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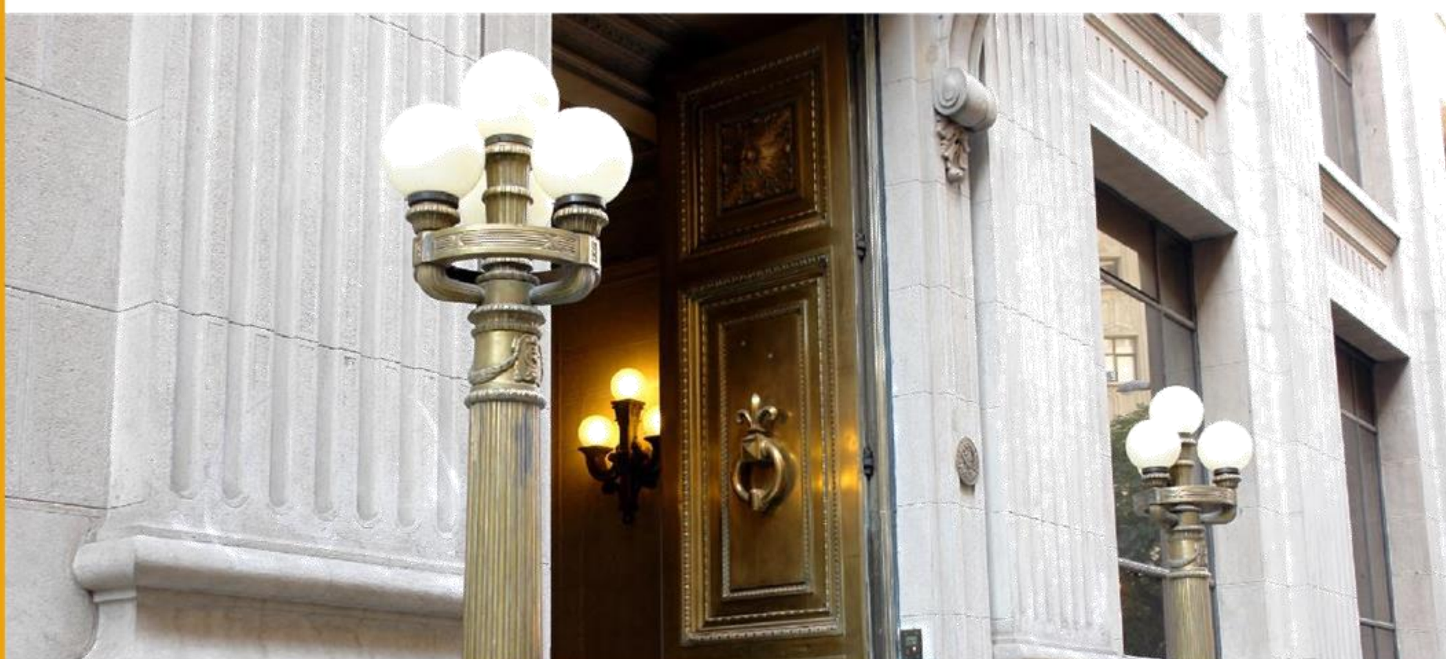

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Monetary Policy Tightening and Bank Lending Standards: Evidence from the Chilean Bank Loan Survey*

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Abstract

Our paper studies the banking channel as an amplification mechanism of monetary policy shocks in an Emerging Market Economy. We analyze the aggregated responses to the Chilean Bank Loan Survey, focusing on the average response of lending standards across different credit segments. Our results show that a positive monetary policy shock tightenslending standards in all credit segments, with corporate and mortgage loans being less sensitive than SMEs and consumer loans. We also examine the impact of monetary policy shocks on lending standards during periods of highly contractionary monetary policystance and periods when banks' capital position becomes a constraint. We find statistically significant amplification effects within these periods, affecting different credit segments heterogeneously. Overall, our results support the notion that the banking channel operates as an effective amplification mechanism, providing evidence consistent with a self-reinforcing operation of the bank-lending, risk-taking, and balance-sheet channels .

Resumen

Nuestro artículo estudia el canal bancario como un mecanismo de amplificación de los shocks de política monetaria en una economía de mercado emergente. Analizamos las respuestas agregadas a la Encuesta de Crédito Bancario (ECB) de Chile, centrándonos en la respuesta promedio de los estándares de crédito para préstamos orientados a diferentes segmentos. Nuestros resultados muestran que un shock positivo de política monetaria endurece los estándares de crédito en todos los segmentos, siendo los préstamos corporativos e hipotecarios menos sensibles que los préstamos a empresas de menor tamaño y los préstamos de consumo. También examinamos el impacto de los shocks de política monetaria en los estándares de crédito durante períodos en que la instancia de la política monetaria es altamente contractiva, y en períodos en que la posición de capital de los bancos es restrictiva para el otorgamiento de créditos. Al respecto, los efectos de amplificación son estadísticamente significativos durante dichos períodos, afectando a los préstamos orientados a diferentes segmentos de manera heterogénea. En general, nuestros resultados respaldan la idea de que el canal bancario opera como un mecanismo efectivo de amplificación de la política monetaria, proporcionando evidencia consistente con el auto reforzamiento de los canales del crédito bancario, de toma de riesgos y de hoja de balance.

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1 Introduction

In the aftermath of the Global Financial Crisis (GFC) of 2007–2009, most of the literature related to the role banks play in amplifying the transmission of monetary policy, the so-called banking channel, focused primarily on the impact of an environment of relatively low monetary policy rates and ample liquidity due to asset purchases.[1/] However, after the pandemic shutdowns, the associated supply bottlenecks, and Russia's invasion of Ukraine, a worldwide resurgence of high inflation rates motivated many Central Banks to tighten their monetary policy stances. Against this backdrop, Chile's monetary policy rate shifted from 0.5% to 11.25% between July 2021 and November 2022, among the first to initiate and the sharpest tightening cycles worldwide.[2/]

In a recent speech, Philip Lane, member of the ECB Executive Board, emphasizes the banking channel as an amplification mechanism that operates through changes in lending standards that affect bank credit availability and quality.[3/] This mechanism amplifies the traditional cost of capital channel, that is, how the level of market interest rates affects borrowing costs across all economic sectors.

The literature distinguishes among three mechanisms through which the banking channel operates, which can self-reinforce by interacting with each other (see Figure A.1). First, the broad credit channel—which operates through borrowers' net worth—affects the external finance premium of firms and the collateral value, closely related to house prices, resulting in tighter lending conditions for both firms and households during hiking cycles.[4/] Second, the bank lending channel focuses on the impact of monetary tightening on the supply of bank loans to the economy via increased bank funding costs, decreased willingness to lend due to borrower-lender agency costs, and bank balance sheet constraints. Therefore, the heterogeneity of banks affects the effectiveness of this mechanism.[5/] Third, the risk taking channel operates mainly during low-interest rate and high-liquidity environments, through fewer incentives to engage in costly monitoring, making risky investments more attractive and extracting duration risk due to asset purchase programs. During high-interest rate environments and the unwinding of asset purchase programs, this channel still operates by decreasing the risk tolerance, which leads to a contraction in the supply of credit.[6/]

Examining the significance of these channels entails an enduring challenge, namely the need to disentangle loan demand from loan supply. One approach in which the empirical literature has addressed this challenge is to exploit the heterogeneity among banks. For example, Kashyap and Stein [2000] support the existence of a bank lending channel by providing evidence of a more pronounced impact of monetary policy on lending to small, less liquid, less profitable, and less capitalized banks.[7/] Within an alternative approach, Jiménez et al. [2012] propose that monetary policy can directly influence banks' lending standards and risk appetite. They present evidence that expansionary monetary policy leads to an increase in credit risk taking by banks, as indicated by the probability of default and loan loss provisions; as a corollary, monetary policy authorities should also keep an eye on financial stability, as emphasized by Smets [2018].

In recent years, a significant body of literature has examined the relationship between loan volumes and lending standards, particularly using data from the US Senior Loan Officer Opinion Survey (SLOOS) or the Euro Area Bank Lending Surveys (BLS).[8/] However, as Choi et al. [2021] emphasize, BLS data have been

1/See Jiménez et al. [2012], Buch et al. [2014], and Dell'Ariccia et al. [2017].

2/See Monetary Policy Report of the Central Bank of Chile, December 2022, graph I.3, page 10.

3/See The banking channel of monetary policy tightening in the euro area.

4/See Bernanke and Blinder [1992], Bernanke and Gertler [1995], and Bernanke and Mihov [1998].

5/See Kashyap and Stein [1995], Kashyap and Stein [2000], Kishan and Opiela [2000], and Sapriza and Temesvary [2020].

6/See Borio and Zhu [2012], Adrian and Shin [2010], and Gambacorta [2009]. A theoretical model about the risk-taking channel is developed by apRoberts Warren [2019].

7/See Alfaro et al. [2003] for a similar approach applied to Chile.

8/See Lown and Morgan [2006], Dell'Ariccia and Marquez [2006], Altunbas et al. [2010], Maddaloni and underutilized in the context of emerging market economies (EMEs). Among the few studies, we can cite Choi et al. [2021] itself, Wróbel et al. [2018], and Pintaric [2016], which exploit this information using BLS data for the Korean, Polish, and Croatian economies, respectively.

