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# Capital Controls, Domestic Macroprudential Policy and the Bank Lending Channel of Monetary Policy

**Andrea Fabiani    Martha López Piñeros    José-Luis Peydró    Paul E. Soto**

## *Abstract*

We study how capital controls and domestic macroprudential policy tame credit supply booms, either directly or by enhancing the local bank-lending channel of monetary policy. We exploit credit registry data and the introduction of capital controls on foreign exchange (FX) debt inflows and increase of reserve requirements on domestic bank deposits in Colombia during a boom. We find that capital controls strengthen the bank-lending channel. Increasing the local monetary policy rate widens the interest rate differential with the U.S.; hence, relatively more FX-indebted banks carry-trade cheap FX-funds with expensive peso lending, especially toward riskier firms. Capital controls tax FX-debt and break the carry-trade. Differently, raising reserve requirements on domestic deposits directly reduces credit supply, particularly for riskier firms, rather than enhancing the bank-lending channel. Importantly, banks differentially finance credit with domestic vis-à-vis FX-financing; hence, capital controls and domestic macroprudential policy complementarily mitigate the credit boom and related bank risk-taking.

*JEL codes:* E52; E58; F34; F38; G21; G28.

*Keywords:* Capital controls; Macroprudential and monetary policy; Carry trade; Credit supply; Risk-taking.

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## 1. Introduction

Credit booms greatly amplify business cycle fluctuations and are the main predictors of financial crises, especially credit booms that are financed with foreign liquidity (Gourinchas and Obstfeld, 2012; Jordà, Schularick, and Taylor, 2011; Mendoza and Terrones, 2008; Reinhart and Reinhart, 2008; Schularick and Taylor, 2012). Macroprudential policies, including capital controls (CC), try to tame excessive credit booms. Since the Global Financial Crisis (GFC) of 2008-2009, macroprudential policies have become increasingly popular among both academics and policymakers (Freixas, Laeven and Peydró, 2015) and their use has risen constantly (Claessens, 2015; Alam et al., 2019).

Moreover, the International Monetary Fund (IMF) has endorsed capital controls, initially as a temporary and last resort tool for managing credit booms led by large capital inflows (Blanchard, 2013; IMF, 2012, 2018; Ostry et al., 2010; Qureshi et al., 2011) and more recently also as a preemptive policy to mitigate risks from external debt (IMF, 2022). In the same spirit, a class of models rationalizes capital controls as a Pigouvian tax to reduce the negative externalities on systemic risk and aggregate demand due to excessive foreign debt (Benigno et al., 2016; Bianchi, 2011; Brunnermeier and Sannikov, 2015; Jeanne and Korinek, 2010; Korinek, 2011, 2018; Korinek and Sandri, 2016; Schmitt-Grohé and Uribe, 2016). Other authors support capital controls based on the idea that controls insulate local monetary policy from shocks originated in global financial centers (Rey, 2015; Farhi and Werning, 2012, 2014, and 2016; Davis and Presno, 2017).

In this paper, we study how capital controls and domestic macroprudential policy tame credit supply booms, either directly or by enhancing the local bank-lending channel of monetary policy. In particular, we focus on two research questions. First, we ask whether (and if so, how) CC on FX-financing strengthen the local bank-lending channel of monetary policy by increasing the pass-through of variations in the *local* monetary policy rate on domestic credit supply, and its implication on bank risk-taking. Second, we investigate the impact of domestic macroprudential measures, specifically reserve requirements (RR) on local household and firm deposits, on credit supply and risk-taking, including through the interaction with monetary policy rates. Moreover, we horse-race these two policies. Answers to these questions play a pivotal role in understanding whether these two macroprudential policies operate through different channels by targeting either foreign or domestic bank liabilities, and mitigating risks stemming from excessive credit booms.

Our analysis exploits the simultaneous adoption of CC and tightening of RR by the Central Bank of Colombia on May 2007. The Central Bank enforced CC as a 40 percent *unremunerated* reserve requirement (URR) on FX debt inflows, borne by the borrower. At the time, local interest rates – as reflected by the overnight interbank rate – were as high as 8.4 percent. Hence, the new regulation resulted in high taxation of FX debt inflows as a large part (40 percent) of the inflows had to stay at the central bank for six months without any remuneration. Borrowers could withdraw the deposit before this deadline, but upon the payment of a heavy fee (decreasing in time and ranging from 9.4 percent of the deposit in the first month to 1.6 percent during the sixth and last month). Banks would bear CCs if FX funding served the purpose of financing peso investments (including lending).<sup>1</sup> The Central Bank of Colombia lifted CC by October 2008, amid signs of an economic slowdown related to the unfolding of the GFC after Lehman Brothers’ collapse. Regarding domestic macroprudential measures, in May 2007 the Central Bank of Colombia modified its traditional reserve requirements (RR) policy on peso-denominated deposits. In particular, the Central Bank introduced a *marginal* RR on bank deposits, on top of the ordinary reserve requirement, applied to the overall volume of new deposits received after May 7<sup>th</sup>, 2007. The marginal RR did not pay any remuneration (at a time of high local interest rates) and amounted to 27 percent of (the volume of new) checking deposits and to 12 percent of savings deposits, though the Central Bank eventually uniformed the RR to 27 percent for both savings and checking deposits by June 2007. The Central Bank removed the marginal RR in August 2008.

Identifying the repercussions of CC and RR on credit supply poses challenges, as such policies are not random, but rather induced by the credit boom, and influence both the demand and the supply of credit. To isolate supply motives, we employ a combination of granular administrative datasets, including loan-level data on commercial loans from the credit registry and supervisory bank balance sheet data. We identify credit supply by exploiting variation in loan conditions for the same firm in a given year:quarter, across banks with different exposure to either CC (ex-ante bank foreign FX funding) or RR (ex-ante domestic deposit funding).<sup>2</sup> These two sources of funding

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<sup>1</sup> When a bank’s FX funding finances FX loans to local firms, the bank’s customer pays the CC (i.e., to avoid double taxation of capital inflows, bank FX funding is exempted). We also analyze FX loans to firms. Further, together with CC, the Central Bank fixed a cap on banks’ gross FX-position (i.e. the sum of on- and off-balance-sheet FX assets and liabilities), equal to 500% of banks regulatory capital, which further constrained banks’ ability to access FX-financing.

<sup>2</sup> Our empirical strategy identifies the *relative* effects of CC and RR across differently exposed banks through FX and domestic deposits funding, respectively. We do not quantify the aggregate (macro-level) impact of the two policies on credit, which would require a macroeconomic model; this falls out of the scope of the paper.

(which finance 54% of total assets on average) correlate negatively with each other (by a factor of -0.37) – i.e., banks in part finance themselves either with foreign or local liquidity – however these two sources of liquidity for banks do not offset each other perfectly. Hence, by exploiting variation across banks (within a firm in a specific time-period), we effectively identify two distinct channels.

We run loan-level regressions saturated with firm\*year:quarter fixed effects, absorbing all idiosyncratic, observed and unobserved, time-varying firm-level shocks, including firm-level credit demand (see Khwaja and Mian, 2008). Moreover, to understand the interaction of CC and RR with the monetary policy rates, we further interact banks' exposures with the local policy rate (see Kashyap and Stein, 2000; Jiménez et al., 2012, 2014), and crucially for understanding the mechanism, with the spread between the local and the US monetary rates. We also analyze the impact of both macroprudential policies on risk-taking in credit supply (see Jiménez et al., 2017).

Our analysis yields the following robust results. First, under capital account openness – i.e. before CC - banks use cheaper FX-funding from abroad to arbitrage higher local monetary (interest rate) policy rates. An increase in the local monetary policy rate raises the interest rate differential with respect to the United States, thereby inducing more FX-funded banks to expand credit supply to a given firm in a specific time-period (as compared to less FX-funded banks). In addition, our estimates suggest that carry trade lending promotes bank risk-taking, as during the boom we find a disproportionate increase of the supply of credit towards risky and opaque companies, which are likely to suffer more during a subsequent bust. Capital controls, by taxing FX-debt, break the carry trade, enhancing the bank-lending channel of local monetary policy rates as well as reducing the associated bank risk-taking.

The effects are economically meaningful. In response to a 1 percentage point (p.p.) jump in the policy rate spread between Colombia and the U.S., before CC, banks with a 1 standard deviation (s.d.) higher share of FX funds expand credit supply – to a given firm and in a specific time period – in relative terms by 3.8 p.p.. After CC, however, the same combination of spread-increase and larger FX funding is associated with a relative reduction in credit supply by 7.3 p.p. (as compared to the ex-ante effect of interacted FX funds and policy rate spread). Results suggest that the introduction of CC sharply reduces carry trade incentives and therefore enhances local monetary policy transmission to lending by highly FX indebted banks.

Second, the increase in reserve requirements on domestic deposits has a strong *direct* effect on credit supply. Our estimates imply that, during the period of enforcement of the RR, a 1 s.d. increase in reliance on local deposits funding across banks reduce credit to the same firm by 5.4 p.p. (as compared to before the policy adoption). Moreover, the credit supply cut disproportionately affects risky and opaque firms, so that domestic macroprudential measures also mitigate bank risk-taking during the credit boom. Interestingly, however, the increase in reserve requirements on domestic deposits does not enhance the effects of monetary rates on credit supply. That is, banks with different ex-ante domestic deposits funding do not differentially expand credit to a same firm in a given time period when the policy rate spread (or the policy rate) changes.

All results are robust to a wide variety of robustness checks. We run a large battery of models, and modify the main specifications by altering: the set of included fixed effects and/or observable controls; the strategies for the estimation of standard errors; and the sample period as well (i.e. we document that the effects take place around the introduction of the policies). Crucially, while our baseline findings on the interaction between CC and monetary policy rates exploit the policy rate spread (to highlight carry-trade motives), we show their robustness to employing alternative proxies of local monetary policy rates, including an index of local monetary policy surprises as well as the component of the policy rate spread predicted by such surprises. Those findings are especially important in that they: i) show that an unexpected component of monetary policy rates drives our results; ii) reassure about CC strengthening the pass-through of *local* monetary policy rate changes on credit supply, rather than just isolating it from the influence of US (external) monetary policy shocks. Moreover, results (using either the spread or the index of local monetary policy surprises) hold in a dynamic model, in which – instead of looking only at the response of current credit to lagged changes in the policy rates – we characterize through local projections (Jordà 2005) the impulse-response function over different periods after the policy rate change.

We investigate the carry-trade mechanism even further. Banks refrain from accumulating FX-risk, because under the Basel rules (already in place during our sample) this implies costly additional capital charges. Consistently, we show that carry-trade lending is especially reactive to variations in the policy rate spread that trigger deviations from the Covered Interest Parity (CIP), granting positive carry returns under fully hedged FX-risk. Furthermore, results on carry-trade lending are entirely due to variations in peso-denominated loans, as opposed to FX-denominated

loans, which is important as CC would tax banks' FX-funding only aimed at financing investments in peso, including peso loans to local firms. Moreover, we find that CC reduce bank risk-taking not only in bank assets (credit supply to riskier firms) but also in bank liabilities, as banks finance this (asset-side) risk-taking with fragile FX funding, thereby highlighting a novel important prudential mechanism of CC, which is especially beneficial given the poor performance of carries during major financial downturns (see Kojien et al., 2018).

Finally, as already mentioned, banks' reliance on domestic deposits and FX-financing are negatively correlated (by -0.37, highlighted in Figure 5), suggesting that those banks which restrict credit supply more due to capital controls are less influenced by the domestic reserve requirements, and vice versa.<sup>3</sup> It follows that the two policies are complementary in reducing credit supply and risk-taking, or, put differently, that both contribute to slowing down the credit boom and bank risk-taking. This result has broader policy implications. As credit booms stem from *both* foreign *and* local liquidity, our findings suggest that a Tinbergen rule with two (macroprudential) instruments is necessary to tackle the two (intermediate) objectives (sources of liquidity).

We organize the rest of the paper as follows. Section 2 discusses the related literature. Section 3 describes the policy changes and the datasets. Section 4 presents the results on capital controls, while Section 5 presents the results on reserve requirements. In Section 6 we briefly conclude.

## 2. Related Literature

We contribute to various strands of literature. First, as we show that CC, by reducing banks' carry-trades, increase the effectiveness of *local* monetary policy rates on credit supply, we contribute to the literature on the bank-lending channel (e.g. Kashyap and Stein, 2000; Jiménez et al., 2012 and 2014; Drechsler, Savov and Schnabl, 2017), including papers on international finance and monetary policy (e.g. Bräuning and Ivashina, 2020ab; Bruno and Shin, 2015ab; Cetorelli and Goldberg, 2012; Morais et al., 2019; Rey, 2015).

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<sup>3</sup> Regarding the analysis of the direct effects of RR, as we exploit a standard diff-in-diff model, we check, among other things, the validity of the parallel trend assumptions, by showing that before the RR-tightening heterogeneity in local deposit funding did not exert an influence on credit supply. Last, but not least, we verify that the key results (on the interaction between CC and the policy rate spread and on the direct effect of RR) survive in a model where we directly horse-race them against each other, which is important for this paragraph.

Several studies investigate empirically the extent of monetary policy autonomy depending on the degree of capital account openness, often in a cross-country framework (e.g. Klein and Shambaugh, 2015; Han and Wei, 2018). We contribute by showing a specific mechanism through which capital inflows reduce the pass-through of *local* interest rate policy to domestic credit, namely carry trade strategies by domestic banks.<sup>4</sup> This finding is consistent with a recent model from Cavallino and Sandri (2019) in which a local monetary contraction – by widening the interest rate differential between a small open economy and the rest of the world – drives carry trade inflows, increasing credit and risk in the local economy. Empirically, Fendoglu, Gulsen and Peydró (2019) document, in line with our results, that carry trade inflows on the interbank market impaired the bank-lending channel of monetary policy in Turkey. Crucially, we show that CC are effective in breaking the carry trade, thereby increasing the effectiveness of domestic monetary policy rates on bank credit supply (postulated by Rey, 2015). Furthermore, we find that CC reduce bank risk-taking in both bank assets and liabilities. The pre-CC bank carry trade, driven by the local interest rate policy, increases credit supply to the ex-ante riskier and more opaque firms. At the same time, banks finance this risk-taking with fragile FX funding (Dagher and Kazimov, 2015; Demirgüç-Kunt and Huizinga, 2010; Hahm, Shin and Shin, 2013; IMF, 2019; Ivashina, Scharfstein and Stein, 2015). This result highlights a novel, crucial prudential mechanism of CC, beneficial given the poor performance of carry trade strategies during major financial downturns (Kojien et al., 2018).<sup>5</sup>

Closer to our paper, Dias et al. (2021) exploit the Colombian CC in 2007 to analyze the relation between capital controls and monetary policy. This important paper concludes that CC strengthen the transmission of monetary policy rates on lending. However, our focus is different, centered on the influence of *local* (as opposed to *international*) monetary policy. We also analyze a particular mechanism, namely banks' carry trade from cheaper FX funds to the supply of credit in higher-rate peso loans (and even more to riskier and opaque local firms), which we show to be especially

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<sup>4</sup> Other studies focus on carry trades by large nonfinancial companies (NFCs) in Emerging Markets (Acharya and Vij, 2016; Caballero, Panizza, and Powell, 2016; Bruno and Shin, 2017), highlighting how their U.S. dollar debt increases when carries are more favorable. Liao (2020) shows that carry trade explains a large fraction of international bond issuance. Differently, our attention rests on carry trades by domestic banks in Emerging Markets, involving local currency loans to domestic NFCs, including SMEs.

<sup>5</sup> Our paper also speaks to a growing literature on the deviations from CIP, documented by, e.g., Borio, McCauley and McGuire (2016), Cerutti, Obstfeld and Zhou (2019), Du and Schreger (2016), Du, Tepper and Verdelhan (2018). Consistent with our findings, Avdjiev et al. (2019) and Keller (2021) document that CIP deviations trigger variations in credit supply. We show that CIP-deviations can hamper the transmission of local monetary policy rate hikes to domestic credit and that CC are useful to enhance the local monetary policy transmissions.



responsive to the difference between *local* and *international* policy rates. Moreover, we analyze the interaction with different macroprudential policies, finding that capital controls and domestic macroprudential policy complementarily mitigates the credit boom and the associated bank risk-taking through two distinct channels, operating through global and domestic liquidity, respectively. Therefore, our two papers complement each other.

Our results also contribute to the literature on macroprudential policy (Galati and Moessner, 2013; 2018) by showing complementarities between macroprudential policies and capital controls, highlighted theoretically by Korinek and Sandri (2018). Credit booms stem from both local and foreign sources of liquidity, with the latter flowing to the local economy either through foreign lending or through domestic bank international non-core FX funding (Avdjiev, McCauley and McGuire, 2012; Borio, McCauley and McGuire, 2011; Hahm, Shin and Shin, 2013). We show that CC tame credit booms because, by targeting foreign bank debt, they increase the effectiveness of domestic monetary policy rates on credit supply. However, CC do not target domestic liquidity - e.g. bank deposits from local households and firms. We show that domestic macroprudential policy via RR cuts credit supply by targeting domestic bank deposits. The increase in RR on domestic deposits directly reduces credit supply during the boom, and more so for riskier firms, rather than (indirectly) enhancing the effects of local monetary rates on credit supply.<sup>6</sup> Ultimately, our results suggest that a “prudential Tinbergen rule” targeting both domestic and foreign liquidity, heavily used by financial intermediaries for their lending activities, can tame a strong credit boom and risk-taking. Two instruments, i.e. CC and one domestic prudential measure (RR) in our Colombian setting— are necessary to tackle the two (intermediate) objectives (sources of liquidity).

### **3. Institutional Settings and Data**

#### **3.1 Capital Controls on Capital Inflows and Reserve Requirements Policy in Colombia**

The Colombian economy expanded rapidly in the mid-2000s, with annual GDP growth above 4 percent in both 2004 and 2005. At least from early 2006, inflationary pressures further intensified due to a pronounced surge in domestic credit. The annual growth rate of commercial credit more than doubled in 2006- from less than 10 percent to 22 percent (Figure 1, Panel A). The Central

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<sup>6</sup> We analyze CC in conjunction with other domestic RR-policies, highlighting different channels of transmissions to credit supply, whereas most existing studies focus on just one of the two policies. For empirical evidence on prudential RR, see, among others, Barroso et al. (2020), Cordella et al. (2014) and Federico, Vegh and Vuletin (2014).

Bank reacted by steadily increasing the interest rate, from 6 percent at the end of 2005 to 8 percent by early 2007 and further up to 10 percent in mid-2008. Higher monetary policy rates triggered a widening interest rate differential *vis-à-vis* the U.S. Fed Funds Rate as early as mid-2006 (Figure 1, Panel B). These developments attracted strong capital inflows - especially non-FDI debt inflows – by the third quarter of 2006 (and peaking in first quarter 2007 just before the introduction of capital controls), as well as a sharp appreciation of the Peso-USD nominal exchange rate.

To deal with the acceleration of domestic credit boom, financed in part with foreign liquidity, the Central Bank resorted to a package of unconventional prudential measures on May 7<sup>th</sup>, 2007.

[Insert Figure 1 here]

First, the Central Bank introduced Capital Controls in the form of an Unremunerated Reserve Requirement (URR) on all new FX debt inflows. The URR initially did not apply to portfolio inflows; however, after just one week, the Central Bank made them subject to the URR. Foreign direct investments (FDI) were not subject to the URR, though in May 2008 the Central Bank introduced a minimum-stay requirement of 2 years. The URR works as follows: upon disbursement of the FX credit to a Colombian firm (either a bank or a nonfinancial company), that firm has to park 40 percent of the nominal loan amount in an account at the Central Bank, with no remuneration in return. The ultimate borrower always bears the deposit and can withdraw it without penalty only after six months. At the time, local interest rates –as reflected by the overnight interbank rate– were as high as 8.4 percent. The new regulation resulted therefore in high taxation of FX debt inflows. The borrower could withdraw the deposit before the expiration of the 6-month deadline, but conditional on the payment of a heavy penalty. The penalty decreased in time and ranged from 9.4 percent of the deposit in the first month to 1.6 percent during the sixth and last month. Importantly, banks would bear CC to the extent that they used FX funding to finance peso investments, including lending. When bank FX funding finances FX lending, the bank’s customer pays the CC; the exemption of bank FX-funding avoids in this way the double taxation of capital inflows. In this paper, we focus on the impact of CC on domestic credit through a bank-financing channel, where most firms in Colombia are small and medium sized enterprises (SMEs) without access to FX corporate debt.<sup>7</sup> Finally, the Central Bank removed CC in October 2008 amid signs

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<sup>7</sup> In a related paper (Fabiani et al., 2021), we analyze the effects of CC directly borne by non-financial companies, focusing in particular on the subsample of roughly 1,200 (large and export-oriented) firms issuing FX-debt without

of an economic slowdown related to the unfolding of the GFC after Lehman's collapse. Moreover, joint with CC, the Central Bank introduced an upper bound on the banks' gross FX-position (i.e. the sum of on- and off-balance-sheet FX assets and liabilities), equal to 500% of banks regulatory capital. This constrained further banks' ability to access FX-financing.

Contemporaneously with the CC, the Central Bank also modified its policy on Reserves Requirements (RR) on bank domestic financing. In May 2007 the Central Bank introduced a *marginal* RR on bank deposits, applied on top of the ordinary reserve requirements to new deposits received after May 7<sup>th</sup>, 2007. That is, the *marginal* RR would only apply to the increase in total bank deposits after May 7<sup>th</sup>, 2007. The marginal RR did not pay any remuneration (at a time of high local interest rates) and amounted to 27 percent of (the volume of new) checking deposits and to 12 percent of savings deposits. At the time of the introduction of the *marginal* RR, the level of ordinary RR was 12 percent and 6 percent for checking and savings deposits, eventually raised to 8.3 percent just one month later in June 2007 – contemporaneously, the Central Bank uniformed the marginal RR to 27 percent for both savings and checking deposits. The Central Bank removed the marginal RR in August 2008.<sup>8</sup>

### 3.2 Data and Summary Statistics

Our work exploits two administrative datasets provided by the Colombian Financial Supervisory Authority (*Superintendencia Financiera de Colombia*). First, we have access to the National Credit Registry (CR), which collects detailed quarterly information at the loan level for corporate loans. For each loan, we observe the outstanding amount and other loan characteristics, including interest payments (not interest rates) and an indicator for whether the maturity of the loan is less than one year, which we exploit as indicators of credit risk and liquidity risk, respectively. The CR tracks information on the universe of commercial loans provided to nonfinancial companies. We aggregate loan-level data at the firm\*bank level, by computing the total debt provided by a given bank to a company in a given year:quarter. For other loan characteristics, we compute the firm\*bank level weighted average, with weights given by the loan

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credit intermediation by banks operating in Colombia. For comparison, the largest sample in this paper comprehends 110,226 companies.

<sup>8</sup> Jointly to the introduction of CC and RR in May 2007, there was a change in the rule for computing banks' loan losses provisions, based on expected rather than incurred losses. Throughout the paper, we show that our findings are robust to controlling for such policy change. For a specific investigation of this policy, see López, Tenjo and Zárate (2014) and Morais et al. (2020).

share out of total outstanding firm\*bank debt. Second, we have access to bank supervisory quarterly balance sheets, which include data on bank size, profitability, capitalization, nonperforming loans (NPL), and, most importantly for our purposes, the volume of the sources of bank financing taxed through RR and CC, i.e. domestic deposits and foreign FX inflows, respectively. We match the two datasets through unique banking group identifiers.

We report the summary statistics in Table A1 of the Appendix. In Panel A, we show the summary statistics for the largest sample we analyze throughout the paper, referring to regressions where we exploit time-variation to measure the unconditional impact of monetary policy rates on bank credit. In this setting, we apply at most firm\*bank fixed effects and bank controls. Therefore, the only requisite for a firm\*bank pair to enter the sample is that it appears twice in the CR during the period of analysis 2005Q2-2008Q2.<sup>9</sup> This leaves us with 110,226 companies and 40 banks, corresponding to 12 major banking groups. Throughout the different year:quarters, this sample accounts on average for about 90 percent of total commercial credit, as we exclude both financial companies and public utilities from the analysis, accounting for 10% of total commercial credit.  $\text{Loan}_{f,b,yq}$  is expressed as the log of total outstanding (end of quarter) firm-(f)\*bank-(b) debt, expressed in Colombian pesos as of 2005Q1. Regarding the magnitude of loans, the average loan is roughly 8,500USD as of 2005Q1. There are large differences in loan size across companies, though. A one interquartile variation in loan size reflects larger loans by more than 40,000USD as of 2005Q1.

Throughout our period of analysis, the (lagged) monetary policy rate, labelled as  $i_{yq-1}$ , is close to 7.5 percent on average. For robustness purposes, we extract a surprise-component from the local policy rate using information from a survey of professional forecasters, provided by Bloomberg. In practice, we compute the monetary policy rate surprises at each announcement by the Central

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<sup>9</sup> Note: The Central Bank removed CC in early October 2008, i.e. in 2008Q4. Nonetheless, we always stop our sample in 2008Q2 to avoid contaminating the effects of capital controls with those of the 2008-2009 Global Financial Crisis, which implied a sharp increase in the volatility of capital inflows (Forbes and Warnock, 2012) and which unfolded beyond the US borders after the failure of Lehman Brothers in mid-September 2008. All results on CC presented below are robust to the inclusion of observations for 2008Q3 in our samples. Moreover, our main results are even qualitatively robust (and, if anything, quantitatively stronger) after restricting the sample to 2007Q3, despite the significant reduction in the heterogeneity in monetary policy rates and banks' FX-financing (note that the Colombian central bank raised the interest rate during this period). Additional cross-country (time-series) analysis based on BIS data shows that credit in Colombia slowed down significantly after 2007Q2, relative to other Emerging Economies, including a subsample of Latin America countries. Results based on different samples (either shorter or longer) are available upon request.

Bank of Colombia as the difference between the policy rate and the average forecast by professional forecasters. Next, we compute the monetary policy surprise index,  $\Xi_{yq}$ , as the cumulative sum of surprises over time, in the spirit of Romer and Romer (2004), Coibion (2013) and Ramey (2016).<sup>10</sup> We plot the resulting monetary policy surprise index (labelled  $\Xi_{yq}$ ) next to the policy rate in Appendix Figure A1; the two series correlate very strongly with each other, suggesting that surprises are a key driver of variations in the monetary policy rate throughout our sample period.

A further important measure in our analysis is the spread between the local policy rate and the effective US FED Funds Rate, i.e.  $MPspread^{US}_{yq-1}$ . During the period of analysis, the spread is constantly positive and about 3 percent on average. Moreover, the distribution of the spread between the 3-month sovereign Colombian and U.S. yields mirrors very closely that of  $MPspread^{US}_{yq-1}$ , as evident from Appendix Figure A2. A factor explaining the sovereign spread may be deviations from the CIP, also plotted in Appendix Figure A2. Although the largest deviations from the CIP generally occurred after the Financial Crisis (see, e.g., Borio et al., 2016), they are still significant throughout our period of analysis and amount on average to 17 percent of the mean sovereign yield spread, i.e. roughly 0.5 p.p..<sup>11</sup> Interestingly, CIP deviations peak at around 1.5 p.p. around 2006:Q2, the period in which the Colombia-US policy rate spread starts tightening. Moreover, in one fourth of the quarters CIP deviations were at least as large as 1 p.p.. These figures suggest strong incentives for carry-trades, even after fully hedging against FX-risk through forward contracts. Finally, throughout all regressions on monetary policy rates, we apply further lagged macro controls, namely the annual growth rate of GDP, the lagged CPI index with base in 2005Q1 and the log Peso-USD exchange rate (expressed as Colombian Pesos per 1USD, so that an increase corresponds to a depreciation of the local currency). The Peso-USD exchange rate substantially correlates with both the VIX, reflecting a large influence of global liquidity

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<sup>10</sup> The s.d. for this variable in Appendix Table A1 is close to 23 b.p.. Further details on the construction of the monetary policy surprise index are available in the Supplementary Material.

<sup>11</sup> We retrieve deviations from the CIP from Du and Schreger (2016). In particular, they note that - absent CIP deviations - at a given tenor, the Colombia-US sovereign yield spread should equal the forward premium. Hence, they collect data on forward premia (labelled as  $FP_{yq-1}$  in Panel B of Table A1) and subtract it from the Colombia-U.S. sovereign yield spread, obtaining a series of deviations from the CIP. Du and Schreger (2016) compute those deviations for different sovereign bond tenors. We retain data for the 3-month tenor for two reasons. First, such data are available throughout the entire period of analysis for Colombia. Second, there is a tight link between the Colombian-US monetary policy rate spread and the 3-month sovereign yield spread, as documented in Appendix Figure A2. We aggregate data at the quarterly level by taking the average of the daily values. We discuss further CIP deviations and other proxies of carry-trade incentives, such as UIP deviations and carry-to-risk ratio, in the Supplementary Material.

conditions on the Colombian external sector, and with the oil price - which we alternatively use in some regressions – reflecting Colombia’s dependence on oil exports.

Panel B of Appendix Table A1 shows summary statistics for the smaller sample we focus on for the investigation of carry trade lending strategies triggered by variations in the local monetary policy rate. In this framework, we saturate the model with firm\*year:quarter fixed effects, which excludes companies borrowing from only one bank in a given year:quarter, explaining the drop in observations with respect to Panel A. Note that companies with multiple lending relationships are typically larger, reflected by the fact that average loan size almost doubles. Indeed, the smaller sample of 37,867 multibank companies in Panel B represents a very large share of total commercial credit, close to 80 percent on average in our period (and, in turn, 90 percent of the aggregate credit in the sample of Panel A). Credit supply channels identified from regressions run over this sample therefore provide a representative picture of macroeconomic developments in bank credit. Regarding bank-level variables, the average FX indebtedness, denoted by  $FX\text{-Funds}_{b,yq-1}$ , equals 4.6 percent of total assets in the period from 2005Q2 to 2008Q2. This is a relatively big figure, larger for instance than the average common equity capital ( $CET_{b,yq-1}$ ) over the same period, and more than half of the minimum threshold for regulatory capital (summing up Tier 1 and Tier 2 capital), fixed at 9 percent of total assets. Importantly, the distribution of bank  $FX\text{-Funds}_{b,yq-1}$  displays large heterogeneity, with a s.d. of 2.59 p.p..

Nonetheless, domestic liquidity constitutes the bulk of bank liabilities. In particular, savings deposits, denoted by the variable  $SavingD_{b,yq-1}$ , finance on average more than a third of a bank’s total assets, whereas checking deposits (i.e. current accounts) -represented by the variable  $CheckingD_{b,yq-1}$ - fund 13.6 percent of total assets on average. Further, we have data on bank size (i.e. log total assets), nonperforming loans and return on assets.

Finally, for analyzing risk-taking associated with carry trade lending, we build various indicators of firm-level riskiness and opaqueness. First, we measure credit risk through the average yield paid by a company over the pre-policy period 2005Q1 to 2007Q1, proxied through interest payments (rescaled by loan size) and denoted by  $Firm\ Risk_{f,pre}$ , obtained as follows. In each year:quarter, we compute the weighted average of the loan-level yields, with weights given by the loan shares relative to the total volume of bank debt at the firm level. Next, we take a firm-level average across the period 2005Q1 to 2007Q1. Note that an interquartile variation in such a variable

corresponds to a 6.1 p.p. increase in the average firm-level yield, i.e. a 43 percent increase relative to the mean value, which we interpret as a sizable magnification of credit risk. We compute the average reliance on short-term debt with an analogous procedure, based on a 0/1 dummy for whether a loan has maturity no longer than one year. Companies rely on short-term debt for roughly one third of their total borrowing, on average. The distribution, however, reveals significant differences across firms. An interquartile variation implies higher reliance on short-term debt by a factor of 46.8 p.p.. Firms in the fourth quartile of the distribution have more than half of their total debt with outstanding maturity below or equal to one year. These figures reflect large heterogeneity in refinancing risk across companies. As an additional proxy for firm (default) risk, we build a dummy with a value of 1 if a company has one or more loans with payments at least 30 days past due over the period 2005Q1 to 2007Q1, and 0 otherwise. In fact, the average value for this dummy shows that roughly 30 percent of the loans in our sample are granted to firms with such past due payments. Finally, we measure firm opaqueness through a 0/1 dummy for whether a company's balance sheet is supervised by a public authority or not in the pre-policy period,<sup>12</sup> under the implicit assumption that balance sheet disclosure enhances firm transparency. Supervised companies represent about 10 percent of the firms in our sample, although they account for 30 percent of the loans, suggesting that those firms are larger and have more lending relationships outstanding.

