Pass-through, expectations, and risks.
What affects Chilean banks' interest rates?

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Abstract

The analysis in this paper is focused on how the pass-through of changes in the monetary policy rate (MPR), expectations of MPR changes, and different measures of risks affect banks' interest rates. Nominal and real lending and deposit rates are examined as are different maturities for the cases of nominal lending rates. Several measures of risk are constructed and incorporated into the analysis to take into account credit, market, liquidity, and interest rate risk.

Evidence suggests that the pass-through of MPR changes is symmetric and instantaneous complete for the majority of the lending horizons of commercial and consumer loans with nominal rates. Pass-through is symmetric for commercial loans and deposits with real rates, but not for mortgage loans. Generally, liquidity, market, and credit risks are important for the banks when setting interest rates, while interest rate risks affect mainly consumer loans and deposits with nominal rates. Inflation changes affect the real rates of commercial loans and deposits as well as nominal consumer loans with a long maturity. Inflation expectations are mainly taken into account when setting real rates of commercial and mortgage loans. Expectations of MPR changes affect principally the rates of mortgage loans.

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1. Introduction

Several parameters affect the way retail banks set interest rates. The present analysis incorporates different measures of risk to evaluate how they affect interest rate determination when allowing for possible asymmetric pass-through of changes in the monetary policy rate (MPR), and the fact that expectations of policy changes may or may not be met. Hence, the study reveals the degree of monetary pass-through when controlling for these factors. The investigation is made with nominal and real interest rates of loans (consumer and commercial) and deposits, and nominal lending rates are also analyzed with respect to different maturities of the loans. Distinguishing between real and nominal rates and different horizons may reveal information about retail banks' behavior and preferences when confronting different kinds of risks. Incidentally, it is important to note that in Chile, real interest rates are widely used in bank operations.

Studying the monetary pass-through taking into account the effect of different risks is useful for the understanding the effectiveness of the monetary policy. It is, however, also interesting from a financial stability point of view. Adrian and Liang (2014) present a resume of papers focusing on the connection between the stance of monetary policy and how banks expose themselves to risk. The present analysis contributes to this important discussion in the sense that if banks take into account changes in risks when determining which interest rates to apply, this will affect the effect of the risk-taking channel[1] of the monetary transmission mechanism.[2]

In a nutshell the study seeks answers to numerous questions regarding what affects commercial banks' interest rates in Chile: Is the monetary pass-through symmetric? Is it complete? Does risk associated with the interbank market (liquidity risk) affect interest rates? What is the impact of inter-monthly variations in the banking rates (market risk)? How do changes in client risk (credit risk) between months move interest rates? Is there an impact from general global and local risk measures (interest rate risk)? Does it matter if policy expectations are met or not? Do different risk measures affect nominal and real

[1] See Adrian and Shin (2010) and Borio and Zhu (2012).

[2] With euro area data Altunbas et al. (2010) find evidence of a bank lending cannel which operates via risk.

rates? Are rates of different lending horizons affected differently? In this context, the paper in hand investigates risks related to funding costs[3] as well as those related to the evaluation of customers.

While numerous scholars have addressed the issues of monetary pass-through[4] and policy expectations,[5] few studies have focused on the effect of risk measures on interest rates. One exception is Becerra et al. (2010), who find that lack of pass-through in Chile in times of financial turbulence can be explained by higher domestic and international risk.[6] While Jiménez et al. (2014) study Spanish loan applications and contracts to identify the effects of monetary policy on credit-risk taking, few studies are concerned with the effects of client (credit) risk on commercial interest rates and it is uncommon to find works that distinguish different lending horizons.[7] The present paper contributes to the literature on determination of banks' interest rates by introducing ways to measure related risks, particularly those concerning credit, and evaluating how they affect bank rates.

The results suggest that, when controlling for risks, expectations and the macroeconomic state, MPR pass-through is symmetric and instantaneously complete for the main part of the loans with nominal rates. The pass-through of MPR hikes to nominal deposit rates is also instantaneously complete, but that of MPR decreases is less than instantaneously complete. With respect to the real rates, pass-through is symmetric for those of commercial

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[3] The issue of banks' funding costs has been analyzed by e.g. Illes et al. (2015).

[4] Several early studies find evidence in favor of asymmetric interest pass-through (e.g. Hannan and Berger (1991) and Lim (2001)), but results of investigations applying more recent samples are less conclusive (e.g. Gambacorta and Iannotti (2007)). With Chilean data from 1993 to 2002, Espinosa-Vega and Rebucci (2004) find that the pass-through is faster in Chile than in other countries and incomplete in the long run. They find no evidence of asymmetric behavior.

[5] Kuttner (2001) finds that US bond rates react little to expected changes in the Fed funds rate, while unanticipated movements have large effects. Kleimeier and Sander (2006) argue that pass-through to lending rates is faster when banks correctly anticipate policy changes, while deposit rates are more rigid. Banerjee et al. (2013) argue that banks anticipate short-term rates when setting interest rates on loans as well as deposits.

[6] The important issue of asymmetric pass-through under different levels of risk, e.g. liquidity risk, is beyond the scope of the present paper and will be left for future research.

[7] Luttini and Pedersen (2015) find that Chilean interest rates of short-term commercial loans react quite fast to changes in the policy rate, while those of the long run seem to react more to inflation.

loans and deposits but not so for mortgage rates, where decreases have larger effects in the period analyzed. Liquidity risk seems to affect real lending and deposit rates as well as nominal rates of deposit, while market risk influences the rates of commercial loans and deposits. Credit risk is important for banks' setting of all rates analyzed but those of short-term consumer loans and interest risk mainly affects nominal rates of consumer loans and deposits. Changes in inflation have an impact on the setting of real rates of commercial loans and deposits as well as on long-term consumer loans with nominal interest rate. Real rates of commercial loans are also influenced by inflation expectations as are those of mortgage loans. The role of MPR expectations seems to be limited, although they appear to have some impact on long-term loans to consumers and mortgage loans.

The next section discusses ways to measure different types of risks empirically, which to the author's knowledge has not been applied in related studies. Section 3 presents the econometric model employed in the empirical analysis and provides a detailed discussion of the data utilized, while section 4 reports the results of the empirical analysis. The last section of the paper offers some concluding remarks.

2. Measuring risks

This section discusses the measures of risk included in the analysis. After a general discussion of these measures (Freixas and Rochet, 2008), the first subsection describes risk measures related to the portfolio of clients, the so-called credit risk. The second reveals how other types of risks are measured, i.e. market risk, liquidity risk, and interest rate risks, while the third subsection presents the correlations of the calculated measures.

Credit risk refers to the fact that banks have to input the probability of default of a client when determining the price of the loan.[8] A theoretical example is the classical model of Merton (1974), which applies options to price default risk.[9] As described in subsection 2.1,

[8] Credit risk has been widely studied in different contexts. Examples include Delis and Karavias (2015) who study the optimal level of credit risk from the bank's point of view, Greenwood and Hanson (2013) that look at credit risk related to corporate bonds, while Kelly and O'Malley investigate credit risk at the mortgage market.

[9] Memmel et al. (2015) study common drivers of default risk in Germany.

this is evaluated by higher order moments of the interest rate distribution. Market risk has to do with the fact that market prices are affected by volatility. Theoretically this has been described in articles such as those of Markowitz (1952), Lintner (1965) and Sharpe (1965) that discuss how to optimally select a portfolio of risky assets. Liquidity risk refers to risks linked to the banks' management of their funds and, hence, the administration of the stock. A theoretical setup for this kind of risk is supplied by e.g. Ho and Sanders (1981), who present a model where the bank acts as intermediary between demanders and suppliers of funds. An important part of banks' liquidity is provided via the interbank market[10] and, hence, characteristics of this market are utilized to approximate the liquidity risk facing the bank when supplying loans and fixing returns on deposits. Finally, interest rate risk is related to the fact that fluctuations in the interest rate directly affect the banks' income (and balance sheet) and, thus, has to do with the term structure of interest rates. The classical paper by Cox et al. (1985) supplies a theory of the term structure of interest rates applying an intertemporal general equilibrium model of asset pricing. In the present context, risks related to general interest rate fluctuations are approximated by an international measure of financial market risk and a national country-risk measure.

