Cross-Border Bank Funding Shocks and the Bank Lending Channel in a Monetary Union: Evidence from Slovenia[☆]

Uroš Herman[a], Matija Lozej[b,*]

[a]*Goethe University Frankfurt, Germany*
[b]*Central Bank of Ireland, Ireland*

Abstract

We investigate the effects of shocks to the supply of foreign funding to banks on lending to firms, inflation and real activity when a country is in a monetary union. Using an indicator of foreign funds supply to banks, we find that shocks to the supply of foreign funding to banks have strong, significant and persistent positive effects on bank loan supply to firms, real activity and inflation. Without taking into account cross-border debt flows, the impact of shocks to domestic bank loan supply is ambiguous. These findings hold if we identify shocks using sign restrictions or recursively. They imply that changes in the availability of foreign funds have helped fuel the boom after the entry into the Eurosystem and exacerbated the bust after the Great Recession in Slovenia. The mechanism is not country-specific and applies to any small open economy in a monetary union.
JEL classification: E32, E51, F33, F36, G21.

Keywords: Financial integration, Cross-border capital flows, Bank lending channel, Bank funding channel, Business cycles

1. Introduction

Cross-border financial flows have long been considered as important drivers of economic fluctuations and the main source of exchange rate volatility. Until recently, there has been only little discussion of the effects such flows in a monetary union, where the exchange rate is irrevocably fixed. The creation of the Euro has fostered financial integration and the resulting elimination of exchange rate risk had a bigger impact on debt-type flows, in particular those entering the economy through its banking system. As argued by Lane (2013) and Lane and McQuade (2014), a domestic credit boom may be amplified by cross-border debt inflows to domestic banking system. Small and more open countries that are typically more financially integrated or just relatively small compared to the size of capital flows are more susceptible to fluctuations of cross-border debt flows.

Typically, all cross-border capital flows have been considered as something exogenous for the recipient economy. This may not always be the case. Blanchard (2011) pointed this out: "We often think of inflows and outflows as coming primarily from decisions by foreign investors. The reality is that many of these inflows and outflows often come from decisions by domestic investors." It is important to distinguish whether the cross-border debt flows come from changes in the supply or from changes in the demand for funds, as this may both have different consequences for the economy and may require different policy responses.

The hypothesis we investigate is that fluctuations in the supply of foreign funds available to the domestic banking sector lead to large and persistent fluctuations in domestic economy. We investigate this hypothesis along two lines. First, we focus on a small open economy that is a member of the Euro Area, implying that capital flows are completely free. The main object of investigation are banks, which are the most important intermediaries of cross-border funds in the Euro Area (Lane, 2013), and their role in passing funds obtained abroad to domestic firms. Second, we focus on the *supply* of foreign wholesale funding to banks and investigate whether this affects banks' supply of loans to firms.[1] To achieve this, we exploit the detailed flow-of-funds dataset that enables us to identify - under certain assumptions - the effects of fluctuations in the supply of foreign wholesale funding to domestic banks. We call this mechanism the *bank funding channel*, to distinguish it from the fluctuations of bank loan supply to firms, known as the bank lending channel.

Unlike some recent papers that attempt to identify loan supply shocks using interest rates or spreads (e.g., Bijsterbosch and Falagiarda (2015), Gambetti and Musso (2012)), our identification is based on outstanding stock of different types of debt. The identification is based on the idea of Kashyap et al. (1993), who pointed out that if the share of one source of financing in the sum of similar alternative sources, called the Mix, declines, then this is an indication that the

---

[1] We use terms 'firms' and 'non-financial corporations' interchangeably.

supply of this particular source of financing declined, relative to the supplies of other sources.[2] Unlike the identification of loan supply shocks using interest rates, this approach can better capture effects of credit rationing, which may not be reflected in interest rates.[3] The key ingredient required for the identification of loan supply shocks in this way is sufficiently detailed data on gross sectoral flow of funds, ideally by type of instrument. Few countries have such data, which has hindered this type of analysis (see, for instance, Lane (2014)).

To analyse the operation of the bank funding channel, we estimate a series of (structural) vector autoregresions (VAR), each including a measure of the supply of different types of funds to banks. In line with Kashyap et al. (1993), we refer to such measures as 'Mix'. Each Mix is defined as the ratio of the type of funding that we are investigating to the sum of itself and its alternatives. An increase in each Mix indicates that the supply of the funding source in the numerator of the Mix has increased.

We begin by examining the effect of an increase in the supply of foreign wholesale funds to banks. If the hypothesis that the supply of cross-border funds to banks is generating a business cycle at home, then lending and real activity should increase after such shock. The results indicate that this is the case. An increase in the supply of foreign wholesale funds increases bank loan supply and has a strong and persistent positive effect on lending, real activity and inflation.

To investigate whether an increase in the supply of funding to banks causes an increase in the domestic loan supply to firms, we include a measure of the bank loan supply to non-financial corporations in the VAR. The results indicate that this is the case. Banks increase their supply of loans to non-financial corporations after the increase in foreign funding supply to banks, while the effects on all other variables are not altered.

Next, we investigate two alternative hypotheses. The first alternative hypothesis is that large cross-border debt flows are due to monetary policy, and the second is that an increase in domestic loan demand induces bank borrowing abroad. If the first alternative hypothesis is true, then a monetary contraction should cause a reduction in the supply of foreign funds to banks. We find that banks tend to temporarily increase their reliance on foreign loans following a monetary contraction, which is not consistent with the alternative hypothesis.

The second alternative hypothesis that a purely domestic loan supply shock can generate strong and persistent expansion of lending and real activity is also rejected. A purely domestic positive bank loan supply shock at best causes a mild expansion, which is not statistically significant.

To the best of our knowledge, we are the first to use the flow of funds data of a small open economy that is a member of the monetary union to investigate

---

[2]When different sources of funding are substitutes, fluctuations in demand should have no effect on such ratio, as demand for all types of funding would increase proportionally.

[3]Many banks in the Euro Area reported tightening credit standards at the onset of the recession and easing afterwards. See e.g. Ciccarelli et al. (2014).

the issues related to the supply of foreign wholesale funding to banks. Although we perform the analysis on data for Slovenia, the findings are applicable to other small open economies that are members of the monetary union, especially those where the banking system is the predominant source of debt funding for domestic firms and households.

Fluctuations in financial flows in Slovenia since the accession to the Euro Area are also not country-specific. Most countries that have joined the Euro experienced capital inflows, followed by significant outflows during the recent crisis. In Slovenia, foreign debt capital entered the country almost exclusively through the domestic banking system. At the start of the financial crisis, these flows reversed sharply and the outflow of funds from the banking sector due to foreign debt repayment has exceeded 30% of GDP since 2008. Our findings confirm the anecdotal evidence that this reversal had large negative effects on the domestic economy, which amplified the recession and reduced the synchronisation of Slovenian business cycle with that of Slovenia's main trading partners (Jazbec et al., 2014).

There are two reasons for focusing on bank lending to firms. The first is that, unlike households, firms can raise funding from other, non-bank sources. The second is that banks in Slovenia have borrowed mainly to finance loans to firms. At the peak in 2008, loans to firms represented about two thirds of bank loans to the non-financial sector and have decreased to about a half by the end of 2014 (Bank of Slovenia, 2015). Direct lending of foreign banks to domestic firms has been relatively rare (see Gabrijelčič et al. (2014)), while household borrowing has been very restrained.[4]

The paper begins with a brief description in Section 2 of the data used and a set of stylised facts at business cycle frequencies in Section 3. Section 4 contains the VAR analysis of the effects of shocks to wholesale bank funding on domestic economic activity, examines an alternative hypothesis and assesses the main drivers of co-movement between firm various debt components and GDP. Section 5 concludes.

2. Data

For the empirical analysis we use a sample of quarterly data spanning the period from 2004Q1 to 2013Q3. The data used for the identification of the bank lending channel come from the flow of funds statistics, which is available at quarterly frequency only since 2004.[5]

To identify bank funding and loan supply shocks, we construct several Mix indicators using financial accounts data on cross-sector lending by types of financial instruments. For the VAR analysis we use standard macroeconomic

---

[4]Households in Slovenia are among the least indebted in Europe Arrondel et al. (2014).

[5]We stop in 2013Q3 because of the transfer of a large portion of loans to the Bank Asset Management Company, which is not classified as a bank in the flow-of-funds accounts, but lumped together with the government, which causes a structural break in the series.

variables such as aggregate output, prices, bank loans to firms and the monetary policy rate. Output is measured by real GDP, developments in prices are proxied by the GDP deflator, bank loans to firms are in nominal terms. The policy rate is the main refinancing operations (MRO) rate set by the ECB.[6] All data are in log-levels, except loan supply indicators, bank funding indicators and the central bank interest rate, which are in levels.

3. Stylised facts

We first report some typical stylised facts about financial variables in our sample over the business cycle.[7] The top panel of Figure 3 shows the evolution of the key debt series (left axis) and the Mix variables (right axis). The middle panel of Figure 3 shows the cyclical components of real GDP (thick line) and various components of nominal firm debt, all as percentage deviations from trend. Table 1 reports contemporary correlations of cyclical components of firm debt variables with cyclical components of real GDP and the price level.

Over the business cycle, various types of firm debt are by an order of magnitude more volatile than real output, which is typical for financial data. What is interesting is that out of all debt types, only trade credit and foreign loans to banks are strongly positively correlated with real output at cyclical frequencies. Over the business cycle higher prices coincide with more firm borrowing and higher deposits, but with lower levels of other types of financing.

