Banks' lending growth in Chile: the role of the Senior Loan Officers Survey *

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May 23, 2017

Abstract

In order to understand the influence of banks' perceptions on their lending and thus, contribute to the understanding of the transmission of monetary policy, we studied the role of the Senior Loan Officers Survey (SLOS, hereafter), published quarterly by the Central Bank of Chile. The SLOS accounts for changes in the supply of loans and factors affecting the willingness to lend, as well as variations in the demand for credit and its motivations. By including the SLOS in the analysis, we can go beyond the traditional determinants of credit growth rates that appear in the literature. After controlling for macroeconomic factors and idiosyncratic characteristics of banks, we found that the perceptions reported in the SLOS are statistically and economically significant in explaining the dynamics of credit. This result holds for all market segments, and is robust to several specifications. Moreover, we establish that the impact of credit standards and demand perceptions in credit growth rates is asymmetrical and non-linear, being more significant when conditions are tightening.

Keywords: Credit growth, lending standards, credit channel, SLOS.

JEL Classification Number: C23, E32, E44, E51, E52, G21, G28

*We are grateful to Claudio Raddatz and colleagues in the Financial Policy Division at the Central Bank of Chile for their helpful comments at different stages of this research. The opinions expressed in this article are the authors' own and do not necessarily represent the views of the Central Bank of Chile or its Board Members. The usual disclaimer applies.

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1 Introduction and motivation

A key issue in macroeconomics is to understand the transmission mechanisms of monetary policy into the real economy. Although there is consensus about the non-neutrality of monetary policy in the short run (Bernanke and Gertler, 1995), there is less agreement about the channels through which monetary policy is transmitted. As a response arises the credit channel, composed by the interaction between the balance sheet channel and its bank lending component. The balance sheet channel is associated with the effects of interest rates on agents' balance-sheets and income statements, making it closely related to credit demand. In turn, the bank lending channel is associated with the implications of monetary policy on banks' willingness to lend and therefore it relates with credit supply. Although important, this framework is still debateable, mainly because of the difficulties encompassed in disentangling demand and supply influences on credit growth rates. This is where the more recent literature frames the use of Senior Loans Officers' Surveys (SLOS) on lending standards and demand perceptions, in their power to help to identify credit dynamics and their determinants.

Changes in lending standards contained in SLOS are key to understanding credit dynamics because they reflect banks' expectations about the economy and the risks faced by the banking sector. As such, they help to address one of the most challenging aspects of the credit channel, namely the magnitudes and directions of the bank lending component and its effects on the real economy.[1] Along these lines, Ciccarelli et al. (2011) emphasizes that the capacity of SLOS in disentangling demand and supply factors behind credit growth rates relies precisely on the possibility to capture banks' expectations.

The empirical evidence shows that lending standards contained in SLOS help to identify the bank lending channel and, consequently, to understand the overall role of the credit channel in the transmission of monetary policy. In fact, changes in lending standards have been linked to changes in credit growth rates and interest rates (Berg et al, 2005; Bell and Pugh, 2014). By the same token, provided that credit supply shifts, loosening in lending standards has been associated with excessive credit growth rates and higher delinquency rates (Keeton, 1999). Moreover, there is evidence that the credit channel tends to amplify the monetary policy effects on output and inflation and that the strictness in credit standards for mortgage loans observed during the sub-prime crisis reduced economic activity

[1] The balance sheet channel, on the other hand, is relatively simpler to address, since it relates to the interest rate effects on the agents' budget constraints and its effects on spending.

(Ciccarelli et al., 2011). Finally, there is also evidence that lending standards outperform other variables —in particular risk metrics—in determining real activity (Waters, 2012), and that a subset of banks' perceptions are able to reasonably predict credit growth and interest rates one quarter ahead (Bell and Pugh, 2014).

Despite the evidence supporting the relevance of lending standards at the aggregate level, their contribution at the sectorial level is less conclusive. For instance, Cunninham (2006) shows that the disaggregation of lending standards at different market segments (e.g mortgage, commercial, consumer) helps to explain the dynamics of real activity in the US, but not the credit growth rates in those specific segments. On the flip side, Del Giovane et al. (2011) focus on the corporate sector to show that banks' perceptions about firms' risk, jointly with their level of capital adequacy, played an important role with respect to changes in the credit supply during the sub-prime crisis. Additionally, Basset el al. (2014) by the means of the US SLOS, construct an index of credit supply based on the survey's information on household and corporate loans. They find that, after controlling for specific banks' characteristics and macro variables, the index of credit supply, when tightened, can explain lower demand for credit and the ease of monetary policy.

Credit market equilibrium depends not only on the supply of credit, but also on the demand. While macroeconomic factors, such as GDP growth and interest rates, can closely track aggregate demand for credit, SLOS can provide valuable information about banks' perception of credit demand. For example, Breeden and Canals-Cerdá (2016) use the US SLOS to identify periods of high demand for credit. They find that periods of high demand correspond to low-risk cohorts of borrowers and periods of low demand correspond to high-risk vintages. Therefore, by considering demand-side factors, like the ability and willingness to consume and invest, the authorities can improve their assessment of loan performance.

At the policy level, central banks use the insights embedded in SLOS, such as banks' willingness to lend and their perceptions about credit demand, when making decisions about interest rates and other types of policies. In fact, SLOS helps them to disentangle the mechanisms behind the monetary policy transmission and to better understand and regulate credit markets. Since banks can influence credit cycles through their forward-looking decisions on loan-loss provisioning (Balasubramanyan et al., 2014), their behavior generates a feedback effect on lending standards, lending activity, and output (Lown et al., 2000, 2006).

In Chile, the SLOS surveys top bank officials since 2003 on a quarterly basis, providing qualitative information regarding the banks' willingness to lend (changes in lending stan-

dards) and their perception about the demand for credit. The Chilean SLOS asks about banks' opinions on different market segments (commercial, consumer, mortgage, construction), comparing current lending standards with the standards of the previous quarter. The SLOS in Chile also provides answers to the causes that may be underlying banks' decisions to change their lending standards (e.g. macroeconomic environment, banks' capital, funding conditions). It also asks about the specific conditions that may be affecting lending standards (e.g. credit lines, spreads, collateral).[2] As shown in Calani et al. (2010), the SLOS can be used as a reasonable instrument to address the identification problem faced traditionally in panel estimations of bank credit growth rates in Chile.

Aside from Calani et al. (2010)'s contribution, there have been few attempts to understand what drives credit dynamics based on credit standards and banks' perceptions in Chile. In this paper we fill this gap by studying the role played by the Chilean SLOS in understanding banks' lending growth rates during the 2003q1-2015q3 sample period. We find that, after controlling for macroeconomic factors and banks' balance sheet characteristics, the SLOS add valuable information to the dynamic of bank lending. In particular, we find that changes in lending standards have a stronger impact than changes in demand perceptions. These results are valid for all market segments (commercial, consumer, and mortgage) and are robust to different specifications. Moreover, we find that the impact of the SLOS on credit growth rates is asymmetric and non-linear, being more significant when conditions are tightening.

