

IDB WORKING PAPER SERIES Nº IDB-WP-797

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## A Non-Conventional Bank Lending Channel?

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April 2017

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Cataloging-in-Publication data provided by the  
Inter-American Development Bank  
Felipe Herrera Library

Chirinos-Leañez, Ana María.

Credit supply in Venezuela: a non-conventional bank lending channel? / Ana María

Chirinos-Leañez, Carolina Pagliacci.

p. cm. — (IDB Working Paper Series ; 797)

Includes bibliographic references.

1. Credit-Venezuela-Econometric models. 2. Bank loans-Venezuela-Econometric models. 3. Fiscal policy-Venezuela-Econometric models. I. Pagliacci, Carolina. II. Inter-American Development Bank. Department of Research and Chief Economist. III. Title. III. Series.

IDB-WP-797

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## Abstract\*

This paper evaluates whether fiscal and foreign exchange policy shocks can explain both credit and credit supply in Venezuela. Empirical evidence suggests that between 65 and 90 percent of credit growth is linked to the buildup of banks' deposits caused by the monetary effects of fiscal expansions. For these cases, since credit is provided at equal or reduced interest rates, credit supply takes place. Loan supply can occur either endogenously, when fiscal domestic spending increases with expansionary aggregate supply shocks, or exogenously, when fiscal policy shocks emerge. The role of exogenous fiscal shocks in accounting for credit supply is preponderant in the long run. This evidence suggests fiscal shocks represent a non-conventional bank lending channel. Because this exogenous fiscally-triggered credit supply does not significantly contribute to boosting real activity, its major cost might be associated with high credit volatility.

**JEL classifications:** E5, E63, C32

**Keywords:** Credit, Credit supply, Fiscal policy shock, SVAR, Sign restriction

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\* The authors are very grateful for the comments provided by the Financial Stability and Development Group of the Inter-American Development Bank (IDB) and by members of the Central Bank of Colombia. The opinions in this paper are the exclusive responsibility of the authors and do not necessarily reflect the views of the Board of Directors of the Central Bank of Venezuela or the IDB. Pagliacci (corresponding author): Deputy Manager of the Economic Research Office, Central Bank of Venezuela. [cpagliac@bcv.org.ve](mailto:cpagliac@bcv.org.ve). Av. Urdaneta Esq. Las Carmelitas, 1010 Caracas, Venezuela. Telephone: + 58-2128015919; fax: + 58-2128015498.

## **1. Introduction**

The interconnections between credit and real activity have been a continuous concern for central bankers and policymakers. But this theoretical discussion has evolved over time. The traditional perspective is that increasing real activity also increases credit demand. After Bernanke and Gertler (1995) explicitly proposed the bank lending channel, monetary policy decisions occupied a primary role in accounting for credit behavior. That is, monetary policy became a significant means of affecting banks' credit supply and consequently, aggregate demand and real activity in the economy. More recent empirical analyses point out to credit supply shocks as an important source of banking credit fluctuations (Gambetti and Musso, 2016, and Barnett and Thomas, 2014, among others). For these works, banking decisions could become an exogenous source of booms and busts of credit that usually ends up affecting business cycle fluctuations. A preponderant role assigned to credit supply also suggests that credit markets can potentially turn into promoters of financial and economic distress, especially when credit shocks do not stimulate real activity. But the reasons why these credit supply shocks emerge are not necessarily well understood. Poor institutional frameworks and weak regulations are conceptually good candidates for rationalizing these banking decisions. Nonetheless, expectations, financial-technological innovations and financial disturbances to banking operational variables (loan to value and capital ratios, for instance) can provide alternative explanations of these idiosyncratic-type shocks.

As a general objective, this paper aims to understand the sources of credit supply in Venezuela, an oil-dependent country that most likely exhibits a non-standard monetary arrangement and an uncommon mix of policies. These features make the Venezuelan economy an interesting case of study with potential lessons for other economies. The institutional arrangement imposes that the management and distribution of oil proceeds take place through the Central Bank balance sheet. As a consequence, both fiscal spending and foreign exchange allocation of oil earnings are decisive in defining the general monetary conditions of the economy. In this setting, monetary policy becomes secondary in shaping monetary conditions, and the role of monetary policy actions is no longer preponderant (this is explained in detail in Section 2). Since 2003, authorities have also implemented an exchange rate control that limits

the quantity and price of current account and capital transactions.<sup>1</sup> That decision has transformed the provision of foreign currency into an administrative action with an important discretionary exogenous component that does not respond to changing economic conditions. All the above institutional features and the fiscal and foreign exchange (FX) policy decisions have fostered real and monetary conditions that might have importantly affected credit. In fact, a major credit expansion took place at the beginning of the control, between 2004 and early 2008, with real annual growth rates above 25 percent.

One natural question that arises in the former context is whether oil inflows are mostly responsible for such an enormous credit flood. A couple of empirical works on Venezuela already provide some evidence on this question: oil shocks do have an important role in explaining credit. Bárcenas, Chirinos and Pagliacci (2013) and Chirinos and Pagliacci (2014) show that, for the exchange rate control period, positive oil shocks and high levels of imports are observed to deliver a credit glut with significant (nominal and real) credit growth and dropping interest rates. These effects are associated with a path of growing activity, lower inflationary pressure and an increase in fiscal primary money creation, i.e., the monetary effect of domestic fiscal expenditures. Therefore, the provision of banking credit could be attributed to the combined effect of real and monetary expansions. Nonetheless, recognizing the impact of oil prices on credit does not elucidate which factors are more important for credit supply: the behavior of the real activity caused by oil surprises or the exogenous monetary expansions that might also occur. This becomes a problem especially when monetary conditions may be explained by policy innovations that are independent of oil cycles.

In the above context, this paper has two specific objectives. The first is to evaluate how fiscal and FX policy shocks may affect the credit market and the supply of credit in Venezuela. In a related work, Carvallo and Pagliacci (2016) find that these two policy shocks appear to have significant effects on nominal credit. But their work does not attempt to investigate the associations that arise within the credit market or whether credit is being supplied by banks or demanded by clients. In this paper, since we more carefully evaluate the connections that emerge among policy shocks, monetary conditions, interest rates and loans, we are able to characterize whether these shocks trigger a larger supply or demand of credit. But more importantly, because

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<sup>1</sup> This exchange rate control continues to be implemented up to the present. The government grants import licenses and simultaneously sets the official exchange rate at which imports and exports are traded. These constraints generate a dual exchange market that operates with a significant exchange rate premium for non-official transactions.

policy shocks have sizable monetary effects, we can also test whether they enable the emergence of a non-conventional bank lending channel. That is to say, to what extent do exogenous monetary innovations—not related to monetary policy—bring about an increase in loan supply.

Second, we want to find out the effects of goods market fluctuations on credit. This would shed light on the general question of whether credit is an endogenous response to the real cycle or depends on exogenous factors such as policy decisions. It also can help to determine whether credit expansions related to real activity are driven by aggregate supply or demand shocks. This second objective is achieved by focusing our discussion on the effects of goods market shocks, rather than oil shocks, on credit. This does not imply that the impact of oil on the model is neglected, but that it is indirectly captured through goods markets shocks instead. In fact, as already suggested, oil shocks in the Venezuelan economy behave as supply shocks (Bárceñas, Chirinos and Pagliacci, 2013, and Chirinos and Pagliacci, 2014). Consequently, identifying supply shocks also addresses oil and other supply-related shocks that may affect credit.<sup>2</sup>

From the econometric point of view, the empirical strategy is as follows. In a structural VAR (SVAR) of nine variables, we identify two types of shocks: two policy shocks (fiscal and FX shocks) and two aggregate shocks (supply and demand shocks). Because the identification of these policy shocks entails including variables that describe the monetary effects of policy actions, we therefore include the following two: monetary creation related to domestic fiscal expenditures and monetary drain associated with the provision of FX currency. The general identification strategy differentiates shocks either by their effect on the goods market or by the monetary conditions elicited. Identification is enhanced by implementing a combination of zero and sign restrictions. These zero restrictions help us to accurately distinguish goods market shocks from policy shocks. This approach also guarantees that aggregate shocks are exclusively identified with the set of information that comes from goods markets, while policies shocks use information from co-movements between monetary and credit variables. After evaluating the impact of all four shocks on credit, interest rates and monetary conditions, we classify shocks according to their consequences on the credit market, i.e., whether they promote a supply or a demand of credit.

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<sup>2</sup> Econometrically, once goods market and policy variables were included in the model, the significance of oil variables in explaining credit was rejected.

Empirical evidence found in this paper suggests that a sizable part of credit fluctuations in Venezuela (around 55 percent) can be directly related to the occurrence of shocks that have their origin in fiscal and FX actions. This evidence also points out that policy shocks have, on average, contributed importantly to explaining credit expansion during the exchange rate control. While an unexpected increase in fiscal spending generates a significant and persistent rise in credit, a larger FX provision leads to a temporary credit swell instead.