The lower panel of Figure 3 shows cyclical components of various forms of bank debt with the cyclical component of real GDP. Debt components of banks are even more volatile than those of firms at cyclical frequencies. All bank liabilities except deposits and foreign loans are negatively correlated with real output at cyclical frequencies.

However, positive correlation of various types of debt and real output at cyclical frequencies can be caused by many factors and should not be taken as evidence for a bank lending channel (Kashyap and Stein, 1994) or that an increase in foreign loans to banks stimulates output. For example, while the positive relationship between bank loans to firms and real output is consistent with the bank lending channel, there are many plausible alternative explanations, for instance that the increase in bank loans is driven by demand for bank loans. A similar case can be made for the weak or negative correlation of most bank debt components with real output.

All stylised facts presented here are unconditional - correlations and volatilities are driven by all shocks that have affected the economy during the sample period. The volatilities and correlations depend on the frequency and magnitudes of shocks, as well as on the strength of the reaction of each variable. Our

[6]For the period before 2007, we use the interest rate on 60-day Tolar bills as the relevant policy rate. Results are not affected if we use the MRO rate.

[7]To obtain the cyclical components we use the Christiano-Fitzgerald filter in order to avoid putting too much emphasis on the most recent observations, as is typically the case when using the Hodrick-Prescott filter. Results do not differ materially if the latter is used instead.

Table 1: Correlations and standard deviations at cyclical frequencies

	Rel. std.	Corr. with GDP	Corr. with prices
Banks			
Deposits	1.55	0.26	0.56
Securities	11.58	-0.16	-0.23
Loans	2.89	0.00	-0.33
Foreign securities	22.38	-0.22	-0.24
Foreign loans	2.46	0.58	-0.43
Firms			
Trade credit	2.42	0.70	-0.63
Securities	6.48	-0.13	-0.61
ST loans	3.29	0.22	0.54
LT loans	1.19	0.08	0.70
Foreign loans	2.82	-0.17	0.80
Foreign trade credit	2.90	0.68	-0.65

goal is to establish whether shocks to the supply of foreign funds to the banking system have driven these statistics and, if so, how important was this influence. To achieve this, we have to condition the co-movement between bank and firm debt components and real activity on the type of shocks.

4. A structural VAR analysis

We use a structural vector autoregressive (VAR) model to condition the analysis on shocks. The estimated reduced-form VAR takes the following form:[8]

$$Y_t = c + t + A_0 D_t + \sum_{i=1}^{q} A_i Y_{t-i} + u_t, \qquad (1)$$

where c is a constant, t is a linear trend, D_t is a vector of quarterly dummies, Y_t is a vector of endogenous variables that includes a policy instrument, and u_t is a reduced-form error term. q is the number of lags and A_i are coefficient matrices.[9] The vector Y_t contains variables whose current values are in the central bank's information set, $Y_{1,t}$, a policy instrument, r_t, and variables whose current values are not in the central bank's information set, $Y_{2,t}$, so that $Y_t = [Y_{1,t}, r_t, Y_{2,t}]$.[10]

---

[8]The VAR is estimated using ordinary least squares, with all variables in levels or log-levels. This yields consistent estimates even when variables used are (co)integrated, as long as sufficient number of lags is used. We opt for three lags in all specifications.

[9]Strictly speaking, including a deterministic trend is not necessary, although it is common in empirical work (see, e.g., den Haan (2000)). We have examined the robustness of our results to alternatives with no trend and with quadratic trend. The results are not materially affected.

[10]All lagged values of all variables included are in the central bank's information set.

$Y_{1,t}$ always includes GDP deflator, real GDP and one of debt series. $Y_{2,t}$ includes one or more Mixes.

The relationship between reduced-form shocks u_t and structural shocks ε_t is

$$u_t = B\varepsilon_t, \tag{2}$$

where B is a square matrix and ε_t are uncorrelated structural shocks with unit variance. We therefore assume that

$$E[u_t u_t'] = BB'. \tag{3}$$

To obtain the necessary number of restrictions that allow us to identify at least some structural shocks, we either assume that B is a lower-triangular matrix, which allows us to recover the elements of B, or we rely on sign restrictions to obtain a matrix that transforms reduced-form shocks into structural ones.

4.1. Identification

Identifying shocks to bank loan supply or bank funding supply from abroad is difficult. To achieve identification, we rely on a set of loan supply indicators and use two approaches to identify shocks. The first approach is based on timing assumptions and is standard in the literature (see Christiano et al. (1999)). The second approach is based on sign restrictions, as in Uhlig (2005) or Fry and Pagan (2011).

While the identification of the monetary policy shock is fairly standard, the identification of changes in bank loan supply is more controversial. We exploit the idea of Kashyap et al. (1993), who suggested that if the share of bank loans among firm liabilities with similar characteristics declines, then this is due to the (relative) tightening of the supply of bank loans. They used as a measure of bank loan supply a ratio of short-term bank loans to the sum of short-term bank loans and commercial paper issued by non-financial corporations, and called this variable the 'Mix'. Their reasoning was that if short-term bank loans and commercial paper are close substitutes, then changes in demand for financing will not affect the Mix, because firms will seek financing both at banks and on the markets. Only if there is a change in the supply of bank loans (relative to the supply of commercial paper), the Mix will be affected. Their original application of the analysis was to monetary policy. The reasoning was that when firms reduce demand for financing after a monetary contraction, they will reduce it equally for all types of debt forms that are close substitutes. If the reduction in bank loans is more than proportional (i.e., the Mix declines), then this must be due to the contraction in the supply of bank loans.

We use the same idea and apply it to liabilities of banks in order to identify shocks to the supply of foreign funding to domestic banks. Our reasoning is that if banks have several sources of funding available that are close substitutes, then a decline in the proportion of funding from one source must indicate the reduction in the supply of that type of funding. We use the same approach when considering the liabilities of non-financial corporations.

The advantage of using Mix indicators based on outstanding stock of debt instead of interest rates is that they better capture the effect of credit rationing than interest rates do. Because interest rates are a bad screening device, there may be borrowers that are willing to take a loan at a given interest rate, but are not able to obtain one because they are rationed (Stiglitz and Weiss, 1981). This implies that fluctuations in the supply of funds may not be fully reflected in interest rates, either quoted or those based on actual transactions.[11] Our approach is therefore complementary and potentially more precise than those of Bijsterbosch and Falagiarda (2015) or Gambetti and Musso (2012), who use spreads or interest rates for the identification of credit supply shocks.

The main concern regarding the Mix-based indicators of loan supply is that changes in the indicators may be driven by shifts of financing between different types of banks or firms. For instance, Oliner and Rudebusch (1996) pointed out that the decline in the Mix following a monetary contraction may be due to the shift of all forms of financing from small firms to large firms. Because the latter rely less on bank debt (and more on commercial paper), this results in the decline in the Mix.

This argument is less of a concern in Slovenia, where all firms are small from the financing perspective (i.e., commercial paper was either not used during the sample period or its use was negligible). Therefore, the argument that there has been a shift in the Mix carries less weight.[12] The same argument applies to banks. The main players in the banking system are domestic and foreign banks, and both have extensively used foreign loans as the main source of wholesale funding.[13]

4.1.1. Recursive identification

When we use timing assumptions to identify a monetary policy shock, we assume that the short-term central bank rate is the monetary policy instrument and that inflation, real activity, and the volume of loans react to an exogenous innovation in the monetary policy rate with a lag. To strengthen this identification assumption, the monetary policy rate used is the average monetary policy rate over the last month of the quarter.[14]

When timing assumptions are used to identify loan supply shocks (either

---

[11]There is ample evidence that banks changed credit standards in Europe and in Slovenia during the recent crisis. See Ciccarelli et al. (2014) and Bank of Slovenia (2015).

[12]Data on firm balance sheets by firm size, industry, etc. are not available at quarterly frequencies and not detailed enough by instruments and sectors, which prevents a formal investigation of potential distributional shifts. A plausible hypothesis could be that large firms have more access to foreign financing and are therefore less dependent on domestic bank loans. If all forms of finance shift to large exporting firms that are less reliant on domestic bank loans, then this could potentially changes in the Mix. We have investigated this issue using interpolated annual data and found no significant differences between large and small firms. The results are available upon request.

[13]Large domestic banks have occasionally issued some securities, but the amounts were negligible compared to loans.

[14]Using the average policy rate over the entire quarter makes no material difference.

supply of foreign funds to banks or supply of loans from banks to firms), we assume that all other variables in the VAR react with a lag to an exogenous innovation in the indicators of the foreign supply of funding to banks or to banks' supply of loans to firms.

4.1.2. Identification with sign restrictions

Timing assumptions are not necessarily appropriate for the identification of shocks that do not depend on institutional structure the way monetary policy does. We therefore augment our analysis with the identification based on sign restrictions.

Table 2 summarises the sign restrictions we use to identify the bank funding supply shock. We wish to distinguish two financial shocks, a shock to the home bank loan supply (a bank loan supply shock) and a shock to the supply of large-scale funding to banks (a bank funding supply shock). A positive bank loan supply shock is identified as the increase in the proportion of domestic bank loans among the alternative sources of firm finance, denoted by $MixH$, and the decrease in the proportion of foreign funding of banks, $MixF$. A positive bank funding supply shock is identified when both $MixF$ and $MixH$ increase. The reasoning is that if the expansionary shock originates from bank funding supply, it is passed on to bank lending and both mixes increase. If an expansionary bank loan supply shock originates in the domestic banking system, we assume that banks have excess funding and will try to repay some of their wholesale liabilities, which will cause $MixF$ to decrease.[15] Bank loans should increase after both bank loan supply and bank funding supply shocks.