Finally, Panel C reports the summary statistics for the sample we analyze in the section on RR policy. Since shocks to the RR take place over the period 2007Q2-2008Q2, we build symmetric pre/post five quarter windows by running regressions over the year:quarters from 2006Q1 to 2008Q2. Again, as we isolate credit supply saturating the model with firm\*year:quarter fixed effects, the sample includes companies with at least two banking relationships in a given year:quarter. To measure a bank's exposure to the RR shocks, we fix bank-level variables at their 2007Q1 value, the year:quarter preceding the shocks. We consider both savings and checking deposits alone, and their sum, denoted by the variable  $RR-Depo_{b,2007Q1}$ , providing a measure of a bank's overall reliance on the liabilities targeted through the RR policy. The sum of checking and saving deposits accounts for nearly half of bank total assets in 2007Q1. In general, the distribution

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<sup>12</sup> Companies with sufficiently large size, as measured by total assets, must disclose their balance sheet to the Colombia's Authority for Supervision of Corporations (*Superintendencia de Sociedades*). Such data are also publicly available at the Authority's website.

of all bank balance sheet items in 2007Q1 is very similar to that described above for the longer period 2005Q2-2008Q2, suggesting substantial stickiness in bank capital structure.

## 4. Capital Controls and the Bank-Lending Channel of Monetary Policy

### 4.1 Empirical Strategy

We first investigate the transmission of the spread between the local policy rate and the US Effective Federal Funds Rate to bank credit through the lens of a loan-level regression model which exploits time variation over the period 2005Q2-2008Q2 within a given firm-bank pair. We employ the following model:

$$(1) \text{ Loan}_{f,b,yq} = \beta_1 \text{MPspread}_{yq-1}^{\text{US}} + \beta_2 \text{Post}_{yq} + \beta_3 \text{Post}_{yq} * \text{MPspread}_{yq-1}^{\text{US}} + \gamma_1 \text{MacroControls}_{yq-1} + \gamma_2 \text{BankControls}_{b,yq-1} + \gamma_3 \text{FirmCredit}_{f,yq-1} + \delta_{f,b} + \varepsilon_{f,b,yq}$$

The dependent variable (i.e.  $\text{Loan}_{f,b,yq}$ ) is the log total volume of outstanding debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq$ . The main coefficient of interest is  $\beta_3$ , describing the additional marginal effect of the lagged Colombia-vs-US policy rate spread  $\text{MPspread}_{yq-1}^{\text{US}}$  on bank credit after the enforcement of CC and RR, on top of the pre-policy marginal effect, captured by  $\beta_1$ . In the baseline versions of the model, we apply the policy rate spread between Colombia and US because this difference correlates positively with the profitability of a carry-trade strategy in which investors borrow in USD and lend in pesos. In fact, in the next subsections, we will show that such mechanism is key for explaining the relation between macroprudential policies, especially capital controls, and the bank-lending channel of monetary policy. Nonetheless, we also estimate models replacing the monetary policy rate spread with the lagged Colombian policy rate, i.e.  $i_{yq-1}$ , or its surprise component,  $\Xi_{yq-1}$ . Using the lagged (instead of the contemporaneous) monetary policy rate attenuates reverse causality concerns about the relation between the dynamics of domestic credit and monetary policy rates and is common practice in the empirical literature on the bank lending channel of monetary policy (see, e.g., Ongena et al., 2021, for a recent contribution). However, in further robustness checks, we illustrate the dynamic response of credit to changes in the policy rate spread over a 3-quarter horizon, including the potential reaction at impact.  $\text{Post}_{yq}$  is a dummy variable with value 1 from 2007Q2 onward and with value 0 before.



As macroeconomic developments drive variations in monetary policy rates (and possibly bank credit as well) we include a vector of macro controls,  $\text{MacroControls}_{yq-1}$ . The Colombian monetary (interest rate) policy rate formally sticks to a pure inflation-targeting regime. Hence, we employ the lagged annual GDP growth rate and level of price, proxied by the CPI. Moreover, we add the lagged log exchange rate, controlling for the eventual influences of external factors (e.g. the dynamics of the Balance of Payments) on the local policy rate.

We further augment the model with a vector of lagged bank controls, consisting of bank FX funding, savings and checking deposits, size, ROA, common equity, and NPLs. Those variables control for bank balance sheet items identified by the previous literature as significantly interacting with variation in the policy rate. We also control for lagged total firm credit, proxying for firm leverage,<sup>13</sup> as companies with greater leverage respond differently to macroeconomic and monetary policy changes (see, e.g., Caglio et al., 2021). We saturate the model with firm\*bank fixed effects, denoted by  $\delta_{f,b}$ , absorbing all (observed and unobserved) time-invariant heterogeneity at the level of the single lending relationship. Finally,  $\varepsilon_{f,b,yq}$  is an error term. We double-cluster standard errors at the firm and bank\*(four-digit SIC)-industry level, a convention held throughout the paper. Hence, we allow for correlation of the error-term both within-borrower (across time and lenders) *and* within-lender (across time and firms of a given industry).<sup>14</sup>

Next, and most importantly, we estimate a model which sheds light on the influence of (ex-ante sticky) banks' capital structure, especially the liabilities taxed either through CC (i.e., FX-funds) or through RR (i.e., domestic deposits), on the transmission of monetary policy rates on bank credit. We present the most robust version of the model, estimated over the period 2005Q2-2008Q2:

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<sup>13</sup> For most companies we do not observe total assets nor equity, so that we cannot compute the exact financial leverage, though we control for firm fixed effects.

<sup>14</sup> Clustering at the bank\*industry level is economically sensible because changes in monetary policy rates affect different industries in different ways and because demand for credit is industry-specific. Moreover, from an econometric perspective, if we were to cluster standard errors at the bank level, we would be left with 12 clusters (due to the fact that bank balance sheet data are consolidated across major banking groups), which is strictly below the conventional threshold of 50 clusters (Cameron and Miller, 2015) granting asymptotic properties of the variance-covariance matrix. By taking the interaction of bank and industry dummies, we obtain 4,246 clusters. Moreover, we show in robustness checks that our results survive under more conservative clustering strategies, including triple-clustering at the firm, bank and time (i.e., year:quarter) level and even the overly conservative bank clustering.

$$\begin{aligned}
(2) \text{ Loan}_{f,b,yq} = & \text{FX-Funds}_{b,yq-1} * \left( \beta_1 + \beta_2 \text{MPspread}_{yq-1}^{\text{US}} + \beta_3 \text{Post}_{yq} + \beta_4 \text{MPspread}_{yq-1}^{\text{US}} * \text{Post}_{yq} \right) + \\
& \text{SavingD}_{b,yq-1} * \left( \sigma_1 + \sigma_2 \text{MPspread}_{yq-1}^{\text{US}} + \sigma_3 \text{Post}_{yq} + \sigma_4 \text{MPspread}_{yq-1}^{\text{US}} * \text{Post}_{yq} \right) + \\
& \text{CheckingD}_{b,yq-1} * \left( \phi_1 + \phi_2 \text{MPspread}_{yq-1}^{\text{US}} + \phi_3 \text{Post}_{yq} + \phi_4 \text{MPspread}_{yq-1}^{\text{US}} * \text{Post}_{yq} \right) + \\
& \text{FX-Funds}_{b,yq-1} * \left( \mu_1 + \mu_2 \text{Macro}_{yq-1} + \mu_3 \text{Post}_{yq} + \mu_4 \text{Macro}_{yq-1} * \text{Post}_{yq} \right) + \\
& \text{BankControls} * \left( \Gamma_1 + \Gamma_2 \text{MPspread}_{yq-1}^{\text{US}} + \Gamma_3 \text{Post}_{yq} + \Gamma_4 \text{MPspread}_{yq-1}^{\text{US}} * \text{Post}_{yq} \right) + \\
& + \delta_{f,b} + \delta_{f,yq} + \varepsilon_{f,b,yq}
\end{aligned}$$

The dependent variable is the log total outstanding debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq$ . We study how this variable reacts to variations in the local versus U.S. policy rate spread, depending on the banks' relative reliance on FX liabilities (affected by the CC). As before, to highlight the carry trade mechanism, we report in our main table results employing the policy rate spread, but we also show that results are robust if we use the simple lagged local policy rate or its component driven by monetary policy surprises.

The main coefficients of interest are  $\beta_2$  and  $\beta_4$ . Under the carry trade hypothesis,  $\beta_2$  is positive, as banks with higher FX funding lend relatively more when the wedge between the policy rates goes up, while  $\beta_4$  is negative, as CC break the carry by increasing the costs of FX funding, thereby reducing the gains associated with larger policy rate wedges.

We also horse race our carry trade mechanism against the alternative hypothesis that domestic deposit funding drives the different relation between loan volume and the policy rate spread before and after 2007Q2, by interacting both saving and checking deposits with it and with the post dummy as well.<sup>15</sup>

Moreover, we control for the interactions of bank FX funding with the other macro controls (and with the post-dummy), e.g. because variations of the exchange rate, which correlate with the MP-spread, might induce a different reaction in credit supply across differently FX exposed banks. Also, we allow for all remaining bank characteristics to influence bank debt differently depending on the lagged level of the policy rate spread, before and after the enforcement of the policy (e.g.

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<sup>15</sup> Formally, the simple sensitivity of  $\beta_2$  and  $\beta_4$  to the inclusion of the full interaction of domestic deposits with the interest rate spread and the post dummy does not prove itself that RR are key to strengthening the bank-lending channel of monetary policy. This would also require that the coefficients  $\sigma_2$ ,  $\phi_2$ ,  $\sigma_4$  and  $\phi_4$  are statistically significant.

higher levels of bank capitalization are associated with credit expansions when the interest rate is relatively higher, Jiménez et al., 2012).

Finally, we saturate the model with firm\*bank fixed effects,  $\delta_{f,b}$ , and, crucially, firm\*year:quarter fixed effects, denoted by the parameters  $\delta_{f,yq}$ . The latter vector of fixed effects is key for isolating the bank lending channel of monetary policy (Khwaja and Mian, 2008; Jiménez et al., 2012 and 2014). In fact, it allows us to compare the evolution of credit to the same firm in a given point in time, in response to variations of the policy rate and conditional on the different funding structures of the firm's lenders. In other terms, firm\*year:quarter fixed effects fully control for firm-level's time-varying shocks, including credit demand shocks.

For easing the interpretation of the coefficients, we demean all independent variables. We always apply this convention throughout the paper.

## 4.2 Results

Column 1 of Table 1 shows the results from the estimation of the (unconditional) model in equation (1) in the largest available sample. In the pre-policy period, the monetary policy rate spread does not exert any significant effect on credit. After the enforcement of CC and RR, however, the relation becomes negative, corresponding to an enhancement of the bank-lending channel. From a quantitative perspective, a 1 p.p. increase in the policy rate spread is associated to an ex-post decline in credit by 4.25 p.p., as compared to the pre-policy period. Put differently, the period of enforcement of CC and RR brings about an economically meaningful strengthening of the relation between the monetary policy spread and credit. In column 2, we estimate the model in the smaller sample of firms with multiple lending relationships, resulting from the eventual application of firm\*year:quarter fixed effects. Results hold both qualitatively and quantitatively.

[Insert Table 1 here]

In column 3, we start testing the carry trade mechanism by fully interacting bank FX funding with the lagged interest rate spread and the post dummy.<sup>16</sup> In this regression, we control

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<sup>16</sup> In column 3, there is an increase in the number of observations with respect to column 2, as we do not control anymore for firm lagged credit. Indeed, once we interact banks FX-funding with the policy rate spread and the macro-controls, firm lagged credit does not have a tangible impact on our estimates, so that we prefer to retrieve the maximum number of observations. Moreover, in the most robust version of the carry-trade regressions, we use firm\*year:quarter fixed effects, which fully absorb firm credit (and any other firm-level variable).

for time-varying macro-economic shocks by including year:quarter fixed effects. This allows us to absorb the average (unconditional) effect of the policy rate spread and to focus on the cross-sectional response across banks that rely differently on FX-funds. We also control for the full interaction of banks FX-funding with macro controls, and allow other bank characteristics to exert a different impact on credit before and after the introduction of the prudential measures in 2007Q2.

In line with carry trade lending strategies,  $\beta_2$  is positive and  $\beta_4$  is negative. That is, before CC, banks with higher share of FX funds expand credit relatively more when the spread goes up, while after CC they reduce lending in reaction to a positive variation of the spread (as compared to before). Interestingly, an increase in the interest rate spread amplifies an average positive effect of FX-funds on credit under capital mobility, and a negative one after the imposition of capital controls. Notice, in fact, that the coefficients loading FX-funds, either alone or interacted with the post dummy, are positive and negative, respectively.

In column 4, we take our first step in isolating credit supply by augmenting the model with industry (four-digit SIC)\*year:quarter shocks, but the resulting variation in coefficients is minimal. In column 5, we finally introduce firm\*year:quarter fixed effects, therefore fully controlling for time-varying firm-level idiosyncratic demand shocks. If anything, the magnitude of the coefficients  $\beta_2$  and  $\beta_4$  increases.

Finally, in column 6, we report the most robust version of the model (i.e. regression equation (2) presented in the previous subsection) where we additionally interact all the banks characteristics with the policy rate spread and with the post dummy. Validating the carry trade mechanism,  $\beta_2$  and  $\beta_4$  are still statistically significant and increase in absolute terms, if anything. Importantly, the impact of carry trade lending strategies on bank domestic credit is also economically strong. In response to a 1 p.p. jump in the policy rate spread, before CC, banks with a 1 s.d. (i.e. 2.6 p.p., see Appendix Table A1) higher share of FX funds expand credit supply in relative terms by 3.8 p.p. (to a same firm in a given point in time). After CC, however, the same combination of spread-increase and larger FX funding is associated with a relative reduction in credit supply by 7.3 p.p. (as compared to the ex-ante effect of interacted FX funds and policy rate spread), resulting in an overall statistically significant contraction of credit supply by 3.5 p.p..<sup>17</sup> The application of CC

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<sup>17</sup> The statistical significance of the overall negative effect partially depends on the level at which we cluster standard errors, as one can see in columns 7 to 9 of Appendix Table A3 and in Panel A of Table B5 of the Online Appendix.

therefore sharply reduces carry trade incentives and contributes to restoring a negative relation between variations in the policy rate spread and credit among highly FX indebted banks.

Differently, as shown in Appendix Table A2, whereby we display the horse race between the FX and the RR taxed liabilities, the interaction of the latter domestic liabilities with the policy rate spread (and the post dummy) is not significant. The same result holds in column 2 of Table B8 in the Online Appendix if, instead of interacting saving and checking deposits with the policy rate spread and the post dummy, we interact the sum of the two (i.e., the variable  $RR-Depo_{b,yq-1}$ ), which is a proxy of bank-level overall exposure to the RR-shock. These findings indicate that the change in RR-policy did not contribute to strengthening the bank-lending channel of monetary policy rates.

### 4.3 Robustness

#### 4.3.1 The (Unconditional) Effect of Monetary Policy Rates on Bank Credit

To start with, we perform a variety of robustness checks to validate that the finding in columns 1 and 2 of Table 1 – namely, the influence of monetary policy rates on credit is more negative after the introduction of CC – is not sensitive to alternative model specifications. First, in Table B3 in the Online Appendix, we report coefficients under progressively saturated versions of the model. In particular, in column 1, we employ just firm fixed effects, a minimal set of controls accounting for differences in loan size across firms. Next, we augment the model progressively introducing macroeconomic controls (column 2), bank fixed effects (column 3), firm\*bank fixed effects (column 4), bank controls (column 5) and a lagged proxy of firm leverage (column 6). Importantly, under all such different model specifications, our main coefficient of interest (the interaction between the spread and the post dummy) is negative and statistically significant at the 1% level. Moreover, post-estimation diagnostics suggest that under most model specifications, including importantly the most robust one in column 6, the overall ex-post effect of an increase in monetary policy rate spread (i.e.,  $\beta_1 + \beta_3$ ) is negative.

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However, an insignificant total (ex-post + ex-ante) effect of monetary policy rates conditional on banks FX-funding is still a result suggesting a *stronger* monetary policy rates transmission on credit supply under capital controls. As a matter of fact, this implies that with capital controls in place banks are not able anymore to arbitrage jumps in monetary policy rates by borrowing in FX and lending in peso, which contributes to sharpening the pass-through of monetary policy rates on credit supply (i.e., the FX funding channel does not matter anymore).

In Table B4 of the Online Appendix, we further augment the most robust model with additional controls and/or fixed effects and we validate the robustness of our findings to alternative clustering of the standard errors. In column 1, we include a linear time trend. Indeed, results are virtually identical. There may be concerns that the described effect of Colombian monetary policy rate reflects muting global risk aversion. Hence, in column 2, we control directly for US monetary policy rate augmenting the model with the Effective Federal Funds Rate (EFFR), an important exogenous driver of risk aversion worldwide (see, e.g. Bruno and Shin, 2015b). In column 3, we include a country-specific indicator of risk aversion, i.e. the JP-Morgan Emerging Market Bond Index (EMBI) for Colombia.<sup>18</sup> In both models, the effect of the policy rate spread on credit remain insignificant before the introduction of CC and RR, and negative thereafter. In column 4, we saturate our equation with firm\*quarter-of-the-year fixed effects (on top of firm\*bank fixed effects), which account for firm-specific seasonal demand shocks for credit (Berg et al., 2021) and prompt a negative pre-policy response of credit to a rise in the policy rate spread, nonetheless reinforced after the introduction of CC and RR. In column 5, we additionally control for the lagged loan-level provision for losses, rescaled by the loan amount. Contemporarily to the prudential shocks, the Central Bank of Colombia modified the rules for computing loan loss provisions and we show that this does not interact significantly with our findings. In column 6, we rerun the baseline model weighting observation by the log loan size; the nearly unchanged coefficients reassure that the baseline estimates do not reflect variations in very small loans. Likewise, applying the same weighting scheme to the demanding models controlling for firm\*quarter-of-the-year fixed effects and provisions does not alter our findings (column 7 and 8, respectively).

Next, we estimate the baseline model under alternative clustering strategies at the level of firm and bank in column 9, firm and bank and year:quarter in column 10, and firm and bank\*industry and year:quarter in column 11, and find that our coefficients of interest are nonetheless significant at conventional levels. Moreover, the overall ex-post effect of the monetary policy rate spread on credit (i.e.,  $\beta_1 + \beta_3$ ) remains also negative and statistically significant at least at 10% level.<sup>19</sup>

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<sup>18</sup> The EMBI index is generally thought to be a good indicator of investors' risk appetite for Latin American assets and it does in fact respond to dynamics in global risk appetite and/or muting external sector conditions (see, e.g. Österholm and Zettelmeyer, 2008); similar considerations apply to its Colombian counterpart (Julio et al., 2013).

<sup>19</sup> In Panel A of Table B5 in the Online Appendix, results are robust also using the very conservative bank-level clustering.

Moreover, we verify that our findings hold when using either the simple policy rate or its surprise component. We report findings in Table A4 in the Appendix, which reproduce Table 1 using either the monetary policy rate (Panel A) or the monetary policy rate surprises index (Panel B) instead of the policy rate spread. Reassuringly, in line with our previous findings, estimates suggest that an increase in both the policy rate or in its surprise component generally exert an insignificant impact on credit prior to the imposition of CC, and a negative one with CC in place. Based on estimates in column 1 of Panel A, after the enforcement of CC, a 1 p.p. jump in the local policy rate is linked to a relative cut in credit by 3.46 p.p.. Likewise, a 25 b.p. increase in the surprise component of the policy rate cuts credit by roughly 10 p.p. after the enforcement of CC.<sup>20</sup>

We also pin down a dynamic loan-level response of bank credit to monetary policy rates by running local projections (Jordá, 2005). That is, we sequentially estimate otherwise identical linear models to equation (1), though with the dependent variable forwarded by 0, 1, 2 and 3 quarters with respect to the independent variables. Plotting the resulting coefficients provides the impulse response functions (IRF) of bank credit to an increase in a given proxy of policy rate. We show the IRFs in Figure B1 of the Online Appendix. Panel A displays the IRFs obtained using the policy rate spread between Colombia and US. Panel B employs the surprise component of the policy rate, so to capture unanticipated changes in the local policy rate. In both cases, the figures indicate that under capital mobility the effect of an increase in the policy rate on credit is nil over the considered horizon (see the red IRF). Differently, under CC there is a significant negative reaction at impact, which persists over the 3-quarter period following the innovation in monetary policy rates (see the blue IRF). The lack of mean-reversion in the IRF may be due to the (data-driven) short horizon over which we can estimate the reaction of credit to monetary policy rates.

### **4.3.2 Monetary Policy Rates and Carry-Trade Lending**

In this subsection, we show that carry-trade lending induced by higher monetary policy rates is a robust result across a wide variety of modeling strategies and is not dependent on any specific choice presented so far.

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<sup>20</sup> Note that this is a fairly large shock, corresponding to a 1 s.d. change in the index of monetary policy surprises. Over our sample period, this index varies from -37 b.p. to 42 b.p.. Hence, a 25 b.p. corresponds to roughly 1/3 of the min-max variation. For comparison, we calibrate the response to the simple interest rate differential to a 1 p.p. increase, corresponding to 1/3 of its s.d. and to 20% of its own min-max variation.

In Appendix Table A3, we estimate alternative specifications of the model. In column 1, we further control for loan loss provisions, and their interaction with both the policy rate spread and the post dummy. In column 2, we rerun the baseline model (in column 6 of Table 1) with observations weighted by log loan size, thereby estimating coefficients driven from more meaningful credit relationships. In column 3, we complement the WLS estimation with the full interaction of the loan loss provisions with the policy rate spread and the post dummy. In columns 4 to 6, we estimate both by OLS and WLS the baseline model (and its augmented version with loan loss provisions), removing firm\*year:quarter fixed effects and substituting them with industry\*year:quarter fixed effects. By doing so, we include also companies borrowing from one bank only. Importantly, coefficients are virtually unaffected from all such modifications of our baseline model.<sup>21</sup> Next, we estimate the baseline model under alternative clustering strategies at the level of firm and bank in column 7, firm and bank and year:quarter in column 8, firm and bank\*industry and year:quarter in column 9, and find that our coefficients of interest are nonetheless significant at conventional levels.<sup>22</sup>

Moreover, in Table B6 of the Online Appendix, we verify that our results are robust to alternative definitions of the bank-level variables. First, there may be worries about the fact that heterogeneity in bank-level variables reflect common changes across banks over time. Using time fixed effects, either alone or interacted with industry and firm dummies, already takes care largely of this concern. Confirming this intuition, if we explicitly subtract time fixed effects from bank-level variables (from separate bank-level regressions for each bank control on time dummies), we obtain nearly identical results, as evident in column 1. Second, while employing lagged values of bank-level variables ensures that bank balance sheet items are predetermined with respect to the dependent variable, one may argue that, setting their capital structure in a forward-looking manner, banks FX-funding may predict future levels of lending. This issue does not seem especially worrisome in our context, given notable stickiness in banks' capital structure. As a relevant example, bank fixed effects alone explain roughly 70% of the variation in FX-funding across bank.

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<sup>21</sup> We further validate that our findings are robust to controlling for the full interaction of the policy rate spread and the post-dummy with an indicator for whether a bank is foreign-owned or not (the related regression table is available upon request). Indeed, our main coefficients of interest related to the carry-trade channel remain both qualitatively and quantitatively unchanged.

<sup>22</sup> In Panel A of Table B5 in the Online Appendix we show that our coefficients of interest are significant at conventional levels also under bank-level clustering.



Nonetheless, we rerun our analysis using fully predetermined bank balance sheets (i.e., measured at their 2005q1 value) or fixed at their average level over the period of analysis. Not surprisingly, results in columns 2 and 3 suggest that both modifications do not alter our findings. Third, exploiting the ratio between FX-funding and assets, our findings may be capturing variations in bank size rather than heterogeneity in (ex-ante) reliance on FX-debt. Once again, this is unlikely to happen, as we do directly control for bank log total assets (interacted with both the policy rate spread and the post dummy). However, we test our model rescaling all bank-level ratios used as independent variables by either fully predetermined bank total assets as of 2005Q1 or average total assets over the period of analysis. Results are robust to this sensitivity check (see, respectively, column 4 and 5).

We next examine the evolution of the carry trade lending mechanism over our period of analysis. In our regressions, we check the relative difference of the conditional response of FX indebted banks to the policy rate spread before and after the introduction of CC in 2007Q2. However, one might worry that the contraction in the strength of carry trade lending strategies that we attribute to the CC period reflects a declining trend taking place before the introduction of CC. To address such concerns, we estimate the following model:

$$\text{Loan}_{f,b,yq} = \{\beta_1 + \beta_2 * \mathbf{1}_{yq}[2006Q2-2008Q2] + \beta_3 * \mathbf{1}_{yq}[2007Q2-2008Q2]\} * \text{MPspread}_{yq-1}^{\text{US}} * \text{FX-Funds}_{b,yq-1} + \text{Controls}_{b,yq-1} + \delta_{f,b} + \delta_{f,yq} + \varepsilon_{f,b,yq}$$

where:  $\mathbf{1}_{yq}[2006Q2-2008Q2]$  is a dummy with value 1 from 2006Q2 onward and 0 otherwise, whereas  $\mathbf{1}_{yq}[2007Q2-2008Q2]$  is our usual post-policy dummy with value 1 from 2007Q2 onwards. Under this specification:  $\beta_1$  represents the intensity of the carry trade lending strategy during the period 2005Q2 to 2006Q1;  $\beta_2$  estimates the intensity over 2006Q2-2007Q1 compared with the previous period; and finally,  $\beta_3$  measures the change in the strength of carry trade lending over the CC-period 2007Q2-2008Q2 (relative to the period 2006Q2-2007Q1). We depict these three coefficients in Figure 2. The coefficient  $\beta_1$  is positive but barely statistically significant, whereas the larger and statistically significant coefficient  $\beta_2$  suggests that the strongest period for carry trade has been 2006Q2-2007Q1.

[Insert Figure 2 here]

Finally,  $\beta_3$  is strongly negative and statistically significant, ultimately suggesting that the contraction in carry trade lending after the enforcement of capital controls does not relate to preexisting trends. Moreover, the strengthening of the carry trade lending strategy over the period 2006Q2 to 2007Q1 is consistent with both aggregate and bank-level figures on FX inflows. Note in Figure 1, Panel B, it is around 2006Q2 that Colombia has large (non-FDI) capital inflows. In Figure 3, we show the total quarterly FX debt intakes by Colombian banks (through long-term loans and bonds).<sup>23</sup> Also, this more granular chart shows that the capital boom ramps up at the end of 2006 and beginning of 2007 and is eventually halted by CC, therefore tightly mirroring the dynamics portrayed by our estimates.

[Insert Figure 3 here]

In Appendix Table A4 we check that the carry trade channel is robust to substituting the policy rate spread with the simple policy rate (panel A) or with its surprise component (panel B). The coefficients from the most robust version of the model in column 7 of Panel A imply that, before CC, banks with a 1.s.d. larger FX funds respond to a 1 p.p. jump in the policy rate increasing lending by 1.8 p.p. (to the same firm in a given period). Under CC, the same combination of policy rate increase and larger FX funding is associated with a relative lending cut by 2.5 p.p., as compared to the pre-policy effect. Likewise, results in column 6 of Panel B imply that during the pre-policy period that a 25 b.p. jump in the surprise component of the local policy rate brings a 2.2 p.p. relative ascent in credit supply for banks with 1 s.d. higher FX-funding. Conversely, the same combination of tighter surprise index and greater FX-funding contracts credit supply by roughly 10 p.p. with CC in place (as compared to before). In columns 7 and 8, we use the predicted values from regressions of policy rate and policy rate spread against the surprise component, denoted by  $\tilde{i}_{yq-1}$  and  $\widetilde{MPSpread}_{yq-1}$ , respectively.<sup>24</sup> Both variables reproduce results consistent with our baseline findings.

An especially important and interesting set of controls in our analysis is the interaction of bank FX funding with proxies of conditions in the Colombian external sector, which influence the ability

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<sup>23</sup> Importantly, this measure excludes FX-liabilities issued by Colombian banks through foreign subsidiaries and therefore significantly underestimates the extent of FX-borrowing.

<sup>24</sup> The regression of the simple policy rate (policy rate spread) on  $\Xi_{yq-1}$  confirms that the surprise component predicts a large extent of its observed variation. The estimated coefficient amounts to .051 (.046) and is significant at the 1% level with robust standard errors. Moreover, the F-Statistic equals 61 (32) and the R-squared 52% (75%).

of local banks to access FX liabilities as well as the value of such liabilities over time. In Appendix Table A5, we show our findings under alternative proxies. First, in column 1, we display the baseline model in column 6 of Table 1, in which we use the log exchange rate (expressed as Colombian Pesos per 1 USD, so that an increase denotes a depreciation of the local currency). Interestingly, before CC, a 1 s.d. appreciation of the exchange rate triggers a relatively larger increase in lending by 1 p.p. among banks with a 1 s.d. larger FX funding. However, under CC, this effect is not significant. In column 2, we replace the log exchange rate with the VIX, commonly interpreted as an indicator of global risk aversion (liquidity conditions) that significantly responds to U.S. monetary policy shocks (Miranda-Agrippino and Rey, 2020) and drives capital flows worldwide (Rey, 2015).<sup>25</sup> Our main coefficients of interest are robust to this replacement. Moreover, the interaction of the VIX with banks FX funding suggests that a 1 s.d. loosening in global risk aversion (decline in VIX) is associated with a relative jump in lending by 2.4 p.p. for banks with a 1 s.d. larger FX funding before CC. In line with results for the exchange rate, though, CC nullify such influence. In column 3, we use oil price as an indicator of external sector conditions for Colombia. Oil represents the bulk of Colombian exports; however, its price is largely exogenous and correlates substantially with the exchange rate (over our period, by a factor of 80 percent). Once again, this does not affect the carry trade coefficients. Moreover, a 1 s.d. increase in oil prices drives (ex-ante) a relative expansion of lending by 5 p.p. for banks with a 1 s.d. larger FX funding, an influence halted by CC. All these results suggest that when global conditions are loose, the value of bank FX liabilities increases, thereby boosting their credit supply (see, e.g., Bruno and Shin, 2015b). CC eventually break this channel. Finally, in column 4, we apply the JP-Morgan EMBI index for Colombia, a proxy for investors' risk aversion for Colombian assets. Corroborating the results described so far, in the pre-policy period, a 1 s.d. decline in risk aversion (i.e., a decline in EMBI by 30 basis points) is associated to a relative expansion in credit supply by 1 p.p. for banks with a 1 s.d. higher FX funding. The introduction of CC nullifies this effect.

Last, we analyze the dynamics of the carry-trade mechanism through local projections in Figure B2 of the Online Appendix, obtained using either variations in the policy rate spread (Panel

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<sup>25</sup> Reflecting a significant interdependence between the VIX indicator and external sector conditions in Colombia, the joint inclusion of the VIX and the exchange rate in a regression model generates multicollinearity issues. For this reason, we include the two variables separately in alternative models rather than altogether. Similar considerations apply to oil price, which is the main driver of Colombian exchange rates, given the prominent role of oil exports, and to the Colombian EMBI.

A) or in the surprise component of the Colombian policy rate (Panel B). The latter figure aims at reassuring that the dynamic response of credit is due to unanticipated variation in the local policy rate. From a practical perspective, we use a specular model to the one analyzed so far, in which the dependent variable is however forwarded by  $h$  quarters,  $h=0,1,2,3$  (as compared to the left-hand side variables). Panel A plots the coefficients employing the policy rate spread, calibrated to a 1 p.p. increase in the policy rate spread and to a 1 s.d. higher bank FX-funding, and suggests that the carry-trade channel is operative at any horizon over the considered period. Similar considerations apply for Panel B, where we calibrate the IRF to a 25 b.p. increase in the policy rate surprises and to a 1 s.d. jump in bank FX-funding. Moreover, the dynamics obtained through variations in the surprise index match very closely those from the simple policy rate spread, suggesting that unanticipated variation in the local policy rate influence substantially the policy rate spread. In both circumstances, the lack of mean-reversion in the IRF may arise because of the (data-driven) short horizon over which we can estimate the reaction of credit to monetary policy rates.