Regarding the portion of credit depending on goods market shocks (the other 45 percent), credit growth is almost entirely explained by expansionary aggregate supply shocks. This result contrasts with the widespread view that aggregate demand shocks generate more significant credit responses. We presume that the credit surge during supply shocks can be linked to two factors: the expansion in real activity and the increase in banking deposits due to the monetary effect of fiscal expenses. From the point of view of credit endogeneity, the above results also imply that the nature of credit is mixed, although they tilt toward exogenous factors. Paradoxically, the policy-driven portion of credit could account, in the best case scenario, for a slim 14 percent of real activity growth.

These results for policy and goods market shocks, when analyzed from the viewpoint of suppliers and borrowers, also have another interesting reading. Strong and persistent credit provision—without rising interest rates—always follows from a significant buildup of banks' deposits caused by fiscal monetary expansions. In other words, the monetary effect of fiscal expenses always produces a supply of loans by banks. This credit supply represents between 65 percent and 90 percent of credit variability and can occur either endogenously, when fiscal domestic expenditures augment with aggregate supply shocks, or exogenously, when fiscal shocks emerge. But more than half of this credit supply takes place with exogenous fiscal innovations. Fiscal shocks seem essential as well to account for the changes in monetary conditions that trigger credit supply. In fact, fiscal surprises can explain almost 50 percent of fiscal money creation and more than 70 percent of real deposit variability. These results on fiscal shocks are considered evidence of a non-conventional bank lending channel, i.e., a lending mechanism not triggered by monetary policy actions. Overall, results also suggest that credit supply in Venezuela is fundamentally a monetary phenomenon.

The remaining 10 to 35 percent of credit growth is related to the credit demand that comes about during expansionary aggregate demand shocks and FX provision shocks. For these



shocks, credit provision is triggered by borrowers, but it has a short lifespan. This rapid credit leveling can be attributed either to the upward interest rate adjustments or to the fall in banks' liabilities operating along these shocks. Because FX shocks increase credit demand in a context of tight monetary conditions, they cannot be associated with a non-conventional bank lending channel.

This paper contributes to the standard credit supply literature (Gambetti and Musso, 2016; Barnett and Thomas, 2014; Eickmeier, Gambacorta, and Hofmann, 2014; Hristov, Hülsewig and Wollmerhäuser, 2012; and Busch, Scharnagl and Scheithauer, 2010, among others) by showing that fiscal policy shocks, rather than monetary policy shocks, can importantly explain credit supply. Likewise, this result relates to the extensive literature stemming from the seminal work of Bernanke and Gertler (1995) regarding the traditional bank lending channel. The empirical support found in this paper for a non-conventional lending channel puts forward the need for testing credit supply effects of fiscal and other types of policies in countries with particular institutional arrangements.

The paper is organized as follows. Section 2 provides a rationale for studying fiscal and FX policy shocks in Venezuela by discussing the Venezuelan institutional arrangement and the effects of these shocks on monetary conditions. It also explains and justifies the identification strategy. Section 3 presents and interprets empirical results in terms of impulse-responses and variance decomposition, while Section 4 summarizes the findings and lays out some policy recommendations. Appendix 1 addresses the general SVAR methodology and some details on the identification scheme implemented.

## **2. Fiscal and FX Policy Shocks**

### ***2.1. Their Role in Monetary Conditions***

How are monetary conditions determined in Venezuela? Venezuela is an economy whose external proceeds depend fundamentally on oil exports. By law, the part of the state oil income that is domestically spent must be sold to the Central Bank for obtaining its domestic currency counterpart. Once the government and the state oil company spend these resources in domestic currency (buying local goods and services), new money flows into the economy, increasing the liabilities of the banking system. We refer to this process as fiscal primary money creation. Because the Central Bank is the foremost supplier of foreign currency to the economy, the

provision of FX also affects its international reserves. Differently from most countries, this FX provision is not understood as an occasional FX intervention, but as a systematic way to allocate foreign currency among private agents. But FX provision is not sterilized, causing a contractionary monetary effect. For the exchange control regime, that monetary effect takes place when the Central Bank liquidates the FX currency that the government previously assigned. Generally, this process can be understood as a form of money destruction associated with FX transactions. As a consequence, we refer to net primary money creation as the combined effect of fiscal money creation and the monetary contraction of FX currency liquidations. Since 2003, net primary monetary creation has tended to increase, especially with positive oil shocks.

The above institutional features have made fiscal and FX policy actions decisive for shaping the general monetary conditions of the economy. This is the case because fiscal and FX policies constitute the redistribution mechanisms for the oil rent. Every time the oil rent changes or fiscal and FX decisions are modified, the expansions and contractions of the Central Bank balance sheet determine net primary money creation. Consequently, money creation depends basically on the amount of domestic public expenditures not financed with domestic (non-oil) taxes, and on the money destruction caused in different degrees by both the dynamic path of the exchange rate and the amount of currency allocated. The magnitudes of these monetary effects are enormous and tend to wipe out any monetary compensation that could arise from monetary policy actions. This explanation suggests that, even if the monetary policy were active in compensating the monetary effects of fiscal and FX policies, it is not clear whether monetary policy could efficiently manage monetary conditions in the economy.

Another interesting reflection on this institutional arrangement is that, although the Central Bank is operationally involved along all the process of net primary money creation, decisions are decentralized among different institutions of the public sector. The competence or capability of such institutions to affect monetary conditions will depend, among other things, on the selection of the exchange rate regime. For example, during exchange rate controls, fiscal spending and FX management (provision, liquidation and price) are mostly controlled by different branches of the executive power. For floating regimes, given the amount of foreign currency sold by the state oil company to the Central Bank, FX provision is decided by the Central Bank, while the exchange rate is market-determined. For such regimes, fluctuations of the exchange rate heavily affect the amount of money creation related to domestic fiscal

expenditures. The more appreciated the foreign currency, the larger the domestic currency creation for each dollar domestically spent. Likewise, the availability of foreign currency for public expenses depends on the oil rent remaining after oil investments, which might rely on executive-power or state-oil-company decisions, depending on who controls the oil business. Consequently, although these instances of decisions have different objectives in theory, they all contribute to determining the economy's monetary conditions because of the direct involvement of the Central Bank balance sheet.

Since Bernanke and Gertler (1995), a major role has been assigned to monetary authority actions and interest rate movements in accounting for credit market developments. For the Venezuelan case, Bárcenas, Chirinos and Pagliacci (2013) find that the conventional bank lending channel is not operating in the economy, i.e., credit supply does not react to changes in monetary policy decisions.<sup>3</sup> These authors argue that the management, price and term conditions of the policy instrument do not cause a sufficiently strong impact on the overnight interest rate to affect the credit market. Additionally, Bárcenas, Chirinos and Pagliacci (2013) show that traditional monetary policy actions do not produce any significant response in macroeconomic variables. This empirical evidence confirms the secondary importance of monetary policy actions for modifying monetary conditions in Venezuela.

Because fiscal and FX actions also affect the liabilities of the banking system, there is the possibility that these policies could have direct impacts on credit supply. In particular, if a deposit buildup caused by fiscal primary money creation leads to an increase in loans without rising loan rates, then fiscal policy would be triggering credit supply. Contrarily, if a deposit accumulation, produced by a reduction in FX provision, generates an increase in credit—without increasing loan rates—then FX policy would be enabling credit supply. In both cases, we would be describing non-conventional forms of the bank lending channel produced by the monetary effects of policy actions not taken by the monetary authority.

In Figure 1, we show the dynamics of real credit growth in contraposition to relevant variables: the annual growth rate of oil prices, annual fiscal money creation (as a percentage of

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<sup>3</sup> The broad distinction between the credit channel and the narrower bank lending channel is whether the transmission mechanism of monetary policy decisions relates or not to particular banks' characteristics affecting banks' balance sheets.

the one year-lagged money base), and the annual domestic currency drain of FX liquidations (as a percentage of the one year-lagged money base).<sup>4</sup>