Table 2: Sign restrictions for bank funding supply shocks

Expansionary shock	GDP defl.	GDP	Loans	MixH	MixF
Bank funding supply			+	+	+
Home bank loan supply			+	+	-
Aggregate supply	-	+	+	-	
Aggregate demand	+	+	+	-	

To improve our identification, we also use sign restrictions for other shocks (Fry and Pagan, 2011). To do so, we use the standard assumptions regarding the effects of aggregate supply and demand shocks, consistent with a number of theoretical models (see for instance Gambetti and Musso (2012), or Bijsterbosch and Falagiarda (2015) for an overview). What distinguishes aggregate demand and supply shock is the negative impact of positive supply shock on the price level. We assume that both aggregate demand and supply shocks increase lending, but that they more than proportionally increase non-bank lending at home. The reason is that the main alternative to bank lending to firms is trade credit,

---

[15]We consider several definitions of both Mix indicators.

9

which increases with economic activity more than bank loans.[16] The implied sign restrictions for expansionary shocks are shown in Table 2. In all cases, we only impose sign restrictions on impact responses. We leave the responses of GDP and the price level after both bank loan supply and bank funding supply shocks unrestricted, as these are the variables in whose response we are interested in.

When examining alternatives without the bank funding supply shock, we replace this shock with a monetary policy shock and use sign restrictions as shown in Table 3. Expansionary monetary policy increases prices, GDP, and decreases the central bank rate and $MixH$.[17] We leave the response of output to an expansionary loan supply shock unrestricted.

Table 3: Sign restrictions for home bank loan supply shocks

Expansionary shock to	GDP defl.	GDP	Loans	CB rate	MixH
Home bank loan supply	-		+		+
Aggregate supply	-	+	+		-
Aggregate demand	+	+	+	+	-
Monetary policy	+	+		-	-

To distinguish the home bank loan supply shock from the monetary policy shock, we assume that an expansionary shock to the home bank loan supply induces a drop in prices, an increase in loans (Gerali et al., 2010), and an increase in the proportion of bank loans among alternative sources of financing (Kashyap et al., 1993). The assumption of a negative effect of home bank loan supply shock on inflation is somewhat controversial. In Gerali et al. (2010) this is due to the increase in bank loan supply due to the increase in bank capital. In Atta-Mensah and Dib (2008) this is because marginal costs of firms are directly affected by the bank lending rate.[18] However, other causes of the increase in bank loan supply may have opposite effects, see Gambetti and Musso (2012). We therefore check robustness of our results with an alternative identification, where we leave inflation unrestricted and use a zero restriction on monetary policy rate when home loan supply increases. Our rationale is that the ECB does not react to shocks that occur in a small country in the Euro Area.

In all cases, we first generate a set of 100 models that all satisfy sign restrictions in Tables 2 and 3. This is what Fry and Pagan (2011) call *structural identification*. To select a single model from this set of models (*model identification*), we use the median target approach of Fry and Pagan (2011).[19] Confidence

---

[16]One of the reasons is that trade credit increases automatically with economic activity, while obtaining bank loans involves costs and delays related to loan applications.

[17]We leave loans unrestricted, as we expect heterogeneous responses of short- and long-term loans after a monetary policy shock. See Bernanke and Gertler (1995), Gertler and Gilchrist (1993), and Gertler and Gilchrist (1994).

[18]Note that this is essentially the same mechanism that has been suggested to explain the price puzzle in VARs.

[19]This approach picks the model whose impulse responses are closest to the median of

bands are generated using bootstrap around the median target response.

4.2. The bank funding channel

We begin by exploring the effect of supply shocks to bank funding on economic activity and inflation. The idea is that, *given demand of bank customers for loans*, banks will obtain funds to satisfy this demand from the source that is the easiest for them to tap. This implies that if the proportion of a particular source of bank funding among other bank liabilities increases, then the supply of this source of funding has eased relative to the supply of other sources of funding.[20]

We define three proportions that we use as measures of the supply of funds to banks, all on a consolidated basis, and corresponding to $MixF$ in table 2:[21]

1. *Loans Mix* is the proportion of domestic and foreign loans obtained by banks in the sum of all loans, securities, and deposits.
2. *Foreign Loans Mix* is the proportion of foreign loans obtained by banks in the sum of all loans, securities and deposits.
3. *Foreign Mix* is the proportion of all foreign loans and securities in the sum of all loans, securities, and deposits.

The Loans Mix intends to measure the availability of wholesale loan funding, regardless of the source. Loans have also been the most important source of wholesale funds for banks in Slovenia (see top panel of Figure 3). Foreign Loans Mix is intended to capture the availability of loans from abroad to resident banks. Foreign Mix measures the availability of all wholesale funds from abroad and captures the potentially different behaviour of foreign creditors.[22]

We begin by investigating the effect of a change in the (relative) supply of each of the type of funds considered, using recursive identification. We call a change in any Mix a bank funding shock and order it last (so that all other variables react with a lag to an innovation in any of the mixes). This is done in Figure 4.2, which shows the effect of an increase in each particular Mix on the other variables.[23] Note that it is irrelevant for our purpose whether a particular Mix increases because of an increase in the numerator or a decrease in the denominator (or both, or any other combination that leads to the increase

---

the responses of all models that satisfy sign restrictions. The measure of proximity is the minimum squared distance between the model's impulse responses and the median impulse response from the set of models that satisfy sign restrictions.

[20]This is simply the application of the idea by Kashyap et al. (1993) to bank balance sheets.

[21]We use all debt variables on a consolidated basis, i.e., we take into account only funds that come from other sectors. Intra-sector lending does not represent an inflow in the sector, which is why we exclude it.

[22]We include government deposits in the denominator, but all results carry through if we exclude them.

[23]A similar exercise, but without the central bank rate, has been used by Iacoviello and Minetti (2008). We keep the central bank rate in the VAR because it is more likely that the central bank will react to an innovation in the European wholesale market. The results are not materially affected if the central bank rate is left out.

of the Mix). An increase in the Mix means that, given demand of banks for funding, they have used more of the type of funds in the numerator. The supply of this type of funding has therefore become more relaxed, *relative* to the supply of alternative types of funding.

The most interesting results in Figure 4.2 are the strength and uniformity of effects of positive shocks to the supply of wholesale bank funding on domestic bank lending, inflation, and GDP, despite the accompanying strong increase in the interest rate. Bank lending to firms and GDP increase strongly and significantly. The increase in any Mix by about one percentage point results in about 3% increase in bank loans to firms and about 1.2% increase in real GDP after approximately two years. Inflation decreases initially, but picks up after about a year and persists for about two years.

A concern regarding these findings is that a shock to bank funding supply may not properly identified. For example, a similar set of responses could also be observed if, after an increase in firms' demand for loans, banks resort to wholesale funding sources to meet the increase in loan demand. This would lead to an increase in all wholesale sources of bank funding and bank loans to firms. If such explanation is true, then any indicator of the bank loan supply *to firms*, relative to other types of firm financing, should remain unchanged, as firms increase demand for all types of financing, not only bank loans.

To investigate this issue, we include the firm-level Mix in the VAR. This Mix is defined as the ratio of all bank loans in the sum of all bank loans and trade credit used by firms, with the latter almost exclusive alternative source of funding to firms in Slovenia.[24] If the firm-level Mix remains unchanged, then it is likely that firms' demand for financing caused the relative increase in banks' wholesale funding.[25]

Figure 4.2 shows that the firm-level Mix *increases* significantly after a positive shock to bank funding. This indicates that firms borrow relatively more from banks than from alternative sources, indicating that the *supply* of bank lending to firms has eased. Therefore, the shock to wholesale bank funding does not mask a shock to domestic demand for funding. Note also that the responses are not consistent with the domestic demand shock, as inflation falls or remains unchanged during the first year after the shock, while one would expect an increase of inflation after a demand shock. The responses of other variables are not materially different from those shown in Figure 4.2.

The above findings suggest that shocks to bank funding, and foreign funding in particular, play an important role in generating or amplifying fluctuations in the domestic economy. The results are robust. We used various measures of bank loans and Mix definitions and obtained similar results.

As there is a concern that recursive identification is not appropriate for the

---

[24]The use of trade credit as an alternative to bank loans has been advocated by e.g. Oliner and Rudebusch (1996), among others.

[25]We follow Iacoviello and Minetti (2008) and exclude the central bank rate from our analysis to preserve degrees of freedom given our relatively short sample. If we include it, the results are not materially different.

identification of supply shocks to bank funding, we use sign restrictions as an alternative (see table 2). All restrictions are imposed on impact and that we do not restrict either inflation or output. The results are presented in Figure 4.2.

The identification using sign restrictions essentially confirms our previous findings, except for the Foreign Mix where the GDP response is not significant at 90% level (but the responses of other variables are). Note that prices increase on impact and stay at elevated levels for a long period. The initial increase in prices is different from the case when we use recursive identification. Nevertheless, results from the identification with sign restrictions still indicate that an increase in the supply of bank funding is passed on by banks through an increase in bank lending supply. This results in an increase in real GDP and inflation (with a delay). The effects on GDP, inflation and loans are somewhat smaller, but still sizeable.

4.3. Alternative explanations: Monetary policy and the bank lending channel

This section investigates two alternative explanations. The first alternative explanation is that large procyclical cross-border debt flows to the banking sector are caused by monetary policy. This could be due to the balance sheet channel at the bank level (Disyatat, 2011). If such channel operates, a monetary contraction should lower creditworthiness of banks and make their access to wholesale funds more difficult. Therefore, if this hypothesis is true, a monetary contraction should cause a reduction in the supply of foreign funds to banks.

The second alternative explanation is that a purely domestic loan supply shock can generate a strong and persistent expansion of lending and real activity at home, which subsequently attract foreign funds.