#### **4.4 More Evidence on the Carry Trade Mechanism: CIP deviations and Peso vs FX-Lending**

In this subsection, we provide further evidence consistent with a carry-trade mechanism behind the (robust) relation between policy rate changes, banks FX-funding and capital controls. Such a carry-trade lending strategy involves borrowing in cheap US Dollars (USD) debt and investing in expensive Colombian Peso (COP) loans. If unhedged, such carry triggers exchange risk. Importantly, the Basel rules (already in place before the imposition of CC) imply that banks fully hedge their FX-position through derivatives absorbing exchange rate risk. In fact, unhedged FX-positions trigger additional capital charges, which are prohibitively costly for banks. Hence, the strongest incentives for carries must come from interest rates differential not fully accounted for by forward premia, thereby granting positive returns also with a fully hedged FX-position. That is, banks ought to respond more prominently to deviations from the Covered Interest Parity (CIP).

[Insert Table 2 here]

We test this hypothesis by augmenting the baseline model with the full interaction between bank-level variables (including FX-funding), the 3-month forward premium and the post dummy. By doing so, we isolate credit supply channels associated to variations in the policy rate spread

which directly translate into deviations from the CIP.<sup>26</sup> Under the hypothesis that a fully-hedged carry-trade lending drives our findings, the interaction between banks FX-funds and the policy rate spread should have larger repercussions on credit supply in the augmented model, as in the baseline model the spread also comprises unhedged carry returns (which banks may not be able to profit from). Columns 1 and 2 of Table 2 compare estimates from the baseline and augmented model, respectively. Encouragingly, variations in the policy rate spread corresponding to CIP deviations amplify carry trade motives. In column 2, after controlling for the effect of interacted forward premia and bank balance sheet variables, a 1 p.p. increase in the policy rate spread triggers an expansion in credit by 6 p.p. among banks with 1 s.d. larger FX-funding. After the introduction of CC, the same combination of higher spread and access to FX-funding are associated to a contraction in credit supply of about 14 p.p. (relative to the pre-policy period). For comparison, the equivalent figures in the baseline estimates (in column 1) are 3.8 p.p and 7.3 p.p., respectively.

Next, we repeat this exercise over a smaller sample of observations for which loan volume is broken down by currency, i.e. domestic (peso) and FX-lending.<sup>27</sup> The rationale behind these regressions is twofold and points to a plausibly larger effect on peso lending. First, while a carry trade strategy is in principle profitable also with FX loans (under the reasonable assumption that these are more expensive in Colombia than in global interbank and wholesale funding markets), the strategy will nonetheless grant higher returns through peso-lending, given the positive interest rate differential. Second, banks would bear the CC-tax only if FX funds finance peso-denominated loans, so that credit supply variations induced by CC must show up among peso loans. Results in columns 3-6 of Table 2 validate this intuition. In both columns 3 and 4, showing respectively coefficients for baseline and forward-premium augmented regressions on peso loans, the carry-trade is statistically significant (though stronger in the augmented model). In contrast, both versions of the model produce insignificant estimates with FX- loans in columns 5 and 6.

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<sup>26</sup> We employ data on forward premia from Du and Schreger (2016), who retrieve CIP deviations based on the following identity:  $y_t - y_t^{US} = CIP_t + FP_t$ , where  $y_t - y_t^{US}$  is the Colombia-US sovereign-yield spread at the 3-month tenor and  $FP_t$  the forward premium at comparable tenor. Since, as it is clear from Appendix Figure A2,  $y_t - y_t^{US} \cong MPspread_t^{US}$ , it follows that  $CIP_t \cong MPspread_t^{US} - FP_t$ . We operate this approximation for illustrative purposes, i.e. to highlight the implications of higher policy rate spreads. However, if we use sovereign spreads (or the original series of deviations from the CIP), we obtain virtually identical findings; we avoid reporting them for brevity. Finally, we discuss thoroughly deviations from CIP and UIP over our sample period in the Supplementary Material.

<sup>27</sup> We report the summary statistics for this smaller sample in Table B1 of the Online Appendix. Note that this sample consists of large companies with supervised balance sheets and accounts across time for 55 percent to 60 percent of the total loan volume for multibank nonfinancial companies in the regression sample in Table 1.

To conclude, Table B9 of the Online Appendix reports a thorough analysis of deviations from the UIP and other proxies of carry-trade incentives for Colombia during our sample period. First, in columns 1-4, our coefficients remain significant in models isolating deviations from UIP, i.e. in models augmented with the full interaction of bank-level variables with the post dummy and ex-ante expected or ex-post realized exchange rate depreciation (as opposed to regressions augmented with interacted forward premia as in the case of CIP discussed so far). In line with the hypothesis that banks are especially sensitive to CIP deviations, however, we show that accounting for UIP deviations does not magnify coefficients as compared to the baseline model. Second, in column 5, our findings are robust to substituting the policy rate spread with the carry-to-risk ratio, a popular proxy of carry-trade incentives (Bruno and Shin, 2017) which rescales the 3-month sovereign yield by a proxy of exchange rate risk.

#### **4.5 Carry Trade and Risk-Taking: Heterogenous Effects across Firms**

We investigate whether carry trade lending heightens bank risk-taking, and the eventual influence of CC on it, by looking for heterogenous effects across companies, depending on their riskiness and opaqueness. In detail, we proxy for credit risk by sorting companies based on quartiles of the distribution of the average interest payments in the pre-policy period, i.e.  $\text{Firm Risk}_{f,\text{pre}}$ . An identical classification ranks firms by liquidity risk based on the distribution of the average pre-policy reliance on short-term debt, i.e.  $\text{Short-Term Debt}_{f,\text{pre}}$ . Additionally, we split companies depending on whether they defaulted on at least one loan during the period 2005Q1-2007Q1, which further proxies for default risk. Finally, we divide companies by transparency and opaqueness based on whether their balance sheet is publicly supervised or not.

[Insert Table 3 here]

Table 3 reports estimates from the regressions from the most robust version of the model.<sup>28</sup> To start with, carry-trade lending does not impact companies in the first quartile of credit risk ( $\text{Firm Risk}_{f,\text{pre}}$ ), neither before nor after CC. On the contrary, firms with greater credit risk experience larger fluctuations in bank debt associated with the carry, and especially so for companies with

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<sup>28</sup> We choose to present results based on separate regressions for firms in different risk groups to ease the interpretation of our coefficients, based at most on triple interactions. However, in Panel A of Table B10 of the Online Appendix, we estimate pooled regressions for the firm risk results. The results are qualitatively and quantitatively similar.

above-median credit risk. For instance, in reaction to a 1 p.p. jump in the policy rate spread, before CC, banks with a 1 s.d. higher share of FX funds expanded credit to firms in the fourth quartile of credit risk by 7.3 p.p. After CC, these firms also suffer sharper cuts, by 15.1 p.p. relatively to the pre-policy effect, resulting in an overall credit supply contraction by 7.8 p.p..

Similar dynamics apply to firms with different levels of liquidity risk. Indeed, carry trade lending does not affect bank debt of firms with the lowest liquidity risk, but significantly impacts loans to firms with higher reliance on short-term debt. Moreover, before CC, when the spread goes up by 1 p.p., companies that ex-ante default (do not default) on one or more loans enjoy a relative credit expansion of 5.1 p.p. (2.9 p.p.) by banks with a 1 s.d. higher share of FX funds. After CC, the same combination of jumps in the spread and in lenders' FX funds brings a relative credit reduction of 9.7 p.p. (6.1 p.p.), as compared to the pre-policy effect. Finally, opaque firms do not benefit more than transparent ones from carry lending before CC, but after their enforcement they undergo a larger reduction in credit (as compared to the pre-CC period), by 8.78 p.p. in response to the usual jumps by 1 p.p. increase in the spread and by 1 s.d. in banks' FX exposure.

Overall, these findings are consistent with increased bank risk-taking due to carry trade lending. Also, they indicate that CC contribute to mitigating these risks, as the post-CC reduction in lending by highly FX indebted banks (following an interest rate spread increase) concentrates among risky and opaque borrowers.

## **5. The Impact of Reserve-Requirements on Bank Credit**

### **5.1 Empirical Strategy**

We run a difference-in-differences exercise in symmetric five-quarter windows around the modification of the RR-policy in 2007Q2, i.e. over the period 2006Q1 to 2008Q2. We employ the following model:

$$(3) \text{Loan}_{f,b,yq} = \beta_1 \text{Post}_{yq} * \text{RR-Depo}_{b,2007Q1} + \gamma \text{Post}_{yq} * \text{BankControls}_{b,2007Q1} + \delta_{f,b} + \delta_{f,yq} + \varepsilon_{f,b,yq}$$

The dependent variable is loan volume. The main coefficient of interest is  $\beta_1$ , describing the impact of ex-ante heterogeneity in RR-taxed deposits, i.e. the sum of checking and saving deposits, on the ex-post volume of credit. Note that we fix heterogeneity across bank reliance on deposits taxed by the RR-shock at its 2007Q1 value; we apply an identical convention to bank controls. We

augment the model with firm\*bank dummies,  $\delta_{f,b}$ , whereas we control for firms' credit demand through firm\*year:quarter fixed effects,  $\delta_{f,yq}$  (Khwaja and Mian, 2008).  $\varepsilon_{f,b,yq}$  is an error term, double-clustered at the firm and bank\*industry level.

The consistency of our estimates crucially depends on the parallel trend assumption: absent the modification of RR policy in 2007Q2, banks with different reliance on checking and savings deposits would experience parallel ex-ante and ex-post credit dynamics. We test the validity of such assumption in our setting using the alternative model:

$$(4) \text{Loan}_{f,b,yq} = \beta_{1,yq} * (1[\text{year:quarter}=yq]) * \text{RR-Depo}_{b,2007Q1} + \gamma \text{Post}_{yq} * \text{Bank Controls}_{b,2007Q1} + \delta_{f,b} + \delta_{f,yq} + \varepsilon_{f,b,yq}$$

That is, we allow the relation between  $\text{RR-Depo}_{b,2007Q1}$  and loan volume to vary over the different year:quarters in our sample, as  $1[\text{year:quarter}=yq]$  is a dummy variable with value 1 in year:quarter  $yq$  and 0 otherwise. We fix 2007Q1 as the baseline period. A validation of the parallel trend assumption requires that the RR-treatment effect is not statistically different from zero before 2007Q2, and statistically significant thereafter.

## 5.2 Baseline Results

[Insert Table 4 here]

We report baseline results in Table 4. In column 1, we apply a minimal set of controls, including firm fixed effects and bank controls, interacted with the post dummy. The treatment effect is negative and significant at the 1 percent level. We next saturate the model, first by including firm\*bank fixed effects, which imply an increase in the R-squared by roughly 30 p.p.. Nonetheless, the treatment effect remains negative and significant (column 2). We then control for time-varying shocks, either common across all firms (column 3) or industry-specific (column 4), by applying year:quarter and industry\*year:quarter fixed effects, respectively. Coefficients are virtually unaffected.

In column 5, we fully shut down firm demand shocks with firm\*year:quarter fixed effects (hence estimating the most robust model presented in regression equation (3) in the previous subsection). The treatment effect remains significant at the 1 percent level, suggesting also a strong economic impact of RR-shock. A 1 s.d. (7.8 p.p.) increase in the share of total assets financed with either savings or checking deposits implies a 5.4 p.p. reduction in bank credit (to a given firm in a



specific period). In column 6, we test separately for the effect of checking and savings deposit exposures. The coefficients suggest a stronger effect of exposure to checking deposits, as a 1 s.d. (4.1 p.p.) jump implies a 7.6 p.p. reduction in loan volume. The effect of exposure to saving deposits is smaller, but still economically meaningful, corresponding to about 2.9 p.p. in reaction to a 1 s.d. (7 p.p.) increase.

### 5.3 Robustness

First, in Panel A in Appendix Table A6, we estimate alternative specifications of the model. In column 1, we further control for loan loss provisions, both alone and interacted with the post dummy. In column 2, we rerun the baseline model (from column 5 of Table 4) with observations weighted by log loan size to smooth the influence of small credit relationships. In column 3, we complement the WLS estimation with loan loss provisions and their interaction with post dummy. In columns 4 to 6, we estimate, both by OLS and WLS, the baseline model (and its augmented version with loan loss provisions), removing firm\*year:quarter fixed effects and substituting industry\*year:quarter fixed effects. This allows us to include in the regression sample those companies that borrow from only one bank. Importantly, coefficients do not change meaningfully across all such modifications of our baseline model, so that both the qualitative and quantitative interpretation of our channel provided in the previous subsection go through.

In columns 7, 8, and 9, we estimate the baseline model under alternative clustering strategies. In column 7, we estimate at the level of firm and bank. In column 8, firm and bank and year:quarter. And in column 9, firm and bank\*industry and year:quarter. Our coefficients of interest remain significant at least at the 12 percent level in the case of firm and bank clustering.<sup>29</sup>

Second, we run cross-sectional regressions in which the dependent variable is loan growth rate between 2007Q1 (the period before the shock to RR) and  $j$  quarters ahead,  $j = \{1, 2, 3, 4, 5\}$ , to validate

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<sup>29</sup> If we apply bank-level clustering, the significance level for the coefficient on  $RR-Depo_{b,2007Q1}$  falls to just 19%. Nonetheless, the effect of the increased taxation on checking deposits on credit supply is significant at 1% level (Panel B of Table B5 of the Online Appendix), which is reassuring given the larger economic significance of the coefficient on checking deposits (as compared to that for saving deposits) described in section 5.2 in the paper. The coefficient on checking deposits is likewise significant at conventional levels under double clustering at the firm and bank level (not shown). Recall, however, that clustering at the bank level raises issues about a small number of clusters (strictly below 50).

that the treatment effect persists across shorter periods than the five-quarter window analyzed in the baseline model. Results in Panel B of Appendix Table A6 suggest that this is the case.

[Insert Figure 4 here]

Third, we further inspect the validity of the parallel trend assumption. Figure 4 depicts the time-varying coefficient of the treatment effect (relative to a baseline, fixed at zero, for 2007Q1), obtained from the estimation of regression equation (4). Indeed, before 2007Q2, overall exposure to savings and checking deposits does not affect bank credit. After the RR shock, however, the coefficient becomes markedly negative and statistically different from zero, providing suggestive evidence in favor of the parallel trend assumption.

Fourth, we run a placebo test, i.e. we consider a pre-policy sample from 2005Q1 to 2006Q4, and fix exposures and bank controls as of 2005Q4. This is a “fake” exposure, which should not be associated with a contraction in credit, confirmed in Panel C of Appendix Table A6.<sup>30</sup>

#### **5.4 Heterogenous Effects across Firms**

As with carry trade regressions, we sort companies according to proxies of credit risk, liquidity risk, default risk, and opaqueness, and repeat the baseline exercise across such different groups of firms. Table 5 displays the results.

[Insert Table 5 here]

The reduction in credit is not significant among firms with the lowest credit risk (those in the lowest quartile of the ex-ante distribution of average interest payments over loans). On the other hand, it is significant across riskier companies, and the reduction in credit among them increases (in absolute terms) as their riskiness does. In particular, firms in the upper quartile of credit risk experience a 15 p.p credit on loans from banks more RR-exposed by a 1 s.d. increase. Similarly, only companies with above-median liquidity risk suffer credit reduction from more RR-exposed financial institutions. Furthermore, there is not a statistically significant difference between companies with and without ex-ante loan defaults, but stark differences emerge between transparent companies and opaque companies. The former do not suffer any credit reductions due

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<sup>30</sup> The summary statistics for the placebo test are in Table B2 of the Online Appendix.

to RR shocks, whereas the latter suffer a 7.8 p.p. credit cut by lenders more exposed to RR by a 1 s.d. increase.<sup>31</sup>

### 5.5 Banks' Domestic and Foreign Funding: Complements or Substitutes?

We have so far shown that: i) CC strengthen the bank-lending channel of monetary policy rates, through their impact on bank foreign liquidity; ii) the shocks to RR exert a large direct negative effect on bank credit by raising the cost of core domestic liquidity. Both policies therefore contribute to taming credit booms. It remains to be understood whether the foreign and domestic liquidity are complements or substitutes in bank funding structure, i.e. whether banks that use more FX funds also employ larger core deposits to finance their assets, or not. In this respect, the sum of domestic (saving and checking) deposits and FX-funding constitutes, on average, roughly 54 percent of banks' total assets. Hence, whether banks with a higher share of domestic deposits are more or less indebted in FX is ultimately an empirical question.

[Insert Figure 5 here]

The scatterplot in Figure 5, which reports bank (time-varying, quarterly) reliance on savings and checking deposits on the x-axis and bank FX funds on the y-axis, indicates that banks that use more FX liquidity rely less on domestic core deposits. In other terms, banks more exposed to RR are *less* exposed to CC. Over the period of analysis the two variables do in fact correlate negatively (by a factor of 37 percent, significant at 1 percent level).<sup>32</sup>

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<sup>31</sup> We obtain nearly identical results if, instead of running separate regressions for firms in different risk groups, we estimate a pooled model exploiting the triple interaction between the post dummy, the bank-level ex-ante exposure to RR and the different dummies for firm risk (see Panel B of Table B10 in the Online Appendix).

<sup>32</sup> For a more detailed view on the correlation across bank-level variables, both before and after removing time fixed effects, see respectively Panel A and B of Table B7 of the Online Appendix. An important question is *why* some banks' funding depend relatively more on external sources, as opposed to domestic ones. Indeed, the decision to seek financing abroad depends on a multitude of factors, including the institutional and regulatory setting, the domestic economy, firm characteristics, and financial conditions abroad. A broad and general discussion of those determinants falls outside the scope of the paper. Nonetheless, we highlight some differences between such banks within our sample. The correlation matrix in Table B7 in the Online Appendix suggests that larger banks with fewer non-performing loans (NPLs) rely relatively more on FX liquidity, even after removing time fixed effects. This may suggest that one driver of the surge in FX-funding was that larger and less risky (based on NPL) banks obtained relatively better foreign financing terms. Moreover, reliance on domestic deposits correlate positively with bank size and negatively with capitalization. Large groups may be more inclined to finance their expansion through debt rather than equity financing, given a larger deposit franchise. Finally, an interesting result is that saving deposits explain the negative correlation between FX-funding and domestic deposit funding. Saving deposits constitute the bulk of deposit funding for banks in our sample and are relatively longer-term liabilities, as compared to checking deposits. In fact, the correlation between checking deposits and FX-funding is positive. Hence, banks relatively more oriented towards FX-financing

A formal way to discern whether RR and the CC operate in a complementary fashion is to directly horse race them in a regression model. In Table 6, we show results from such an exercise (run over the longer period from 2005Q2 to 2008Q2), in which we contemporarily employ the full interaction of the policy rate spread with banks FX funds and the post dummy, as well as the full interaction of the RR-taxed checking and savings deposits with the post dummy.<sup>33</sup> In those regressions, both the decline in carry trade lending due to CC and in credit provided by banks more reliant on RR-taxed liabilities are significant, suggesting the two macroprudential policies operate through two distinct channels, complementary for taming the boom. Moreover, in Table B8 of the Online Appendix the same result holds employing the sum of saving and checking deposits (i.e.,  $RR-Depo_{b,yq-1}$ ) rather than the two separate variables.

[Insert Table 6 here]

Put differently, CC and RR - i.e. macroprudential measures targeting foreign and domestic bank debt, respectively - affect bank credit supply through different channels, as banks more affected by CC suffer less from RR, and vice versa. Policy-makers may therefore need both measures to slow down a boom driven by both foreign and domestic liquidity.

## 6. Conclusions

We study how capital controls and domestic macroprudential policy tame credit supply booms, either directly or by enhancing the bank-lending channel of monetary policy. Our work exploits: (i) the simultaneous introduction of capital controls and increase of reserve requirements on domestic bank deposits in Colombia during a strong credit boom; (ii) administrative credit registry and supervisory bank balance sheet data.

In brief, we find the following robust results. First, banks use cheaper FX funding from abroad to arbitrage higher local monetary policy rates (which raise the policy rate spread against the U.S.), by carry trading cheap FX funds with expensive local lending, especially to ex-ante riskier, more opaque local firms. Capital controls, by taxing FX debt, reduce the interest rate differential and break the carry trade, enhancing the bank-lending channel of local monetary (interest rate) policy

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may be more reliant on short-term borrowing. We leave the discussion of the determinants of the domestic deposit vs FX-funding segmentation for future research.

<sup>33</sup> Note that columns 1 through 3 in Table 6 correspond to columns 3 through 5 in Table 1 (check the carry trade coefficients). In Table 6, however, we explicitly show the effect of RR-taxed liabilities, before and after 2007q2.

and reducing bank risk-taking. Second, the increase in reserve requirements on domestic deposits directly reduces credit supply during the boom, and more so for riskier firms, rather than (indirectly) enhancing the effects of monetary policy rates on credit supply.

Our main contribution to the literature is to show that both capital controls and (domestic) macroprudential policy tame credit supply booms, including credit supply to ex-ante riskier firms, by targeting different sources of bank debt. Capital controls target foreign bank debt, thereby improving the effectiveness of the bank lending channel of (local) monetary policy -by halting carry trade lending strategies by local banks- and domestic macroprudential policy targets local bank debt, directly attenuating credit supply booms.

Credit booms stem from *both* foreign *and* local liquidity and reliance on domestic deposits *versus* foreign (FX) debt negatively correlate across banks (so that financial intermediaries more affected by capital controls suffer less due to the tightening of reserve requirements, and vice versa). Hence, our results suggest that a Tinbergen rule with two (macroprudential) instruments is necessary to tackle the two (intermediate) objectives (sources of liquidity).

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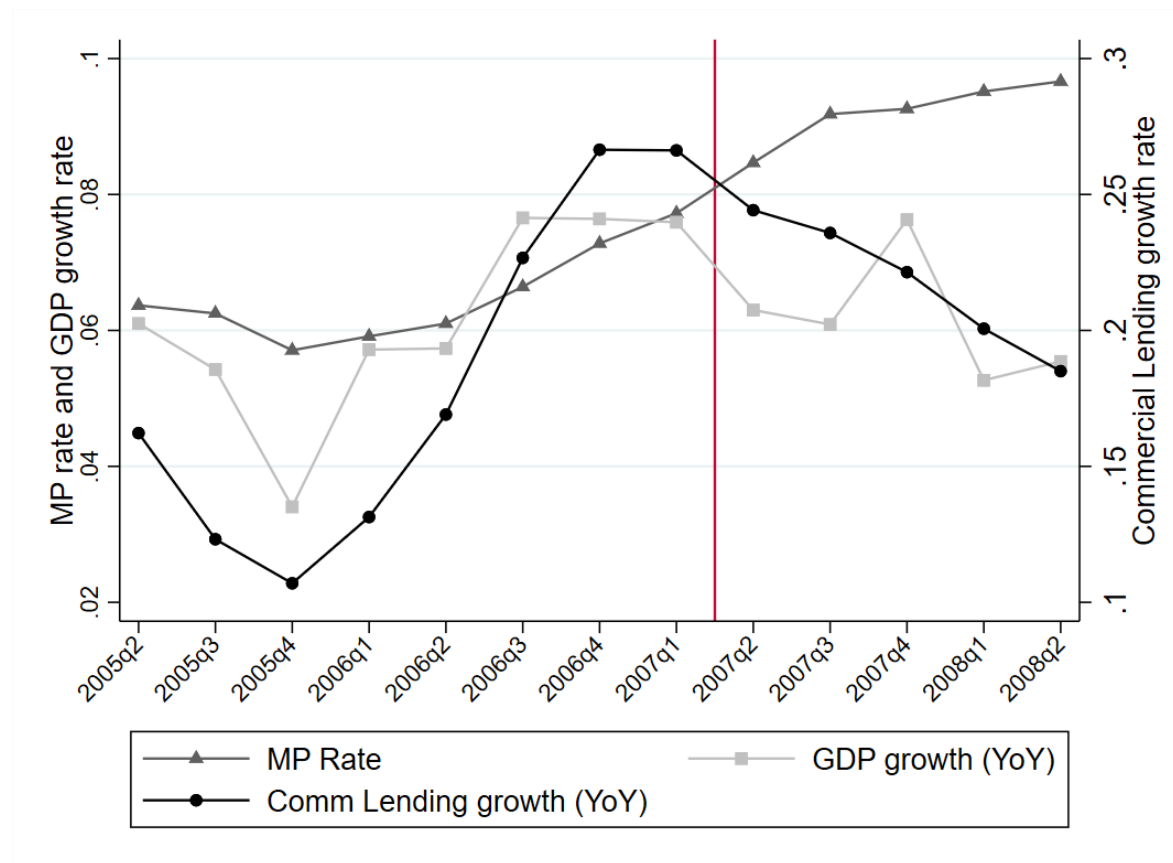
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## Figures

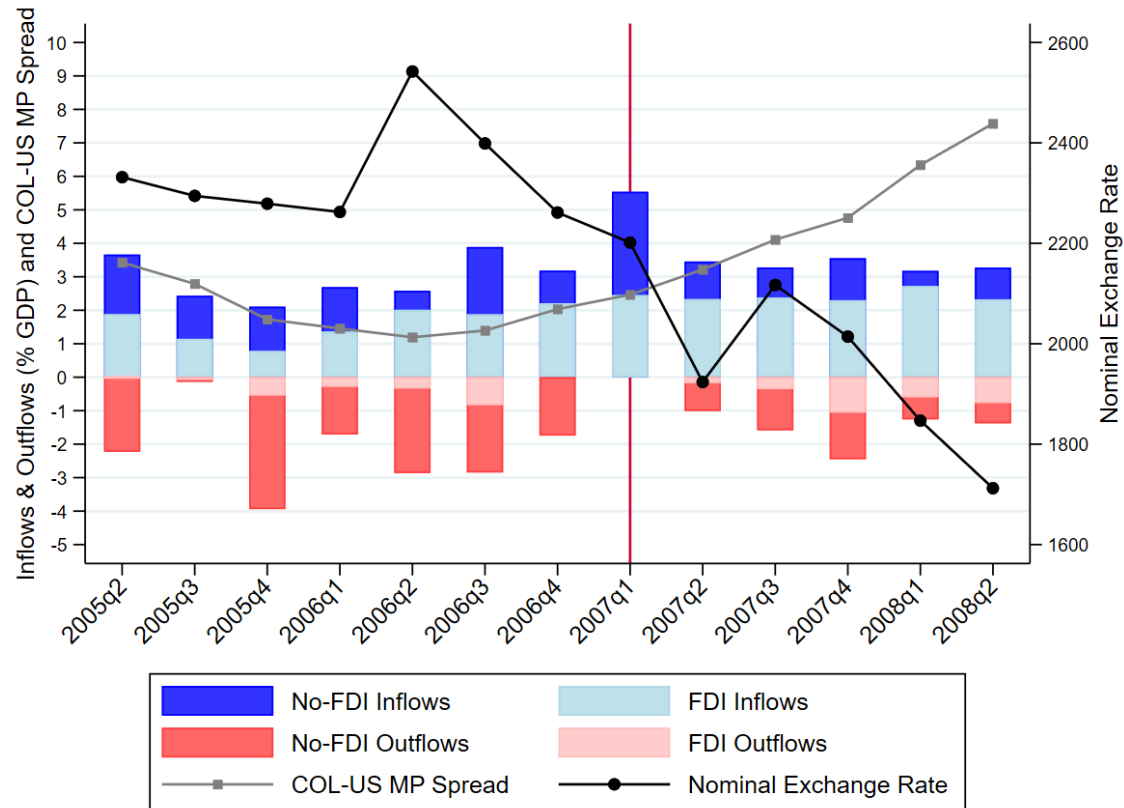
**Figure 1: Monetary Policy and Credit Growth**

Panel A: Credit Growth, Monetary Policy Rate and Economic Growth



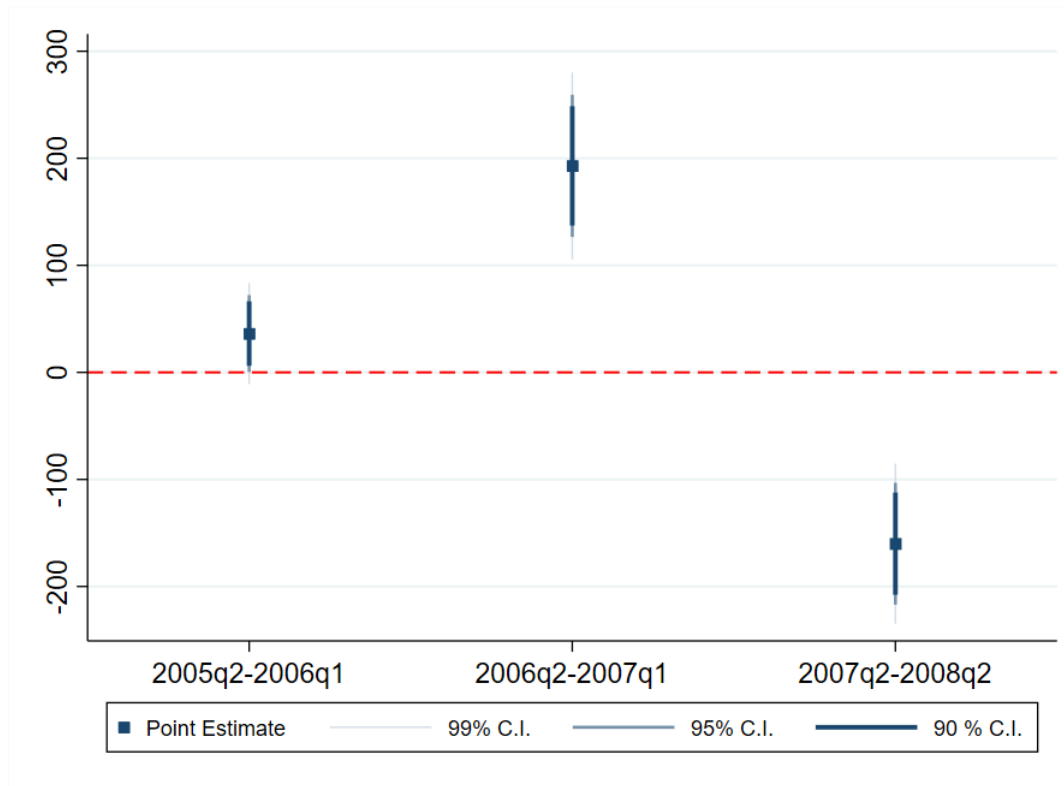
In this figure, the dark gray line – connected by triangles - represents the monetary policy rate (left y-axis), i.e. the prevailing interbank overnight rate. The light gray line – connected by squares - draws the evolution of the yearly growth rate of GDP (left y-axis). The black line – connected by circles - refers to the yearly growth rate of commercial credit (right y-axis). All data are from the Central Bank of Colombia.

Panel B: Exchange Rate, Colombia-US Monetary Policy Rate Spread and Financial Inflows and Outflows



In this figure, the light blue bars represent gross FDI inflows. The dark blue bars denote gross no-FDI inflows, i.e. the sum of gross portfolio inflows and other gross debt inflows. The light red bars represent gross FDI outflows (reported on a negative scale), whereas the dark red bars denote gross no-FDI outflows (also reported on a negative scale). We express inflows and outflows as a percentage of GDP on the left y-axis. The gray line - connected by squares - draws the evolution of the spread between the Colombian monetary policy rate, i.e. the prevailing interbank overnight rate, and the Effective FED Funds Rate, expressed in percentage points (left y-axis). The black line - connected by circles - depicts the Colombian Peso/US Dollar nominal exchange rate - i.e. Pesos per 1 US Dollar, so that an increase (decrease) corresponds to a depreciation (appreciation) of the Peso against the US dollar -, measured on the right y-axis. All data are from the Central Bank of Colombia apart from the Effective FED Funds Rate, retrieved from FRED.