In this regard, our paper contributes to the literature by studying the banking channel using BLS data for an EME (Chile). We ask whether a monetary policy tightening is associated—on average—with more restrictive lending standards within a one-year horizon, exploiting the heterogeneity across different credit segments by distinguishing between corporate, SMEs, consumer, and mortgage loans. We then focus on periods of highly contractionary monetary policy stance and when the capital position of banks becomes a constraint.[9/] This approach allows us to dig deeper into exploring if the banking channel effectively amplifies the impact of a monetary policy tightening, by analyzing whether the lending response to changes in the monetary policy stance is uniform across all lending categories or it is driven by specific types of lending.

To capture the dynamics of lending standards, we utilise an aggregate measure that reflects the net percentage of banks that have loosened/tightened their lending standards to some extent, compared to the previous quarter.

Some methodological issues are worth highlighting. First, following Bassett et al. [2014], Ciccarelli et al. [2015] and Van der Veer and Hoeberichts [2016], to better address the identification issues associated with the demand and supply of loans, we add as a control variable the perceived changes in loan demand as reported in the BLS. Second, as suggested in the literature (see, for example, Ramey [2016]), to properly identify economic responses to monetary policy, we construct an exogenous shock of monetary policy that corresponds to the contemporaneous error term of an estimated equation between the monetary policy surprise, the unanticipated inflation, and the unanticipated output growth rate. Third, we use Jordà [2005]'s local projection approach to evaluate the dynamic responses of bank lending standards to this well-identified monetary policy shock within a one-year horizon. After analyzing the average impulse responses (our baseline specification), we distinguish two cases: (i) periods of highly contractionary monetary policy stance, when the monetary policy rate is within the upper quartile of its distribution; and (ii) periods when the capital position of the banks is a constraint, as declared by them in answering the BLS. Finally, we go beyond traditional statistical inference based on confidence intervals constructed around the impulse response function using robust standard errors (Newey-West), by complementing it with the so-called significance bands and a joint significance test, as suggested by Inoue et al. [2023] within the context of local projections.

Our baseline results indicate that lending standards for corporate and mortgage loans are less sensitive to monetary policy shocks compared to SMEs and consumer loans. After a shock of monetary policy tightening implemented three to six months ago, approximately a net of 20% banks reported that their lending standards for SMEs and consumer loans become more restrictive to some extent within a one-year horizon. Furthermore, during periods of highly contractionary monetary policy stance, this amplification mechanism becomes stronger, since approximately a net of 40% of banks responds that their lending standards for SMEs loans are more restrictive to a certain extent relative to the previous quarter, within the same time frame. This amplification effect is also statistically significant for consumer and mortgage loans, but not for corporate loans. A similar amplification effect—but statistically significant for all loans, with the exception of mortgage loans—is observed during periods when the capital position of banks becomes a constraint.

As a robustness check, we defined alternative monetary policy shocks at 6-month, 1-year, 18-month, and 2-year horizons. Our results underscore a general tightening of lending standards for SMEs loans. Although the significance of the impact on corporate, consumer, and mortgage loans depends on the time horizon of the shock, we highlight the role of monetary policy shocks defined for periods longer than 1-year in amplifying the effects on mortgage lending standards during periods of high monetary policy stance.

Overall, our results support the notion that the banking channel operates as an effective amplification mechanism during periods of highly contractionary monetary policy stance, providing evidence that is consistent with a self-reinforcing operation of the bank lending, risk taking, and balance sheet channels. Fur-

Peydró [2011], Paligorova and Santos [2017], Khosravi [2018], and Albertazzi et al. [2020].

[9/]This is in line with the theoretical literature on banking, which predicts that risk taking is a function of the capital structure of a bank. See, for example, Laeven et al. [2010].

thermore, our results related to periods of tightening of monetary policy that occur in tandem with periods when the capital position of banks is a constraint provide additional support for the bank-lending channel. In summary, our findings reveal a statistically significant and more pronounced response of bank lending to SMEs and consumers, suggesting the presence of an interaction among the various components of the banking channel that further magnifies the impact of the initial policy impulse on credit conditions.

The remainder of this article is organized as follows. Section 2 elaborates about the Chilean BLS. Section 3 explains other data as well as methodological issues. Section 4 presents our main results. Finally, Section 5 concludes with final remarks and directions for future research.

2 The Chilean Survey of Bank Lending Standards

The Chilean BLS or *"Encuesta de Crédito Bancario"* surveys senior managers of commercial banks since the first quarter of 2003. The primary purpose of this survey conducted by the Central Bank of Chile (BCCh) is to identify demand and supply factors that affect the dynamic of bank lending growth rates in different credit segments.[10/] On the one hand, supply-side conditions—reflecting banks' willingness to lend—are captured by changes in banks' lending standards (tighten, loosen, or unchanged). On the other, demand-side factors—reflecting the willingness of firms and households to borrow from banks—are captured by changes in the perception of senior bank officers about the demand for credit (stronger, weaker, or unchanged). In both cases, these changes are relative to the previous quarter.

Since individual banks' responses are not available to the public, we rely on aggregate measures published quarterly by the Central Bank of Chile. In particular, our aggregate measure of lending standards reflects the net percentage of banks that loosened lending standards somehow and those that tightened them. For aggregation purposes, individual banks' responses are assigned a +1 when lending standards are less restrictive (loosened) to a certain degree; a 0, when there are no changes in lending standards; and a -1, when lending standards are more restrictive (tightened) to a certain degree. Therefore, lending standards are bounded by +100 (all banks became less restrictive) and -100 (all banks became more restrictive).

Figure 1 shows the dynamics of the aggregate measure of lending standards for different credit segments for the 2003q1-2022q4 sample period. A positive (negative) number means that a higher (lower) number of banks are loosening their lending standards compared to those that are tightening them.

Banks' senior officers are also surveyed about their perception of credit demand for different segments. A positive (negative) response corresponds to an increase (decrease) in demand perception, while zero represents no change. The aggregate measure captures the difference between the percentage of banks that perceive an increased demand for credit and those who perceive a decreased demand for credit. Therefore, the values of this indicator of demand perception for new loans by type of credit—which are used as explanatory variables in the regression specifications presented below—are also bounded between -100 and +100.[11/]

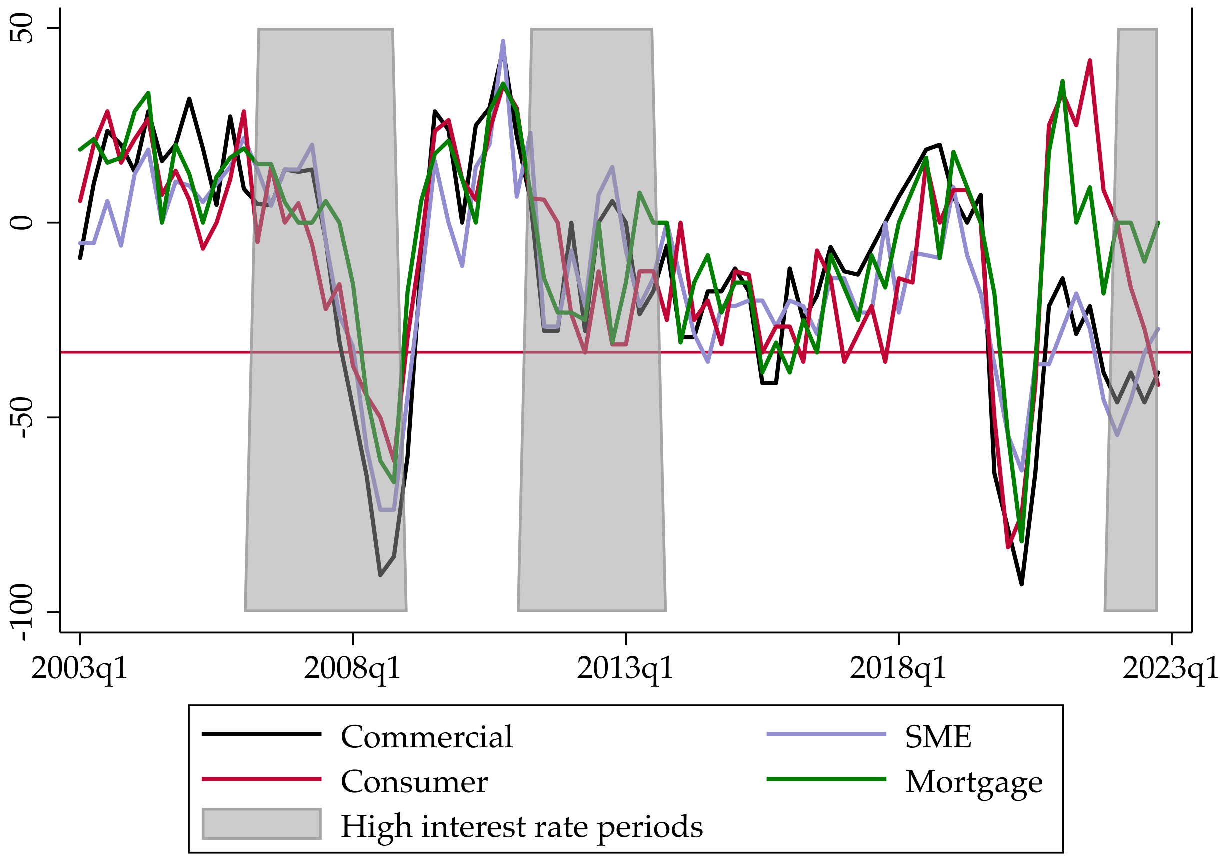
3 Methodological Issues and Data

The main goal of our paper is to study the dynamic responses of banks' lending standards for different types of credit—captured by the aggregate measures of the Chilean BLS presented above—to a well-identified Taylor-rule-based monetary policy shock (a TBR-MPS onward); and to see if this impact differs depending on

[10/] According to BCCh's statement, "The purpose of this quarterly survey-–carried out to senior bank officers in Chile–is to inform about the changes in their standards for lending approvals, as well as their perception about the demand of new loans. Thus, the survey results are useful to better understand the economic and financial factors that explain the evolution of credit behavior."

