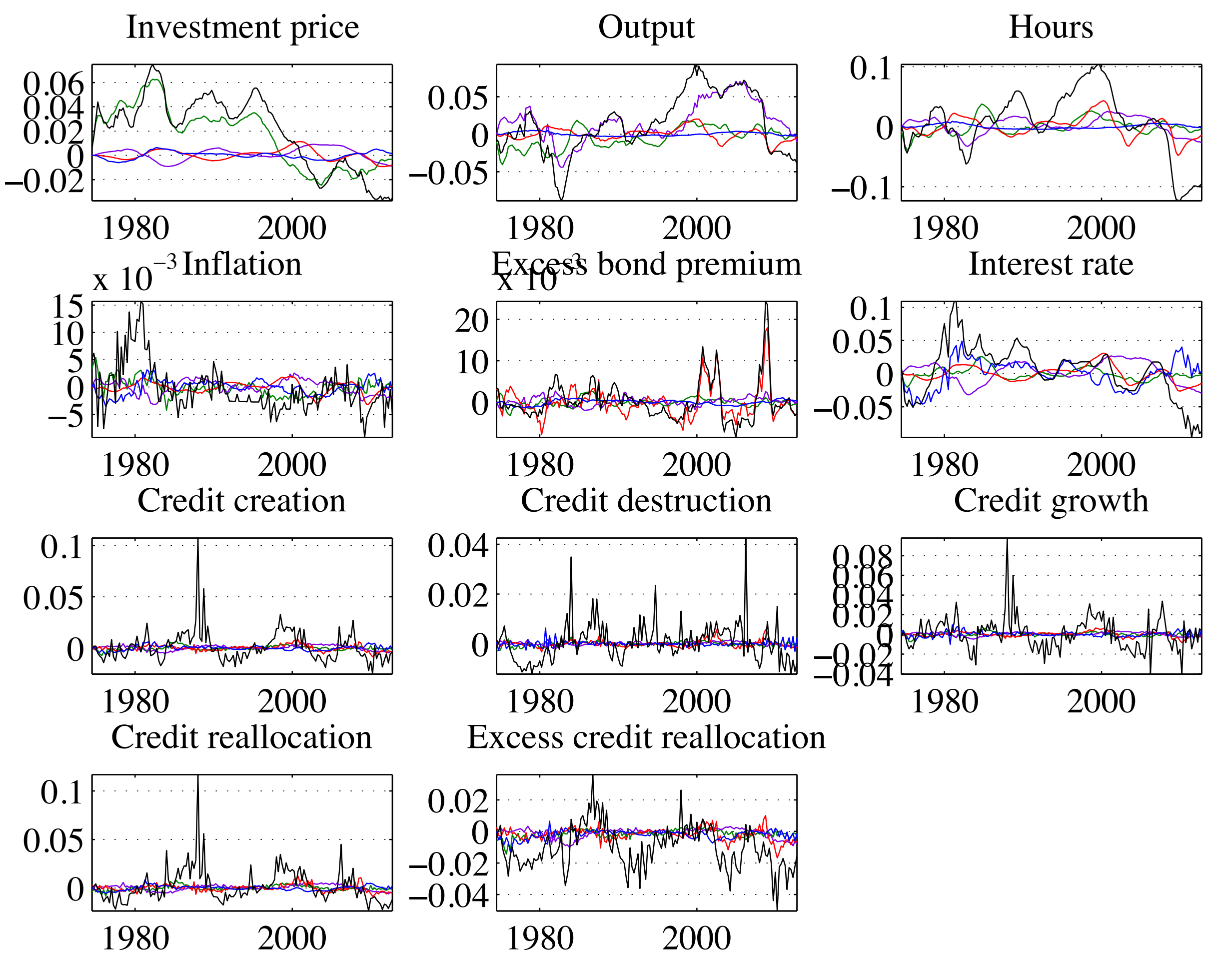
A Appendix

Figure A.1: Total Loans: Historical Decomposition.