**Figure 2:** Monetary Policy Rate Spread and Credit: Carry Trade Mechanism over Time

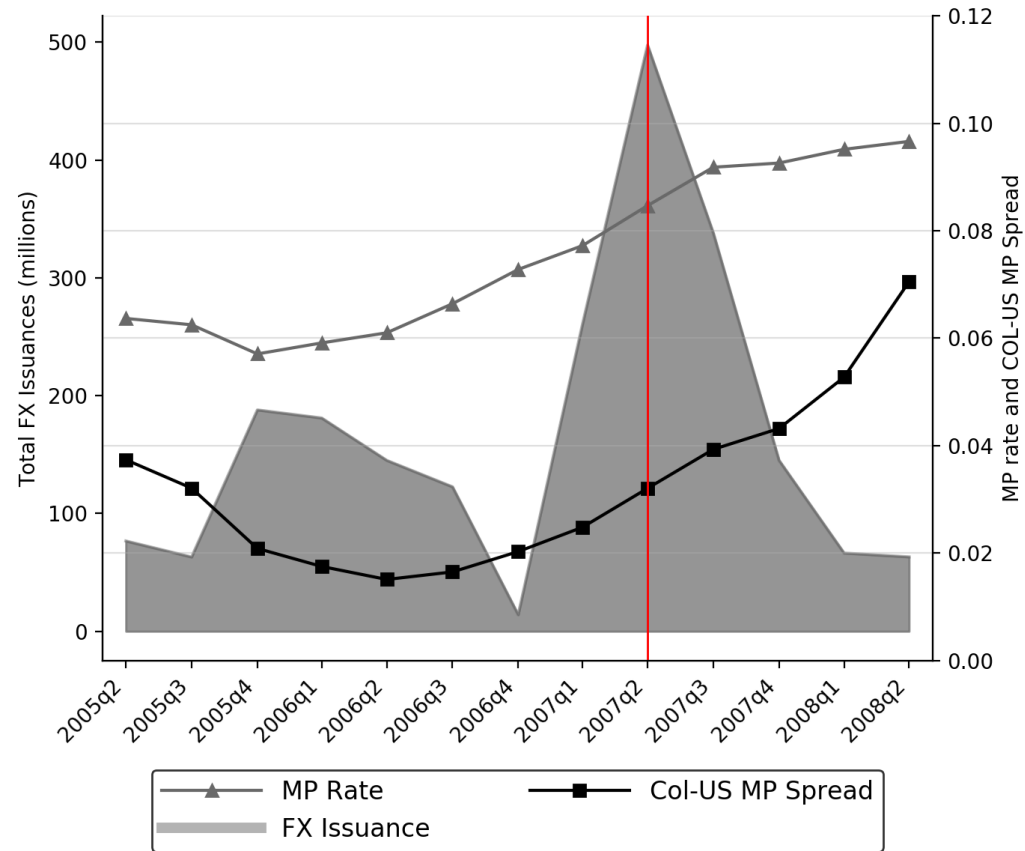


This figure reproduces the time-varying coefficient for the interaction between  $MPspread_{yq-1}^{US}$  and  $FX-Funds_{b,yq-1}$  from the following regression:

$$Loan_{f,b,yq} = \{\beta_1 + \beta_2 * \mathbb{1}_{yq}[2006Q2-2008Q2] + \beta_3 * \mathbb{1}_{yq}[2007Q2-2008Q2]\} * MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1} + Controls_{b,yq-1} + \delta_{f,b} + \delta_{f,yq} + \varepsilon_{f,b,yq}$$

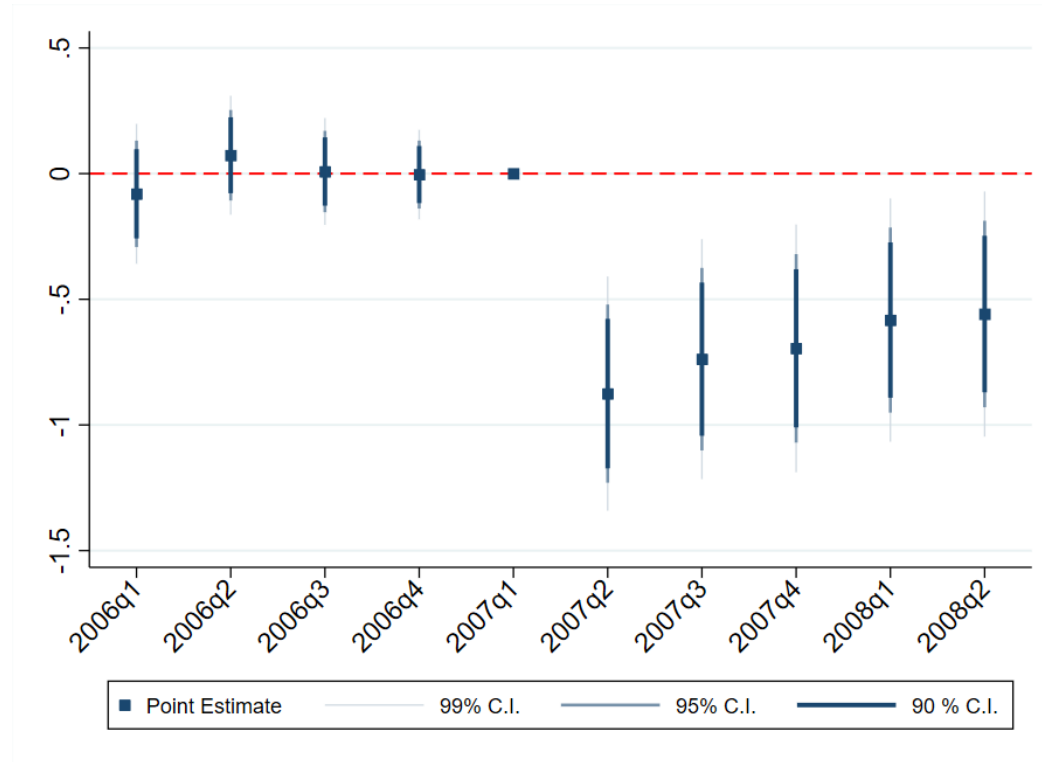
$Loan_{f,b,yq}$  is the log of total debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq$ .  $\mathbb{1}_{yq}[2006Q2-2008Q2]$  is a dummy with value 1 from 2006Q2 onward and with value 0 otherwise.  $\mathbb{1}_{yq}[2007Q2-2008Q2]$  is a dummy with value 1 from 2007q2 onward and with value 0 otherwise.  $Controls_{b,2007Q1}$  is a vector of bank controls (as of 2007Q1) including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans) - all being fully interacted with  $MPspread_{yq-1}^{US}$  and the time dummies – as well as the full interaction of  $FX-Funds$  with the lagged GDP growth rate, CPI index and log exchange rate.  $\delta_{f,b}$  is a vector of Firm\*Bank fixed effects;  $\delta_{f,yq}$  is a vector of Firm\*Year:Quarter fixed effects and  $\varepsilon_{f,b,yq}$  is an error term. The square markers denote the point-estimate of the time-varying coefficients and the lines around them are confidence intervals at different levels. Standard errors are double-clustered at the firm and bank\*industry level.

**Figure 3: FX Liabilities, Monetary Policy Rate and Colombia-U.S. Monetary Policy Rate Spread**



In this figure, the dark gray area represents the total amount of FX liabilities issued by Colombian banks (left y-axis), measured as the two-quarter moving average of total issuances of bonds and long-term loans (excluding issuances by Colombian banks through foreign subsidiaries). The dark gray line shows the monetary policy rate (right y-axis), i.e. the prevailing interbank overnight rate. The black line represents the evolution of the spread between the Colombian monetary policy rate and the Effective FED Funds Rate (right y-axis). All data are from the Central Bank of Colombia apart from the Effective FED Funds Rate, retrieved from FRED.

**Figure 4: Reserve Requirements Shock – Time-Varying Coefficient**



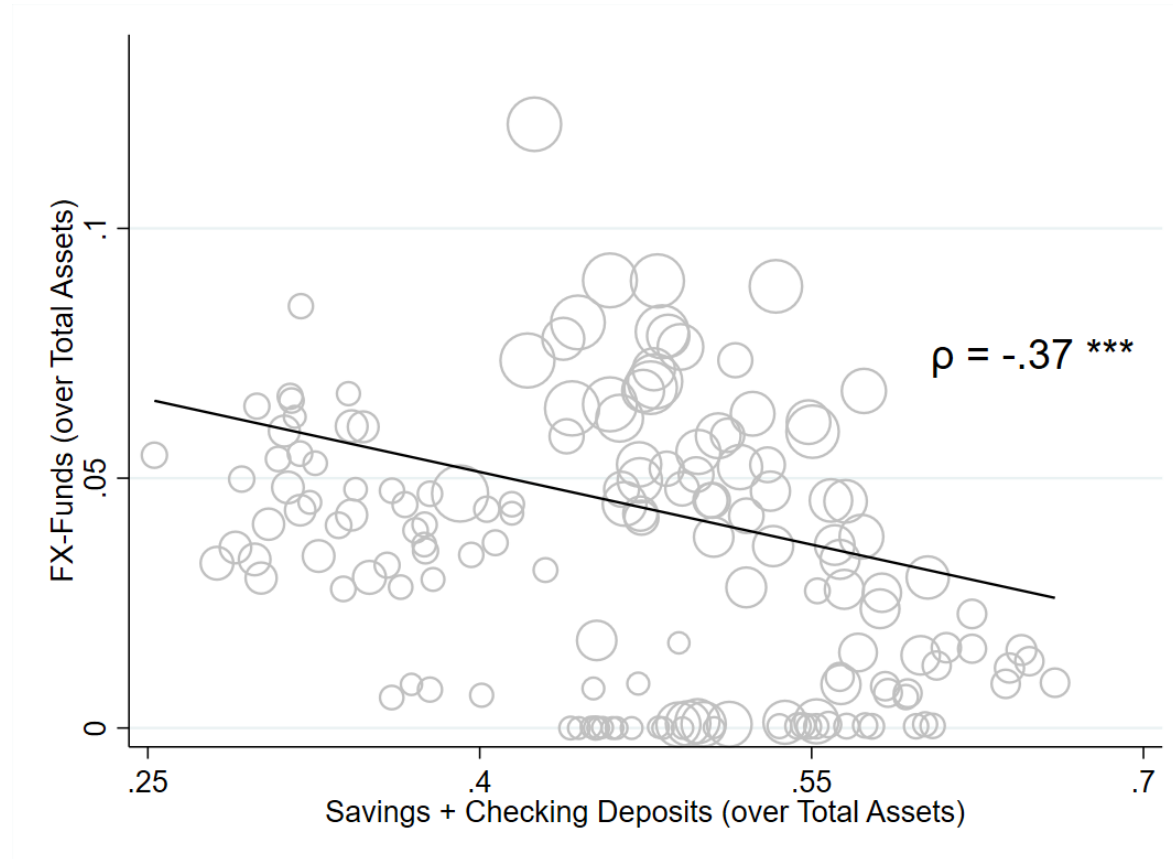
This figure reproduces the time-varying coefficient for  $RR-Depo_{b,2007Q1}$  (given by the sum of checking and savings deposits as of 2007Q1) from the following regression:

$$Loan_{f,b,yq} = \sum_{yq \neq 2007Q1} \beta_{yq} * RR-Depo_{b,2007Q1} + \gamma Post_{yq} * Bank\ Controls_{b,2007Q1} + \delta_{f,b} + \delta_{f,yq} + \varepsilon_{f,b,yq}$$

$Loan_{f,b,yq}$  is the log of total debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq$ .  $RR-Depo_{b,2007q1}$  is the sum of checking and saving deposits (rescaled by Total Assets) as of 2007Q1.  $Bank\ Controls_{b,2007Q1}$  is a vector of bank controls (as of 2007Q1) including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans).  $\delta_{f,b}$  is a vector of Firm\*Bank fixed effects.  $\delta_{f,yq}$  is a vector of Firm\*Year:Quarter fixed effects.  $\varepsilon_{f,b,yq}$  is an error term. Bank Controls are interacted with a post dummy, with value 1 (0) from 2007Q2 to 2008Q2 (from 2006Q1 to 2007Q1). The squared markers denote the point-estimate of the time-varying coefficients  $\beta_{yq}$  - representing the variation of loans relative to 2007Q1 induced by a unitary (100 p.p.) increase of  $RR-Depo_{b,2007q1}$  - and the lines around them are confidence intervals at different levels. For reference, a 1 s.d. change in  $RR-Depo_{b,2007q1}$  corresponds to 7.8 p.p.. Standard errors are double-clustered at the firm and bank\*industry level.



**Figure 5:** Banks FX-Funds *versus* Savings and Checking Deposits



This chart shows the negative correlation between bank FX-funds (y-axis) and bank Savings and Checking Deposits (x-axis) – affected by Capital Controls and Reserve Requirements, respectively – over the period from 2005Q1 to 2008:Q2. Each marker represents a bank-year:quarter pair and is weighted by the relative size (i.e. total assets) of a bank balance sheet with respect to the overall size of the banking sector in a given year:quarter. The coefficient  $\rho$  describes the pairwise correlation among the variables, which is equal to  $-.37$  and statistically significant at 1% level.

## Tables

**Table 1: Policy Rate Differential, Carry-Trade and Bank Credit**

|   | (1)                  | (2)                  | (3)                     | (4)                     | (5)                     | (6)                     |
|---|----------------------|----------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|   |                      |                      |                         | Loan <sub>f,b,yq</sub>  |                         |                         |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  |                      |                      | -105.444***<br>(36.668) | -109.090***<br>(33.361) | -109.358***<br>(37.228) | -280.971***<br>(59.067) |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  |                      |                      | 50.837**<br>(21.018)    | 53.148***<br>(17.790)   | 81.225***<br>(21.185)   | 144.609***<br>(28.647)  |
| FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  |                      |                      | -4.521***<br>(0.998)    | -4.852***<br>(0.894)    | -5.746***<br>(0.994)    | -6.001***<br>(1.019)    |
| FX-Funds <sub>b,yq-1</sub>  | -0.384***<br>(0.125) | -0.564***<br>(0.151) | 1.174*<br>(0.642)       | 1.294**<br>(0.567)      | 2.252***<br>(0.681)     | 3.678***<br>(0.747)     |
| MPspread <sup>US</sup> <sub>yq-1</sub> *Post <sub>yq</sub>  | -4.252***<br>(0.842) | -3.613***<br>(0.941) |                         |                         |                         |                         |
| MPspread <sup>US</sup> <sub>yq-1</sub>  | 0.344<br>(0.385)     | -0.319<br>(0.468)    |                         |                         |                         |                         |
| Observations  | 1,309,024            | 826,849              | 895,247                 | 895,247                 | 895,247                 | 895,247                 |
| R-squared   | 0.857                | 0.828                | 0.808                   | 0.810                   | 0.886                   | 0.886                   |
| Firm*Bank FE  | Yes                  | Yes                  | Yes                     | Yes                     | Yes                     | Yes                     |
| Macro Controls*Post   | Yes                  | Yes                  | -                       | -                       | -                       | -                       |
| Bank Controls   | Yes                  | Yes                  | -                       | -                       | -                       | -                       |
| Lagged Firm Credit  | Yes                  | Yes                  | No                      | No                      | -                       | -                       |
| Bank Controls*Post  | -                    | -                    | Yes                     | Yes                     | Yes                     | -                       |
| FX-Funds*Macro Controls*Post  | No                   | No                   | Yes                     | Yes                     | Yes                     | Yes                     |
| Year:Quarter FE   | No                   | No                   | Yes                     | -                       | -                       | -                       |
| Industry*Year:Quarter FE  | No                   | No                   | No                      | Yes                     | -                       | -                       |
| Firm*Year:Quarter FE  | No                   | No                   | No                      | No                      | Yes                     | Yes                     |
| Bank Controls*MPspread <sup>US</sup> <sub>yq-1</sub> *Post  | No                   | No                   | No                      | No                      | No                      | Yes                     |
| H0: MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> +<br>MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0 | -                    | -                    | .056                    | .04                     | .349                    | .003                    |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to the policy rate spread. The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the US Effective Federal Funds Rate. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets) and Checking Deposits (rescaled by Total Assets). Lagged Firm Credit represents the lagged (by one quarter) log outstanding total bank debt held by a firm. The last row reports the p-values for the tests with null hypothesis specified in the first column. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 2: Policy Rate Differential, CIP Deviations and Carry-Trade Lending**

|  | (1)                    | (2)                  | (3)                         | (4)                  | (5)                       | (6)               |
|--|------------------------|----------------------|-----------------------------|----------------------|---------------------------|-------------------|
|  | Loan <sub>f,b,yq</sub> |                      | Peso Loan <sub>f,b,yq</sub> |                      | FX Loan <sub>f,b,yq</sub> |                   |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> | -281.0***<br>(59.07)   | -542.0***<br>(80.51) | -417.6***<br>(113.6)        | -997.7***<br>(171.9) | 230.8<br>(427.6)          | -347.7<br>(626.5) |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>                     | 144.6***<br>(28.65)    | 230.1***<br>(40.66)  | 222.8***<br>(54.93)         | 266.8***<br>(76.48)  | 87.43<br>(157.8)          | 50.60<br>(212.8)  |
| FX-Funds <sub>b,yq-1</sub> *Post <sub>yq-1</sub>                                       | -6.001***<br>(1.019)   | -6.152***<br>(0.992) | -11.44***<br>(2.136)        | -9.074***<br>(2.075) | 2.687<br>(8.592)          | 8.542<br>(8.501)  |
| FX-Funds <sub>b,yq-1</sub>   | 3.678***<br>(0.747)    | 3.994***<br>(0.772)  | 6.989***<br>(1.411)         | 6.925***<br>(1.462)  | -2.977<br>(4.798)         | -2.194<br>(4.606) |
| Observations   | 895247                 | 895247               | 315692                      | 315692               | 22686                     | 22686             |
| R-squared  | 0.886                  | 0.886                | 0.835                       | 0.835                | 0.891                     | 0.891             |
| FP <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>                     | No                     | Yes                  | No                          | Yes                  | No                        | Yes               |
| FP <sub>yq-1</sub> *Bank Controls*Post <sub>yq</sub>                                   | No                     | Yes                  | No                          | Yes                  | No                        | Yes               |
| FP <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>   | No                     | Yes                  | No                          | Yes                  | No                        | Yes               |
| Firm*Bank FE   | Yes                    | Yes                  | Yes                         | Yes                  | Yes                       | Yes               |
| FX-Funds*Macro Controls*Post   | Yes                    | Yes                  | Yes                         | Yes                  | Yes                       | Yes               |
| Firm*Year:Quarter FE   | Yes                    | Yes                  | Yes                         | Yes                  | Yes                       | Yes               |
| Bank Controls*MPspread <sup>US</sup> <sub>yq-1</sub> *Post <sub>yq</sub>               | Yes                    | Yes                  | Yes                         | Yes                  | Yes                       | Yes               |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to the policy rate differential, depending on deviations from CIP. Loan<sub>f,b,yq</sub> is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) Colombian and US policy rate. FP<sub>yq-1</sub> is the 3-month Peso/US\$ forward premium. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate (though we exclude the exchange rate in columns 2, 4 and 6). Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 3: Policy Rate Differential, Carry-Trade and Bank Credit: Firms Heterogeneity**

| VARIABLES   | (1)                   | (2) Firm Risk <sub>f,pre</sub> |                          |                          | (4)                  | (5) Short Term Debt (maturity ≤ 1y) <sub>f,pre</sub> |                         |                          |                         | (9) 30-day Past Due <sub>f,pre</sub> |                        | (11)                    | (12) |
|---|-----------------------|--------------------------------|--------------------------|--------------------------|----------------------|--|-------------------------|--------------------------|-------------------------|--------------------------------------|------------------------|-------------------------|------|
|   | Q=1                   | Q=2                            | Q=3                      | Q=4                      | Q=1                  | Q=2  | Q=3                     | Q=4                      | No                      | Yes                                  | Yes                    | No                      |      |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  | -105.273<br>(126.604) | -180.306*<br>(98.811)          | -372.841***<br>(108.351) | -580.156***<br>(122.752) | -36.999<br>(117.014) | -440.819***<br>(110.905)                             | -246.261**<br>(103.590) | -344.682***<br>(119.150) | -233.226***<br>(70.705) | -374.137***<br>(97.968)              | -175.004<br>(108.069)  | -337.660***<br>(67.337) |      |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  | -31.157<br>(56.965)   | 149.059***<br>(48.352)         | 323.919***<br>(53.627)   | 280.806***<br>(67.520)   | -13.254<br>(55.996)  | 165.874***<br>(52.355)                               | 155.713***<br>(50.472)  | 241.275***<br>(60.950)   | 111.753***<br>(35.249)  | 194.653***<br>(46.441)               | 194.357***<br>(52.406) | 124.372***<br>(32.643)  |      |
| FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  | -4.609**<br>(2.101)   | -6.731***<br>(1.821)           | -5.240***<br>(1.991)     | -8.099***<br>(2.193)     | 2.277<br>(2.048)     | -7.405***<br>(1.916)                                 | -6.054***<br>(1.833)    | -10.563***<br>(2.087)    | -5.602***<br>(1.231)    | -6.687***<br>(1.707)                 | -6.355***<br>(1.170)   | -5.439***<br>(1.939)    |      |
| FX-Funds <sub>b,yq</sub>  | 0.786<br>(1.530)      | 3.801***<br>(1.276)            | 5.035***<br>(1.334)      | 5.344***<br>(1.685)      | 0.355<br>(1.462)     | 4.395***<br>(1.333)                                  | 4.195***<br>(1.320)     | 4.976***<br>(1.611)      | 3.008***<br>(0.918)     | 4.964***<br>(1.197)                  | 3.390***<br>(0.857)    | 4.480***<br>(1.378)     |      |
| Observations  | 228,304               | 254,153                        | 224,366                  | 180,450                  | 192,261              | 229,372  | 240,160                 | 225,480                  | 617,034                 | 270,840                              | 270,253                | 624,994                 |      |
| R-squared   | 0.884                 | 0.863                          | 0.859                    | 0.886                    | 0.914                | 0.876  | 0.873                   | 0.876                    | 0.881                   | 0.894                                | 0.862                  | 0.887                   |      |
| Firm*Bank FE  | Yes                   | Yes                            | Yes                      | Yes                      | Yes                  | Yes  | Yes                     | Yes                      | Yes                     | Yes                                  | Yes                    | Yes                     |      |
| FX-Funds*Macro Controls*Post  | Yes                   | Yes                            | Yes                      | Yes                      | Yes                  | Yes  | Yes                     | Yes                      | Yes                     | Yes                                  | Yes                    | Yes                     |      |
| Firm*Year:Quarter FE  | Yes                   | Yes                            | Yes                      | Yes                      | Yes                  | Yes  | Yes                     | Yes                      | Yes                     | Yes                                  | Yes                    | Yes                     |      |
| Bank Controls* MPspread <sup>US</sup> <sub>yq-1</sub> *Post   | Yes                   | Yes                            | Yes                      | Yes                      | Yes                  | Yes  | Yes                     | Yes                      | Yes                     | Yes                                  | Yes                    | Yes                     |      |
| H <sub>0</sub> : MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> + MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0 | 0.21                  | 0.61                           | 0.56                     | 0                        | 0.60                 | 0  | 0.24                    | 0.28                     | 0.03                    | 0.02                                 | 0.82                   | 0                       |      |

This table shows how carry trade strategies by local banks impact the reaction of bank credit to the policy rate spread, across different groups of companies. In columns 1 through 4, we sort companies according to the distribution of the average interest payments over total assets paid between 2005Q1 and 2007Q1. In columns 5 through 8, we sort companies according to the distribution of the average share of bank debt with maturity no longer than one year borrowed between 2005Q1 and 2007Q1. In columns 1 through 8, Q=j denotes that a company falls in the j-th quartile of the relevant distribution, j={1,2,3,4}. In columns 9 through 10, we divide companies depending on whether they are 30 days past due with respect to at least one bank loan between 2005Q1 and 2007Q1. Finally, in columns 11 and 12, we group companies based on whether their balance sheet is publicly supervised. Loan<sub>f,b,yq</sub> is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the FED Effective Funds Rate. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). The last row reports the p-values for the tests with null hypothesis specified in the first column. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 4: Reserve Requirement Shock and Bank Credit**

|  | (1)                    | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  |
|--|------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|  | $\text{Loan}_{f,b,yq}$ |                      |                      |                      |                      |                      |
| $\text{Post}_{yq} * \text{RR-Depo}_{b,2007Q1}$   | -1.542***<br>(0.196)   | -0.994***<br>(0.181) | -1.017***<br>(0.181) | -1.048***<br>(0.160) | -0.697***<br>(0.178) |                      |
| $\text{Post}_{yq} * \text{SavingD}_{b,2007Q1}$   |                        |                      |                      |                      |                      | -0.419**<br>(0.179)  |
| $\text{Post}_{yq} * \text{CheckingD}_{b,2007Q1}$ |                        |                      |                      |                      |                      | -1.845***<br>(0.281) |
| $\text{Post}_{yq}$                               | 0.023***<br>(0.011)    | -0.082***<br>(0.009) | -                    | -                    | -                    | -                    |
| $\text{RR-Depo}_{b,2007Q1}$                      | 0.817***<br>(0.295)    | -                    | -                    | -                    | -                    | -                    |
| Observations                                     | 742,950                | 742,950              | 742,950              | 742,950              | 742,950              | 742,950              |
| R-squared  | 0.536                  | 0.829                | 0.829                | 0.830                | 0.897                | 0.897                |
| Bank Controls*Post                               | Yes                    | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Firm FE  | Yes                    | -                    | -                    | -                    | -                    | -                    |
| Firm*Bank FE                                     | No                     | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Year:Quarter                                     | No                     | No                   | Yes                  | -                    | -                    | -                    |
| Industry*Year:Quarter                            | No                     | No                   | No                   | Yes                  | -                    | -                    |
| Firm*Year:Quarter                                | No                     | No                   | No                   | No                   | Yes                  | Yes                  |

This table shows the evolution of bank credit in reaction to the Reserve Requirement (RR) shock. The dependent variable is  $\text{Loan}_{f,b,yq}$ , i.e. the log of total debt provided by bank b to firm f in year:quarter yq. RR-Depo is the sum of savings ( $\text{SavingD}_{b,2007Q1}$ ) and checking ( $\text{CheckingD}_{b,2007Q1}$ ) deposits, both rescaled by total assets, as of 2007Q1. We include only firms that borrowed from at least two banks. Bank Controls is a vector of bank controls (as of 2007Q1), including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans). The  $\text{Post}_{yq}$  dummy has value 1 from 2007Q2 onward and value 0 before. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table 5: Reserve Requirement Shock and Bank Credit – Firms Heterogeneity**

|  | (1)  | (2)                 | (3)                  | (4)                  | (5)  | (6)               | (7)                  | (8)                 | (9)                        | (10)                | (11)              | (12)                 |
|--|--|---------------------|----------------------|----------------------|--|-------------------|----------------------|---------------------|----------------------------|---------------------|-------------------|----------------------|
|  | Dependent Variable: $\text{Loan}_{f,b,yq}$ |                     |                      |                      |  |                   |                      |                     |                            |                     |                   |                      |
|  | Firm Risk $_{f,pre}$                       |                     |                      |                      | Short-Term Debt (maturity $\leq 1y$ ) $_{f,pre}$ |                   |                      |                     | 30-day Past Due $_{f,pre}$ |                     | Supervised $_f$   |                      |
|  | Q=1  | Q=2                 | Q=3                  | Q=4                  | Q=1  | Q=2               | Q=3                  | Q=4                 | No                         | Yes                 | Yes               | No                   |
| $\text{Post}_{yq} * \text{RR-Depo}_{b,2007Q1}$ | 0.290<br>(0.378)                           | -0.666**<br>(0.298) | -1.201***<br>(0.361) | -1.929***<br>(0.412) | -0.548<br>(0.414)                                | -0.366<br>(0.345) | -1.079***<br>(0.324) | -0.759**<br>(0.342) | -0.680***<br>(0.216)       | -0.724**<br>(0.313) | -0.066<br>(0.327) | -0.994***<br>(0.217) |
| Observations                                   | 190,059                                    | 210,516             | 185,059              | 149,342              | 159,653  | 190,170           | 199,186              | 185,967             | 521,480                    | 214,097             | 218,269           | 524,681              |
| R-squared                                      | 0.894                                      | 0.880               | 0.873                | 0.894                | 0.921  | 0.890             | 0.885                | 0.888               | 0.892                      | 0.906               | 0.877             | 0.897                |
| Bank Controls*Post                             | Yes  | Yes                 | Yes                  | Yes                  | Yes  | Yes               | Yes                  | Yes                 | Yes                        | Yes                 | Yes               | Yes                  |
| Firm*Bank FE                                   | Yes  | Yes                 | Yes                  | Yes                  | Yes  | Yes               | Yes                  | Yes                 | Yes                        | Yes                 | Yes               | Yes                  |
| Firm*Year:Quarter                              | Yes  | Yes                 | Yes                  | Yes                  | Yes  | Yes               | Yes                  | Yes                 | Yes                        | Yes                 | Yes               | Yes                  |

This table evaluates the effects of the Reserve Requirement on shock on bank credit, across different groups of companies. In columns 1 through 4, we sort companies according to the distribution of the average interest payments over total assets paid between 2005Q1 and 2007Q1. In columns 5 through 8, we sort companies according to the distribution of the average share of bank debt with maturity no longer than one year borrowed between 2005Q1 and 2007Q1. In columns 1 through 8, Q=j denotes that a company falls in the j-th quartile of the relevant distribution,  $j=\{1,2,3,4\}$ . In columns 9 through 10, we divide companies depending on whether they are 30 days past due with respect to at least one bank loan between 2005Q1 and 2007Q1. Finally, in columns 11 and 12, we group companies based on whether their balance sheet is publicly supervised.  $\text{Loan}_{f,b,yq}$  is the log of total debt provided by bank b to firm f in year:quarter yq. RR-Depo is the sum of savings ( $\text{SavingD}_{b,2007Q1}$ ) and checking ( $\text{CheckingD}_{b,2007Q1}$ ) deposits, both over total assets, as of 2007Q1. Bank Controls is a vector of bank controls (as of 2007Q1) including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans). The  $\text{Post}_{yq}$  dummy has value 1 from 2007Q2 onward and value 0 before. In all columns, the regressions include companies that borrowed from at least two banks. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