[11/] For a complete analysis of the Chilean BLS, see Jara et al. [2017], which shows that the survey performs well in terms of identifying the dynamics of demand and supply of banks' credit in Chile.

Figure 1. Chilean Aggregate Bank Lending Standards, by credit segments



Note: net percentage of banks that loosen their lending standards compared to those that tighten them. The high and low interest rate periods correspond to the top and bottom quartiles of the Chilean monetary policy rate distribution.

Source: authors' elaboration based on information from the Central Bank of Chile.

the level of the monetary policy rate—with a special focus on periods when they are high—and when banks' capital position becomes a constraint. The methodological and data issues described below are consistent with this general goal.

3.1 A Local Projections Approach

The local projection methodology (LPM) suggested by Jordà [2005] has become a widely used and well-established tool to estimate impulse response functions in macroeconomics [Barattieri and Cacciatore, 2023]. The idea behind the LPM is to run a sequence of predictive regressions of a variable of interest (e.g., lending standards) on a structural shock (e.g., a TRB-MPS) for different prediction horizons and construct impulse responses as a direct multistep forecasting regression, providing a flexible and parsimonious approach that does not impose (potentially inappropriate) dynamic restrictions. In other words, the advantage of this nonparametric methodology is that it is model-free, not restricted to the invertibility condition, as in the case of vector autoregressive models (VAR), and it is less sensitive to specification errors (see Brugnolini [2018] and Montiel Olea and Plagborg-Møller [2021]).[12/]

In order to assess the dynamic responses of banks' lending standards to a well-identified monetary policy shock for different types of credit, our baseline model specification is the following:

$$BLS^i_{t+h} = \alpha_{0,h} + \beta_{0,h} S^j_t + \sum_{k=1}^{K} \lambda_{k,h} BLS_{t-k} + \sum_{n=0}^{N} \phi_{n,h} X_{t-n} + \mu_{t+h} \quad \text{for } h = \{0, \cdots, H\} \tag{1}$$

Where:

- BLS^i_{t+h} is the net percentage of banks' responding that lending standards in credit type i in the period $t+h$ is loosen/tighten.
- S^j_t is the monetary policy shock in period t for the horizon j.
- K is the number of lags in the dependent variable.
- N is the number of lags in the control variables.
- H is the time horizon in the local projection.
- X represents the set of control variables, including (i) the perception of aggregate demand for the specific credit segment (see Section 2); (ii) aggregate factors driving the decision (macro environment, capital constraint, liquidity constraint); (iii) specific factors driving the decision (credit risk, competition, regulation); (iv) a group of macrofinancial controls described later (see subsection 3.3); (v) a dummy to capture non-convetional monetary policy and other economic policies during the Covid-19 crisis; and (vi) trend and trend squared.
- μ_{t+h} represents the error term in period $t+h$, assumed to be heteroskedastic and possibly autocorrelated up to some lag, a reason for using Newey–West standard errors.

Additionally, we consider a model specification that accounts for the interaction effect of monetary policy shocks with a dummy variable (D_t) that takes the value of 1 when the monetary policy rate is high and zero otherwise. Alternatively, we run the same specification, but re-defining D_t as a dummy variable that takes the value of 1 during periods when banks' capital becomes a constraint and zero otherwise.

Periods of high interest rate correspond to those when the Chilean monetary policy rate is within the upper quartile of the distribution (which is equivalent to 5% or above for the period 2003q1-2022q4) and zero otherwise (see Figure 2), while periods when banks' capital position becomes a constraint are those when the net percentage of banks declare in the BLS that their capital position is an important or very important reason to tighten their lending standards (see Figure 3).[13/] In particular,

$$BLS^i_{t+h} = \alpha_{0,h} + \beta_{0,h} S^j_t + \beta_{1,h} S^j_t * D_t + \beta_{2,h} D_t + \sum_{k=1}^{K} \lambda_{k,h} BLS_{t-k} + \sum_{n=0}^{N} \phi_{n,h} X_{t-n} + \mu_{t+h} \quad \text{for } h = \{0, \cdots, H\} \tag{2}$$

Therefore, by estimating Equation (2), we can compare the effect of monetary policy shocks on lending standards when $D_t = 1$, (i.e., $\beta_{0,h} + \beta_{1,h}$), and when $D_t = 0$ (i.e., $\beta_{0,h}$). In other words, we can assess whether

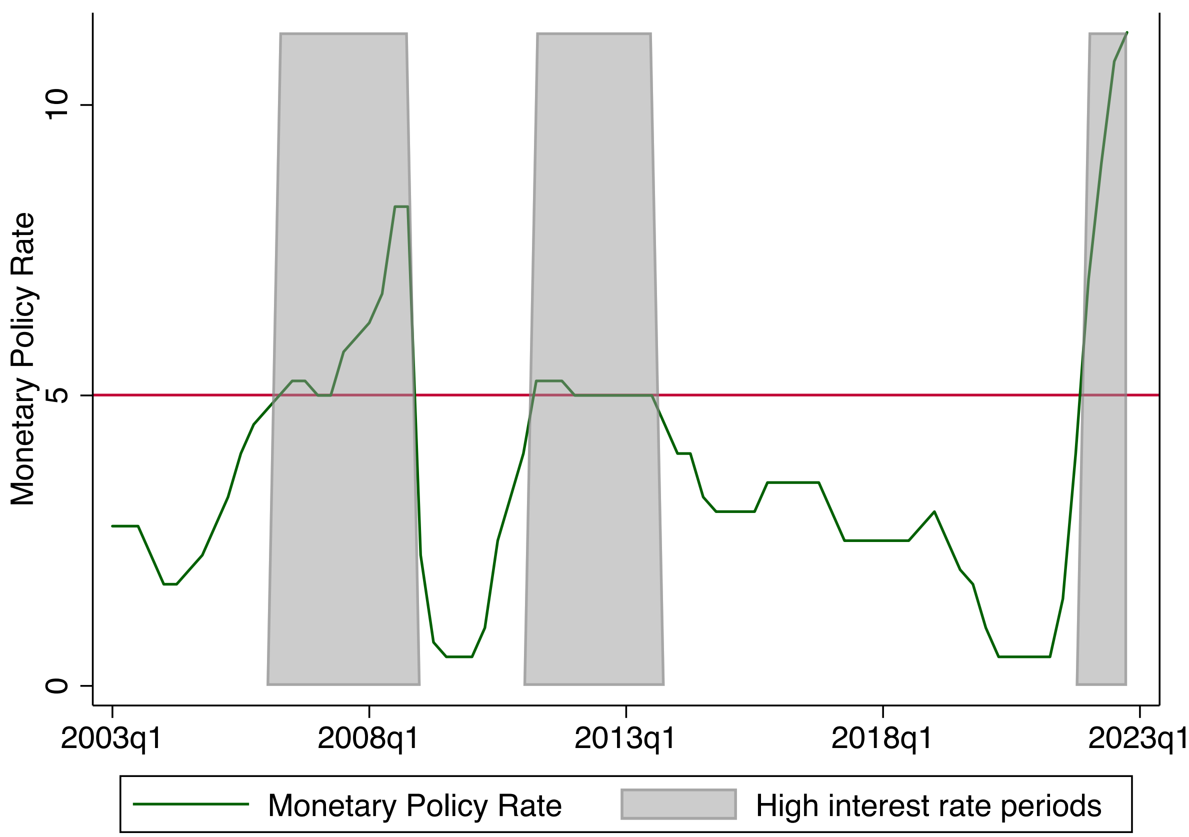
[12/]Similar applications of local projections to banking and financial related issues can be found in Holm-Hadulla et al. [2023], Chen et al. [2020], and Jara and Piña [2022].

[13/]These correspond to periods when there is a negative net response in that factor as a driver of changes in lending standards.

there is an amplification mechanism of monetary policy on lending standards that works during periods of high interest rates and periods when banks' capital position is a constraint.

Finally, we use a statistical inference toolkit. This toolkit goes beyond traditional confidence intervals with robust (Newey-West) standard errors constructed around the impulse response function. In addition to the latter, we use significance bands and a joint significance test. These methods are suggested by Inoue et al. [2023] within the context of local projections.

