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Abstract

We establish that macroprudential policies limiting capital flows can curb risks arising from corporate foreign currency borrowing in emerging markets. Using detailed firm- level data from India, we show that propensity to issue foreign currency debt for the same firm is higher when the difference in short-term interest rates between India and the US is higher, i.e., when the dollar 'carry trade' is more profitable; this behavior is driven by the period after the global financial crisis. The positive relationship between issuance and the 'carry trade' breaks down once regulators institute more stringent interest-rate caps on foreign currency borrowing. Riskier borrowers such as importers and those with higher interest costs cut issuance most. Firm equity exposure to foreign exchange risk rose after issuance in favorable funding conditions and emerged as a source of external sector vulnerability during the 'taper tantrum' of 2013. Macroprudential policy action limiting capital flows is able to nullify this effect, such as during the market stress due to the COVID-19 pandemic.

JEL Classification: F31, F34, G15, G30

Keywords: emerging markets, foreign currency debt, Foreign exchange risk, taper tantrum

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Foreign Currency Borrowing of Corporations as Carry Trades: Evidence from India*

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November 9, 2020

Abstract

We establish that macroprudential policies limiting capital flows can curb risks arising from corporate foreign currency borrowing in emerging markets. Using detailed firm-level data from India, we show that propensity to issue foreign currency debt for the *same* firm is higher when the difference in short-term interest rates between India and the US is higher, i.e., when the dollar 'carry trade' is more profitable; this behavior is driven by the period after the global financial crisis. The positive relationship between issuance and the 'carry trade' breaks down once regulators institute more stringent interest-rate caps on foreign currency borrowing. Riskier borrowers such as importers and those with higher interest costs cut issuance most. Firm equity exposure to foreign exchange risk rose after issuance in favorable funding conditions and emerged as a source of external sector vulnerability during the 'taper tantrum' of 2013. Macroprudential policy action limiting capital flows is able to nullify this effect, such as during the market stress due to the COVID-19 pandemic.

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Over the last 15 years, non-financial corporations in emerging market economies (EMEs) have increasingly issued foreign currency debt in global markets. According to Bank for International Settlements (BIS) statistics, the stock of foreign currency debt securities of EME non-financial corporations grew eightfold between 2004 and 2019[1]. Concern has risen that the magnitude of this foreign currency debt not only leaves the borrowing firms vulnerable to adverse exchange rate movements but, given their size, it might have implications for the stability of the local financial sector as well as domestic growth[2]. With a view to control these incipient risks, many EMEs made macroprudential regulation more stringent (IMF, 2020).

What caused the surge in foreign currency borrowing by EME corporates? What risks does this phenomenon pose? And how effective are macroprudential policies that seek to limit capital flows in curbing these risks? Much of the extant academic research has focused on hypothesizing channels of transmission as well as documenting aggregate trends[3]. Our paper contributes to this literature by employing detailed borrowing, accounting and market data on Indian firms. To the best of our knowledge, we are the first to tease out the impact on corporate foreign currency borrowing of a specific macroprudential policy seeking to limit capital flows.

We start by documenting that the *same* firm is more likely to issue debt in foreign currency when the difference in short-term interest rates between India and the US is higher, i.e., when the dollar 'carry trade' is more profitable. This phenomenon is driven by the period immediately following the global financial crisis of 2008. Firms that borrow when the 'carry trade' is more profitable, whom we refer to as 'carry trade' borrowers, see their exposure to foreign exchange risk increase. During periods of market stress such as the 'taper tantrum' episode of 2013, it is these 'carry trade' borrowers that perform the most poorly.

[1] Available under Table C3 at https://stats.bis.org/statx/toc/SEC.html

[2] See Acharya et al. (2015); Shin and Zhao (2013); Chui, Fender and Sushko (2014); Du and Schreger (2017) for a discussion of the potential risks posed by increasing corporate foreign currency borrowing

[3] Important exceptions are Bruno and Shin (2017, 2020); Caballero, Panizza and Powell (2015); Frank and Shen (2016)

However, we show that policy action can play an important role in curbing these risks. Soon after the 'taper tantrum' episode of 2013, the positive relationship between foreign currency debt issuance and the dollar 'carry trade' breaks down. This change coincides with the institution of more stringent interest-rate caps on foreign currency borrowing of corporations by India's central bank, the Reserve Bank of India (RBI). We show that firms with higher implied interest expenses are exactly those that cut borrowing, suggesting the regulatory constraints do bind. During periods of market stress following the stricter norms, including the COVID-19 outbreak in March 2020, the 'carry trade' borrowers are not differentially affected providing market-based evidence that macroprudential regulation can be effective in mitigating risks inherent in foreign currency borrowing.

Foreign currency borrowing is an increasingly popular source of financing for non-financial companies in emerging markets (Gutierrez, Ivashina and Salomao, 2020). Figure 1 documents the sustained increase in the amount of external commercial borrowings (ECB) outstanding in India. Multiple reasons could lead firms to increase their borrowing in foreign markets: first, if their revenues are earned in foreign currency, the sales provide a natural hedge for the debt and allow firms to access deeper international funding markets[4]; second, firms wanting to invest in long-lived foreign assets (e.g. oil and gas companies) would like to finance those assets in the same currency as the cash flows (Caruana, 2016); and third, owing to favorable funding conditions in international markets, non-financial corporates may indulge in a *'carry trade'* whereby they borrow cheaply abroad and park those funds as short-term wholesale deposits in domestic banks (Shin and Zhao, 2013). This 'carry trade' is profitable if firms are able to unwind, i.e., pay off the debt before the currency depreciates.

Disentangling these competing hypotheses requires firm-level analysis. Using a sample of Indian firms that borrow abroad, both through the bond market as well as bank loans, we first show that macro factors drive issuance more than firm-specific factors. In particular, the

[4]Trade financing is another source of increased foreign currency borrowing. However, since our focus is on debt with a maturity above three years, we ignore this interesting topic in this paper since trade financing is generally of a short maturity.

difference in short-term rates between India and the US, a proxy for the profitability of the *'carry trade'*, is positively associated with a given firm issuing foreign currency debt even after controlling for firm fixed effects. This phenomenon is much stronger right after the financial crisis. Figure 2 shows the aggregate time-series relationship between the number of issues in a quarter and the CT index, which we define as the difference between Indian and US 3-month interest rates scaled by the implied volatility of 3-month FX options. The correlation is negative before the collapse of Lehman Brothers in September 2008 but strongly positive after, not just for the number of issues but also the total amount raised. The correlation reverses, however, in the period following the 'taper tantrum' episode, a source of significant stress in emerging markets, including India.

A major innovation in our study compared to existing work is our ability to analyze the impact of macroprudential capital controls put in place in response to the growth in foreign currency borrowing in EMEs. The 'taper tantrum' led many emerging markets to significantly strengthen their reserves management and capital control frameworks (IMF, 2020). Acharya and Krishnamurthy (2019) theoretically analyze these *ex-post* and *ex-ante* tools, and point out that they function as complements rather than substitutes. In their model, firms which contribute more to the fire-sale externality in the case of a 'sudden stop'[5] should be taxed more. India provides a good case study for the implications of the model as Indian capital controls were tightened in 2015 by reducing the all-in-cost (AIC) issuance ceilings for ECBs. This was done to allow only high quality borrowers access to the ECB route.

We test how the interest-rate caps impact foreign currency borrowings. We show that, in the post-crisis period, the positive relationship between issuance and the CT index is driven *wholly* by periods in which the AIC spread is high. When the spread is lowered, i.e., regulation is tightened, the relationship breaks down and is, in fact, negative, consistent with the relationship prior to the crisis. This correlation suggests that the CT index stops

[5]The externality arises because individuals firms do not internalize that, on realization of a negative shock, repaying their past debt leads to exchange rate depreciations further exacerbating the shock (Korinek, 2018).

mattering at the same time that controls are strengthened. To confirm that the policy action is driving the change, we test how firms with differing implied interest expenses react following the policy change. We find that high interest expense firms are exactly the ones that reduce issuance following the policy change. In other words, the constraint put in place by the policy action does bind. Consistent with the model in Acharya and Krishnamurthy (2019), the policy change succeeds in restricting access to ECBs to better firms.

If a non-fundamental financial factor such as the 'carry trade' is driving foreign currency borrowing, we expect firms with the least fundamental incentive to borrow abroad to increase their borrowing more during these periods. A natural corollary to exporters having a natural hedge when borrowing in dollars is that importers are uniquely exposed. Their revenues are in local currency and they have additional non-interest expenses in foreign currency. Consistent with the asymmetry of exposure between importers and exporters, we uncover a striking aggregate pattern. We find that India's trade balance had a *negative* correlation with the CT index in the period between the onset of the financial crisis and the macroprudential tightening in 2015 (Figure 3), a correlation that reverses right after. We confirm in firm-level analysis that importers are more likely to borrow when policy is loose, and the interest-rate caps are able to prevent these ex-ante riskier borrowers from taking advantage of the 'carry trade'.

Having established the characteristics of 'carry trade' borrowers, we investigate the effects on firm outcomes. First, we document that foreign currency borrowing is a substitute for other sources of funds, i.e., when money raised domestically is lower, the amount raised in foreign currency is higher. The magnitude of the substitutability is significantly lower in the period between the financial crisis and the 'taper tantrum'. Firms borrow abroad even when they have sufficient source of funds at home. However, following the 'taper tantrum' this decline in substitutability vanishes, and we show that macroprudential tightening is responsible for this change. 'Carry trade' borrowers use the raised funds for investment, the most popular stated rationale, but more importantly to increase cash holdings. Once

macroprudential policy restricts their access to the ECB market, their investment and cash holdings decline; profitability remains unaffected.

Foreign currency corporate borrowers face rollover risks arising from dollar appreciation and tightening international funding conditions. The final step of our analysis is to measure these risks. A stock market-based measure of a corporation's foreign exchange rate exposure (an FX β) rises right after issuance in the post-crisis and pre-taper tantrum period, suggesting firms do not totally hedge their exposure. However, borrowers in the post-taper tantrum period do not see their FX β rise[6]. Once again, we demonstrate that this is due to the imposition of tighter capital controls following the taper tantrum, evidence that targeted policy action can ameliorate potential risks of foreign currency borrowing. And again, the entire effect is driven by the firms that are targeted by the policy action – 'carry trade' borrowers and high interest expense firms.

We also confirm this risk reduction via macroprudential policy using the event-study methodology. The *'taper tantrum'* episode of Summer 2013 was an unexpected negative shock to the exchange rate and equity markets (Chari, Stedman and Lundblad, 2020) during a time when controls were looser. We show that firms more likely to borrow when CT is higher are worst affected during the stress period. These results support the idea that 'carry trade' incentives have been at least partly responsible for the rise in foreign exchange borrowings in EMEs, the currency risk is not completely hedged and it is exactly those firms that obtain funding when it is cheap that are most vulnerable at times of stress.

We complement the *'taper tantrum'* event study with an analysis of periods of market stress that came after the tightening of capital controls. In October 2018, there was a sudden depreciation in the Indian Rupee and a spurt of outflows owing primarily to an increase in oil prices[7]. In March 2020, Indian markets were roiled by the uncertainty caused by the COVID-19 pandemic. An analysis of market reactions to both these events suggests that

[6] A positive FX β indicates a positive correlation with the Indian Rupee's performance relative to the US Dollar

[7] See https://www.business-standard.com/article/markets/rupee-crashes-to-all-time-low-of-73-81-on-capital-outflows-oil-prices-118100400991_1.html

high CT issuers are no longer more vulnerable during times of stress. By restricting access, the policy change succeeded in mitigating the risks inherent in foreign currency borrowing.