**Figure 1. Real Credit Growth and Related Variables**

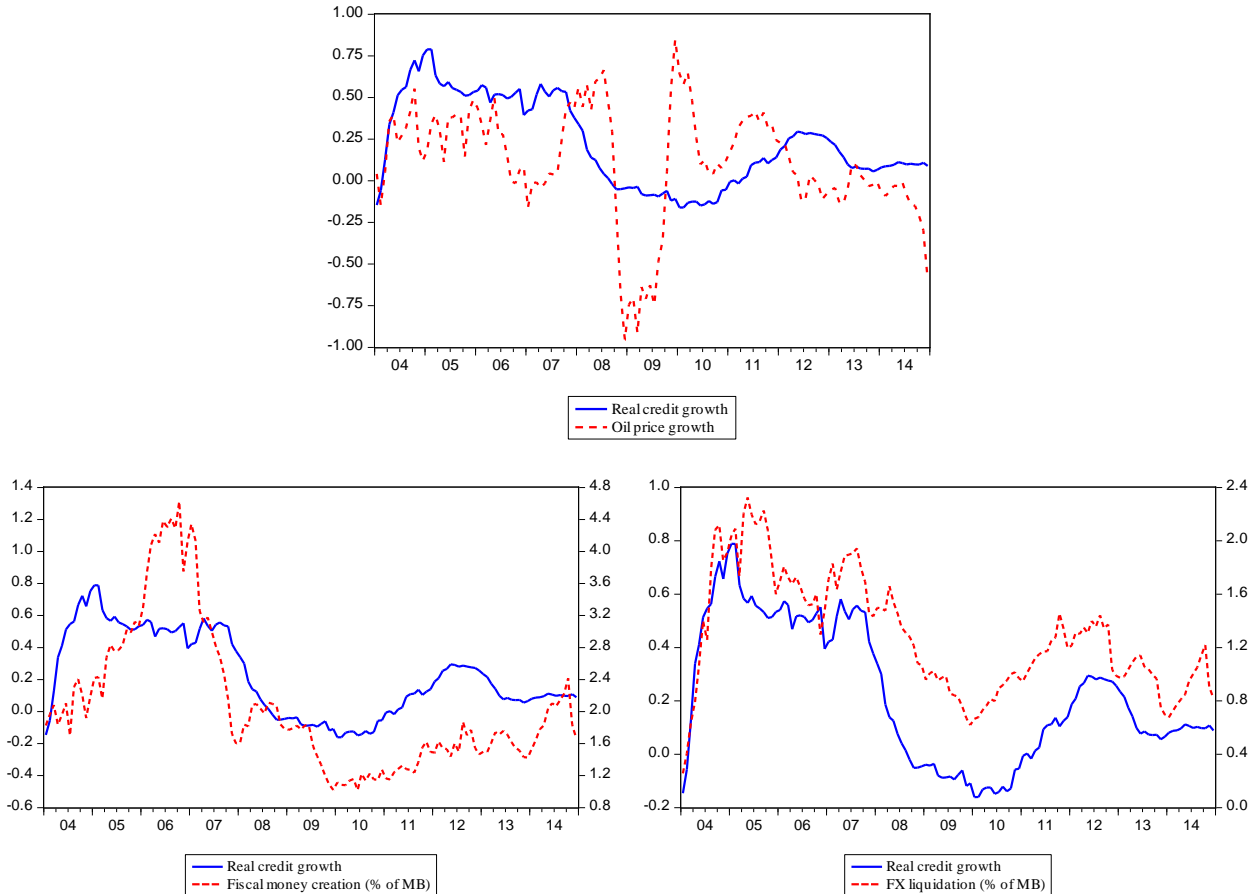


Figure 1 qualitatively shows that, although the growth rate of oil prices might be relevant for explaining credit variations, the correlations that arise between loans and the monetary variables of fiscal and FX actions are clearly greater (0.29 versus 0.68 and 0.85 respectively). In other words, it would seem that monetary expansions and contractions of primary money are important in credit developments. But curiously, a rise in the monetary drain of FX liquidations is associated with expansions, and not contractions, of credit. This clearly indicates that credit cannot be related to the monetary effects of FX provision. It could rather be linked to the

<sup>4</sup> The monetary effects of fiscal actions and FX provision are directly calculated by the Financial Programming Department at the Central Bank by monitoring the movements of banking and fiscal accounts at the Central Bank.

financing needs (in domestic currency) of agents buying foreign currency. This also suggests that only fiscal actions could allow the emergence of a non-conventional bank lending channel.

In most economies, the institutional arrangement behind the process of primary money creation tends to be simpler, or more concentrated in the hands of the monetary authority. However, to different degrees, fiscal or FX actions could be also important for determining monetary conditions in other economies. In this sense, lessons learned on the impact of these policy shocks on Venezuelan credit markets could be applicable to other economies.

## ***2.2. Econometric Identification Strategy***

Econometrically, we address policy and good market shocks by estimating an SVAR that combines nine variables corresponding to the goods market, the monetary effects of fiscal and FX actions and the credit market. The variables included are the following: the annual growth rate of the index of real activity for the non-oil sector (Y), the annual growth rate of the consumer price index (P), the ratio of fiscal money to money base or simply the fiscal money creation of the public sector (FM),<sup>5</sup> the ratio of the monetary drain associated with foreign currency liquidation to money base (FX-LQD), the annual change of the overnight interest rate (OVER), the spread between the lending rate and the overnight rate in levels (SPREAD), the annual growth rate of the outstanding amount of loans to the private sector in real terms (LOANS), the annual change of the bank lending rate (LR), and annual growth rate of real deposits (DEP). All growth rates are computed as log-differences of level variables, except for interest rates, which are calculated as absolute-differences (in percentage points). In terms of data, model estimation covers monthly information from January 2004 to December 2014 (132 observations).

Following Carvalho and Pagliacci (2016), we refer to these policy shocks as, respectively, a fiscal shock and a FX provision shock. The general identification strategy is based on the characterization of the different monetary and real impacts of these shocks.

A positive fiscal shock relates to an increase in fiscal expenditures that generates an unexpected elevation in primary money creation (FM).<sup>6</sup> As mentioned before, when the public

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<sup>5</sup> This fiscal money regards banks' deposits created with transactions of the national oil company (PDVSA), a major public development bank (BANDES), and the treasury (central government).

<sup>6</sup> This shock only considers the part of domestic expenses financed with external (oil or debt) resources. External expenses or domestic expenses financed with domestic taxes or debt are being excluded from this type of analysis because they do not have a monetary effect.

sector finances domestic expenditures with the oil rent, the amount of banking deposits (DEP) increases. This rise in aggregate deposits reduces all rates due to the generalized loose monetary conditions prevailing in the economy. From the short-term perspective, banks become more liquid and tend to increase the supply of funds in the overnight market, triggering a decline in the funding rate (OVER). Deposit and loan rates (LR) likewise diminish accordingly.<sup>7</sup> For the Venezuelan case, since the monetary effect of fiscal actions is comparable to the effect of monetary policy actions in other countries, we impose a positive adjustment in SPREAD, i.e., a stronger reduction of the short-term rate. In other words, short-term rates tend to overreact to changes in monetary conditions, as they would do if the changes were triggered by monetary policy actions.<sup>8</sup> Because this shock characterizes an increase in fiscal expenditures with positive monetary effects, it clearly leads to an expansion in aggregate demand that makes both real activity (Y) and inflation (P) rise. With respect to other fiscal shocks defined in the literature, the distinguishing feature of this shock is its strong positive liquidity effect, which follows from the institutional arrangement between the fiscal and the monetary authority. That liquidity effect prevents the rise of interest while increasing real demand.

We define the second policy shock as a larger provision of foreign currency by the Central Bank. During the exchange rate control, because the Central Bank delivers foreign currency to the private sector in exchange for domestic currency at a pre-established (mostly fixed) exchange rate, a larger FX provision is equivalent to an increase in the monetary drain observed in domestic currency (FX-LQD).<sup>9</sup> This shock does not represent a traditional foreign exchange market intervention either, because it entails an administrative decision based on the discretionary management of the exchange rate control. From the monetary point of view, we presume that a positive (higher) FX liquidation brings about a reduction in banks' deposits (DEP). Since the assignment of FX currency across banks is typically asymmetric, the fall in deposits is asymmetric as well, bringing about a reallocation of banking funds through the overnight market. That is, the short term rate (OVER) rises and consequently, the lending spread (SPREAD) falls. As in the former shock, the adjustment in the spread takes place due to the

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<sup>7</sup> The decline of all interest rates as a response to an exogenous innovation in fiscal money is also reported in Chirinos and Pagliacci (2014) and Carvallo and Pagliacci (2016).

<sup>8</sup> In Eickmeier, Gambacorta and Hofmann (2014), an expansionary monetary policy shock increases the (loan-short term rate) spread as well.

<sup>9</sup> This is not necessarily the case under other regimes, where the continuous adjustment in the exchange rate affects the domestic currency counterpart of FX provision.

presumption that short-term interest rates are more sensitive than loan rates to changes in monetary conditions that stem from variations in primary money. From the goods market perspective, a larger provision of FX currency is associated with greater imports of both final and intermediate goods, which lead to an increase in real activity (Y) and to lower inflation (P). Because the contractionary monetary effect of FX provision occurs in a context of increasing aggregate supply, instead of increasing aggregate demand, the lending rate (LR) is not constrained to rise.<sup>10</sup>

Goods market shocks are classified into supply and demand shocks, à la Blanchard and Quah (1989), imposing short-run restrictions, rather than long-run restrictions, on real activity and prices. We presume that an expansionary aggregate supply shock implies a rise in real output growth (Y) and a reduction in the inflation rate (P), while an aggregate demand shock involves simultaneous positive movements in real output growth and inflation.<sup>11</sup> Since both policy shocks have impacts on the goods market as well, it is necessary to impose other restrictions in order to properly differentiate them. Aggregate demand shocks are assumed to cause an increase in loan rates (LR), as in Gambetti and Musso (2016) and Bijsterbosch and Falargiarda (2014). Notice that such adjustment in rates differentiates the aggregate demand shock from the fiscal policy shock, which also causes a simultaneous positive variation in activity and prices, but with descending loan rates. For the aggregate supply shock, we use the evidence found in prior investigations and impose an expansionary liquidity effect tied to a buildup of banking deposits (DEP). This behavior of deposits distinguishes this shock from a positive FX policy shock, which has associated a contractionary monetary effect and a reduction in banks' deposits.