Figure 2. Monetary policy rate and periods of highly contractionary monetary policy stance in Chile



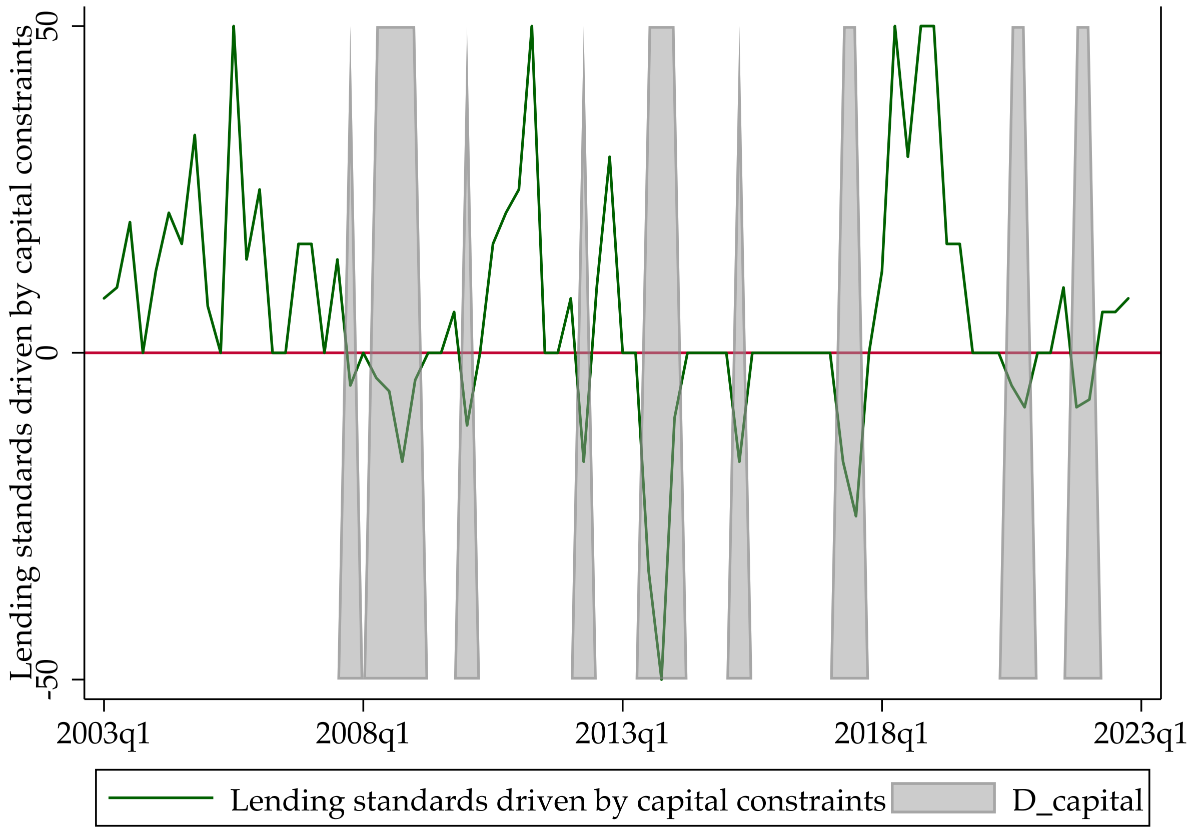
Note: the gray area represents the period when the Chilean nominal monetary policy rate was above or equal to 5%, equivalent to the upper quartile of the monetary policy distribution during the sample period.

Source: based on data from the Central Bank of Chile.

3.2 A Taylor Rule Based Monetary Policy Shock (TRB-MPS)

The challenge of identifying monetary shocks in empirical research is common, as biases in estimations using effective monetary policy measures result from simultaneity and omitted variables, especially in domestic contexts. To properly identify economic responses to monetary policy deviations, as suggested in the

Figure 3. Periods when the banks' capital position is a constraint

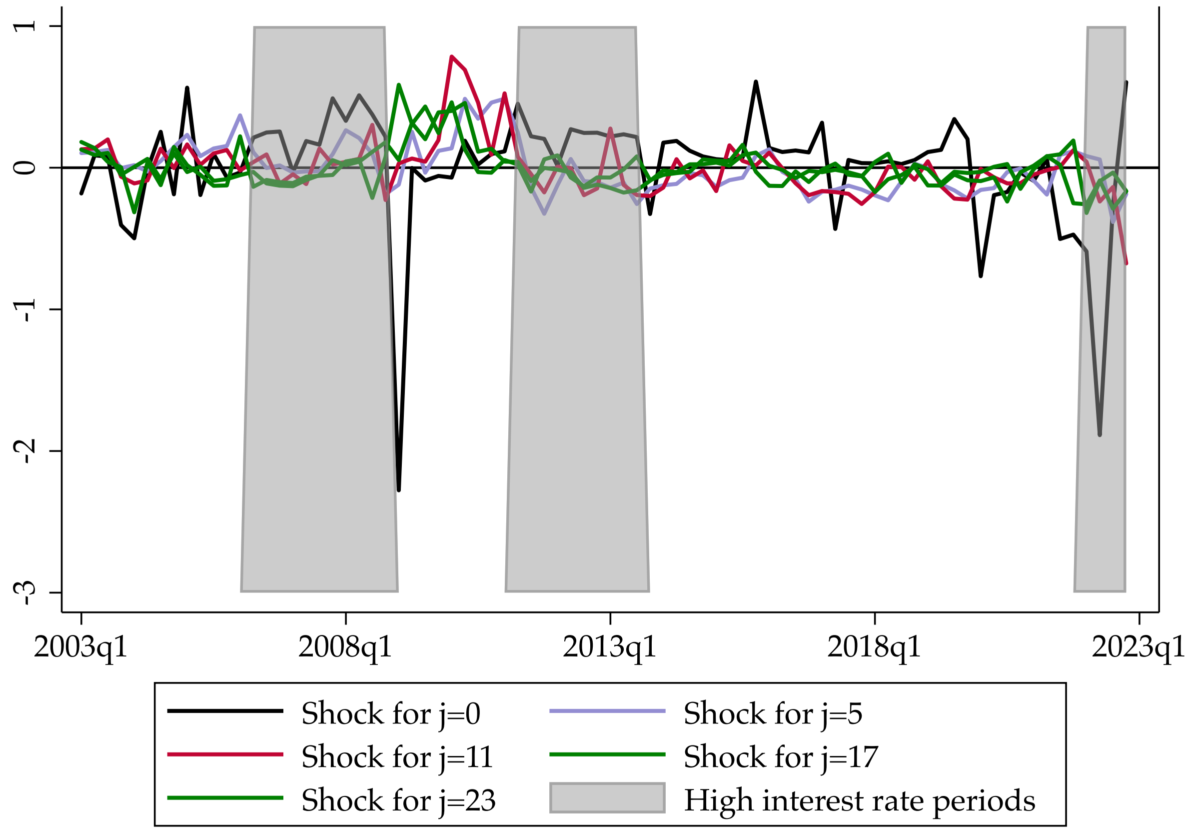


Note: the gray area represents the periods when the capital position of banks is a constraint.
Source: based on data from the Central Bank of Chile.

literature [Ramey, 2016], we follow the methodology suggested in Gómez et al. [2020] and Vicondoa [2019], and estimate the monetary policy shocks for Chile at different time horizons. In particular, the monetary policy shock at $j = 0$ is defined as S_t^0 and corresponds to the error term of an estimated equation between the monetary policy surprise (the difference between the actual rate of monetary policy and its expectation) and the unanticipated inflation and the unanticipated output growth rates (i.e., the difference between their actual inflation/growth rates and their expectations). For $j > 0$, we calculated the anticipated movements of monetary policy expectations, inflation, and growth for different time horizons (see Figure 4 and B for more details).[14/]

[14/]The actual and expected variables are constructed from monthly data. In particular, expected data are taken from the Central Bank's Monthly Survey of Economic Expectations. However, previous research such as Larraín [2007] found similar results using future contracts.

Figure 4. Monetary policy shocks at different time horizons



Note: the gray area represents the period when the Chilean nominal monetary policy rate was above or equal to 5%, equivalent to the upper quartile of the monetary policy distribution during the sample period.

Source: based on data from the Central Bank of Chile.

3.3 Other Control Variables

The vector X_t of the control variables is meant to capture macroeconomic and financial factors that may affect the supply of bank loans (see Table D.1 for summary statistics). In particular, we include the following variables:

1. VIX: Chicago Board Options Exchange (CBOE) Volatility Index. VIX measures the market expectation of near-term volatility conveyed by the prices of options in the stock index.
2. EMBI: the Emerging Markets Bond Index or EMBI spread for Chile measures the country risk.
3. IIE: Economic Policy Uncertainty Index. This index was constructed for Chile by CLAPES UC based on the selection of keywords in press articles.
4. ER volatility: quarterly standard deviation of the nominal exchange rate (CLP / USD) calculated using end-of-day data.

5. BCU10y: secondary market interest rate, 10-year BCCh UF bonds.[15/]
6. A dummy that captures non-conventional monetary policy actions undertaken by the BCCh during the Covid-19 pandemic.[16/]

4 Results

Our results focus on the impact of monetary policy shocks on lending standards, i.e. the net percentage of banks loosening/tightening their lending standards after a contractionary monetary policy shock.

We present the graphs for the impulse response coefficients based on local projections for the four loan categories considered (corporate, SMEs, consumer, and mortgage), together with their respective confidence bands of one and two standard deviations (66% and 95% confidence levels, respectively), asymptotic and nonparametric significance bands (wild bootstrap), and p-value for the joint significance test, as described previously in subsection 3.1.

Our results show that monetary policy shocks have a significant and heterogeneous effect on lending standards across different types of loans, with SMEs and consumer loans being the most sensitive, in general terms, than corporate and mortgage loans.