Outline of Paper: The rest of the paper proceeds as follows: Section 1 reviews the related literature; Section 2 provides context on foreign currency borrowing by Indian companies; Section 3 describes the data and summary statistics; Section 4 focuses on the carry trade motive for external borrowing; Section 5 studies the efficacy of macroprudential policy changes; Section 6 analyzes the use of funds raised by corporations; Section 7 measures the change in market risks due to foreign currency borrowing; Section 8 discusses other macroprudential policies and time periods, and Section 9 concludes.

1 Related Literature

Our results fit into a burgeoning literature on the risks to local growth and financial stability from worsening external debt position of the corporate sector. Du and Schreger (2017) show, in a cross-country setting, that higher reliance on foreign currency borrowing on the part of corporates is associated with a higher default risk on sovereign debt. Shin and Zhao (2013) provide evidence that the balance sheet dynamics of non-financial corporations in India and China suggest that they are behaving like surrogate financial intermediaries. Financial assets and liabilities for these firms covary positively as is the case for regular intermediaries. One hypothesis is that non-financial firms in EMEs are better able to circumvent capital controls (Caballero, Panizza and Powell, 2015), i.e., regulatory arbitrage is driving this behavior. Chui, Fender and Sushko (2014) hypothesize that these changes have led to local banks facing risks on both sides of their balance sheet. Stressed corporates might default on domestic loan obligations while wholesale funding might get squeezed if banks have come to rely on corporate deposits for funding.

A set of closely related papers consists of Bruno and Shin (2017); Caballero, Panizza and Powell (2015); Frank and Shen (2016). Like us, these papers do a firm-level analysis to distinguish between the different hypotheses regarding foreign currency borrowing by EME

firms. Bruno and Shin (2017) find that emerging market firms with high cash holdings tend to issue dollar-denominated bonds and add to their cash pile. This behavior is more pronounced during times when the (financial) carry trade is more profitable [8]. Caballero, Panizza and Powell (2015) confirm these findings and show that this motive is concentrated in countries with higher capital controls on inflows. In contrast, Frank and Shen (2016) look at Chinese firms and find evidence that new dollar issuances are being used to finance productive investments.

All of these papers focus on dollar bond issuance since they use the SDC database. We collect issuance data from India's central bank which allows us to study both bank debt and bond issuance. The vast majority of foreign currency debt issuance by Indian firms is through bank loans. Since firms with access to bond markets tend to be larger, our study covers a more representative sample of external borrowing firms. Importantly, our bank-driven results provide a complement to the hypothesis that the Second Phase of Global Liquidity (Shin, 2014) is driven primarily by global asset managers 'reaching for yield' in international debt markets. Our results show that global liquidity transmission is still at work through the bank channel. Another feature of our empirical analysis is that we incorporate *firm fixed effects* in all our tests. Controlling for unobserved time-invariant firm-specific heterogeneity, our results specify how the same firm behaves under different macroeconomic and financial conditions.

We also study how the risks arising from foreign currency borrowing manifest during times of market stress. Kalemli-Özcan, Kamil and Villegas-Sanchez (2016) study the effects of currency crises accompanied by banking crises. Bruno and Shin (2020) find that when the local currency depreciates, firms that borrowed in foreign currency when financing conditions were favorable are the ones that experience higher stress in terms of market values. We find similar results when we examine stock market returns for Indian firms around the 'taper

[8]There is a vast literature on the classic carry trade wherein financial market participants borrow in a low interest rate currency and invest in a high interest rate currency (see for e.g., Brunnermeier, Nagel and Pedersen (2008), Lustig, Stathopoulos and Verdelhan (2019)). The profitability of the carry trade is a failure of the uncovered interest rate parity (UIP) condition

tantrum' episode. Papers such as Eichengreen and Gupta (2015); Chari, Stedman and Lundblad (2020); and Sahay et al. (2014) study the 'taper tantrum' episode and its impact on asset prices, particularly in emerging markets. Sahay et al. (2014) find that the US Federal Reserve's monetary policy announcement is strongly correlated with asset prices and capital flows in emerging markets, and this phenomenon strengthened during the post-crisis phase of unconventional monetary policy.

This viewpoint is now part of a wider literature on the centrality of dollar funding and US monetary policy in driving cross-border flows (Rey, 2013; Miranda-Agrippino and Rey, 2020; McCauley, McGuire and Sushko, 2015; Kalemli-Özcan, 2019; Bräuning and Ivashina, 2020). Rey (2013) argues that surges and retrenchments in capital flows driven by a common global factor that can be linked to US monetary policy. This global financial cycle (GFC), intermediated by global banks, affects risky asset prices and leverage in recipient countries. Domestic monetary policy or exchange rate management is unable to undo the effects of US monetary policy spillover. Kalemli-Özcan (2019) argues, instead, that US monetary policy spills over into other countries through global investors' risk perceptions and its effect can be undone by allowing exchange rate flexibility. di Giovanni et al. (2019) show the transmission of the GFC to local EME credit markets in the context of Turkey.

Within this broader framework, macroprudential regulations can mitigate the domestic effects of the global financial cycle of capital flows. Korinek (2018) and Acharya and Krishnamurthy (2019) provide a theoretical analysis of the potential benefits of these tools. In their models, foreign currency borrowing on the part of individual firms creates a negative pecuniary externality since, when the risk of a sudden stop arises, firms scramble to make large dollar repayments further amplifying the shock. Prudent macroprudential policy can dampen these risks by discouraging the use of excessive dollar debt. Our detailed firm-level analysis for India provides strong evidence of such dampening in the context of a particular policy regulating corporate foreign currency debt.

Other papers analyzing macroprudential regulations, in a cross-country panel setting,

include Ahnert et al. (2020), Ostry et al. (2012), and Bruno, Shim and Shin (2017). Erten, Korinek and Ocampo (Forthcoming) provides a comprehensive survey on capital controls. These policies often have leakages or unintended consequences as in Reinhardt and Sowerbutts (2015), Keller (2019), and Jung (2016). We do not attempt to quantify the welfare effects of the policies we study but the direct consequence seems to be as intended in the Indian case.

2 Institutional Background

India's total external debt at the end of March 2019 was $543 billion[9] of which 38% was made up of commercial borrowings. These borrowings are the largest component of the external debt followed by deposits of Non-Resident Indians (24%), short-term trade credit (18.9%), and loans from multilateral or bilateral agencies (15.4%).

The share of external commercial debt in the country's overall external borrowing has increased sharply over the last 15 years. In 1995, this ratio was 13.1%. It had risen to only 19.7% by 2005 before rapidly climbing to 38% at the end of 2015. It has been around that level since then. Multiple factors have been suggested for the increasing dominance of foreign currency commercial borrowing in India's external debt. These include strong investment demand at home, increase in investor risk appetite for emerging market credit, rising domestic interest rates relative to foreign rates, improved sovereign credit ratings and continued underdevelopment of India's local corporate bond market.

The external commercial debt currently has three major components: (i) Corporate loans and bonds denominated in foreign currency; (ii) Foreign Portfolio Investment (FPI) in domestic corporate bonds; and (iii) Rupee-Denominated Bonds (RDBs) issued overseas. We focus on the first component since the latter two refer to domestic currency debt.

One of the features of the Indian market for foreign currency commercial debt is the relative scarcity of convertible bond issuance compared to bank debt. Figure 5 compares the

[9] https://dea.gov.in/sites/default/files/STATUSREPORT2018-19.pdf

number of External Commercial Borrowings (ECBs) to Foreign Currency Convertible Bonds (FCCBs) taken out by Indian firms in every year from 2005 to 2019. ECBs include bank debt and secured borrowings. Though FCCBs were somewhat popular from 2005 to 2007, their number has become very small post the crisis. As far as volumes are concerned, over 90% of issuance is through the ECB route since 2010. Given the scarcity of FCCB issuance, we do not distinguish between the two types of debt in our analysis. Though we include FCCB issues in all our tests, from here on we refer to all foreign currency commercial borrowing as ECB.

The major purposes for which ECBs are undertaken include the import of capital goods, modernization, rupee expenditures on local capital goods, overseas acquisitions, new projects and refinancing of existing ECBs.

Macroprudential Regulation

ECB issuance is regulated by India's central bank, the Reserve Bank of India (RBI). The goal of these guidelines is to guard against the debilitating effects of a sudden stop (Acharya and Krishnamurthy, 2019). Along with reserve accumulation, capital controls are the primary tools of macroprudential regulation. The controls place limits on issue size, maturity, use of funds, and cost[10]. All issue sizes above $750 million need RBI approval. The minimum maturity allowed is three years. On-lending or investment of proceeds in capital markets in India is generally not permitted. The all-in-cost of borrowing is capped, as a spread over 6 month LIBOR, with a view to restricting access to high quality borrowers. These all-in-cost limits also vary by maturity. Figure 4 plots how the cost limits have varied over time for lower maturity and higher maturity issues. We use the variation of this limit in the post-crisis period as our main proxy for the stance of macroprudential policy.

In addition to regulating individual debt issues, the RBI also imposes aggregate caps across the three components of India's external commercial debt. The FPI limit for domestic

[10]The updated regulations are available at https://www.rbi.org.in/Scripts/BS_ViewMasDirections.aspx?id=11510

corporate debt is currently around $42 billion, having increased by almost $10 billion in the last three years. Aggregate limits on RDBs of approximately $6 billion were counted against the FPI limit but starting October 2017, RDB limits were integrated with the foreign currency ECB, thereby increasing FPI limits on domestic corporate bonds.

3 Data and Summary Statistics

The RBI maintains a public database on the foreign currency borrowing of Indian firms[11]. The data, available from January 2004 onwards, has the following information on all instances of ECB issuance: the identity of the borrower, issue size in US dollars, maturity and calendar month and year of issue. Our sample covers issues between January 2004 and October 2019. Over this period, the data show that there were 12452 instances of foreign currency borrowing by 5355 distinct firms.

Accounting and stock price data comes from the Prowess database of the Centre for Monitoring Indian Economy (CMIE).The database has annual balance sheet and income statement data as well as daily data on stock prices. Since the financial year ends on March 31 for the vast majority of Indian firms, our Prowess sample covers the period from March 2004 to March 2019. We also collect data on exchange rates and interest rates from Datastream.

There is no common identifier linking firms in Prowess to the companies in the RBI data on foreign currency borrowing. In order to link the two data sources, we match names using a string matching algorithm and supplement this approach with a manual match for verification and completeness. This process results in a match of 1786 firms between the two databases. Though these 1786 firms form only 33.4% of the firms in the RBI database, they account for 46.7% of the issues and 82.6% of the total amount issued. The firms that are not matched comprise mainly financial firms, whom we exclude from our analysis, and smaller private firms for whom financial data is unavailable in Prowess. The matched Prowess-RBI

[11] Available at https://rbi.org.in/Scripts/ECBView.aspx

sample is the basis of all the analysis from here on.

Figure 6 graphically represents some of the characteristics of the foreign currency debt issued by firms in the matched sample. Figure 6a shows that the average (inflation-adjusted) issue amount rose from less than $30 million to over $50 million in a four-year span just before the crisis. Issue sizes decreased during the crisis and right after but started rising around 2012. There was another sharp decrease in 2015-16 but they have started climbing again and now are at their highest level in the sample period.