2.1. Credit risk

Bank interest rates (i_t) are usually reported as weighted averages where the interest rate of each bank operation is weighted by the amount. Hence, behind each published interest rate there is a distribution of rates and higher moments of this distribution can be utilized to evaluate changes of risk segments. Figure 1 shows an example of how changes in the distribution may affect a given rate and thereby distort the evaluation of monetary pass-through. The illustration is made with rates of commercial loans the months of December 2003 and January 2004, where the MPR was lowered from 2.25% to 1.75%, while the commercial rate increased from 5.68% to 6.85%. This hike was caused by a change in the distribution of clients towards some with higher credit risk that were charged higher rates.

[Figure 1]

[10] Bank balance data from Chile for the period 2008-14 show that, on average, one third of the funding is done via the interbank market.

The weighted moments of the distributions are reported in table 1. The change in the distribution was revealed in all moments, higher variance, less positive skewness (movement to the right) and lower kurtosis. The change of the skewness reflects that riskier clients obtained loans in January 2004.

[Table 1]

As illustrated in the example, looking at higher moments of the interest rate distribution may help to understand to what extent changes of the interest rate are due to changes of the risk segments of bank customers. In the present analysis the second, third and fourth moments of the distribution are taken into account. The second moment (variance, $\sigma_t^{2w}(i_t)$) tells something about differences of risk segments in a given month: the higher the variance the more variation amongst clients. The third moment (skewness, $\sigma_t^{3w}(i_t)$) shows if the distribution leans towards loans with low or high risk costumers; positive (negative) skewness implies a larger proportion of low-risk (high-risk) clients. The fourth moment (kurtosis, $\sigma_t^{4w}(i_t)$) indicates if loans of a given months are particularly influenced by clients with low and high risk profiles. Kurtosis is normalized to that of the normal distribution such that it is positive (negative) if there are few (many) clients with high and low risks.

2.2. Other measures of risk

Market risk is measured by the variability in the bank system, i.e. how much the daily average rate varies over the period. The weighted variance ($\sigma_t^{2w}(i_t^{sys})$) is utilized to measure the variability.

Interbank rates (r_t) are applied to measure liquidity risk. Three measures are calculated: i) variance over the period ($\sigma_t^2(r_t)$) to quantify the general variability in the market, ii) difference between maximum and minimum rates ($r_t^{max} - r_t^{min}$) to capture the spread of interbank market operations, and iii) transactions (Q_t^r) as a measure of how liquid the interbank market is at a given time.

Interest rate risk is captured by two general measures of market risk. Global risk is approximated by the VIX, while domestic risk is measured by the EMBI. Further details are supplied in the data description section.

2.3. Are risk measures correlated?

One can think of several situations where some measures of risk are correlated. Some relate to the same kind of risk, e.g. correlation of the variance and the max-min measure of the interbank market, but there may also be correlations across other measures. One example could be that higher domestic risk could be correlated with fewer transactions in the interbank market. The correlation matrix of the risk measure is shown below (total commercial rates used for credit and market risks):

	Liquidity risk			Market risk	Credit risk			Interest rate risk	
	$\Delta\sigma_t^2(r_t)$	$\Delta(r_t^{max}-r_t^{min})$	$\Delta\ln(Q_t^r)$	$\Delta\sigma_t^{2w}(i_t^{sys})$	$\Delta\sigma_t^{2w}(i_t)$	$\Delta\sigma_t^{3w}(i_t)$	$\Delta\sigma_t^{4w}(i_t)-3$	$\Delta\ln(EMBI_t)$	$\Delta\ln(VIX_t)$
$\Delta\sigma_t^2(r_t)$	1.00								
$\Delta(r_t^{max}-r_t^{min})$	0.14	1.00							
$\Delta\ln(Q_t^r)$	-0.07	0.12	1.00						
$\Delta\sigma_t^{2w}(i_t^{sys})$	-0.23	-0.04	-0.04	1.00					
$\Delta\sigma_t^{2w}(i_t)$	-0.13	0.03	0.02	0.30	1.00				
$\Delta\sigma_t^{3w}(i_t)$	0.17	-0.05	-0.13	-0.03	-0.19	1.00			
$\Delta\sigma_t^{4w}(i_t)-3$	0.16	-0.03	-0.13	-0.04	-0.33	0.94	1.00		
$\Delta\ln(EMBI_t)$	-0.07	-0.01	-0.12	0.15	0.02	-0.04	-0.02	1.00	
$\Delta\ln(VIX_t)$	-0.14	0.05	-0.04	0.31	0.08	-0.17	-0.12	0.55	1.00

Generally the correlations among the different risk measures are small, but for the total commercial rates, the coefficient between the skewness and kurtosis is quite large (more than 0.9). This is also the case for short-term commercial loans, and the correlation between market risk and the variance measure of credit risk for short-term consumer loans is also above 0.9.

3. Econometric model and discussion of data

This section describes, firstly, the econometric model applied in the empirical analysis and, secondly, the data utilized. The second subsection is divided into two parts, where the first discusses the interest rate data and related risk measures (liquidity, market, and credit), while the second describes the macroeconomic variables and the measures related to interest rate risk. The interest rate section also includes a brief review of the Chilean banking sector.

3.1. The econometric model

The statistical model takes into account several possible characteristics of the pass-through from the MPR to bank rates. Firstly, it may be asymmetric such that hikes in the policy rate affect bank rates with different impact than decreases. Also it is considered that noise in the interbank market may affect bank rates when there are no changes in the policy rate. Secondly, as discussed in section 2, several measures of risks are included in the model to evaluate to what extent the rates are affected by them. Thirdly, the model controls for effects of the macroeconomic environment and, finally, expectations of policy changes are taken into account.

To allow for the fact that residuals across the different interest rate equations may be correlated, for the empirical analysis the methodology of seemingly unrelated regressions (SUR), as proposed by Zellner (1962), is utilized.

The models estimated can be represented as

$$\underbrace{\begin{bmatrix} \Delta i_{1t} \\ \Delta i_{2t} \\ \vdots \\ \Delta i_{nt} \end{bmatrix}}_{Y_t} = \underbrace{\begin{bmatrix} (\beta_1' \quad \gamma_1') & 0 & \cdots & 0 \\ 0 & (\beta_2' \quad \gamma_2') & & \vdots \\ \vdots & & \ddots & 0 \\ 0 & \cdots & 0 & (\beta_n' \quad \gamma_n') \end{bmatrix}}_{(\beta' \quad \gamma')} \underbrace{\begin{bmatrix} (\Delta x_{1t} \quad \Delta z_t)' \\ (\Delta x_{2t} \quad \Delta z_t)' \\ \vdots \\ (\Delta x_{nt} \quad \Delta z_t)' \end{bmatrix}}_{(X_t \quad Z_t)'} + \underbrace{\begin{bmatrix} \phi_1' D_t \\ \phi_2' D_t \\ \vdots \\ \phi_n' D_t \end{bmatrix}}_{\phi' D_t} + \underbrace{\begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \vdots \\ \varepsilon_{nt} \end{bmatrix}}_{\varepsilon_t}, \qquad (1)$$

where $E(\varepsilon_{jt}\varepsilon_{js}|X_t, Z_t) = 0, t \neq s$, and $E(\varepsilon_{jt}\varepsilon_{kt}|X_t, Z_t) = \sigma_{jk}$.[11] The matrix x_{jt} ($j = 1,2,\ldots,n$) includes the variables, which are specific to the bank interest rate i_{jt}, while z_t contains those that are general for all interest rates. The deterministic terms are a constant, seasonal dummies, and dummies for outliers of the type {…,0,0,1,0,0,…}.[12]

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[11] In all the models employed the Breusch-Pagen test strongly rejects the null of no cross-equation correlation among the residuals (see appendix A).

[12] While standard unit root tests reveal mixed results with respect to stationarity of the bank rates, there is little evidence that the interbank rate and inflation expectations have unit roots. Hence, no long-run relations were included in the models. Espinosa-Vega and Rebucci (2004) note that the Chilean interest series appear stationary for the period they analyze.

