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POLICY INTEREST RATE EXPECTATIONS AND THE BEHAVIOR OF THE INTERBANK MONEY MARKET

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Policy Interest Rate Expectations and the Behavior of the Interbank Money Market*

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Abstract

This article analyzes the influence of monetary policy rate expectations on the daily reserve accumulation behavior of financial institutions in the Peruvian interbank money market. Using daily data from 39 institutions between January 2017 and September 2024, we show that expectations of policy rate hikes are associated with a faster pace of reserve build-up, while expectations of rate cuts are followed by a slower accumulation pattern. These findings suggest that reserve accumulation dynamics reflect not only liquidity needs driven by legal reserve requirements but also strategic responses to anticipated changes in the policy interest rate. Our empirical analysis, based on fixed-effects panel regressions, provides evidence on the existence of a significant effect of rate expectations on reserve build-up, providing valuable insights for commercial bank's liquidity management strategies and the design of central bank open market operations.

Keywords reserve requirements · interbank market · monetary policy expectations

1 Introduction

Since the Global Financial Crisis (GFC), there has been increased interest in understanding central banks' monetary policy implementation schemes and their consequences for financial markets and macroeconomic dynamics (Freixas and Jorge (2008); Gertler and Kiyotaki (2010); Afonso and Lagos (2015); Bianchi and Bigio (2022); Baglioni (2024); Afonso et al. (2024)). Despite the growing relevance of expectations as major drivers of financial markets and the macroeconomy, their role in influencing the interbank money market and the implementation of monetary policy has not been assessed.

Given the interest rate targeting approach widely undertaken by central banks (Bindseil (2004)), the expected monetary policy rate determines the expected value of the price of interbank reserve funds. When a rate cut (hike) is anticipated,

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financial institutions would expect to accumulate reserves at a lower (higher) price following the monetary policy decision. Therefore, they may be incentivized to reduce (increase) their demand for reserves in the days leading up to the decision, and subsequently increase (decrease) it to meet the monthly reserve requirement once the rate cut is implemented (or not).

As the interbank money market demand depends on policy rate expectations, the volume of traded funds and the level of the interbank interest rate might be influenced by these. While an optimal scheme of monetary policy implementation needs to acknowledge this relationship, it has not been previously analyzed in the literature. Previous research on the interbank money market behavior has emphasized the role of open market operations, the liquidity effect (Hamilton (1997)) and its relationship with the level of excess reserves (Afonso et al. (2024)). Although the relevance of policy rate expectations on the formation of the equilibrium interbank interest rate has been discussed (Hamilton (1996)), the influence of expected changes has not. Expected changes, however, have been proven to affect interest rates in varying maturities (Ito (2017)).

In this paper, we address this gap by assessing the role of monetary policy rate expectations in shaping the daily reserve accumulation behavior of financial institutions in the interbank money market. Specifically, we explore how anticipated changes in the policy interest rate, captured through market-based surveys, affect the timing and pace of reserve build-up across financial institutions in Peru. To address this question, we use a unique daily panel dataset from January 2017 to September 2024, which includes non-public data on reserve accumulation provided by the Central Reserve Bank of Peru (BCRP). We estimate a series of fixed-effects panel regressions that account for unobserved heterogeneity across institutions. Furthermore, we control for the actual policy rate, opening liquidity, calendar effects, and deviations between expected and realized policy rate decisions.

This paper contributes to the literature by providing the first assessment on how expectations on the policy rate evolution shape the behavior of the interbank money market. Understanding this relationship is relevant for the optimal design of open market operations and monetary policy implementation schemes, as well as commercial banks' strategies for liquidity management in portfolio decisions.

Our empirical findings indicate that expectations about the monetary policy rate have a significant impact on the pace of reserve accumulation. In particular, anticipated policy rate hikes prompt a faster build-up of reserves, while expectations of rate cuts lead financial institutions to postpone reserve accumulation. These effects emerge during the first week of each reserve requirement period and persist throughout the month. The results remain robust across different model specifications, alternative approaches to measuring monetary policy expectations, and to the COVID-19 pandemic period. These findings underscore the central role of expectations in shaping bank behavior and interbank liquidity dynamics, with important implications for the design and implementation of central bank operations.

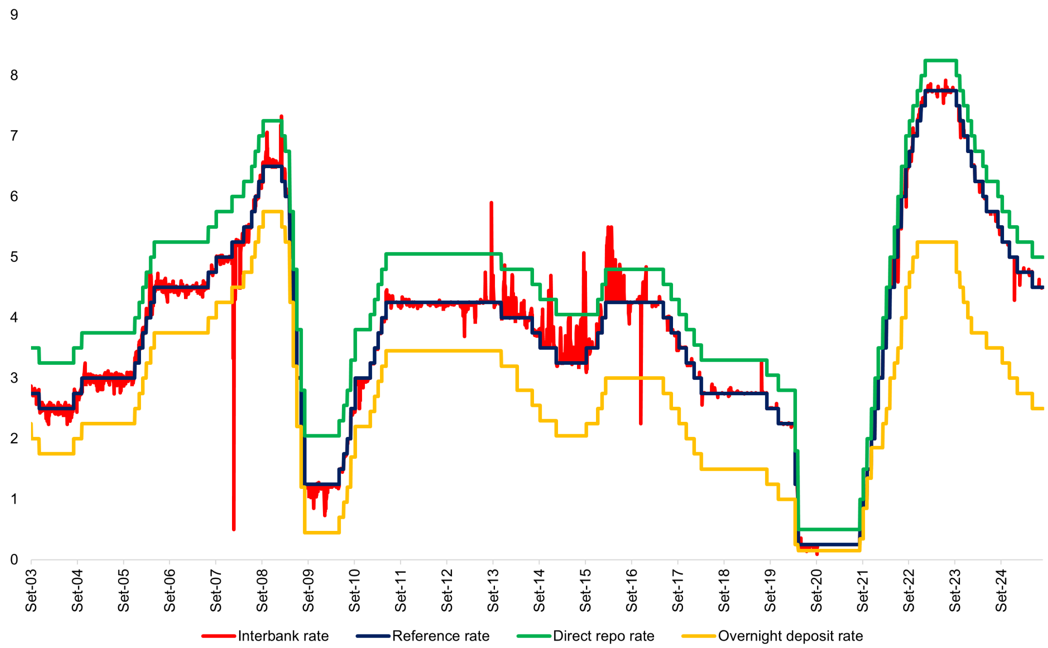
The remainder of this paper is organized as follows. Section 2 describes the Peruvian interbank money market institutional context. Section 3 presents the literature review. Section 4.1 describes the data and provides descriptive statistics. Section 4.3 outlines the empirical model. Section 4.4 reports the empirical results. In Section 4.5, we test the robustness of our findings. Finally, Section 5 concludes and suggests directions for future research.

2 Institutional Context

As standard, the interbank money market constitutes the arena for monetary policy implementation in Peru. In this market, banks negotiate overnight loans on reserve funds. The resulting average interest rate is known as the overnight interbank interest rate (TIBO)[2]. The monetary authority conducts daily open market operations to balance the supply and demand for reserve funds at a level consistent with its operational target for monetary policy. In doing so, the BCRP seeks to keep the overnight interbank interest rate close to its reference rate and within the interest rate corridor, as illustrated in Figure 1. Hence, a proper understanding of the factors that may influence the supply and demand conditions for reserve funds contributes to the optimal design of the BCRP's liquidity operations.