Compared to issue size, maturity is much less volatile, averaging near 6 years throughout the sample. Figure 6b plots a histogram of issue maturities. Issues of a maturity less than 3 years are very rare. This is unsurprising since regulatory approval is required to issue foreign currency debt with those maturities. Even though many of the assets being funded through these borrowings are long-lived and take time to generate cash flows, long maturity issues remain relatively rare. This is partly due to most of the debt being bank loans and partly due to a hesitation on the part of creditors to extend long maturity credit given the somewhat uncertain strength of creditor rights in the Indian legal context. Term loans of five year duration are, by far, the most popular kind of claim issued.

Panel A of Table 1 tabulates summary statistics on the issuance characteristics of the firms in the matched Prowess-RBI sample. From 2004 to 2019, these 1786 firms issued a total of 5821 foreign currency debt claims. The median firm borrowed twice in the period but the firm at the 95th percentile borrowed 10 times. There is a significant positive skew in issue size as the median size is $13 million but the average size is $59.4 million.

In Panel B of Table 1, we turn our attention to key balance sheet measures and ratios for the sample firms. Current and fixed assets are held in similar proportions (0.370 vs. 0.341). On the liabilities side, we find that the median firm-year shows a debt-to-asset ratio of 0.353. Most of the debt is long-term in nature, i.e., not due within the next year. The median long-term to total debt ratio is 0.727. Prowess also has some data on a firm's outstanding foreign currency debt. Their definition also includes trade credit which is not a part of the RBI

data. Including debt taken from suppliers, the ratio of foreign currency to total debt is 0.290 for the median firm-year. There is a wide variance in this ratio with the standard deviation being 0.291, almost the same as the median. Interestingly, foreign currency borrowing is not dominated by export-dominated firms. In fact, the median firm-year in our sample of ECB issuers has an exports-to-sales ratio of less than 3%. A majority of the firms that borrow abroad do not have a natural hedge through the channel of foreign currency revenues.

4 Carry Trade and ECB Issuance

In this section, we test the determinants of the issuance decision. Motivated by the results in Bruno and Shin (2017) and Caballero, Panizza and Powell (2015), we test whether foreign currency borrowing (both bank and bond debt), within our sample of Indian corporates, is affected by a 'carry trade' motive. Our first hypothesis is that Indian firms issue more ECB when the carry trade is more profitable.

To test this hypothesis we estimate the following logit model at the firm-month level to predict issuance:

$$Issue_{it} = \alpha_i + \beta_{CT} CT_{t-1} + \beta_i r_{i,t-1} + \beta_M r_{M,t-1} + \beta_{FX} r_{FX,t-1} + \gamma X_{i,y-1} + \varepsilon_{it} \qquad (1)$$

The left-hand side variable takes the value 1 if firm i issues ECB in month t, and 0 otherwise. The main variable of interest is CT which is a measure of the profitability of the carry trade that, following Bruno and Shin (2017), we define as $CT = \frac{\text{3M rate(IND)} - \text{3M rate(US)}}{\text{IV of 3M FX options}}$, i.e., the difference in short-term interest rates between India and the US standardized by the implied volatility of 3 month INRUSD options. It can be thought of as the Sharpe ratio of the carry trade. We control for the monthly NIFTY index return and the INRUSD return. To control for firm-level determinants, we include a set of accounting measures recorded at the previous fiscal year-end. These are total assets, leverage, cash-to-assets ratio, and exports-to-sales ratio. Importantly, to control for unobserved time invariant firm-level characteristics, we also employ firm fixed effects in certain specifications. In those specifications, the results

we get reflect within-firm estimates of *Carry Trade* profitability on the issuance decision. Standard errors are clustered at the firm level.

Results

Figure 2 plots how aggregate issuance and our carry trade index (CT) move over time. The figure is quite stark - before the financial crisis of 2008 (demarcated by the vertical red line), there seems to be a negative relation between the number of issues in a quarter against the CT measure in the quarter. However, post-crisis this pattern almost completely reverses. Aggregate ECB issuance and the profitability of the carry trade seem to be strongly positively correlated. That is, until the taper tantrum episode of Summer 2013 (indicated by the dashed green lines). During May-September 2013, the US Federal Reserve made a series of statements about the probability of the tapering of their quantitative easing (QE) program. Sahay et al. (2014) show that the 'taper tantrum' led to a surge of capital outflows from emerging markets, creating turmoil and a sharp decline in asset prices including in equities. Dollar liquidity declined precipitously, and tighter funding conditions were anticipated.

Following the taper tantrum, the correlation between ECB issuance and the CT index is considerably weakened. The table below Figure 2 reports the monthly pairwise correlations between issuance activity (both counts and volume) and the CT index. Over the whole sample, the correlation is near zero. However, this masks widely differing correlations across three distinct periods. From Jan 2004 to August 2008 ('pre-crisis'), the correlation is moderately negative. Between September 2008 and September 2013 ('post-crisis'), the correlation is strongly positive but weakens starting October 2013 ('post-taper') and after the macroprudential tightening of November 2015, it turns strongly negative.

We systematically confirm these patters at the firm-month level by estimating equation 1. The results are in Table 2. Excluding the firm-level market return allows us to include private firms in these tests. In columns (1) and (2), we exclude firm fixed effects while in columns (5) and (6), we include them. The results across the four specifications are qualitatively consistent. A higher value of the CT index predicts higher foreign currency borrowing in the

next month, and the effect is statistically significant at the 1% level. In the specifications with firm fixed effects, it means that the same firm is more likely to issue ECBs in months immediately following those in which the carry trade is more profitable. Quantitatively, the effect is large. Using the estimated coefficient of 0.448 in column (6), a one standard deviation increase in the CT index (The CT index has a standard deviation of 0.263 during the sample period) would increase a firm's probability of issuing ECBs by 11.8%. These results confirm our first hypothesis that firms in India borrow in foreign currency when the carry trade is more profitable.

Does the propensity to issue when the carry trade is more profitable change over time? The aggregate evidence in Figure 2 seems to suggest so but is this true at the firm level? To test this, we re-estimate equation 1 but with a couple of additional variables included. The first is the interaction of the CT index with a dummy variable that takes the value 1 for the period between September 2008 and September 2013 ('post-crisis'). The coefficient on this interaction term is the differential probability of issuing in the post-crisis period. The second is the interaction of the CT index with a dummy variable that takes the value 1 for the period after September 2013 ('post-taper tantrum'). The coefficient on this interaction term is the differential probability of issuing in the post-tantrum period. The differential effect for both interaction terms is relative to the effect of the CT index in the base or pre-crisis period.

These results are in columns (3) and (4) (without firm fixed effects) and columns (7) and (8) (with firm fixed effects) of Table 2. The results are again consistent across specifications. If we look at column (8), the coefficient on CT is insignificant though negative in magnitude. In the pre-crisis period, issue propensity is not significantly related to the carry trade profitability. However, in the post-crisis period, the coefficient is positive and significant. The magnitude is large – the coefficient of 1.286 implies that a one standard deviation increase in the CT index would increase a firm's probability of issuing ECBs by 33.8%. For the post-taper tantrum period, the coefficient on the interaction is small and

insignificant suggesting the effect of the *CT* index on ECB issuance is similar to that before the crisis.

5 The Effect of Macroprudential Policy Action

The analysis in the previous section shows that there were three clear phases of foreign currency borrowing in India. The first was prior to the global financial crisis. During this phase, the carry trade was not a determinant of ECB issuance. In the second phase, during and immediately following the crisis, the carry trade became a strong predictor of issuance. Finally, in the period following the taper tantrum, the carry trade again became less important. The transition from the first to the second phase seems to be a result of the crisis and ensuing monetary policy expansion in the US (Rey, 2013; Bruno and Shin, 2017). Our interest is in the transition from the second to third phase and the role played by local macroprudential policy, if any.

In response to risks arising from enhanced foreign currency borrowing, many EMEs tightened macroprudential regulation (IMF, 2020). India was among them, tightening limits on aggregate borrowing, investments by investor type, debt maturity, and cost of borrowing (Acharya and Krishnamurthy, 2019). Of these measures, we test the effects of reducing the ceiling on the all-in-cost (AIC) of external commercial borrowings. We hypothesize that this tightening, soon after the taper tantrum episode, prevented riskier firms from using foreign currency borrowing as carry trades. Figure 4 shows how the AIC limits vary over time. There are different limits for issuances of less than 5 years and those more than 5 years. The spreads are over 6-month LIBOR.

To test our hypothesis, we estimate a variant of our base Equation 1. We include a dummy for whether the AIC spread is over its sample median in the post-crisis period from September 2008 onwards[12]. A *High AIC Spread* signals looser macroprudential regulation. We also include a term which is the interaction of *CT* and *High AIC Spread*. This coefficient

[12]We restrict ourselves to the period from September 2008 onwards our interest is in the transition from the second to third phase.

on this interaction term is our coefficient of interest – our hypothesis suggests that it should be positive. If the AIC spread is high, the carry trade plays a greater role in explaining issuance. Conversely, when the AIC spread is low, i.e., regulation is tight, the carry trade motive is less important.

Results

The results presented in Table 3 confirm our hypothesis. We see that the coefficient on the interaction term is positive and highly significant in all specifications - with and without firm fixed effects and control variables. The results imply that, from 2008 onwards, the carry trade motive explains issuance only in periods when macroprudential regulation was loose. In periods when limits on borrowing costs were tight, the carry trade's relationship with issuance was actually negative. Given that tighter limits were introduced only after the taper tantrum episode (Figure 4), these results potentially explain the dichotomy we find in the post-crisis and post-taper periods in our earlier results. The carry trade motive became less important because of macroprudential regulation.

To confirm that the macroprudential regulation is responsible for curbing carry trade borrowing, we implement another test. Since the regulation we study is a cap on the cost of borrowing, we would expect it to reduce borrowing among firms with high costs of borrowing. Though we do not see actual borrowing costs in our sample of ECB issues, we can use Prowess financial data to get an implied annual interest cost for each firm[13]. Our assumption is that riskier firms will have higher interest costs in both domestic and foreign borrowing markets. Our hypothesis is that firms with high interest costs are more likely to borrow when regulations are loose (*High AIC Spread*) and *CT* is high. To implement this, we extend the previous methodology to include a triple difference term which is the interaction of *CT*, *High AIC Spread* and the firm's implied interest cost. For interest cost, we use both the actual value as well as a dummy indicating that it is above the median.

The results are in Table 4. The coefficients on the triple interaction in columns 2 and 4

[13]This is simply the annual interest expense divided by the average debt outstanding over the year.

confirm our hypothesis. In column 2, we see the coefficient is positive and significant implying that when the carry trade is profitable and regulations are looser, firms with high interest costs, i.e., riskier firms are more likely to issue ECB than firms with lower interest costs. Conversely, the negative coefficient on the interaction of CT with Interest Cost indicates that when carry trade is profitable but regulations are tighter, firms with high interest costs, i.e., riskier firms are less likely to issue ECB than firms with lower interest costs. All in all, these results confirm that the regulations do bind and do prevent riskier firms from taking advantage of the carry trade.

Importers are naturally exposed to foreign currency appreciation. Their revenues are local but expenses are in foreign currency. Importers who borrow in foreign currency are thus uniquely exposed to exchange rate risk[14]. If a non-fundamental financial factor such as the 'carry trade' is driving borrowing, we expect firms with the least fundamental incentive to borrow abroad, i.e., importers to increase their borrowing more during these periods.

A striking aggregate pattern we uncover on plotting India's trade balance against CT is that in the period between the onset of the financial crisis and the macroprudential tightening of 2015 (Figure 3), the correlation is strongly negative. Before the crisis, it was nearly zero. Following the imposition of capital controls in the form of interest rate caps on foreign currency borrowing, the correlation becomes strongly positive. These results suggest that imports surge relative to exports when funding conditions are favorable and macroprudential policy is loose. The surge in imports could be due to importers using the funds from ECBs to fund expansion in their operations.