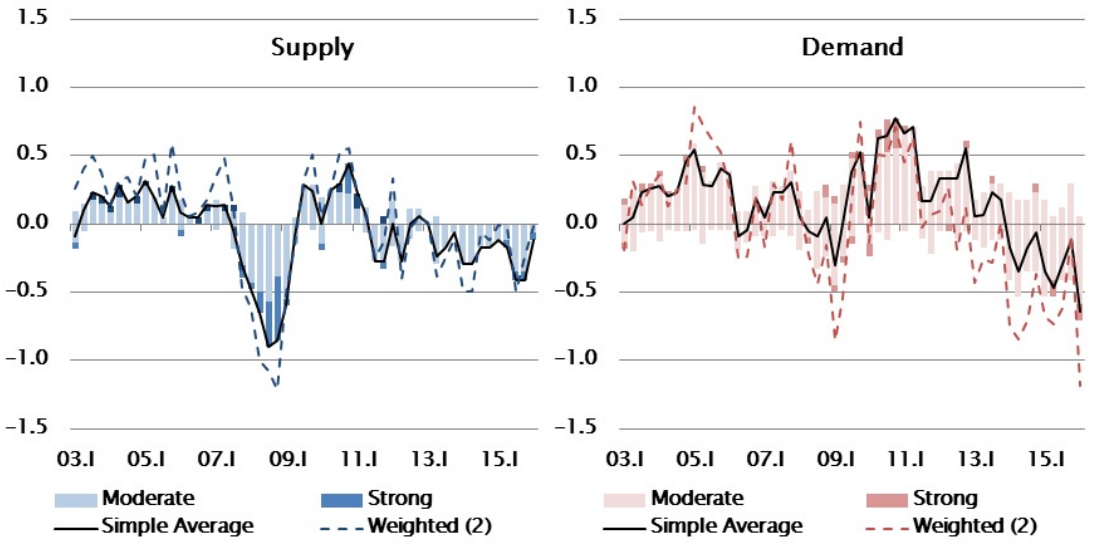
The paper is organized as follows. Section 2 briefly describes the structure of the Chilean SLOS and its main aggregate results since it was first released. It emphasizes the need to go beyond the aggregate behavior of the SLOS in order to avoid the aggregation bias resulting from the heterogeneous responses at the bank level. Section 3 describes the empirical strategy used to address the role of the SLOS in lending growth rates. It presents different specifications aimed to account for the persistence in the SLOS responses. Section 4 addresses the issue of asymmetry and non-linearity. Section 5 concludes.

2 The Chilean SLOS

The Chilean SLOS or "Encuesta de Crédito Bancario" (ECB), quarterly surveys senior managers of commercial banks in Chile since earlier 2003. The main purpose of this survey is to assess demand and supply factors affecting the dynamic of banks' lending growth

[2]See Jara and Silva (2007) for a more detailed description of the Chilean SLOS.

rates. The survey is used to get a better understanding about the transmission of monetary policy, as well as the potential financial risks associated with changes in the behavior of banks. Supply-side conditions are measured by changes in the banks' willingness to lend, while demand-side factors are measured by changes in the banks' perception about credit demand. In addition, the survey allows to identify the reasons behind those changes and, in the case of supply conditions, it allows to identify the specific factors reflecting such conditions.



Note: The LHS panel shows banks' changes in their willingness to lend. A positive (negative) number means that banks have loosened (tightened) their lending conditions compared to the previous quarter. The RHS panel shows banks' perception about demand for credit. A positive (negative) number means that the perception of banks is that the demand is stronger (weaker) compared to the previous quarter. Source: Authors' calculations based on the Chilean Senior Loan Officers Survey, Central Bank of Chile.

Figure 1: Lending conditions and demand perception for corporate loans

The Chilean SLOS asks specifically about how lending conditions have changed compared to the previous quarter. Senior officers have to choose between five options, depending on whether lending conditions have become: (i) strongly loosened, (ii) moderately loosened, (iii) unchanged, (iv) moderately tightened, or (v) strongly tightened. As for credit demand, they are asked about their perception compared to the previous quarter, having to choose also between five options, depending on whether their perception is that the demand for credit is: (i) strongly higher, (ii) moderately higher, (iii) unchanged, (iv) moderately weaker, or (v) strongly weaker.

Figure 1 shows the aggregate results of lending conditions and demand perceptions in the corporate market segment (i.e commercial loans to large firms). Positive numbers are associated with loose lending standards and higher demand perceptions, while negative numbers are associated otherwise. The answers for both, lending conditions and demand perceptions are mapped into the 1.5 and -1.5 range in order to be able to distinguish strong from moderate answers. Although it is a common practice in the literature to equally weight moderate and strong changes in supply conditions and demand perceptions, in Chile stronger changes have a greater impact on credit growth rates than moderate changes.[3] Figure 1 also shows the aggregate index constructed from the unweighted answers (simple average) and the index constructed after weighting the responses by the banks' specific market share.[4]

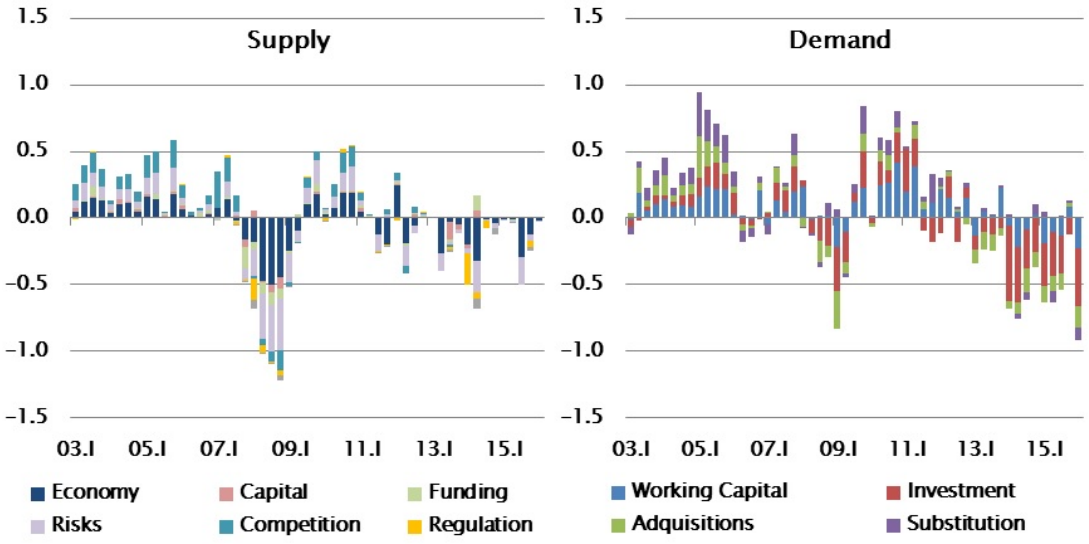
In Chile, lending conditions were moderately loose before 2007, but became tightened and strongly tightened during the Global Financial Crisis (GFC, hereafter). Since then, banks increased their willing to lend for a short period, but less so by the end of the sample period. Demand perceptions followed a similar cyclical pattern than lending conditions, however they fell less dramatically during the GFC. Moreover, demand perceptions showed a persistent, although moderate, decreased since late 2012, something that was less pronounced in the supply conditions. In addition, there has been higher discrepancy between weighted and unweighted values for demand perceptions than for credit standards, which suggests a higher heterogeneity in this component.

Figure 2 shows the factors behind the change in banks' willingness to lend and the factors that banks consider are behind the changes in the demand for credit. On average, banks argue that the economic conditions, as well as the riskiness of their portfolio, are the most relevant factors that explain their changes in lending conditions. Meanwhile, idiosyncratic factors, such as the level of capital and the funding conditions, have not played a significant role in explaining banks' willingness to lend in Chile. On the other hand, all factors behind the changes observed in demand perceptions play some role. Nonetheless, when the demand for commercial loans was perceived to be weaker —as it was during the GFC and during the last two years of the sample—it was because investments and acquisitions fell, and less so because there were changes in the need for working capital or in the degree of substitution from other sources of credit.

[3]For a further discussion on this issue see Section 4.

[4]The distinction between weighted and unweighted aggregate indexes is, in principle, relevant in Chile because banks' sizes are very heterogeneous.

The Chilean SLOS also have shown high degree of heterogeneity in the responses for both, lending conditions and demand perceptions. This heterogeneity has been particularly important when lending standards have become loosen, and when demand perceptions have changed moderately.[5] In other words, when lending conditions are tightened, all banks seem to go to restricted mode. Similarly, banks tend to agree about their perceptions on extremely high and extremely low changes in the demand for credit.