[2]The TIBO is defined as the weighted average interest rate of uncollateralized loans conducted among private commercial banks in domestic currency with a one-day maturity, excluding outlier values to ensure the representativeness of the indicator. See Banco Central de Reserva del Perú (2023) for a technical description. The TIBO is determined according to the prevailing supply and demand conditions in the interbank lending market, where commercial banks exchange liquid reserves through one-day loans.

Figure 1: Reference rate, interbank rate and interest rate corridor
(In percent)



Note: The direct repo rate and the overnight deposit rate are the interest rates set by the BCRP for its standing facility operations in domestic currency with financial institutions.

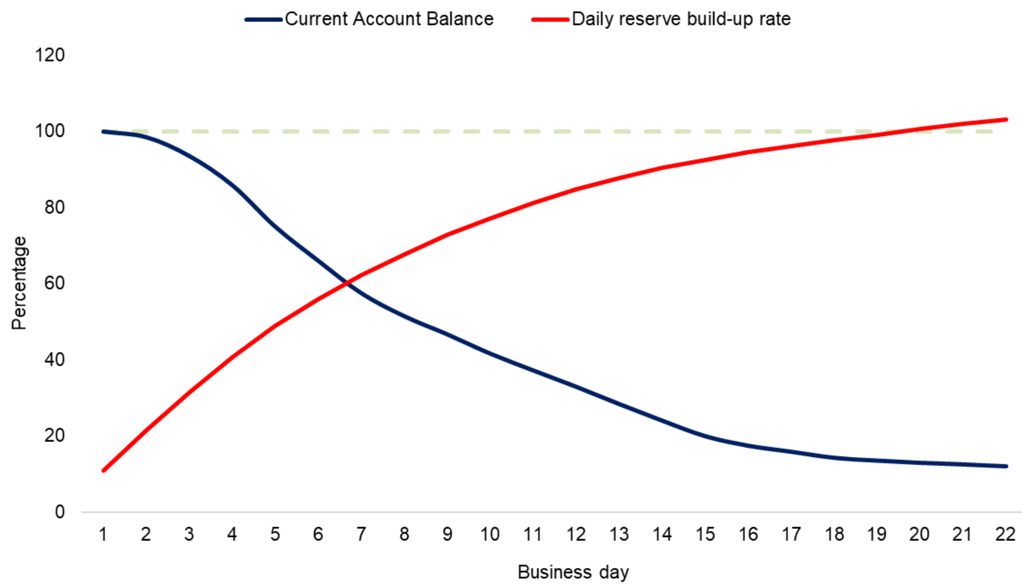
Motives for demanding reserve funds can be varied, such as liquidity management in portfolio decisions, meeting non-negative reserves rules, customer deposit withdrawals and meeting reserves requirements over maintenance periods. The required reserve obligations for financial institutions are established by the BCRP through a minimum reserve ratio[3] and represent a legal mandate for these institutions. Given the monthly nature of these requirements, financial institutions are free to choose how they accumulate daily reserve balances throughout the month. Figure 2 illustrates the typical evolution, in an average month, of the portion of these funds held by institutions at current account deposits in the BCRP, along with the corresponding daily progress in fulfilling the required reserves (hereafter, reserve accumulation progress). The daily progress in meeting reserve requirements is defined as the proportion of the month's required current account that a financial institution has accumulated up to a given day t. It is calculated according to the following formula:

$$\text{Daily reserve build-up rate}_t = \frac{\text{Accumulated current account}_t}{\text{Monthly required current account}} \quad (1)$$

The usual monthly pattern of reserve funds shows a declining trend: at the beginning of the month, institutions tend to accumulate reserve funds more intensively, resulting in a faster increase in the level of reserve accumulation progress. As business days progress, the pace of accumulation slows, and so does the reserve accumulation progress.

[3]The minimum reserve requirement rate defines the proportion of the monthly average of daily deposits received by financial institutions that must be held as liquid reserves, either in vault cash or in their current account at the BCRP (2024).

Figure 2: Path of the Median Current Account Balance of Commercial Banks and Daily Reserve build-up
(In percent)



Note: For the construction of the daily path of the median current account for an average month, the median current account balance of commercial banks between January 2023 and September 2024 was used, normalizing the balance on the first business day to 100 percent. For the daily path of the reserve build-up, the formula referenced in equation 1 was applied.

Taking into account this characteristic pattern, the daily reserve build-up rate serves as a natural indicator to gauge the presence of supply or demand pressures in the interbank market[4]. As shown in Figure 3, an accelerated accumulation of reserves (i.e., a positive deviation of the build-up rate) is associated with downward pressures on the interbank rate, reflected in negative deviations of the interbank rate. Indeed, a high reserve build-up rate is typically associated with lower demand for reserves, as financial institutions would be more comfortable meeting their monthly reserve requirements. Faced with lower demand, the BCRP would tend to reduce its net supply of reserve funds[5] until market supply and demand conditions align with its operational target. On the other hand, a low reserve build-up rate is associated with higher demand. In this context, the BCRP would tend to increase its net supply of funds to balance supply and demand conditions.

The evolution of the daily reserve build-up may, however, depend on the expected change of the policy rate. The Board of the BCRP sets the monetary policy rate on a monthly basis. This decision typically takes place on the second Thursday of each month. As monetary policy decisions occur within the monthly reserve maintenance periods, financial institutions face an incentive to adjust their reserve accumulation path to profit from the expected policy rate change. More precisely, policy rate cuts (increases) imply a lower (higher) opportunity cost of accumulating unremunerated reserves once the monetary policy decision is taken. Therefore, expectations of policy rate cuts (increases) may induce a slower (faster) reserve build-up. In the following, this relationship is explored.