We first present the baseline results (subsection 4.1), which account for average impulse responses of lending standards to monetary policy shocks. Subsequently, we distinguish two cases:

1. Periods of a highly contractionary monetary policy stance, i.e., when the monetary policy rate is within the upper quartile of the distribution (subsection 4.2).
2. Periods when the capital position of banks is a constraint, as declared by them in responding to the BLS (subsection 4.3).

Finally, as robustness checks, we present how alternative definitions of monetary policy shocks (previously mentioned) affects lending standards for different types of credit (subsection 4.4).

4.1 Baseline results.

Figure 5 presents the baseline estimates for the impulse response coefficients (i.e., $\beta_{0,h}$ in Equation 1), the confidence and significance bands, and the p-value for the joint significance test for each loan category.

Although the net percentage of banks tightening their lending standards after the contractionary monetary policy shock increases in all credit segments (that is, it becomes negative after the monetary policy shock) the impulse response coefficients for SMEs and consumer loans are the only significant at a 95% confidence level in the second and first quarters after the shock, respectively.

This is in contrast to the information provided by the significance bands. According to these bands, the impulse response coefficients for corporate loans are significant between the first and the third quarter; for SMEs loans between the first and the third quarter; for consumer loans, before the first quarter and until the third quarter; and for mortgage loans, before the second quarter and until the third quarter.

[15/]The UF or Unidad de Fomento is a CPI-indexed unit of account.

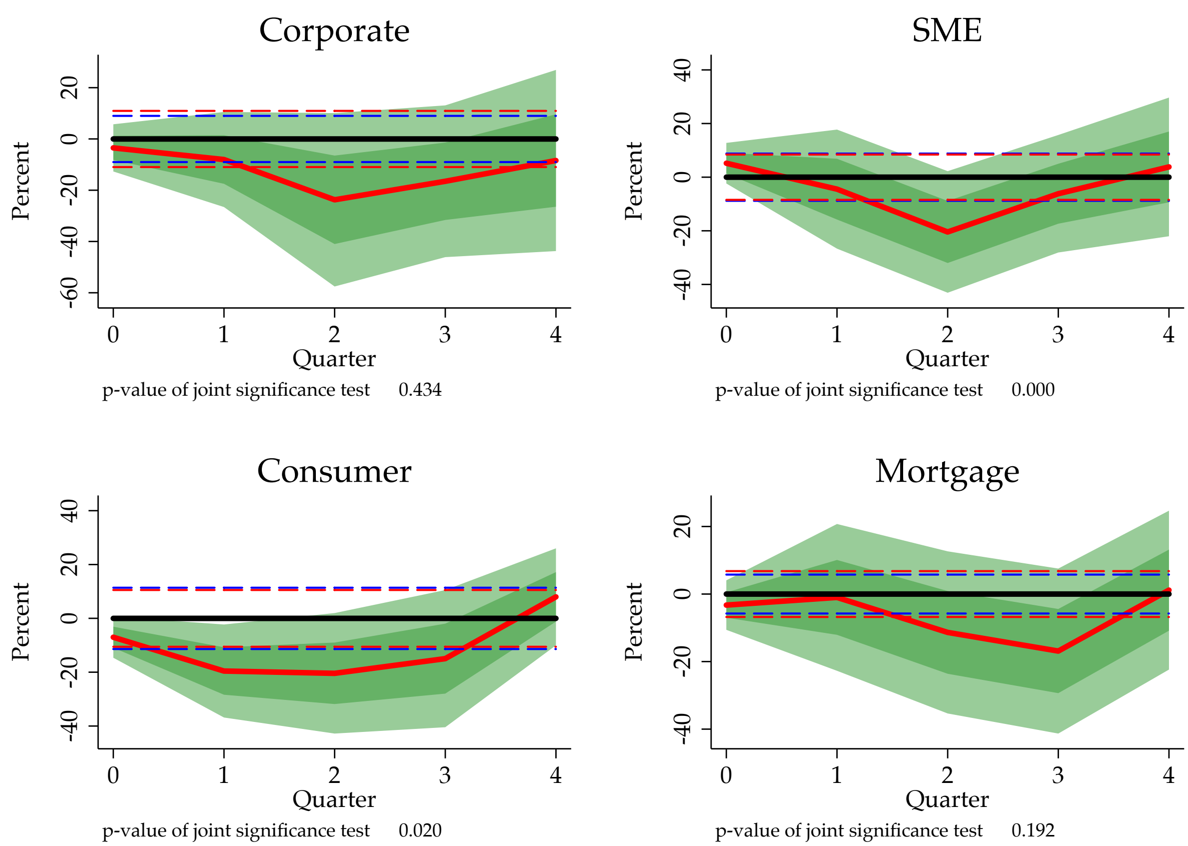
[16/]Between March 2020 and June 2021 the BCCh implemented a series of actions aimed at facilitating the flow of liquidity to the financial market in times of stress associated to the COVID-19 pandemic crisis. Furthermore, during that period, three withdrawals 10% of the accumulated balance in the individual capitalization accounts of the private pension scheme that has been in place in Chile since the early 1980s were allowed to alleviate the financial situation of the households. These withdrawals amounted to a significant positive liquidity shock for the economy. To capture all these issues, we include a dummy variable that takes the value 1 between the first quarter of 2020 and the second quarter of 2021.

However, the previous picture that depicts the significance by each quarter should be interpreted in the context of the overall significance for the one-year horizon after the monetary policy shock, which is provided by the p-value for the joint significance test; in this regard, those that display overall significance are the lending standards for SMEs (p-value=0.000) and consumer loans (p-value=0.020).

Taking into account all this statistical inference information, the evidence suggests that lending standards for corporate and mortgage loans are less sensitive to monetary policy shocks, compared to SMEs and consumer loans.

Finally, in terms of the magnitude of the response, after a monetary policy tightening shock implemented three to six months ago, approximately 20% of the banks respond that their lending standards for SMEs and consumer loans are more restrictive to some extent compared to the previous quarter.

Figure 5. Monetary policy shocks impact on lending standards - Baseline results



Note: the red straight line are the impulse response coefficients. The 95% significance bands are displayed in dashed lines, asymptotic in blue and bootstrap in red. The dark green shaded area correspond to one standard deviation error band, while the light green shaded area correspond to 95% band of a standard Confidence Interval.
Source: authors' elaboration.

4.2 Periods of highly contractionary monetary policy stance

Now, we report the results for the model specified in Equation 2. In particular, we report the impact of monetary policy shocks on lending standards when $D_t = 1$, that is, when the monetary policy rate is within the upper quartile of the distribution (see Figure 2) and 0 otherwise, equivalent to $\beta_{0,h} + \beta_{1,h}$ in Equation 2, and compare these coefficients when $D_t = 0$, that is, when the monetary policy rate is at a normal or low level ($\beta_{0,h}$). Therefore, $D_t = 1$ captures the transmission of monetary policy shocks during periods of a highly contractionary monetary policy rate, and, $D_t = 0$, captures the transmission when the monetary policy rate is low or normal.

Regarding impulse response coefficients, the impact of monetary policy shocks on lending standards is clearly amplified for corporate, SMEs, and mortgage loans, while this pattern is not so clear for consumer loans. However, the difference in the magnitude of the coefficients must be evaluated considering the statistical inference toolkit that we previously mentioned, which includes the confidence and significance bands, and the p-value for the joint significance test for each of the two periods defined by the value taken by $D_t = 1$.

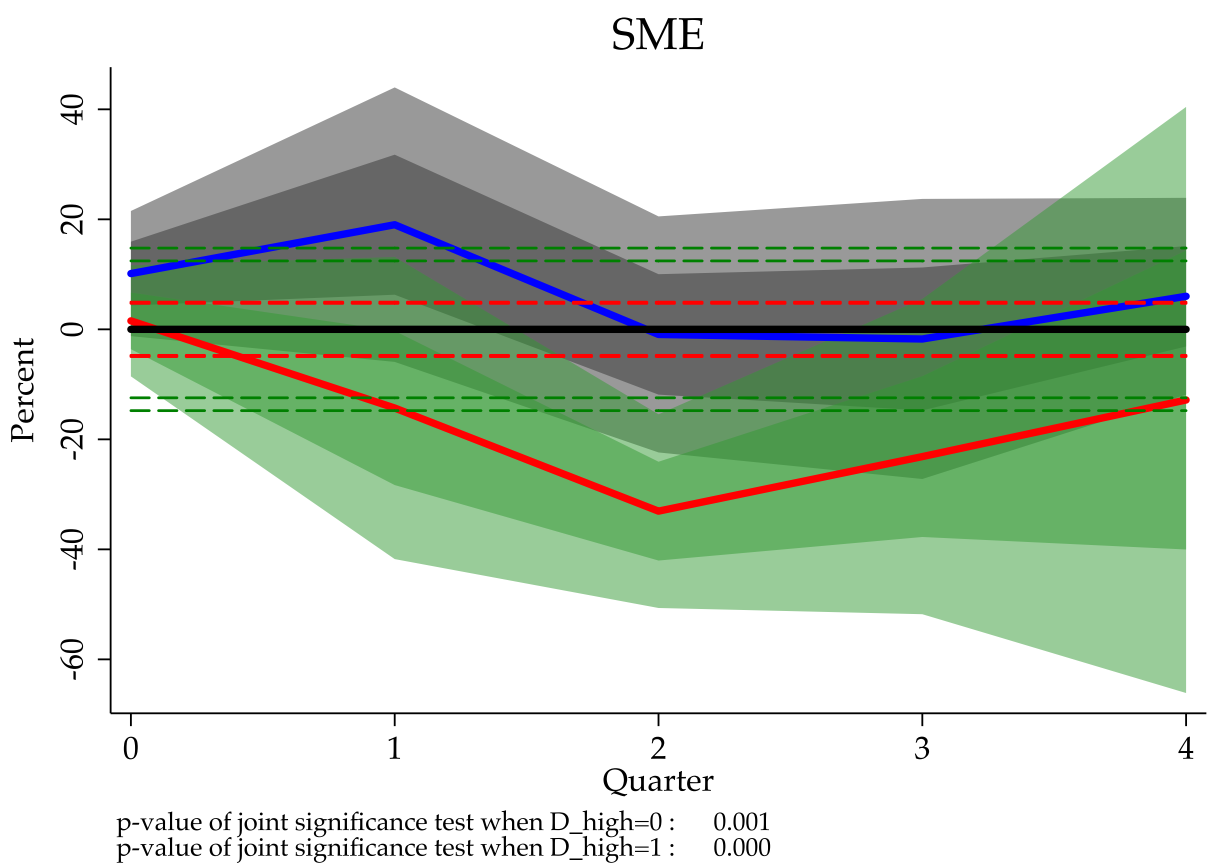
Figure 6 highlights the results for SMEs loans. in particular, the red line represents the $\beta_{0,h} + \beta_{1,h}$ coefficients (when $D_t = 1$), while the blue line represents the $\beta_{0,h}$ coefficient (when $D_t = 0$).