Note: The LHS panel shows banks' changes in their willingness to lend. A positive (negative) number means that banks have loosened (tightened) their lending conditions compared to the previous quarter. The RHS panel shows banks' perception about demand for credit. A positive (negative) number means that the perception of banks is that the demand is stronger (weaker) compared to the previous quarter. The area within each bar represents the weighted contribution of the factors that explain those changes. Source: Authors' calculations based on the Chilean Senior Loan Officers Survey, Central Bank of Chile.

Figure 2: Reasons why lending conditions and demand perception for corporate loans have changed

3 Empirical strategy and results

In this section, we summarize the empirical strategy used to analyze the role of lending conditions and demand perceptions in the dynamic of lending growth. We briefly describe the data used in the regression analysis and the implementation of different specifications and tests. As a general approach, we choose a panel data regression over an aggregated

[5] To support these findings, Figure B.1 in the Annex compares the standard deviation of individual bank responses and the actual answers to questions about lending conditions and demand perceptions.

regression at the banking system level for various reasons. First, because this approach takes into account the heterogeneity described above, increases the sample size, and enhances the statistical properties. Additionally, because this type of specification allows us to avoid aggregation biases.[6]

3.1 The data

Our empirical approach relies on the combination of several datasets. First, we use the SLOS information for 10 individual banks regarding their changes in lending standards and their perception of credit demand in different market segments (commercial, consumer, mortgage) published quarterly by the Central Bank of Chile (CBC).[7] Second, we construct a dataset of credit growth rates and other banks' characteristics based on balance sheet information published by the Superintendency of Banks and Financial Institutions (SBIF). Our dataset specifically deals with the issue of mergers and acquisitions in the traditional fashion.[8] Finally, we use a set of aggregate macroeconomic and financial variables from the CBC that might affect either the demand for credit or the willingness to lend by bankers.[9]

As explained above, extreme alternatives given in the survey for supply conditions and demand perceptions are weighted more than moderated changes. In particular, we define the lending conditions for each bank b at time t as L^c_{bt}, such that:

$$L^c_{bt} = \begin{cases} 1.5 & \text{if lending standards are strongly loosened} \\ 1.0 & \text{if lending standards are moderately loosened} \\ 0 & \text{if lending standards are unchanged} \\ -1.0 & \text{if lending standards are moderately tightened} \\ -1.5 & \text{if lending standards are strongly tightened} \end{cases} \tag{1}$$

In general, tighter lending standards can take the form of higher spreads, smaller lines of credit, or the requirement to provide better collateral. These changes are the result of

[6] See Appendix A for further details on the aggregation bias.

[7] We focus our empirical analysis on these 10 banks because they responded the SLOS in the three market segments and they responded the survey during the entire sample period. In addition, these 10 banks account for 94% of the total credit.

[8] Specifically, if a currently active bank is the result of a merger or acquisition in the past, we construct a fictitious bank for the period before the merger was effective as in Avanzini and Jara (2015).

[9] See Table C3 in the Appendix.

banks' general perception about credit risk, funding conditions, and the level of capital.

In a similar fashion, we define the demand perception for each bank b and time t as D^p_{bt}, such that:

$$D^p_{bt} = \begin{cases} 1.5 & \text{if demand is strongly higher} \\ 1.0 & \text{if demand is moderately higher} \\ 0 & \text{if demand is unchanged} \\ -1.0 & \text{if demand is moderately weaker} \\ -1.5 & \text{if demand is strongly weaker} \end{cases} \tag{2}$$

The survey also asks about the reasons why banks think that their perception about the demand has changed (liquidity needs, competition, among others).

Table 1 shows the frequency of changes for L^c_{bt} and D^p_{bt} during the period 2003q1-2015q3 for commercial, consumer, and mortgage loans. Note that for all market segments, demand perceptions present a higher proportion of non-zero responses than lending conditions. Also, changes in lending conditions are split fairly evenly among tighter and looser, while demand perceptions are biased towards perceiving stronger than weaker demand.

Survey	# of time changes	# of time changes (tight/weak)	# of time changes (loose/strong)	Proportion of non-zero
Commercial loans				
L^c	176	90	86	0.352
D^p	308	114	194	0.616
Consumer loans				
L^c	148	80	68	0.296
D^p	297	97	200	0.594
Mortgage loans				
L^c	136	70	66	0.272
D^p	272	78	194	0.544

Note: This table reports the number of changes in lending conditions and demand perceptions, as reported by banks' senior officers during the 2003q1-2015q3 sample period. Source: Authors' calculations based on the Chilean Senior Loan Officers Survey, Central Bank of Chile.

Table 1: Frequency of changes in lending conditions and demand perceptions

3.2 Regression analysis

To configure the baseline regression specification we follow conventional microeconomic theory adapted to the credit market. In essence, to identify the relationship between credit growth rates and its determinants we need to combine macroeconomic factors, idiosyncratic banks' characteristics and the instruments that account separately for demand and supply shifts.[10] This is where we recourse to the use of the Chilean SLOS. After defining the demand for and supply of credit we determine the following credit growth equation for each bank unit:

$$\Delta Y_{b,t} = \alpha_0 + \alpha_1 X_t + \alpha_2 X_{b,t-1} + \alpha_3 L^c_{bt} + \alpha_4 D^p_{bt} + f_b + \epsilon_{b,t} \quad (3)$$

where $\Delta Y_{b,t}$ is the quarterly log change in domestic lending of bank b at time t. X_t represents the contemporaneous macroeconomic factors, including GDP growth and the domestic interest rates. $X_{b,t-1}$ represent the one-quarter lagged vector of idiosyncratic banks' characteristics, including size, capital adequacy ratio, deposits to total assets and the liquidity ratio. L^c_{bt} and D^p_{bt} represent banks' lending conditions and demand perceptions, and f_b represents banks' fixed effects.[11]

In our baseline regression of equation (3), lending conditions and demand perceptions are included in levels. However, following Del Giovane et al (2011) and in order to take into account the role of persistency in the SLOS's responses, we also include the cumulative changes of these variables in alternative specifications to equation (3). In fact, according to Del Giovane et al (2011) there should be a rigorous consideration about the persistence of lending standards and demand perceptions when studying their potential affect on credit growth rates. Lending standards may vary in an infrequent manner, making the effect of one specific change in lending standards be insignificant on credit growth rates (i.e. one swallow does not make summer). However, if these infrequent variations are aggregated through time, they could influence credit activity. Put differently, if cumulative credit rejections grow steadily, this makes a case for determining credit growth variations. However, the argument for accumulating changes in demand perception is less strong, because these changes are by nature more persistent, due to the learning process about the states of nature that characterize borrowers' behavior (Milani, 2007).

[10] Appendix A describes the simple conceptual framework underlying in the identification of supply and demand factors.

[11] See Table C4 in the Appendix for the definition of these variables.

To examine this issue —and as robustness check—Del Giovane et al. (2011) accumulate the responses to the SLOS through time and create the respective new variables of credit supply standards and demand perceptions. These authors test the simultaneous accumulation of both components and find evidence pointing out that the supply responses may be informative when accumulated through time. However, they find that such aggregation is not satisfactory for demand perceptions after controlling for various idiosyncratic and macroeconomic factors.