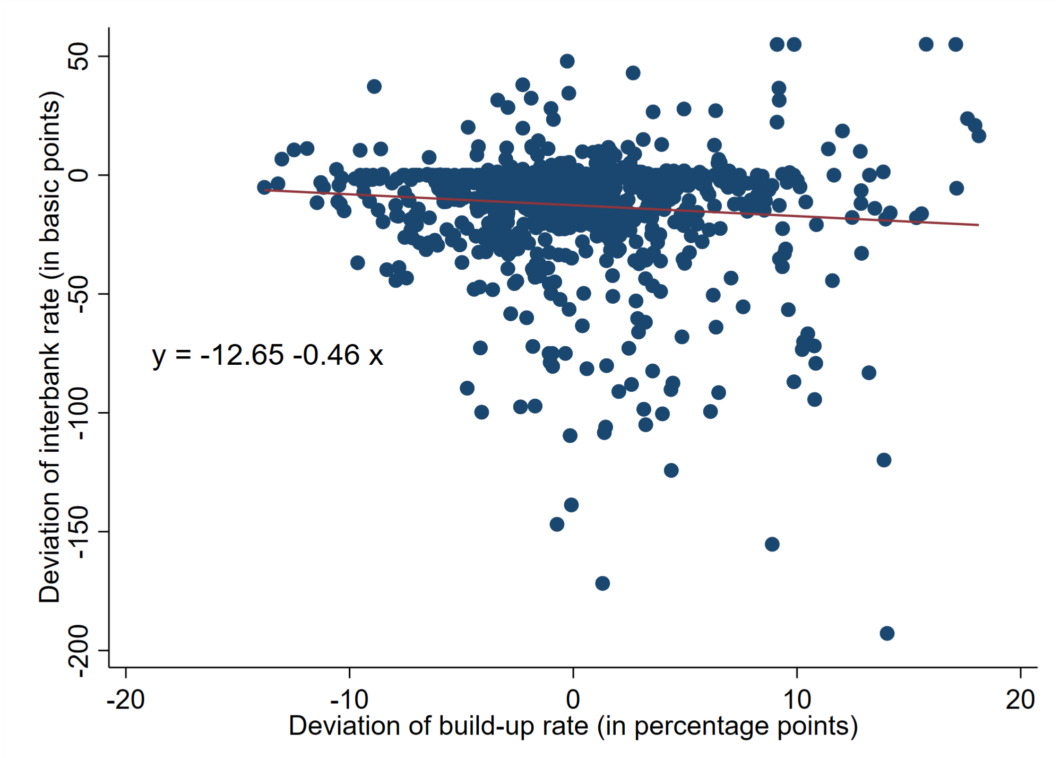
3 Related Literature

Theoretical foundations and empirical evidence provide extensive support for the hypothesis that expectations drive interest rates, market yields, exchange rates, among other financial assets. In all cases, expectations about monetary policy rate's evolution are suggested to be a major driver. Traditional finance and macroeconomic models highlight that the behavior of exchange rates and market yields are explained by interest rate parity conditions. In the case of exchange rates, benchmark dynamic stochastic general equilibrium models feature the uncovered interest parity (UIP)

[4]For an an analysis of the supply and demand of reserve funds in the Peruvian case, see Castillo et al. (2011)

[5]The net supply of reserves is defined as the difference between the amounts of the BCRP's liquidity injection and sterilization operations, after accounting for the net maturities of operations from previous days.

Figure 3: Deviations of the interbank rate and the daily reserve build-up rate



Note: The deviation of the interbank rate is defined as the difference, measured in basis points, between the average interbank rate and the policy rate. Similarly, the deviation of the daily reserve build-up rate is defined as the difference, measured in percentage points, between the daily reserve build-up rate and the median value of the reserve build-up rate observed on the same calendar day over the preceding four months. The regression uses data from January 2021 to September 2024 to avoid potential biases arising from the COVID-19 period.

(Engel (2014)), while market yields are typically rationalized through a version of the expectations hypothesis (EH) of the yield curve (Della Corte et al. (2008)).

Although the empirical validity is typically rejected for both the UIP ((Fama (1984)); (Engels (1996)); (Engels et al. (2022))) and the EH ((Fama and Bliss (1987)); (Campbell and Shiller (1991)); (Della Corte et al. (2008)); (Caldeira and Smaniotto (2018))), expectations remain as a first-order determinant of these assets' values. In both cases, the existence of time-varying risk premium components are usually argued to explain the failure of forward rates as unbiased predictors (Fama (1984); Engels (1996); Gabaix and Maggiori (2015); Itskhoki and Mukhin (2021); Yakhin (2022); Yakhin (2025); Dai and Singleton (2002); Cieslak and Povala (2016); Osterrieder and Schotman (2017)).

The popularization of forward guidance as an additional tool of non-conventional monetary policy boosted research on the spillover of policy rate expectations into the financial system. Evidence has proven that this kind of policy can be effective in influencing expectations, financial markets and the macroeconomy (Jiang and Huang (2023); Sutherland (2023); Swanson (2021); Hubert and Labondance (2018)).

The literature identifies three main approaches for measuring monetary policy expectations: surveys, yield curves, and financial derivatives (Joyce et al. (2008); Christensen and Kwan (2014); Alsterlind and Dillén (2005)). Survey-based measures—such as those conducted among economic analysts or market participants—provide direct insights into agents' expectations for the future path of policy rates. Their main advantage is their transparency, as they do not require further decomposition. However, they may be subject to limitations such as low update frequency and potential sample unrepresentativeness.

Yield curve-based measures infer the average market expectation of the policy rate from the implied forward rates of fixed-income instruments. While widely employed, these measures conflate policy rate expectations with credit risk, liquidity, and term premia, complicating their interpretation. Concerns related to credit and liquidity risk are mitigated by relying on highly rated, liquid instruments such as Treasury securities. To isolate expectations, forward rates are typically adjusted using estimated term premia, which can be derived through regression-based methods, survey-based measures, or affine term structure models. Notably, different techniques often yield divergent estimates of the term premium (Joyce et al. (2008)).

Finally, derivative-based measures—such as Overnight Index Swaps (OIS) or federal funds futures—extract expectations directly from market prices. Like yield curve-based approaches, they offer high-frequency updates. Their main limitation lies in the dependence on the availability and liquidity of the underlying markets, which can affect the precision and reliability of the expectations estimated.

The literature on the role of expectations on the interbank money market is scarcer. As banks meet reserve requirements, trading days within a reserve maintenance period should be perfect substitutes for banks' liquidity management decisions. Conditional on this proposition, the interbank interest rate would be given by the future expected rate, following a martingale over the reserve maintenance period. Hamilton (1996) provides evidence against this hypothesis for the US case, arguing that it could be caused by lack of perfect substitutability related to the existence of line limits, transaction costs, and weekend accounting conventions. Despite its failure, policy rate expectations seem to influence interbank interest rates in the maturities of one, three and six months (Ito (2017)).

Monetary policy influence commercial bank's profitability (Borio et al. (2015)), the return from holding liquid assets (Freixas et al. (2011)) and balance sheets (Kashyap and Stein (1995); Alpanda and Aysun (2012); Li (2024); Afonso et al. (2025)). As a consequence, expectations on the policy stance might affect banks' portfolio decisions, including liquidity management and their behavior in the interbank money market.

Recently, the theoretical modeling of the interbank money market has yielded a stylized search and matching over-the-counter framework (Afonso and Lagos (2015); Bech and Monnet (2016); Bianchi and Bigio (2022)). In this set up, banks' portfolio decisions are affected by tightness conditions at the money market, which ultimately drive the existence of a liquidity premium. Moreover, the path of the intraday equilibrium interbank interest rate is defined by expectations of future rates, as these capture the opportunity cost of postponing a transaction. Generalizing the idea to a reserve maintenance period, expectations over the future policy rate determine the expected opportunity cost of postponing the accumulation of reserves. As a consequence, expectations influence banks' portfolio decisions, their pattern of accumulation of required reserves over the maintenance period, interbank transactions and the equilibrium interbank interest rates.

The literature on the interbank money market was popularized on the onset of the Global Financial Crisis (GFC). Prior to it, the implementation of monetary policy was considered of second-order importance due to a Modigliani-Miller result (Wallace (1981);Curdia and Woodford (2011)): In a frictionless environment and once the monetary policy interest rate is set, balance sheet operations are irrelevant for market yields and the macroeconomic equilibrium. Thereafter, the arena for the implementation of monetary policy gained increased attention, examining its influence on the banking system and macroeconomic conditions (Freixas and Jorge (2008); Gertler and Kiyotaki (2010); Giri (2018); Bianchi and Bigio (2022)).

Mostly, the literature on the interbank money market behavior focuses on the role of liquidity. Poole (1968) seminal paper, which initiated this research branch, shows that uncertainty regarding daily reserves flows explains the existence of excess reserves and the use of window facilities in equilibrium. In this context, Ennis and Keister (2008) show that the use of reserve maintenance periods, rather than daily reserve requirements, contributes to smoothing liquidity shocks' effects on interbank interest rate fluctuations. Furthermore, Davis et al. (2020) suggest that liquidity requirements may be helpful in reducing the incidence of bankruptcies.