When $D_t = 1$, the tightening effect of monetary policy on lending standards becomes amplified as they become more negative. Moreover, the magnitude of the impulse response coefficients is statistically significant both according to the confidence and significance bands, as well as the p-value for the joint significance test (p-value = 0.000). Therefore, during periods of highly contractionary monetary policy stance, approximately 40% of the banks respond that their lending standards for SMEs loans are more restrictive to some extent relative to the previous quarter after a shock of tightening of the monetary policy that occurred six months earlier.

Since for other types of loans the pictures are less clear than for the case of SMEs loans, (Figure C.1 in the Appendix) the p-value for the joint significance test may be more informative. Thus, the amplification effect is also jointly significant for consumer and mortgage loans, but not for corporate loans. The joint significance of the amplification effect for SMEs and consumer loans during periods of highly contractionary monetary policy stance is consistent with the bank-lending and risk-taking channel, while that of mortgage loans with the balance sheet channel.

In general, our results support the notion that the banking channel operates as an effective amplification mechanism for periods of highly contractionary monetary policy stance, suggesting the presence of an interaction among the various components of the banking channel that further magnifies the impact of the initial policy impulse on credit conditions.

Figure 6. Monetary policy shocks impact on bank lending standards for SMEs loans: role of highly contractionary monetary policy stance periods



Note: the straight lines are the impulse response coefficients, red (highly contractionary) and blue (other periods). The 95% significance bands displayed in dashed lines, asymptotic and bootstrap: red (highly contractionary); green (other periods). The dark green/gray shaded area correspond to one standard deviation error band, while the light green/gray shaded area correspond to 95% band of a standard confidence interval: green (highly contractionary); gray (other periods).
Source: authors' elaboration.

4.3 Periods when the banks' capital position is a constraint

We now turn to the results for the model specified when $D_t = 1$ in Equation 2 represents the periods when the capital position of the banks is a constraint (see Figure 3). In this regard, we are concerned about the amplification mechanisms that surge from banks' balance sheet constraints when interacted with the monetary policy shock.

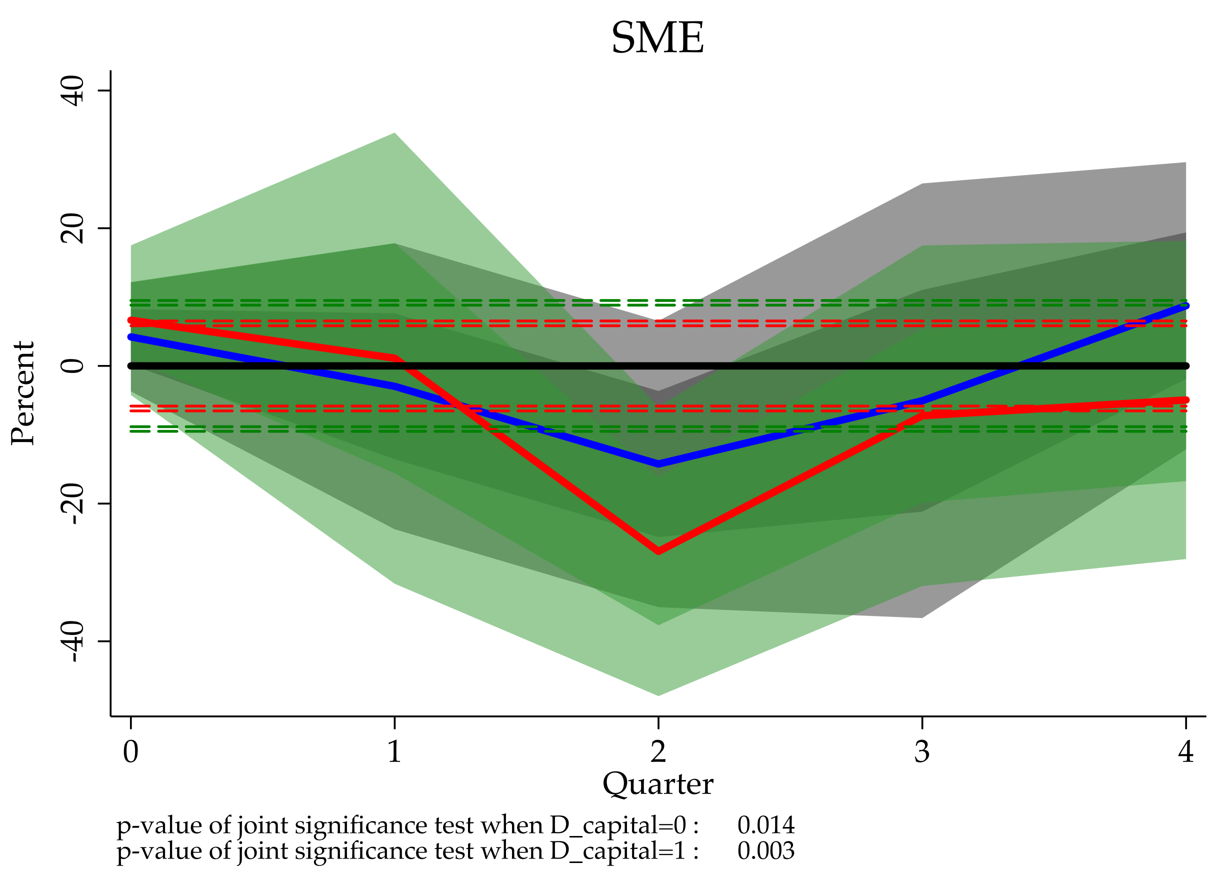
Therefore, the results when $D_t = 1$ are periods of tightening of monetary policy that occur in conjunction with periods when the capital position of banks is a driving factor for tightening the lending standards. In this regard, this specification provides a more direct test on the bank lending channel.

Our results show that the impact of monetary policy shocks on lending standards is clearly amplified for all types of loans when banks' capital position becomes constraint (i.e., when $D_t = 1$).

However, when we evaluate the amplification effect with the confidence and significance bands, we find that the amplification effect that occurs when $D_t = 1$ is statistically significant for all types of loans, except mortgage loans, in coherence with the p-value for the joint significance test (p-value=0.187). These results are consistent with the bank-lending channel.[17/]

Figure 7 shows the amplification of monetary policy shocks on the lending standards for SMEs loans when $D_t = 1$; for other types of loans, see C.2 in the Appendix.

Figure 7. Monetary policy shocks impact on bank lending standards for SMEs loans: role of periods when the banks' capital position is a constraint



Note: the straight lines are the impulse response coefficients, red (capital as a constraint) and blue (other periods). The 95% significance bands displayed in dashed lines, asymptotic and bootstrap: red (capital as a constraint); green (other periods). The dark green/gray shaded area correspond to one standard deviation error band, while the light green/gray shaded area correspond to 95% band of a standard confidence interval: green (capital as a constraint); gray (other periods).
Source: authors' elaboration.

[17/] Since the risk-weight associated to mortgage loans used to compute the capital adequacy ratio is much lower than corporate, consumer, and SME loans, provided they have collateral, it is reasonable to expect that banks' capital is less binding for this type of loan.

4.4 Monetary policy shocks at different time horizons

In this section, our aim is to assess the effects of monetary policy shocks on lending standards by considering monetary policy shocks at various time horizons and comparing them with the findings presented earlier, which focused on contemporaneous shocks (when $j = 0$).

These shocks at different time horizons are constructed by considering surprises in inflation expectations and economic growth expectations at period j, as elaborated in the Appendix. Specifically, we focus on the impact of shocks at six months, one year, eighteen months, and two years (when $j = 5$, 11, 17, and 23, respectively). Notice that these shocks, as it were the case of contemporaneous shocks, capture the unexpected component of interest rate fluctuations.

By analyzing the impact of monetary policy shocks at different time horizons, we can gain a deeper understanding of the dynamics and persistence of these shocks on credit standards. This analysis allows us to assess whether the effects of monetary policy shocks vary over different time periods and whether there are any long-term implications for lending standards.