We follow a similar strategy than Del Giovane et al. (2011), but in order to improve the span of possible combinations, we also test the effects of accumulating these variables in conjunction with considering the responses of the SLOS in levels. Table 2 summarizes these results for commercial, consumer, and mortgage loans. More specifically, we define the cumulative lending conditions for bank b at time t or Supply(cum.) as $\sum_{k=0}^{t} L^{c}_{bt-k}$, and the cumulative demand perceptions for bank b at time t or Demand(cum.) as $\sum_{k=0}^{t} D^{p}_{bt-k}$. Notice that, apart from including supply conditions and demand perceptions in different forms, all estimations presented in Table 2 correspond to the weighted OLS regressions that control by X_t, $X_{b,t-1}$, f_b, and use robust standard errors.[12] Furthermore, in order to make the estimated coefficients of the SLOS comparable in magnitude, we standardize lending conditions and demand perceptions by their total (time and bank) standard deviation (σ_{L^c} and σ_{D^p} respectively).[13]

The main results of Table 2 can be summarized as follows. First, after controlling for macroeconomic conditions, as well as for idiosyncratic characteristics, lending conditions and demand perceptions have a statistically significant impact on lending growth rates. Thus, the SLOS variables aggregate new information that is not contained in the control variables. Second, our best results suggest that, when accounting for lending growth rates, cumulative changes in supply conditions are more significant that changes in levels; while the opposite occur for demand perceptions. Third, cumulative changes in lending conditions have a relatively greater economic impact on lending growth rates than changes in demand perceptions for households credit (consumer and mortgage loans). On the contrary, the effect of demand changes are slightly greater than supply changes for the commercial loans. As such, these results are consistent with the conjecture posed by Del Giovane et al.

[12]The observations are weighted by each bank specific market share. Without loss of generality, we also show the results of the unweighted version of Table 2 in the in Table C1 of the Appendix, where our main results prevail.

[13]The standardize lending conditions are therefore equal to L^{c}_{bt}/σ_{L^c}, and the standardize demand perceptions are equal to D^{p}_{bt}/σ_{D^p}.

	Commercial			Consumer			Mortgage		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Supply	0.2089			0.2522			0.0049		
	(0.216)			(0.155)			(0.964)		
Demand	0.7693***		0.7630***	0.9074***		0.9577***	0.3258***		0.2866***
	(0.000)		(0.000)	(0.000)		(0.000)	(0.006)		(0.008)
Supply (cum.)		0.8370***	0.5927**		1.6160***	1.5100***		1.4844***	1.3031***
		(0.002)	(0.022)		(0.002)	(0.003)		(0.000)	(0.000)
Demand (cum.)		-0.2073			-0.1299			-0.2605	
		(0.336)			(0.569)			(0.237)	
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.190	0.152	0.195	0.256	0.220	0.288	0.154	0.196	0.206
Adjusted R-squared	0.160	0.120	0.165	0.228	0.191	0.261	0.122	0.166	0.177

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports OLS regression estimates with banks fixed effects for the 2003q1-2015q3 sample period. The LHS variable corresponds to the quarterly change in the log of the stock of credit. All regressions include macroeconomic and banks' idiosyncratic controls (see the main text). Additionally, observations are weighted by the respective market share, and robust p-values are included in parentheses. Source: Authors' calculations.

Table 2: The role of SLOS on banks' lending growth rates

(2011), in the sense that a persistent change in lending conditions is required to have an impact on credit growth rates. However, for demand perceptions, our results show that no accumulation is required, as perceptions in levels are significant in explaining credit growth rates in all market segments.

3.3 Addressing collinearity

One issue that need further attention is the potential collinearity that might exist between supply and demand conditions, and between these conditions and the macroeconomic and idiosyncratic controls included in equation (3); and how this potential collinearity might affect our previous findings.

To address the first issue, we run the regressions presented in columns (3) of Table 2 taking supply and demand factors separately, and compare these estimated coefficients to those when the two factors are included. These results are shown in Table 3. As can be seen, these coefficients are almost the same for consumer and mortgage loans, meaning that the correlation between supply and demand factors in those market segments are not significant. Some collinearity appears to exist between supply and demand factors in commercial loans, as these coefficient do differ slightly.[14]

[14]These results are consistent with those found when looking at the correlations between supply conditions and demand perceptions. In fact, these are equal to 0.17, -0.00, and 0.07 for commercial, consumer,

	Commercial			Consumer			Mortgage		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Supply (cum.)	0.8117***		0.5927**	1.5955***		1.5100***	1.3501***		1.3031***
	(0.002)		(0.022)	(0.002)		(0.003)	(0.000)		(0.000)
Demand		0.8109***	0.7630***		0.9863***	0.9577***		0.3269***	0.2866***
		(0.000)	(0.000)		(0.000)	(0.000)		(0.005)	(0.008)
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.150	0.187	0.195	0.220	0.252	0.288	0.193	0.154	0.206
Adjusted R-squared	0.120	0.159	0.165	0.192	0.226	0.261	0.164	0.124	0.177

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports OLS regression estimations with banks fixed effects for the 2003q1-2015q3 sample period. The LHS variable corresponds to the quarterly change in the log of the stock of credit. All regressions include macroeconomic and banks' idiosyncratic controls (see the main text). Additionally, observations are weighted by the respective market share, and robust p-values are included in parentheses. Source: Authors' calculations.

Table 3: The role of SLOS on banks' lending growth rates

As for the potential collinearity between the SLOS and the macroeconomic and idiosyncratic controls, we run a two 2-steps procedures. In the first procedure, we take supply and demand factors in the first step regression against the credit growth rates. Then, we regress the residuals of these regressions against the macroeconomic and idiosyncratic factors (second step). In the second procedure we first regress credit growth rates against the macroeconomic and idiosyncratic factors (first step), and the residuals of these regressions against the SLOS (second step).

These results are shown in Table 4. Column (1) represents the regression when both, SLOS and macroeconomic and idiosyncratic controls are included simultaneously (similarly than in column (3) of Table 2). Column (2) represents the results when the SLOS is included in the first step, while in column (3) the SLOS is included in the second step.[15]

Our results show that the SLOS improves the estimation of credit growth rates. In other words, supply and demand factors included in the Chilean SLOS add additional information that is not included in the set of macroeconomic and idiosyncratic factors used as controls. Despite this, there is some correlation between supply and demand factors and the macroeconomic and idiosyncratic controls. Above all, the information contained in the SLOS allow us to identify the contribution of supply and demands factors underlying the

and mortgage loans respectively. While the respective p-vales for the null hypothesis that the correlations are equal to zero are equal to 0.000, 0.916, and 0.118.

[15]Note that the overall R-squared of both procedures is by construction equal to the R-squared when credit growth rates are regressed against the SLOS and the macroeconomic and idiosyncratic controls simultaneously.

dynamic of credit growth rates. Moreover, and the overall relative significance of supply conditions and demand perceptions remain the same than previously found in every market segment.

Variables	Commercial			Consumer			Mortgage		
	(Simult.)	(First)	(Second)	(Simult.)	(First)	(Second)	(Simult.)	(First)	(Second)
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Supply (cum.)	0.5927**	0.8295***	0.3983*	1.5100***	1.2213**	1.1625**	1.3031***	1.1952***	0.9591***
	(0.022)	(0.001)	(0.087)	(0.003)	(0.017)	(0.017)	(0.000)	(0.000)	(0.000)
Demand	0.7630***	0.7660***	0.5948***	0.9577***	1.2161***	0.6795***	0.2866***	0.3604***	0.2590**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.002)	(0.015)
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.195	0.195	0.195	0.288	0.288	0.288	0.206	0.206	0.206
Adjusted R-squared	0.165	0.165	0.165	0.261	0.261	0.261	0.177	0.177	0.177

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Column (1) represents the regression when both, SLOS and macroeconomic and idiosyncratic controls are included simultaneously (similarly than in column (3) of Table 2). Column (2) represents the results when the SLOS is included in the first step, where in column (3) the SLOS is included in the second step (see the main text for more details). Additionally, observations are weighted by the respective market share, and robust p-values are included in parentheses. Source: Authors' calculations.