The lack of perfect substitutability among trading days is argued to be key for the existence of the liquidity effect of central banks' open market operations. Evidence of the liquidity effect is provided in empirical applications that measure the macroeconomic consequences of monetary policy shocks (Bernanke and Mihov (1998)) and microeconomic applications that measure the effect of central banks liquidity operations on the interbank rate (Hamilton (1997); Afonso et al. (2024)).

In environments of increased risk, open market operations are suggested to be effective in stabilizing the interbank interest rate and increasing banks' capacity to address liquidity needs (Allen et al. (2009); Matsuoka (2012)). In general, and particularly relevant for bimonetary econmies, banks liquidity management contemplate multiple currencies. In this context, liquidity spillovers among currencies might influence trading behavior and interbank interest rates (Siklos and Stefan (2021); Bianchi et al. (2023); Armas and Ortiz (2020)).

Regarding interbank money market dynamics, the literature has mainly focused on the role of available excess reserves. By measuring market exits of net lenders, Hryckiewicz and Kozlowski (2018) show that liquidity imbalances significantly affect banks' liquidity positions and their credit supply. Increases in excess central bank reserves lead to an imbalance in trading offers, increasing the number of reserves suppliers and decreasing the number of reserves buyers (Fuhrer (2018)). In the extreme, this dynamic leads to a 'floor' or 'ample reserves' system. In this context, the excessive increase in available liquidity leads the interbank interest rate to its floor and to the disappearance of interbank trading (Bianchi and Bigio (2022); Baglioni (2024)).

In a floor system, the abundance of reserves mitigates the liquidity effect, causing open market operations to have no impact on the interbank interest rate. In a time-varying framework, Afonso et al. (2024) shows that the slope of the reserves' demand curve is decreasing in absolute value in relation to the level of excess reserves. Furthermore, the interest rate pass through is enhanced in this context through a compression of commercial banks' liquidity premiums (Bianchi and Bigio (2022)).

Finally, the breakdown of the federal funds market during the 2007/08 crisis boosted research on systemic risk exposure in the interbank money market. As relationships among banks represent an important feature of the market (Temizsoy et al. (2015); Chiu et al. (2020)), network analysis proliferated to account for this phenomenon (Bai et al. (2023); Craig and Ma (2022); Blasques et al. (2018)).

As shown, there exists a growing research agenda on the behavior of the interbank money market and its role for the banking system, financial stability and macroeconomic conditions. Similarly, the literature on the influence of monetary policy rate expectations on financial markets is extensive. Despite existing theoretical frameworks being able to account for the role of policy expectations on interbank money market dynamics, to our best knowledge, the literature has not yet provided an empirical assessment of the relationship.

4 Empirical Analysis

4.1 Data description

To answer our research question, we use use non-publicly available data[6] of daily reserve build-up rates from 39 financial institutions for the period from January 2017 to September 2024. The variable is measured in percentage terms, according to the definition provided in equation (1).

For interest rate expectations, we use Bloomberg's Economist Estimates (ECOS) survey, which provides forecasts of key macroeconomic variables from professional economists affiliated with international commercial and investment banks, consulting firms, academic institutions, and other organizations. We use this survey because it contains data starting in July 2006, thereby enabling a broader temporal coverage for our analysis. Expectations regarding the policy rate are proxied by the survey's median forecast, while expected changes in the policy rate (Exp) are expressed in basis points. In the robustness exercise 4.5.2, expectations of policy rate adjustments are further represented by two dummy variables—one for anticipated rate cuts ("Expectations of Reduction", EPR) and another for anticipated rate hikes ("Expectations of Increase", EPI)—to examine potential asymmetries in the effects of expectations.

The monetary policy rate (MPR), the spot exchange rate, the liquidity shock, and firm size are obtained from BCRP data, while the forward exchange rate, the VIX, the federal funds rate (FFR), and the Peru EMBIG are sourced from Bloomberg. The MPR, the FFR, and the Covered Interest Parity (CIP) are expressed in percentage terms.[7] The liquidity shock is defined as the difference between the opening current account balance of commercial banks forecasted by the BCRP and the realized opening balance (measured in billions of soles). The CIP is defined as the difference between the MPR and the FFR, adjusted by the expected depreciation rate. The monetary policy surprise (MPS) represents the deviation between the actual MPR and the expected MPR (expressed in basis points). Firm size is proxied by the average monthly amount of liabilities subject to reserve requirements (measured in billions of soles).

Table 1 presents descriptive statistics for the main variables. Since the data spans from January 2017 to September 2024, it includes both tightening and easing periods of monetary policy. Accordingly, the MPR reaches a minimum value of 0.25% during the pandemic episode and a maximum of 7.75% during the most recent inflationary episode. Regarding the expectation dummies, we observe that 19% and 18% of the observations correspond to expectations of rate cuts and hikes, respectively, which reflects the variability of our main regressors.

[6] We thank the Division of Reserve Management from the Monetary Operations and Financial Stability Department of the Central Reserve Bank of Peru for providing this.

[7] The expected depreciation rate is computed as the percentage difference between the forward and spot exchange rates. Given that reserve demand is managed within a short-term horizon, the one-month forward rate is employed.

Table 1: Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Min	Max	No. obs.
Reserve build-up rate	65.49	66.48	42.94	0.00	1110.12	101941
Exp	3.03	0.00	24.08	-100.00	50.00	101951
Expectation of reduction (EPR)	0.19	0.00	0.39	0.00	1.00	101951
Expectation of increase (EPI)	0.18	0.00	0.39	0.00	1.00	101951
Day	15.73	16.00	8.80	1.00	31.00	101951
Day^2	324.69	256.00	285.84	1.00	961.00	101951
Holiday	0.48	0.00	0.50	0.00	1.00	101951
MPR	3.68	3.00	2.42	0.25	7.75	101951
Liquidity shock	79.68	49.85	683.36	-4904.05	5772.92	101951
Firm size	6587.52	1740.84	12437.83	0.53	75323.27	101951
MPS	-1.99	0.00	13.60	-100.00	25.00	101951
VIX	18.67	16.88	7.74	9.14	82.69	101951
EMBIG	164.54	160.00	33.49	104.00	372.00	101951
CIP	0.36	-0.03	4.69	-47.85	56.45	101951

Note: "Holiday" and "Monetary Policy Surprise" are dummy variables. The former takes the value of 1 if the first calendar day of the month is a non-business day, while the latter equals 1 if the policy rate decision deviates from market expectations.

4.2 Preliminary analysis

In this subsection, with the data described above, we present a preliminary assessment and stylized facts of the role of the monetary policy rate expectations of the dynamics of reserve accumulation.

Given that the reserve accumulation path serves as an indicator of supply and demand conditions in the interbank market, it is necessary to characterize its behavior. In this regard, the periods of policy rate hikes and cuts observed since 2017 suggest that expectations regarding changes in the monetary policy rate (MPR) may be a relevant factor in the dynamics of this indicator.

As shown in Panel A of Figure 4, the average daily reserve accumulation is lower during periods in which financial institutions expect a reduction in the policy rate. Conversely, in periods of expected policy rate hikes, the average daily reserve accumulation tends to be higher. Dividing the month into four weeks reveals that this relationship tends to persist throughout the entire period. From the first week, the average daily reserve accumulation is lower when a rate cut is expected and higher when a rate hike is anticipated (Figure 4, Panel B). This pattern remains in place during the second, third, and fourth weeks (Figure 4, Panels C, D, and E).