The vectors x_{jt} and z_t include the following variables:

$$x_{jt} = \begin{bmatrix} i_{jt-1} \\ \sigma_{jt}^{2w}\left(i_{jt}^{sys}\right) \\ \sigma_{jt}^{2w}\left(i_{jt}\right) \\ \sigma_{jt}^{3w}\left(i_{jt}\right) \\ \sigma_{jt}^{4w}\left(i_{jt}\right) - 3 \end{bmatrix}, \Delta z_t = \begin{bmatrix} \Delta r_t \times I_t^1 \\ \Delta \sigma_t^2(r_t) \\ \Delta(r_t^{max} - r_t^{min}) \\ \Delta \ln(Q_t^r) \\ \Delta \ln(EMBI_t) \\ \Delta \ln(EMBI_t) \\ Y_t - \bar{Y} \\ \Delta \pi_t \\ \Delta E(\pi_t) \\ \Delta \ln(FLAP_t) \\ I_t^2 \end{bmatrix}.$$

The variables particular for each interest rate are the lagged value of the rate, i_{jt-1}, and the variables related to market and credit risk. Market risk is measured by the weighted variance of daily bank interest rates (weighted average) measuring general variability over a given period of time. The following three variables account for credit risk: weighted variance, weighted skewness and weighted excess kurtosis calculated with daily data from banks that performed operations that day.

With respect to the general variables, the vector I_{1t} includes three indicator functions, which take the value 1 if the condition inside the brackets is fulfilled and 0 otherwise:

$$I_t^1 = \begin{bmatrix} I(\Delta MPR_t > 0) \\ I(\Delta MPR_t < 0) \\ I(\Delta MPR_t = 0) \end{bmatrix},$$

where *MPR* is the monetary policy rate. Liquidity risk is considered by the following three variables: i) monthly variance of daily interbank rates, r_t, ii) difference between monthly average of maximum and minimum interbank rates, and iii) logarithm of average daily transactions in the interbank market. The next two variables concern interest rate risk, i.e. change in national risk, measured by EMBI (Emerging Market Bond Index), and change in global risk, measured by the VIX (Chicago Board Options Exchange Market Volatility Index). To control for the macroeconomic environment, the state of the business cycle,

$Y_t - \bar{Y}$, changes in annual inflation rate, π_t, changes in annual inflation expectations, $E(\pi_t)$, and changes in the unconventional monetary policy measure, which is named FLAP,[13] are included in the estimations. Finally, the vector I_{2t} contains indicator functions with value 1 if the condition in the brackets is fulfilled and 0 otherwise. It includes four functions related to MPR expectations: expected change, change different from expected, non-expected change, and no change when expected:

$$I_t^2 = \begin{bmatrix} I(E(\Delta MPR_t) = \Delta MPR_t \neq 0) \\ I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t \neq 0) \\ I(0 = E(\Delta MPR_t) \neq \Delta MPR_t \neq 0) \\ I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t = 0) \end{bmatrix}.$$

A total of four SUR models are estimated with feasible generalized least squares (FGLS): total nominal interest rates (commercial, consumer, and deposit); total real interest rates (commercial, mortgage, and deposit); commercial rates with different lending horizons and consumer rates with different horizons.

3.2. Data description

3.2.1. Interest rates and risk measures

The source of the interest rate data utilized is Central Bank of Chile (CBC). Monthly data are constructed with daily observations from each bank that in a given month has had operations in a given lending / deposit segment. To avoid possible distortions from the fact that monetary policy meetings (MPM) are not held the same day each month,[14] observations are constructed such that they include data for between-MPM periods, i.e. the first daily observation used to calculate data for month *t* is the day after the MPM in month *t* and the last observation is the day of the MPM in month *t*+1. To eliminate effects of potential outliers, 2.5% of the tails are trimmed away and, when available, data from January 2002 to July 2014 are used in the empirical analysis.

The analysis is focused on loans and deposits in Chilean pesos (CLP) with nominal and real interest rates, where loans are separated by type: consumer, commercial and mortgage. As

[13] For its abbreviation in Spanish: **F**acilidad de **l**iquidez **a** **p**lazo.

[14] During the period analyzed the earliest MPM was held the 4th day of the month and the latest, the 19th.

shown in table 2, the main part of the lending activity and deposits with nominal interest rates are in private banks, while the state-owned bank accounts for one third of deposits bearing a real interest rate. With respect to the lending market, table 3 shows that the main part of consumer and commercial loans is with nominal interest rate, while mortgage loans are with real rates. Real interest rate commercial loans are often real estate, e.g. a building or an office, but if a natural person buys land, this is also characterized as a commercial loan. Three quarters of the deposits yield a nominal rate in CLP, while the share with real rate is substantially smaller.

[Table 2]

[Table 3]

Loans with nominal rates are also analyzed for different horizons. This separation may be important as loans with different horizons differ with respect to the components they contain, as shown in table 4. While rates of amortizing loans are supposedly quite flexible as they are negotiated at the time of taking the loan, rates of overdrafts are often fixed by contracts and are typically renegotiated rarely. For this reason, a priori the MPR pass-through may be expected to be less for short-horizon loans, more so for consumer loans because of the weights and because firms probably have greater negotiating power than natural persons. As reported in table 5, the main part of consumer loans has relatively short horizons, while commercial loans are mainly medium-to-long-termed.

[Table 4]

[Table 5]

Because interest rates are calculated as weighted averages, the second, third and fourth moments, used as measures of changes in credit risks as explained in section 2, are also weighted by the amounts of the operations. Daily observations from each bank are applied to calculate the moments. As a measure of market risk, the variation of daily bank interest rates is calculated. More precisely, this risk is calculated as the weighted variance of daily interest rates of operations in the period between MPMs. Hence, higher variability indicates higher risk a given month.

To estimate pass-through coefficients, interbank rates, which are quite close to the MPR, are utilized. To allow for possible asymmetric pass-through, a separation is made between interbank rate changes when the MPR is increased and when it is lowered. Also the situation where the MPR is unchanged is included to evaluate to what extent noise in the interbank market affects changes of banks' interest rates. Three liquidity risk measures are included in the analysis, namely the variance of the interbank rate during the period, the difference between maximum and minimum rates, and the amount of operations in the interbank market.

Measures of MPR expectations are included to analyze whether surprises affect the way banks set interest rates. Expectations (median) are extracted from the Economic Expectations Survey published monthly by the CBC. As described in subsection 3.1, four dummy type variables are included in the analysis. Table 6 reports that during the period considered, the CBC has changed the MPR 58 times, 35 hikes and 23 reductions. Of the 93 times the CBC maintained the policy rate, the market expected hikes six times. When policy was contractionary it was usually expected by the private forecaster, but they were surprised four times, and other four times the change was larger than expected. Expansionary policy, on the other hand, often surprised the forecasters, i.e. ten of the 23 times the policy rate was reduced. About one third of the times it was in line with expectations and five times the policy was more expansionary than expected.

[Table 6]

3.2.2. Macroeconomic variables and interest rate risk measures

Three macroeconomic variables are included in the investigation: the business cycle, changes in the inflation rate, and changes in inflation expectations. The series are from the CBC and the business cycle is calculated with the monthly indicator of economic activity (Imacec) applying a Hodrick-Prescott filter with data spanning from January 1986 to September 2014. To account for the unconventional monetary policy conducted in 2009-10, the so-called term liquidity facility (FLAP) is included. This series includes observations from July 2009 to May 2010 and measures outstanding stock in millions of CLP. Daily observations are extracted from CBC bases and used to calculate between MPM monthly averages of which changes of logarithms are included in the econometric models.

One global and one local risk measure are also included in the models to account for interest rate risk. The global measure is the VIX of the Chicago Board Options Exchange extracted from its web page, while the local measure is the CBC's EMBI Chile. Daily observations are utilized and the data included in the estimations are changes of the logarithm of monthly averages for the between MPMs periods.