Restrictions are summarized in Table 1. Overall, notice that the identification strategy differentiates shocks either by their effect in the goods market or by their monetary consequences. Shocks that are alike from the goods market perspective tend to have opposed monetary conditions. Equally, shocks with similar monetary conditions exhibit opposed goods market effects (supply or demand type of adjustments). This provides further statistical consistency to the identification strategy.

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<sup>10</sup> Carvallo and Pagliacci (2016) do not find evidence that an increase in FX provision leads to a rise in loan and deposit rates.

<sup>11</sup> For a detailed discussion on the rationality of this identification strategy for goods market shocks, see Pagliacci (2016).

Notice also that, for none of the shocks identified, do we impose restrictions on the growth rate of loans. This is so to evaluate their actual effect on this variable.<sup>12</sup> However, for improving shocks' identification, we do impose some zero restrictions that differentiate goods market shocks from policy shocks. These zero restrictions prevent the immediate response of the goods market to policy shocks. That is, policy shocks cannot affect the goods market variables contemporaneously, but they can do so with a lag. Conversely, goods market shocks can affect deposits, monetary and credit variables contemporaneously, because these variables are assumed to respond hastily. The imposition of these zero-restrictions is achieved using a rotation matrix Q with a block diagonal structure, similar to the one used in Mumtaz and Surico (2009). Appendix 1 covers in detail the complete econometric structure of the model.

All four shocks are identified simultaneously to ensure orthogonality among shocks. Restrictions are imposed for six consecutive periods in order to capture persistent effects on variables. The optimal lag-length structure of the SVAR corresponds to two lags (according to Schwarz and Hannan-Quinn information criteria).

**Table 1. Restrictions on Variables' Impulse-Responses**

Structural Shocks	Restricted variables for a positive shock							
	Y	P	FM		OVER	LR	SPREAD	DEP
Fiscal policy shock	+	+	+		-	-	+	+
FX provision shock	Y	P		FXLQD	OVER		SPREAD	DEP
	+	-		+	+		-	-
Aggregate supply shock	Y	P						DEP
	+	-						+
Aggregate demand shock	Y	P				LR		
	+	+				+		

Y: real output growth; P: inflation rate; LOAN: Real credit growth; FM: fiscal money creation; FX-LQD: monetary drain of FX liquidations; LR: absolute change in lending rate; OVER: absolute change in overnight rate; SPREAD: difference between lending and overnight rate; DEP: real deposit growth.

For measuring the impact of these structural shocks on credit market variables, we compute impulse-responses (IRs) based on 300 accepted draws of Qs (rotation matrices) that satisfy the restrictions imposed (Table 1). Responses to shocks are accumulated along the IR horizon in order to show the net effect of shocks on variables. For all shocks identified, variables responses remain significant at least during the first year, meaning that shocks elicit strong

<sup>12</sup> Hence, we are implementing an “agnostic” type of identification strategy, as proposed in Uligh (2005). This type of identification is also pursued in Arias, Caldara and Rubio-Ramírez (2015).



responses that are supported by the data and not only driven by the restrictions themselves. The next section describes the IRs obtained, which are shown in Figures 1-4.

### **3. Interpretation of Results**

#### ***3.1. What Drives Credit Supply?***

For all shocks identified (Figures 1-4), credit increases significantly, but with different intensities. That is, credit rises in the presence of either loose or tight monetary conditions.

The most vigorous and persistent credit expansions take place when monetary conditions are loose and deposits in the banking system build up. Those are the cases for the fiscal policy shock (Figure 1) and the aggregate supply shock (Figure 3). For both shocks, the accumulation of banks' deposits responds to a net primary money creation that results from the prevalence of fiscal money creation over the FX drain. But the way loose monetary conditions take place in these two shocks is slightly different. When an aggregate supply shock occurs, the overnight rate modestly increases for few periods (instead of falling), and the spread strongly declines (instead of rising). This indicates that the amount of monetary drain associated with the FX liquidation is greater for the aggregate supply shock than for the fiscal policy shock, also indicating that the provision of FX to the economy is larger as well. But again, this larger provision of FX does not prevent the occurrence of loose monetary conditions. In fact, lending rates do not increase for the aggregate supply shock, even if the estimation allows for this possibility.

Overall, because the strong accumulation of deposits triggered by these two shocks is also associated with a rise in banking credit—without generating an increase in lending rates—we consider these results as evidence of more loans being supplied by banks. That is, despite the observed expansion in real activity, which potentially would produce a greater credit demand and would force lending rates upward, banks voluntarily channel their increased liabilities through new loans without increasing their price. This is exactly the characterization of a process of credit supply.<sup>13</sup>

This larger provision of credit by banks is also not totally alike for these two shocks. For the aggregate supply shock, the mere occurrence of the shock substantially boosts real activity

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<sup>13</sup> Contrary to what Eickmeier, Gambacorta, and Hofmann (2014) suggest, credit supply in Venezuela can take place with either falling or growing spreads, and not only with falling spread. This is because credit supply strictly depends on the expansion of banking liabilities that occurs during both aggregate supply (falling spreads) and fiscal (rising spreads) shocks.

with an endogenously moderate buildup of banks' deposits. For the fiscal policy shock, the enormous increase in deposits occurs with the exogenous surprise in domestic spending, while the increase in real activity ends up being slim. As a consequence, the potential influence of real activity on bank loans supply is probably much more important for the aggregate supply shock than for the fiscal policy shock. That is, in the aggregate supply shock, credit is probably supplied by banks as a combination of a greater availability of deposits in a context of a better performing economy, with positive growth and lower inflation. For the fiscal policy shock, however, credit supply emerges fundamentally as the result of an exogenous liabilities' expansion, which compulsorily needs to be allocated among different assets. As a consequence, the amount of loans created by each unit of deposit is smaller for the fiscal policy shock.<sup>14</sup> These differentiated processes also imply that only the fiscal policy shock fosters a provision of credit by banks, mostly due to the changes in monetary conditions. In other words, only the fiscal policy shock enables the occurrence of a bank lending channel.

For the other two shocks, the FX policy shock (Figure 2) and the aggregate demand shock (Figure 4), credit increases temporarily, loan rates do not drop and deposits fall. These contractionary monetary conditions arise in both cases for the prevalence of FX liquidations over fiscal monetization (net primary money destruction). However, monetary adjustments for these two shocks are slightly different and are reflected in the differentiated behavior of the lending rate and the spread. While in the aggregate demand shock the loan rate increases considerably, in the FX policy shock the loan does not change significantly (i.e., does not clearly adjust upward, but it does not fall either). In the FX shock, the overnight rate increases instead and the spread falls, reflecting the reallocation of funds across banks. Regardless of these monetary differences, both shocks represent instances of higher credit demand. In the expansionary aggregate demand shock, credit volumes and rates are clearly driven by higher goods demand, which also explains the initial rise in activity and inflation. Credit demand probably increases because rising consumption, investment and working capital needs induce borrowers to demand more funds. As the lending rate soars and real activity relents, so does credit. In the FX shock, larger provision of FX by the Central Bank induces banks to look for more funds. But part of those funds is probably delivered to clients to help them satisfy their financing needs (in domestic currency) to

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<sup>14</sup> In fact, for the first month, the elasticity of loans to deposits calculated for the aggregate supply shock is 1.5 (compared to 0.2 for the policy shock) and after two years, becomes equal to 1 (compared to 0.64).

pay for foreign currency. In this case, although loan rates do not change significantly, we presume that credit is driven by the unexpected higher demand from those clients. The fact that banks are augmenting loans without increasing the lending rate could be explained by the existence of other types of fees for handling FX transactions. Consequently, we also think of this case as credit demand. However, differently from the aggregate demand shock, credit is probably undertaken mostly by corporate clients, who are generally the final recipients of FX currency. For the aggregate demand shock, credit is presumably more allocated toward consumption loans.<sup>15</sup>

Another way to describe IRs is by comparing shocks that have similar effects on the goods market. The fiscal policy and the aggregate demand shock increase both real activity and inflation. Besides their differences in monetary conditions, only the aggregate demand shock produces a major effect on real activity. Similarly, both the FX policy and the aggregate supply shock increase real activity and reduce inflation. But only the aggregate supply shock has a long-lasting effect on activity. In this sense, one general consideration regarding policy shocks is that their real effects are weak probably because their occurrence relies on actions (spending or FX provision) that cannot be sustained over time.