We undertake a firm-level analysis to confirm this finding. We set up a similar specification as in Table 4 but replace Interest Cost with the fraction of raw materials that are imported. We use both the actual value as well as a dummy indicating that it is above the median. The results are in Table 5. The coefficients on the triple interaction in columns 2 and 4 provide strong evidence that when AIC spreads are high and the CT index is high,

[14]This is a corollary of exporters having a natural hedge when they borrow in foreign currency

firms with a higher fraction of imports are more likely to issue foreign currency debt. These results confirm that easier funding conditions invite ex-ante riskier firms[15] into the issuance market but macroprudential tightening can reverse this phenomenon.

6 Effects on Firm Outcomes

What happens to the money raised by Indian businesses abroad? The stated purpose of most foreign currency borrowing is capital expenditure – in our data, over 80% of the issuances give this as the rationale for the issue. The next most popular purpose is refinancing of loans. But do firms abide by their stated rationale? If the carry trade really is responsible for the rise in foreign currency borrowing, we would expect firms to hold the proceeds as cash or bank deposits rather than invest it in risky capital projects. Perhaps, firms are substituting equity with debt and paying out higher dividends.

To figure out how exactly ECB proceeds are being used in practice, we follow the methodology of Kim and Weisbach (2008) which allows us to benchmark the use of ECB proceeds with funds raised by the firm through other sources. We define two new variables: firstly, $Log(1 + \frac{ECBAmount_{it}}{TotalAssets_{i,t-1}})$ where $ECBAmount_{it}$ is the total amount (in INR) that the firm i raised through the ECB route in year t[16]; and secondly, $Log(1 + \frac{OtherSources_{it}}{TotalAssets_{i,t-1}})$. We measure other sources of funds as the difference between total sources and the amount raised through ECB in year t. Total sources is the sum of funds from operations, sale of fixed assets, long-term debt issuances, and sale of common and preferred stock. We scale both the ECB amount and the other sources by beginning-of-year assets, and take logs to minimize the impact of outliers. Before we test how ECB funds are used, we analyze the substitutability between foreign currency debt and other sources of funds. We estimate the following

[15] Here they are risky since they are naturally exposed to adverse exchange rate movements

[16] The RBI data has ECB amounts in USD. We convert to INR using the INRUSD exchange rate at the end of the calendar month in which the issuance was undertaken

equation by OLS:

$$Log\left(1+\frac{ECBAmount_{it}}{TotalAssets_{i,t-1}}\right)=\alpha_i+\beta Log\left(1+\frac{OtherSources_{it}}{TotalAssets_{i,t-1}}\right)+\gamma Log(Assets)_{i,t-1}+\delta_t+\varepsilon_{it} \tag{2}$$

Controlling for beginning-of-year assets as well as firm and year fixed effects, this model asks how sensitive ECB borrowing is to the quantum of other funds. We expect $\beta < 0$, i.e., the higher other sources of funds, the lower the amount raised through the ECB route. Since the other sources of funds are primarily comprised of internally generated funds and domestic debt, by the pecking order theory Myers and Majluf (1984) we expect them to be prioritized as a source of funds compared to foreign currency debt.

Next, we test how firm outcomes evolve for firms that borrow when the carry trade is more profitable. We compare outcomes in the post-taper period to the post-crisis period, as well as when policy is loose compared to when it is tight. To identify "carry trade borrowers" we define a Firm CT index which is a weighted average of the CT index when the firm borrows. To construct Firm CT, we only use firms with at least 4 issuances in the sample. We estimate the following regression by OLS at the firm-fiscal year level:

$$Y_{ijt}=\alpha_i+\beta\text{Post-Taper}_t\times\text{Firm CT}_{ij}+\gamma X_{ijt}+\delta_{jt}+\varepsilon_{ijt} \tag{3}$$

The dependent variable, Y_{ijt}, can be (i) gross investment (Change in gross fixed assets from year t-1 to t) in year t, (ii) cash holdings at end of year t, (iii) debt at end of year t, and (iv) profits in year t. All dependent variables are scaled by year t assets.

The independent variable of interest is the interaction of a *Post-Taper* dummy with the value of the Firm CT index. The coefficient β tells us how the outcome changes in the post-taper period for a company which generally issues when the CT index is high compared to one which issues when the CT index is low. Industry-Year fixed effects are included to

control for industry-wide macroeconomic shocks and ensure all comparisons are between firms in the same industry while firm fixed effects control for unobserved time invariant firm characteristics. We cluster standard errors at the firm level.

Results

The results from the OLS estimation of equation 2 are in Table 6. In column (1) we see that the coefficient on $Log(1+\frac{OtherSources_{it}}{TotalAssets_{i,t-1}})$, i.e., β is -0.076 and is significantly different from zero at the 1% level. When funds raised through other sources are higher, proceeds from ECB issuances are lower, confirming that the two sources are substitutes. We've seen earlier that carry trade incentives post the financial crisis seem to explain issuance behavior better than firm-level variables. If firms are raising money abroad primarily because of favorable funding conditions, we expect to see the substitutability between ECB funds and other sources to be lower in the post-crisis period. This is exactly what the result in column(2) shows. When we include an interaction between $Log(1+\frac{OtherSources_{it}}{TotalAssets_{i,t-1}})$ and *PostCrisis*, a dummy that takes the value 1 between September 2008 and September 2013, we find that the coefficient on this interaction term is positive and significant, and the magnitude of the coefficient is nearly half that of β in the same regression (0.036 vs. -0.086). The substitutability between the two types of funds is significantly lower (though still present) post the financial crisis. However, in the post-taper period, the substitutability returns to the pre-crisis level. The coefficient on the interaction between $Log(1+\frac{OtherSources_{it}}{TotalAssets_{i,t-1}})$ and *PostTaper* is insignificant.

Was the return to the pre-crisis level a result of the macroprudential regulation of the RBI? In the previous section, we saw that the positive link between the CT measure and ECB issuance was broken once tighter borrowing norms were imposed. We test whether the decline in substitutability is also reversed following the lowering of maximum borrowing costs. In column (3), we interact $Log(1+\frac{OtherSources_{it}}{TotalAssets_{i,t-1}})$ with *Hi AIC*, a dummy taking the value 1 when maximum borrowing costs are above their sample median. We find that the coefficient on this interaction is negative, indicating that when macroprudential policy is loose, the substitutability between sources is lower; firms are borrowing abroad even though

they might have sufficient funds from other sources. Another way to look at this is that the post-taper reversal is driven by the tightening of policy.

A concern with the above set of results is that our dependent variable takes the value 0 in most firm-years (about 80%) since most firms undertake foreign currency borrowing only sporadically. It is possible that the decision to issue abroad is linked to funds available from other sources, but not the amount, i.e., this substitutability only holds at the extensive margin. To clearly analyze whether the amount of money raised is also linked to other sources of funding, we re-run the tests of the first three columns but restrict the sample to only those firm-years in which the firm issued abroad. These results are in columns (4)-(6). We see that the coefficient β is still negative and significant, and is larger in magnitude than in the previous columns (-0.145 in column(3) vs. -0.076 in column (1)). Given the decision to issue abroad, the substitutability between the funds raised in foreign currency and those in domestic currency is larger than the unconditional. Results in column (5) and (6) are also consistent with this – in the post-crisis period, the association between other funds and the ECB amount is less negative than in the pre-crisis period.

How do we interpret the magnitudes in these tables, such as the -0.145 coefficient in column (4). The median firm-year has a ratio of other sources to beginning-of-year assets of 0.136 (Panel B of Table 1). If there is a 20 % positive shock (0.0272) to this value, keeping all else equal, the reduction in ECB amount would be from median value 0.096 of total assets to 0.092, a decrease of about 4%. Perhaps surprisingly, the magnitude of the substitution is not as large as one might have expected.

Next, we turn to firm outcomes. The results are in Table 7. In Panel A, we find that firms with a high Firm CT index see a reduction in investment and, more strongly, cash holdings in the post-taper period. There is no effect on leverage or ROA. We've seen earlier that the sensitivity of issuance to carry trade profitability reduces following the taper tantrum, and now we confirm that the firms which are likely to have taken advantage of the carry trade cut down on investment but more strongly on cash holdings, a result consistent with carry

trade behavior (Bruno and Shin, 2017).

In Panel B, we test once again whether the difference between the post-crisis and post-taper period is due to macroprudential policy. When the AIC spread is high, i.e., policy is loose, issuers with a high Firm CT index have higher investment and cash holdings. Equivalently, when policy is tightened, their investment and cash holdings are lower. This confirms that tighter policy constrains issuers who take advantage of carry trade borrowing, and affects their investment and liquidity position.

7 Firm Exposure to FX Risk

Having studied the determinants and uses of foreign currency borrowings, in this section, we study how these borrowings affect the risks to which the firms are exposed, particularly foreign exchange risk. A primary concern that regulators expressed about the rise in ECB issuance is that borrowers were leaving the resulting foreign currency exposure unhedged (Ministry of Finance, 2015). This report, also known as the Sahoo Committee report, identifies two primary reasons why companies might not hedge their exposure post issuance: first, the local derivatives market is illiquid and firms lack access to offshore markets; and second, they imagine an implicit guarantee from the RBI that it won't let the currency depreciate outside a narrow band [17]. To measure the extent of exposure that is left unhedged at the time of issuance, we look at market-based measures obtained from stock returns.

To obtain a market-based measure of foreign exchange risk, we estimate the following market model separately for each firm:

$$r_{it} = \alpha + \beta_M r_{Mt} + \beta_{FX} r_{FX,t} + \varepsilon_{it} \tag{4}$$

r_{it} is the return for firm i in month t. r_{Mt} represents the return on the broader Indian stock market and is proxied by the NIFTY index return. $r_{FX,t}$ is the INRUSD monthly return

[17] The danger with the perpetuation of the low volatility exchange rate regime is that when the eventual adjustment does take place it will be sharp

and is defined as $\frac{P_t - P_{t-1}}{P_{t-1}}$ where P_t is the number of USD required to buy 1 INR at the end of period t. The model is estimated using OLS with an estimation window of 60 months[18], allowing us to obtain rolling estimates of β_{FX} for each firm. Low FX β firms, presumably exporters, are the ones that do well when the Indian Rupee depreciates against the US Dollar while high FX β firms are the ones that do badly. Summary statistics in Panel C of Table 1 suggest that the median firm in our sample has an FX β of 0.11 indicating that the median firm would lose value on a currency depreciation.

Motivated by concerns expressed by policymakers, we hypothesize that firms that borrow abroad do not fully hedge their foreign exchange exposure. This leads to the hypothesis that firm FX $\beta's$ increase following ECB issuance.

To test this hypothesis, we estimate the following equation:

$$beta_{it} = \alpha + \beta_1 Issue_{i,t-1} + \nu_t + \eta_i + \varepsilon_{it} \tag{5}$$

The dependent variable is the β estimated for firm i from the market model in a 60-month trading windows starting at the beginning of month t . The independent variable is a dummy that takes value 1 if firm i made an ECB issuance in month $t-1$. We include time and firm fixed effects. The results from this estimation are presented in Table 8. In the first column, we see that the FX β does not change right after ECB issuance in the full sample analysis.