In general, our results confirm that monetary policy shocks at different time horizons are associated with more restrictive lending standards in SME loans (see Table 1). For consumer and corporate loans, the statistical significance of the impact of monetary policy shocks on lending standards depends on the horizon over which the shock is measured. Notice that shocks at longer time horizons generate a statistically significant impact on mortgage loan lending standards.

Finally, Table 2 shows the p-values for specification 2, both for periods of high interest rates and when bank capital is a constraint. In general, we find that the associated coefficients when the dummy is equal to 1 are statistically significant for SME loans, regardless of the horizon at which the monetary policy shock is measured. Although the results are less consistent for other types of credit, the fact that high interest rate levels can generate amplifying effects in mortgage credit when taking into account shocks at horizons greater than one year stands out, which is corroborated even when bank capital is a constraint.

Table 1. Monetary policy shocks at different time horizons (j): p-value for joint significance test

j	Corporate	SME	Consumer	Mortgage
0	0.434	0.000	0.020	0.192
5	0.224	0.004	0.392	0.359
11	0.000	0.000	0.286	0.453
17	0.000	0.004	0.008	0.000
23	0.360	0.000	0.000	0.001

Source: authors' calculations.

5 Concluding Remarks

By extensively exploiting the information contained in the aggregated responses to the Chilean Bank Loan Survey (BLS), we show that, on average, a positive monetary policy shock tends to tighten lending standards in all credit segments (corporate, SMEs, consumer, and mortgage). Furthermore, the response of lending standards gets amplified during periods of highly contractionary monetary policy stance as well as in periods when the capital position of banks becomes a constraint. However, this amplification is not significant for

Table 2. Monetary policy shocks at different time horizons (j): p-values for joint significance tests

High-interest-rates

j	Corporate		SME		Consumer		Mortgage	
	$D^{high}=0$	$D^{high}=1$	$D^{high}=0$	$D^{high}=1$	$D^{high}=0$	$D^{high}=1$	$D^{high}=0$	$D^{high}=1$
0	0.15	0.24	0.00	0.00	0.37	0.00	0.17	0.03
5	0.09	0.01	0.01	0.01	0.00	0.12	0.29	0.17
11	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.80
17	0.00	0.03	0.00	0.36	0.28	0.06	0.00	0.01
23	0.27	0.55	0.00	0.00	0.00	0.00	0.00	0.00

Capital position a constraint

j	Corporate		SME		Consumer		Mortgage	
	$D^{capital}=0$	$D^{capital}=1$	$D^{capital}=0$	$D^{capital}=1$	$D^{capital}=0$	$D^{capital}=1$	$D^{capital}=0$	$D^{capital}=1$
0	0.21	0.06	0.01	0.00	0.00	0.06	0.41	0.19
5	0.09	0.14	0.00	0.12	0.04	0.45	0.07	0.40
11	0.35	0.00	0.00	0.03	0.28	0.16	0.49	0.11
17	0.00	0.00	0.00	0.01	0.00	0.19	0.01	0.00
23	0.74	0.48	0.00	0.00	0.00	0.00	0.05	0.00

Note: sample 1 refers to the subgroup of 4 publicly listed banks in the stock market. Sample 2 refers to Chile's 11 medium and large banks, defined according to **?**.

Source: authors' calculations are based on information obtained from CMF.

every type of loan. For instance, in periods of highly contractionary monetary policy stance the amplification effect is not significant for corporate loans. Similarly, in periods when the capital position of banks becomes a constraint the amplification effect is not significant for mortgage loans. Our findings are consistent with the banking channel playing a key role as an amplification mechanism of monetary policy.

Therefore, the implications for monetary policy in an environment where there are asymmetries in the way that the access to bank credit is affected for different credit segments need further consideration. This includes evaluating the efficiency of monetary policy for mitigating excessive consumption to stop inflation and its impact on the real economy. This highlights the impact of how a monetary policy tightening may trigger a credit supply shock that amplifies business cycle fluctuations, an issue that has been studied by Bijsterbosch and Falagiarda [2015] for the euro area.

While the aggregated information contained in the Chilean BLS survey may help in addressing these issues, a deeper understanding can be obtained from the responses of individual banks, and the incorporation of other emerging economies to study this issue in the context of an international panel data, an avenue of future research within our agenda. Additionally, there is room for improvement in the approach that we followed in this paper. For instance, we could assess the role of unconventional policies in a non-discrete way and evaluate the relevance of weighted answers.

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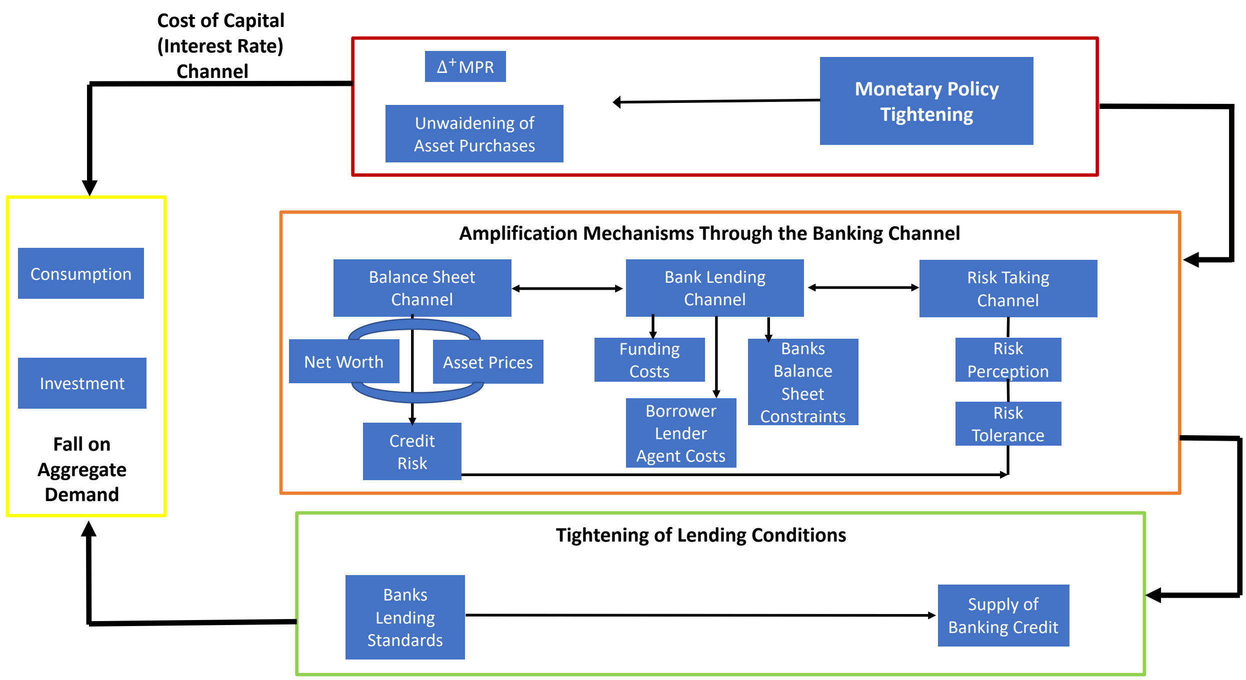
A Analytical framework

Figure A.1. The Banking Channel of Monetary Policy (based on Lane (2023))



B Shocks and surprises to the Monetary Policy Target Rate in Chile

In this section, we follow Gómez et al. [2020] and re-estimate and update the series of their monetary policy shocks from August 2001 to December 2022.

First, we identify anticipated and unanticipated monetary policy shocks using Survey of Economic Expectations (SEE) data. Then, we extract pure monetary shocks by utilizing SEE's macroeconomic variable expectations, since anticipated and unanticipated monetary policy shocks partially reflect the expected reaction of the central bank to anticipated changes in the business cycle.

We define an anticipated movement in the monetary policy rates (i_t) as follows:

$$\Delta i^a_{t,t+j} = \mathbb{E}_{t-1}\left(i_{t+j} - i_{t+j-1}\right) \quad \text{for } j = \{0, 2, 5, ..., 23\}$$

and an unanticipated movement in i_t (or surprise) as:

$$\Delta i^u_t = i_t - \mathbb{E}_{t-1} i_t$$

Shocks to the policy target interest rate are estimated as the residuals of an OLS regression of surprises on annual inflation and output growth. The unanticipated shock for the current period S^0_t is given from:

$$\Delta i^u_t = \alpha_0 + \alpha_1 i_{t-1} + \alpha_2(\hat{y}_t - \mathbb{E}_{t-1}\hat{y}_t) + \alpha_3(\hat{\pi}_t - \mathbb{E}_{t-1}\hat{\pi}_t) + \underbrace{(\epsilon_t - \mathbb{E}_{t-1}\epsilon_t)}_{S^0_t} \tag{3}$$