Table 4: The role of SLOS on banks' lending growth rates

3.4 Supply or demand?

Figure 3 presents the average sources of variation of corporate credit growth rates based in the estimation reported in column (3) of Table 2. It distinguishes the effect of: (i) control variables (macro and idiosyncratic), (ii) lending conditions, (iii) demand perceptions, and (iv) the unexplained factors.[16]

From equation (3) we obtain:

$$\Delta \widehat{Y}_{b,t} = \widehat{\alpha}_0 + \widehat{\alpha}_1 X_t + \widehat{\alpha}_2 X_{b,t-1} + \widehat{\alpha}_3 L^c_{bt} + \widehat{\alpha}_4 D^p_{bt} + f_b \tag{4}$$

Then, we construct the system's annual growth rates from the following expression:

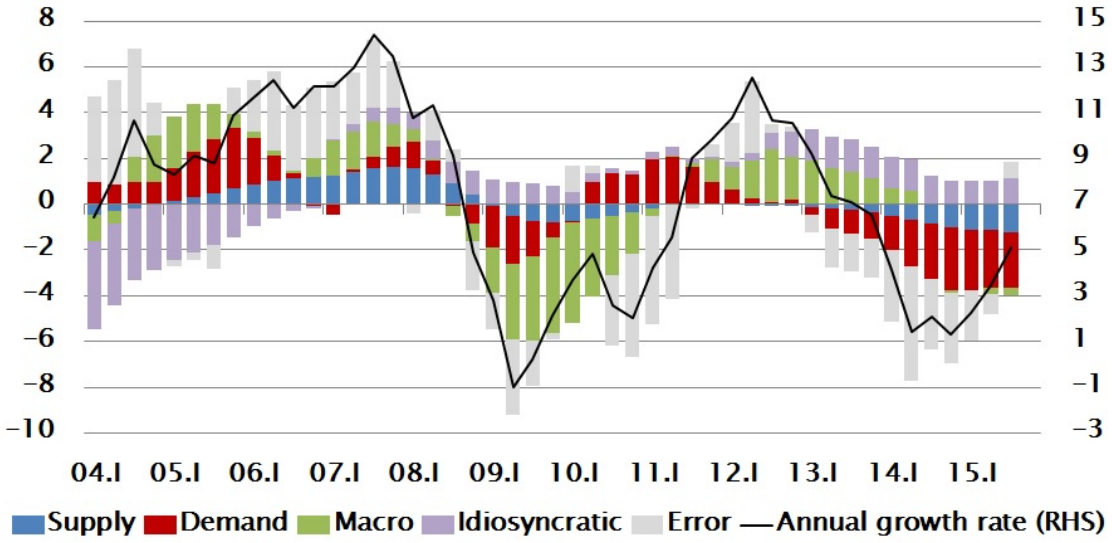
$$\sum_{i=0}^{3} \sum_{b=1}^{n} \omega_{b,t-1} \Delta \widehat{Y}_{b,t-i} = A + S_t + D_t + M_t \tag{5}$$

Where A represents the constant term, S_t is the supply factor, D_t is the demand factor,

[16] See Appendixes B2 and B3 for the same analysis of consumer and mortgage loans, respectively.

and M_t represent the contribution of the control variables.

Figure 3 shows that the changes in lending conditions explain on average less of the overall lending growth rates than changes in demand perceptions. Notice that supply and demand factors tend to move in the same direction as the control variables, which explain in part the significant contraction in the lending growth rate during the GFC.



Note: This figure shows the annual growth rates for corporate loans and the factors (controls, supply, demand, error) that explain that change according to the regression estimated in column (3) of Table 2 for corporate loans. Source: Authors' calculations based on the Chilean Senior Loan Officers Survey, Central Bank of Chile, and banks' balance sheet information from the Superintendency of Banks and Financial Institutions.

Figure 3: Sources of lending growth rates for corporate loans

Nonetheless, there are some periods when supply and demand factors do not necessarily follow the dynamic of the macroeconomic and banks' idiosyncratic variables. Also, occasionally, supply and demand may move in opposite directions. Notice that during 2005 and the period 2014-2015, credit growth rates were mainly determined by supply and demand factors, showing that the information contained in the SLOS improved the identification over the macro-financial variables. In addition, the acceleration period observed between 2006 and 2007 was driven initially by the strengthening of the demand, and then by an easying of the supply. However, later in 2009, the economic environment weakened, decelerating the credit growth rates, despite the fact that demand was starting to increase. Finally, the recent slowdown observed in commercial credit growth rates are explained mainly by a debilitated demand, some supply restrictions, but almost no effect

of macro-financial factors.

		Supply	Demand	Macro	Idiosyncratic	R2
Commercial		20.9	30.7	26.7	21.7	0.195
	2003-2006	23.4	21.4	24.8	30.4	0.348
	2007-2012	27.5	26.3	26.1	20.0	0.285
	2012-2015	15.5	20.7	21.7	42.1	0.326
Consumer		11.9	37.9	24.8	25.5	0.288
	2003-2006	14.8	10.8	20.7	53.7	0.229
	2007-2012	15.7	35.0	29.6	19.8	0.497
	2012-2015	22.2	22.7	25.7	29.3	0.444
Mortgage		29.3	20.5	23.6	26.5	0.206
	2003-2006	17.6	17.6	22.8	41.9	0.311
	2007-2012	34.6	21.3	20.4	23.7	0.537
	2012-2015	21.5	23.0	21.9	33.6	0.610

Note: These numbers represent the percentage of the aggregate variance being explained by the macroeconomic and idiosyncratic controls, supply conditions, and demand perceptions according to the regressions estimated in column (3) of Table 2 for each type of credit. Source: Authors' calculations based on the Chilean Senior Loan Officers Survey, Central Bank of Chile, and banks' balance sheet information from the Superintendency of Banks and Financial Institutions.

Table 5: Variance decomposition

Table 5 shows the variance decompositions when considering the model of column (3) in Table 2. It indicates again that, while controls explain a higher portion of the aggregate variance, changes in demand perceptions account for more of the aggregate variability of lending growth rates than changes in lending conditions for commercial and consumer loans. Additionally, we can observe that the fit of the model varies over time. In particular, the commercial credit growth rates during the pre-GFC period is explained similarly by supply conditions, demand perception, and macroeconomic and idiosyncratic factors. However, after the crisis period, there is relative more importance of the demand factors and particular characteristics of the banks. The increase over time of the relevance of demand factors in explaining the overall variance of credit growth rates

4 Asymmetric and non-linear effects

In this section we deal with two issues. First, we look at whether lending conditions and demand perceptions have a symmetric effect on lending growth rates. Second, we explore

if there is any evidence of non-linearity, i.e whether strong changes in SLOS have a more differentiated impact on lending growth rates than moderate changes. In both cases, we use as the baseline regression specification the one presented in column (3) of Table 2, for each type of credit (commercial, consumer, and mortgage). Notice that, in order to avoid over-parametrization, we compiled the variables under analysis in two separate groups.[17]

The asymmetric effect is captured by estimating the following equation:

$$\begin{aligned} \Delta Y_{b,t} &= \beta_0 + \beta_1 X_t + \beta_2 X_{b,t-1} + \\ &\beta_3 cumL_{bt}^{loosened} + \beta_4 cumL_{bt}^{tightened} + \beta_5 D_{bt}^{higher} + \beta_6 D_{bt}^{weaker} + f_b + \epsilon_{b,t} \end{aligned} \tag{6}$$

where $L_{bt}^{lossened}$ takes the value of +1 when lending conditions are more flexible, and 0 otherwise. Similarly, $L_{bt}^{tighter}$ takes the value of -1 when lending conditions are tightening, and 0 otherwise. Then, we compute the cumulative effect for both variables ($cumL_{bt}^{loosened}$ and $cumL_{bt}^{tighter}$, respectively), in the same fashion as explained above. For demand perceptions we follow the same method, D_{bt}^{higher} takes value of +1 when it is stronger, and 0 otherwise; while D_{bt}^{weaker} accounts for -1 when it is weaker, and 0 otherwise. In this case, we test the effect in levels instead of the cumulative one.