In the second column, we introduce interaction terms to test whether the lack of a change in foreign exchange risk exposure after issuance holds during different periods. Motivated by our prior analysis, we introduce two interaction terms so we can test across three time periods. $Issue \times PostCrisis$ is 1 if the issuance takes place between September 2008 and September 2013 while $Issue \times PostTaper$ is 1 if the issuance takes place after September 2013. On estimating this regression we find that the the coefficient on $Issue$ is negative and significant (column 2) suggesting that in the base pre-crisis period, ECB issuance is associated with a *decline* in FX β, perhaps reflecting a selection effect, i.e., firms start borrowing abroad exactly

[18]Results are similar with 36 and 48-month estimation windows

when their risk exposure to currency depreciation reduces, perhaps through an expansion in their export business. However, in the post-crisis period, this phenomenon is reversed with FX β rising post issuance. The positive, significant coefficient of 0.118 on the interaction term is large given a median FX β of 0.109. This result suggests that currency risk for ECB borrowers increases only in the post-crisis period. In the post-taper period, risk changes are not significantly different from the pre-crisis period.

The reversion to the pre-crisis pattern in the post-taper period is consistent with our prior analysis that macroprudential policy tightening soon after the taper tantrum changed aggregrate borrowing behavior by restricting riskier firms from accessing ECBs. In the third column of Table 8, we directly test for this phenomenon by introducing an interaction term $Issue \times HiAIC$ which is 1 when the max AIC allowed is above its sample median, i.e., when policy is loose. In column (3), we find the coefficient on this interaction term to be positive and significant. This means that when policy is less stringent, the firms that borrow see their foreign exchange exposure go up. Another way of saying this is that when policy is stricter, riskier firms are unable to access the ECB market and hence firm-level FX risk does not increase during these periods.

In columns (4)-(6) of Table 8, we conduct the same tests but use the NIFTY (or market) β as the dependent variable. There is no significant change of the market β in either the full sample or any of the three distinct periods. These results serve as a placebo test emphasizing that the effects we pick up are indeed due to the ECB issuance and not due to some fundamental change in the firm's business risk.

In Table 9, we test how the FX β post-issuance changes for different sets of firms. In Panel A, we split firms by their Firm CT measure while in Panel B, we use the Interest Cost. Do firms which borrow when funding conditions are favorable (High Firm CT) or firms which pay higher interest rates (High Interest Cost) see more of an increase in FX β following issuance?

Results in Table 9 suggest that this is true. All the increase in post-issuance FX β

that we see in Table 9 comes from High Firm CT and High Interest Cost issuers. The macroprudential policy is effective because it constrains exactly these firms and hence is able to keep FX risks down. We next show this formally using event study analysis around unexpected shocks.

These results are consistent with models that emphasize that firms do not internalize the pecuniary externality created by their individual borrowing (Korinek, 2018; Acharya and Krishnamurthy, 2019). It is exactly when the risk of a sudden stop rises that these firms need to scramble for foreign currency to pay off their debts putting further downward pressure on the local currency, further stressing their balance sheets. A direct implication is that the local currency should depreciate more when more foreign currency debt of corporations is due to be repaid analogous to carry trade unwinding by financial market participants leadings to currency crashes (Brunnermeier, Nagel and Pedersen, 2008). We test this time series implication in Appendix Table C.4. Our issuance data tells us the month in which bond or loan matures. We calculate the total amount of ECBs maturing in each month. This number is determined years in advance of the month itself. But we find that the change in the log amount of ECB maturing negatively predicts the change in the logged exchange rate, i.e., it predicts a rupee depreciation. The effects are stronger for issuances done following the crisis and before the tightening of macroprudential policy.

Taper Tantrum and COVID-19 as natural experiments

A tightening of international funding conditions, and dollar appreciation pose rollover risks to corporations that borrow abroad (Acharya et al., 2015). Capital controls and reserve accumulation on the part of the monetary authority are strategies that may help countries cope with the risks posed by a sudden stop (Acharya and Krishnamurthy, 2019). In the previous section, we saw that the tightening of borrowing cost ceilings in India was effective in ameliorating the carry trade motive when it came to foreign currency borrowing. The question remains if it was successful in reducing the risks associated with foreign currency

borrowing. To test this, we conduct tests in the spirit of Bruno and Shin (2020) who find that local currency depreciation is associated with higher market stress for firms that use foreign currency borrowing as carry trades, i.e., borrow cheaply abroad and invest in liquid assets locally. We conduct our analysis using the event study methodology focusing on discrete, unexpected events characterized by capital outflows and sharp depreciation in the Indian Rupee.

The first set of events involve the 'taper tantrum' episode of Summer 2013. During May-September 2013, the US Federal Reserve made a series of statements about the probability of the tapering of their quantitative easing (QE) program. We use these statements as proxies for shocks to foreign exchange volatility, and as a preview of tighter future funding conditions. Sahay et al. (2014) show that the 'taper tantrum' led to a surge of foreign capital outflows from emerging markets, creating turmoil and a sharp decline in asset prices including in equities. The Indian market was not spared during this period – from the start of May to the end of September, the Indian Rupee declined almost 14% against the US Dollar while the NIFTY market index fell about 2.35%. In fact, in August 2013 the RBI responded by imposing capital controls on outflows by residents[19].

Through an event study framework, we analyze which foreign currency borrowers experienced the largest abnormal stock returns, and how this was related to their propensity to borrow when the carry trade is favorable. To clearly identify the effects of the taper tantrum episode, we focus on three distinct events that market participants identify as having significantly altered the probability of tapering:

- *May 22, 2013*: In a testimony to the Joint Economic Committee of the US Congress, Federal Reserve Chairman Ben Bernanke suggested that tapering could begin after the next couple of meetings of the Federal Open Market Committee[20].

- *June 19, 2013*: In a press conference following the FOMC meeting, Chairman Bernanke

[19] see https://rbi.org.in/scripts/BS_PressReleaseDisplay.aspx?prid=29309

[20] http://www.marketwatch.com/story/bernanke-premature-tightening-could-end-growth-2013-05-22

again suggested that asset purchases would be reduced later in 2013[21].

- *September 18, 2013*: After the FOMC meeting, Chairman Bernanke unexpectedly announced that the Fed was going to delay tapering till economic conditions improved[22].

We consider the first two dates as having increased the probability of tapering while the third decreased the probability. Consistent with this interpretation, we find that the INR depreciated on the day after the first two events (by 0.14% and 1.69% respectively) and appreciated by 2.15% the day after the third event[23]. In the results that follow, for the sake of brevity, we only report results from the events of June 19, 2013. Market reactions were strongest on that date and we believe that date provides the cleanest shock related to tapering.

The 'taper tantrum' episode divides the post financial crisis period into two parts in our prior analysis. At the time of the taper tantrum, capital controls were looser. Following the episode, they were tightened. We complement our taper tantrum event study analysis with two events that take place in the post taper tantrum period, specifically in the period after the tightening of capital controls. These are:

- *October 3, 2018*: In October 2018, there was a sudden depreciation in the Indian Rupee and a spurt of outflows owing primarily to an increase in oil prices[24].

- *March 11, 2020*: In light of the intensifying COVID-19 pandemic, US President Donald Trump announced a series of restrictions including bans on travel from most of the European Union. This led to a sharp decline in global markets including India[25].

[21] https://research.stlouisfed.org/publications/es/article/10036

[22] http://www.bloomberg.com/news/articles/2013-09-18/fed-refrains-from-qe-taper-keeps-bond-buying-at-85-bln

[23] The NIFTY stock index actually rose by 0.28% after the first event date. On the other two dates, the impact was much starker – the index fell 2.86% following the second event date and rose 3.66% after the third

[24] See https://www.business-standard.com/article/markets/rupee-crashes-to-all-time-low-of-73-81-on-capital-outflows-oil-prices-118100400991_1.html

[25] https://www.livemint.com/market/live-blog/sensex-nifty-live-today-12-03-2020-nifty-nse-bse-news-updates-11583982298421.html

With respect to each of the event dates, we estimate the market model (Equation 4) over a 180 calendar day window ending at $t = -6$ where $t = 0$ captures the event date. The estimated market and FX $\beta's$ are used to predict returns around the event date. The abnormal return on a particular date is the difference between the actual and predicted return. We focus on the Cumulative Abnormal Return (CAR) on the first 3 trading days following the event (CAR[0,3]).

Next, we sort the sample of firms into terciles based on different metrics. The CAR is then regressed on indicator variables for each tercile. The first metric we use measures the propensity of firms to issue when the CT value is high, i.e., Firm CT. For each firm that has at least 4 issuances in the sample, we calculate a firm-specific CT measure which is the amount-weighted average of the CT index values in the immediate month preceding issuance. Firms in the top tercile of the CT are those with a higher propensity to issue when the carry trade is more profitable. Our second sorting metric is the implied % Interest Cost in the period before the event.

Event Study Results

Table 10 has the results from the event study analysis around significant events of market stress in India. In the first panel, the firms are sorted based on the firm-specific CT measure while in Panel B, the sorting is done on the basis of the implied % Interest Cost.

The results from the first column of Panel A indicate that it is exactly those firms that issue more when the carry trade is more profitable (high CT issuers) that see the sharpest negative abnormal reaction to the taper tantrum (06/19/13). Their CAR is smaller than -2%, about 2% worse than low CT issuers. Figure 7 plots the difference in CAR for high and low CT issuers as it develops over the 5 days before and after the event date. The difference in CAR between high and low CT issuers is large in magnitude and statistically significant (at the 10% level) though we have a small sample of firms since we need firms that have issued at least 4 times over the sample period. Another interesting finding is that the entire sample of repeat foreign currency borrowers experiences large negative declines

following increase in taper risk (post 19 June 2013). Since we are controlling for the overall market reaction in the market model, this implies that foreign currency borrowers perform worse compared to non-borrowers (who can be thought of as the omitted group).

The second panel suggests that the abnormal reaction post event is sharpest for the firms with high interest costs. Over the 3 days following June 19, 2013, the cumulative abnormal return for low FX β firms was 0.5% points more negative than that for low interest cost firms. This difference is statistically insignificant.

When we turn to our two post-taper events (columns 2 and 3), we find that high CT issuers now no longer react significantly worse to negative events. The magnitude of the difference across firms is significantly lower, perhaps suggesting that in an environment of tighter capital controls, the difference in risk exposure between high and low CT issuers is significantly lower. The same lack of difference exists between high interest cost and low interest cost firms.

8 Other Macroprudential Policies and Time Periods

The preceding results provide strong support for our hypothesis that the tightening of macroprudential policy undertaken by the RBI in 2015, the decrease in the maximum borrowing cost for ECBs, was able to reduce foreign currency borrowing by 'carry trade' borrowers - firms taking advantage of easy funding conditions to borrow abroad. There are, however, a couple of alternate explanations that could be consistent with the results we obtain. We attempt to rule them out in turn. In this section, we briefly discuss other macroprudential policy changes made by the RBI around the same time. We also test whether reductions in borrowing costs prior to the crisis had similar effects as in the post-crisis period.

Other policies targeted at external debt may have induced an indirect effect in ECB issuance. We focus on two key changes - guidelines on the issuance of Rupee-Denominated Bonds (RDBs) in overseas markets and the relaxation of limits on Foreign Portfolio Investment (FPI) in domestic corporate bonds. The RDB guidelines were introduced in September

2015 and the first set of RDBs under these guidelines were in the third quarter of 2016. To rule out the decline in ECB issuance we document is not just substitution to RDBs, we collect data on RDB issuance. Figure A.1 shows the evolution of RDB issuance since 2016 and compares it to ECB issuance over the same period. RDB issuance is significantly lower than ECBs and the volume of RDBs has declined significantly. The volume of non-financial RDB issuance averages only 5% of the volume of ECB issuance in the period from 2016 to 2019. Many RDB issuers are financial issuers, a category we explicitly exclude in our ECB analysis.