4. Empirical analysis

This section presents the results of the empirical analysis. A general-to-specific approach is applied and only the most parsimonious models are presented. Intermediate results are available upon request. First the results for total interest rates are presented followed by a discussion of how the results for nominal lending rates change when different lending horizons are taken into account. Subsection 4.3 discusses if the monetary pass-through is asymmetric, while the fourth subsection focuses on whether or not expectations of monetary policy matters for changes in the banks' interest rates.

Details on specifications of the models estimated are presented in appendix A. The tables show the dummies included in each of the models as well as outcomes of the Breusch-Pagan tests of no correlation of the residuals across equations, which clearly support the SUR approach adopted for the analysis. Tests on the residuals suggest that these are Gaussian distributed and not affected by autocorrelation. Finally, the tables reveal tests for inclusions of seasonal dummies in each of the models.[15]

[15] While statistical significance of these dummies cannot be interpreted as seasonality in the interest rates, regressions explaining the rates by seasonal dummies indicate that indeed the majority of the rates are affected by seasonality. Rates on consumer loans with horizons longer than a year seem to decrease more in March and increase more in April, September and December. Deposit rates seem to decrease more the two first months of the year and increase more in the last quarter, while mortgage rates increase more in January and decrease more in March and April. Murfin and Petersen (2014) argue that commercial lending rates in the U.S. are affected by seasonality.

4.1. Results for overall interest rates

Estimation results for total nominal and real rates are reported in table 7.[16] While nominal rates seem to have negative persistence, it is positive for the real rates. Monetary pass-through coefficients are statistically significant for the nominal rates, while this is the case only for real commercial and mortgage rates when the policy is expansionary. Point estimates indicate that MPR hikes result in contemporaneous higher increases in the total nominal rates and, in the case deposits, less than full contemporaneous pass-through when the MPR is lowered. Particularly in the case of consumer rates, expansionary monetary policy seems to result in more than complete pass-through instantaneously, which may be a sign of normalization of these rates that have a high spread with respect to the MPR, 27 percentage points on average for the period considered. Pass-through is explored in further detail in subsection 4.3. General movements of interbank rates affect only nominal deposit rates and those of mortgage loans.

[Table 7]

Interest rates of deposits and real commercial loan are to some extent affected by liquidity risk. Nominal commercial rates do not seem to be affected by the variability in the interbank market, while real ones decrease. With respect to deposit rates the coefficient is negative for nominal rates and positive for the real ones, suggesting that confronted with higher liquidity risk the banks have a preference for operating with real rates. This is also reflected in the mortgage rate that decreases when the spread of interbank market rates increases. When transacted amounts in the interbank market decrease, the banks lower the real rates of commercial loans, which again may reflect a preference for operations with real rates when liquidity risk increases. On the other hand, real deposit rates also decrease, which contradicts this argument and indicates certain precaution for paying real rates on deposits when the interbank market is less liquid.

Commercial loans and deposits are affected by increases in market risk in the sense that the rates increase, nominal as well as real. This indicates that higher uncertainty with respect to

[16] Wald tests of exclusions of the variables not reported in the table could not be rejected with *p*-values of 0.07 and 0.68 for nominal and real rates, respectively.

market risk implies higher rates on commercial loans and the banks prefer to a higher degree to finance loans with deposits. With respect to credit risk, this affects loans, but not deposits, as expected. Higher variability, and higher kurtosis in the case of nominal commercial loans, implies a preference for loans with real rates, such that nominal rates increases while real ones decrease. Also as expected, a shift in the client portfolio towards more risky ones implies higher lending rates.

Concerning interest rate risk, higher local risk implies that banks prefer to fund loans with nominal deposits and, hence, the nominal deposit rate increases. On the other hand, higher international risk increases rates on consumer loans and decreases those of nominal deposits and, hence, increases the spread of the banks. While the state of the business cycle does not affect how banks set interest rates, higher inflation and inflation expectations influence the real negatively, which suggests that when inflation and its expectation increase, banks prefer to grant loans with real rates, but they are less willing to receive deposits with real rates. The direct effect of the unconventional monetary policy in 2009-10 seems to have been on commercial loans with real interest rates.

Changes in the MPR affect mainly mortgage rates while MPR changes not met affect nominal commercial rates positively and non-expected policy changes affects nominal deposit rates negatively. Expected policy changes have positive effects on mortgage rates, as do larger than expected and unexpected changes. This suggests that banks to some extent anticipate MPR changes when fixing mortgage rates. The role of expectations to the monetary policy is studied in greater details in subsection 4.4.

4.2. Results for different horizons

This subsection reports the results for different lending horizons. First the results for nominal commercial lending rates are supplied followed by consumer rates.

4.2.1. Commercial lending rates

As shown in table 8,[17] there is some heterogeneity among interest rates of commercial loans with different maturities, though the negative persistence is present for al horizons. The

[17] The Wald test of model reduction could not be rejected with a *p*-value of 0.17.

pass-through is higher for MPR hikes, as with the overall rate, except for the one-to-three year horizon, where the coefficient is not statistically significant. Asymmetric pass-through is discussed in subsection 4.3. Only for loans with horizons between one and three months, about five percent of all loans, does general noise in interbank market rates affect the commercial rates.

[Table 8]

Growing uncertainty at the interbank market affects rates of medium-term loans positively and those with horizons longer than one year negatively, suggesting that increasing liquidity risk makes banks prefer commercial loans with longer horizons. Contrary to what was indicated for total commercial rates, though with a small coefficient, market risk impacts rates negatively for loans with maturities between one and three months and longer than one year, indicating the banks' preference for these horizons when facing increased insecurity at the bank lending market.

With respect to credit risk, the signs of the coefficients are as expected and in line with findings for the total rate. Changes in client portfolios have higher impact for loans with longer horizons, which also feature the main part of the transactions. Increased local risk affects the rate of loans with horizons between one and three months positively. In the three-to-twelve months segment it seems that increasing inflation expectations have positive impact on the lending rate.

MPR expectations have little impact on nominal commercial rates, though surprises seem to have some influence at the short-term rates, i.e. expected changes which are not met have positive impact on loans with horizons less than a month, while monetary policy surprises impacts rates of loans with horizons between one and three months. More analysis of the role of expectations is supplied in subsection 4.4.

4.2.2. Consumer rates

The estimations for the rates of consumer loans divided by lending horizons are shown in table 9.[18] As with the commercial rates, an increased rate in one month is followed by a

[18] The Wald test of model reduction could not be rejected with a *p*-value of 0.06.

decrease the following, ceteris paribus. For most of the rates, the pass-through of decreased MPR is higher than for hikes, in fact, in a couple of cases the point estimate of the pass-through is negative when the monetary policy is contractionary, which, as mentioned earlier, may have to do with a tightening of the spread to the MPR for these rates. The only statistically significant negative coefficient is found for the segment of horizons longer than three years, which accounts for about seven percent of total consumer loans. Variations in interbank market rates in months with no policy changes are transferred to the segment with the shortest maturity and that with horizons between one and three years.

[Table 9]

Liquidity risk seems to affect merely the rates of long-term loans, while increased market risk affects all segments even though it did not affect the overall rate. The effect is, however, different such that short-term rates decrease when market risk increases, while those at longer terms increase. This may reveal banks' preferences towards short-term consumer loans when market risk increases. With respect to credit risk, variability, including increased kurtosis, implies that rates on loans with maturities longer than one year increase. Changes in client portfolios also have the expected signs, such that rates of loans with horizons longer than one month are sensitive to these changes. The effect is larger the longer the lending horizon.

While interest rate risk does not have effect in any of the horizons, even though VIX changes affected the overall rate, inflation changes affect longer-termed rates positively. This may be explained by higher inflation uncertainty affecting long-term rates. Somewhat puzzling, however, increased inflation expectations seem to have negative impact on the one-to-three year rates, which contradicts this explanation for this particular segment. The FLAP seemed to have negative impact on short-term nominal consumer rates, which are also affected positively when the MPR changes are unexpected. Long-term rates are influenced by expected as well as unexpected MPR changes. This issue is explored further in subsection 4.4.