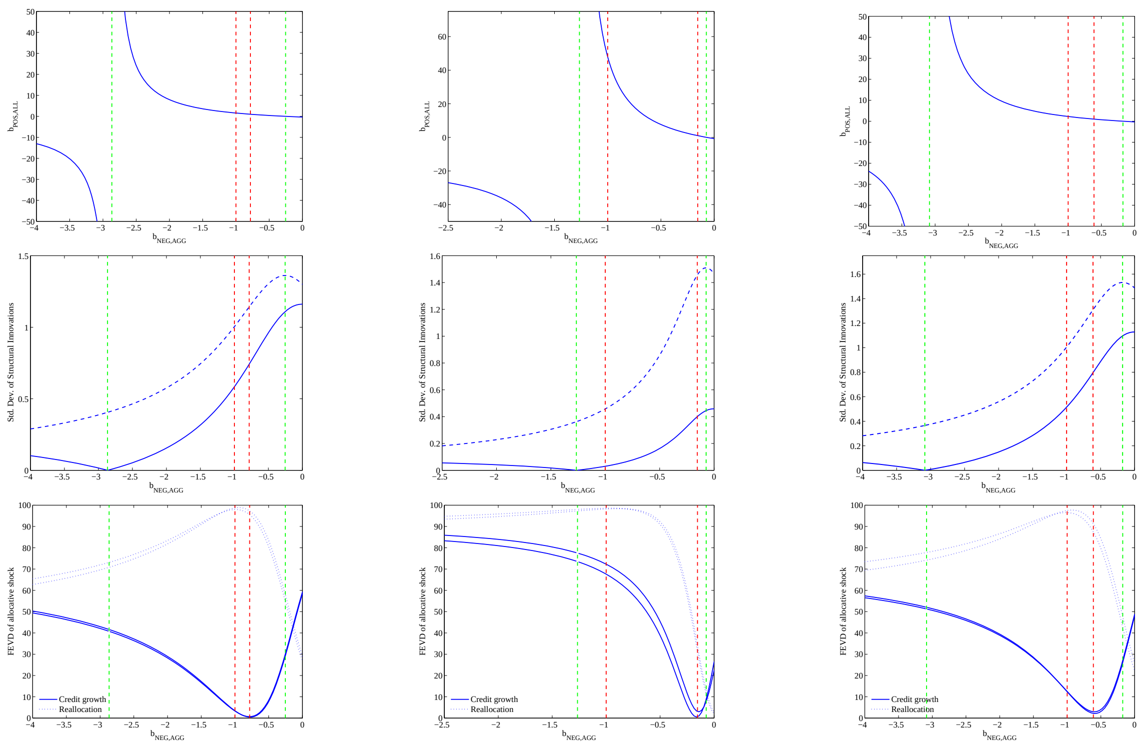
Monetary shocks are in plotted in blue, financial shocks in red, embodied technology shocks in green, neutral technology shocks in purple, and demeaned data in black.

Figure A.2: Total Debt: Historical Decomposition.