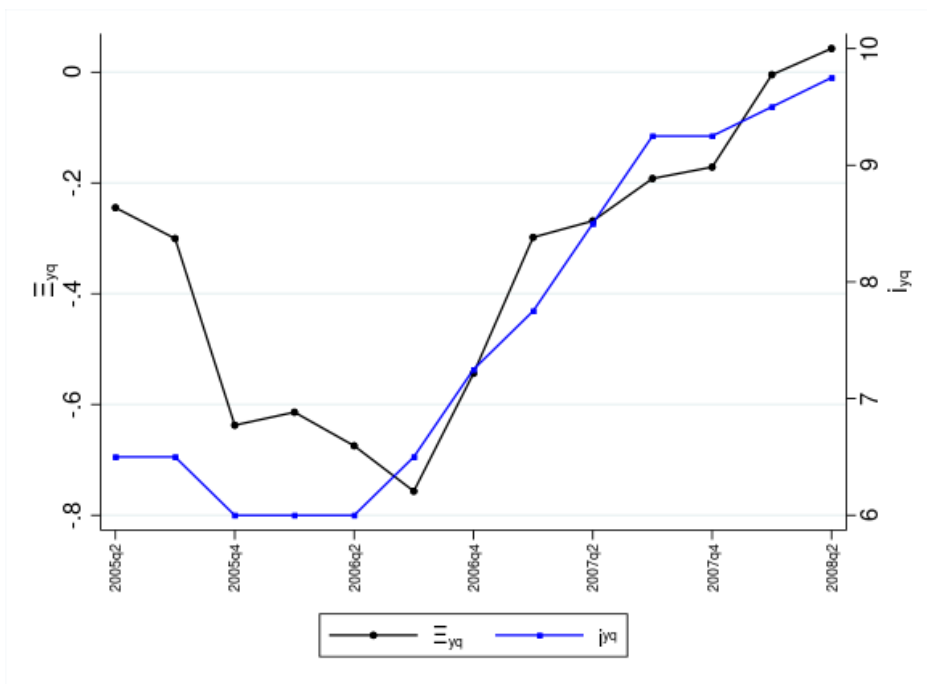
**Table 6: Capital Controls, Domestic Macroprudential Policy and the Bank Lending Channel of Monetary Policy**

|  | (1)                     | (2)                     | (3)                     |
|--|-------------------------|-------------------------|-------------------------|
|  |                         | Loan <sub>f,b,yq</sub>  |                         |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> | -105.444***<br>(36.668) | -109.090***<br>(33.361) | -109.358***<br>(37.228) |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>                     | 50.837**<br>(21.018)    | 53.148***<br>(17.790)   | 81.225***<br>(21.185)   |
| FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>   | -35.367<br>(32.976)     | -41.893<br>(30.034)     | -9.303<br>(35.459)      |
| FX-Funds <sub>b,yq-1</sub>   | -36.322***<br>(13.718)  | -35.900***<br>(12.604)  | -51.056***<br>(14.946)  |
| CheckingD <sub>b,yq-1</sub> *Post <sub>yq</sub>  | -0.411***<br>(0.143)    | -0.425***<br>(0.143)    | -0.367**<br>(0.158)     |
| CheckingD <sub>b,yq-1</sub>  | -0.136<br>(0.120)       | -0.133<br>(0.103)       | -0.055<br>(0.123)       |
| SavingD <sub>b,yq-1</sub> *Post <sub>yq</sub>  | -0.696***<br>(0.113)    | -0.715***<br>(0.098)    | -0.679***<br>(0.108)    |
| SavingD <sub>b,yq-1</sub>  | -0.069<br>(0.119)       | -0.075<br>(0.107)       | -0.064<br>(0.121)       |
| Observations   | 895,247                 | 895,247                 | 895,247                 |
| R-squared  | 0.808                   | 0.810                   | 0.886                   |
| Firm*Bank FE   | Yes                     | Yes                     | Yes                     |
| Macro Controls*Post  | -                       | -                       | -                       |
| Bank Controls  | -                       | -                       | -                       |
| Bank Controls*Post   | Yes                     | Yes                     | Yes                     |
| FX-Funds*Macro Controls*Post   | Yes                     | Yes                     | Yes                     |
| Year:Quarter FE  | Yes                     | -                       | -                       |
| Industry*Year:Quarter FE   | No                      | Yes                     | -                       |
| Firm*Year:Quarter FE   | No                      | No                      | Yes                     |

This table shows the impact of capital controls and reserve requirements on bank credit. The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the FED Effective Funds Rate. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). SavingD<sub>b,yq-1</sub> denotes (lagged) bank savings deposits (over total assets). CheckingD<sub>b,yq-1</sub> denotes (lagged) bank checking deposits (over total assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans). The sample consists only of companies that borrowed from at least two banks. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

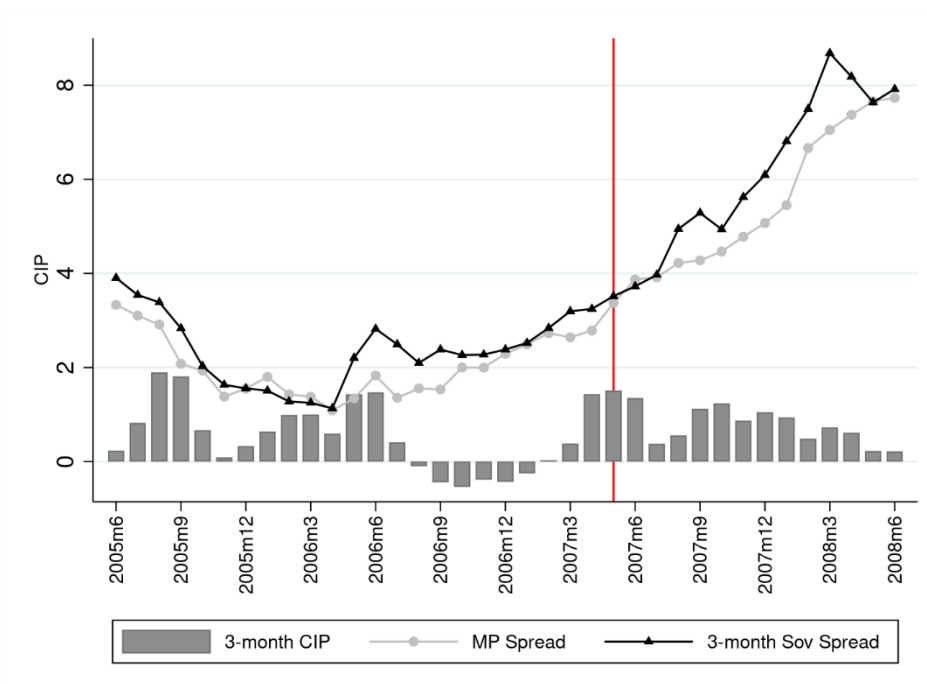
# Appendix

**Figure A1: Monetary Policy Surprise Index (Cumulated Shocks) vs Policy Rate**



This figure shows the policy rate (blue line, connected by squares, measured on the right y-axis) against the monetary policy surprise index (black line, connected by circles, measured on the left y-axis). The index is the cumulative sum of the average difference between expected (by a pool of professional forecasters) and realized interest rate announcements, starting in 2004Q3.

**Figure A2: Deviations from the Covered Interest Parity**



This figure depicts the deviations from the Covered Interest Parity (CIP). We report CIP deviations through grey bars, corresponding to the difference between the 3-month Colombia-US sovereign yield spread (depicted by black line, connected by triangles) and the 3-month COP-USD forward premium (Du and Schreger, 2018). For illustrative purposes, we also report – though a light grey line, connected by circles - the policy rate spread between Colombia and the US



**Table A1: Summary Statistics**

## Panel A: Largest Sample for Regressions Exploiting Time Variation

| VARIABLES                             | Definition: Timing                           | N         | Mean   | P25    | P50    | P75    | SD    |
|---------------------------------------|--|-----------|--------|--------|--------|--------|-------|
| <b>Loan-level Variables</b>           |  |           |        |        |        |        |       |
| $\text{Loan}_{f,b,yq}$                | Log(Loan): current year:quarter              | 1,475,369 | 16.843 | 15.317 | 17.051 | 18.507 | 2.573 |
| $\text{Provision}_{f,b,yq-1}$         | Loan Losses Provision (over Loan): 1Q-lagged | 1,320,710 | 0.042  | 0.002  | 0.008  | 0.019  | 0.148 |
| <b>Macro Variables</b>                |  |           |        |        |        |        |       |
| $i_{yq-1}$                            | Local Policy Rate: 1Q-lagged                 | 1,475,369 | 0.075  | 0.062  | 0.073  | 0.092  | 0.014 |
| $\Delta_{1y}\text{GDP}_{yq-1}$        | 1y-Growth of Local Policy Rate: 1Q-lagged    | 1,475,369 | 0.062  | 0.054  | 0.061  | 0.076  | 0.013 |
| $e_{yq-1}$                            | Log(Exch. Rate: Pesos per 1 USD) : 1Q-lagged | 1,475,369 | 7.692  | 7.608  | 7.724  | 7.754  | 0.090 |
| $\text{EMBI}_{yq-1}$                  | Log(Colombian EMBI): 1Q-Lagged               | 1,475,369 | 5.326  | 5.193  | 5.236  | 5.565  | 0.301 |
| $\text{CPI}_{yq-1}$                   | CPI (base: 2005Q1): 1Q-lagged                | 1,475,369 | 1.077  | 1.041  | 1.067  | 1.117  | 0.049 |
| $\text{MPspread}_{yq-1}^{\text{US}}$  | Local – US Policy Rate: 1Q-lagged            | 1,475,369 | 0.030  | 0.017  | 0.028  | 0.041  | 0.015 |
| $\text{SOVspread}_{yq-1}^{\text{US}}$ | Local – US (3-m) Sovereign yield: 1Q-lagged  | 1,475,369 | 0.036  | 0.023  | 0.033  | 0.047  | 0.018 |
| $\text{CIP}_{yq-1}$                   | Deviations from CIP: 1Q-lagged               | 1,475,369 | 0.006  | 0.003  | 0.007  | 0.010  | 0.006 |
| $\Delta_{2q}i_{yq-1}$                 | 2q-Growth of Local Policy Rate: 1Q-lagged    | 1,475,369 | 0.005  | -0.003 | 0.007  | 0.012  | 0.007 |
| $\Delta_{1y}i_{yq-1}$                 | 1y-Growth of Local Policy Rate: 1Q-lagged    | 1,475,369 | 0.008  | -0.005 | 0.016  | 0.020  | 0.013 |
| $\bar{E}_{yq-1}$                      | Monetary Policy Surprises (%) : 1Q-lagged    | 1,475,369 | -0.378 | -0.613 | -0.298 | -0.192 | 0.229 |
| <b>Bank-level Variables</b>           |  |           |        |        |        |        |       |
| $\text{FX-Funds}_{b,yq-1}$            | FX-Funds (over TA): 1Q-lagged                | 1,475,369 | 0.047  | 0.034  | 0.047  | 0.064  | 0.026 |
| $\text{SavingD}_{b,yq-1}$             | Savings Deposits (over TA): 1Q-lagged        | 1,475,369 | 0.353  | 0.303  | 0.348  | 0.400  | 0.073 |
| $\text{CheckingD}_{b,yq-1}$           | Checking Deposits (over TA): 1Q-lagged       | 1,475,369 | 0.137  | 0.108  | 0.126  | 0.173  | 0.045 |
| $\text{Size}_{b,yq-1}$                | Bank Log(TA): 1Q-lagged                      | 1,475,369 | 30.301 | 30.02  | 30.383 | 30.704 | 0.523 |
| $\text{CET}_{b,yq-1}$                 | Common Equity Capital (over TA): 1Q-lagged   | 1,475,369 | 0.042  | 0.032  | 0.039  | 0.050  | 0.013 |
| $\text{NPL}_{b,yq-1}$                 | Non Perf. Loans (over Tot. Loans): 1Q-lagged | 1,475,369 | 0.027  | 0.020  | 0.024  | 0.029  | 0.010 |
| $\text{ROA}_{b,yq-1}$                 | Return on Assets: 1Q-lagged                  | 1,475,369 | 0.014  | 0.008  | 0.012  | 0.019  | 0.007 |
| <b>Firm-level Variable</b>            |  |           |        |        |        |        |       |
| $\text{FirmCredit}_{f,yq-1}$          | Log(Total Firm Credit): 1Q-lagged            | 1,326,480 | 18.186 | 16.513 | 18.333 | 19.981 | 2.718 |

This table shows summary statistics referred to the sample used in regressions for monetary policy rate which exploit time variation only, over the period 2005Q2 to 2008Q2. All the variables not defined as shares are expressed in (logs of) real Colombian Pesos with base year:quarter 2005Q1.

Panel B: Carry Trade Regressions

| VARIABLES                               | Definition: Timing                                | N       | Mean   | P25    | P50    | P75    | SD    |
|---|---|---------|--------|--------|--------|--------|-------|
| <b>Loan-level Variables</b>             |   |         |        |        |        |        |       |
| Loan <sub>f,b,yq</sub>                  | Log(Loan): current year:quarter                   | 895,247 | 17.665 | 16.434 | 17.780 | 19.102 | 2.309 |
| <b>Macro Variables</b>                  |   |         |        |        |        |        |       |
| MPspread <sup>US</sup> <sub>yq-1</sub>  | Local – US Policy Rate: 1Q-lagged                 | 895,247 | 0.031  | 0.017  | 0.028  | 0.041  | 0.015 |
| i <sub>yq-1</sub>                       | Local Policy Rate: 1Q-lagged                      | 895,247 | 0.075  | 0.062  | 0.073  | 0.092  | 0.014 |
| Δ <sub>1y</sub> GDP <sub>yq-1</sub>     | 1y-Growth of Local Policy Rate: 1Q-lagged         | 895,247 | 0.062  | 0.054  | 0.061  | 0.076  | 0.013 |
| e <sub>yq-1</sub>                       | Log(Exch. Rate: Pesos per 1 USD): 1Q-lagged       | 895,247 | 7.690  | 7.608  | 7.724  | 7.754  | 0.091 |
| CPI <sub>yq-1</sub>                     | CPI (base: 2005Q1): 1Q-lagged                     | 895,247 | 1.078  | 1.041  | 1.067  | 1.117  | 0.050 |
| EMBI <sub>yq-1</sub>                    | Log(Colombian EMBI): 1Q-Lagged                    | 895,247 | 5.323  | 5.193  | 5.236  | 5.565  | 0.302 |
| VIX <sub>yq-1</sub>                     | Log(VIX) <sub>yq-1</sub> : 1Q-lagged              | 895,247 | 2.705  | 2.483  | 2.640  | 2.890  | 0.267 |
| Oil <sub>yq-1</sub>                     | Log(Brent Price) <sub>yq-1</sub> : 1Q-lagged      | 895,247 | 4.286  | 4.090  | 4.246  | 4.488  | 0.239 |
| SOVspread <sup>US</sup> <sub>yq-1</sub> | Local – US (3-month) Sovereign Yield: 1Q-lagged   | 895,247 | 0.036  | 0.023  | 0.033  | 0.047  | 0.018 |
| CIP <sub>yq-1</sub>                     | Deviations from CIP: 1Q-lagged                    | 895,247 | 0.006  | 0.003  | 0.007  | 0.010  | 0.006 |
| FP <sub>yq-1</sub>                      | 3-month COP-US\$ Forward Premium: 1Q-lagged       | 895,247 | 0.030  | 0.020  | 0.027  | 0.040  | 0.017 |
| <b>Bank-level Variables</b>             |   |         |        |        |        |        |       |
| FX-Funds <sub>b,yq-1</sub>              | FX-Funds (over TA): 1Q-lagged                     | 895,247 | 0.046  | 0.030  | 0.047  | 0.063  | 0.026 |
| SavingD <sub>b,yq-1</sub>               | Saving Deposits (over TA): 1Q-lagged              | 895,247 | 0.351  | 0.299  | 0.348  | 0.400  | 0.077 |
| CheckingD <sub>b,yq-1</sub>             | Checking Deposits (over TA): 1Q-lagged            | 895,247 | 0.136  | 0.106  | 0.125  | 0.173  | 0.047 |
| Size <sub>b,yq-1</sub>                  | Bank Log(TA) : 1q-lagged                          | 895,247 | 30.262 | 29.931 | 30.327 | 30.640 | 0.541 |
| CET <sub>b,yq-1</sub>                   | Common Equity Capital (over TA): 1Q-lagged        | 895,247 | 0.043  | 0.032  | 0.041  | 0.052  | 0.013 |
| NPL <sub>b,yq-1</sub>                   | Non Perf. Loans (over Tot. Loans): 1Q-lagged      | 895,247 | 0.027  | 0.020  | 0.024  | 0.030  | 0.011 |
| ROA <sub>b,yq-1</sub>                   | Return on Assets: 1Q-lagged                       | 895,247 | 0.014  | 0.008  | 0.012  | 0.019  | 0.007 |
| <b>Firm-level Variables</b>             |   |         |        |        |        |        |       |
| Firm Risk <sub>f,pre</sub>              | Mean Interest Payments (over Loan): 2005Q1-2007Q1 | 887,273 | 0.142  | 0.110  | 0.140  | 0.171  | 0.047 |
| Short-Term Debt <sub>f,pre</sub>        | Mean Share of ST Debt: 2005Q1-2007Q1              | 887,530 | 0.341  | 0.080  | 0.274  | 0.548  | 0.296 |
| Default <sub>f,pre</sub>                | At least 1 loan default: 2005Q1-2007Q1            | 887,874 | 0.305  | 0.000  | 0.000  | 1.000  | 0.460 |
| Supervised <sub>f,pre</sub>             | Balance Sheet Supervised: 2005Q1- 2007Q1          | 895,247 | 0.302  | 0.000  | 0.000  | 1.000  | 0.459 |

This table shows summary statistics for the regression sample used for carry trade regressions, over the period 2005Q2 to 2008Q2. All the variables not defined as shares are expressed in (logs of) real Colombian Pesos with base year:quarter 2005Q1. In the definitions of bank variables, TA denotes banks total assets. In the definition of firm-level variables, ST Debt stands for Short-Term Debt, i.e. with maturity no longer than one year. Default<sub>f,pre</sub> is a 0/1 dummy. A loan default refers to a loan with payments which are at least 30 days past due. Supervised<sub>f,pre</sub> is a 0/1 dummy, with value 1 if the balance sheet is publicly supervised.

Panel C: Reserve-Requirements Regressions

| VARIABLES                        | Definition: Timing                           | (1)<br>N | (2)<br>Mean | (3)<br>P25 | (4)<br>P50 | (5)<br>P75 | (6)<br>SD |
|----------------------------------|--|----------|-------------|------------|------------|------------|-----------|
| <b>Loan-level Variables</b>      |  |          |             |            |            |            |           |
| Loan <sub>f,b,yq</sub>           | Log(Loan): current year:quarter              | 742,950  | 17.658      | 16.437     | 17.778     | 19.096     | 2.314     |
| Provision <sub>f,b,yq-1</sub>    | Loan Losses Provision (over Loan): 1Q-lagged | 678,483  | 0.037       | 0.005      | 0.009      | 0.022      | 0.129     |
| <b>Bank-level Variables</b>      |  |          |             |            |            |            |           |
| RR-Depo <sub>b,2007Q1</sub>      | Checking + Saving Dep. (over TA):2007Q1      | 742,950  | 0.514       | 0.483      | 0.534      | 0.574      | 0.078     |
| SavingD <sub>b,2007Q1</sub>      | Saving Deposits (over TA): 2007Q1            | 742,950  | 0.381       | 0.309      | 0.392      | 0.400      | 0.071     |
| CheckingD <sub>b,2007Q1</sub>    | Checking Deposits (over TA): 2007Q1          | 742,950  | 0.133       | 0.107      | 0.142      | 0.173      | 0.041     |
| Size <sub>b,2007Q1</sub>         | Bank Log(TA) – 2007Q1                        | 742,950  | 30.321      | 30.067     | 30.330     | 30.594     | 0.512     |
| CET <sub>b,2007Q1</sub>          | Common Equity Capital (over TA): 2007Q1      | 742,950  | 0.040       | 0.032      | 0.034      | 0.050      | 0.013     |
| NPL <sub>b,2007Q1</sub>          | Non Perf. Loans (over Tot. Loans): 2007Q1    | 742,950  | 0.025       | 0.020      | 0.023      | 0.024      | 0.007     |
| FX-Funds <sub>b,2007Q1</sub>     | FX-Funds (over TA): 2007Q1                   | 742,950  | 0.052       | 0.043      | 0.050      | 0.067      | 0.025     |
| ROA <sub>b,2007Q1</sub>          | Return on Assets: 2007Q1                     | 742,950  | 0.006       | 0.005      | 0.007      | 0.007      | 0.002     |
| <b>Firm-level Variables</b>      |  |          |             |            |            |            |           |
| Firm Risk <sub>f,pre</sub>       | Mean Int. Paym. (over Loan): 2005Q1-2007Q1   | 734,976  | 0.142       | 0.110      | 0.141      | 0.173      | 0.047     |
| Short-Term Debt <sub>f,pre</sub> | Mean Share of ST Debt: 2005Q1-2007Q1         | 735,233  | 0.343       | 0.080      | 0.277      | 0.552      | 0.298     |
| Default <sub>f,pre</sub>         | At least 1 loan default: 2005Q1-2007Q1       | 735,577  | 0.291       | 0          | 0          | 1          | 0.454     |
| Supervised <sub>f,pre</sub>      | Balance Sheet Supervised: 2005Q1-2007Q1      | 742,950  | 0.294       | 0          | 0          | 1          | 0.455     |

This table shows summary statistics for the sample used in the regressions on Reserve Requirements policy – computed over the period 2006q1-2008q2. All the variables not defined as shares are expressed in (logs of) real Colombian Pesos with base year:quarter 2005Q1. In the definitions of bank variables, TA denotes banks total assets. In the definition of firm-level variables, ST Debt stands for Short-Term Debt, i.e. with maturity no longer than one year. Default<sub>f,pre</sub> is a 0/1 dummy: in its definition, a loan default refers to a loan with payments which are at least 30 days past due. Supervised<sub>f,pre</sub> is a 0/1 dummy, with value 1 if the balance sheet is publicly supervised.

**Table A2: Policy Rate Differential, Foreign vs Domestic Bank Funding and Credit**

|   | (1)   |
|---|---|
| $MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1} * Post_{yq}$  | Loan <sub>f,b,yq</sub><br>-280.971***<br>(59.067) |
| $MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1}$              | 144.609***<br>(28.647)                            |
| $MPspread_{yq-1}^{US} * SavingD_{b,yq-1} * Post_{yq}$   | -11.210<br>(10.749)                               |
| $MPspread_{yq-1}^{US} * SavingD_{b,yq-1}$               | -7.413<br>(7.117)                                 |
| $MPspread_{yq-1}^{US} * CheckingD_{b,yq-1} * Post_{yq}$ | -13.325<br>(9.307)                                |
| $MPspread_{yq-1}^{US} * CheckingD_{b,yq-1}$             | 8.429<br>(14.103)                                 |
| R-squared   | 0.886   |
| Firm*Bank FE  | Yes   |
| FX-Funds*Macro Controls*Post                            | Yes   |
| Firm*Year:Quarter FE                                    | Yes   |
| Bank Controls* $MPspread_{yq-1}^{US}$ *Post             | Yes   |

This table shows the impact of the monetary policy rate spread on bank credit, conditional on different bank funding structures. (Note: this table reproduces column 6 of Table 1, displaying additional coefficients). The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq.  $MPspread_{yq-1}^{US}$  is the difference between the (lagged) local monetary policy rate and the FED Effective Funds Rate.  $FX-Funds_{b,yq-1}$  represents (lagged) bank FX-Funds (over Total Assets).  $SavingD_{b,yq-1}$  denotes (lagged) bank savings deposits (over total assets).  $CheckingD_{b,yq-1}$  denotes (lagged) bank checking deposits (over total assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans). The sample includes only those companies that borrowed from at least two banks. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table A3: Policy Rate Differential, Carry Trade and Bank Credit – Carry Trade Mechanism: Robustness**

|  | (1)                     | (2)                     | (3)                     | (4)                     | (5)                     | (6)                     | (7)                     | (8)                     | (9)                     |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|  |                         |                         |                         |                         | $Loan_{f,b,yq}$         |                         |                         |                         |                         |
| $MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1} * Post_{yq}$   | -288.329***<br>(56.723) | -231.786***<br>(51.920) | -244.143***<br>(50.517) | -414.111***<br>(45.070) | -328.787***<br>(37.933) | -297.866***<br>(36.776) | -280.971**<br>(112.997) | -280.971**<br>(126.842) | -280.971**<br>(112.734) |
| $MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1}$   | 156.579***<br>(27.880)  | 136.535***<br>(25.537)  | 148.287***<br>(25.089)  | 157.006***<br>(21.804)  | 146.446***<br>(18.954)  | 159.482***<br>(18.602)  | 144.609**<br>(50.188)   | 144.609**<br>(49.075)   | 144.609***<br>(46.711)  |
| $FX-Funds_{b,yq-1} * Post_{yq}$  | -4.596***<br>(0.996)    | -4.854***<br>(0.867)    | -3.862***<br>(0.863)    | -6.966***<br>(0.867)    | -5.203***<br>(0.683)    | -4.049***<br>(0.659)    | -6.001**<br>(2.086)     | -6.001**<br>(2.146)     | -6.001**<br>(2.023)     |
| $FX-Funds_{b,yq-1}$  | 4.142***<br>(0.728)     | 3.284***<br>(0.664)     | 3.802***<br>(0.656)     | 3.625***<br>(0.561)     | 3.140***<br>(0.489)     | 3.565***<br>(0.486)     | 3.678**<br>(1.589)      | 3.678*<br>(1.791)       | 3.678*<br>(1.804)       |
| Observations   | 791,322                 | 895,247                 | 791,322                 | 1,475,262               | 1,475,262               | 1,302,847               | 895,247                 | 895,247                 | 895,247                 |
| R-squared  | 0.894                   | 0.889                   | 0.898                   | 0.834                   | 0.846                   | 0.857                   | 0.886                   | 0.886                   | 0.886                   |
| Loan-Size Weighted   | No                      | Yes                     | Yes                     | No                      | Yes                     | Yes                     | No                      | No                      | No                      |
| Firm*Bank FE   | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     |
| FX-Funds*Macro Controls*Post   | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     |
| Industry*Year:Quarter FE   | -                       | -                       | -                       | Yes                     | Yes                     | Yes                     | -                       | -                       | -                       |
| Firm*Year:Quarter FE   | Yes                     | Yes                     | Yes                     | No                      | No                      | No                      | Yes                     | Yes                     | Yes                     |
| Bank Controls* $MPspread_{yq-1}^{US} * Post$   | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     | Yes                     |
| Provision* $MPspread_{yq-1}^{US} * Post$   | Yes                     | No                      | Yes                     | No                      | No                      | Yes                     | No                      | No                      | No                      |
| Companies  | Multi-Bank              | Multi-Bank              | Multi-Bank              | All                     | All                     | All                     | Multi-Bank              | Multi-Bank              | Multi-Bank              |
| Cluster  | F + B*I                 | F + B*I                 | F + B*I                 | F + B*I                 | F + B*I                 | F + B*I                 | F + B                   | F + B + YQ              | F + B*I + YQ            |
| $H_0: MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1} + MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1} * Post_{yq} = 0$ | .003                    | .017                    | .015                    | 0                       | 0                       | 0                       | .12                     | .136                    | .119                    |

This table shows robustness exercises about how carry trade strategies by local banks impacts the reaction of bank credit to the policy rate spread. The dependent variable,  $Loan_{f,b,yq}$ , is the log of total debt provided by bank b to firm f in year:quarter yq. In columns 1 through 3, we augment the baseline model with either further controls and/or fixed effects, under OLS and WLS estimation. In columns 4 through 6, we estimate different versions of the model over a sample of companies including also firms borrowing from one bank only, whereas in the other columns Firm\*Year:Quarter FE restrict the estimation sample to just those firms with at least two lenders (Multi-Bank firms). In columns 7 through 9, we apply alternative standard errors' clustering strategies.  $MPspread_{yq-1}^{US}$  is the difference between the (lagged) local monetary policy and the US Effective Federal Funds Rate.  $FX-Funds_{b,yq-1}$  represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets) and Checking Deposits (over Total Assets). Provision is the lagged loan-level provision, rescaled by the loan value. The last row reports the p-values for the tests with null hypothesis specified in the first column. All independent variables are demeaned. Standard errors are double-clustered at the level of: Bank\*Industry and Firm in columns 1 through 6; Bank and Firm in column 7; Bank, Firm and Year:Quarter in column 8; Bank\*Industry, Firm and Year:Quarter in column 9. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table A4:** Using the Local Monetary Policy Rate or Monetary Policy Surprises instead of the Colombia-U.S. Policy Rate Spread

Panel A: Local Monetary Policy Rate

|  | (1)       | (2)       | (3)       | (4)       | (5)                    | (6)       | (7)         |
|--|-----------|-----------|-----------|-----------|------------------------|-----------|-------------|
|  |           |           |           |           | Loan <sub>f,b,yq</sub> |           |             |
| $i_{yq-1} * FX-Funds_{b,yq-1} * Post_{yq}$ |           |           | -81.450** | -73.523** | -77.064**              | -83.296** | -126.016*** |
|  |           |           | (35.405)  | (35.386)  | (31.494)               | (35.624)  | (48.314)    |
| $i_{yq-1} * FX-Funds_{b,yq-1}$             |           |           | 39.253    | 31.008    | 33.505                 | 61.832**  | 68.681**    |
|  |           |           | (25.366)  | (25.343)  | (21.475)               | (25.547)  | (33.358)    |
| $FX-Funds_{b,yq-1} * Post_{yq}$            |           |           | -7.997    | -12.628   | -18.946                | -20.728   | -5.914      |
|  |           |           | (24.695)  | (24.460)  | (21.806)               | (24.511)  | (25.108)    |
| $FX-Funds_{b,yq-1}$                        | -0.385*** | -0.567*** | -19.159*  | -13.521   | -12.200                | -16.207   | -19.789*    |
|  | (0.125)   | (0.152)   | (11.208)  | (11.092)  | (10.251)               | (11.876)  | (12.000)    |
| $i_{yq-1} * Post_{yq}$                     | -3.462*** | -2.634*** |           |           |                        |           |             |
|  | (0.732)   | (0.842)   |           |           |                        |           |             |
| $i_{yq-1}$                                 | 0.420     | -0.522    |           |           |                        |           |             |
|  | (0.497)   | (0.603)   |           |           |                        |           |             |
| Observations                               | 1,309,024 | 826,849   | 895,247   | 895,247   | 895,247                | 895,247   | 895,247     |
| R-squared                                  | 0.808     | 0.802     | 0.808     | 0.808     | 0.810                  | 0.886     | 0.886       |
| Firm*Bank FE                               | Yes       | Yes       | Yes       | Yes       | Yes                    | Yes       | Yes         |
| Macro Controls*Post                        | Yes       | Yes       | Yes       | -         | -                      | -         | -           |
| Bank Controls                              | Yes       | Yes       | -         | -         | -                      | -         | -           |
| Lagged Firm Credit                         | Yes       | Yes       | No        | No        | No                     | -         | -           |
| Bank Controls*Post                         | No        | No        | Yes       | Yes       | Yes                    | Yes       | -           |
| FX-Funds*Macro Controls*Post               | No        | No        | Yes       | Yes       | Yes                    | Yes       | Yes         |
| Year:Quarter FE                            | No        | No        | No        | Yes       | -                      | -         | -           |
| Industry*Year:Quarter FE                   | No        | No        | No        | No        | Yes                    | -         | -           |
| Firm*Year:Quarter FE                       | No        | No        | No        | No        | No                     | Yes       | Yes         |
| Bank Controls* $i_{yq-1}$ *Post            | No        | No        | No        | No        | No                     | No        | Yes         |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to local monetary policy rate. The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq.  $i_{yq-1}$  is the lagged (by one quarter) local monetary policy rate. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets) and Checking Deposits (over Total Assets). The sample includes only those companies that borrowed from at least two banks. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Panel B: Monetary Policy Surprises