### ***3.2. Variance Decomposition of Shocks***

To address more precisely shocks' impact on credit market variables, we present the information provided by the median impulse-responses in the form of variance decompositions (Table 3). Columns one to four represent the portion of variance explained by each shock identified. In the fifth column, we add up the variance of policy shocks, and in the sixth, the variance of aggregate supply and demand shocks. This is to visualize the distinction between policy and goods market shocks. In the last column, we add up the variance of fiscal and aggregate supply shocks, both of which represent instances of credit supply.

For the loan variable, most of its variance (around 55 percent) is associated with policy shocks, particularly fiscal policy shocks. The FX policy shock can account for 33 percent of credit variability when the shock takes place, but after two years it explains only 7 percent. That is, at the end of two years, the effect of the FX policy shock has already vanished and only the fiscal shock can explain the majority of loan variability.

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<sup>15</sup> These references to loans' allocation come from the descriptions of policy shocks' results available in Carvalho and Pagliacci (2016).

Another steady but important source of credit fluctuation is the occurrence of expansionary aggregate supply shocks, which represent around 40-45 percent of loan variability. This shock also explains an important part of the variability of both FM and FX-LQD (32 percent and 56 percent, respectively, at the end of two years). The initial net effect of these two sources of primary money creation is a modest increase in deposits (3 percent of its variance). Later, that increase represents almost 23 percent of DEP variability. This behavior of deposits indicates that fiscal money creation always exceeds the drain of FX liquidations for positive supply shocks.

Finally, aggregate demand shocks can explain only a small fraction of credit variability (between 1 and 10 percent), in spite of the substantial expansion that is caused in real activity (almost 70 percent at the occurrence of the shock). From the monetary perspective, the aggregate demand shock induces a modest, but statistically significant, reduction in aggregate deposits (up to 5 percent of its variability). In terms of interest rates, a positive aggregate demand shock vigorously raises overnight and lending rates, explaining after two years 80 and 93, respectively, of their variance.

In terms of credit supply, expansionary fiscal policy and aggregate supply shocks explain between 65 and 90 percent of credit fluctuations. Because the portion of credit explained by the fiscal policy shock increases with time, at the end of two years it represents almost 50 percent of credit variability. That is, more than half of the total credit supplied by banks has its origin in the change of monetary conditions triggered by exogenous fiscal shocks. This indicates that the non-conventional bank lending channel of fiscal policy is of paramount importance for the Venezuelan economy. In this process of credit creation, fiscal actions can also account for almost 50 percent of fiscal money creation (FM) and more than 70 percent of real deposit variation (DEP).

The remaining 10 to 35 percent of credit variability is related to fluctuations in credit demand. As explained above, credit demand takes place for the FX policy and the aggregate demand shocks. For these two shocks, rates and the spread importantly change, although the portion of deposit variability explained remains between 7 percent and 12 percent.

Movements in real activity can be attributed basically to shocks originating in the goods market. Aggregate demand shocks are the main source of variation in output growth when they occur, but aggregate supply shocks define mid and long-term volatility (explaining up to 80

percent of real output growth). Policy shocks can account only for a small variance of real activity (only 14 percent). Consequently, for the Venezuelan case, the real cycle seems to be primarily driven by goods market shocks, and not by credit supply shocks related to exogenous fiscal actions. In particular, the bank lending channel of fiscal policy can only explain a small part of real output variance (up to 7 percent). Similarly, for the inflation rate, aggregate demand and especially aggregate supply shocks are the main drivers of variations along the entire IR-horizon.

**Table 3. Accumulated Variance Decomposition of Variables**

Horizon (month)	Accumulated variance by shocks				Total variance by groups		
	Fiscal shock (1)	FX shock (2)	AS shock (3)	AD shock (4)	Policy shocks (1+2)	Goods Market shocks (3+4)	Credit Supply shocks (1+3)
Real output growth ( Y )							
1	0.0%	0.0%	32.7%	67.3%	0.0%	100.0%	32.7%
12	4.7%	2.6%	62.1%	30.6%	7.3%	92.7%	66.8%
24	7.0%	6.5%	81.6%	5.0%	13.4%	86.6%	88.5%
Inflation rate (P)							
1	0.0%	0.0%	62.6%	37.4%	0.0%	100.0%	62.6%
12	1.1%	7.0%	64.0%	27.9%	8.1%	91.9%	65.1%
24	2.3%	10.7%	66.5%	20.5%	13.0%	87.0%	68.8%
Real credit growth (LOAN)							
1	21.8%	33.0%	44.2%	1.0%	54.7%	45.3%	66.0%
12	35.1%	14.3%	40.3%	10.3%	49.3%	50.7%	75.4%
24	49.3%	6.9%	41.6%	2.1%	56.2%	43.8%	90.9%
Fiscal money creation (FM)							
1	17.2%	69.6%	7.7%	5.6%	86.8%	13.2%	24.9%
12	44.1%	12.6%	39.5%	3.9%	56.6%	43.4%	83.5%
24	49.0%	11.9%	32.4%	6.7%	60.9%	39.1%	81.4%
Monetary drain of FX liquidations (FX-LQD)							
1	1.2%	88.5%	5.7%	4.7%	89.6%	10.4%	6.9%
12	0.7%	52.0%	36.9%	10.4%	52.7%	47.3%	37.6%
24	6.6%	33.3%	55.9%	4.1%	39.9%	60.1%	62.5%
Absolute change in lending rate (LR)							
1	74.8%	7.6%	12.4%	5.2%	82.4%	17.6%	87.1%
12	17.1%	2.0%	1.1%	79.7%	19.1%	80.9%	18.2%
24	0.9%	0.0%	6.6%	92.5%	0.9%	99.1%	7.5%

**Table 3, continued**

Horizon (month)	Accumulated variance by shocks				Total variance by groups		
	Fiscal shock (1)	FX shock (2)	AS shock (3)	AD shock (4)	Policy shocks (1+2)	Goods Market shocks (3+4)	Credit Supply shocks (1+3)
Absolute change in overnight rate (OVER)							
1	85.5%	12.2%	0.1%	2.2%	97.7%	2.3%	85.6%
12	33.0%	19.2%	0.0%	47.8%	52.2%	47.8%	33.0%
24	5.6%	5.4%	9.2%	79.7%	11.0%	89.0%	14.8%
Difference between lending and overnight rate (SPREAD)							
1	36.6%	59.1%	1.5%	2.8%	95.7%	4.3%	38.1%
12	31.2%	55.1%	13.2%	0.5%	86.3%	13.7%	44.4%
24	26.3%	56.9%	7.5%	9.2%	83.3%	16.7%	33.8%
Real deposit growth (DEP)							
1	90.3%	6.2%	3.0%	0.5%	96.5%	3.5%	93.3%
12	78.4%	7.8%	9.8%	4.0%	86.2%	13.8%	88.2%
24	70.6%	1.4%	22.7%	5.3%	72.0%	28.0%	93.4%

### ***3.3. Robustness Exercise: Is There an Additional Source for Credit Supply?***

Overall, the description of variables' variations to all four structural shocks reveals that similar monetary conditions can be associated with either goods market or policy shocks. But the supply of credit is only related to the occurrence of loose monetary conditions that are propitiated either exogenously or endogenously by the behavior of fiscal money. In other words, credit supply does not seem to occur due to an exogenous decision of banks to provide funds, based for instance, on the adjustment of particular banking variables. In this sense a fundamental question arises: is there a possibility that an additional (private) source for credit supply exists in Venezuela? This calls for testing whether there is another form of credit supply.

We address this issue by trying to identify a fifth shock in the same 9 variables system: two goods market shocks, two policy shocks, and an additional credit supply shock. The credit supply shock is identified as a positive loan growth with a reduction in loan rates, as the literature does (Gambetti and Musso, 2016; Hristov, Hülsewig and Wollmershäuser, 2012; Busch, Scharnagl and Scheithauer, 2010). We additionally follow Eickemeir, Gambacorta and Hofmann (2014) and impose a reduction on the lending spread following an expansionary credit

supply shock.<sup>16</sup> As an alternative exercise, we impose two additional restrictions on inflation and real activity for identifying the credit supply shock. In this case, we explicitly recognize that a credit supply implies a rise in aggregate demand. After 2,000,000 iterations, the data were unable to support any of these two identification schemes. That is, having already identified goods market and policy shocks, the attempt to identify an additional orthogonal supply shock was unsuccessful. We interpret this outcome as verification that credit supply is already captured by aggregate supply and fiscal shocks. In other words, we econometrically check that the identification strategy that considers only four shocks (two from goods market and two policy shocks) seems to be the most suitable for the given nine-variable system. For further identifying another source of credit supply, we would need to establish a concrete hypothesis on what factors would trigger banks' behavior and include other types of variables for implementing the empirical testing.

#### **4. Concluding Remarks and Policy Implications**

The empirical evidence found suggests that the supply of credit in Venezuela occurs when bank deposits and liabilities increase due to the monetary effects of domestic fiscal expenditures. Such monetary expansions of fiscal origin can take place when expansionary aggregate supply shocks endogenously raise domestic fiscal spending or when the public sector exogenously decides to increase its expenses. We find that in the long run, the effect of discretionary fiscal actions on credit supply is preponderant. This is evidence of a non-conventional bank lending channel, triggered by exogenous fiscal policy actions.