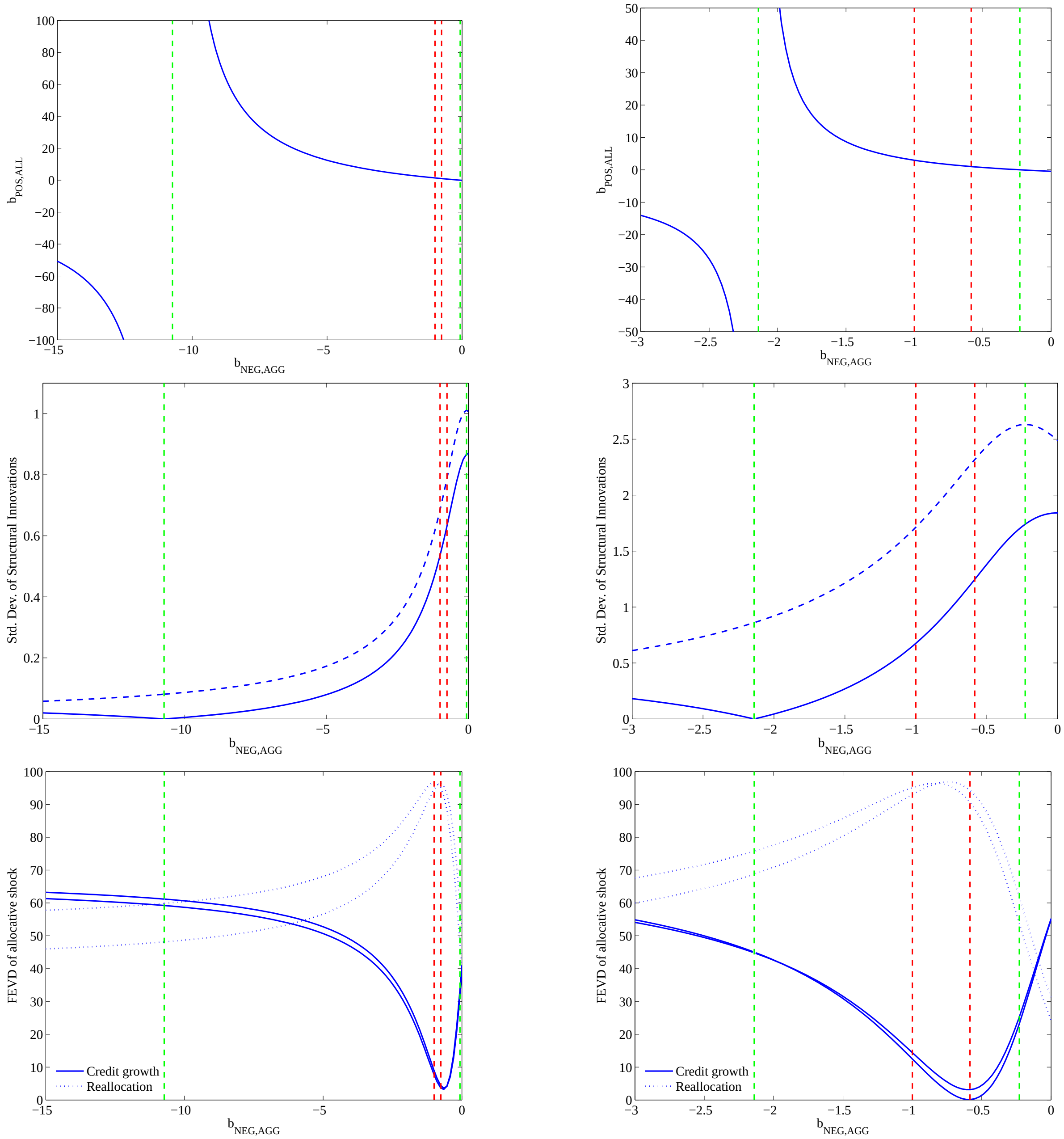
Monetary shocks are in plotted in blue, financial shocks in red, embodied technology shocks in green, neutral technology shocks in purple, and demeaned data in black.

Figure A.3: Implications of Identification for Key Parameters for Categories of Lending.