4.3.1. Monetary policy and cross-border debt flows

To investigate the effect of monetary policy on cross-border debt flows we examine the behaviour of bank funding supply indicators after a monetary contraction, using the standard recursive identification. The variables of interest are the mixes in the bottom row of Figure 4.3.1. The leftmost and the middle column indicate that all loans and foreign loans increase relative to alternative sources of bank funding for about a year after a monetary contraction. Therefore, the supply of foreign loans to banks increases compared to the supply of other sources of bank funding. Foreign Mix decreases, indicating that the supply of market-based sources of financing to banks decreases relatively to the supply of intermediated sources such as loans. Bank lending decreases, but is initially not significant and seems to follow the decrease in output.

These results are not inconsistent with the standard notion of the bank lending channel, whereby a monetary contraction causes a decline in deposits and a reduction in bank lending, as in Kashyap et al. (1993), or Iacoviello and Minetti (2008). They do however indicate that this channel is weaker, because banks can resort to wholesale funding, in particular to foreign loans. The result that the supply of foreign loans to banks increases relatively to the supply of other sources funding after a monetary contraction is at odds with the existence

of a balance sheet channel at the bank level. The absence of such channel can explain why banks do not lose access to foreign loans, their main source of wholesale funding.[26]

4.3.2. Bank lending channel

In this section we investigate the standard bank lending channel, without considering bank funding. The focus of investigation is not the relationship between banks and their suppliers of funds, but between firms and banks. We investigate whether shocks to domestic bank loan supply alone can generate procyclical fluctuations of loans, output and inflation, similar as those observed for shocks to the bank funding supply.

Traditionally, the bank lending channel has been considered as an additional channel of monetary policy transmission (Kashyap et al., 1993). It is operational under the assumption that banks cannot replace the reduction of deposits induced by monetary policy and that firms cannot replace bank loans by other forms of financing.

The notion that banks lose deposits after a monetary contraction or that they are not able to replace them has been challenged, most recently by Jakab and Kumhof (2015). They argue that banks can create deposits through lending and are essentially not constrained by monetary policy. If this is the case, one would not expect to see evidence of bank lending channel after a monetary policy shock. Note also that our finding that banks resort to the use of foreign loans after a monetary contraction is not consistent with this interpretation. Foreign funds are real resources and not something that is created by lending within the economy. Nevertheless, such finding implies that the bank lending channel is weaker.

Because of these arguments, we first establish if there is any evidence that the domestic bank lending channel operates and whether monetary policy affects domestic loan supply. Next, we investigate the effects of a purely domestic bank loan supply shock.

To identify supply shocks to domestic bank lending we use firm balance sheets and define another set of lending indicators *at the firm level*, again following Kashyap et al. (1993). The idea is to define proportions of bank loans to firms in the total of alternative funding sources available to firms. If the proportion of bank loans declines, then this indicates that firms have more difficulties to obtain funds from banks compared to other sources. Therefore, the supply of bank loans must have contracted.

There are two characteristics of the Slovenian economy that lead us to expect a priori that the bank lending channel is present. First, in highly bank-dependent economies, the bank lending channel should be strong (Iacoviello and Minetti, 2008). Second, if firms are homogeneous regarding the choice of financing alternatives, identification of the bank lending channel should be more

---

[26]It may be the case that the balance sheet channel operates only for market-based sources of funds (securities), but is not present for bilateral sources, such as loans.

straightforward, as there is less scope for a particular group of firms with special characteristics to drive the aggregate results.[27] Firms in Slovenia are very homogeneous regarding financing, as they all rely mostly on banks and trade credit.

We follow the argument of Oliner and Rudebusch (1996) and consider all relevant financing alternatives of firms, i.e., trade credit, outstanding securities, and loans from non-bank intermediaries. The only economically important alternative to bank financing in Slovenia, however, is trade credit, and the results are not affected if other alternatives are omitted.[28] Because we wish to measure the amount of funds that flow into the firm sector, all quantities are consolidated, i.e., intra-firm lending and trade credit is excluded.

We assume that types of financing with similar maturity are closer substitutes than those with different maturities, which leads us to define three types of Mix indicators:[29]

1. *All Mix* is the proportion of all bank loans (short-term and long-term) to firms in the sum of all bank loans and (short-term and long-term) alternatives.
2. *Short-term Mix* is the proportion of all short-term bank loans to firms in the sum of all short-term bank loans and short-term alternatives.
3. *Long-term Mix* is the proportion of all long-term bank loans to firms in the sum of all long-term bank loans and long-term alternatives.

We use these definitions in the VAR and employ the standard recursive identification to identify a monetary policy shock. If any of the Mix indicators decreases after a monetary contraction, this indicates a disproportionally large reduction in bank loans, which is consistent with the existence of the bank lending channel. The results for each Mix definition are shown in Figure 4.3.2.

The left column of Figure 4.3.2 shows the impulse responses after a monetary contraction for a VAR with all bank loans. Notably, the Mix decreases and stays at a decreased level for about two years. Other results are standard - the price level decreases after a delay, real output and bank loans to firms decrease. These results are consistent with the bank lending channel hypothesis, i.e., that a monetary policy shock causes a reduction in the supply of bank loans, relative to the supply of other forms of firm financing.

The middle column of Figure 4.3.2 shows the responses to a monetary contraction from a VAR that includes only short-term bank loans and the Short-term Mix. While the Short-term Mix decreases on impact, this decrease is

---

[27]In the U.S., one of the main objections to the idea of Kashyap et al. (1993) was that large firms, which use commercial paper while small firms do not, tend to borrow more after a monetary contraction, which in turn causes the decrease in the proportion of bank loans in the aggregate (Oliner and Rudebusch, 1996).

[28]Loans to firms from abroad are quantitatively less important and limited to only a handful of firms. The data do not allow us to distinguish foreign loans by type of intermediary. While there are securities issued by firms, the amounts outstanding are tiny and have been issued only recently by a handful of large firms.

[29]All Mixes are ratios of nominal series.

barely significant and is quickly reversed. Moreover, short-term bank loans to firms increase initially. These results are not consistent with the bank lending channel hypothesis. While the initial increase in short-term loans to firms may be the result of the increased demand for such loans (e.g., because real GDP does not decrease initially), the volatile reaction of the Short-term Mix may also indicate that banks increase the supply of short-term loans.

The right column of Figure 4.3.2 displays the responses to a monetary tightening in a VAR with the Long-term Mix. The Long-term Mix decreases strongly and significantly, and it remains depressed for about two years. Long-term bank loans also decrease significantly and more sharply than short-term bank loans. These results are consistent with the hypothesis that the bank lending channel exists. Overall, the results from Figure 4.3.2 indicate that if there is a bank lending channel operating through domestic banks, then long-term loans seem to be the main driver of the response of all loans and the Long-term Mix seems to drive the response of the aggregate Mix.[30]

Next, we follow Iacoviello and Minetti (2008) and investigate responses to a bank lending shock. Given our identification assumption, a shock to the Mix is a shock to the bank loan supply. If the bank lending channel operates, the exogenous increase in the Mix should lead to an increase in bank loans and an increase in output.[31]

As Figure 4.3.2 shows, loans and output decline after an increase in the Mix. There is a (statistically insignificant) increase in short-term loans accompanied by a brief increase in GDP, which could be consistent with the hypothesis that there is a bank lending channel. It is more likely, however, that this is the consequence of short-run noise in the data (note that in Figure 4.3.2, the Mix for short-term loans does decrease on impact, but this decrease is very short-lived and later reversed). We obtain similar results if the VARs include various measures of wholesale funding as in Figure 4.2.

While it is possible to find VAR specifications where firm debt and output increase after a shock to the Mix (for instance, by ordering the Mix above the central bank rate), we cannot claim that we find robust evidence for the bank lending channel using standard recursive identification. A possible reason is that the identification is not appropriate.[32]

To address this issue, we use an alternative identification scheme with sign

---

[30]We obtain the same result if we include both Long-term and Short-term Mix in the VAR. Results are not materially different if only trade credit is used as the alternative to bank loans, if trade credit and loans from non-bank intermediaries are used, if securities are added to either, or if consolidated or non-consolidated series are used.

[31]Iacoviello and Minetti (2008) exclude the central bank rate from the VAR where they shock the mix, stating that they wish to exclude the effect of the interest rate. If we do this, the results are not qualitatively different from those reported here.

[32]Recall that the Mix is defined using trade credit in the denominator. If trade credit tends to be more tightly linked to the real activity (which is the case, given the unconditional correlations reported in Table 1), then an increase in the Mix may also contain a negative shock to real activity. Given the lack of other economically meaningful firm funding alternatives, we cannot investigate whether this is indeed the case.

restrictions (see Table 3) to identify the home bank loan supply shock for all three loan categories. The results are presented in Figure 4.3.2.

Results in Figure 4.3.2 are somewhat more favourable to the hypothesis that an expansionary shock to domestic bank loan supply increases lending and real activity. Nevertheless, a shock to domestic loan supply alone has small and not statistically significant effects on GDP and other variables. Moreover, the result turns out to depend on whether we assume that domestic loan supply shock decreases inflation on impact or not.

Recall from section 4.1.2 that the effect of the increase of loan supply on inflation is ambiguous - some claim it is positive and some that it is negative. To leave inflation response unrestricted, we have to introduce an additional restriction in order to distinguish the bank loan supply shock from the monetary policy shock. To achieve this, we assume that the ECB policy rate does not react to country-specific developments, i.e., we impose the restriction that the policy rate response is zero on impact after the domestic loan supply shock.[33] We use the procedure of Haberis and Sokol (2014) to impose the zero restriction. Figure 4.3.2 shows the result, which is similar to the result we obtained using recursive identification. It seems that a positive domestic loan supply shock leads to a brief increase in loans and higher inflation, followed by a decrease in loans and recession.