The key difference between these two forms of credit supply, endogenously driven by goods market shocks or exogenously produced by fiscal actions, is the behavior of real activity. In the first case, the economy stabilizes, displaying vigorous real activity growth and lower inflationary pressures, while the balance sheets of agents in the economy improve. The strong economic expansion comes along with a larger supply of goods and services by domestic firms. In the second case, because credit provision by banks is persistent over time, but its impact on real activity is slim, fiscal expansions imply significant credit booms with latent risks.

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<sup>16</sup> The fall in the spread is expected by the relative stickiness of the overnight rate in contraposition to the dominant adjustment that takes place in the loan rate due to the credit supply movements. That is, the idiosyncratic banking considerations that lead to an increase in the supply of credit are reflected in an exogenous reduction in the loan rate.

According to Carvalho and Pagliacci (2016), when policy shocks produce tight monetary conditions and deposit contractions, banks' instability materializes. These results, combined with our policy shocks' effects on credit, can hint at situations of significant danger for the financial system. For instance, sustained fiscal monetary expansions can foster an unremitting credit boom and bank stability. When these monetary expansions are reversed, situations of credit bust and soaring bank instability tend to emerge. In this case, the volatility that characterizes fiscal expenditures is directly transferred to money creation and is ultimately translated into pervasive credit and instability cycles. Erratic FX provision also adds volatility to these variables by temporarily increasing credit and reducing stability.

As mentioned in the analysis regarding the Venezuelan institutional framework, because the volatility of the net primary money creation is related to the confluence of different instances of public decisions, it is troublesome to think that simple monetary policy mechanisms can be sufficient to mitigate that volatility efficiently. Partly, this is the case because the required adjustments in policy instruments could be huge. In this context, avoiding the important reallocation of banks' balance sheets and the implicit credit volatility in the first place, it is probably more efficient. This could be achieved by sidestepping the volatility of fiscal primary money creation. But in order to circumvent the effects of fiscal and FX actions on money creation we need to consider modifications to the current institutional arrangement. One possibility is to generate rules that preclude the sale of all oil rent for domestically expenditure to the Central Bank. This would imply the creation of a new institutionality in which the mechanisms of monetary creation be under the control of the monetary authority and in which the oil rent is introduced into the economy in an orderly fashion. This institutionality goes beyond the elimination of the exchange rate control and probably needs a thorough evaluation of possible new interactions between fiscal and monetary authorities.

Another implication of the empirical evidence found is the support to the view that considers monetary conditions as crucial determinants for credit supply. The caveat with respect to most of the literature is that fiscal policy, and not monetary policy, is the key policy for determining monetary conditions in Venezuela. The relevance of this result would depend on whether similar processes could take place in other countries. For instance, in countries where commodities are also owned by the state, the role of fiscal policy in defining monetary conditions could be important. In other economies, external factors could condition the control of



primary money creation by the monetary authority. For instance, the presence of capital inflows could importantly affect primary money creation, banks' deposits and credit supply when Central Banks intervene in FX markets and sterilization mechanisms cannot cope with the resulting monetary expansions. Likewise, the effect of these capital inflows can affect credit supply when the financial system directly receives FX deposits that are channeled through credit. In all these cases, the relevant question to ask is whether these different mechanisms triggering credit booms can bring about or come along with simultaneous positive effects on the real economy that do not involve future financial risks. Such risks are difficult to determine *ex ante*, but could probably relate, among other things, to the performance of the goods market. Credit surges in the absence of a larger supply of goods might represent an important source of concern for policymakers. In this sense, an accurate monitoring of the types of shocks affecting the goods market (supply versus demand shocks), along with an accurate observation of the process of money creation, could provide a basic evaluation tool to improve the assessment of financial risk.

## References

- Arias, J., D. Caldara and J.F. Rubio-Ramírez. 2015. “The Systematic Component of Monetary Policy in SVARs: An Agnostic Identification Procedure.” FRB International Finance Discussion Paper 1131. Washington, DC, United States: Federal Reserve Board.
- Bárcenas, L., A.M. Chirinos and C. Pagliacci. 2013. “Transmisión de Choques Macroeconómicos en Venezuela: Un Enfoque Estructural del Modelo Factorial.” *Trimestre Económico* 80(4): 903–942.
- Barnett, A., and R. Thomas 2014. “Has Weak Lending and Activity in the UK Been Driven by Credit Supply Shocks?” *The Manchester School* 82: 60-69.
- Barráez, D., A.M. Chirinos and C. Pagliacci. 2011. “What Else Can We Say about Credit Channel: A Sign Restriction Approach.” Documento de Trabajo 122. Caracas, Venezuela: Banco Central de Venezuela.
- Bernanke, B., and A. Blinder. 1988. “Credit, Money and Aggregate Demand.” *American Economic Review* 78: 435-439.
- Bernanke, B., and M. Gertler. 1995. “Inside the Black Box: The Credit Channel of Monetary Policy Transmission.” *Journal of Econometric Perspectives* 9: 27-48. doi: [10.1111/manc.12071](https://doi.org/10.1111/manc.12071)
- Bijsterbosch, M., and M. Falargiarda. 2014. “Credit Supply Dynamics and Economic Activity in Euro Area Countries: A Time Varying Parameter VAR Analysis.” European Central Bank Working Paper 1714. Frankfurt, Germany: European Central Bank.
- Blanchard, O., and D. Quah. 1989. “The Dynamic Effects of Aggregate Demand and Aggregate Supply Disturbances.” *American Economic Review* 79(4): 654-673.
- Busch, U., M., Scharnagl and J. Scheithauer. 2010. “Loan Supply in Germany during the Financial Crisis.” Deutsche Bank Discussion Paper 05/2010. Frankfurt, Germany: Deutsche Bank.
- Canova, F., and G. De Nicoló. 2002. “Monetary Disturbances Matter for Business Fluctuations in the G-7.” *Journal of Monetary Economics* 49: 1131–1159. doi:[10.1016/S0304-3932\(02\)00145-9](https://doi.org/10.1016/S0304-3932(02)00145-9).
- Carvalho, O., and C. Pagliacci. 2016. “Macroeconomic Shocks, Bank Stability and the Housing Market in Venezuela.” *Emerging Markets Review* 26: 174–196.

- Chirinos, A.M., and C. Pagliacci. 2014. “El Sistema Financiero Venezolano: ¿Qué Compromete su Desempeño?” *Economic Analysis Review* 29(2): 47–74.
- Eickmeier, S., L. Gambacorta and B. Hofmann. 2014. “Understanding Global Liquidity.” *European Economic Review* 68: 1-18. doi: [10.1016/j.euroecorev.2014.01.015](https://doi.org/10.1016/j.euroecorev.2014.01.015)
- Gambetti, L., and A. Musso. 2016. “Loan Supply Shocks and the Business Cycle.” *Journal of Applied Econometrics*. doi: [10.1002/jae.2537](https://doi.org/10.1002/jae.2537)
- Hristov, N., O. Hülsewig and T. Wollmershäuser. 2012. “Loan Supply Shocks during the Financial Crisis: Evidence for the Euro Area.” *Journal of International Money and Finance* 31: 569-592. doi :[10.1016/j.jimonfin.2011.10.007](https://doi.org/10.1016/j.jimonfin.2011.10.007)
- Mumtaz, H., and P. Surico. 2009. “The Transmission of International Shocks: A Factor-Augmented VAR Approach.” *Journal of Money, Credit and Banking* 41(1): 71–100. doi:[10.1111/j.1538-4616.2008.00199.x](https://doi.org/10.1111/j.1538-4616.2008.00199.x)
- Pagliacci, C. 2016. “Are We Ignoring Supply Shocks? A Proposal for Monitoring Cyclical Fluctuations.” CEMLA Research Paper 21. Mexico City, Mexico: Centro de Estudios Monetarios Latinoamericanos.
- Rubio-Ramírez, J.F., D.F. Waggoner and T.A.O. Zha. 2010. “Structural Vector Autoregressions: Theory of Identification and Algorithms for Inference.” *Review of Economic Studies* 77(2): 665-696. doi: [10.1111/j.1467-937X.2009.00578.x](https://doi.org/10.1111/j.1467-937X.2009.00578.x)
- 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.