(a) C&I Loans (b) Real Estate Loans (c) Individual Loans

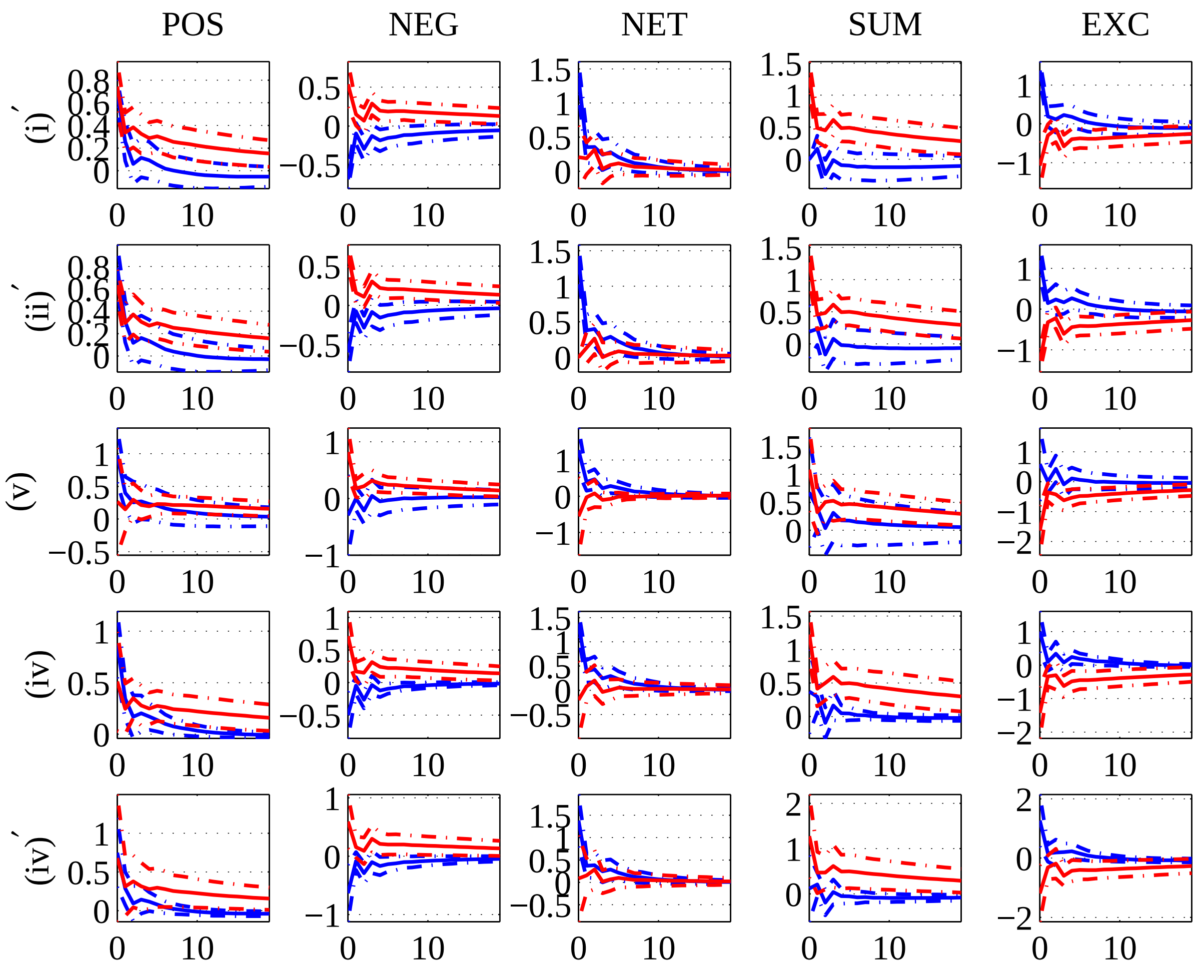
Figure A.4: Implications of Identification for Key Parameters for Categories of Debt.