|  | (1)                  | (2)                  | (3)                  | (4)                    | (5)                  | (6)                  | (7)                  | (8)                   |
|--|----------------------|----------------------|----------------------|------------------------|----------------------|----------------------|----------------------|-----------------------|
|  |                      |                      |                      | $\text{Loan}_{f,b,yq}$ |                      |                      |                      |                       |
| $\bar{\Xi}_{yq-1} * \text{FX-Funds}_{b,yq-1} * \text{Post}_{yq}$                   |                      |                      | -6.809**<br>(2.834)  | -6.996***<br>(2.690)   | -5.059*<br>(2.964)   | -16.79***<br>(4.623) |                      |                       |
| $\tilde{i}_{yq-1} * \text{FX-Funds}_{b,yq-1} * \text{Post}_{yq}$                   |                      |                      |                      |                        |                      |                      | -364.1***<br>(100.3) |                       |
| $\widetilde{\text{MPSpread}}_{yq-1} * \text{FX-Funds}_{b,yq-1} * \text{Post}_{yq}$ |                      |                      |                      |                        |                      |                      |                      | -331.15***<br>(91.19) |
| $\bar{\Xi}_{yq-1} * \text{FX-Funds}_{b,yq-1}$                                      |                      |                      | 1.542***<br>(0.575)  | 1.601***<br>(0.485)    | 2.324***<br>(0.579)  | 3.509***<br>(0.922)  |                      |                       |
| $\tilde{i}_{yq-1} * \text{FX-Funds}_{b,yq-1}$                                      |                      |                      |                      |                        |                      |                      | 76.10***<br>(20.00)  |                       |
| $\widetilde{\text{MPSpread}}_{yq-1} * \text{FX-Funds}_{b,yq-1}$                    |                      |                      |                      |                        |                      |                      |                      | 69.22***<br>(18.189)  |
| $\text{FX-Funds}_{b,yq-1} * \text{Post}_{yq}$                                      |                      |                      | -2.809***<br>(0.687) | -3.072***<br>(0.608)   | -3.682***<br>(0.655) | -1.837**<br>(0.932)  | -2.809***<br>(0.687) |                       |
| $\text{FX-Funds}_{b,yq-1}$   | -0.352***<br>(0.128) | -0.525***<br>(0.156) | 0.102<br>(0.374)     | 0.169<br>(0.333)       | 0.494<br>(0.391)     | 1.302***<br>(0.424)  | -0.352***<br>(0.128) |                       |
| $\bar{\Xi}_{yq-1} * \text{Post}_{yq}$  | -0.395***<br>(0.071) | -0.390***<br>(0.077) |                      |                        |                      |                      |                      |                       |
| $\bar{\Xi}_{yq-1}$   | 0.021*<br>(0.011)    | 0.011<br>(0.014)     |                      |                        |                      |                      |                      |                       |
| Observations   | 1309024              | 826849               | 895247               | 895247                 | 895247               | 895247               | 895247               | 895247                |
| R-squared  | 0.857                | 0.828                | 0.808                | 0.810                  | 0.886                | 0.886                | 0.886                | 0.886                 |
| Firm*Bank FE   | Yes                  | Yes                  | Yes                  | Yes                    | Yes                  | Yes                  | Yes                  | Yes                   |
| Macro Controls*Post  | Yes                  | Yes                  | -                    | -                      | -                    | -                    | -                    | -                     |
| Bank Controls  | Yes                  | Yes                  | -                    | -                      | -                    | -                    | -                    | -                     |
| Lagged Firm Credit   | Yes                  | Yes                  | No                   | No                     | -                    | -                    | -                    | -                     |
| Bank Controls*Post   | No                   | No                   | Yes                  | Yes                    | Yes                  | -                    | -                    | -                     |
| Time FE  | No                   | No                   | Yes                  | -                      | -                    | -                    | -                    | -                     |
| Industry*Time FE   | No                   | No                   | No                   | Yes                    | -                    | -                    | -                    | -                     |
| Firm*Time FE   | No                   | No                   | No                   | No                     | Yes                  | Yes                  | Yes                  | Yes                   |
| Bank Controls*Shock*Post   | No                   | No                   | No                   | No                     | No                   | Yes                  | Yes                  | Yes                   |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to the surprise component of the local monetary policy rate. The dependent variable,  $\text{Loan}_{f,b,yq}$ , is the log of total debt provided by bank b to firm f in year:quarter yq.  $\bar{\Xi}_{yq-1}$  is the monetary policy surprise index, obtained as the cumulative sum of the difference between expected (by a pool of professional forecasters) and realized interest rate announcements.  $\widetilde{\text{MPSpread}}_{yq-1}$  is the predicted value of a regression of the policy rate spread on  $\bar{\Xi}_{yq-1}$ .  $\tilde{i}_{yq-1}$  is the predicted value of a regression of the policy rate on  $\bar{\Xi}_{yq-1}$ .  $\text{FX-Funds}_{b,yq-1}$  represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), Savings Deposits (rescaled by Total Assets) and Checking Deposits (rescaled by Total Assets). Lagged Firm Credit represents the lagged (by one quarter) log outstanding total bank debt held by a firm. All independent variables are demeaned. S.e. are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table A5: Policy Rate Differential, Global Macroeconomic Factors and Bank Credit**

|  | (1)                     | (2)                     | (3)                     | (4)                     |
|--|-------------------------|-------------------------|-------------------------|-------------------------|
|  |                         |                         | Loan <sub>f,b,yq</sub>  |                         |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>   | -280.971***<br>(59.067) | -347.229***<br>(92.252) | -339.030**<br>(145.969) | -323.379***<br>(59.877) |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>   | 144.609***<br>(28.647)  | 166.740***<br>(30.001)  | 294.263***<br>(37.001)  | 190.323***<br>(30.747)  |
| e <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  | 3.025<br>(2.651)        |                         |                         |                         |
| e <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  | -4.190**<br>(1.658)     |                         |                         |                         |
| VIX <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  |                         | 5.868<br>(4.661)        |                         |                         |
| VIX <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  |                         | -3.476**<br>(1.456)     |                         |                         |
| Oil <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  |                         |                         | -12.577<br>(7.905)      |                         |
| Oil <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  |                         |                         | 8.048***<br>(1.185)     |                         |
| EMBI <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>   |                         |                         |                         | 1.632***<br>(0.568)     |
| EMBI <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>   |                         |                         |                         | -1.845***<br>(0.448)    |
| FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>   | -6.001***<br>(1.019)    | -5.630***<br>(0.960)    | -9.764***<br>(1.307)    | -6.454***<br>(0.944)    |
| FX-Funds <sub>b,yq-1</sub>   | 2.481***<br>(0.801)     | 0.035<br>(0.423)        | 2.644**<br>(1.037)      | 3.941***<br>(0.740)     |
| Observations   | 895,247                 | 895,247                 | 895,247                 | 895,247                 |
| R-squared  | 0.886                   | 0.886                   | 0.886                   | 0.886                   |
| Firm*Bank FE   | Yes                     | Yes                     | Yes                     | Yes                     |
| FX-Funds*Macro Controls*Post   | Yes                     | Yes                     | Yes                     | Yes                     |
| Firm*Year:Quarter FE   | Yes                     | Yes                     | Yes                     | Yes                     |
| Bank Controls*MPspread <sup>US</sup> <sub>yq-1</sub> *Post   | Yes                     | Yes                     | Yes                     | Yes                     |
| H <sub>0</sub> : MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> +MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0 | 0                       | 0.03                    | 0.75                    | 0                       |
| H <sub>0</sub> : e <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> +e <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0   | 0.58                    | -                       | -                       | -                       |
| H <sub>0</sub> : VIX <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> +VIX <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0                                       | -                       | 0.58                    | -                       | -                       |
| H <sub>0</sub> : Oil <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> +Oil <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0                                       | -                       | -                       | 0.56                    | -                       |
| H <sub>0</sub> : EMBI <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> +EMBI <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub> =0                                     | -                       | -                       | -                       | 0.58                    |

This table shows how bank FX-funding influences bank credit reaction to global macroeconomic and external factors. The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the FED Effective Funds Rate. e<sub>yq-1</sub> is the lagged (log) nominal exchange rate, expressed as pesos per 1 USD, so that an increase denotes a depreciation of the Colombian peso against the USD. VIX<sub>yq-1</sub> is the lagged (log) VIX index, whereas Oil<sub>yq-1</sub> is the lagged (log) Brent oil price and EMBI<sub>yq-1</sub> is the lagged (log) JP-Morgan EMBI index for Colombia. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets) and Checking Deposits (over Total Assets). The last five rows report the p-values for the tests with null hypothesis specified in the first column. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



**Table A6: Reserve Requirement Shock and Bank Credit: Robustness**

Panel A: Alternative Models

|   | (1)                    | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  | (7)                | (8)                | (9)                 |
|---|------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------|--------------------|---------------------|
|   | Loan <sub>f,b,yq</sub> |                      |                      |                      |                      |                      |                    |                    |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> | -0.675***<br>(0.183)   | -0.647***<br>(0.159) | -0.612***<br>(0.166) | -0.844***<br>(0.134) | -0.871***<br>(0.116) | -0.994***<br>(0.119) | -0.697^<br>(0.414) | -0.697*<br>(0.367) | -0.697**<br>(0.221) |
| Observations                                    | 640,136                | 742,950              | 640,136              | 1,219,366            | 1,219,366            | 1,049,099            | 742,950            | 742,950            | 742,950             |
| R-squared                                       | 0.908                  | 0.900                | 0.911                | 0.851                | 0.862                | 0.877                | 0.897              | 0.897              | 0.897               |
| Loan-Size Weighted                              | No                     | Yes                  | Yes                  | No                   | Yes                  | Yes                  | No                 | No                 | No                  |
| Firm*Bank FE                                    | Yes                    | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                | Yes                | Yes                 |
| FX-Funds*Macro Controls*Post                    | Yes                    | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                | Yes                | Yes                 |
| Industry*Year:Quarter FE                        | -                      | -                    | -                    | Yes                  | Yes                  | Yes                  | -                  | -                  | -                   |
| Firm*Year:Quarter FE                            | Yes                    | Yes                  | Yes                  | No                   | No                   | No                   | Yes                | Yes                | Yes                 |
| Bank Controls*Int Rate*Post                     | Yes                    | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                | Yes                | Yes                 |
| Provision*MP-spread*Post                        | Yes                    | No                   | Yes                  | No                   | No                   | Yes                  | No                 | No                 | No                  |
| Cluster   | F + B*I                | F + B*I              | F + B*I              | F + B*I              | F + B*I              | F + B*I              | F + B              | F + B + YQ         | F + B*I + YQ        |

This table shows robustness exercises about the reaction of bank credit to the Reserve Requirement (RR) shock. In columns 1 through 3, we augment the baseline model with either further controls and/or fixed effects, under OLS and WLS estimation. In columns 4 through 6, we estimate different versions of the model over a sample of companies consisting also of firms borrowing from bank only, whereas in the other columns Firm\*Year:Quarter FE restrict the estimation sample to just those firms with at least two lenders (Multi-Bank firms). In columns 7 through 9, we apply alternative standard errors' clustering strategies. The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq. RR-Depo is the sum of savings (SavingD<sub>b,2007Q1</sub>) and checking (CheckingD<sub>b,2007Q1</sub>) deposits, both rescaled by total assets, as of 2007Q1. Bank Controls is a vector of bank controls (as of 2007Q1) including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans). The Post<sub>yq</sub> dummy has value 1 from 2007Q2 onward and value 0 before. Provision is the lagged loan-level provision, rescaled by the loan value. All independent variables are demeaned. Standard errors are double-clustered at the level of: Bank\*Industry and Firm in columns 1 through 6; Bank and Firm in column 7; Bank, Firm and Year:Quarter in column 8; Bank\*Industry, Firm and Year:Quarter in column 9. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, ^ p<0.12.

Panel B: Cross-Sectional Regressions

| VARIABLES                     | (1)<br>$\Delta_1 \text{Loan}_{fb,2007Q2}$ | (2)                  | (3)<br>$\Delta_2 \text{Loan}_{fb,2007Q3}$ | (4)                  | (5)<br>$\Delta_3 \text{Loan}_{fb,2007Q4}$ | (6)                  | (7)<br>$\Delta_4 \text{Loan}_{fb,2008Q1}$ | (8)                  | (9)<br>$\Delta_5 \text{Loan}_{fb,2008Q2}$ | (10)                 |
|-------------------------------|---|----------------------|---|----------------------|---|----------------------|---|----------------------|---|----------------------|
| RR-Depo <sub>b,2007Q1</sub>   | -0.285**<br>(0.134)                       |                      | -0.673***<br>(0.169)                      |                      | -1.042***<br>(0.207)                      |                      | -0.778***<br>(0.219)                      |                      | -0.842***<br>(0.242)                      |                      |
| SavingD <sub>b,2007Q1</sub>   |   | -0.181<br>(0.133)    |   | -0.548***<br>(0.169) |   | -0.870***<br>(0.209) |   | -0.458**<br>(0.222)  |   | -0.498**<br>(0.246)  |
| CheckingD <sub>b,2007Q1</sub> |   | -0.738***<br>(0.214) |   | -1.222***<br>(0.274) |   | -1.794***<br>(0.326) |   | -2.158***<br>(0.347) |   | -2.302***<br>(0.367) |
| Observations                  | 66,758                                    | 66,758               | 63,993                                    | 63,993               | 60,865                                    | 60,865               | 58,921                                    | 58,921               | 57,199                                    | 57,199               |
| R-squared                     | 0.378                                     | 0.378                | 0.393                                     | 0.394                | 0.405                                     | 0.405                | 0.414                                     | 0.414                | 0.425                                     | 0.426                |
| Bank Controls                 | Yes                                       | Yes                  | Yes                                       | Yes                  | Yes                                       | Yes                  | Yes                                       | Yes                  | Yes                                       | Yes                  |
| Firm FE                       | Yes                                       | Yes                  | Yes                                       | Yes                  | Yes                                       | Yes                  | Yes                                       | Yes                  | Yes                                       | Yes                  |

This table shows the evolution of bank credit in reaction to the Reserve Requirement (RR) shock. We perform cross-sectional regressions. The dependent variable is the difference between  $\text{Loan}_{fb,2007Q1+j}$  and  $\text{Loan}_{fb,2007Q1}$ , signaled by the operator  $\Delta_j$ ,  $j=\{1,2,3,4,5\}$ . Note that the starting year:quarter is always 2007Q1, the year:quarter before the RR-Shock. RR-Depo is the sum of savings ( $\text{SavingD}_{b,2007Q1}$ ) and checking ( $\text{CheckingD}_{b,2007Q1}$ ) deposits, both over total assets, as of 2007Q1. In Panel B, in all columns we include only firms borrowing from at least two banks. Bank Controls is a vector of bank controls (as of 2007Q1) including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans). The  $\text{Post}_{t,yq}$  dummy has value 1 from 2007Q2 onward and value 0 before. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\*  $p<0.01$ , \*\*  $p<0.05$ , \*  $p<0.1$ .

Panel C: Placebo test

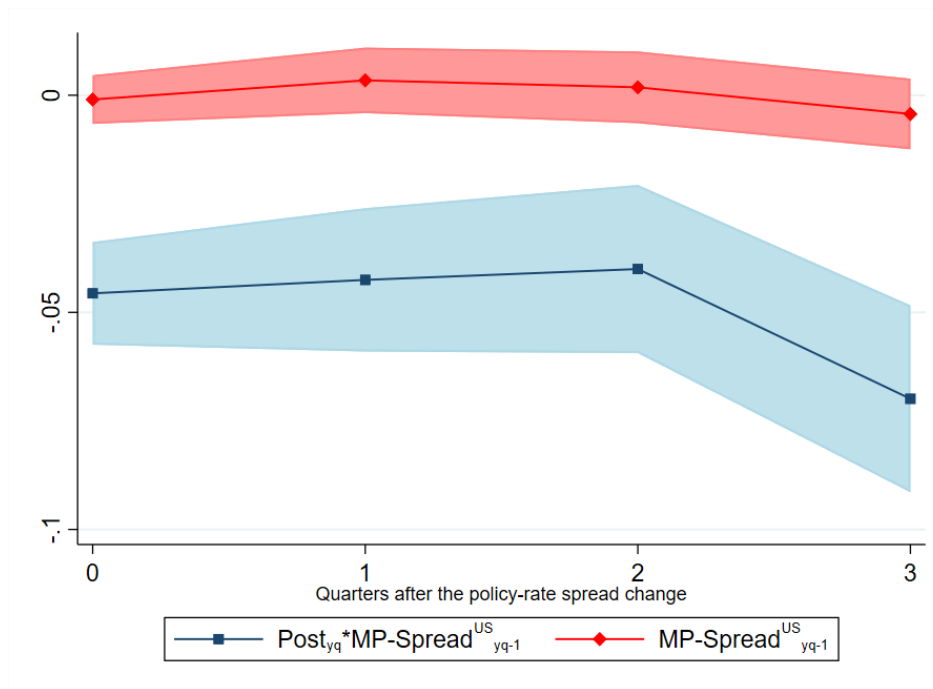
| VARIABLES   | (1)              | Loan <sub>f,b,yq</sub> | (2)                 |
|---|------------------|------------------------|---------------------|
| Post(Fake) <sub>yq</sub> *RR-Depo <sub>b,2005Q4</sub>   | 0.368<br>(0.256) |                        |                     |
| Post(Fake) <sub>yq</sub> *SavingD <sub>b,2005Q4</sub>   |                  |                        | 0.800***<br>(0.299) |
| Post(Fake) <sub>yq</sub> *CheckingD <sub>b,2005Q4</sub> |                  |                        | 0.313<br>(0.255)    |
| Observations  | 486,201          |                        | 486,201             |
| R-squared   | 0.903            |                        | 0.903               |
| Bank Controls*Post                                      | Yes              |                        | Yes                 |
| Firm*Bank FE  | Yes              |                        | Yes                 |
| Firm*Year:Quarter                                       | Yes              |                        | Yes                 |

This table performs a placebo test. The sample goes from 2005Q1 to 2006Q4. The dependent variable is Loan<sub>f,b,yq</sub>, i.e. the log of total debt provided by bank b to firm f in year:quarter yq. Banks variables are measured at 2005Q4, a year:quarter with no RR-intervention. RR-Depo is the sum of savings (SavingD<sub>b,2005Q4</sub>) and checking (CheckingD<sub>b,2005Q4</sub>) deposits, both over total assets, as of 2005Q4. Bank Controls is a vector of bank controls (as of 2005Q4) including: ROA, log Total Assets, Common Equity and FX-Funds (both rescaled by Total Assets), NPL (rescaled by Total Loans). The Post(Fake)<sub>yq</sub> dummy has value 1 from 2006Q1 onward and 0 before. All independent variables are demeaned. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## Online Appendix

**Figure B1:** Monetary Policy Rates and Bank Credit (Dynamic Response estimated through Local Projections)

Panel A: Policy Rate Spread (Colombia – US)

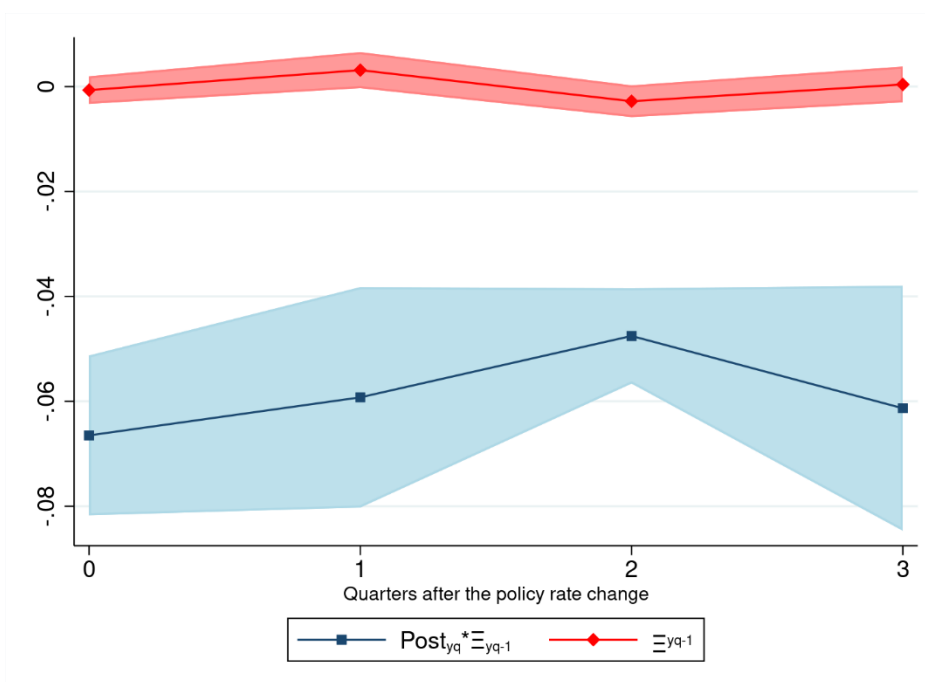


We obtain this chart sequentially estimating the following models:

$$\text{Loan}_{f,b,yq+h} = \beta_{1,h} \text{MP-Spread}_{yq} + \beta_{2,h} \text{Post}_{yq} + \beta_{3,h} \text{Post}_{yq} * \text{MP-Spread}_{yq} + \gamma_h \text{MacroControls}_{yq} + \delta_h \text{BankControls}_{b,yq} + \theta_h \text{FirmCredit}_{yq} + \text{FE} + u_{f,b,yq+h}$$

$\text{Loan}_{f,b,yq+h}$  is the log of total debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq+h$ , where  $h=0,1,2,3$ .  $\text{Post}_{yq}$  is a dummy with value 0 before 2007q2 and with value 1 from 2007q2 onwards.  $\text{MP-Spread}_{yq}$  is the difference between the local (Colombian) policy rate and the Effective Federal Funds Rate. MacroControls include the current values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. BankControls include ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). FE is a vector of firm\*bank fixed effects.  $u_{f,b,yq+h}$  is an error term. The red diamonds denote the point estimates for coefficients  $\beta_{1,h}$ . The blue squares represent the point estimates for coefficients  $\beta_{3,h}$ . The areas around the point estimates depict confidence bands at 5% significance level. We multiply both point estimates and standard errors by 1 p.p., so that the impulse response function are calibrated to an increase in the Colombian-vs-US policy rate spread by 1 p.p.. Standard errors are double-clustered at the firm and bank\*industry level.

Panel B: Surprise Component of the Colombian Policy Rate



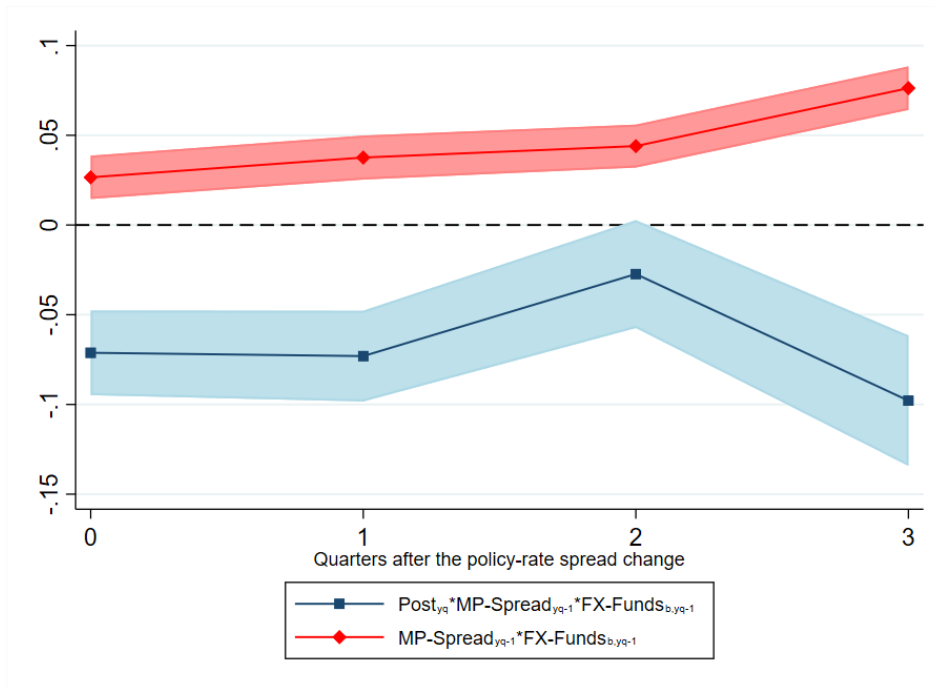
We obtain this chart sequentially estimating the following models:

$$\text{Loan}_{f,b,yq+h} = \beta_{1,h} \Xi_{yq} + \beta_{2,h} \text{Post}_{yq} + \beta_{3,h} \text{Post}_{yq} * \Xi_{yq} + \gamma_h \text{MacroControls}_{yq} + \delta_h \text{BankControls}_{b,yq} + \theta_h \text{FirmCredit}_{yq} + \text{FE} + u_{f,b,yq+h}$$

$\text{Loan}_{f,b,yq+h}$  is the log of total debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq+h$ , where  $h=0,1,2,3$ .  $\text{Post}_{yq}$  is a dummy with value 0 before 2007q2 and with value 1 from 2007q2 onwards.  $\Xi_{yq}$  is the monetary policy surprise index, obtained as the cumulative sum of the average difference between expected (by a pool of professional forecasters) and realized interest rate announcements.  $\text{MacroControls}$  include the current values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate.  $\text{BankControls}$  include ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets).  $\text{FE}$  is a vector of firm\*bank fixed effects.  $u_{f,b,yq+h}$  is an error term. The red diamonds denote the point estimates for coefficients  $\beta_{1,h}$ . The blue squares represent the point estimates for coefficients  $\beta_{3,h}$ . The areas around the point estimates depict confidence bands at 5% significance level. We multiply both point estimates and standard errors by 0.15, so that the impulse response function are calibrated to an increase in the Colombian-vs-US policy rate spread by 15 b.p.. Standard errors are double-clustered at the firm and bank\*industry level.

**Figure B2:** Monetary Policy Rates and Bank Credit – Carry Trade Mechanism (Dynamic Response estimated through Local Projections)

Panel A: Policy Rate Spread (Colombia – US)

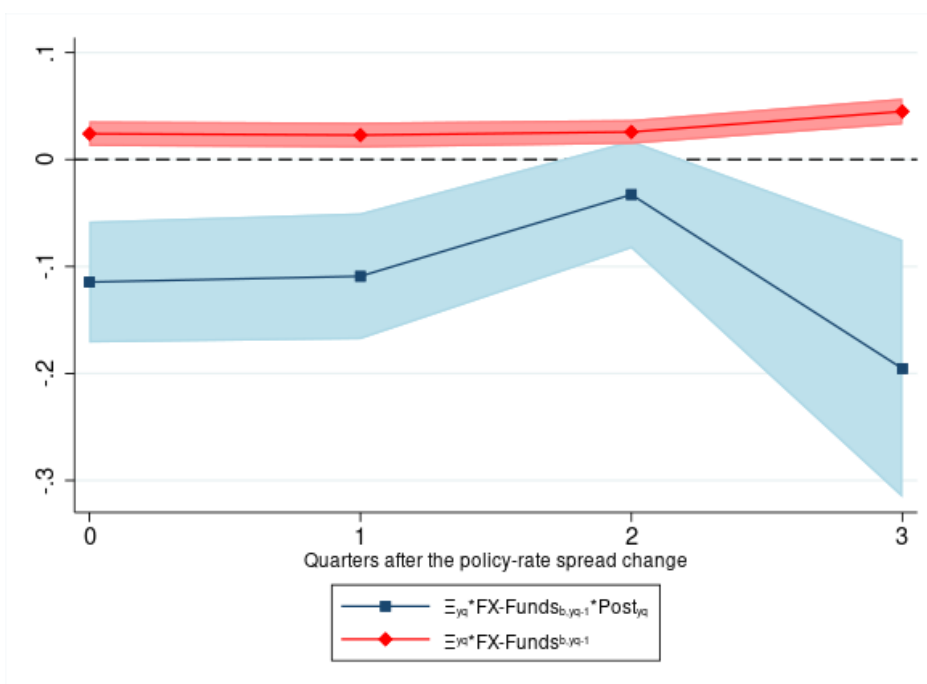


We obtain this chart sequentially estimating the following models:

$$\begin{aligned} \text{Loan}_{f,b,yq+h} = & \text{FX-Funds}_{b,yq} * (\alpha_{1,h} + \beta_{1,h} * \text{MP-Spread}_{yq} + \alpha_{2,h} * \text{Post}_{yq} + \beta_{2,h} * \text{MP-Spread}_{yq} * \text{Post}_{yq}) + \\ & \text{FX-Funds}_{b,yq} * (\gamma_{1,h} * \text{MacroControls}_{yq} + \gamma_{2,h} * \text{MacroControls}_{yq} * \text{Post}_{yq}) + \\ & \text{BankControls}_{b,yq} * (\delta_{1,h} + \vartheta_{1,h} * \text{MP-Spread}_{yq} + \delta_{2,h} * \text{Post}_{yq} + \vartheta_{2,h} * \text{MP-Spread}_{yq} * \text{Post}_{yq}) + \\ & \text{FE} + \epsilon_{f,t,yq+h} \end{aligned}$$

$\text{Loan}_{f,b,yq+h}$  is the log of total debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq+h$ , where  $h=0,1,2,3$ .  $\text{Post}_{yq}$  is a dummy with value 0 before 2007q2 and with value 1 from 2007q2 onwards.  $\text{MP-Spread}_{yq}$  is the difference between the local monetary policy rate and the Effective Federal Funds Rate.  $\text{MacroControls}$  include the current values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate.  $\text{BankControls}$  include ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets).  $\text{FE}$  is a vector of firm\*bank and firm\*year:quarter fixed effects.  $\epsilon_{f,t,yq+h}$  is an error term. The red diamonds denote the point estimates for coefficients  $\beta_{1,h}$ . The blue squares represent the point estimates for coefficients  $\beta_{2,h}$ . The areas around the point estimates depict confidence bands at 5% significance level. We multiply both point estimates and standard errors by 0.026 p.p., so that the impulse response function are calibrated to an increase in the Colombian policy rate by 1 p.p. and to higher bank FX-funding by 1 s.d., i.e. by 2.6 p.p.. Standard errors are double-clustered at the firm and bank\*industry level.

Panel B: Surprise Component of the Colombian Policy Rate



We obtain this chart sequentially estimating the following models:

$$\begin{aligned} \text{Loan}_{f,b,yq+h} = & \text{FX-Funds}_{b,yq} * (\alpha_{1,h} + \beta_{1,h} * \Xi_{yq} + \alpha_{2,h} * \text{Post}_{yq} + \beta_{2,h} * \Xi_{yq} * \text{Post}_{yq}) + \\ & \text{FX-Funds}_{b,yq} * (\gamma_{1,h} * \text{MacroControls}_{yq} + \gamma_{2,h} * \text{MacroControls}_{yq} * \text{Post}_{yq}) + \\ & \text{BankControls}_{b,yq} * (\delta_{1,h} + \vartheta_{1,h} * \Xi_{yq} + \delta_{2,h} * \text{Post}_{yq} + \vartheta_{2,h} * \Xi_{yq} * \text{Post}_{yq}) + \\ & \text{FE} + \epsilon_{f,t,yq+h} \end{aligned}$$

$\text{Loan}_{f,b,yq+h}$  is the log of total debt provided by bank  $b$  to firm  $f$  in year:quarter  $yq+h$ , where  $h=0,1,2,3$ .  $\text{Post}_{yq}$  is a dummy with value 0 before 2007q2 and with value 1 from 2007q2 onwards.  $\Xi_{yq}$  is the monetary policy surprise index, obtained as the cumulative sum of the average difference between expected (by a pool of professional forecasters) and realized interest rate announcements. For any given policy-rate announcement by the Central Bank of Colombia, surprises are computed as the deviation of the average forecast by professional forecasters from the eventually declared policy rate. BankControls include ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). FE is a vector of firm\*bank and firm\*year:quarter fixed effects.  $\epsilon_{f,t,yq+h}$  is an error term. The red diamonds denote the point estimates for coefficients  $\beta_{2,h}$ . The blue squares represent the point estimates for coefficients  $\beta_{1,h}$ . The areas around the point estimates depict confidence bands at 5% significance level. We multiply both point estimates and standard errors by 0.026 p.p. \* 0.25 b.p., so that the impulse response function are calibrated to an increase in  $\Xi_{yq}$  by 25 b.p. and to higher bank FX-funding by 1 s.d., i.e. by 2.6 p.p.. Standard errors are double-clustered at the firm and bank\*industry level.