## Appendix

**SVAR specification.** A structural VAR (  $q$  ) can be written as:

$$B^{-1}Z_t = \Gamma_1 Z_{t-1} + \dots + \Gamma_q Z_{t-q} + u_t \quad u_t \sim (0, \Omega) \quad (1)$$

where  $Z_t$  is a column vector of endogenous variables;  $u_t$  is the vector of structural errors that has a diagonal covariance matrix  $\Omega$  and affects endogenous variables contemporaneously through the matrix of coefficients  $B$ . This SVAR can also be re-written as a reduced-form VAR (1):

$$Z_t = A_1 Z_{t-1} + e_t \quad e_t \sim (0, \Sigma) \quad (2)$$

where  $A$  is the matrix of reduced-form coefficients,  $e_t$  is the vector of reduced-form residuals, which are linear combinations of the structural errors  $u_t$ , being  $e_t = B u_t$ . The covariance matrix of reduced-form residuals is given by  $\Sigma = B \Omega B'$ . Sign restriction identification, developed by Canova and De Nicoló (2002) and Uhlig (2005), consists of finding structural parameters ( $B, \Gamma$ ) that satisfy restrictions imposed on structural impulse-response functions. Identification starts by finding a matrix  $V$  that satisfies  $\Sigma = V V'$ , and defines orthogonal errors  $\varepsilon_t = V^{-1} e_t$ . Because structural shocks are strictly identified by their expected effect on economic variables, orthogonal shocks may not necessarily qualify as such. Therefore, the way sign restriction identification works is by combining orthogonal shocks in such a way that the resulting structural (also orthogonal) shocks have the properties imposed by the analyst. Operationally, if we assume that structural shocks are related to orthogonal shocks through a matrix  $Q$ , such that  $\varepsilon_t = Q u_t$ , then we can write structural impulse-responses from the VAR as:

$$IR(h) = \hat{A}^{h-1} \hat{V} Q \quad (3)$$

for the  $h^{th}$  horizon. However,  $Q$  must be a rotation matrix, which by definition satisfies  $Q'Q = I$  and  $QQ' = I$ , so that we can always write  $\hat{\Sigma} = \hat{V} Q Q' \hat{V}' = \hat{V} \hat{V}'$ , i.e. the properties of the estimated covariance matrix are preserved. According to Rubio-Ramírez, Waggoner, and Zha

(2010),  $Q$  can be obtained by applying the QR decomposition to a uniform random matrix. In this paper, we obtain  $V$  from the Cholesky decomposition of  $\Sigma$ .<sup>17</sup>

Because sign restriction identification does not usually impose zero restrictions on  $B=VQ$ , there could be several sets of structural parameters that satisfy the reduced form model and the restrictions imposed on impulse-responses. This makes, by definition, any SVAR identified with sign restrictions overidentified.<sup>18</sup>

Operationally, sign restriction identification entails finding a set of  $Q$  matrices that satisfy the restrictions imposed on variables' responses according to (3). Notice also that providing sufficient rotation matrices  $Q$ s, we can gauge the level of uncertainty in the model's structural parameters and appropriately characterize structural shocks.

We use a mix of zero and sign restrictions to identify shocks. Zero restrictions are imposed by using a block-diagonal structure for  $Q$ . We impose that goods market variables (activity and inflation) do not immediately respond to policy shocks. More precisely, being

$Q = \begin{bmatrix} Q_1 & 0 \\ 0 & Q_2 \end{bmatrix}$ ,  $Q_1$  and  $Q_2$  are non-zero matrices that preserve  $Q_1 Q_1' = I$  and  $Q_2 Q_2' = I$ . For

our nine variables SVAR,  $Q_1$  has dimension 2x2, while  $Q_2$  has dimension 7x7. Matrix  $VQ$  in (3) corresponds to the 9x4 partition of the potential 9x9 matrix. We impose four zero restrictions in the upper-right hand side of matrix  $VQ$  (of dimension 9x4). Notice that while  $Q_1$  combines information from the goods market variables (the first two columns of  $V$ ),  $Q_2$  combines information from money creation and credit market variables' shocks (the seven last columns of  $V$ ).

**Variance Decomposition.** Variance decomposition measures the portion of the variance of a variable that is attributed to each of the identified structural shocks. It represents an alternative combination of the same information contained in structural impulse-responses. To compute variables' variances, we use median impulse-responses,  $IR^M(h)$ , obtained from all  $Q$ s satisfying restrictions. Because the response of variable  $i$  to shock  $j$  is given by the  $ir^M_{i,j}$  element, then

the total variance of variable  $i$  is be given by  $\omega_i(h) = \sum_{j=1}^4 (ir^M_{i,j})^2$ . The variance of variable  $i$

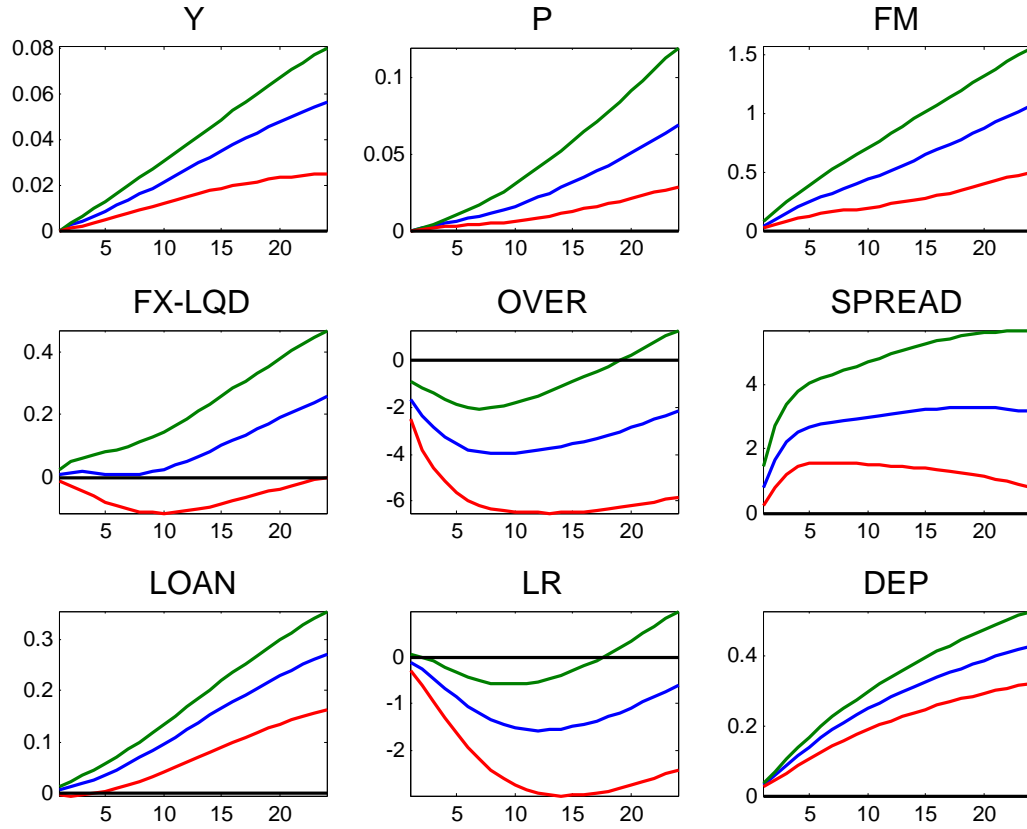
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<sup>17</sup> A spectral decomposition could also be used for the decomposition of sigma.

<sup>18</sup> See Rubio, Waggoner and Zha (2010) for a more detailed discussion on identification of SVARs.

explained by shock  $j$  is simply  $\frac{(ir_{i,j}^M)^2}{\omega_i}$ . The accumulated variance decomposition shows the portion of the variance explained by shock  $j$  when accumulating the effects from period  $1$  up to period  $h$ .

**Figure 1. Impulse-Responses to an Expansionary Fiscal Shock**

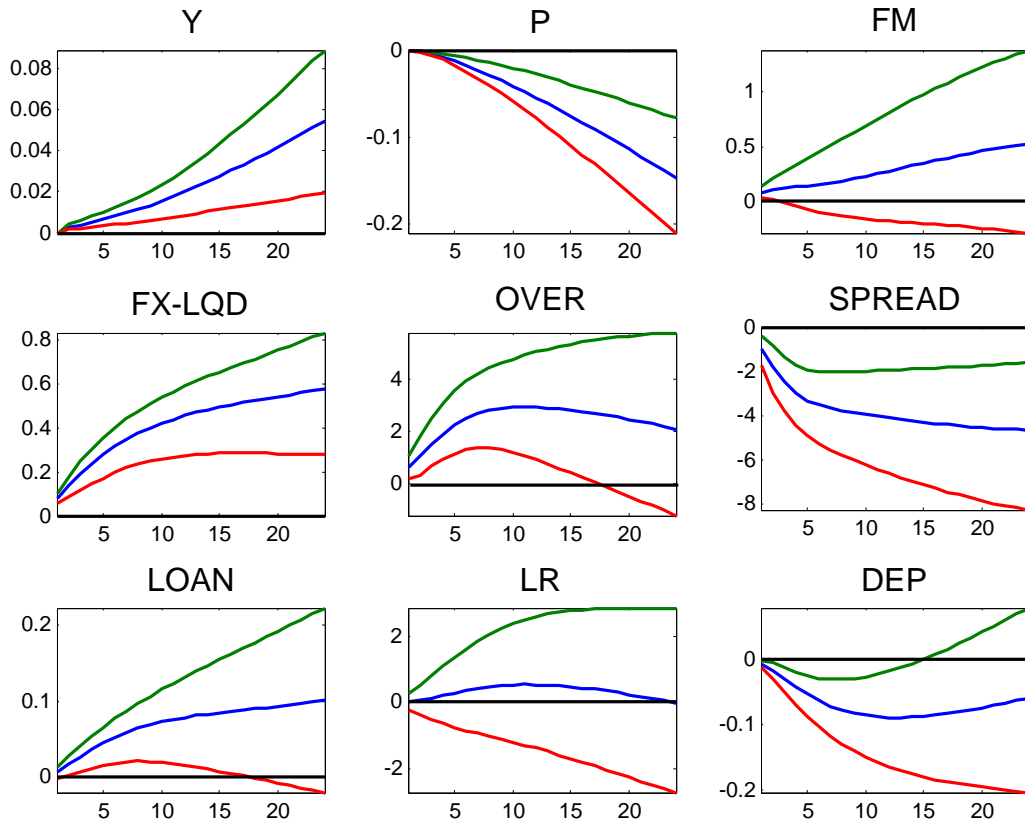


*Notes:* The size of the shock is one standard deviation. The central line is the median response, the upper band is the 84<sup>th</sup> percentile and the lower band is the 16<sup>th</sup> percentile.