4.3. Characterizing the pass-through

This subsection takes a closer look at the pass-through of changes of the MPR. The first question asked is whether pass-through is instantaneously complete and symmetric. Using the model (1), the hypothesis is formulated as $H_0: \gamma_{j,1} = \gamma_{j,2} = 1$, where $\gamma_{j,i}$ is the i-th element of the vector γ_j. If this hypothesis is rejected, it is investigated if i) pass-through is symmetric ($H_0: \gamma_{j,1} = \gamma_{j,2}$), ii) if pass-through is instantaneously complete when the MPR increases ($H_0: \gamma_{j,1} = 1$), and iii) if pass-through is instantaneously complete when the MPR decreases ($H_0: \gamma_{j,2} = 1$). Table 10 presents the p-values for the total rates, while table 11 presents those for the tests for different maturities of nominal commercial and consumer loans.

[Table 10]

[Table 11]

Of the total interest rates, only for nominal commercial ones does the pass-through seem to be instantaneously complete and symmetric and this hypothesis cannot be rejected either for several of the horizons of nominal commercial and consumer loans. For nominal commercial rates with horizons between one and three months, the rejection of the hypothesis indicates that contractionary monetary policy may have higher pass-through than expansionary policy. The hypotheses of symmetric and instantaneously complete pass-through cannot be rejected for any of the other horizons, where the main part of the operations is situated. For consumer loans with nominal rates it is a similar situation, i.e. the pass-through seems to be symmetric and instantaneously complete for the segments with the main part of the operations. Hence, the conclusion is that, in general, is cannot be rejected that MPR pass-through to nominal lending rates is symmetric and instantaneously complete.[19] The pass-through to nominal deposit rate, on the other hand, seems to be complete when monetary policy is tightened, but not when it is loosened, where it is less than instantaneous complete.

[19] This result indicates a change in the Chilean retail banking sector as Espinosa-Vega and Rebucci (2004) found evidence of incomplete pass-through with data for the ten years previous to the period analyzed in this paper.

As expected the pass-through of changes of the nominal MPR to real rates is not instantaneous complete, but it is symmetric for commercial lending rates and deposit rates. For the real mortgage rate it seems that MPR decreases affect the rates with a higher impact than increases. This may be an indication of harder competition in the banking sector for this kind of loans during the period investigated.

4.4. Do policy expectations matter?

No strong evidence from the baseline analysis suggested that expectations about monetary policy are important for interest rate changes except in the cases of nominal consumer loans with long horizons and mortgage loans. In this subsection this issue is studied in greater detail as expectations are interacted directly with changes in the interbank rate. As shown in table 6, this implies in some cases very few available observations and, thus, a small sample caveat is in place for this analysis, which should be seen as merely illustrative.

The general model for each of the equations is

$$\Delta i_{jt} = \beta_j' \Delta x_{jt} + \gamma_j' vec(I_{2t} I_{1t}') \Delta r_t + \delta_j' \Delta z_t + \emptyset_j' D_t + \varepsilon_t, \tag{2}$$

where some of the elements in $vec(I_{2t} I_{1t}')$ by construction are zero and Δz_t is the same as when presented in subsection 3.1 excluding the first and last rows. Hence, model (2) includes eight different situations: i) expected MPR increase, ii) higher than expected increase, iii) unexpected increase, iv) expected MPR decrease, v) higher than expected decrease, vi) unexpected decrease, vii) expected maintenance, and viii) maintenance where an increase was expected. Thus, all the situations that occurred during the period analyzed, according to table 6, are included in the analysis.

Results for total rates are presented in table 12, while tables 13 and 14 report results for different horizons of commercial and consumer loans with nominal rates. The pass-through to nominal total rates is the same no matter what the expectation was, which suggests that banks do not change these rates on the basis of expectation but rather wait until they observe the actual outcome at the policy meeting.

[Table 12]

[Table 13]

[Table 14]

Looking at different maturities for commercial and consumer loans, some exceptions appear. Rates for commercial loans with horizons between one and three years the pass-though is larger if the MPR decrease is a surprise. Rates of commercial loans with horizons between three months and three years react to changes in the interbank rate, when the CBC maintained the MPR while an increase was expected. In fact, for horizons longer than one month point estimates indicate that this is the case. For consumer rates with lending horizons shorter than one month and between three and twelve months the pass-through of more than expected decreases have less impact, though it should be taken into account that this happened mainly during the financial crisis.

The setting of real rates also seems to be independent of policy expectations except in the case of mortgage rates when MPR increases are larger than expected. In this case, banks seem to lower the mortgage rate, which might be related to expectations of higher future inflation.

5. Conclusion

This paper presented an analysis applying intra-policy-meting observations computed with daily data. Based on theoretical contributions, several empirical measures of risk were introduced and constructed for use in the analysis. Hence, liquidity, market, credit, and interest rate risks were considered as potentially important variables for banks when determining interest rates. Finally, possible asymmetric monetary policy rate pass-through and the role of policy expectations were also considered as possibly essential parameters for banks when setting their rates. Both nominal and real rates were analyzed and the first mentioned were also investigated with respect to different lending maturities.

Tests revealed the presence of correlation between the residuals of the regressions estimated with ordinary least squares and, hence, the approach of seemingly unrelated regressions was adopted to obtain more efficient estimates. The results of the empirical analysis suggested that pass-through of changes of the monetary policy rate (MPR) to nominal lending rates is generally instantaneously complete and symmetric, while it is symmetric to real rates of commercial loans and deposits when controlling for different risk measures, macroeconomic factors and expectations of MPR changes. Liquidity risks seem to affect the setting of the rates deposits and real commercial rates, while market risk affects commercial loans and deposits, both with nominal and real rates. As expected, credit risk affects only rates of loans, and interest rate risk influences mainly the fixing of nominal deposit rates. Generally the role of MPR expectations is limited, though some evidence suggests that there is an effect on nominal loans with certain horizons and mortgage loans.

Understanding how banks set interest rates is important for understanding the functioning of the monetary transmission mechanism. This study shed some light on this issue and introduced variables which should be taken into account when evaluating the interest rate pass-through. In this sense, the results presented may be of interest to policy makers when evaluating the impact of policy rate changes as well as changes in different measures of risk.

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Appendix A: Model Specifications

[Table A1]

Tables

Table 1. Changes in interest rate distribution

	MPR	$\bar{x}^{w}$	σ^{2w}	σ^{3w}	σ^{4w}
Dec. 2003	2.25	5.68	11.60	4.71	28.92
Jan. 2004	1.75	6.85	19.97	1.77	3.27

Source: Author's elaboration with data from the Central Bank of Chile.
Note: Total commercial interest rate.

Table 2. Structure of the Chilean financial system (2013)

		Nominal interest rate		Real interest rate	
	Number	% loans	% deposits	% loans	% deposits
Foreign banks	14	44.6	49.9	37.9	30.6
Local private banks	10	50.7	43.1	53.0	35.2
State-owned bank	1	4.7	7.0	9.2	34.2

Source: Author's elaboration with data from the Central Bank of Chile.

Table 3. Structures of the Chilean lending and deposit markets (2013)
(percentage)

	Com.	Cons.	Mort.	Dep.
Nominal	78.8	99.1	0.0	74.7
Real	10.0	0.9	100.0	6.0
USD	11.1	0.1	0.0	19.2

Source: Author's elaboration with data from the Central Bank of Chile.
Notes: Com: Commercial loans, Cons: Consumer loans, Mort: Mortgage loans, Dep: Deposits. Nominal (Real): Loans and deposits in CLP with nominal (real) interest rate. USD: Loans and deposits in USD.