Taken together, the evidence reported in this section gives some indication that there is a domestic bank lending channel for long-term loans operating after a monetary policy shock. However, the evidence examined does not indicate that pro-cyclical credit booms originate from purely domestic-driven loan supply shocks.

4.4. Foreign funds and the correlation of firm debt with GDP

Our next question is to what extent have shocks to the supply of foreign wholesale funds to banks influenced statistics reported in Section 3 and particularly correlations of firm debt types with real GDP reported in table 1. Recall that all statistics discussed in Section 3 are unconditional, i.e., they are a result of *all* shocks that have affected the economy. To condition correlations on a particular shock, we use a VAR that includes GDP deflator, real GDP, a firm debt component, All Mix, and Foreign Mix, and decompose the co-movement between real GDP and each firm debt component, following den Haan (2000). The co-movement between two variables, conditional on a shock, is the standardised product of impulse responses to this shock at a particular time horizon. The results are reported in Figure 4.4.

The main finding is that changes in foreign funds supply to banks seem to be the strongest driver of the co-movement between both short-term and long-term loans granted by banks to firms and real GDP (dotted lines in Figure 4.4), except at very short-term horizon. For other firm debt types, shocks to real activity seem to be the most important driver of the co-movement. Shocks

---

[33]Note that the size of Slovenia is negligible compared to the rest of the Euro Area.

to domestic bank loan supply, denoted with KSW_{all}, are unimportant drivers of the co-movement. Unconditional correlations with real output reported in Table 1 for domestic and foreign trade credit are therefore mainly driven by real activity, while correlations of both short- and long-term bank loans to firms are mainly driven by shocks to foreign funding available to banks.[34]

5. Conclusions

Our findings suggest that the effect of changes of foreign funds supply to banks on the domestic economy is profound. An increase in the relative share of foreign funding to banks results in a protracted expansion of domestic lending, real activity and inflation.

An increase in the proportion of foreign funds among bank liabilities by about one percentage point increases bank lending to non-financial corporations by about 3% and causes a persistent increase of real GDP that peaks at about 1.2% after about two years. Inflation follows after a lag and the price level increases for about 0.5% after about two years.

These findings are robust to alternative model specifications and different identification approaches. Moreover, they are consistent with anecdotal evidence that the boom shortly before and after the entry into the monetary union in Slovenia was exacerbated by easily available foreign debt funding for domestic banks. The subsequent reversal of foreign bank debt inflows after the Great Recession and during the Sovereign debt crisis in the Eurozone significantly contributed to the decline in lending and output.

The transmission mechanism of foreign funding supply to domestic banking system is applicable to any economy whose firms depend to a large extent on bank loans, but it is likely weaker in the economies where firms can themselves issue securities in international markets. Given that our focus was an economy with strongly bank-based financial system, it would be interesting to investigate whether our findings apply to countries where firms have a more diversified debt portfolios. An interesting issue would for instance be whether firms in such economies compensate the decrease in bank funding by increasing other types of debt and whether this dampens the effect of fluctuations in bank funding.

While the channels of shock transmission warrant further investigation, the main message for the policymakers is to pay special attention to changes in bank funding on wholesale markets abroad. In particular, given the strength of the bank funding channel, an environment where banks use the easy access to funding too much may be an indication that policies should be designed to dampen bank borrowing to avoid the ensuing credit boom, output expansion and the increase in prices.

---

[34]Note that the cyclical frequencies of statistics in Table 1 are HP-filtered and that the frequency of fluctuations extracted by the HP-filter is not identical to those of the VAR, which is why total correlation in Figure 4.4 is not exactly the same as that in Table 1.

References

Arrondel, L., Bartiloro, L., Fessler, P., Linder, P., Mathä, T.Y., Rampazzi, C., Savignac, F., Schmidt, T., Schürz, M., Vermeulen, P., 2014. How do households allocate their assets? Stylised facts from the Eurosystem Household finance and consumption survey. Discussion Paper 12/2014. Deutsche Bundesbank.

Atta-Mensah, J., Dib, A., 2008. Bank lending, credit shocks, and the transmission of canadian monetary policy. International Review of Economics and Finance 17, 159–176. doi:`10.1016/j.iref.2006.06.003`.

Bank of Slovenia, 2015. Financial stability review.

Bernanke, B.S., Gertler, M., 1995. Inside the Black Box: The Credit Channel of Monetary Policy Transmission. Journal of Economic Perspectives 9, 27–48.

Bijsterbosch, M., Falagiarda, M., 2015. The macroeconomic impact of financial fragmentation in the euro area: Which role for credit supply? Journal of International Money and Finance 54, 93–115. doi:`10.1016/j.jimonfin.2015.02.013`.

Blanchard, O., 2011. What I learnt in Rio: Discussing ways to manage capital flows. `http://blog-imfdirect.imf.org/2011/06/03/what-i-learnt-in-rio-manage-capital-flows/`. Accessed: 2015-07-30.

Christiano, L.J., Eichenbaum, M., Evans, C.L., 1999. Monetary policy shocks: What have we learned and to what end?, in: Taylor, J.B., Woodford, M. (Eds.), Handbook of Macroeconomics. Elsevier. volume 1, Part A, pp. 65 – 148. doi:`10.1016/S1574-0048(99)01005-8`.

Ciccarelli, M., Maddaloni, A., Peydró, J.L., 2014. Trusting the bankers: A new look at the credit channel of monetary policy. Review of Economic Dynamics, forthcoming. doi:`10.1016/j.red.2014.11.002`.

Disyatat, P., 2011. The bank lending channel revisited. Journal of Money, Credit and Banking 43, 711–734. doi:`10.1111/j.1538-4616.2011.00394.x`.

Fry, R., Pagan, A., 2011. Sign restrictions in structural vector autoregressions: A critical review. Journal of Economic Literature 49, 938–960. doi:`10.1257/jel.49.4.938`.

Gabrijelčič, M., Herman, U., Lenarčič, A., 2014. Debt Financing and Firm Performance before and during the Crisis: Micro-Financial Evidence from Slovenia. Mimeo. Bank of Slovenia.

Gambetti, L., Musso, A., 2012. Loan supply shocks and the business cycle. Working Paper Series 1469. European Central Bank.

Gerali, A., Neri, S., Sessa, L., Signoretti, F.M., 2010. Credit and banking in a DSGE Model of the Euro Area. Journal of Money, Credit and Banking 42, 107–141. doi:10.1111/j.1538-4616.2010.00331.x.

Gertler, M., Gilchrist, S., 1993. The cyclical behavior of short-term business lending: Implications for financial propagation mechanisms. European Economic Review 37, 623 – 631. doi:10.1016/0014-2921(93)90052-C.

Gertler, M., Gilchrist, S., 1994. Monetary policy, business cycles, and the behavior of small manufacturing firms. The Quarterly Journal of Economics 109, 309–340. doi:10.2307/2118465.

den Haan, W.J., 2000. The comovement between output and prices. Journal of Monetary Economics 46, 3 – 30. doi:10.1016/S0304-3932(00)00016-7.

Haberis, A., Sokol, A., 2014. A procedure for combining zero and sign restrictions in a VAR-identification scheme. Technical Report. London School of Economics and Political Science, LSE Library.

Iacoviello, M., Minetti, R., 2008. The credit channel of monetary policy: Evidence from the housing market. Journal of Macroeconomics 30, 69–96. doi:10.1016/j.jmacro.2006.12.001.

Jakab, Z., Kumhof, M., 2015. Banks are not intermediaries of loanable funds - and why this matters. Working Paper 529. Bank of England.

Jazbec, B., Herman, U., Lozej, M., 2014. Synchronization and decoupling of cycles in slovenia, in: Nowotny, E., Ritzberger-Grünwald, D., Backé, P. (Eds.), Financial Cycles and the Real Economy: Lessons for CESEE Countries. Edward Elgar Publishing, Inc., Cheltenham, UK, pp. 77–95.

Kashyap, A.K., Stein, J.C., 1994. Monetary policy and bank lending, in: Mankiw, N.G. (Ed.), Monetary Policy. The University of Chicago Press, pp. 221–261.

Kashyap, A.K., Stein, J.C., Wilcox, D.W., 1993. Monetary policy and credit conditions: Evidence from the composition of external finance. American Economic Review 83, 78–98.

Lane, P.R., 2013. Capital flows in the Euro Area. European Economy - Economic Papers. Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Lane, P.R., 2014. International financial flows and the Irish crisis. Discussion Paper 444. Institute for International Integration Studies.

Lane, P.R., McQuade, P., 2014. Domestic credit growth and international capital flows. The Scandinavian Journal of Economics 116, 218–252. doi:10.1111/sjoe.12038.

Oliner, S.D., Rudebusch, G.D., 1996. Monetary policy and credit conditions: Evidence from the composition of external finance: Comment. The American Economic Review 86, pp. 300–309.

Stiglitz, J.E., Weiss, A., 1981. Credit rationing in markets with imperfect information. The American Economic Review 71, 393–410.