The results of estimating equation (6), are presented in column (2) of Table 6 for each type of credit, and compared to our baseline estimation in column (1).[18] In all market segments we find that the effect of lending conditions is more relevant during tighter periods, and demand perceptions have a stronger effect on lending growth rates when demand is weaker, the only exception being in the mortgage market where a stronger demand is slightly more significant than having a weaker one. Additionally, at the bottom of Table 6, we show the p-vales for the tests of symmetry, i.e the probability that the coefficients associated to positive changes in supply conditions and demand perceptions are equal to the coefficients associated to negative changes ("p-vale S symmetry" and "p-value D symmetry" respectively). Our results show that the probability of a symmetric effect in lending conditions is close to zero, while the hypothesis that demand perceptions are symmetric can not be rejected.

Finally, in order to deal with no-linearity, we split supply conditions and demand perceptions between two sets of responses: strong and moderate. Moderate variables take the value of +1 when lending conditions are "moderately loosened" or when demand for

[17] Specifications where a dummy variable is included for each category provides similar conclusions. These results are available upon request.

[18] See also the unweighted results in Table C2 in the Appendix.

credit is perceived as "moderately higher", and the value of -1 when lending conditions are "moderately tighter" or when demand for credit is perceived as "moderately weaker". The strong variable takes value of +1 when lending conditions are "extremely loosened" or when demand for credit is perceived as "extremely higher", and the value of -1 when lending conditions "extremely tighter" or when demand for credit is perceived as "extremely weaker". In all cases, these variables take the value of 0 otherwise.

Therefore, to deal with the issue of non-linearity we estimate an equation of the following characteristics:

$$\begin{aligned} \Delta Y_{b,t} &= \beta_0 + \beta_1 X_t + \beta_2 X_{b,t-1} + \\ &\beta_3 cumL_{bt}^{strong} + \beta_4 cumL_{bt}^{moderate} + \beta_5 D_{bt}^{strong} + \beta_6 D_{bt}^{moderate} + f_b + \epsilon_{b,t} \end{aligned} \tag{7}$$

The results are shown in column (3) of Table 6. For commercial loans, strong answers in lending conditions and demand perceptions are not significant. The effects on consumer and mortgage loans are significant at 10% and 1% respectively for supply conditions, and at 1% respectively for demand perceptions. Despite that, the coefficients associated to stronger changes are, in general, bigger than the coefficients associated to moderate changes. Moreover, we test the hypothesis whether the coefficients associated to strong changes are equal to 1.5 the coefficient associated to moderate changes for both, supply conditions and demand perceptions.[19] We found that the assumption of an strong answer has an impact equal to 1.5 times the impact generated by a moderate answer is reasonable for commercial and consumer credits, but not for mortgage loans, where the non-linearity appears to be even stronger.

Taking all above analysis into account, the assumption of scaling the extreme values does not have a significant impact on the results, but the consideration of a possible asymmetry improves the understanding of credit growth rates. In fact, our results in Table 6 show that, by dealing with the asymmetric effects of supply conditions and demand perceptions, the adjusted R-squared of our estimations can be improved significantly in every market segment. However, the impact on the adjusted goodness of fit is less significant when incorporating non-linearities.

[19] See "p-value S scale" and "p-vale D scale" at the bottom of Table 6.

	Commercial			Consumer			Mortgage		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Supply (cum.)	0.5927**			1.5100***			1.3031***		
	(0.022)			(0.003)			(0.000)		
Demand	0.7630***			0.9577***			0.2866***		
	(0.000)			(0.000)			(0.008)		
Supply loosened (cum.)		0.1426			1.0943*			0.7306***	
		(0.627)			(0.062)			(0.004)	
Supply tighter (cum.)		0.9008***			2.1430***			2.2782***	
		(0.002)			(0.000)			(0.000)	
Demand higher		0.4990*			0.7326***			0.3096*	
		(0.062)			(0.005)			(0.061)	
Demand weak		0.9529***			1.1272***			0.2841	
		(0.001)			(0.000)			(0.102)	
Supply strong (cum.)			0.5178			1.5962*			3.6827***
			(0.528)			(0.071)			(0.000)
Supply moderate (cum.)			0.6859**			1.6789***			0.9595***
			(0.034)			(0.010)			(0.003)
Demand strong			0.6278			1.6899***			0.7631***
			(0.258)			(0.000)			(0.001)
Demand moderate			0.7925***			0.8927***			0.0807
			(0.000)			(0.000)			(0.557)
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.195	0.214	0.197	0.288	0.308	0.290	0.206	0.242	0.224
Adjusted R-squared	0.165	0.181	0.163	0.261	0.279	0.260	0.177	0.210	0.191
p-value S symmetry		0.003			0.005			0.000	
p-value D symmetry		0.312			0.363			0.925	
p-value S scale			0.616			0.446			0.0394
p-value D scale			0.354			0.443			0.0331

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports OLS regression estimates with banks fixed effects for the 2003q1-2015q3 sample period. The LHS variable corresponds to the quarterly change in the log of the stock of credit. All regressions include macroeconomic and banks' idiosyncratic controls (see the main text). Additionally, observations are weighted by the respective market share, and robust p-values are included in parentheses. Source: Authors' calculations.

Table 6: Dealing with asymmetry and non-linearities

5 Conclusions

Among central banks, senior loan officers' surveys are widely used to comprehend the role of banks in the credit channel and their influence in the transmission of monetary policy, beyond the interest rate effects on credit demand. After the global financial crisis, this information has been used to conduct various studies that show the relevance of these instruments in explaining the dynamics of credit, especially during turbulent economic times.

The Chilean SLOS version named "Encuesta de Crédito Bancario" (ECB) is applied in a quarterly frequency since 2003. In this paper we use the information embedded in the Chilean SLOS and complement it by building a complete panel dataset at the bank level that includes banks' idiosyncratic characteristics and macroeconomic factors. In a similar way to Calani et al. (2010) we investigate the role of the ECB in explaining credit growth. However, we extend the analysis in various respects. First, we refine the variables' frequency and definitions, in order to improve the estimations' statistical properties and save degrees of freedom. Additionally, we investigate the potential asymmetric influence of perception in the credit dynamics. Finally, we are able to compare the magnitude of the influence of credit standards and demand perceptions.

We find that the influence of credit standards and demand perceptions is statistically and economically relevant to determine credit growth. Various pieces of evidence point out in that direction, namely the regression coefficients, standard errors, and the survey variables' contribution in explaining total credit growth variance. This result holds for all market segments and is robust to various idiosyncratic and standard macro variables as controls. Additionally, the evidence suggests that the perceptions' impact is asymmetric, being more relevant during contractionary credit conditions. Thus, our results provide evidence to the issue that financial cycles tend to be more persistent than economic cycles (Borio, 2014), provided that bankers tighten their lending conditions before economic downturns, and loosen them afterwards.

Motivated by the results of the present investigation, we propose to continue this line of research by creating more accurate indices of credit activity that help in macroeconomic forecasting models. However, we leave these developments for future works.

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Appendix A. Conceptual framework

Figure A.1 represents the framework used to understand credit activity. The observed credit growth rate observed in each market segment responds to changes in demand and supply factors. Both demand and supply are affected by macroeconomic variables, such as economic growth and interest rates, as well as by other unobserved variables.