(a) Long-Term Debt

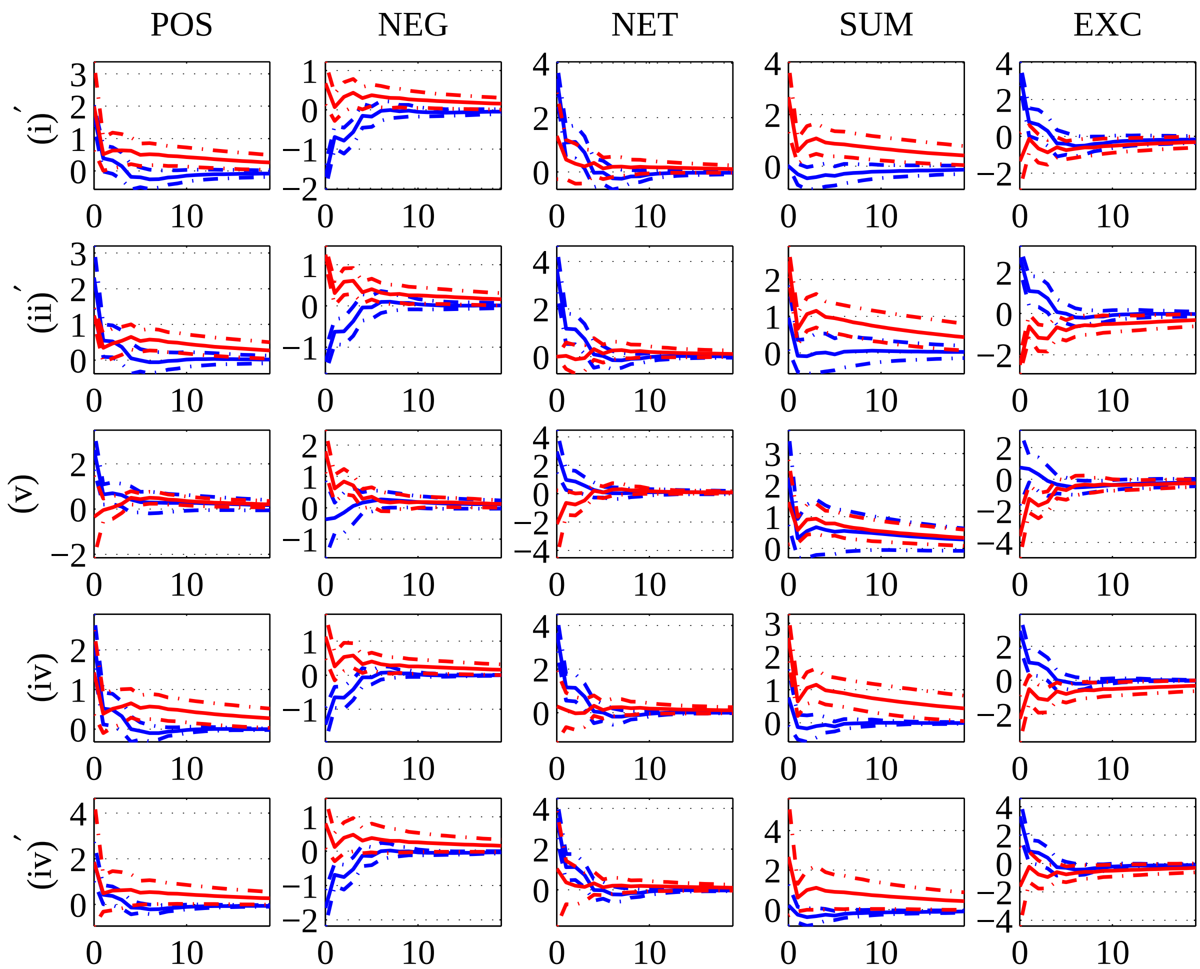
(b) Short-Term Debt

Figure A.5: Long-Term Debt: IRFs from the bivariate VAR.