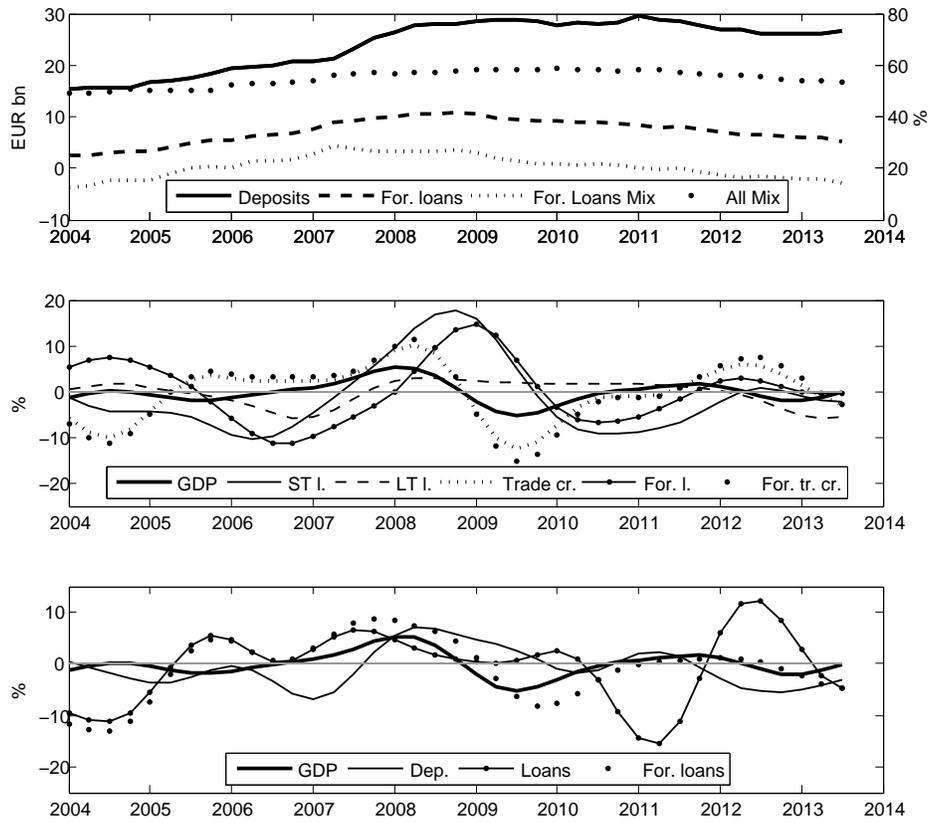Uhlig, H., 2005. What are the effects of monetary policy on output? Results from an agnostic identification procedure. Journal of Monetary Economics 52, 381 – 419. doi:http://dx.doi.org/10.1016/j.jmoneco.2004.05.007.

Figure 1: Data and cyclical components of debt and real GDP. Notes: Deposits and foreign loans in the top panel are shown on the left axis, while both Mix variables are shown on the right axis. Foreign Loans Mix is defined as the share of foreign loans to banks in all bank debt liabilities, and All Mix is defined as the share of bank loans to non-financial corporations in the sum of bank loans, trade credit, and securities issued by non-financial corporations. Cyclical components in the middle and bottom panels are extracted using the Christiano-Fitzgerald filter, at frequencies from 6 - 32 quarters. All filtered variables are in log-levels, GDP is real, debt components are nominal. Cyclical components can be interpreted as percentage deviations from trend.
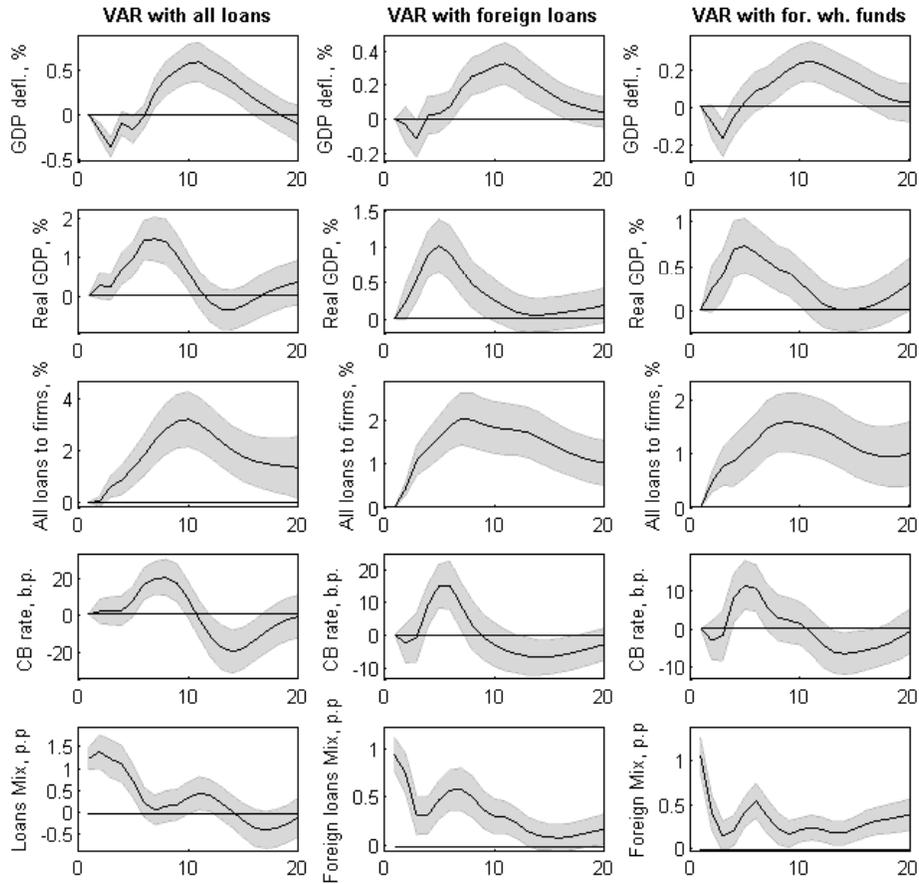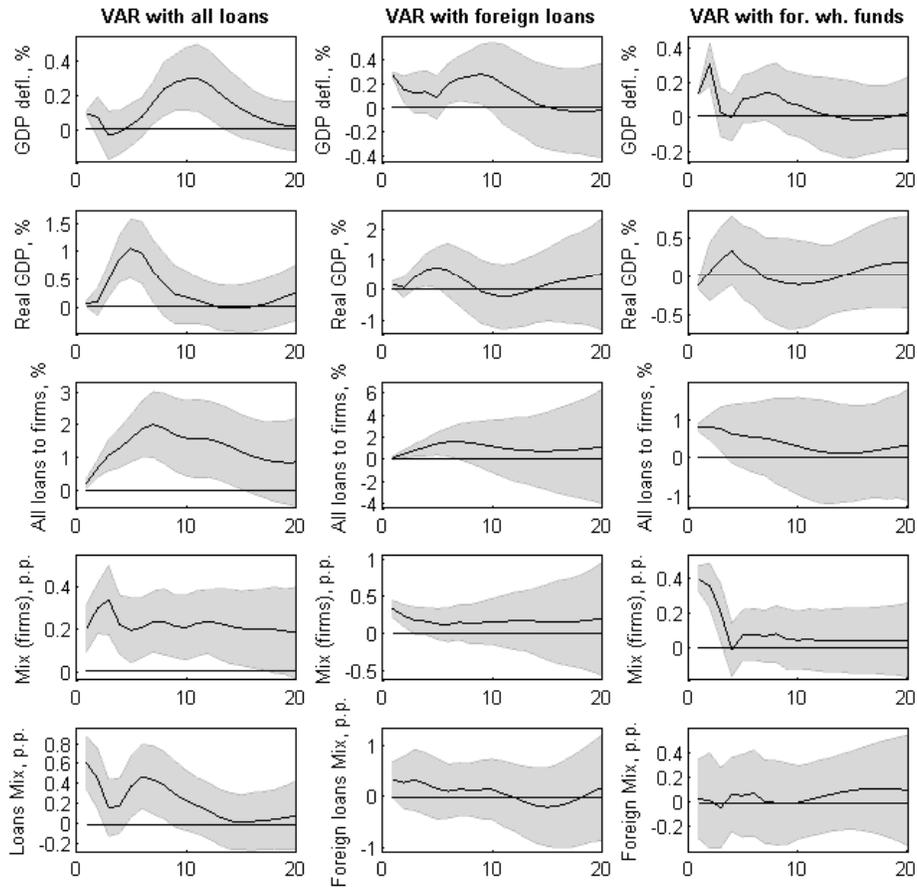
Figure 2: Effects of an expansionary bank funding shock. Notes: Impulse responses to a 1 standard deviation shock in the mix. The responses are percentage deviations from initial values, except for the central bank rate and the mix, which are in basis points and percentage points, respectively. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.
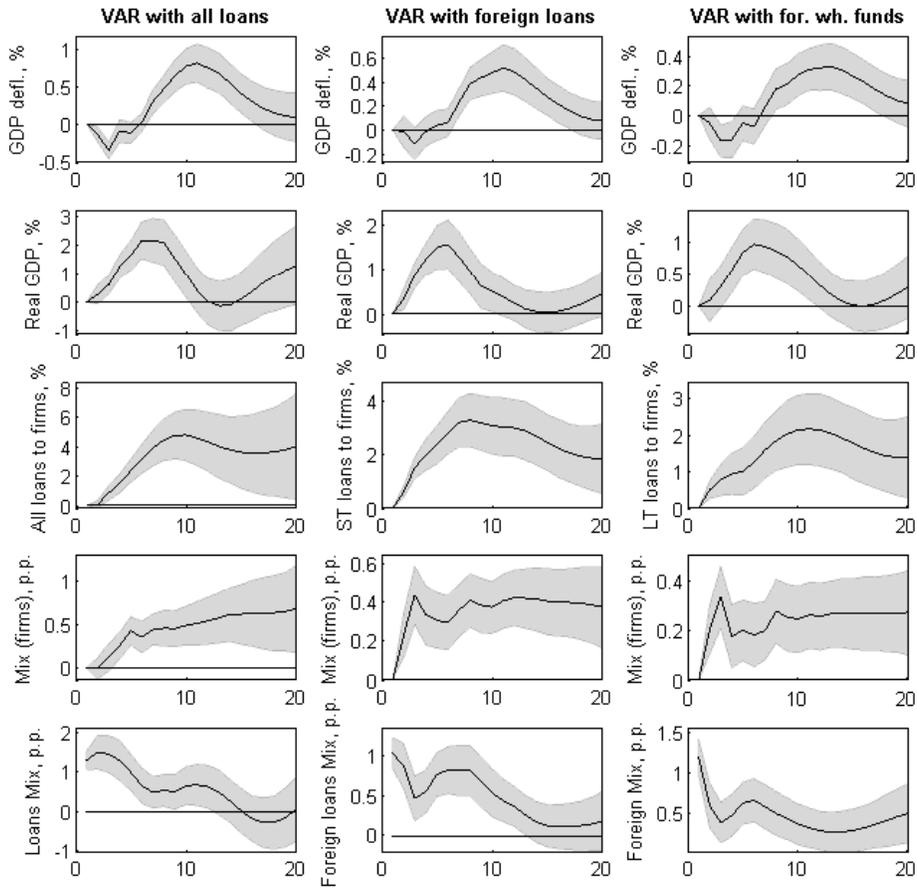
Figure 3: Effects of an expansionary bank funding shock with firm-level Mix. Notes: Impulse responses to a 1 standard deviation shock in the mix. The responses are percentage deviations from initial values, except for the mixes, which are in percentage points. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.
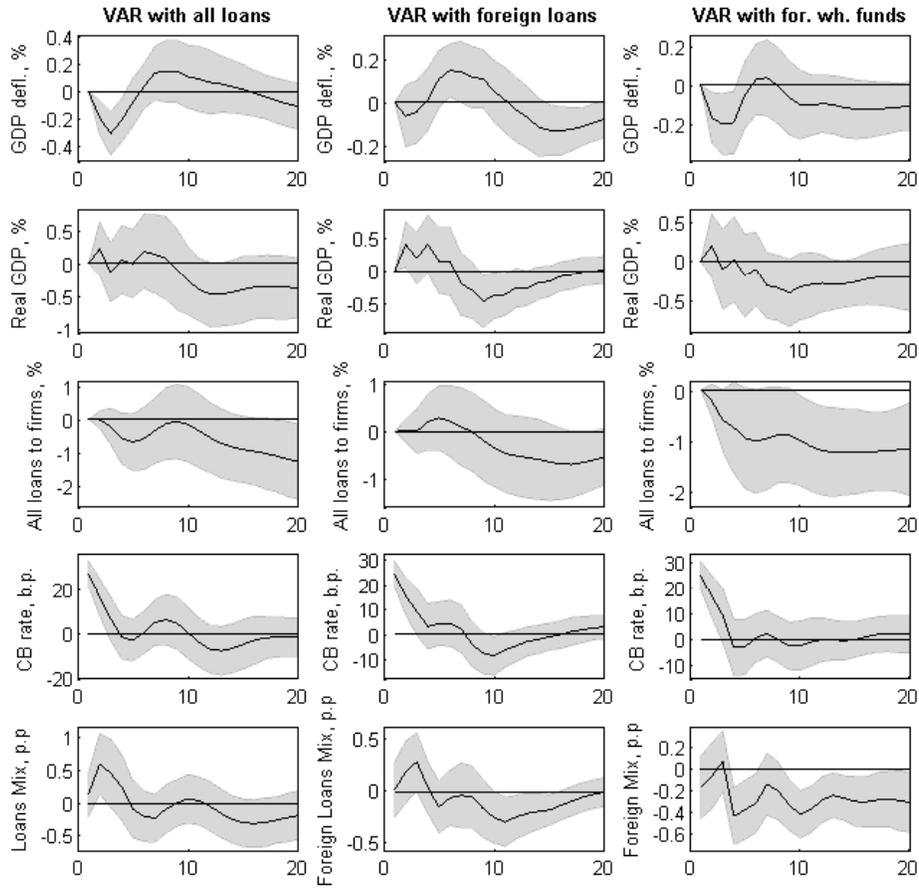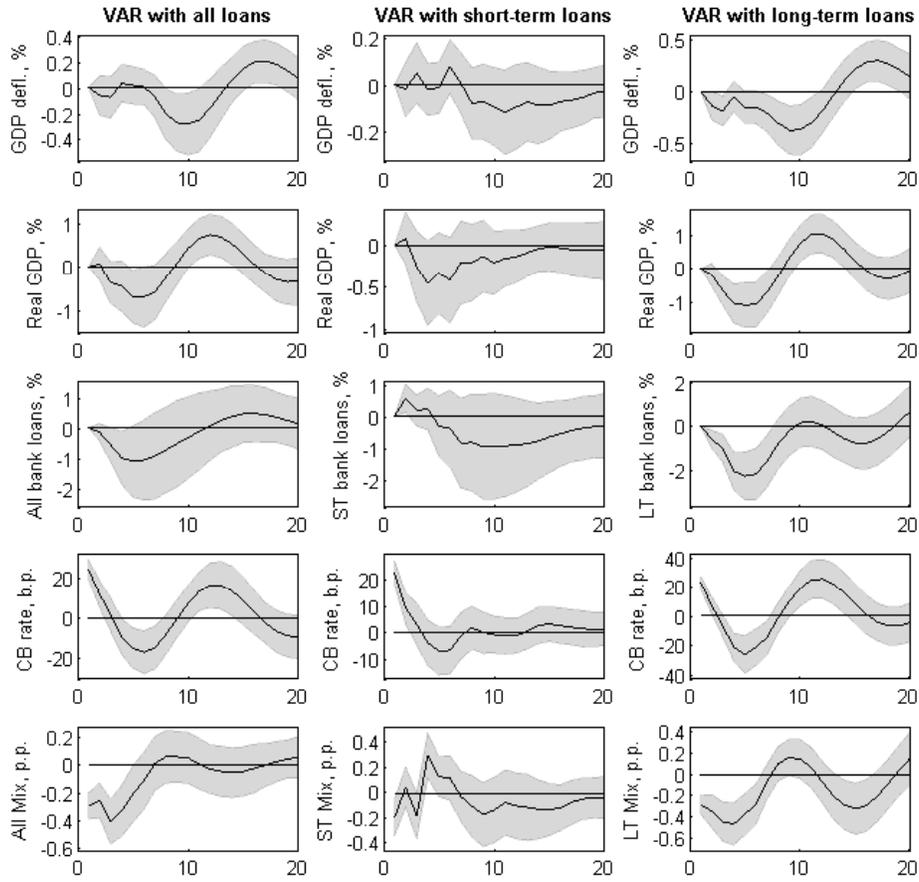
24