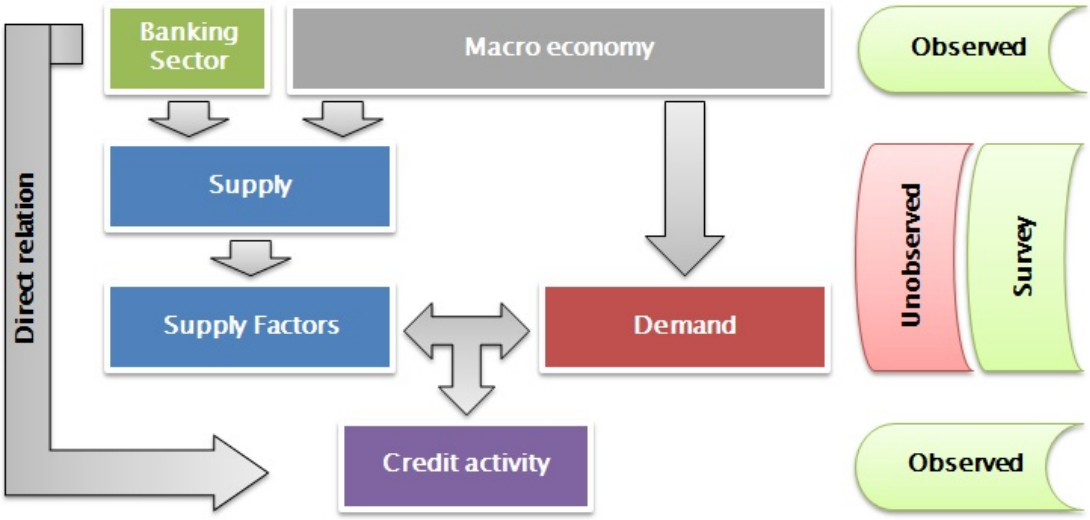


Figure A1: Identification of demand and supply factors

Thus, the identification is given by the following expressions:

$$\textbf{Supply:} \quad g^s_{i,t} = \gamma_{i,1} + \gamma_{i,2} r^s_{i,t} + \gamma_{i,3} m_t + \gamma_{i,4} S_{it} + \nu^s_{i,t} \tag{8}$$

$$\textbf{Demand:} \quad g^d_{i,t} = \delta_{i,1} + \delta_{i,2} r^d_{i,t} + \delta_{i,3} m_t + \delta_{i,4} D_{i,t} + \nu^d_{i,t} \tag{9}$$

Where $g_{i,t}$ is the credit growth of the bank i at quarter t; $r_{i,t}$ is the interest rate; m_t is a set of macro variables; $S_{i,t}$ is the supply factor; and $D_{i,t}$ is the demand factor.

Thus, the reduced form for lending activity is:

$$\textbf{Credit growth:} \quad g_{i,t} = \beta_{i,0} + \beta_{i,m} m_t + \beta_{i,s} S_{i,t} + \beta_{i,d} D_{i,t} + \epsilon^g_{i,t} \tag{10}$$

which must meet the following conditions:

$$\textbf{Credit growth}: \quad \beta_{i,s} = \frac{\gamma_{i,4}\delta_{i,2}}{\delta_{i,2} - \gamma_{i,2}} > 0 \wedge \beta_{i,d} = -\frac{\gamma_{i,2}\delta_{i,4}}{\delta_{i,2} - \gamma_{i,2}} > 0$$

Note that when we aggregate the data at system level we introduce a bias equivalent to:

$$g_{i,t} \equiv \frac{l_{i,t} - l_{i,t-1}}{l_{i,t-1}} \tag{11}$$

with the following dynamics:

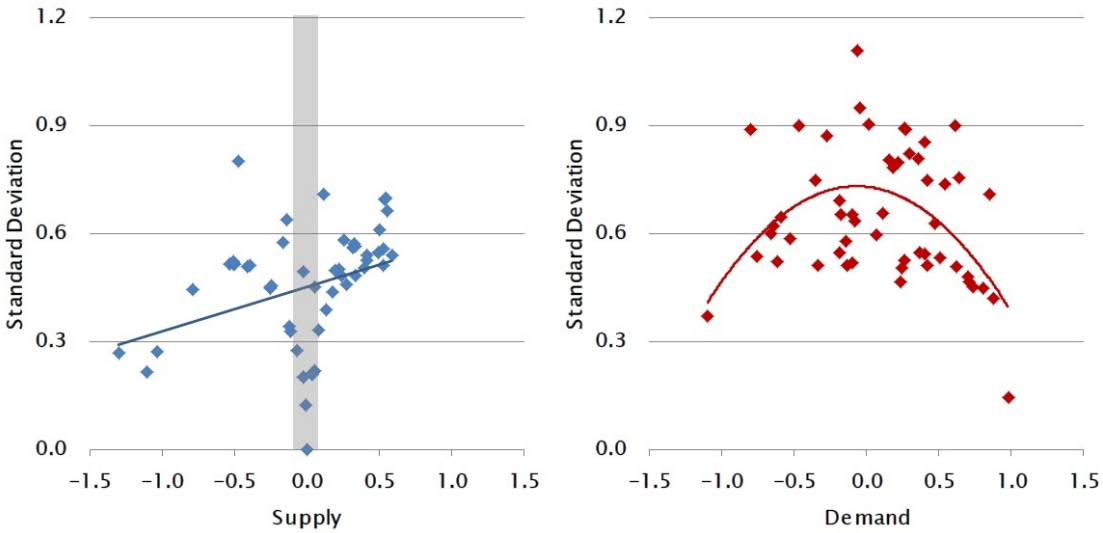
$$g_{it} = \beta_{i,0} + \beta_m m_t + \beta_z z_{i,t} + \beta_s s_{i,t} + \beta_d d_{i,t} + \xi_{i,t} \tag{12}$$

Then, the aggregate growth dynamics corresponds to:

$$G_t \equiv \frac{\sum_{i=1}^{N} (l_{i,t} - l_{i,t-1})}{\sum_{i=1}^{N} l_{i,t-1}} = A + \beta_m m_t + \beta_z Z_t + \beta_s S_t + \beta_d D_t + E_t + \Gamma_t \tag{13}$$

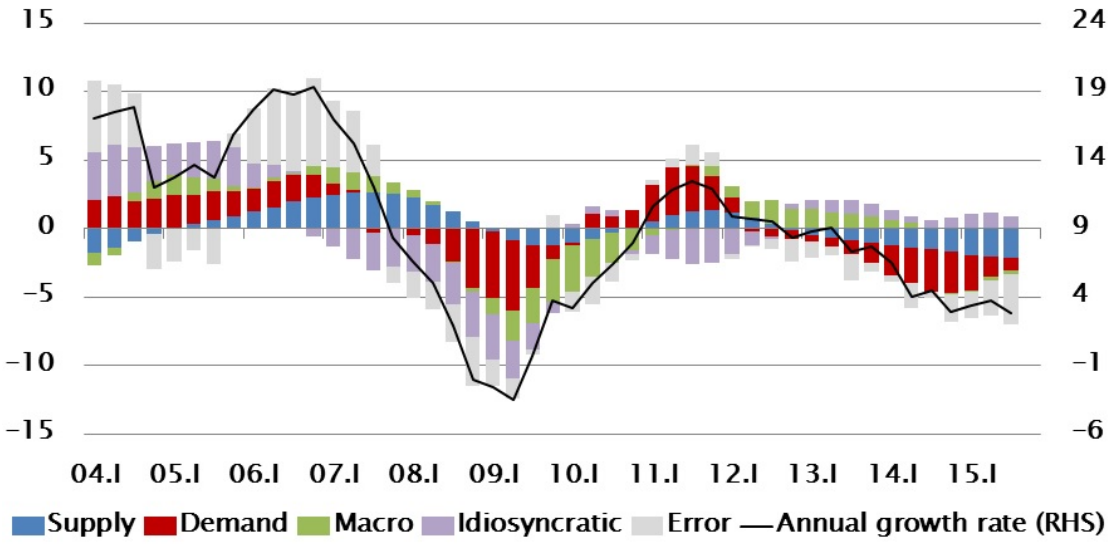
where ω_{t-1} is the vector of market shares at quarter $t-1$; $E_t = \omega'_{t-1}\xi_{i,t}$; and $\Gamma_t = \left(\omega'_{t-1}\beta_0 - A\right) + \beta_z \left(Z_t - \omega'_{t-1} z_t\right)$