**Table B1:** Summary Statistics for Carry Trade Regressions (Smaller Sample with Currency Breakdown of Loan Volume)

| VARIABLES                           | Definition: timing                           | (1)<br>N | (2)<br>Mean | (3)<br>P25 | (4)<br>P50 | (5)<br>P75 | (6)<br>SD |
|-------------------------------------|--|----------|-------------|------------|------------|------------|-----------|
| <b>Loan-level Variables</b>         |  |          |             |            |            |            |           |
| Peso Loan <sub>f,b,yq</sub>         | Log(Peso Loan): current year:quarter         | 315,692  | 18.347      | 17.176     | 18.602     | 19.890     | 2.544     |
| FX Loan <sub>f,b,yq</sub>           | Log(FX Loan): current year:quarter           | 22,686   | 19.525      | 18.570     | 19.797     | 21.002     | 2.359     |
| (Peso Loan/ Loan) <sub>f,b,yq</sub> | Peso Loan / Total Loan: current year:quarter | 322,775  | 0.941       | 1.000      | 1.000      | 1.000      | 0.210     |
| <b>Bank-level variables</b>         |  |          |             |            |            |            |           |
| FX-Funds <sub>b,yq-1</sub>          | FX-Funds (over TA): 1Q-lagged                | 322,775  | 0.046       | 0.030      | 0.046      | 0.062      | 0.025     |
| SavingD <sub>b,yq-1</sub>           | Savings Deposits (over TA): 1Q-lagged        | 322,775  | 0.346       | 0.287      | 0.341      | 0.400      | 0.079     |
| CheckingD <sub>b,yq-1</sub>         | Checking Deposits (over TA): 1Q-lagged       | 322,775  | 0.135       | 0.105      | 0.123      | 0.173      | 0.047     |
| Size <sub>b,yq-1</sub>              | Bank Log(TA) : 1Q-lagged                     | 322,775  | 16.399      | 16.052     | 16.425     | 16.798     | 0.549     |
| CET <sub>b,yq-1</sub>               | Common Equity Capital (over TA): 1Q-lagged   | 322,775  | 0.043       | 0.032      | 0.042      | 0.052      | 0.013     |
| NPL <sub>b,yq-1</sub>               | Non Perf. Loans (over Tot. Loans): 1Q-lagged | 322,775  | 0.027       | 0.020      | 0.024      | 0.029      | 0.010     |
| ROA <sub>b,yq-1</sub>               | Return on Assets: 1Q-lagged                  | 322,775  | 0.014       | 0.008      | 0.012      | 0.018      | 0.007     |



**Table B2:** Summary Statistics for Reserve-Requirements Policy Regressions (Placebo Sample in Panel C of *Table A6*)

| VARIABLES                     | Definition: timing                        | (1)<br>N | (2)<br>Mean | (3)<br>P25 | (4)<br>P50 | (5)<br>P75 | (6)<br>SD |
|-------------------------------|---|----------|-------------|------------|------------|------------|-----------|
| <b>Loan-level Variables</b>   |   |          |             |            |            |            |           |
| Loan <sub>f,b,yq</sub>        | Log(Loan): current year:quarter           | 486,201  | 17.638      | 16.386     | 17.745     | 19.088     | 7.846     |
| <b>Bank-level variables</b>   |   |          |             |            |            |            |           |
| RR-Depo <sub>b,2005Q4</sub>   | Checking + Savings Dep. (over TA): 2005Q4 | 486,201  | 0.491       | 0.459      | 0.520      | 0.530      | 0.079     |
| SavingD <sub>b,2005Q4</sub>   | Savings Deposits (over TA): 2005Q4        | 486,201  | 0.332       | 0.273      | 0.346      | 0.373      | 0.070     |
| CheckingD <sub>b,2005Q4</sub> | Checking Deposits (over TA): 2005Q4       | 486,201  | 0.159       | 0.128      | 0.145      | 0.226      | 0.058     |
| Size <sub>b,2005Q4</sub>      | Bank Log(TA) – 2005Q4                     | 486,201  | 16.339      | 16.092     | 16.375     | 16.598     | 0.523     |
| CET <sub>b,2005Q4</sub>       | Common Equity Capital (over TA): 2005Q4   | 486,201  | 0.040       | 0.030      | 0.034      | 0.050      | 0.013     |
| NPL <sub>b,2005Q4</sub>       | Non Perf. Loans (over Tot. Loans): 2005Q4 | 486,201  | 0.024       | 0.020      | 0.020      | 0.022      | 0.009     |
| FX-Funds <sub>b,2005Q4</sub>  | FX-Funds (over TA): 2005Q4                | 486,201  | 0.045       | 0.028      | 0.038      | 0.059      | 0.029     |
| ROA <sub>b,2005Q4</sub>       | Return on Assets: 2005Q4                  | 486,201  | 0.024       | 0.016      | 0.028      | 0.031      | 0.007     |

**Table B3: Policy Rate Differential and Bank Credit – Progressively Saturated Models**

| VARIABLES   | (1)                    | (2)                  | (3)                  | (4)                  | (5)                  | (6)                  |
|---|------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|   | $\text{Loan}_{f,b,yq}$ |                      |                      |                      |                      |                      |
| $\text{Post}_{yq} * \text{MPspread}_{yq-1}^{\text{US}}$   | -3.268***<br>(0.383)   | -5.651***<br>(0.768) | -5.170***<br>(0.756) | -6.401***<br>(0.673) | -3.226***<br>(0.941) | -4.252***<br>(0.842) |
| $\text{MPspread}_{yq-1}^{\text{US}}$  | 3.166***<br>(0.354)    | 3.990***<br>(0.424)  | 4.076***<br>(0.422)  | 4.331***<br>(0.390)  | 2.656***<br>(0.402)  | 0.344<br>(0.385)     |
| Observations  | 1,475,369              | 1,475,369            | 1,475,369            | 1,475,369            | 1,475,369            | 1,309,024            |
| R-squared   | 0.674                  | 0.674                | 0.678                | 0.832                | 0.832                | 0.857                |
| Firm FE   | Yes                    | Yes                  | Yes                  | -                    | -                    | -                    |
| Macro Control*Post  | No                     | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  |
| Bank FE   | No                     | No                   | Yes                  | -                    | -                    | -                    |
| Firm*Bank FE  | No                     | No                   | No                   | Yes                  | Yes                  | Yes                  |
| Bank Controls   | No                     | No                   | No                   | No                   | Yes                  | Yes                  |
| Lagged Firm Credit  | No                     | No                   | No                   | No                   | No                   | Yes                  |
| $H_0: \text{MPspread}_{yq-1}^{\text{US}} + \text{Post}_{yq} * \text{MPspread}_{yq-1}^{\text{US}} = 0$ | .6                     | .007                 | .068                 | 0                    | .492                 | 0                    |

This table shows the relation between bank credit and the policy rate spread.  $\text{Loan}_{f,b,yq}$  is the log of total debt provided by bank b to firm f in year:quarter yq.  $\text{MPspread}_{yq-1}^{\text{US}}$  is the difference between the (lagged) local monetary policy and the FED Effective Funds Rate. Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). All independent variables (except the Post dummy) are demeaned. The last row reports the p-values for the tests with null hypothesis specified in the first column. Standard errors are double-clustered at the Bank\*Industry and Firm level. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table B4: Policy Rate Differential and Bank Credit – Alternative Models**

| VARIABLES  | (1)                  | (2)                  | (3)                  | (4)                  | (5)                  | (6)                    | (7)                  | (8)                  | (9)                 | (10)                 | (11)                |
|--|----------------------|----------------------|----------------------|----------------------|----------------------|------------------------|----------------------|----------------------|---------------------|----------------------|---------------------|
|  |                      |                      |                      |                      |                      | Loan <sub>f,b,yq</sub> |                      |                      |                     |                      |                     |
| Post <sub>yq</sub> *MPspread <sup>US</sup> <sub>yq-1</sub>                             | -4.994***<br>(1.630) | -4.813***<br>(0.828) | -3.932***<br>(0.837) | -6.143***<br>(1.536) | -4.659***<br>(1.521) | -3.314***<br>(0.678)   | -5.523***<br>(1.330) | -4.330***<br>(1.319) | -4.252**<br>(1.891) | -4.252***<br>(1.191) | -4.252**<br>(1.806) |
| MPspread <sup>US</sup> <sub>yq-1</sub>   | 0.196<br>(0.513)     | -0.597<br>(1.092)    | 0.008<br>(0.437)     | -2.048*<br>(1.239)   | -1.932<br>(1.222)    | 0.462<br>(0.332)       | -1.677<br>(1.070)    | -1.528<br>(1.057)    | 0.344<br>(0.706)    | 0.344<br>(0.621)     | 0.344<br>(1.080)    |
| Observations   | 1,309,024            | 1,309,024            | 1,309,024            | 1,210,066            | 1,203,805            | 1,309,024              | 1,210,066            | 1,203,805            | 1,309,024           | 1,309,024            | 1,309,024           |
| R-squared  | 0.857                | 0.857                | 0.857                | 0.869                | 0.872                | 0.867                  | 0.877                | 0.879                | 0.857               | 0.857                | 0.857               |
| Loan-Size Weighted   | No                   | No                   | No                   | No                   | No                   | Yes                    | Yes                  | Yes                  | No                  | No                   | No                  |
| EFFR   | No                   | Yes                  | No                   | No                   | No                   | No                     | No                   | No                   | No                  | No                   | No                  |
| EMBI   | No                   | No                   | Yes                  | No                   | No                   | No                     | No                   | No                   | No                  | No                   | No                  |
| Macro Control*Post   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                    | Yes                  | Yes                  | Yes                 | Yes                  | Yes                 |
| Firm*Bank FE   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                    | Yes                  | Yes                  | Yes                 | Yes                  | Yes                 |
| Bank Controls  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                    | Yes                  | Yes                  | Yes                 | Yes                  | Yes                 |
| Lagged Firm Credit   | Yes                  | Yes                  | Yes                  | Yes                  | Yes                  | Yes                    | Yes                  | Yes                  | Yes                 | Yes                  | Yes                 |
| Time Trend   | Yes                  | No                   | No                   | No                   | No                   | No                     | No                   | No                   | No                  | No                   | No                  |
| Firm*Quarter FE  | No                   | No                   | No                   | Yes                  | Yes                  | No                     | Yes                  | Yes                  | No                  | No                   | No                  |
| Provision  | No                   | No                   | No                   | No                   | Yes                  | No                     | No                   | Yes                  | No                  | No                   | No                  |
| H <sub>0</sub> : MPspread <sup>US</sup> +Post <sub>yq</sub> *MPspread <sup>US</sup> =0 | .011                 | 0                    | 0                    | 0                    | 0                    | 0                      | 0                    | 0                    | .058                | .002                 | .016                |
| Cluster  | F + B*I              | F + B*I              | F + B*I              | F + B*I              | F + B*I              | F + B*I                | F + B*I              | F + B*I              | F + B               | F + B + YQ           | F + B*I + YQ        |

This table shows robustness exercises about the relation between bank credit and the policy rate spread. In all columns, the dependent variable is Loan<sub>f,b,yq</sub>, the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the FED Effective Funds Rate. In column 1, we augment the baseline model with a linear time trend; in column 2 and 3, we replace the lagged log Peso-US\$ exchange rate with the lagged Effective Federal Funds Rate (EFFR in the legend) or the lagged log EMBI for Colombia, respectively. In column 4, we saturate the baseline model with firm\*quarter(seasonal) fixed effects, eventually augmented with lagged loan losses provisions (rescaled by the lagged loan value) in column 5. In column 6 and 7, we run the latter two models under WLS, with weights given by loan size. In columns 9 through 11, we apply alternative standard errors' clustering strategies. Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). The penultimate row reports the p-values for the tests with null hypothesis specified in the first column. All independent variables are demeaned. Standard errors are double-clustered at the level of: Bank\*Industry and Firm in columns 1 through 8; Bank and Firm in column 9; Bank, Firm and Year:Quarter in column 10; Bank\*Industry, Firm and Year:Quarter in column 11. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table B5: Bank-level Clustering**

Panel A: Policy Rate Differential and Bank Credit

|   | (1)                 | (2)                    |
|---|---------------------|------------------------|
|   |                     | Loan <sub>f,b,yq</sub> |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  |                     | -280.971*<br>(133.587) |
| MPspread <sup>US</sup> <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  |                     | 144.609**<br>(58.465)  |
| Post <sub>yq</sub> *MP-Spread <sub>yq-1</sub>   | -4.252**<br>(1.890) |                        |
| MP-Spread <sub>yq-1</sub>   | 0.344<br>(0.705)    |                        |
| Observations  | 1,309,024           | 895,247                |
| R-squared   | 0.857               | 0.886                  |
| Macro Control*Post  | Yes                 | -                      |
| Firm*Bank FE  | Yes                 | Yes                    |
| Bank Controls   | Yes                 | -                      |
| Lagged Firm Credit  | Yes                 | -                      |
| Bank Controls* MP-Spread <sub>yq-1</sub> *Post <sub>yq</sub>  | No                  | Yes                    |
| Macro Controls*FX- Funds <sub>b,yq-1</sub> *Post  | No                  | Yes                    |
| Firm*Year:Quarter FE  | No                  | Yes                    |
| H <sub>0</sub> : MP-Spread <sub>yq-1</sub> + Post*MP-Spread <sub>yq-1</sub> =0  | .058                | -                      |
| H <sub>0</sub> : FX-Funds <sub>b,yq-1</sub> *MPspread <sup>US</sup> <sub>yq-1</sub> + FX-Funds <sub>b,yq-1</sub> * MPspread <sup>US</sup> <sub>yq-1</sub> * MPspread <sup>US</sup> <sub>yq-1</sub> =0 | -                   | .179                   |

This table shows the relation between bank credit and the policy rate spread. Loan<sub>f,b,yq</sub> is the log of total debt provided by bank b to firm f in year:quarter yq. MP-Spread<sub>yq-1</sub> is the lagged (by one quarter) difference between the local monetary policy rate and the Effective Federal Funds Rate. Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). The last two rows report the p-values for the tests with null hypothesis specified in the first column. All independent variables are demeaned. Standard errors are clustered at the Bank level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

PANEL B: Reserve Requirement Shock and Bank Credit

| VARIABLES  | (1)                 | Loan <sub>f,b,yq</sub> | (2)       |
|--|---------------------|------------------------|-----------|
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub>  | -0.697 <sup>a</sup> |                        |           |
|  | (0.494)             |                        |           |
| Post <sub>yq</sub> *Saving <sub>b,2007Q1</sub>   |                     |                        | -0.419    |
|  |                     |                        | (0.381)   |
| Post <sub>yq</sub> *Checking <sub>b,2007Q1</sub> |                     |                        | -1.845*** |
|  |                     |                        | (0.541)   |
| Observations                                     | 742,950             |                        | 742,950   |
| R-squared  | 0.897               |                        | 0.897     |
| Bank Controls*Post                               | Yes                 |                        | Yes       |
| Firm*Bank FE                                     | Yes                 |                        | Yes       |
| Firm*Year:Quarter                                | Yes                 |                        | Yes       |

This table shows the evolution of bank credit in reaction to the Reserve Requirement (RR) shock. The dependent variable is Loan<sub>f,b,yq</sub>, i.e. the log of total debt provided by bank b to firm f in year:quarter yq. RR-Depo is the sum of savings (SavingD<sub>b,2007Q1</sub>) and checking (CheckingD<sub>b,2007Q1</sub>) deposits, both rescaled by total assets, as of 2007Q1. Bank Controls is a vector of bank controls (as of 2007Q1), including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans). The Post<sub>yq</sub> dummy has value 1 from 2007Q2 onward and value 0 before. All independent variables are demeaned. Standard errors are clustered at the Bank level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, <sup>a</sup>p<0.19.

**Table B6: Alternative Definitions for Bank-Level Variables**

|   | (1)  | (2)                     | (3)                     | (4)                                 | (5)                     |
|---|--|-------------------------|-------------------------|-------------------------------------|-------------------------|
|   | Dependent Variable: $\text{Loan}_{f,b,yq}$ |                         |                         |                                     |                         |
| Bank-Level Variables                            | Lagged Values after Removing<br>Time FE    | 2005Q1 Value            | In-Sample Mean          | Lagged Value / $\text{TA}_{2005Q1}$ | Lagged Value / Mean TA  |
| FX-Funds*MP-Spread $_{yq-1}$ *Post $_{yq}$      | -280.723***<br>(59.060)                    | -211.861***<br>(51.370) | -214.392***<br>(48.674) | -172.993***<br>(35.790)             | -235.194***<br>(52.471) |
| FX-Funds*MP-Spread $_{yq}$                      | 142.418***<br>(28.564)                     | 312.196***<br>(40.991)  | 303.840***<br>(38.462)  | 73.782***<br>(24.089)               | 146.703***<br>(32.248)  |
| Observations                                    | 895,247                                    | 895,247                 | 895,247                 | 895,247                             | 895,247                 |
| R-squared                                       | 0.886                                      | 0.886                   | 0.886                   | 0.886                               | 0.886                   |
| Firm*Time FE                                    | Yes  | Yes                     | Yes                     | Yes                                 | Yes                     |
| FX-Funds*Macro Controls*Post                    | Yes  | Yes                     | Yes                     | Yes                                 | Yes                     |
| Firm*Bank FE                                    | Yes  | Yes                     | Yes                     | Yes                                 | Yes                     |
| Bank Controls*MP-Spread $_{yq-1}$ *Post $_{yq}$ | Yes  | Yes                     | Yes                     | Yes                                 | Yes                     |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to the policy rate spread. The dependent variable,  $\text{Loan}_{f,b,yq}$ , is the log of total debt provided by bank b to firm f in year:quarter yq.  $\text{MPspread}_{yq-1}^{\text{US}}$  is the difference between the (lagged) local monetary policy and the US Effective Federal Funds Rate.  $\text{FX-Funds}_{b,yq-1}$  represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets) and Checking Deposits (rescaled by Total Assets). Across the different columns, we apply alternative definitions and/or rescaling for bank-level variables, including FX-Funds. In column (1), we remove from bank-level variables an aggregate component measured through time fixed effects (in separate regressions for each variable). In column (2), we fix bank-level variables at their 2005Q1 value. In column (3), we fix bank-level variables at their average value over the sample period 2005Q2-2008Q2. In column (4), for those variables rescaled by bank total assets, we use the lagged (by one quarter) numerator and total assets as of 2005Q1 as the denominator. In column (5), for those variables rescaled by bank total assets, we use the lagged (by one quarter) numerator and total assets fixed at their 2005Q2-2008Q2 mean as the denominator. The sample consists of companies that borrowed from at least two banks. All independent variables are demeaned. Standard errors are double-clustered at the firm and bank\*industry level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Table B7: Correlation Matrix for Bank-level Variables**

## PANEL A: Pairwise correlations before removing time fixed effects

| Variables                      | (1)     | (2)     | (3)     | (4)     | (5)     | (6)    | (7)     | (8)   |
|--------------------------------|---------|---------|---------|---------|---------|--------|---------|-------|
| (1) FX-Funds <sub>b,yq-1</sub> | 1.000   |         |         |         |         |        |         |       |
| (2) RR-Depo <sub>b,yq-1</sub>  | -0.376* | 1.000   |         |         |         |        |         |       |
| (3) Saving <sub>b,yq-1</sub>   | -0.584* | 0.938*  | 1.000   |         |         |        |         |       |
| (4) Checking <sub>b,yq-1</sub> | 0.394*  | 0.586*  | 0.268*  | 1.000   |         |        |         |       |
| (5) Tier1 <sub>b,yq-1</sub>    | -0.173  | -0.550* | -0.413* | -0.561* | 1.000   |        |         |       |
| (6) ROA <sub>b,yq-1</sub>      | -0.050  | 0.234*  | 0.139   | 0.326*  | -0.182  | 1.000  |         |       |
| (7) Size <sub>b,yq-1</sub>     | 0.483*  | 0.710*  | 0.548*  | 0.690*  | -0.479* | 0.208* | 1.000   |       |
| (8) NPL <sub>b,yq-1</sub>      | -0.506* | -0.034  | 0.205*  | -0.574* | 0.269*  | -0.169 | -0.352* | 1.000 |

The symbol \* denotes statistical significance at 1% level.

## PANEL B: Pairwise correlations after removing time fixed effects

| Variables                      | (1)     | (2)     | (3)     | (4)     | (5)     | (6)    | (7)     | (8)   |
|--------------------------------|---------|---------|---------|---------|---------|--------|---------|-------|
| (1) FX-Funds <sub>b,yq-1</sub> | 1.000   |         |         |         |         |        |         |       |
| (2) RR-Depo <sub>b,yq-1</sub>  | -0.313* | 1.000   |         |         |         |        |         |       |
| (3) Saving <sub>b,yq-1</sub>   | -0.535* | 0.941*  | 1.000   |         |         |        |         |       |
| (4) Checking <sub>b,yq-1</sub> | 0.427*  | 0.599*  | 0.294*  | 1.000   |         |        |         |       |
| (5) Tier1 <sub>b,yq-1</sub>    | -0.177  | -0.598* | -0.459* | -0.606* | 1.000   |        |         |       |
| (6) ROA <sub>b,yq-1</sub>      | 0.035   | 0.406*  | 0.301*  | 0.437*  | -0.330* | 1.000  |         |       |
| (7) Size <sub>b,yq-1</sub>     | 0.508*  | 0.730*  | 0.565*  | 0.728*  | -0.505* | 0.408* | 1.000   |       |
| (8) NPL <sub>b,yq-1</sub>      | -0.497* | 0.001   | 0.236*  | -0.557* | 0.170   | -0.141 | -0.336* | 1.000 |

The symbol \* denotes statistical significance at 1% level.

**Table B8:** Using the Sum of Saving and Checking Deposits (RR-Depo) instead of the two separated variables

|  | (1)                   | (2)                     |
|--|-----------------------|-------------------------|
|  |                       | Loan <sub>f,b,yq</sub>  |
| MP-Spread <sub>yq-1</sub> * Post <sub>yq</sub> *FX-Funds <sub>b,yq-1</sub> | -90.408**<br>(35.586) | -222.427***<br>(53.792) |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>                      | 75.097***<br>(20.884) | 125.467***<br>(27.297)  |
| Post <sub>yq</sub> *FX-Funds <sub>b,yq-1</sub>                             | -5.240***<br>(0.944)  | -5.060***<br>(0.966)    |
| FX-Funds <sub>b,yq-1</sub>   | 1.991***<br>(0.655)   | 2.944***<br>(0.706)     |
| MP-Spread <sub>yq-1</sub> *Post <sub>yq</sub> *RR-Depo <sub>b,yq-1</sub>   |                       | -8.244<br>(9.839)       |
| MP-Spread <sub>yq-1</sub> *RR-Depo <sub>b,yq-1</sub>                       |                       | -5.532<br>(5.939)       |
| Post <sub>yq</sub> *RR-Depo <sub>b,yq-1</sub>                              | -0.639***<br>(0.102)  | -0.464***<br>(0.124)    |
| RR-Depo <sub>b,yq-1</sub>  | -0.071<br>(0.101)     | -0.260**<br>(0.105)     |
| Observations   | 895,247               | 895,247                 |
| R-squared  | 0.886                 | 0.886                   |
| Firm*Bank FE   | Yes                   | Yes                     |
| Firm*Time FE   | Yes                   | Yes                     |
| FX-Funds*MacroControls*Post  | Yes                   | Yes                     |
| Bank Controls*Post   | Yes                   | -                       |
| Bank Controls*MP-Spread*Post   | -                     | Yes                     |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to the monetary policy rate spread. The dependent variable, Loan<sub>f,b,yq</sub>, is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the US Effective Federal Funds Rate. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). RR-Depo<sub>b,yq-1</sub> represents the sum of (lagged) saving and checking deposits (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans). The sample consists of companies that borrowed from at least two banks. Standard errors are clustered at the Bank level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



**Table B9: UIP Deviations and Carry-to-Risk Ratio**

|  | (1)<br>UIP-RE(1y)    | (2)<br>UIP-RE(3m)      | (3)<br>UIP-EXP(1m)     | (4)<br>UIP-EXP(1y)   | (5)<br>CTR                     |
|--|----------------------|------------------------|------------------------|----------------------|--------------------------------|
| $CTR_{yq-1} * FX-Funds_{b,yq-1} * Post_{yq}$           |                      |                        |                        |                      | -17.22 <sup>^</sup><br>(12.69) |
| $MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1} * Post_{yq}$ | -493.5***<br>(117.3) | -342.8***<br>(60.19)   | -413.9***<br>(157.1)   | -239.4***<br>(72.63) |                                |
| $CTR_{yq-1} * FX-Funds_{b,yq-1}$                       |                      |                        |                        |                      | 17.83***<br>(4.062)            |
| $MPspread_{yq-1}^{US} * FX-Funds_{b,yq-1}$             | 134.5***<br>(30.87)  | 221.2***<br>(33.46)    | 144.4***<br>(30.16)    | 168.5***<br>(48.77)  |                                |
| $FX-Funds_{b,yq-1} * Post_{yq}$                        | -1.702<br>(4.309)    | -7.532***<br>(1.008)   | -9.689***<br>(2.733)   | -5.370***<br>(1.030) | -4.405 <sup>^</sup><br>(2.963) |
| $FX-Funds_{b,yq-1}$                                    | 3.802***<br>(0.935)  | 4.833***<br>(7.16e-09) | 3.559***<br>(2.47e-08) | 3.572***<br>(0.812)  | 2.987***<br>(0.863)            |
| Observations   | 895247               | 895247                 | 895247                 | 895247               | 895247                         |
| R-squared  | 0.886                | 0.886                  | 0.886                  | 0.886                | 0.886                          |
| Firm*Bank FE   | Yes                  | Yes                    | Yes                    | Yes                  | Yes                            |
| FX-Funds*Macro Controls*Post                           | Yes                  | Yes                    | Yes                    | Yes                  | Yes                            |
| Firm*Year:Quarter FE                                   | Yes                  | Yes                    | Yes                    | Yes                  | Yes                            |
| Bank Controls*CTR*Post                                 | No                   | No                     | No                     | No                   | Yes                            |
| Bank Controls* $\Delta_{1y}e_{t-1}$ *Post              | Yes                  | No                     | No                     | No                   | No                             |
| Bank Controls* $\Delta_{3m}e_{t-1}$ *Post              | No                   | Yes                    | No                     | No                   | No                             |
| Bank Controls* $E(\Delta_{1y}e_{t-1})$ *Post           | No                   | No                     | Yes                    | No                   | No                             |
| Bank Controls* $E(\Delta_{1m}e_{t-1})$ *Post           | No                   | No                     | No                     | Yes                  | No                             |
| H0: FX-Funds*CTR + FX-Funds*CTR*Policy=0               | -                    | -                      | -                      | -                    | .96                            |
| H0: FX-Funds*MP-Spread + FX-Funds*MP-Spread*Policy=0   | 0.01                 | .01                    | .08                    | .15                  | -                              |

This table shows how carry trade strategies by local banks impacts the reaction of bank credit to the policy rate spread depending either on the Carry-to-Risk ratio or on deviations from UIP.  $Loan_{f,b,yq}$  is the log of total debt provided by bank b to firm f in year:quarter yq.  $MPspread_{yq-1}^{US}$  is the difference between the (lagged) Colombian and US policy rate.  $CTR_{yq-1}$  is the Colombia-US Carry-to-Risk ratio, defined as the 3-month sovereign spread divided by the at-the-money COP-USD options implied volatility.  $\Delta_{1y}e_{t-1}$  is the (lagged) 1-year ahead realized exchange rate depreciation, whereas  $\Delta_{3m}e_{t-1}$  is its 3-month ahead equivalent.  $E(\Delta_{1y}e_{t-1})$  is the (lagged) 1-year ahead expected exchange rate depreciation.  $E(\Delta_{1m}e_{t-1})$  is the (lagged) 1-month ahead expected exchange rate depreciation.  $FX-Funds_{b,yq-1}$  represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate (though the exchange rate is excluded in columns 2, 3, 4 and 5). Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). The last two reports the p-values for the test with null hypothesis indicated in the legend. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, ^ p<0.15.

**Table B10: Results for Firms Heterogeneity in Pooled Regressions**  
**Panel A: Local Monetary Policy Rate and Bank Credit – Carry Trade Mechanism**

| VARIABLES  | (1)                      | (2)                     | (3)                     | (4)                    |
|--|--------------------------|-------------------------|-------------------------|------------------------|
|  |                          |                         | Loan <sub>f,b,yq</sub>  |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub>  | -51.187<br>(54.615)      | -17.528<br>(54.995)     | 92.684***<br>(33.867)   | 176.583***<br>(50.481) |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [2 <sup>nd</sup> Quartile of Risk <sub>f,pre</sub> ]                               | 177.123**<br>(70.147)    |                         |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [3 <sup>rd</sup> Quartile of Risk <sub>f,pre</sub> ]                               | 369.932***<br>(75.035)   |                         |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [4 <sup>th</sup> Quartile of Risk <sub>f,pre</sub> ]                               | 289.408***<br>(85.684)   |                         |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [2 <sup>nd</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ]                    |                          | 157.454**<br>(74.959)   |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [3 <sup>rd</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ]                    |                          | 166.530**<br>(72.735)   |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [4 <sup>th</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ]                    |                          | 228.259***<br>(81.841)  |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [30-day Past Due <sub>f,pre</sub> ]  |                          |                         | 82.377^<br>(55.294)     |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [Opaque <sub>f,pre</sub> ]   |                          |                         |                         | -73.452<br>(58.561)    |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> *Post <sub>yq</sub>  | -28.245<br>(118.032)     | -10.699<br>(111.546)    | -167.448***<br>(64.396) | -129.482<br>(101.752)  |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [2 <sup>nd</sup> Quartile of Risk <sub>f,pre</sub> ]*Post <sub>yq</sub>            | -86.309<br>(148.009)     |                         |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [3 <sup>rd</sup> Quartile of Risk <sub>f,pre</sub> ]*Post <sub>yq</sub>            | -342.836**<br>(152.150)  |                         |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [4 <sup>th</sup> Quartile of Risk <sub>f,pre</sub> ]*Post <sub>yq</sub>            | -448.212***<br>(160.747) |                         |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [2 <sup>nd</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ]*Post <sub>yq</sub> |                          | -312.393**<br>(150.943) |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [3 <sup>rd</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ]*Post <sub>yq</sub> |                          | -235.245^<br>(147.133)  |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [4 <sup>th</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ]*Post <sub>yq</sub> |                          | -257.230^<br>(158.651)  |                         |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [30-day Past Due <sub>f,pre</sub> ]*Post <sub>yq</sub>                             |                          |                         | -159.170^<br>(107.105)  |                        |
| MP-Spread <sub>yq-1</sub> *FX-Funds <sub>b,yq-1</sub> * 1 [Opaque <sub>f,pre</sub> ]*Post <sub>yq</sub>                                      |                          |                         |                         | -135.291<br>(115.444)  |
| Observations   | 887,273                  | 887,273                 | 887,874                 | 895,247                |
| R-squared  | 0.885                    | 0.885                   | 0.885                   | 0.886                  |
| Firm*Bank FE   | Yes                      | Yes                     | Yes                     | Yes                    |
| Bank Controls*MP Spread*Post*Risk Dummies  | Yes                      | Yes                     | Yes                     | Yes                    |
| FX-Funds*Macro Controls*Post*Risk Dummies  | Yes                      | Yes                     | Yes                     | Yes                    |
| Firm*Time FE   | Yes                      | Yes                     | Yes                     | Yes                    |

This table shows how carry trade strategies by local banks impact the reaction of bank credit to the policy rate spread, across different groups of companies. In column 1, we sort companies according to the distribution of the average interest payments over total assets paid between 2005Q1 and 2007Q1. In column 2, we sort companies according to the distribution of the average share of bank debt with maturity no longer than one year borrowed between 2005Q1 and 2007Q1. In column 3, we split companies depending on whether they are 30 days past due with respect to at least one bank loan between 2005Q1 and 2007Q1. Finally, in column 4, we sort companies according to whether their balance sheet is publicly supervised. If not, we label companies as Opaque. Loan<sub>f,b,yq</sub> is the log of total debt provided by bank b to firm f in year:quarter yq. MPspread<sup>US</sup><sub>yq-1</sub> is the difference between the (lagged) local monetary policy and the FED Effective Funds Rate. FX-Funds<sub>b,yq-1</sub> represents (lagged) bank FX-Funds (over Total Assets). Macro controls include the lagged values of annual GDP growth, of the CPI index and of the (log) Peso-US\$ exchange rate. Bank Controls include lagged (by one quarter): ROA, log Total Assets, Common Equity (rescaled by Total Assets), NPL (rescaled by Total Loans), Savings Deposits (rescaled by Total Assets), Checking Deposits (rescaled by Total Assets). Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, ^ p<0.151.