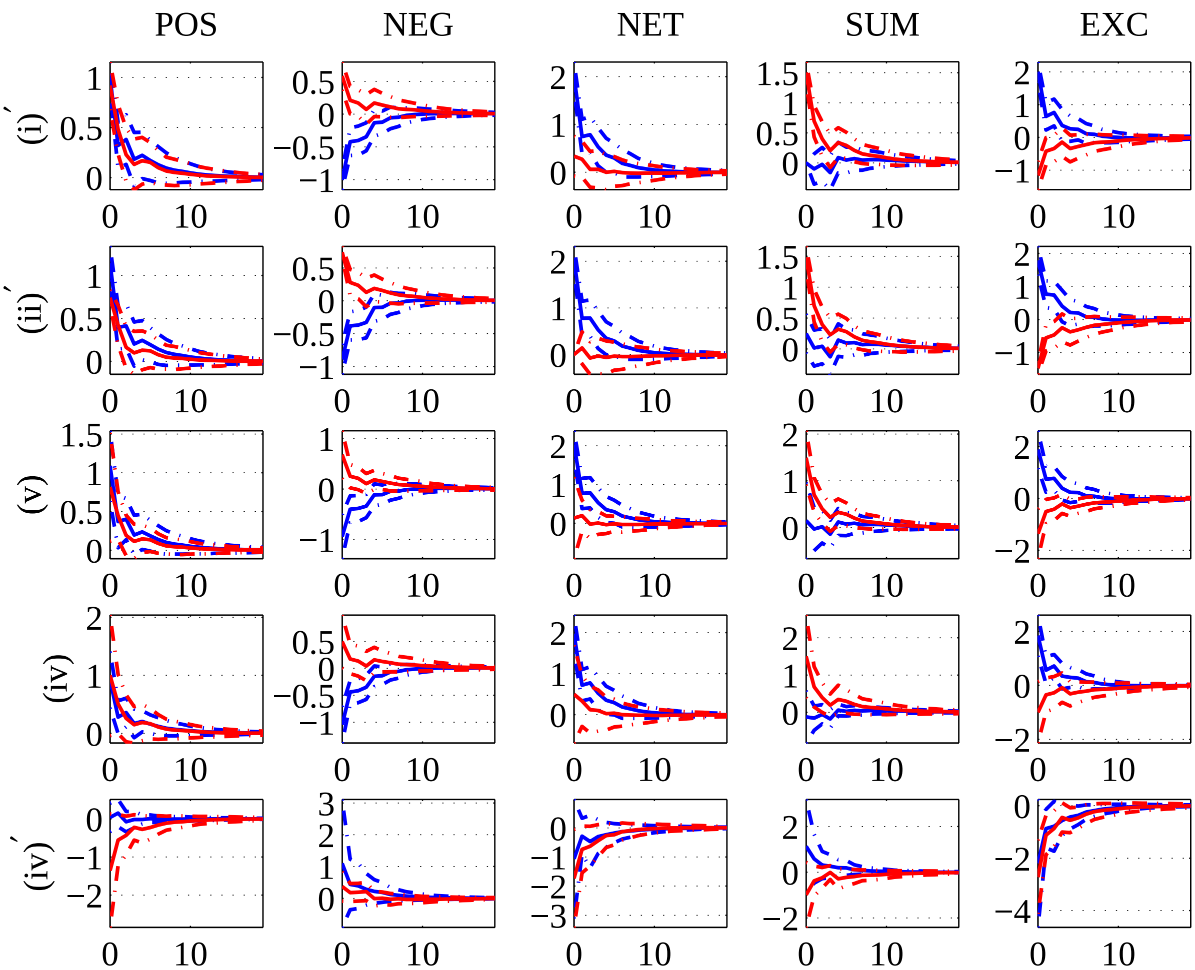
Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1. The horizontal axis is quarters.

Figure A.6: Short-Term Debt: IRFs from the bivariate VAR.