Appendix B. Additional figures



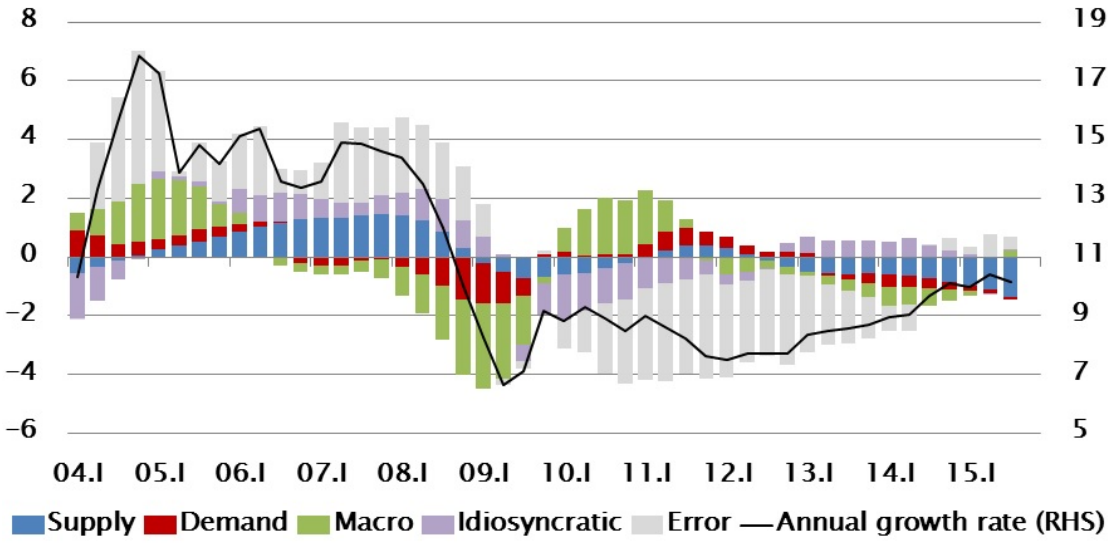
Note: These figures compare the standard deviation of the answers reported by the SLOS and the respective aggregate supply condition and demand perception. Source: Authors' calculations based on the Senior Loan Officers Survey, Central Bank of Chile.

Figure B1: Dispersion of lending standards and demand perceptions: corporate loans



Note: This figure shows the annual growth rate for corporate loans and the factors (controls, supply, demand, error) that explain that change according to the regression estimated in column (3) of Table 2 for consumer loans. Source: Authors' calculations based on the Senior Loan Officers Survey, Central Bank of Chile.

Figure B2: Sources of lending growth rates for consumer loans



Note: This figure shows the annual growth rate for corporate loans and the factors (controls, supply, demand, error) that explain that change according to the regression estimated in column (3) of Table 2 for consumer loans. Source: Authors' calculations based on the Senior Loan Officers Survey, Central Bank of Chile.

Figure B3: Sources of lending growth rates for mortgage loans

Appendix C. Additional tables

	Commercial			Consumer			Mortgage		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Supply	0.1304			0.4071**			0.0125		
	(0.426)			(0.014)			(0.928)		
Demand	0.6419***		0.6297***	1.1687***		1.2493***	0.7126***		0.6701***
	(0.000)		(0.001)	(0.000)		(0.000)	(0.000)		(0.000)
Supply (cum.)		0.6887***	0.5580**		2.6606***	2.4618***		1.5002***	1.2234***
		(0.005)	(0.019)		(0.000)	(0.000)		(0.000)	(0.000)
Demand (cum.)		-0.0438			-0.6771			-0.2287	
		(0.832)			(0.160)			(0.351)	
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.191	0.172	0.197	0.193	0.181	0.213	0.201	0.190	0.221
Adjusted R-squared	0.161	0.141	0.167	0.162	0.150	0.183	0.171	0.159	0.192

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports OLS regression estimations with banks fixed effects for the 2003q1-2015q3 sample period. The LHS variable corresponds to the quarterly change in the log of the stock of credit. All regressions include macroeconomic and banks' idiosyncratic controls (see the main text). Robust p-values are included in parentheses. Source: Authors' calculations.

Table C1: The role of SLOS on banks' lending growth rates (unweighted)

	Commercial			Consumer			Mortgage		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Supply (cum.)	0.5580**			2.4618***			1.2234***		
	(0.019)			(0.000)			(0.000)		
Demand	0.6297***			1.2493***			0.6701***		
	(0.001)			(0.000)			(0.000)		
Supply flexible (cum.)		0.1569			1.2730**			0.5865*	
		(0.571)			(0.022)			(0.056)	
Supply restricted (cum.)		0.7524***			3.5710***			2.5615***	
		(0.002)			(0.000)			(0.000)	
Demand strong		0.4854*			0.7762*			0.4876**	
		(0.053)			(0.092)			(0.050)	
Demand weak		0.6917**			1.6218***			0.9146***	
		(0.034)			(0.000)			(0.000)	
Supply extreme (cum.)			0.2833			0.4078			4.1621***
			(0.726)			(0.747)			(0.000)
Supply moderate (cum.)			0.6768**			3.0482***			0.8381**
			(0.018)			(0.000)			(0.012)
Demand extreme			0.6682			2.8383***			1.5717***
			(0.198)			(0.000)			(0.000)
Demand moderate			0.6376***			1.0403***			0.4328***
			(0.002)			(0.000)			(0.009)
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.197	0.210	0.199	0.213	0.242	0.220	0.221	0.249	0.234
Adjusted R-squared	0.167	0.177	0.165	0.183	0.210	0.188	0.192	0.218	0.202
p-value S scale			0.450			0.0159			0.0201
p-value D scale			0.620			0.111			0.0421
p-value S symmetry		0.009			0.001			0.000	
p-value D symmetry		0.646			0.306			0.304	

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports OLS regression estimations with banks fixed effects for the 2003q1-2015q3 sample period. The LHS variable corresponds to the quarterly change in the log of the stock of credit. All regressions include macroeconomic and banks' idiosyncratic controls (see the main text). Additionally, observations are weighted by the respective market share, and robust p-values are included in parentheses. Source: Authors' calculations.

Table C2: Dealing with asymmetry and non-linearities (unweighted)

Table C3: Definition and source of variables

Variable Names	Report Form Description	Source
Dependent Variables		
Δln(total loans)	Quarterly change in the total loans' logarithm.	SBIF
Independent Variables.		
Log Total Assets	Logarithm of total assets	SBIF
Tier 1 Ratio	Core capital to total assets ratio.	SBIF
Illiquid Assets Ratio	Ratio of total assets minus liquid assets to total assets	SBIF
Core Deposits Ratio	Ratio of term deposits plus sight deposits to liabilities.	SBIF
GDP growth	GDP growth.	CBC
Monetary policy rate	Monetary policy rate.	CBC
SLOS		
L^c	It corresponds to the change in banks' lending conditions.	CBC
D^p	It corresponds to the change in banks' demand perceptions	CBC

		Mean	Std. Dev.	Min	Max	Observations
Supply	overall	-0.012	0.646	-1.500	1.500	N = 500
	between		0.136	-0.220	0.190	n = 10
	within		0.633	-1.572	1.598	T = 50
Demand	overall	0.166	0.797	-1.500	1.500	N = 500
	between		0.216	-0.290	0.460	n = 10
	within		0.770	-1.754	1.596	T = 50
Supply (sum.)	overall	1.614	5.108	-11.000	13.500	N = 500
	between		4.512	-5.700	7.850	n = 10
	within		2.780	-6.236	8.494	T = 50
Demand (cum.)	overall	7.583	7.217	-14.500	25.500	N = 500
	between		5.579	-3.720	14.370	n = 10
	within		4.900	-5.787	18.713	T = 50

Note: This table reports the summary statistics of the SLOS for corporate loans over the 2003q1-2015q3 sample period. Source: Authors' calculations.

Table C4: Summary statistics of changes in the Chilean SLOS