Figure 4: Effects of an expansionary bank funding shock with sign restrictions. Notes: Impulse responses to a 1 standard deviation shock to the Mix. The responses are percentage deviations from initial values, except for the mixes, which are in percentage points. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.

Figure 5: Effects of a monetary contraction on bank funding. Notes: Impulse responses to a 1 standard deviation shock in the central bank rate. The responses are percentage deviations from initial values, except for the central bank rate and the mix, which are in basis points and percentage points, respectively. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.
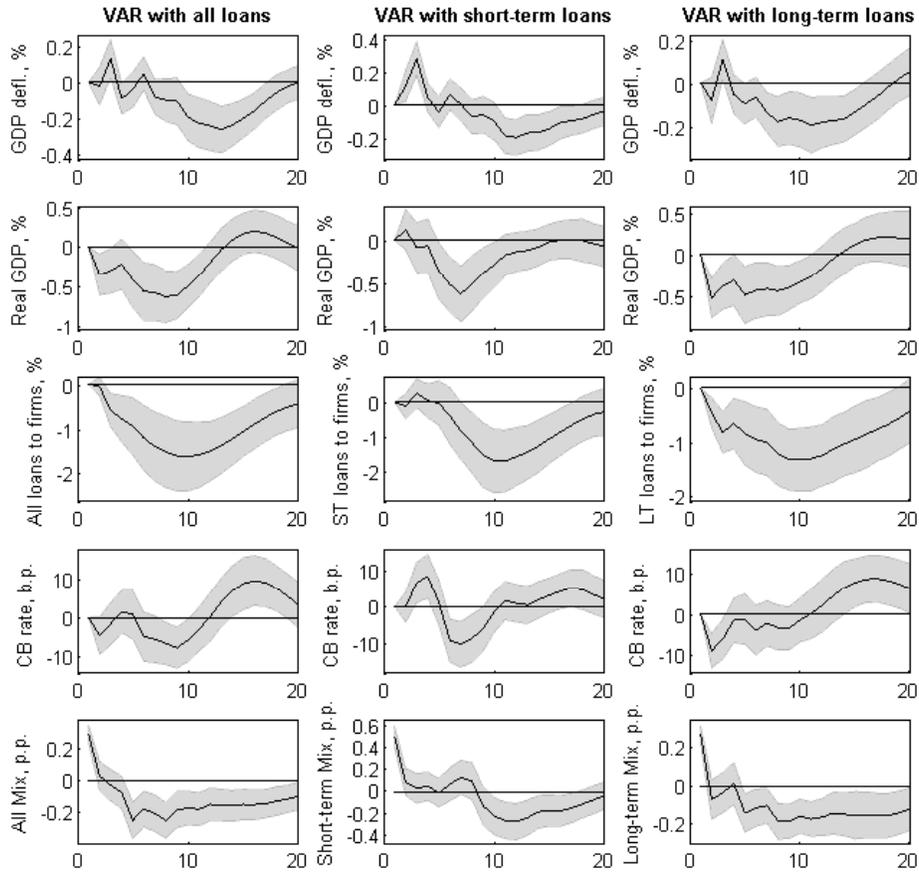
26