In the same vein, Table 2 shows that the reserve accumulation in the first week is significantly higher in periods of expected rate hikes compared to episodes of expected rate holds or cuts. Specifically, during the sample period, 75 percent of reserve accumulation values in tightening episodes range between 46.3 and 52.5 percent, while those in hold and easing episodes fall within 37.6 to 44.6 percent and 38.5 to 43.6 percent, respectively. Thus, expectations of changes in the policy rate appear to influence the reserve accumulation behavior of financial institutions.

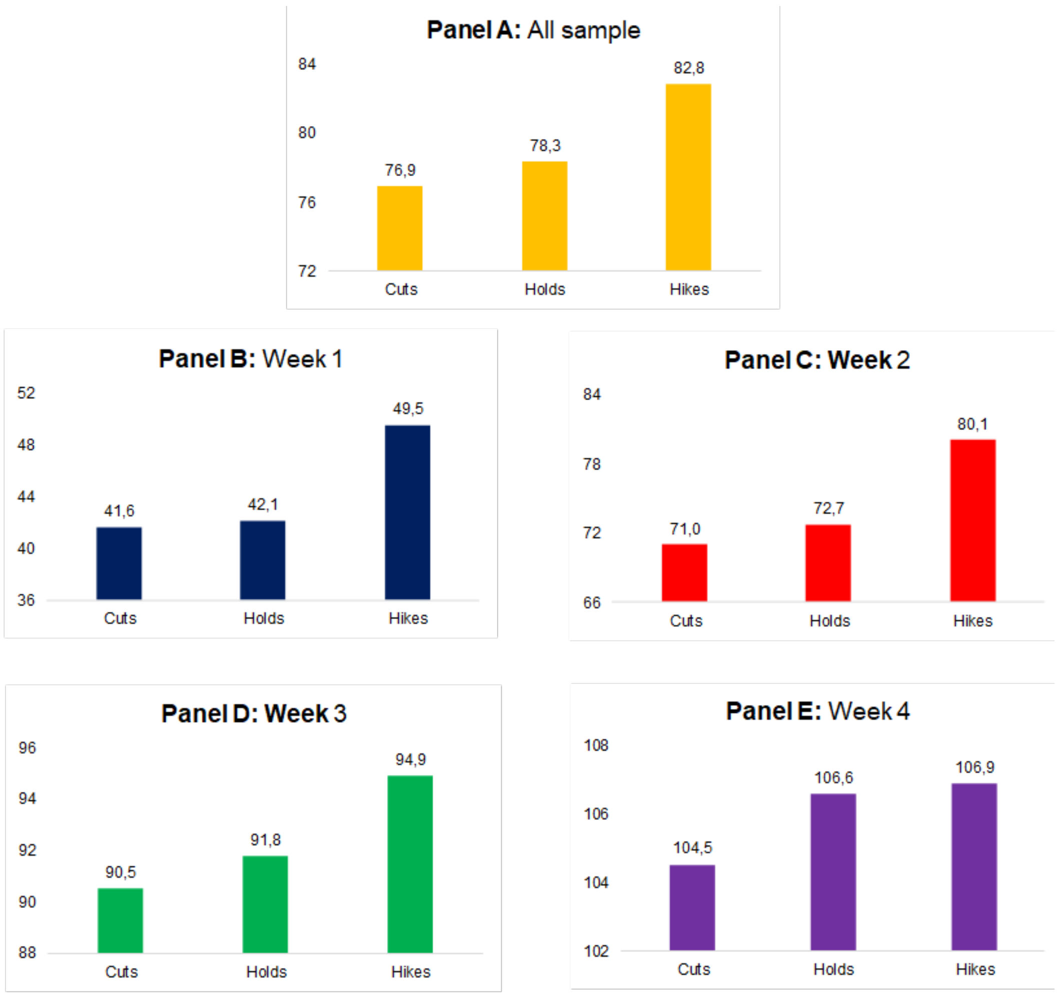
Given BCRP's operational target, the expected policy rate determines the expected value of the average price of reserve funds (TIBO). When a rate cut is anticipated, financial institutions would expect to accumulate reserves at a lower price following the monetary policy decision. Therefore, they may be incentivized to reduce their demand for reserves in the days leading up to the decision, and subsequently increase it to meet the monthly reserve requirement once the rate cut is implemented (or not). Conversely, under expectations of a rate hike, institutions would anticipate accumulating reserves at a higher price following the decision. Given the lower opportunity cost of accumulating reserve funds beforehand, institutions face an incentive to increase their demand for reserves during these days and later compensate by reducing it.

Table 2: Reserve build-up in the First Week, by Quartile and Policy Rate Expectation Period (In percent)

Quartile	Rate Cut Expectation	Hold Expectation	Rate Hike Expectation
Quartile 1	38.5	37.6	46.3
Median	41.0	41.2	48.9
Quartile 3	43.6	44.6	52.5

Note: Based on daily reserve build-up levels observed during the first week of each month, by expected monetary policy stance.

Figure 4: Daily Reserve Requirement Build-up, Average and by Week
(In percent)



Note: The average build-up is calculated as the average of the build-ups during the four weeks of the month.
Source: Based on daily reserve build-up data from 39 financial institutions between January 2017 and September 2024.

Thus, during periods of expectations of a policy rate cut, financial institutions may voluntarily slow down the pace of reserve accumulation at the beginning of the month. As a result, a slower reserve build-up would not necessarily indicate demand-side pressures in the interbank market. Similarly, during periods of expectations of a rate hike, a faster reserve build-up would not necessarily signal supply-side pressures.

4.3 Empirical strategy

To estimate the effect of policy rate expectations on the reserve build-up of financial institutions, we propose the following fixed-effects panel model:

$$y_{it} = \alpha_i + \gamma Exp + \beta' \mathbf{x}_{it} + \varepsilon_{it} \tag{2}$$

where y_{it} is the reserve build-up rate of financial institution i on day t of month m. The main variable of interest is the expectation of change in the policy rate (Exp). The vector $\mathbf{x}_{it}$ includes control variables that account for other influencing factors, such as seasonal patterns, financial conditions in both domestic and foreign currency, and local and global uncertainty. In addition, α_i denotes institution-level fixed effects that control for unobserved, time-invariant heterogeneity across financial institutions, such as firm size, risk tolerance or internal liquidity management strategies.

As represented in Figure 5 (see Appendix), if financial institutions anticipate an increase in the policy rate ($Exp > 0$)—implying a higher future cost of holding reserves—they are likely to accelerate their reserve accumulation. Conversely, if a rate cut is expected ($Exp < 0$), institutions may slow down the pace of reserve accumulation. This behavior would be consistent with a positive estimated coefficient, $\gamma > 0$.

Regarding seasonal patterns in x_{it}, consistent with the reserve requirement fulfillment dynamics shown in Figure 2, we expect a quadratic reserve accumulation path over the month—that is, a positive coefficient on Day and a negative one on Day^2. The Holiday variable is expected to have a negative coefficient. If the first day of the month is a non-business day, the opening balance from the previous month is carried over, implying a relatively low starting reserve level.