Table 4. Distribution of commercial and consumption interest rates
(percentage)

Chile	IFRS		< 1M	1-3M	3-12M	1-3Y	>3Y
Commercial rates							
1105	1302.1.01	Amortizing loan	68.1	53.1	40.5	38.2	59.8
1145	1302.3	Approved overdraft current account	9.4	4.8	55.3	60.2	32.1
1150	1302.9.02	Approved overdraft other accounts and credit cards	3.6	0.0	3.8	0.1	0.0
1155	1302.9.01	Non-approved overdraft current account	18.9	41.9	0.0	0.0	0.0
1160	1302.9.11	Credit card purchases paid in fees	0.0	0.1	0.3	0.1	0.1
1165	1302.9.12	Revolving credit card debt	0.0	0.1	0.0	1.4	8.0
Consumption rates							
Chile	IFRS		< 1M	1-3M	3-12M	1-3Y	>3Y
1205	1305.1	Amortizing loan	2.1	11.0	7.7	25.7	37.8
1210	1305.9.81	Credit paid in fees via paycheck	0.0	0.0	0.2	1.5	3.3
1220	1305.3	Approved overdraft current account	6.1	14.8	52.3	26.1	8.5
1225	1305.9.01	Approved overdraft other accounts and credit cards	21.9	0.1	5.1	1.8	0.0
1230	1305.9.01	Non-approved overdraft current account	69.8	20.3	0.0	0.0	0.0
1235	1305.4.01	Credit card purchases paid in fees	0.0	53.8	34.2	8.2	2.2
1240	1305.4.02	Revolving credit card debt	0.0	0.0	0.6	36.6	48.2

Source: Central Bank of Chile and International Financial Reporting Standards (IFRS).
Notes: Chile (IFRS): Classification in Chile and IFRS.

Table 5. Distribution between lending horizons
(percentage)

	Com.	Cons.
< 30 days	4.4	23.2
30 - 89 days	5.0	29.4
90 days - 1 year	29.9	36.8
1 - 3 years	26.2	3.8
> 3 years	34.4	6.7

Source: Central Bank of Chile.
Note: See table 3.

Table 6. Monetary policy decisions and expectations (Jan.02 – Jul.14)
(numbers of meetings, percentage)

ΔMPR = 0	**93 (61.6%)**	
E(ΔMPR) = ΔMPR		87 (93.5%)
E(ΔMPR) > 0		6 (6.5%)
ΔMPR > 0	**35 (23.2%)**	
E(ΔMPR) = ΔMPR		27 (77.1%)
E(ΔMPR) = 0		4 (11.4%)
0 < E(ΔMPR) < ΔMPR		4 (11.4%)
ΔMPR < 0	**23 (15.2%)**	
E(ΔMPR) = ΔMPR		8 (34.8%)
E(ΔMPR) = 0		10 (43.5%)
0 > E(ΔMPR) > ΔMPR		5 (21.7%)

Source: Author's elaboration with data from the Central Bank of Chile.

Table 7. Estimation results. Dependent variable: Change in interest rate

	Nominal rates			Real rates		
	Com.	Cons.	Dep.	Com.	Mort.	Dep.
Δi_{t-1}	-0.09** (0.05)	-0.06 (0.05)	-0.16*** (0.06)	-0.02 (0.06)	0.28*** (0.04)	0.39*** (0.15)
$\Delta r_t \times I(\Delta MPR_t > 0)$	1.28*** (0.17)	1.17** (0.49)	1.17*** (0.11)	0.29 (0.22)	-0.06 (0.09)	0.35 (0.28)
$\Delta r_t \times I(\Delta MPR_t < 0)$	1.01*** (0.09)	1.63*** (0.24)	0.73*** (0.08)	0.49*** (0.11)	0.25*** (0.04)	0.24 (0.18)
$\Delta r_t \times I(\Delta MPR_t = 0)$			0.50** (0.22)		0.54*** (0.13)	
$\Delta \sigma_t^2(r_t)$			-1.71*** (0.53)	-3.77*** (1.00)		10.37*** (1.29)
$\Delta(r_t^{max} - r_t^{min})$					-0.37** (0.16)	
$\Delta \ln(Q_t^r)$				0.37*** (0.09)		0.29*** (0.10)
$\Delta \sigma_t^{2w}(i_t^{sys})$	0.005*** (0.002)		0.03*** (0.004)	0.08*** (0.01)		0.36*** (0.04)
$\Delta \sigma_t^{2w}(i_t)$	0.07*** (0.01)	0.02*** (0.01)		-0.13*** (0.05)	-0.15*** (0.03)	
$\Delta \sigma_t^{3w}(i_t)$	-1.20*** (0.16)	-4.23*** (0.32)		-0.16*** (0.04)	-0.02*** (0.01)	
$\Delta \sigma_t^{4w}(i_t) - 3$	0.10*** (0.02)					
$\Delta \ln(EMBI_t)$			0.29** (0.14)			
$\Delta \ln(VIX_t)$		1.27*** (0.44)	-0.22** (0.10)			
$Y_t - \bar{Y}_t$						
$\Delta \pi_t$				-0.13** (0.06)		-0.32*** (0.06)
$\Delta E(\pi_t)$				-0.48*** (0.16)	-0.10** (0.04)	
$\Delta \ln(FLAP_t)$				-0.89** (0.37)		
$I(E(\Delta MPR_t) = \Delta MPR_t \neq 0)$					0.09*** (0.03)	
$I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t \neq 0)$					0.13*** (0.05)	
$I(0 = E(\Delta MPR_t) \neq \Delta MPR_t \neq 0)$			-0.11** (0.04)		0.09*** (0.03)	
$I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t = 0)$	0.30** (0.12)					
Obs.	150	150	150	150	149	150
$\bar{R}^2$	0.74	0.74	0.85	0.69	0.83	0.75

Source: Author's elaboration.

Note: See table 3. Numbers in brackets are standard errors. */**/***: Statistical significant when applying a 10%/5%/1% confidence level.

Table 8. Estimations results. Dependent variable: Change in commercial interest rate

	< 1M	1-3M	3-12M	1-3Y	>3Y
Δi_{t-1}	-0.08** (0.04)	-0.18*** (0.05)	-0.20*** (0.05)	-0.11*** (0.03)	-0.18*** (0.04)
$\Delta r_t \times I(\Delta MPR_t > 0)$	1.24*** (0.18)	1.62*** (0.23)	1.10*** (0.23)	0.43 (0.49)	2.17*** (0.64)
$\Delta r_t \times I(\Delta MPR_t < 0)$	1.10*** (0.09)	1.16*** (0.13)	0.92*** (0.12)	1.33*** (0.23)	1.19** (0.30)
$\Delta r_t \times I(\Delta MPR_t = 0)$		1.03** (0.50)			
$\Delta\sigma_t^2(r_t)$			2.81** (0.95)		
$\Delta(r_t^{max} - r_t^{min})$				-2.94** (1.29)	-4.25** (1.70)
$\Delta\ln(Q_t^r)$					
$\Delta\sigma_t^{2w}(i_t^{sys})$		-0.23*** (0.04)		-0.04*** (0.01)	-0.11*** (0.01)
$\Delta\sigma_t^{2w}(i_t)$	0.03*** (0.004)	0.19*** (0.02)	0.07*** (0.01)	0.07*** (0.01)	0.07*** (0.01)
$\Delta\sigma_t^{3w}(i_t)$	-1.31*** (0.13)	-0.59*** (0.10)	-1.64*** (0.18)	-5.45*** (0.27)	-3.47*** (0.28)
$\Delta\sigma_t^{4w}(i_t) - 3$	0.10*** (0.02)	0.05*** (0.01)	0.20*** (0.03)	0.73*** (0.06)	0.30*** (0.06)
$\Delta\ln(EMBI_t)$		0.99*** (0.28)			
$\Delta\ln(VIX_t)$					
$Y_t - \bar{Y}_t$					
$\Delta\pi_t$					
$\Delta E(\pi_t)$			0.34** (0.15)		
$\Delta\ln(FLAP_t)$					
$I(E(\Delta MPR_t) = \Delta MPR_t \neq 0)$					
$I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t \neq 0)$					
$I(0 = E(\Delta MPR_t) \neq \Delta MPR_t \neq 0)$		-0.34** (0.15)			
$I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t = 0)$	0.37*** (0.13)				
Obs.	150	150	150	150	150
$\bar{R}^2$	0.83	0.76	0.68	0.87	0.81

Source: Author's elaboration.
Note: See table 7.