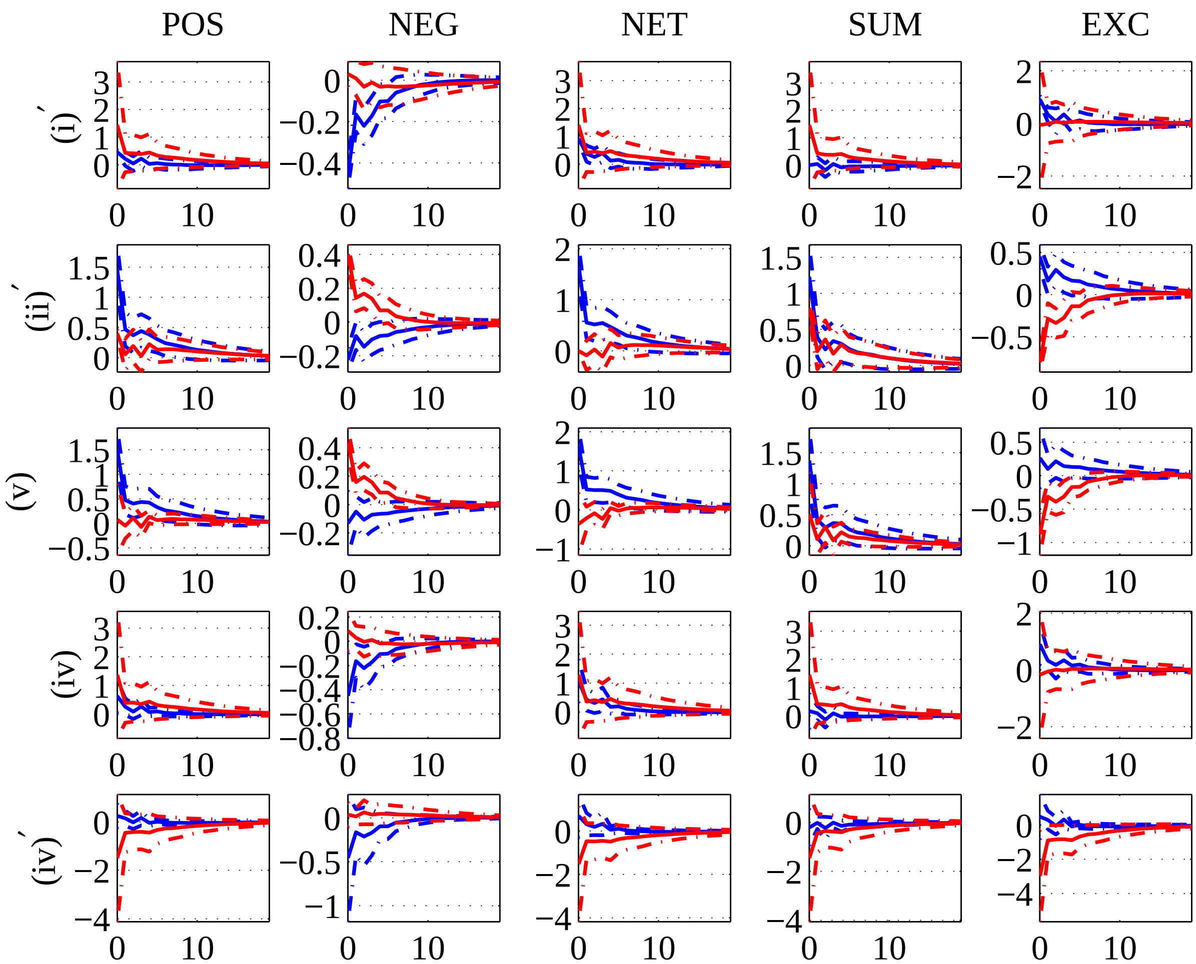
Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1. The horizontal axis is quarters.

Figure A.7: Commercial Loans: IRFs from the bivariate VAR.