Concerning domestic financial conditions, we expect a negative effect of the policy rate, as a higher rate increases the opportunity cost of holding reserves. A positive liquidity shock—higher-than-expected opening liquidity—should raise reserve accumulation. Regarding firm size, proxied by liabilities subject to reserve requirements, larger institutions are expected to hold fewer excess reserves due to better portfolio management strategies. For monetary policy surprises (MPS), a significant coefficient would indicate that institutions adjust their reserve behavior when the realized policy rate deviates from expectations.[8]

The literature on uncertainty shocks documents the importance of distinguishing between first- and second-order moments when analyzing shocks. As we focus on a forward-looking variable, it might correlate with the level of uncertainty that surrounds the economy. To control for this possibility, the VIX and EMBIG-Peru indices are added. Higher global and domestic uncertainty is expected to increase the demand for liquid assets, implying a positive relationship with reserves.

As a partially dollarized economy, an important part of the Peruvian banking system financial intermediation activities is related to the USD. Therefore, foreign-currency liquidity conditions are considered relevant in explaining the behavior of financial institutions. Moreover, given its wide use, foreign-currency conditions might influence the formation of expectations on macroeconomic variables, including the policy rate. Specifically, financial institutions may shift domestic-currency reserves into foreign-currency assets when profit opportunities arise. To control for this, we consider CIP deviations as an extra control variables. A higher CIP deviation, defined as higher returns in PEN, should lead to higher demand for domestic-currency assets. Therefore, it is expected to increase the daily reserve build-up rate.

4.4 Main results

Using this information, five fixed-effects panel regression models are estimated. The main results are reported in Table 3. Column (1) shows a significant estimated effect (0.066) of the expected change of the monetary policy rate on the reserve build-up in a model excluding control variables. Consistent with the patterns observed in Figure 4, the positive relationship among the variables provides evidence that expectations of a policy rate hike (cut) cause an increase (reduction) on the daily reserve accumulation rate. In particular, an expected increase (decrease) of 25 bps. in the policy rate is estimated to cause an average increase (decrease) of 1.65 pp. in the banking system reserve build-up over a reserve maintenance period.

The next columns show how the estimated effect behaves when adding groups of control variables. Column 2 controls for the daily seasonal patterns that characterize the evolution of reserves accumulation (see Section 2). To that purpose, the basic model is extended with three variables that contain information on the business day being studied (Day), its square (Day^2) and whether the reserve maintenance period begins in a non-business day (Holiday). After adding these controls, the estimated coefficient related to monetary policy change expectations remains almost unchanged at a level

[8] On the margin, a lower (higher) realized policy rate relative to the expected level might lead to higher (lower) demand for excess reserves. Moreover, the surprise might incentivize a change in the daily strategy of reserves accumulation.

of 0.064. This suggests that an expected increase (decrease) of 25 bps. in the policy rate is estimated to cause an average increase (decrease) of 1.60 pp. in the daily reserve build-up rate. The estimated relationships of these control variables and the reserve build-up rate features the expected signs, as discussed in Section 4.3. In particular, as days pass-by, the reserve build-up rate significantly increases (on average, it is 4.98 pp. higher every day of the month). Moreover, as days pass-by, the marginal increase of the reserve build-up tends to be lower, as suggested by the significant negative coefficient associated to Day^2 (-0.05). Finally, the estimation suggests that during months that start on a non-business day the daily reserve build-up rate tends to be 1.55 pp. lower on average.

Column 3 controls for domestic-currency liquidity conditions. To do so, the following control variables are included: the level of the monetary policy rate (MPR), a liquidity shock (Liquidity), the financial institution's size, proxied by its total liabilities subject to reserve requirements (Firm size), the surprise component of monetary policy rate decisions, constructed as the difference (in percentage points) between the expected and realized MPR (MPS), and its lag (MPS[-1]). After adding this set of controls, the positive effect of the MPR's expected change remains statistically significant. In this case, it is estimated that an expected 25 bps. increase (reduction) of the MPR leads to an increase (decrease) of 1.925 pp. in the daily reserve build-up rate. Regarding the relationship of newly added control variables, their estimated relationship with the daily reserve buid-up is consistent with the arguments previously provided (Section 4.3). Firstly, a higher MPR is associated with a lower daily reserve build-up rate, as the marginal cost of holding reserves increases. Secondly, in this case, the liquidity shock features a negative relationship with the daily reserve build-up, while it becomes non-significant in the following specifications. Thirdly, a higher firm size significantly leads to a higher reserve build-up rate. Fourthly, a surprise in the MPR decision significantly leads to a higher daily reserve build-up on average. While its lag features a negative coefficient, it is switched to a positive relationship in the following specifications. Regarding the previously added variables, they feature small variation.

Column 4 extends the set of controls to consider domestic and global uncertainty proxies. The estimated effect of expected changes in the MPR remains robust, although lower than in previous specifications. In particular, an expected increase (decrease) of 25 bps. in the MPR is estimated to cause an average increase (decrease) of 1.03 pp. in the banking system reserve build-up over a reserve maintenance period. Both the VIX and EMBIG indices feature a positive relationship with the reserve build-up rate, suggesting a higher demand for liquid assets during periods of higher uncertainty. In general, previously added control variables feature a similar relationship with the dependent variable, except for liquidity shocks (non-significant), firm size (non-significant) and the lagged monetary policy surprise component (positive relationship).

Finally, Column 5 extends the specification to control for CIP deviations. The estimated effect of expected changes in the MPR remains robust: An expected increase (decrease) of 25 bps. in the MPR causes an increase (reduction) of 1.05 pp. in the daily reserve build-up rate on average. Furthermore, an increase in CIP deviations, which leads to higher returns in domestic currency, are related to a significant increase in the daily reserve build-up rate. Regarding previously added control variables, their relationships with the dependent variable feature small variations in comparison to specification (4).

Table 3: Estimates of the effect of monetary policy rate expectations on reserve build-up

	(1)	(2)	(3)	(4)	(5)
Exp	0.066***	0.064***	0.077***	0.041***	0.042***
Day		4.982***	4.990***	4.994***	5.002***
Day^2		-0.048***	-0.048***	-0.048***	-0.049***
Holiday		-1.549***	-1.459***	-1.270***	-1.262***
MPR			-0.471***	-0.523***	-0.495***
Liquidity			-0.000*	-0.000	-0.000
Firm size			0.000***	0.000	0.000
MPS			0.027***	0.079***	0.079***
MPS[-1]			-0.044***	0.032***	0.031***
VIX				0.133***	0.141***
EMBIG				0.040***	0.038***
CIP					0.054***
Obs.	101941	101941	101941	101941	101941
R^2	0.081	0.594	0.600	0.601	0.601

Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

4.5 Robustness

4.5.1 Pooled OLS

As a robustness check, we estimate the five specifications studied in the benchmark case using a simple OLS model (i.e., excluding financial institution-level fixed effects). Results, presented in Table 9, are found to be remarkably robust to the exclusion of institution-level time-invariant controls. In particular, it is evidenced that the maximum difference between point estimates of comparable specifications is 0.001. In all cases, the effect of the expected change of the MPR is found to be positive and significant, with estimated coefficients ranging from 0.041 to 0.077. This suggests that an expected increase (decrease) of 25 bps. in the MPR is estimated to cause an increase (reduction) of the reserve build-up rate in 1.025-1.925 pp. Regarding control variables, their estimated relationship with the daily reserve build-up is also robust to applying Pooled OLS.