Panel B: Reserve Requirement Shock and Bank Credit

| VARIABLES   | (1)                  | (2)               | (3)                    | (4)                 |
|---|----------------------|-------------------|------------------------|---------------------|
|   |                      |                   | Loan <sub>f,b,yq</sub> |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub>   | 0.292<br>(0.378)     | -0.538<br>(0.414) | -0.680***<br>(0.216)   | -0.066<br>(0.327)   |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [2 <sup>nd</sup> Quartile of Risk <sub>f,pre</sub> ]            | -0.958**<br>(0.484)  |                   |                        |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [3 <sup>rd</sup> Quartile of Risk <sub>f,pre</sub> ]            | -1.474***<br>(0.522) |                   |                        |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [4 <sup>th</sup> Quartile of Risk <sub>f,pre</sub> ]            | -2.258***<br>(0.554) |                   |                        |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [2 <sup>nd</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ] |                      | 0.168<br>(0.548)  |                        |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [3 <sup>rd</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ] |                      | -0.535<br>(0.529) |                        |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [4 <sup>th</sup> Quartile of Short-Term Debt <sub>f,pre</sub> ] |                      | -0.232<br>(0.561) |                        |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [30-day Past Due <sub>f,pre</sub> ]                             |                      |                   | -0.045<br>(0.382)      |                     |
| Post <sub>yq</sub> *RR-Depo <sub>b,2007Q1</sub> * 1 [Opaque <sub>,pre</sub> ]                                       |                      |                   |                        | -0.927**<br>(0.396) |
| Observations  | 734,976              | 734,976           | 735,577                | 742,950             |
| R-squared   | 0.896                | 0.896             | 0.896                  | 0.897               |
| Bank Controls*Post  | Yes                  | Yes               | Yes                    | Yes                 |
| Firm*Bank FE  | Yes                  | Yes               | Yes                    | Yes                 |
| Firm*Year:Quarter   | Yes                  | Yes               | Yes                    | Yes                 |

This table evaluates the effects of the Reserve Requirement on shock on bank credit, across different groups of companies. In column 1, we sort companies according to the distribution of the average interest payments over total assets paid between 2005Q1 and 2007Q1. In column 2, we sort companies according to the distribution of the average share of bank debt with maturity no longer than one year borrowed between 2005Q1 and 2007Q1. In column 3, we split companies depending on whether they are 30 days past due with respect to at least one bank loan between 2005Q1 and 2007Q1. Finally, in column 4, we sort companies to whether their balance sheet is publicly supervised. If not, we label companies as Opaque. Loan<sub>f,b,yq</sub> is the log of total debt provided by bank b to firm f in year:quarter yq. RR-Depo is the sum of savings (SavingD<sub>b,2007Q1</sub>) and checking (CheckingD<sub>b,2007Q1</sub>) deposits, both over total assets, as of 2007Q1. In Panel B, in all columns we include only firms that borrowed from at least two banks. Bank Controls is a vector of bank controls (as of 2007Q1) including: ROA, log Total Assets, Common Equity (rescaled by Total Assets), FX-Funds (rescaled by Total Assets), NPL (rescaled by Total Loans). The Post<sub>yq</sub> dummy has value 1 from 2007Q2 onward and value 0 before. In all columns, the regressions include companies that borrowed from at least two banks. Standard errors are double-clustered at the Bank\*Industry and at the Firm level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, , ^ p<0.151.

## Supplementary material

### 1. On Carry Trade incentives, monetary policy rate spread and UIP/CIP deviations

This section shows that banks could profitably exploit interest rate differentials through the following carry-trade lending strategy: borrow cheap US Dollars (USD) debt and invest in expensive Colombian Peso (COP) loans. We start by formalizing few useful concepts for understanding our data work, and provide evidence of deviations from the Covered Interest Parity (CIP) and Uncovered Interest Parity (UIP) over our sample period. We discuss the implications for bank lending in the paper.

#### 1.1 UIP and CIP deviations

Let us consider a  $j$ -month carry in which the investor takes a long position in COP and a short position in USD. The annualized yield on the  $j$ -month zero-coupon Colombian Treasuries is  $i_t^j$ . The equivalent yield on US Treasuries is  $i_t^{j,US}$ . Let  $\varepsilon_t$  be the COP-USD exchange rate, expressed as the number of COP per one unit of USD, so that an increase in  $\varepsilon_t$  denotes a depreciation of the COP against the USD.

Formally, deviations from the UIP are defined as:

$$(1) \quad \text{DUIP}_t^j = i_t^j - i_t^{j,US} - \left[ E_t \left( \frac{\varepsilon_{t+j}}{\varepsilon_t} \right) - 1 \right]$$

If UIP holds, then  $\text{DUIP}_t^j = 0$  and investors cannot profit from interest rate spread, as expected exchange rate growth neutralize any differential in nominal returns. If  $\text{DUIP}_t^j > 0$ , investors who take a long position on the COP and a short position on the USD profit from the carry. Importantly, this definition considers *ex-ante* expected carry returns. In fact, the *ex-post* realized returns amount to:

$$(2) \quad \text{DUIPRE}_t^j = i_t^j - i_t^{j,US} - \left[ \left( \frac{\varepsilon_{t+j}}{\varepsilon_t} \right) - 1 \right]$$

That is, *ex-post* returns depend on the realized COP-USD depreciation. In a rational expectation model,  $E_t \left( \frac{\varepsilon_{t+j}}{\varepsilon_t} \right) = \frac{\varepsilon_{t+j}}{\varepsilon_t}$  so that the definitions in equations (1) and (2) coincide. Under this assumption (Fama, 1984), it is possible to proxy UIP deviations through the *ex-post* realized carry returns, given the limited availability on future expected exchange rates and the many limitations of survey data, the typical primary source for expectation data.

Differently, the CIP states that investors should not be able to profit from carries where the exchange rate at which currencies trade at the terminal data is fixed through a forward contract. That is, investors should not be able to profit from carries, after accounting for exchange rate risk. Let  $f_t^j$

be the value of the COP-USD exchange rate for period  $t+j$ , set up by a time  $t$  forward contract. Then, deviations from CIP equal:

$$(3) \quad DCIP_t^j = i_t^j - i_t^{j,US} - \left[ \frac{f_t^j}{\varepsilon_t} - 1 \right]$$

If CIP holds, then  $DCIP_t = 0$  and investors cannot profit from interest rate spread, since the forward premium (second term on the right-hand side of equation (3)) exactly offsets the interest rate spread. If  $DCIP_t^j > 0$ , investors who take a long covered position on the COP profit from the carry.

We now bring these concepts to the data to gauge the attractiveness of COP-USD carries during the sample period. First, in Figure R1, we report the dynamics of the deviations from the Covered Interest Parity, defined in equation (3) and borrowed from Du and Schreger (2018). Panel A reports CIP deviations on a 3-month tenor, at which the Colombia-US sovereign spread reflects to a large extent the policy rate spread, as is clear from the picture (correlation factor close to 92%). On top of having a closer link with the policy rate, we look at the 3-month tenor because data on forward premia at longer tenors are generally not available for Colombia for the whole period of analysis. During the pre-policy period, the deviations from the CIP are, on average, as large as 56 b.p., thereby accounting for roughly 27% (23%) of the average policy rate spread (sovereign spread). Moreover, in 25% of the months CIP deviations were at least as large as 1 p.p.. Interestingly, there is a distinct spike in May 2006 (from 56 b.p. to 143 b.p.), when the policy rate spread starts increasing at a fast pace; similar levels were reached just before the implementation of capital controls in May 2007. Taken altogether, these figures suggest that banks may have benefitted from carry-trade lending.

We next move to documenting deviations from the UIP. Figure R2 shows a measure of ex-post carry-trade returns, based on the rational expectation model discussed in equation (2). Considering uncovered carries on a 3-month and 1-year horizon, respectively, the average ex-post realized returns in the pre-policy period amount to 4.4 p.p. and 9.82 p.p.. If anything, these measures suggest even stronger carry-trade incentives than the deviations from the CIP. Importantly, both display substantial time variation and exhibit, consistently across tenors and with the dynamics of the CIP documented above, a notable jump in May 2006, representing an inflection point in the relative dynamics of the Colombian and US policy rate, with the spread accelerating on a fast pace.

Additionally, we gather information on future expected exchange rates, collected by the Central Bank of Colombia among economic analysts<sup>34</sup> for the 1-month and 1-year horizons. We employ them

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<sup>34</sup> The data come from the “Monthly Survey of Economic Analysts Expectations” and is publicly available at the website: <https://www.banrep.gov.co/es/estadisticas/encuesta-mensual-expectativas-analistas-economicos>. For these surveys,

to compute UIP deviations based on ex-ante carry returns, as in equation (1), plotted in Figure R3. The figure shows large differences in the levels of the deviations at the 1-month and 1-year horizon. While the average UIP deviation in the pre-policy period at the 1-month horizon is 1.91 p.p.,<sup>35</sup> the corresponding figure at the 1-year horizon is -1.66 p.p.. As a result, the two proxies suggest opposite incentives for uncovered carries: going long on the COP and short on the USD would be profitable over a short-term period of 1-month, but generally not over a 1-year horizon. Interestingly, however, they both indicate large returns (by at least 4.85%) in May and June 2006, when the policy spread jumps and reverts to a positive trend.

As a final observation, the dynamics of the ex-ante deviations from the UIP at the 1-year tenor (generally negative over the pre-policy period) do not translate into negative CIP deviations at a comparable tenor. In Figure R5, we plot the two series close to each other. Unfortunately, CIP deviations are not available from December 2006 to April 2007; however, for those periods in which forward premium data allow computing them, they show a positive sign and equal 52 b.p., on average (similarly to CIP deviations on 3-month tenor), with the usual spike to 2 p.p. in May 2006. Likewise, the ex-post realized returns on 1-year carries are generally positive and very large over the pre-policy period (averaging to 9.82 p.p., as already discussed with reference to Figure R2). Hence, the result on the low attractiveness of carries based on ex-ante UIP deviations (at the 1-year tenor) may not be very reliable, as they are due to large systematic deviations of the expected exchange rate depreciation (measured by the Central Bank surveys) from both forward premia and realized ex-post depreciation.

This last paragraph triggers broader considerations on the profitability of uncovered carries. Forecasting exchange rates is notoriously difficult; relatedly, the large differences across forecasts of expected depreciation, forward premia and realized ex-post returns suggest that investors' ability to price future movements in exchange rates should not be overstated. Relatedly, in our sample, the correlation between UIP and CIP deviations is relatively low (ranging between 7% and 25% across the measures illustrated so far). Such low correlation between UIP and CIP deviations is an empirical regularity applying as well in a larger and longer cross-country sample (including Colombia) analyzed by Kalemli-Özcan and Varela (2021). While investigating the UIP-CIP divergences further falls

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which also report estimates of GDP and inflation growth, the Central Bank of Colombia interviews financial institutions and other research centers providing independent forecasts for the Colombian inflation rate and other relevant macroeconomic indicators.

<sup>35</sup> The Colombian government does not issue sovereign bonds with 1-month maturity. Hence, we proxy the Colombia-US policy rate spread at such tenor with the policy rate, which reflects, however, differences in the respective overnight interbank (annualized) interest rates. As a result, for a given expected depreciation, our proxy will generally underestimate UIP deviations at the 1-month horizon. Indeed, for robustness we also compute UIP deviations at the 1-month horizon considering the interest rate spread based on 3-month sovereign yields. The dynamics of UIP deviations are substantially unchanged, as clear from Figure R4, where we plot the two measures close to each other. On average, there is a 30 b.p. wedge between the UIP deviations based on 3-month sovereign spread and the policy rate.

outside the scope of our work, we here remark the fact that large CIP deviations ought not to coincide with large UIP deviations, and vice versa. Put differently, UIP deviations do not generally imply a strong incentive to carry for banks.

Finally, as a matter of fact, financial investors often rely on different indicators, discounting measurable exchange rate risk (i.e. volatility) from the gains associated to nominal interest rate differentials. Among others, a popular indicator of (uncovered) carry-trade profitability is the Carry-to-Risk ratio (CTR), akin to a Sharpe Ratio for uncovered carries. In fact, The CTR rescales the yield spread by a measure of exchange rate volatility, providing a risk-adjusted measure of returns from the carry:

$$(3) \quad \text{CTR}_t^j = \frac{i_t^j - i_t^{j,US}}{\sigma_t^j}$$

For practical purposes, we borrow CTR data from Gamboa-Estrada (2018), who divide the 3-month Colombia-US spread by the three-month implied volatility of the at-the-money COP/USD exchange rate options. In an influential study, Bruno and Shin (2017) show that an analogous indicator drives FX-bond issuance by large corporations in Emerging Economies, with USD bond issuance jumping when the CTR goes up, that is, when the risk-adjusted US yields are relatively lower than local ones. We plot the resulting CTR in Figure R6. The CTR correlates substantially with the sovereign spread, suggesting that it is reasonable to proxy carry-trade incentives through the spread itself (see also Allayannis et al., 2003), i.e. the approach we followed so far. During our sample period, the implied volatility of the exchange rate offsets only partially the fluctuations in carry profitability due to the variations in the interest rate spreads.

## 2. Details on the Monetary Policy Surprise Index

We build our Monetary Policy Surprise Index exploiting information from a survey of professional forecasters, provided by Bloomberg and available from 2004Q3 onwards. Let  $i_{t,yq}$  be the interest rate announced by the Central Bank on date  $t$  in year-quarter  $yq$  and  $E(i_{t,yq})$  be the expected interest rate from professional forecasters (proxied by the average forecast). Then, we define monetary policy surprises as the deviation of actual interest rate from such expectation:

$$(7) \quad \epsilon_{t,yq} = i_{t,yq} - E(i_{t,yq})$$

We next collapse the data at the quarterly frequency by taking the sum of the surprises in a given quarter, i.e.  $\epsilon_{yq} = \sum_t \mathbf{1}(t \in yq) * \epsilon_{t,yq}$ . Finally, we then construct our monetary policy surprise index  $\Xi_{yq}$  as the cumulative sum of such shocks over time (see, among others, Romer and Romer, 2004; Coibion, 2012; Ramey, 2016), adjusted following standard practice (e.g. Ottonello and Winberry,

2020 and Meier and Reinelt, 2020). In practice, since we cumulate shocks over quarters, the adjustment only implies that current quarter shocks are weighted proportionally to the remaining time in the current quarter (after the shock takes place). So, taking an extreme example, consider the monetary policy index as of 2007Q4,  $\Xi_{2007Q4}$ . Shocks happening on the first day of the trimester, i.e. on the 1<sup>st</sup> of October of 2007, will concur to defining  $\Xi_{2007Q4}$  with full weight. Differently, a shock on the 31<sup>st</sup> of December of 2007 will be given 0 weight in  $\Xi_{2007Q4}$ . An intermediate shock on the 15<sup>th</sup> of November will have 50% weight in the 2007Q4 index, and so on.

We plot the index in Figure R7, alongside the Colombian policy rate (reported as Appendix Figure A1 in the paper). The two series exhibit large correlation (close to 72%), suggesting that the simple policy rate reflects to a notable extent monetary policy surprises.

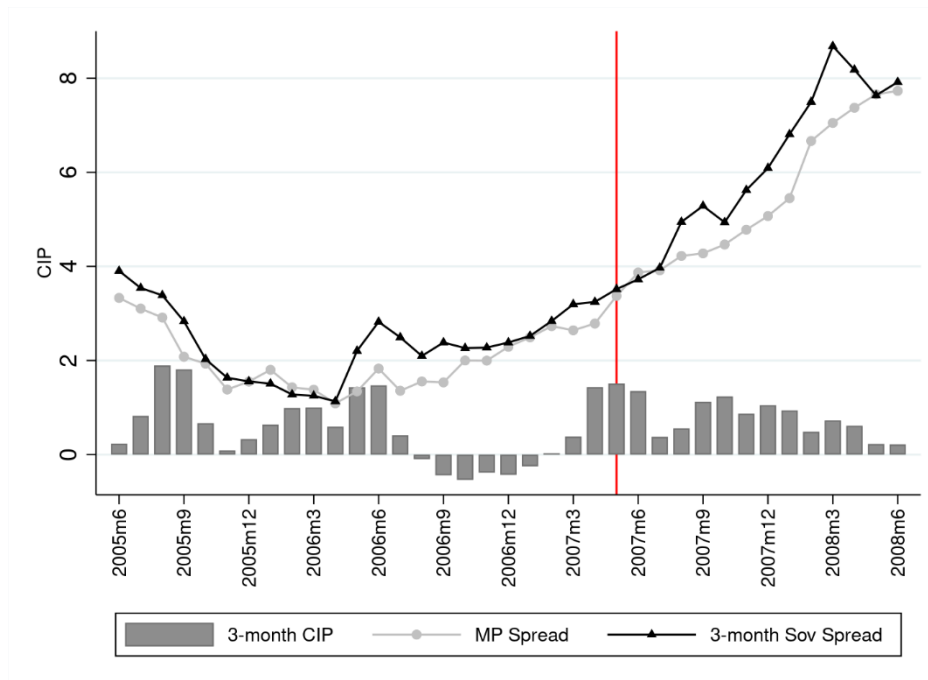
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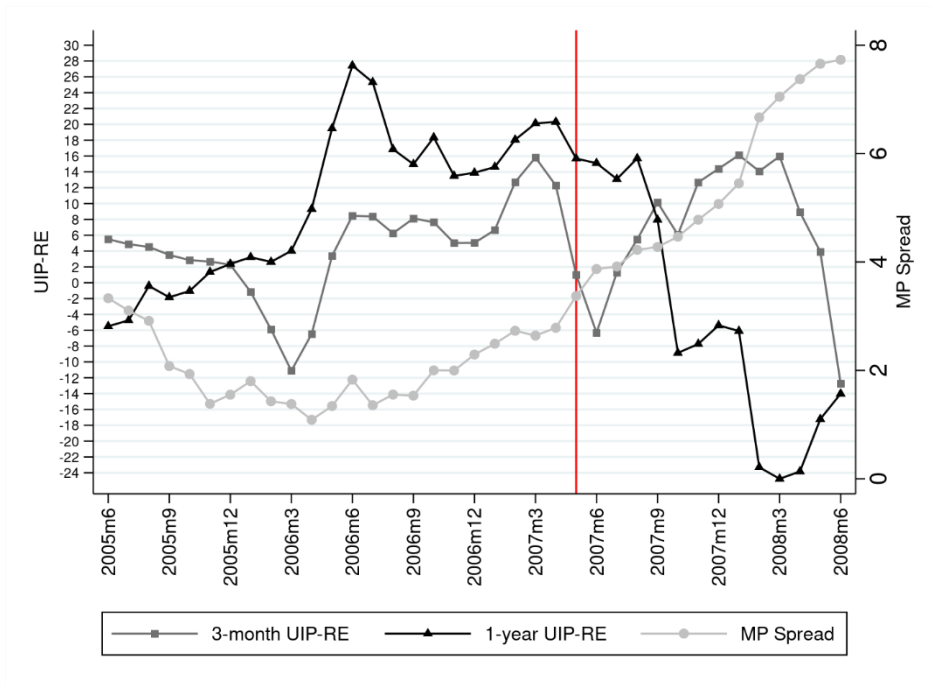
## Figures

**Figure R1: Deviations from the Covered Interest Parity**



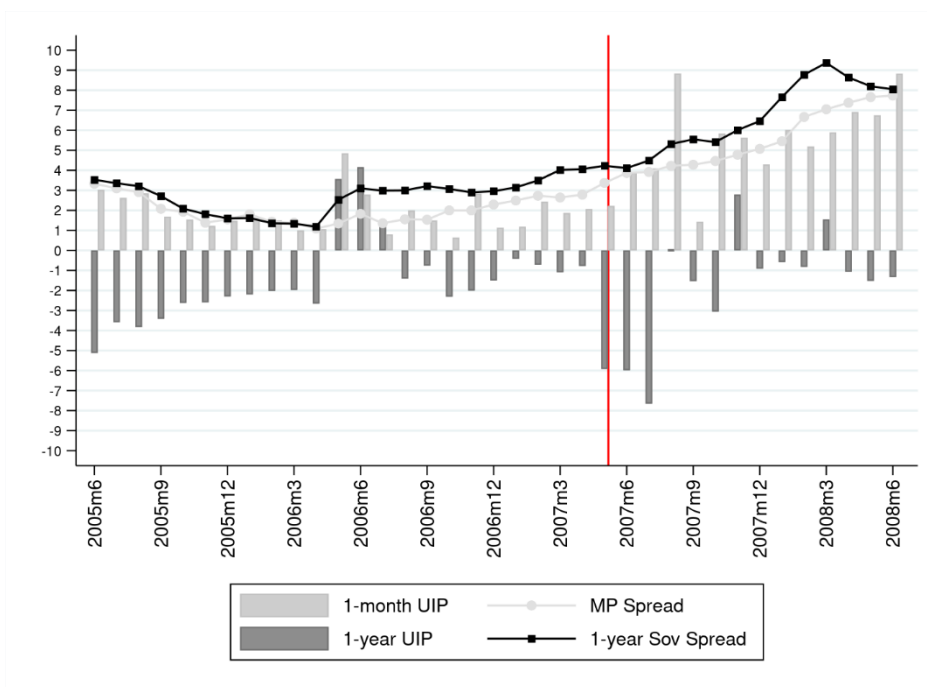
This figure depicts the deviations from the Covered Interest Parity (CIP). We report CIP deviations through grey bars, corresponding to the difference between the 3-month Colombia-US sovereign yield spread (depicted by black line, connected by triangles) and the 3-month COP-USD forward premium (Du and Schreger, 2018). For illustrative purposes, we also report – though a light grey line, connected by circles - the policy rate spread between Colombia and the US.

**Figure R2: Ex-Post Realized Returns from Uncovered Carries**



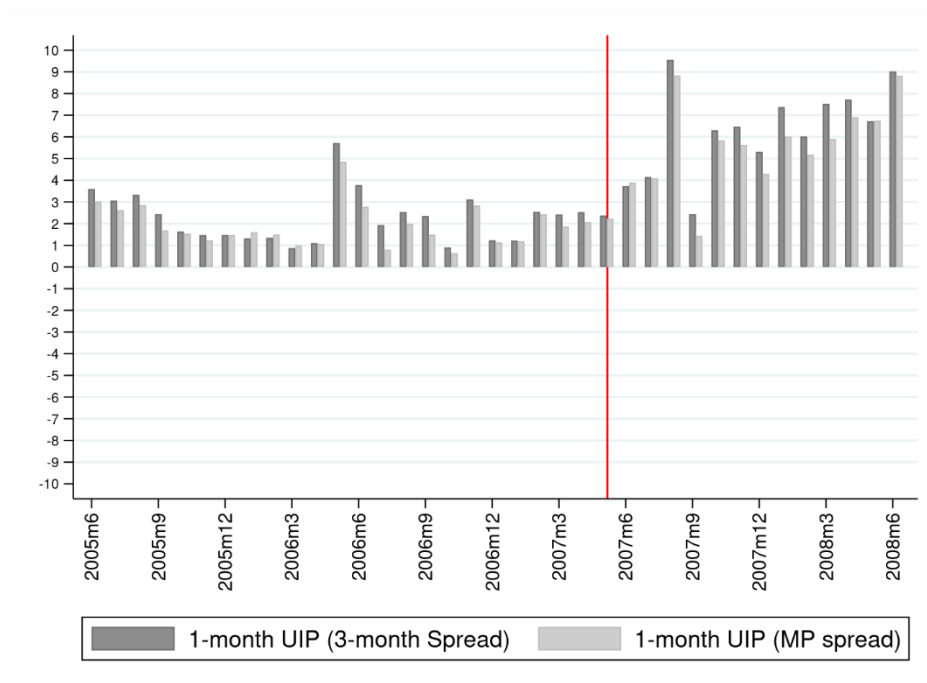
This figure depicts the deviations from the UIP based on a rational expectation model. That is, UIP deviations are the ex-post realized returns from uncovered carries - long on COP and short on USD - on a 3-month horizon (dark grey line, connected by squares) and on a 1-year horizon (black line, connected by triangles), defined as the interest rate differential minus the ex-post realized exchange rate depreciation. For illustrative purposes, we also report (on the right y-axis) the policy rate spread between Colombia and the US.

**Figure R3: Ex-Ante Realized Returns from Uncovered Carries**



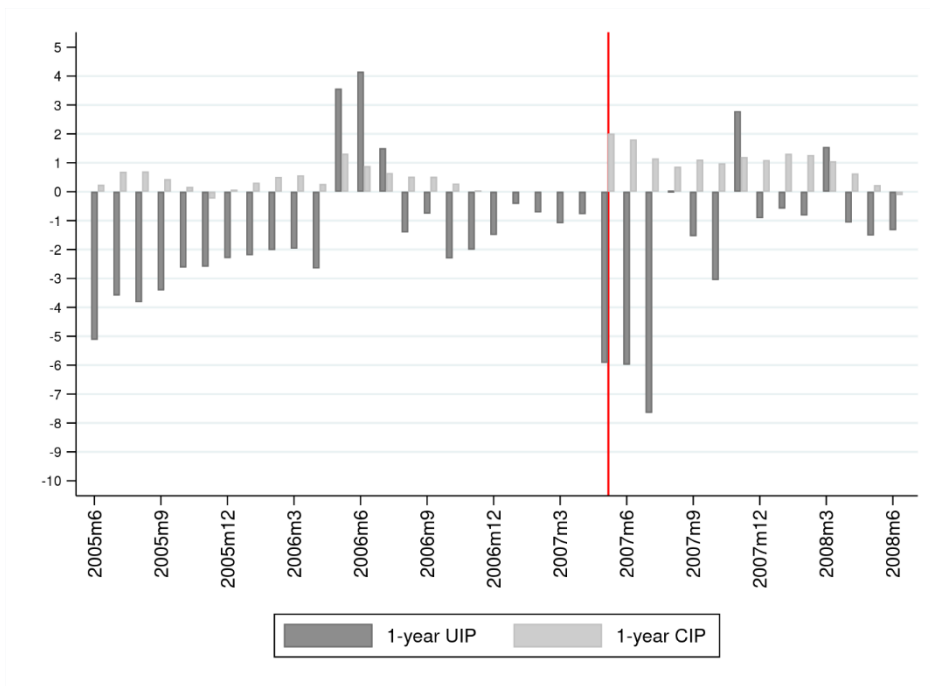
This figure shows the deviations from the UIP based on ex-ante returns from uncovered carry trade. That is, we compute UIP deviations as the Colombia-US interest rate spread minus the expected COP-USD exchange rate depreciation (based on survey data) at a relevant tenor. Light grey bars refer to such UIP deviations at the 1-month tenor; dark grey bars at the 1-year tenor. For illustrative purposes, we also report the policy rate spread (light grey line, connected by circles) and the 1-year sovereign yield spread (black line, connected by squares) between Colombia and the US.

**Figure R4: Different Proxies of 1-month UIP deviations**



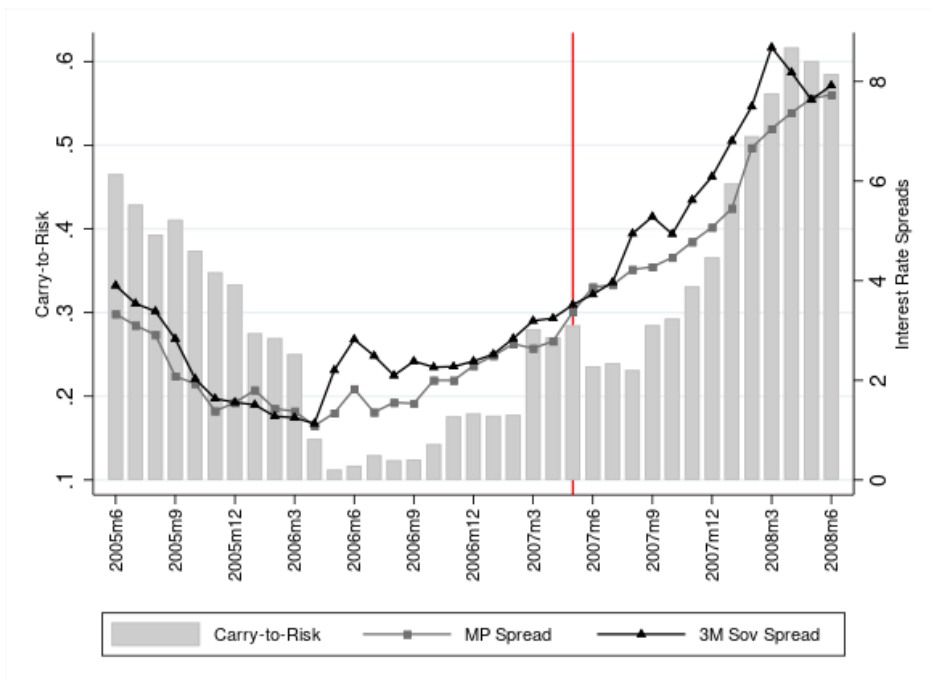
This figure shows the deviations from the UIP at the 1-month horizon based on ex-ante returns from uncovered carry trade. That is, we compute UIP deviations as the Colombia-US interest rate spread minus the expected COP-USD exchange rate depreciation (based on survey data) at the 1-month horizon. Not having 1-month sovereign spread, we proxy the Colombia-US interest rates either with the policy spread or with the 3-month sovereign spread, obtaining UIP deviations depicted through light grey and dark grey bars, respectively.

**Figure R5: Ex-ante UIP and CIP deviations at the 1-year tenor**



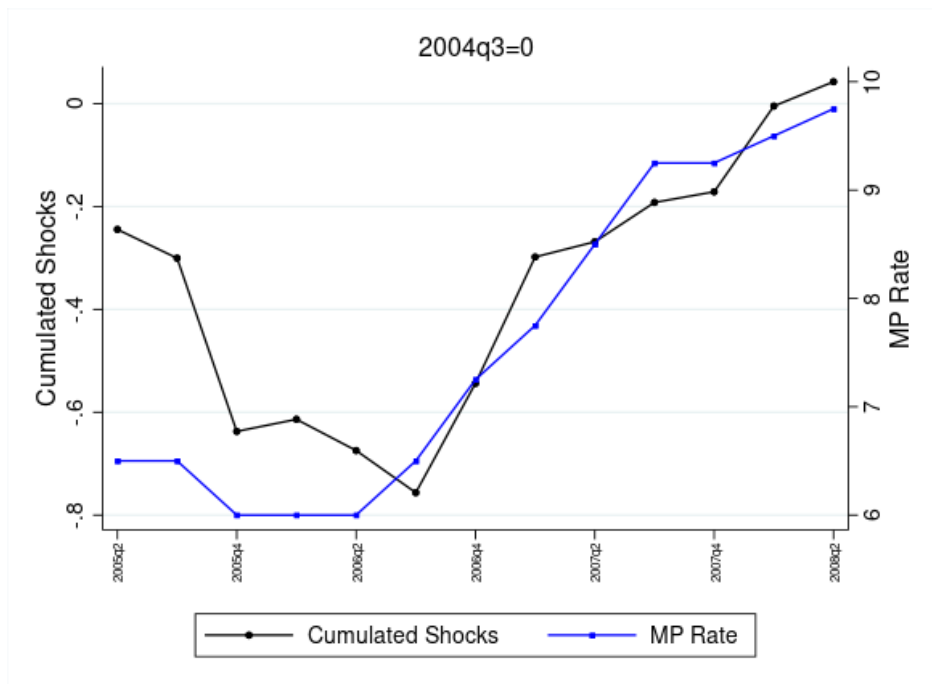
This figure shows the deviations from the UIP at the 1-month horizon based on ex-ante returns from uncovered carry trade and the deviations from CIP at comparable tenor. UIP deviations result from the difference between the Colombia-US interest rate spread and the expected COP-USD exchange rate depreciation (based on survey data) at the 1-year horizon. We plot them as the dark grey bars. We show CIP deviations – difference between the 1-year sovereign yield spread and the 1-year forward premium – as light grey bars.

**Figure R6: Carry-to-Risk Ratio (Bruno and Shin, 2017)**



This figure shows the carry-to-risk ratio (CTR), defined as the 3-month sovereign spread between Colombia and US – reported as a black line, connected by triangles – and the at-the-money FX-options implied volatility. We show the resulting CTR through the light grey bars.

**Figure R7: Monetary Policy Surprise Index (Cumulated Shocks) vs Policy Rate**



This figure shows the policy rate (blue line, connected by squares, measured on the right y-axis) against the monetary policy surprise index (black line, connected by circles, measured on the left y-axis). The index is the cumulative sum of the average difference between expected (by a pool of professional forecasters) and realized interest rate announcements, starting in 2004.