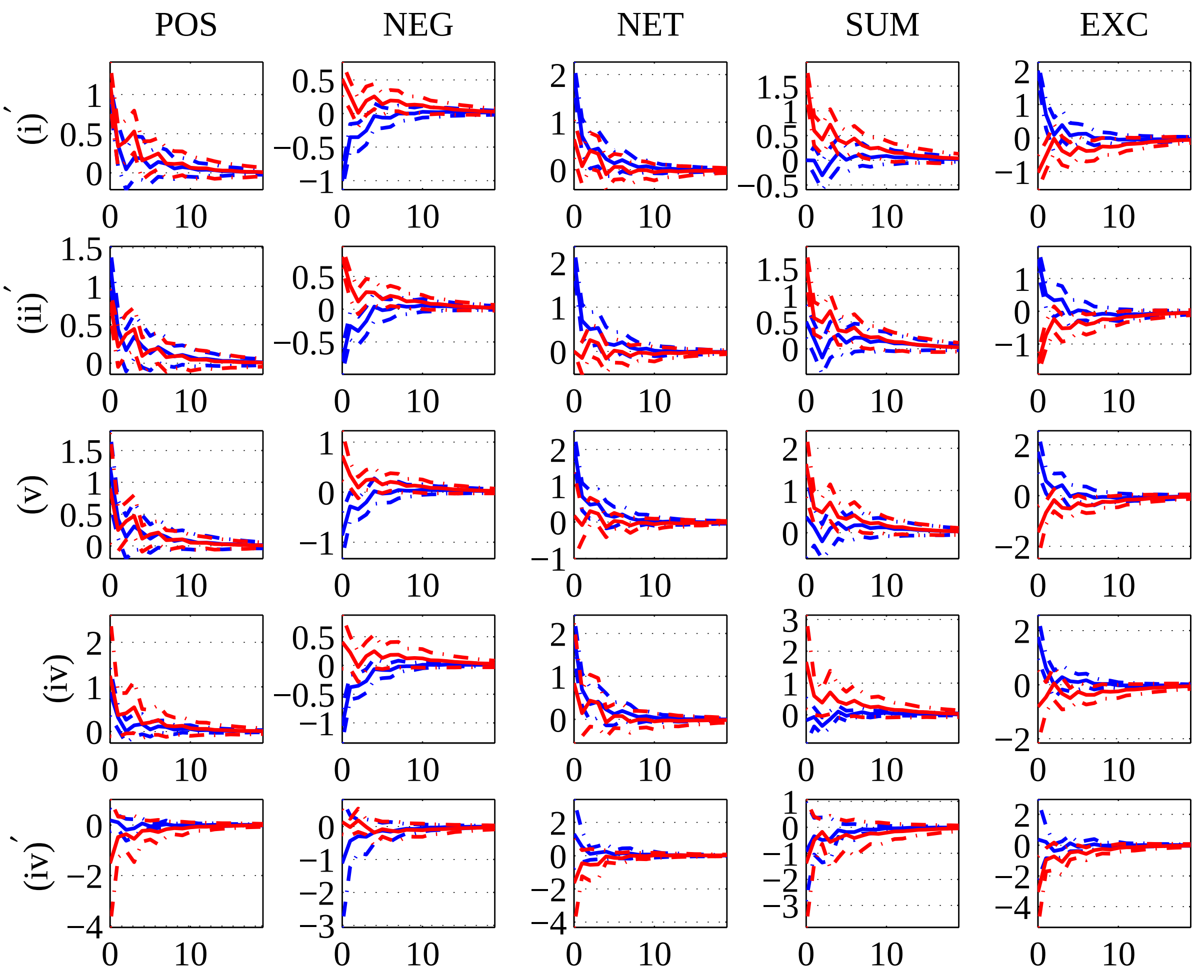
Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1. The horizontal axis is quarters.

Figure A.8: Real Estate Loans: IRFs from the bivariate VAR.



Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1. The horizontal axis is quarters.

Figure A.9: Individual Loans: IRFs from the bivariate VAR.



Note: IRFs to aggregate shocks are plotted in blue and to allocative shocks are plotted in red. Each line represents a particular identification restriction identified in section 4.1. The horizontal axis is quarters.