Table 9. Estimations results. Dependent variable: Change in consumer interest rate

	< 1M	1-3M	3-12M	1-3Y	>3Y
Δi_{t-1}	0.01	-0.11**	-0.18***	-0.09*	-0.02
	(0.04)	(0.05)	(0.06)	(0.04)	(0.04)
$\Delta r_t \times I(\Delta MPR_t > 0)$	-0.44	0.61	1.65**	1.79***	-1.70**
	(0.77)	(1.20)	(0.70)	(0.48)	(0.80)
$\Delta r_t \times I(\Delta MPR_t < 0)$	1.54***	0.60	1.14***	1.77***	1.48***
	(0.42)	(0.57)	(0.33)	(0.25)	(0.31)
$\Delta r_t \times I(\Delta MPR_t = 0)$	5.29***			2.12**	
	(1.66)			(1.04)	
$\Delta \sigma_t^2(r_t)$					4.34*
					(2.31)
$\Delta(r_t^{max} - r_t^{min})$					
$\Delta \ln(Q_t^r)$					
$\Delta \sigma_t^{2w}(i_t^{sys})$	-0.09***	-0.03***	0.04***	0.03***	0.02**
	(0.005)	(0.01)	(0.01)	(0.01)	(0.01)
$\Delta \sigma_t^{2w}(i_t)$				0.04***	0.05***
				(0.01)	(0.01)
$\Delta \sigma_t^{3w}(i_t)$		-0.82***	-1.30***	-3.99***	-4.39***
		(0.14)	(0.19)	(0.25)	(0.25)
$\Delta \sigma_t^{4w}(i_t) - 3$				0.75***	0.82***
				(0.23)	(0.20)
$\Delta \ln(EMBI_t)$					
$\Delta \ln(VIX_t)$					
$Y_t - \bar{Y}_t$					
$\Delta \pi_t$				0.32***	0.41***
				(0.11)	(0.12)
$\Delta E(\pi_t)$				-0.68**	
				(0.32)	
$\Delta \ln(FLAP_t)$	-2.22*				
	(1.26)				
$I(E(\Delta MPR_t) = \Delta MPR_t \neq 0)$					0.65***
					(0.24)
$I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t \neq 0)$	2.03***				1.27***
	(0.54)				(0.42)
$I(0 = E(\Delta MPR_t) \neq \Delta MPR_t \neq 0)$					0.80***
					(0.26)
$I(0 \neq E(\Delta MPR_t) \neq \Delta MPR_t = 0)$					0.92***
					(0.34)
Obs.	150	150	150	150	150
$\bar{R}^2$	0.78	0.47	0.30	0.86	0.86

Source: Author's elaboration.
Note: See table 7.

Table 10. *p*-values of coefficient tests. Total rates

	Nominal rates			Real rates		
	Com.	Cons.	Dep.	Com.	Mort.	Dep.
$H_0: \gamma_{j,1} = \gamma_{j,2} = 1$	0.26	0.03	0.00	0.00	0.00	0.00
$H_0: \gamma_{j,1} = \gamma_{j,2}$		0.41	0.00	0.41	0.00	0.67
$H_0: \gamma_{j,1} = 1$		0.72	0.12	0.00	0.00	0.02
$H_0: \gamma_{j,2} = 1$		0.01	0.00	0.00	0.00	0.00

Source: Author's elaboration.
Note: See table 3.

Table 11. *p*-values of coefficient tests

	< 1M	1-3M	3-12M	1-3Y	>3Y
Commercial					
$H_0: \gamma_{j,1} = \gamma_{j,2} = 1$	0.23	0.01	0.71	0.21	0.14
$H_0: \gamma_{j,1} = \gamma_{j,2}$		0.10			
$H_0: \gamma_{j,1} = 1$		0.01			
$H_0: \gamma_{j,2} = 1$		0.24			
Consumption					
$H_0: \gamma_{j,1} = \gamma_{j,2} = 1$	0.12	0.72	0.57	0.00	0.00
$H_0: \gamma_{j,1} = \gamma_{j,2}$				0.98	0.00
$H_0: \gamma_{j,1} = 1$				0.35	0.00
$H_0: \gamma_{j,2} = 1$				0.00	0.12

Source: Author's elaboration.

Table 12. Importance of expectations. Total rates

	Nominal rates			Real rates		
	Com.	Cons.	Dep.	Com.	Mort.	Dep.
$\boldsymbol{I(\Delta MPR_t > 0)}$						
$\Delta MPR_t = E(\Delta MPR_t)$	1.32***	0.99*	1.19***	0.24	0.03	0.39
	(0.19)	(0.53)	(0.12)	(0.24)	(0.09)	(0.32)
$\Delta MPR_t > E(\Delta MPR_t) > 0$	1.05**	2.11*	0.89***	0.57	-0.70***	0.25
	(0.41)	(1.14)	(0.21)	(0.50)	(0.23)	(0.58)
$\Delta MPR_t > E(\Delta MPR_t) = 0$	1.75**	-0.03	1.82***	0.31	0.16	0.33
	(0.79)	(2.24)	(0.61)	(0.97)	(0.41)	(1.25)
$H_0: \gamma_{j,1} = \gamma_{j,2} = \gamma_{j,4}$	0.70	0.59	0.23	0.83	0.01	0.97
$\boldsymbol{I(\Delta MPR_t < 0)}$						
$\Delta MPR_t = E(\Delta MPR_t)$	0.92***	2.00***	0.66***	0.72***	0.21***	0.17
	(0.19)	(0.54)	(0.11)	(0.23)	(0.07)	(0.31)
$\Delta MPR_t < E(\Delta MPR_t) < 0$	1.05***	1.50***	0.74***	0.47***	0.34***	0.26
	(0.10)	(0.26)	(0.08)	(0.12)	(0.05)	(0.20)
$\Delta MPR_t < E(\Delta MPR_t) = 0$	0.81**	2.35***	0.89***	0.39	0.28	0.33
	(0.31)	(0.85)	(0.29)	(0.38)	(0.19)	(0.44)
$H_0: \gamma_{j,5} = \gamma_{j,6} = \gamma_{j,8}$	0.66	0.47	0.65	0.58	0.34	0.93
$\boldsymbol{I(\Delta MPR_t = 0)}$						
$\Delta MPR_t = E(\Delta MPR_t)$	-0.01	1.60	0.44*	-0.11	0.46***	-0.00
	(0.43)	(1.20)	(0.24)	(0.56)	(0.14)	(0.64)
$\Delta MPR_t < E(\Delta MPR_t)$	1.56	2.01	0.91	-1.81	0.87**	0.01
	(1.67)	(2.97)	(0.57)	(1.33)	(0.35)	(1.54)
$H_0: \gamma_{j,9} = \gamma_{j,12}$	0.34	0.90	0.44	0.24	0.30	0.99

Source: Author's elaboration.

Notes: See table 7. Numbers in the lines stating the null hypotheses are *p*-values.

Table 13. Importance of expectations. Commercial rates

	< 1M	1-3M	3-12M	1-3Y	>3Y
$\boldsymbol{I(\Delta MPR_t > 0)}$					
$\Delta MPR_t = E(\Delta MPR_t)$	1.22***	1.64***	1.08***	0.60	2.13***
	(0.20)	(0.24)	(0.25)	(0.51)	(0.70)
$\Delta MPR_t > E(\Delta MPR_t) > 0$	1.15***	2.02**	1.46***	0.31	2.27
	(0.41)	(0.86)	(0.52)	(1.15)	(1.49)
$\Delta MPR_t > E(\Delta MPR_t) = 0$	2.12***	0.63	0.81	-2.14	3.47
	(0.81)	(0.97)	(1.01)	(2.15)	(3.05)
$H_0: \gamma_{j,1} = \gamma_{j,2} = \gamma_{j,4}$	0.53	0.52	0.77	0.44	0.91
$\boldsymbol{I(\Delta MPR_t < 0)}$					
$\Delta MPR_t = E(\Delta MPR_t)$	0.92***	0.83***	0.76***	0.39	1.00
	(0.20)	(0.26)	(0.24)	(0.51)	(0.68)
$\Delta MPR_t < E(\Delta MPR_t) < 0$	1.12***	1.21***	0.94***	1.39***	1.11***
	(0.10)	(0.22)	(0.13)	(0.25)	(0.33)
$\Delta MPR_t < E(\Delta MPR_t) = 0$	1.46***	1.20***	0.99**	2.64***	2.45**
	(0.36)	(0.37)	(0.40)	(0.83)	(1.14)
$H_0: \gamma_{j,5} = \gamma_{j,6} = \gamma_{j,8}$	0.38	0.46	0.78	0.04	0.50
$\boldsymbol{I(\Delta MPR_t = 0)}$					
$\Delta MPR_t = E(\Delta MPR_t)$	0.53	1.07*	0.07	-1.15	0.74
	(0.43)	(0.57)	(0.58)	(1.19)	(1.75)
$\Delta MPR_t < E(\Delta MPR_t)$	-1.27	2.73**	3.75***	8.40***	7.16*
	(1.72)	(1.32)	(1.35)	(2.89)	(3.96)
$H_0: \gamma_{j,9} = \gamma_{j,12}$	0.31	0.25	0.01	0.00	0.14

Source: Author's elaboration.
Note: See table 12.