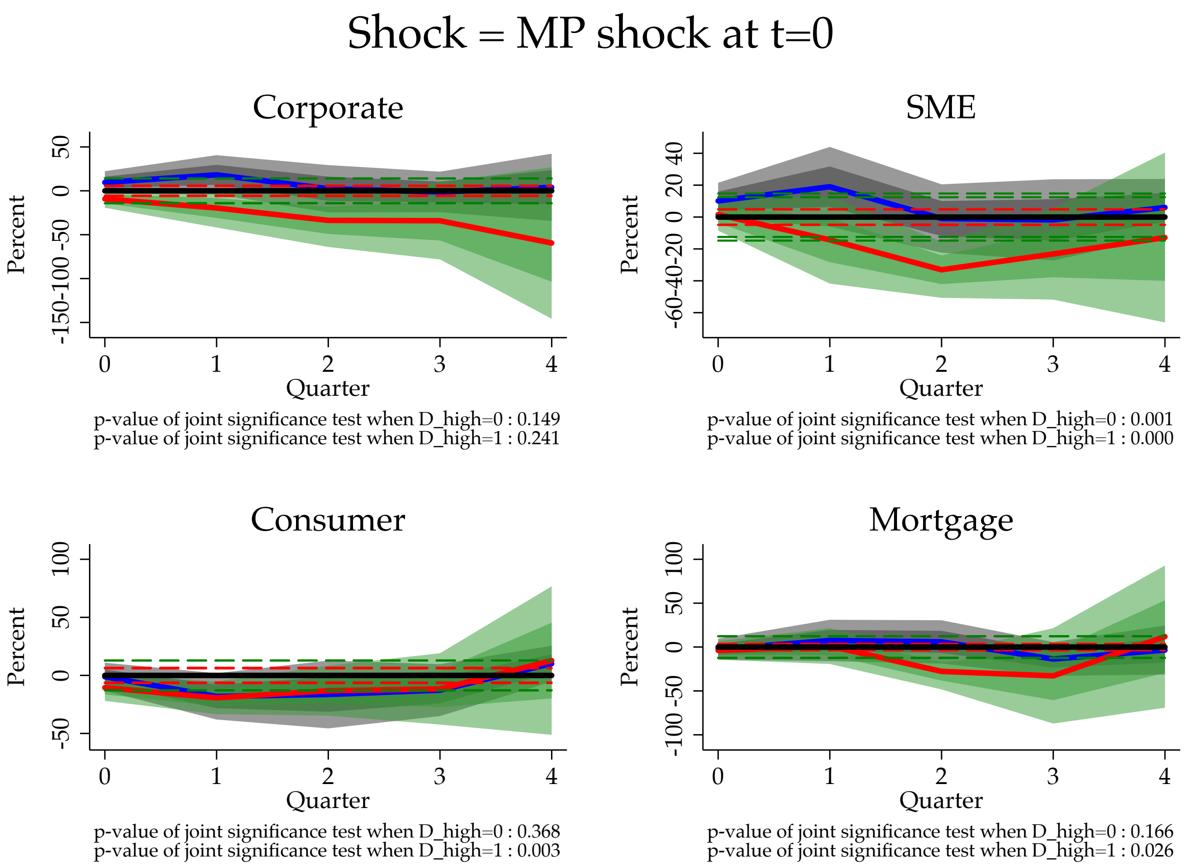
and for next periods, i.e. S^j_t:

$$\begin{aligned} \Delta i^a_{t,t+j} &= \gamma_{0,j} + \gamma_{1,j}\mathbb{E}_{t-1}\left(i_{t+j-1}\right) + \gamma_{2,j}\mathbb{E}_{t-1}\left(\hat{y}_{t+j} - \hat{y}_{t+j-1}\right) \\ &+ \gamma_{3,j}\mathbb{E}_{t-1}\left(\hat{\pi}_{t+j} - \hat{\pi}_{t+j-1}\right) + \underbrace{\mathbb{E}_{t-1}\left(\epsilon_{t+j} - \epsilon_{t+j-1}\right)}_{S^j_t} \quad \text{for } j = \{0, 2, 5, \cdots, 23\} \end{aligned} \tag{4}$$

These equations are estimated by OLS.

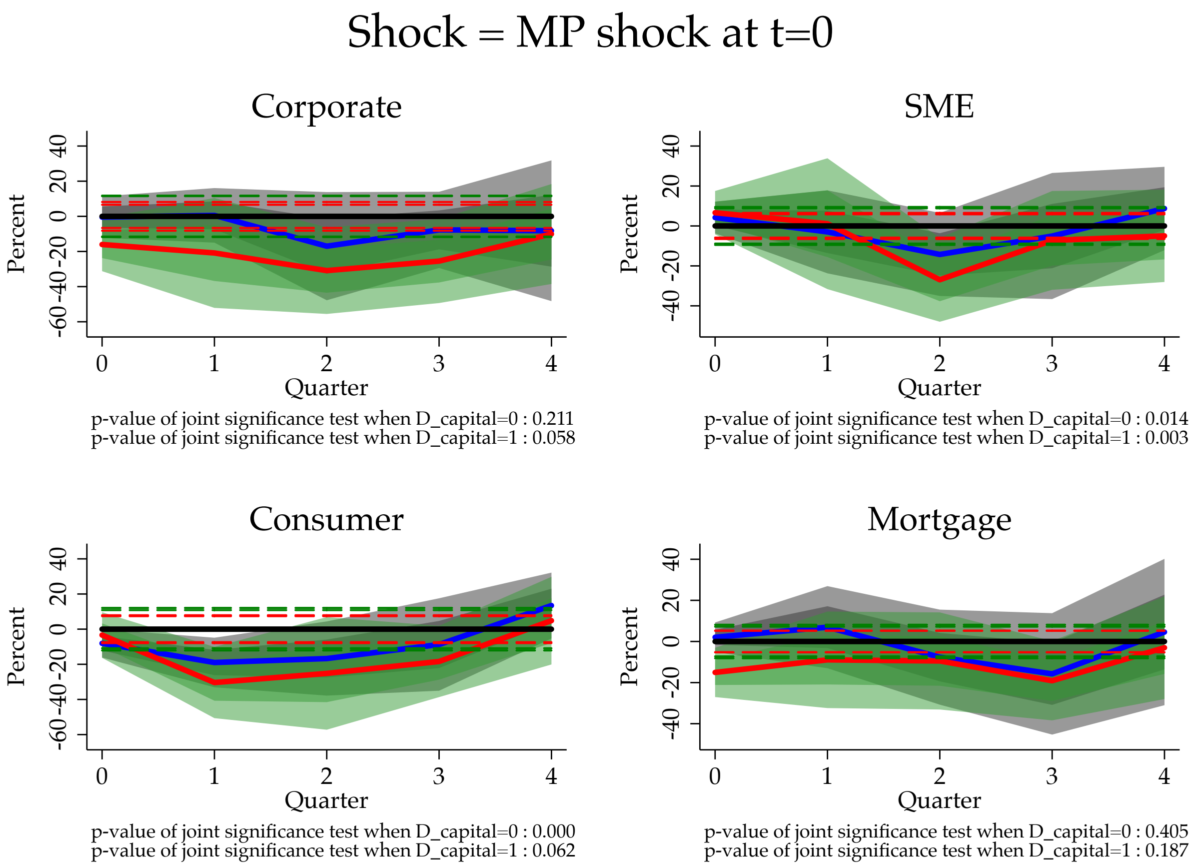
C Additional figures

Figure C.1. Monetary policy shocks impact on lending standards: highly contractionary monetary policy stance periods vs. other periods



Note: the straight lines are the impulse response coefficients, red (highly contractionary) and blue (other periods). The 95% significance bands displayed in dashed lines, asymptotic and bootstrap: red (highly contractionary); green (other periods). The dark green/gray shaded area correspond to one standard deviation error band, while the light green/gray shaded area correspond to 95% band of a standard confidence interval: green (highly contractionary); gray (other periods).
Source: authors' elaboration.

Figure C.2. Monetary policy shocks impact on lending standards: periods when the banks' capital position is a constraint vs. other periods



Note: the straight lines are the impulse response coefficients, red (capital as a constraint) and blue (other periods). The 95% significance bands displayed in dashed lines, asymptotic and bootstrap: red (capital as a constraint); green (other periods). The dark green/gray shaded area correspond to one standard deviation error band, while the light green/gray shaded area correspond to 95% band of a standard confidence interval: green (capital as a constraint); gray (other periods).
Source: authors' elaboration.

D Additional tables

Table D.1. Summary Statistics

variable	N	mean	sd	min	max
Lending standards					
Corporate	80	-11.2	30.5	-92.9	44.4
SME	80	-13.3	23.6	-73.7	46.7
Consumer	80	-8.3	26.0	-83.3	41.7
Mortgage	80	-4.8	23.8	-81.8	36.4
Monetary policy shocks					
S^0	80	0.0	0.4	-2.3	0.6
S^5	80	-0.0	0.2	-0.4	0.5
S^{11}	80	-0.0	0.2	-0.7	0.8
S^{17}	80	-0.0	0.1	-0.3	0.5
S^{23}	80	-0.0	0.2	-0.3	0.6
Macro controls					
MP rate	80	3.656	2.243	0.500	11.250
VIX (in logs)	80	2.903	0.340	2.333	4.071
EMBI (in logs)	80	4.915	0.355	4.035	5.875
IIE (in logs)	80	4.740	0.534	3.874	6.074
ER (volatility)	80	13.607	7.745	1.465	37.323
BCU10y	80	2.230	1.023	-0.260	4.152
Demand perception					
Corporate	80	8.2	31.7	-64.7	77.8
SME	80	11.0	28.1	-36.4	86.7
Consumption	80	6.8	38.9	-100.0	76.5
Mortagage	80	7.5	39.6	-100.0	71.4

Source: authors' calculations.

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