The RBI imposes capital controls through the imposition of limits on FPI investment in Indian debt and equity markets. In Figure A.2a, we plot FPI investment against the maximum limits. The limits were fixed from 2013 to 2017 but in early 2018, the RBI started gradually loosening them and has continued to loosen them. FPI debt reached its peak in August 2019, at almost the maximum limit, but has declined since then and is well below 50% of the maximum limit at the moment. In Figure A.2b, we plot net FPI debt flows over our entire sample period. The graph indicates that flows have become significantly larger and more volatile since the financial crisis. There were significant outflows due to the taper tantrum, but these reversed soon after. Importantly, the macroprudential tightening of ECB borrowing in November 2015 is not accompanied by significant inflows. This enables us to rule out that the results we document are not an artifact of foreign investors substituting foreign currency corporate debt with domestic currency debt. Instead, the reduction in ECB is driven by the policy tightening itself.

Lastly, we test how macroprudential tightening affected issuance in the pre-crisis period.. Since tightening is economy-wide, it is possible that some unobserved time-varying shock is driving our results. Though our cross-sectional tests using interest costs and import share point against this explanation, we also conduct a placebo test to rule it out further. Since we've already shown that CT did not predict issuance in the pre-crisis period, we would not expect macroprudential tightening in the pre-crisis period to affect "carry trade" borrowing.

The RBI did lower AIC limits on borrowing in 2007. In Appendix A2, we run the pre-crisis complements to Tables 3, 4, and 5 and find no evidence of the interaction of *CT* and *High AIC Spread* playing any role in issuance behavior. In Table B.2, we find that the total effect of tightening on High Interest Cost firms is near zero. This suggests that the AIC limits in the pre-crisis periods were not binding. This could be due to the difference in the type of firms borrowing in the pre-crisis period. The median interest cost of High Interest Cost firms in the pre-crisis period is 3 pp lower than of those firms in the post-crisis period, further suggesting that favorable funding conditions following the crisis attracted riskier firms to the ECB market.

9 Conclusion

Our results have several implications for the literature on emerging market corporate debt as well as for policymakers tasked with preventing the spread of any stress that emerges due to firms' foreign currency borrowings. Given that we find favourable funding conditions to be a much stronger determinant of issuance than any firm-level factors, it is reasonable to conclude that these risks will re-emerge as we enter another US monetary policy easing cycle owing to the COVID-19 pandemic. Our results indicate that capital controls can be a means of curbing risk-taking on the part of the corporate sector. However, this must be balanced against the imperative of allowing local firms access to sources of funding that may be cheaper than local sources. Proper targeting of macroprudential regulation is required to balance these competing interests.

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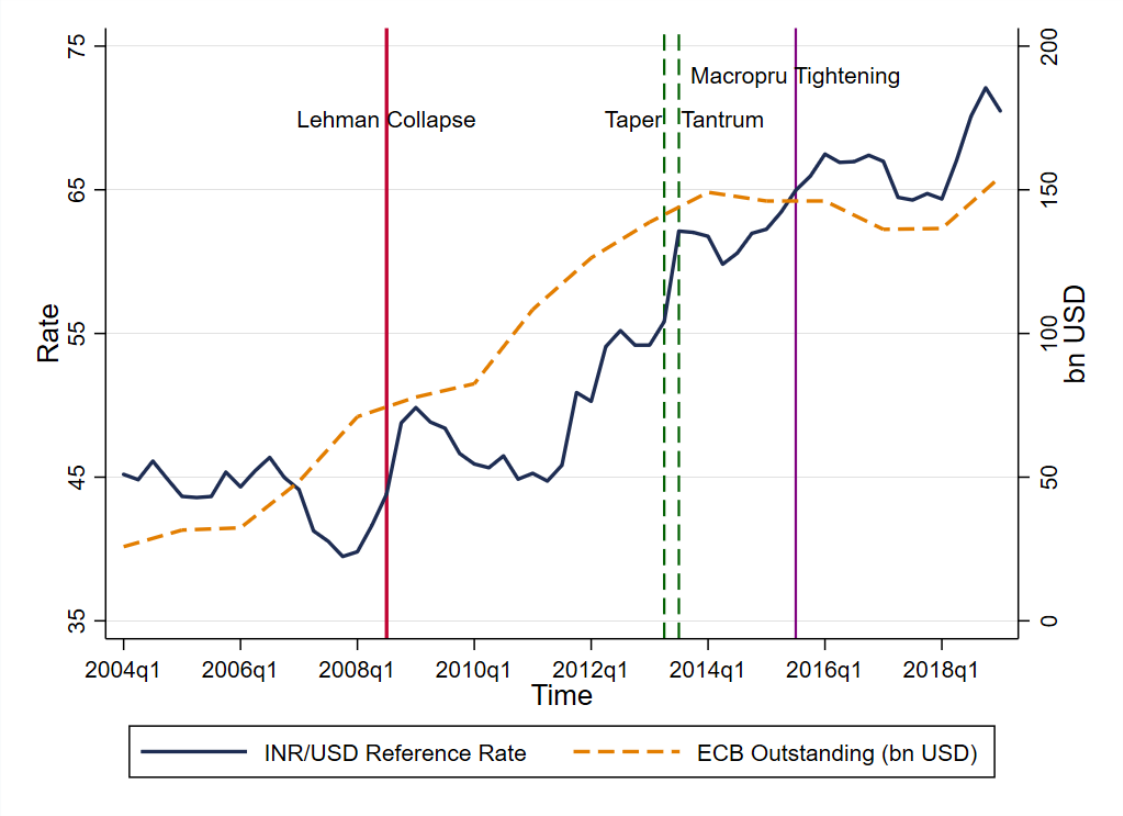


Figure 1: **INR/USD Exchange Rate and ECB Outstanding**
The figure shows the evolution of the INR/USD exchange rate and the stock of ECB outstanding over the period March 2004 to March 2019.

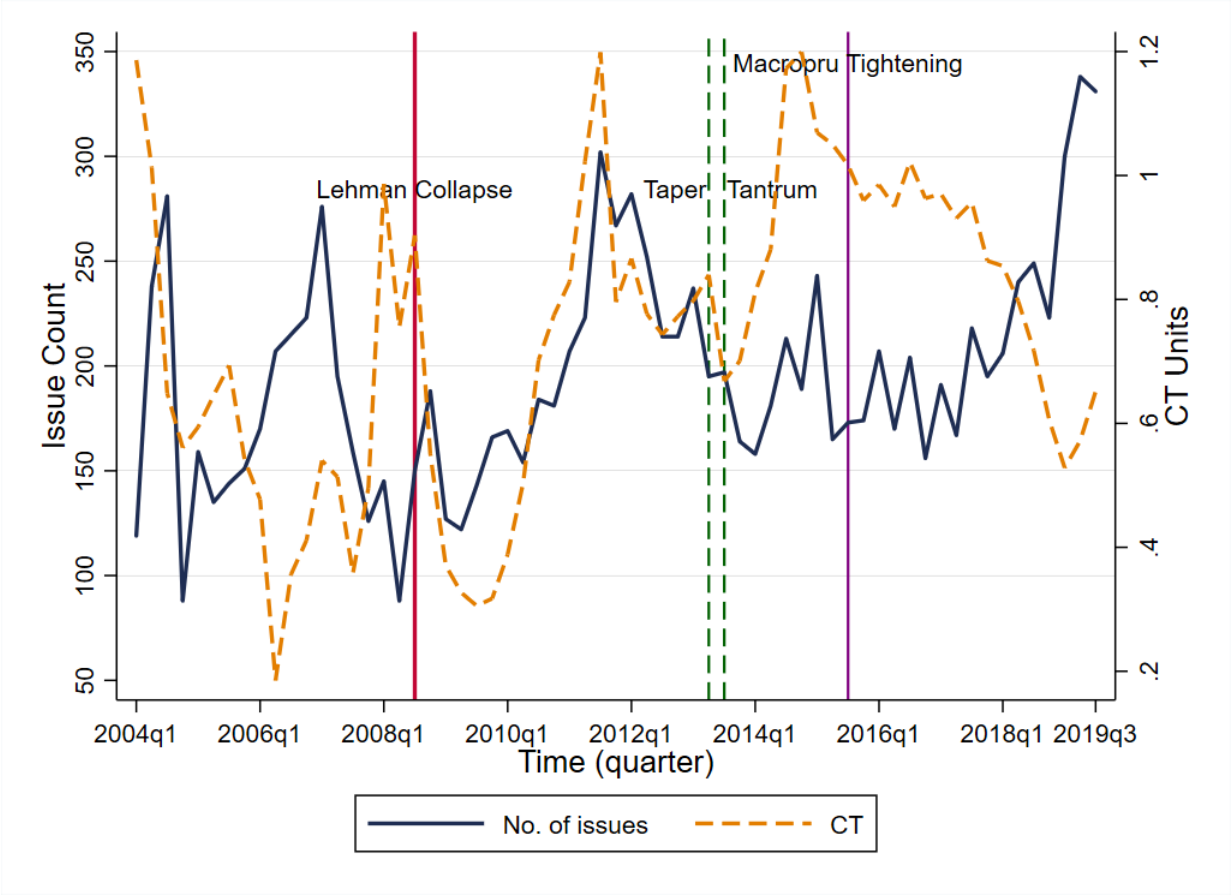


Figure 2: **Carry Trade and Aggregate ECB Issuance**
The figure plots the total number of ECB issues each quarter against CT, a proxy for the difference in short-term rates between India and the US. CT is defined as the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. The sample period is from Jan 2004 to Sep 2019.

The table below lists the correlation between the monthly CT index and the monthly ECB issuance count and total amount issued.

ρ (monthly)	Jan 04-Sep 19	Jan 04-Aug 08	Sep 08-Sep 13	Oct 13-Oct 15	Nov 15-Sep 19
ρ(Issues, CT)	0.0801	-0.1727	0.5584	0.3621	-0.6838
ρ(Amount, CT)	0.0034	-0.2973	0.4542	0.4607	-0.5397