Table 14. Importance of expectations. Consumer rates

	< 1M	1-3M	3-12M	1-3Y	>3Y
$\boldsymbol{I(\Delta MPR_t > 0)}$					
$\Delta MPR_t = E(\Delta MPR_t)$	-0.40	0.54	1.07	1.96***	-1.17
	(0.79)	(1.30)	(0.75)	(0.52)	(0.91)
$\Delta MPR_t > E(\Delta MPR_t) > 0$	0.12	2.02	4.33***	0.82	-3.05
	(2.96)	(2.79)	(1.60)	(1.09)	(1.95)
$\Delta MPR_t > E(\Delta MPR_t) = 0$	-1.09	-9.98*	-0.27	1.47	-2.95
	(3.34)	(5.51)	(3.17)	(2.15)	(3.27)
$H_0: \gamma_{j,1} = \gamma_{j,2} = \gamma_{j,4}$	0.96	0.14	0.16	0.62	0.62
$\boldsymbol{I(\Delta MPR_t < 0)}$					
$\Delta MPR_t = E(\Delta MPR_t)$	3.24***	1.87	2.60***	1.42***	1.07*
	(0.78)	(1.28)	(0.74)	(0.54)	(0.60)
$\Delta MPR_t < E(\Delta MPR_t) < 0$	0.64	0.22	0.69*	1.81***	1.78***
	(0.67)	(0.63)	(0.36)	(0.27)	(0.44)
$\Delta MPR_t < E(\Delta MPR_t) = 0$	3.33**	1.80	2.27*	2.40***	1.63
	(1.48)	(2.11)	(1.22)	(0.82)	(1.52)
$H_0: \gamma_{j,5} = \gamma_{j,6} = \gamma_{j,8}$	0.03	0.43	0.04	0.58	0.63
$\boldsymbol{I(\Delta MPR_t = 0)}$					
$\Delta MPR_t = E(\Delta MPR_t)$	6.72***	4.43	1.88	2.56**	2.10*
	(1.80)	(3.03)	(1.73)	(1.15)	(1.14)
$\Delta MPR_t < E(\Delta MPR_t)$	1.91	0.16	5.35	2.89	-3.84
	(4.35)	(7.13)	(4.16)	(2.82)	(4.66)
$H_0: \gamma_{j,9} = \gamma_{j,12}$	0.31	0.58	0.44	0.92	0.21

Source: Author's elaboration.
Note: See table 12.

Table A1. Model specifications

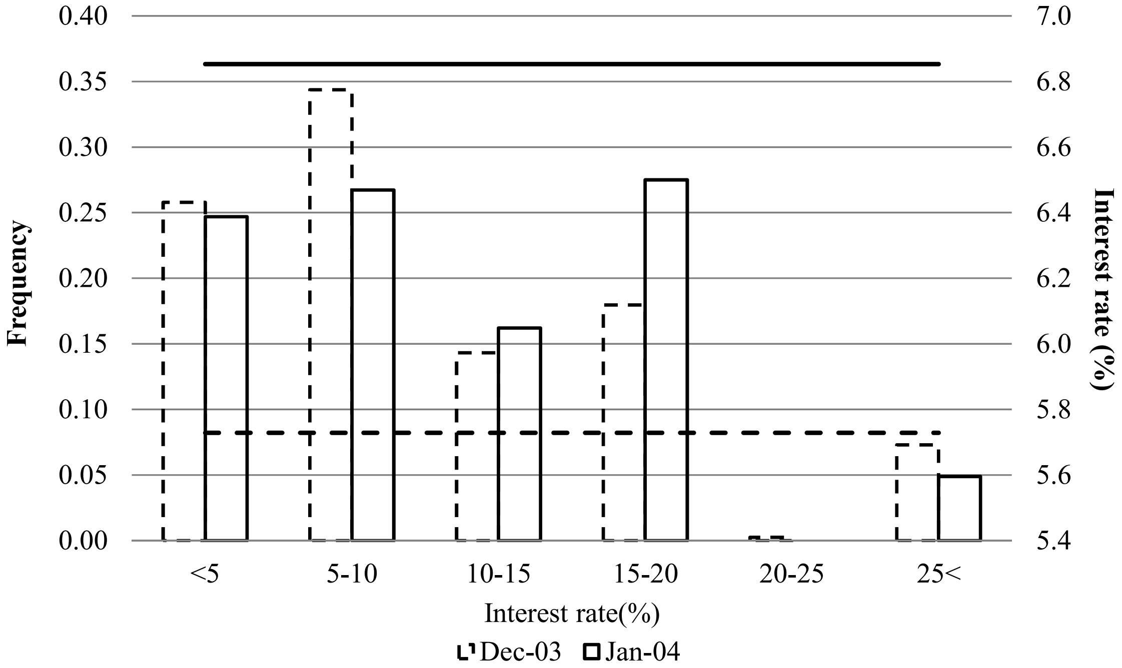
	Dummies	BP	JB	Q(2)	Q(12)	Seas. Dum Min(t)	Seas. Dum $\chi^2(11)$
Nominal		0.00	1.00	0.22	0.08		
Com.			0.10			0.37	0.62
Cons.	14m6		0.19			0.00	0.00
Dep.	09m1, 09m2		0.38			0.00	0.00
Real		0.01	1.00	0.05	0.09		
Com.			0.20			0.00	0.00
Mort.	03m1, 03m2, 03m4, 03m5, 04m4, 08m10, 09m5, 09m12		0.16			0.00	0.29
Dep.	06m11, 07m12, 13m5		0.97			0.00	0.00
Commercial		0.00	1.00	0.06	0.18		
< 1M	12m11		0.53			0.18	0.43
1-3M	02m4		0.80			0.27	0.55
3-12M	09m8, 11m10, 13m3		0.06			0.00	0.02
1-3Y	03m4, 11m9, 14m7		0.40			0.16	0.03
> 3Y	02m4, 02m12, 03m4, 04m3, 05m1		0.31			0.00	0.00
Consumption		0.00	1.00	0.17	0.40		
< 1M	04m1, 04m3		0.12			0.01	0.09
1-3M	04m4, 14m4, 14m6		0.12			0.01	0.11
3-12M			0.45			0.06	0.02
1-3Y			0.74			0.00	0.00
> 3Y	08m7, 08m9, 12m12		0.06			0.00	0.00

Source: Author's elaboration.

Notes: See table 3. BP: *p*-values of the Breusch-Pagan test of no contemporaneously correlation of errors across equations. JB: *p*-values of the Jarque-Bera statistics of normal distributed errors (Doornik and Hansen, 2008). Q(2) / Q(12): *p*-values of Pormanteau tests of no autocorrelation of order 2 and 12. Min(t): Minimum *p*-value of the *t*-statistics of each of the seasonal dummies. $\chi^2(11)$: *p*-value of the Wald test for exclusion of the seasonal dummies.

Figures

Figure 1. Histograms of commercial rates, Dec.-03 and Jan.-04



Source: Author's elaboration with data from the Central Bank of Chile.
Notes: Horizontal lines are weighted averages of the interest rate shown at the right axis.