Table 4: Estimates of the effect of monetary policy rate expectations on reserve build-up. Pooled OLS estimator.

	(1)	(2)	(3)	(4)	(5)
Exp	0.067***	0.065***	0.077***	0.041***	0.042***
Day		4.982***	4.990***	4.993***	5.000***
Day^2		-0.048***	-0.048***	-0.048***	-0.049***
Holiday		-1.581***	-1.488***	-1.277***	-1.269***
MPR			-0.397***	-0.471***	-0.446***
Liquidity shock			-0.000*	-0.000	-0.000
Firm size			0.000***	0.000***	0.000***
MPS			0.027***	0.077***	0.078***
MPS[-1]			-0.044***	0.032***	0.030***
VIX				0.130***	0.137***
EMBIG				0.040***	0.0038***
CIP					0.051**
Obs.	101941	101941	101941	101941	101941
R^2	0.001	0.515	0.518	0.519	0.519

Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

4.5.2 Rate Hikes vs Rate Cuts

The literature on the transmission of policy rate changes emphasize the existence of asymmetries related to rate hikes and rate cuts. To analyze how potential asymmetries might affect our results, we create two dummy variables. On one hand, EPR takes the value of 1 if the policy rate is expected to be reduced and 0 otherwise. On the other hand, EPI takes the value of 1 if the policy rate is expected to increase and 0 otherwise. These dummies are then interacted with the expected change of the policy rate. Then, the five basic specifications are estimated through fixed-effect regressions.

Across all specifications, estimates suggest that the effect of expected changes in the MPR on the daily reserve build-up rate are significant whether an increase or a reduction is expected. While the estimated effect of expected policy rate reductions ranges from 0.016 to 0.083, the estimated effect of expected increases ranges from 0.037 to 0.069. Evidence of asymmetry is found at all 5 specifications. However, while specifications (1)-(3) suggest that the effect is stronger for expected reductions, specifications (4)-(5) suggest the opposite. Therefore, we conclude that the direction of asymmetry is unclear. Analyzing the most complete specification (5), it is found that expected increases tend to cause a higher effect than expected decreases. In particular, an expected increase (reduction) of 25 bps. in the MPR causes a 1.725 pp. (0.4375 pp.) average increase (decrease) of the daily reserve build-up rate.

Table 5: Estimates of the effect of monetary policy rate expectations on reserve build-up. Rate hikes vs Rate cuts

	(1)	(2)	(3)	(4)	(5)
Exp * EPR	0.083***	0.076***	0.082***	0.016***	0.0175***
Exp * EPI	0.037***	0.041***	0.053***	0.069***	0.069***
Day		4.983***	4.991***	4.994***	5.001***
Day^2		-0.048***	-0.048***	-0.048***	-0.049***
Holiday		-1.487***	-1.448***	-1.414***	-1.403***
MPR			-0.479***	-0.504***	-0.479***
Liquidity shock			-0.000**	-0.000	-0.000
Firm size			0.000***	0.000	0.000
MPS			0.022***	0.086***	0.086***
MPS[-1]			-0.031***	0.025***	0.024***
VIX				0.134***	0.141***
EMBIG				0.048***	0.046***
CIP					0.048***
Obs.	101941	101941	101941	101941	101941
R^2	0.081	0.594	0.595	0.597	0.597

EPR = expectation of reduction. EPI = expectation of increment.
Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

4.5.3 Marginal accumulation of reserves

As financial institutions progress in their accumulation of legal reserve requirements, the demand for reserves is lower. Then, as this accumulation is faster (lower) before the monetary policy decision during periods featuring expected policy rate hikes (cuts), it is expected to observe the opposite behavior once the monetary policy decision is taken. The logic is the following: If an institution accumulates extra reserves as a consequence of its belief of a policy rate hike, it has already accumulated a higher fraction of its legal reserves requirements. Then, as the remaining part of its reserves requirements is lower, the firm will necessarily lower its reserve accumulation pace once the monetary policy decision is taken, independently of whether the firm's expectation was correct or not.

So far, our benchmark model and the robustness exercises have focused on the average effect throughout a reserve maintenance period. However, as stated, this average effect might hide two opposing forces. In this subsection, to control for this possibility, we study the effect of expected policy rate changes on the behavior of the marginal rate of reserves accumulation (or the daily variation of the reserve build-up rate) before and after the monetary policy decision.

Table 6 shows the effect of expected policy rate changes in the marginal rate of reserves accumulation. The effect is studied in the days previous to the monetary policy decision (coefficient associated to the variable Exp) and in the days after the monetary policy decision (Exp + ExpMP). Results are robust in this alternative specification. On one hand, an expected increase (reduction) of the policy rate is associated to an increase (decrease) in the marginal rate of reserves accumulation in a significant level in the days previous to the monetary policy decision. For instance, a 25 bp. expected increase leads to a 0.22-0.41 pp. higher marginal rate. On the other hand, the effect is estimated to be negative in the days after the monetary policy decision, consistent with the argument described. In particular, in periods when a 25 bp. increase (decrease) of the MPR is expected, the marginal rate of accumulation increases (decreases) in 0.075 pp.[9].

Regarding the behavior of control variables, the expected relationship is changed in some cases. As shown in Figure 5, the marginal reserve accumulation rate decreases as days pass-by. Furthermore, it features a convex pattern, in contrast to the cumulative build-up rate behavior. Accordingly, negative and positive coefficients associated to Day and Day^2, respectively, are estimated in this case. Regarding the remaining control variables, their estimated relationships remain in line with the benchmark specification.

[9]The estimated effect after the monetary policy decision, constructed by adding the coefficients of Exp and ExpMP, is found to be significant at 1% confidence level according to the Wald test across all five specifications

Table 6: Estimates of the effect of monetary policy rate expectations on reserve build-up. Marginal rate of acummulation

	(1)	(2)	(3)	(4)	(5)
Exp	0.0164***	0.0106***	0.0104***	0.0087***	0.0089***
ExpMP	-0.0207***	-0.0125***	-0.0117***	-0.0119***	-0.0120***
Day		-0.270***	-0.267***	-0.267***	-0.265***
Day^2		0.006***	0.006***	0.006***	0.006***
Holiday		-0.071***	-0.076***	-0.066***	-0.065***
MPR			-0.066***	-0.066***	-0.062***
Liquidity shock			-0.000***	-0.000***	-0.000***
Firm size			0.000***	0.000	0.000
MPS			0.002**	0.005***	0.005***
MPS[-1]			0.000	0.004***	0.004***
VIX				0.008***	0.009***
EMBIG				0.002***	0.002**
CIP					0.009***
Obs.	101941	101941	101941	101941	101941
R^2	0.029	0.085	0.088	0.088	0.088

Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

4.5.4 COVID-19

As a robustness check, we estimate the five specifications studied for two subsamples excluding the COVID-19 pandemic: 2017:1-2019:12 and 2022:1-2025:9. Results are reported in Tables 7 and 8. The results suggest that the estimated effect of expected policy changes on the reserve build-up rate are robust to both subsamples. On one hand, in subsample 2017-2019, the estimated effect ranges from 0.033 to 0.107. This finding implies that a 25 bp. expected increase (reduction) in the MPR leads to a 0.825-2.675 pp. increase (decrease) of the daily reserve build-up rate on average. On the other hand, in subsample 2022-2024, the estimated effect ranges from 0.065 to 0.094. This estimates imply that a 25 bp. increase (decrease) of the MPR cause an increase (decrease) of 1.625-2.35 pp. in the daily reserve build-up rate on average.