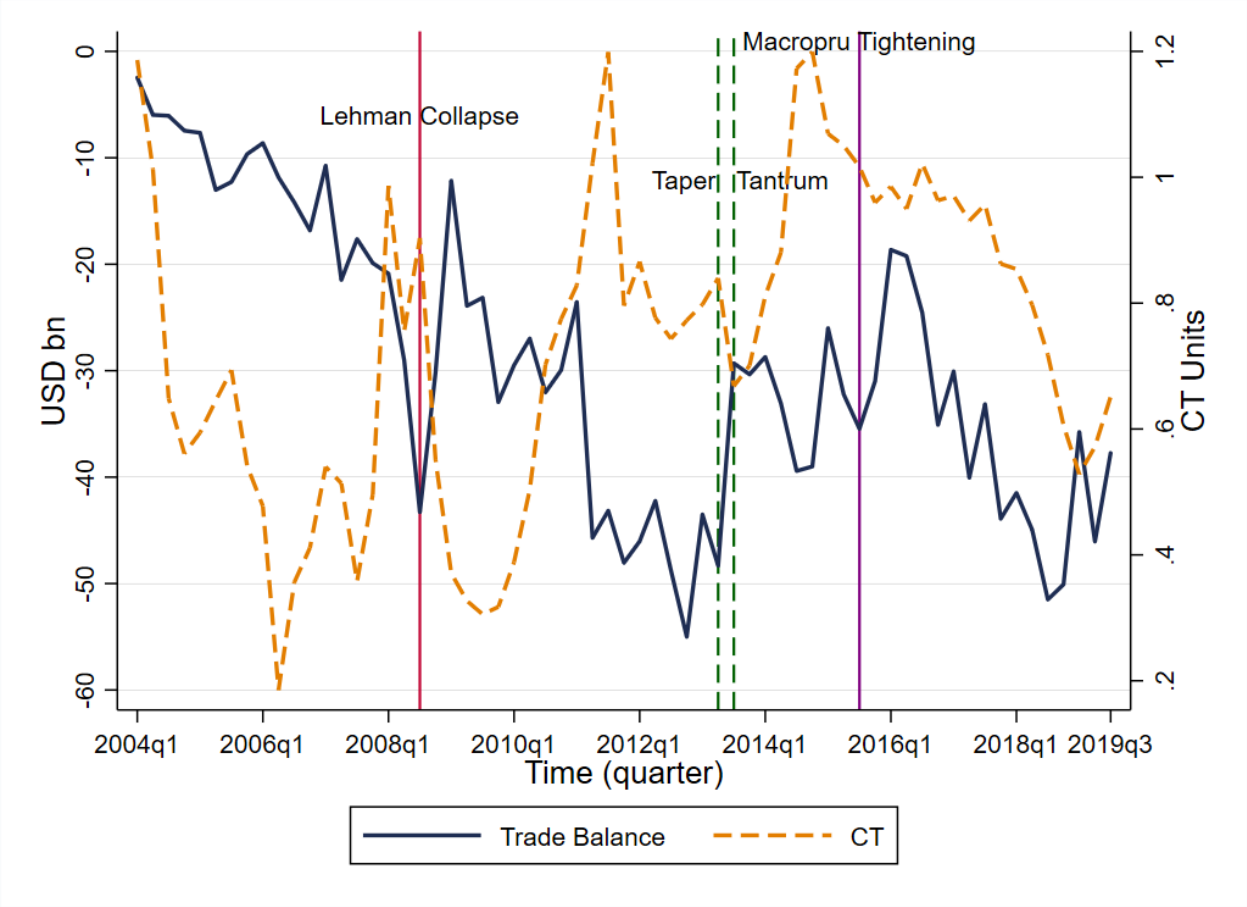


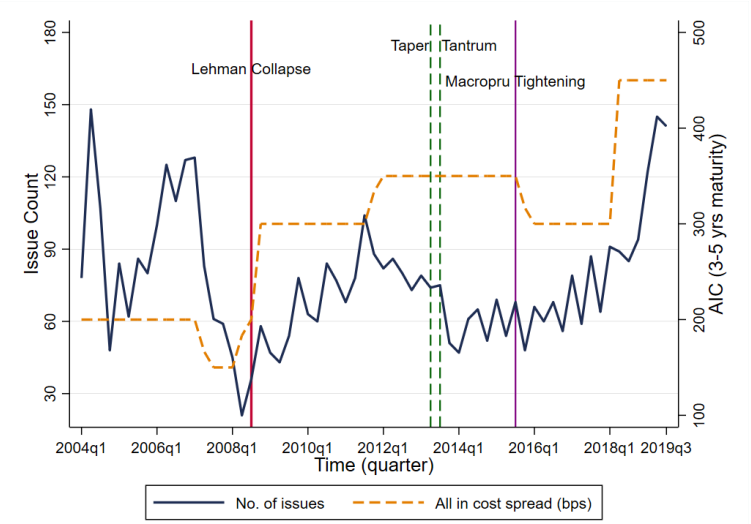
Figure 3: **Carry Trade and Trade Balance**

The first figure plots India's quarterly trade balance, in billions of dollars, against CT, a proxy for the difference in short-term rates between India and the US. CT is defined as the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. The second figure plots quarterly imports and exports, scaled by previous quarter GDP, against CT. The sample period is from Jan 2004 to Sep 2019.

The following table shows the correlation between the monthly CT index and trade balance.

ρ (monthly)	Jan 04-Sep 19	Jan 04-Aug 08	Sep 08-Sep 13	Oct 13-Oct 15	Nov 15-Sep 19
ρ(Trade Bal, CT)	-0.3066	0.0039	-0.5903	-0.4660	0.5461

(a) Max All-In-Cost for Maturity less than 5 years and No. of ECB Issued



(b) Max All-In-Cost for Maturity more than 5 years and No. of ECB Issued

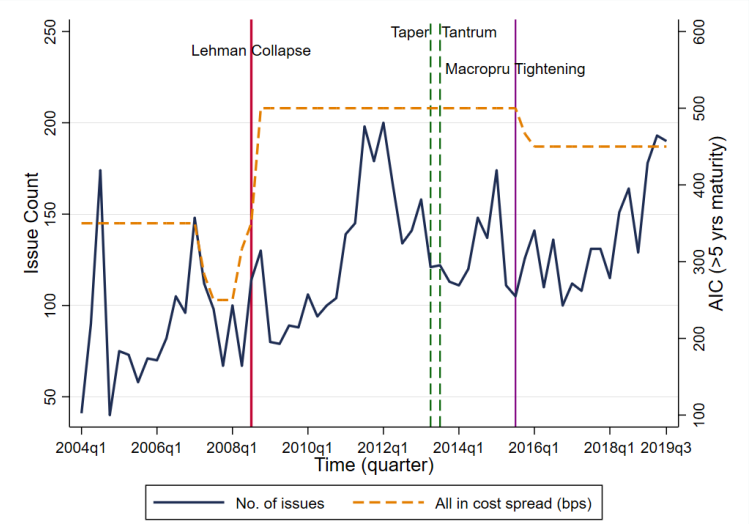


Figure 4: **Macroprudential Policies and ECB Issuance**

The figure graphically depicts the evolution of ECB issuance activity and the maximum permissible all-in-cost (AIC) spread over 6-month LIBOR for ECBs issued. A higher AIC spread is our proxy for looser macroprudential regulation. The sample period is from Jan 2004 to Sep 2019. Figure (a) depicts issuances with maturity less than 5 years. Figure (b) depicts issuances with maturity more than 5 years.

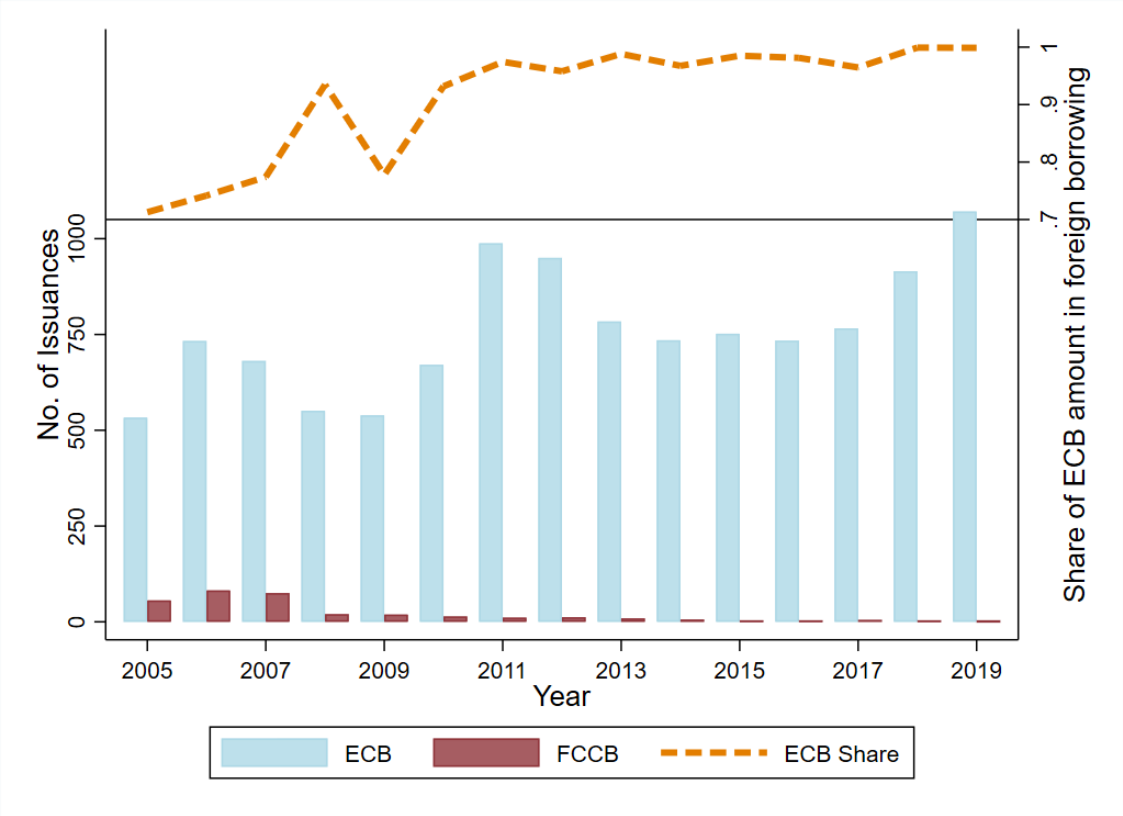
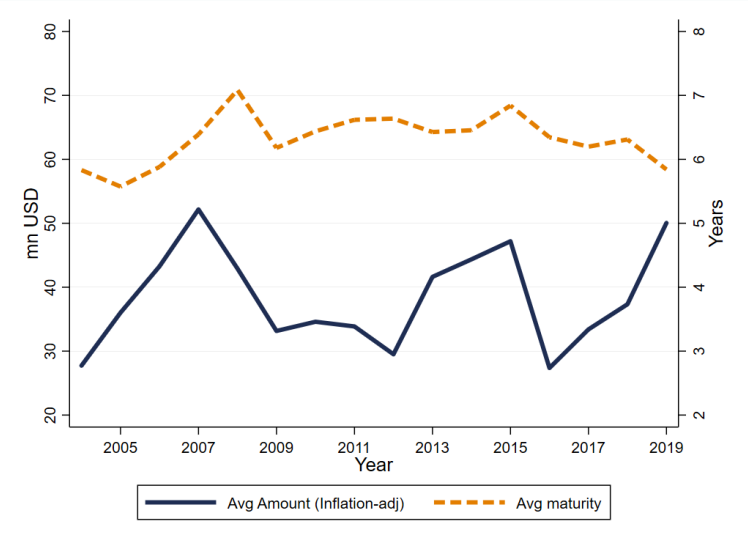


Figure 5: **Bonds vs. Bank debt**

The figure shows the relative importance of bond financing compared to bank debt in the foreign currency borrowing of Indian firms over the period Jan 2005 to Sep 2019. The bars are the number of issues of External Commercial Borrowing (ECB) and Foreign Currency Convertible Bonds (FCCB) in each year while the dashed line captures the percentage of total amount borrowed that is in the form of ECB.

(a) Average amount and maturity of ECB issuance (2004-2019)



(b) Distribution of maturity of ECB Issuances

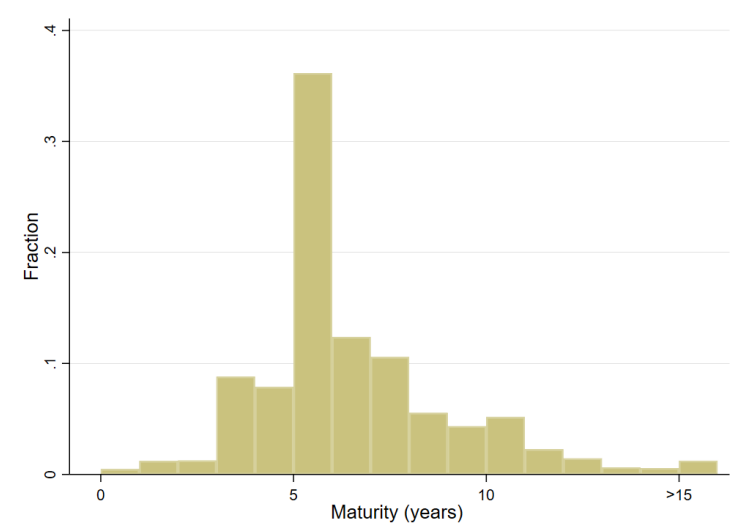


Figure 6: **Characteristics of ECB Issuances**

The figure graphically depicts the salient characteristics of External Commercial Borrowings (ECB) of firms that can be matched to the Prowess database. The sample period is from Jan 2004 to Sep 2019. Figure (a) shows how the inflation-adjusted average issuance amount and maturity vary over time. Figure (b) is a histogram showing the distribution of maturities of the borrowings.