Figure 6: Monetary policy shock and the bank lending channel. Notes: Impulse responses to a 1 standard deviation shock in the central bank rate. The responses are percentage deviations from initial values, except for the central bank rate and the mix, which are in basis points and percentage points, respectively. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.
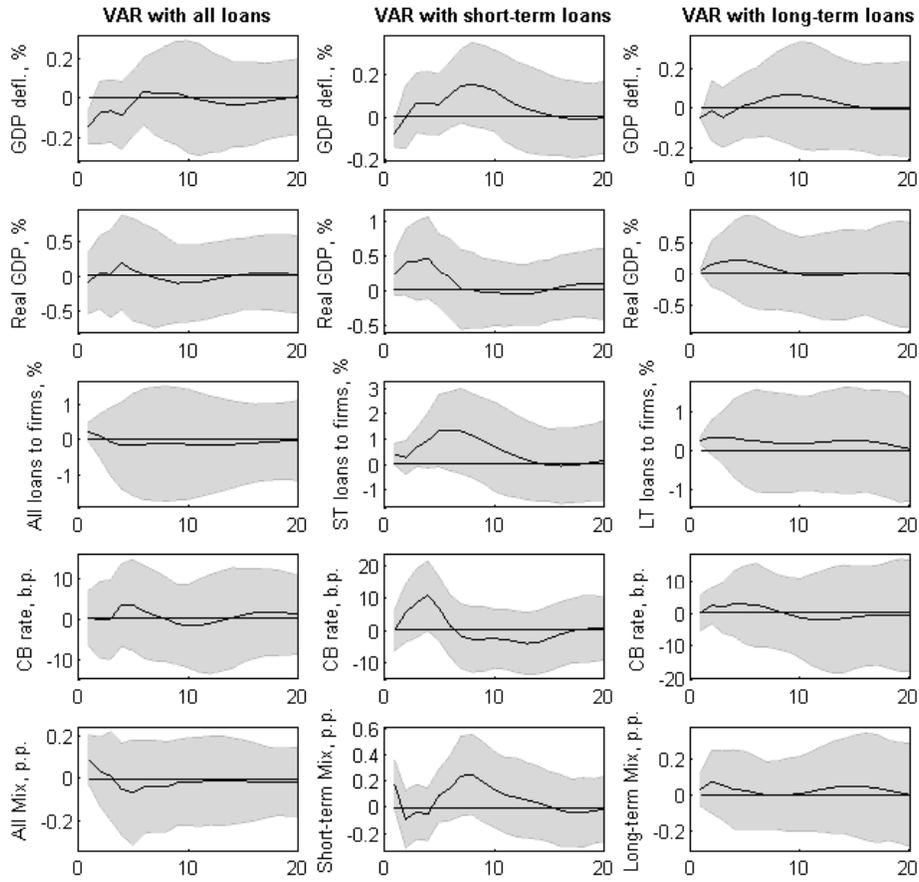
27

Figure 7: Effects of an expansionary shock to domestic bank loan supply. Notes: Impulse responses to a 1 standard deviation shock to the Mix. The responses are percentage deviations from initial values, except for the central bank rate and the mix, which are in basis points and percentage points, respectively. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.

Figure 8: Effects of an expansionary shock to domestic bank loan supply with sign restrictions. Notes: Impulse responses to a 1 standard deviation shock to the Mix. The responses are percentage deviations from initial values, except for the central bank rate and the mix, which are in basis points and percentage points, respectively. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.
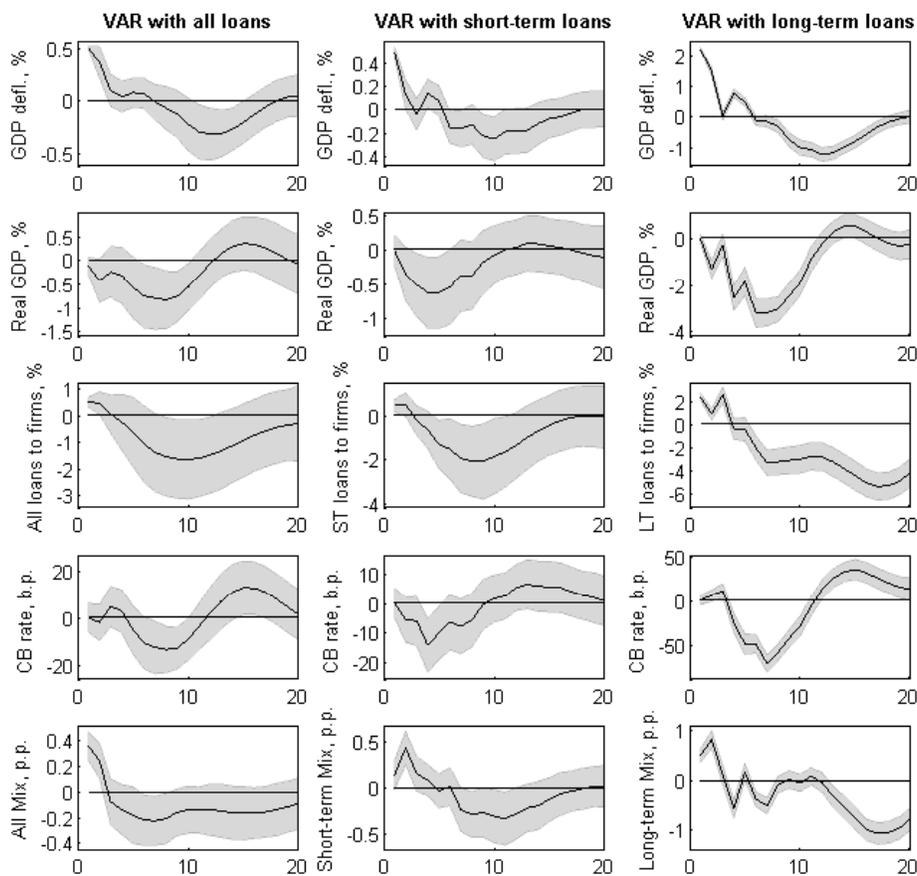
Figure 9: Effects of an expansionary shock to domestic bank loan supply with zero restrictions. Notes: Impulse responses to a 1 standard deviation shock to the Mix. The responses are percentage deviations from initial values, except for the central bank rate and the mix, which are in basis points and percentage points, respectively. Shaded areas are 90 percent confidence bands, generated using bootstrap with 1000 draws.
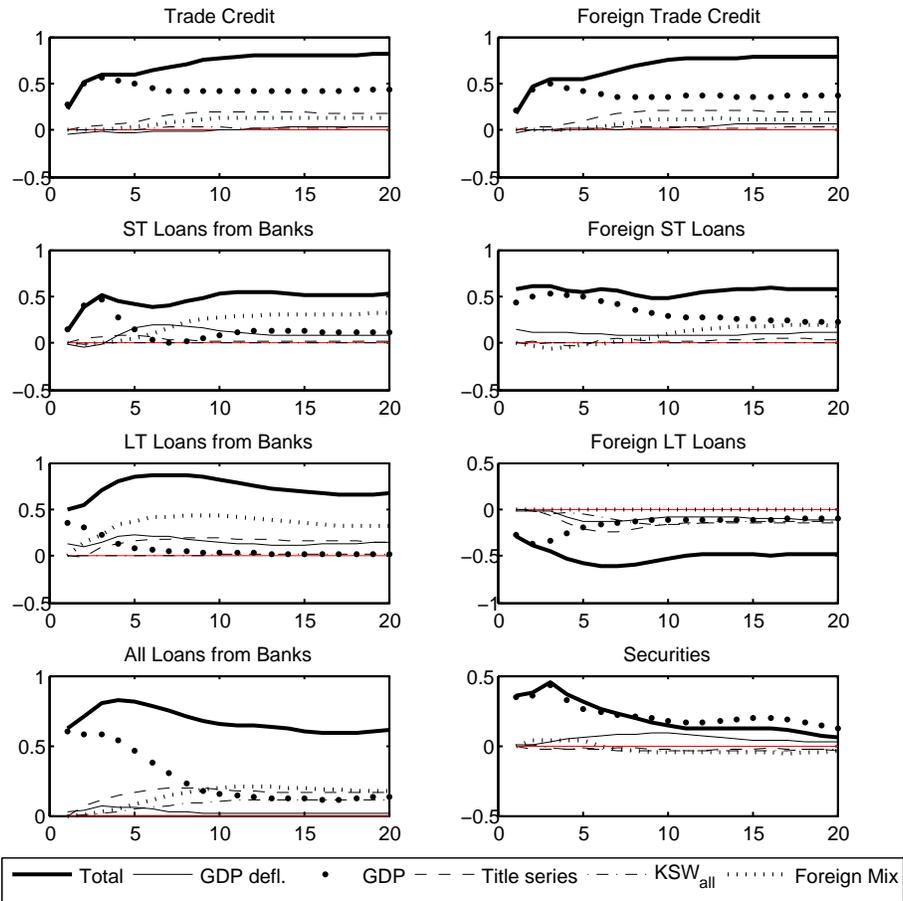
30

Figure 10: Co-movement decomposition. Notes: Each line shows the contribution of a shock to a particular variable in the VAR to the correlation of the variable in the title of each panel with real GDP. The values on the x-axis indicate the time horizon in quarters, at which the correlation is measured. The label 'Title series' indicates the co-movement induced by a shock to the series in the title of each panel in the figure.