Table 7: Estimates of the effect of monetary policy rate expectations on reserve build-up. Before Covid: 2017-2019.

	(1)	(2)	(3)	(4)	(5)
Exp	0.033*	0.076***	0.091***	0.107***	0.107***
Day		4.751***	4.751***	4.741***	4.741***
Day^2		-0.044***	-0.044***	-0.043***	-0.043***
Holiday		-1.849***	-1.769***	-1.694***	-1.688***
MPR			0.685***	1.039***	1.035***
Liquidity shock			0.000	0.000	0.000
Firm size			-0.000	-0.000**	-0.000**
MPS			0.026***	0.037***	0.038***
MPS[-1]			0.025***	0.035***	0.036***
VIX				0.021	0.020
EMBIG				-0.039***	-0.040***
CIP					0.021
Obs.	101941	101941	101941	101941	101941
R^2	0.073	0.874	0.874	0.874	0.874

Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

Table 8: Estimates of the effect of monetary policy rate expectations on reserve build-up. After Covid: 2022-2024.

	(1)	(2)	(3)	(4)	(5)
Exp	0.067***	0.065***	0.079***	0.094***	0.094***
Day		5.238***	5.227***	5.232***	5.231***
Day^2		-0.060***	-0.059***	-0.059***	-0.059***
Holiday		-1.376***	-1.331***	-1.195***	-1.195***
MPR			0.494***	0.734***	0.742***
Liquidity shock			-0.000***	-0.000***	-0.000***
Firm size			0.000***	0.000***	0.000***
MPS			-0.017*	-0.012	-0.012
MPS[-1]			-0.018*	-0.029***	-0.028***
VIX				0.058	0.059
EMBIG				-0.029***	-0.029***
CIP					0.027
Obs.	101941	101941	101941	101941	101941
R^2	0.129	0.755	0.755	0.755	0.755

Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

4.5.5 Heterogeneity

Finally, we examine whether there is heterogeneity in the effect of policy rate expectations on reserve accumulation. It is plausible that banks manage their liquidity more efficiently than nonbank institutions, implying a stronger response to monetary policy expectations. To test this hypothesis, the regression includes the interaction term Exp $\times$ Banc, where the variable Banc takes the value of 1 for banks. As shown in all specifications, the coefficient on this interaction term is positive and statistically significant.

Table 9: Estimates of the effect of monetary policy rate expectations on reserve build-up. Heterogenity.

	(1)	(2)	(3)	(4)	(5)
Exp	0.045***	0.044***	0.057***	0.022***	0.022***
Exp * Banc	0.046***	0.046***	0.044***	0.044***	0.045***
Day		4.982***	4.990***	4.994***	5.002***
Day^2		-0.048***	-0.048***	-0.048***	-0.049***
Holiday		-1.546***	-1.458***	-1.268***	-1.260***
MPR			-0.469***	-0.521***	-0.492***
Liquidity shock			-0.000*	-0.000	-0.000
Firm size			0.000***	0.000	0.000
MPS			0.027***	0.079***	0.080***
MPS[-1]			-0.043***	0.033***	0.032***
VIX				0.133***	0.142***
EMBIG				0.040***	0.038***
CIP					0.055***
Obs.	101941	101941	101941	101941	101941
R^2	0.081	0.594	0.595	0.597	0.597

Obs. = Observations.
*** Statistically significant at 1%, ** statistically significant at 5%, * statistically significant at 10%.

5 Conclusions

In conclusion, consistent with economic theory, the empirical evidence suggests that expectations regarding changes in the policy rate play an important role in the behavior of reserve accumulation. During periods of rate cut expectations, financial institutions anticipate a future decrease in the cost of reserve funds and therefore accumulate reserves more slowly. Conversely, during periods of rate hike expectations, institutions anticipate an increase in cost, leading to faster reserve accumulation. This result is robust to the estimation method (fixed effects and pooled OLS), the potential existence of asymmetries related to expected rate hikes and cuts, the subsamples excluding the COVID-19 period and heterogeneity across financial institutions types. This information contributes to a better understanding of the dynamics of reserve demand in the interbank market and thus enables improved scheduling of liquidity injection and/or sterilization operations carried out by the Central Reserve Bank to ensure the achievement of its operational target and the implementation of monetary policy.

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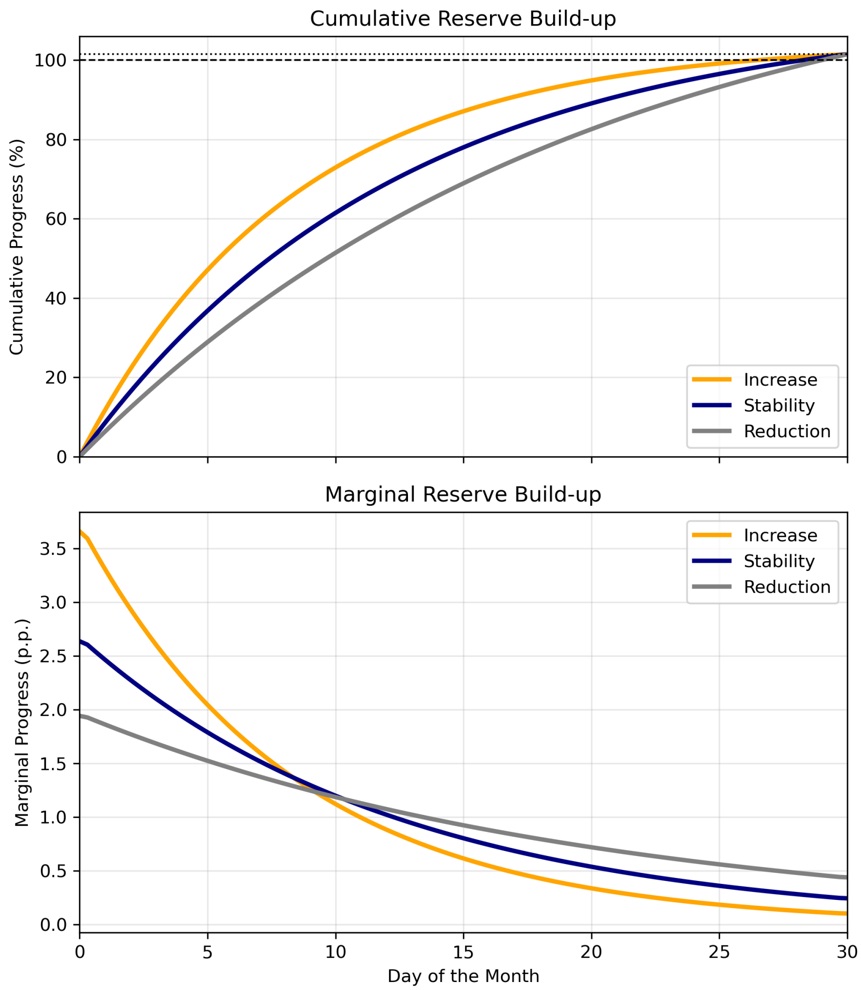
6 Appendix

Figure 5: Monthly Path of Daily Reserve Build-up, by Policy Rate Expectations



Note: The figure depicts theoretical trajectories of cumulative and marginal reserve accumulation across the three types of monetary policy expectations.