Y: real output growth; P: inflation rate; LOAN: real credit growth; FM: fiscal money creation (% of MB); FX-LQD: monetary drain of FX liquidations (% of MB); LR: change in lending rate (in percentage points); OVER: change in overnight rate (in percentage points); SPREAD: difference between lending and overnight rate; DEP: real deposit growth.

Restrictions are imposed according to Table 1.

**Figure 2. Impulse-Responses to an Expansionary FX Provision Shock**



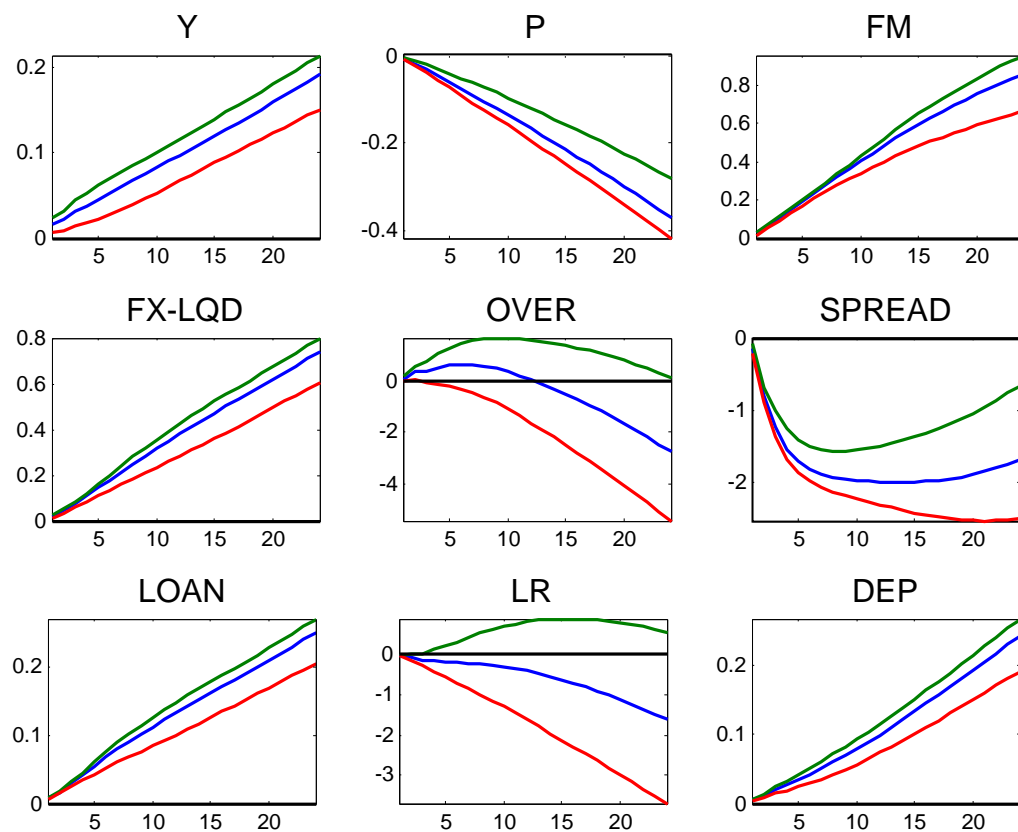
*Notes:* The size of the shock is one standard deviation. The central line is the median response, the upper band is the 84<sup>th</sup> percentile and the lower band is the 16<sup>th</sup> percentile.

Y: real output growth; P: inflation rate; LOAN: real credit growth; FM: fiscal money creation (% of MB); FX-LQD: monetary drain of FX liquidations (% of MB); LR: change in lending rate (in percentage points); OVER: change in overnight rate (in percentage points); SPREAD: difference between lending and overnight rate; DEP: real deposit growth.

Restrictions are imposed according to Table 1.



**Figure 3. Impulse-Responses to an Expansionary Aggregate Supply Shock**

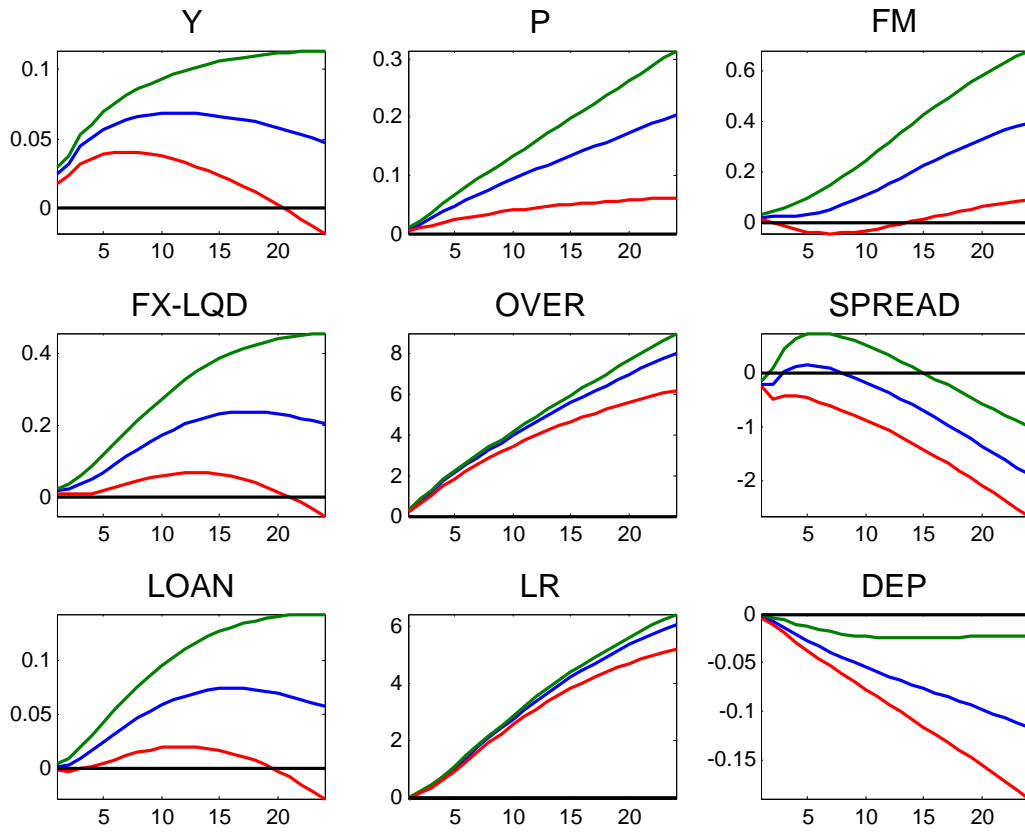


*Notes:* The size of the shock is one standard deviation. The central line is the median response, the upper band is the 84<sup>th</sup> percentile and the lower band is the 16<sup>th</sup> percentile.

Y: real output growth; P: inflation rate; LOAN: real credit growth; FM: fiscal money creation (% of MB); FX-LQD: monetary drain of FX liquidations (% of MB); LR: change in lending rate (in percentage points); OVER: change in overnight rate (in percentage points); SPREAD: difference between lending and overnight rate; DEP: real deposit growth.

Restrictions are imposed according to Table 1.

**Figure 4. Impulse-Responses to an Expansionary Aggregate Demand Shock**



*Notes:* The size of the shock is one standard deviation. The central line is the median response, the upper band is the 84<sup>th</sup> percentile and the lower band is the 16<sup>th</sup> percentile.

Y: real output growth; P: inflation rate; LOAN: real credit growth; FM: fiscal money creation (% of MB); FX-LQD: monetary drain of FX liquidations (% of MB); LR: change in lending rate (in percentage points); OVER: change in overnight rate (in percentage points); SPREAD: difference between lending and overnight rate; DEP: real deposit growth.

Restrictions are imposed according to Table 1.