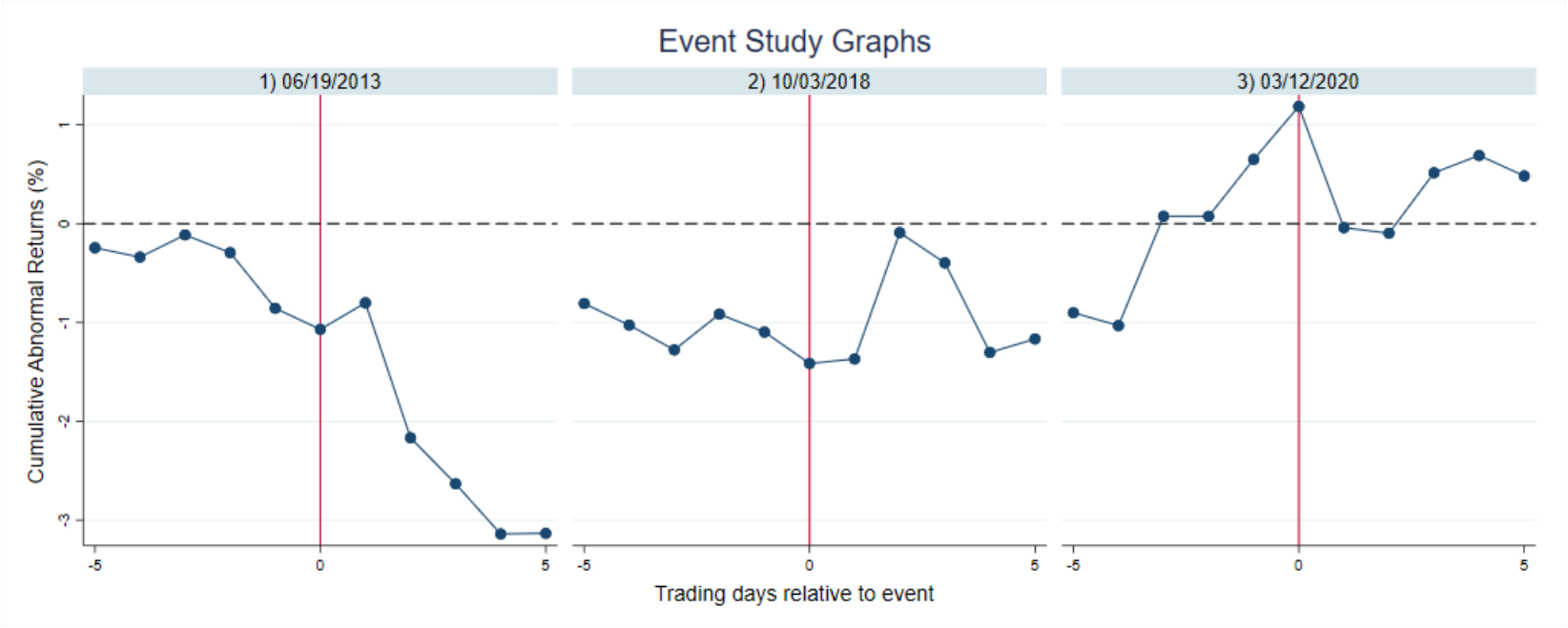


Figure 7: **Event Study: CAR of high CT issuer (top tercile) relative to low CT issuer (bottom tercile)** The figure shows the cumulative abnormal return (CAR) for high CT issuer stocks relative to low CT issuer stocks, for three event dates, from 5 days prior to the event date to 5 days after. June 19, 2013 is a date on which likelihood of tapering went up, October 03, 2018 is a date when the rupee fell sharply owing to a spike in oil prices and March 12, 2020 was the date after the US imposed travel restrictions from Europe owing to the COVID-19 pandemic. A multivariate market model is used for estimation with the NIFTY return proxying for the market return while INRUSD return proxies for FX return. The estimation window is 180 calendar days and ends 5 trading days before the announcement date.

Table 1: **Summary Statistics: ECB and firm characteristics**

Panel A has statistics on the issuance of External Commercial Borrowings (ECB) by Indian corporates as per data from the Reserve Bank of India (RBI). The sample has the 1786 firms that can be matched to the Prowess database and is from Jan. 2004 to Sep. 2019. Panel B has summary statistics on the balance sheet of firms that appear both in Prowess and in the RBI data on ECB. The foreign currency borrowing is as per Prowess. Panel C has daily market returns data and the monthly CT index. The sample period is from Jan 2004 to Sep 2019.

Panel A: ECB Facilities

	N	Mean	Median	St. Dev.	P5	P95
Amount (mn USD)	5,821	59.359	13.000	154.089	0.852	300.000
Maturity (Years)	5,821	6.344	5.500	2.879	3.000	11.417
No. of facilities (per firm)	1,786	3.259	2	4.653	1	10

Panel B: Firm Balance Sheets

	N	Mean	Median	St. Dev.	P5	P95
Total Assets (bn INR)	17,516	26.19	4.57	74.49	0.19	116.64
Cash/Assets	17,510	0.052	0.00	0.31	0.00	0.09
Fixed/Total Assets	17,248	0.354	0.341	0.203	0.038	0.721
Current/Total Assets	17,467	0.377	0.370	0.208	0.044	0.737
Total Debt (bn INR)	16,586	10.18	1.447	29.825	0.036	48.129
Foreign Currency Debt (bn INR)	7,432	4.61	0.719	13.022	0.034	19.845
Long-Term/Total Debt	16,584	0.668	0.727	0.298	0.049	1.000
Foreign Currency/Total Debt	7,432	0.370	0.290	0.291	0.029	0.990
Debt/Assets	16,585	0.372	0.353	0.232	0.037	0.756
Dividends/Total Assets	8,290	-0.016	-0.010	0.020	-0.050	-0.001
Return on Assets	15,560	0.150	0.141	0.132	-0.023	0.367
Exports/Sales (%)	17,401	16.282	2.966	25.586	0.000	80.287
Total Sources$_t$/Total Assets$_{t-1}$	14,313	0.220	0.150	0.337	-0.035	0.644
ECB Amt$_t$/Total Assets$_{t-1}$ (Issue Years)	2,536	0.339	0.096	1.136	0.016	1.004
Other Sources$_t$/Total Assets$_{t-1}$	14,313	0.185	0.136	0.304	-0.090	0.586

Panel C: Returns Data

	N	Mean	Median	St. Dev.	P5	P95
Stock return (%)	1842081	0.072	-0.084	3.180	-4.550	5.028
NIFTY Return (%)	4,021	0.075	0.087	1.421	-2.120	2.132
USDINR Return (%)	4,021	-0.008	0.000	0.419	-0.698	0.618
NIFTY β	1794005	0.857	0.800	0.624	0.058	1.877
FX β	1794005	0.108	0.109	1.867	-1.855	2.039
CT	183	0.745	0.784	0.263	0.322	1.158

Table 2: **Determinants of ECB Issuance: Carry Trade and the post-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *CT*PostCrisis* is the value of *CT* interacted with a dummy that takes the value 1 if the month is between September 2008 and September 2013, and 0 otherwise. *CT*PostTaper* is the value of *CT* interacted with a dummy that takes the value 1 if the month is after September 2013, and 0 otherwise. The INRUSD and NIFTY market returns are included in all specifications. These independent variables are one-month lagged values. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CT	0.351***	0.402***	-0.163	-0.299*	0.357***	0.448***	-0.165	-0.266
	(0.071)	(0.100)	(0.127)	(0.177)	(0.072)	(0.106)	(0.129)	(0.183)
CT*PostCrisis			1.111***	1.258***			1.134***	1.286***
			(0.160)	(0.223)			(0.163)	(0.228)
CT*PostTaper			-0.158	0.009			-0.160	0.004
			(0.210)	(0.305)			(0.213)	(0.314)
FX Return	-0.001	0.006	0.003	0.008	-0.001	0.007	0.003	0.008
	(0.007)	(0.010)	(0.007)	(0.010)	(0.008)	(0.010)	(0.008)	(0.010)
NIFTY return	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
PostCrisis	0.205***	-0.216***	-0.537***	-1.016***	0.209***	-0.122	-0.548***	-0.937***
	(0.049)	(0.063)	(0.113)	(0.155)	(0.050)	(0.079)	(0.116)	(0.165)
PostTaper	-0.219***	-0.981***	0.080	-0.741***	-0.223***	-0.899***	0.081	-0.641**
	(0.063)	(0.081)	(0.175)	(0.254)	(0.064)	(0.115)	(0.178)	(0.282)
Firm Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm FE	No	No	No	No	Yes	Yes	Yes	Yes
Observations	298440	133106	298440	133106	287640	123326	287640	123326
PseudoR^2	0.003	0.034	0.005	0.036	0.004	0.016	0.006	0.018

Table 3: **Carry Trade and Macroprudential Policies in the post-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB in the sample period of Sep 2008 to Mar 2019. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *High AIC* is a dummy that takes the value 1 if the All-in-cost spread was above its sample median for the post-crisis period. *CT*Hi AIC* is the value of *CT* interacted with *High AIC*. The INRUSD and NIFTY market returns are included in all specifications. These independent variables are one-month lagged values. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			
	(1)	(2)	(3)	(4)
CT [β_1]	-2.302***	-2.841***	-2.254***	-2.816***
	(0.284)	(0.399)	(0.276)	(0.372)
High AIC	-2.526***	-2.749***	-2.489***	-3.298***
Spread	(0.246)	(0.346)	(0.239)	(0.356)
CT*Hi AIC	2.870***	3.328***	2.830***	3.668***
Spread [β_2]	(0.296)	(0.418)	(0.288)	(0.405)
FX Return	-0.006	-0.014	-0.006	-0.012
	(0.009)	(0.013)	(0.010)	(0.013)
NIFTY return	-0.002	0.000	-0.003	0.003
	(0.004)	(0.006)	(0.004)	(0.005)
$Pr(\beta_1 + \beta_2 = 0)$	0	0	0	0
Firm Controls	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes
Observations	210566	106014	160147	77801
PseudoR^2	0.006	0.029	0.008	0.021

Table 4: **Carry Trade, Macroprudential Policies and Interest Costs in the post-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB in the sample period of Sep 2008 to Mar 2019. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *High AIC* is a dummy that takes the value 1 if the All-in-cost spread was above its sample median for the post-crisis period. *CT*Hi AIC* is the value of *CT* interacted with *High AIC*. *Int Cost* is the ratio of total interest expense to debt outstanding. The INRUSD and NIFTY market returns are included in all specifications. These independent variables are one-month lagged values. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			
	(1)	(2)	(3)	(4)
CT	0.467***	-2.792***	0.414**	-2.344***
	(0.173)	(0.492)	(0.203)	(0.555)
High Int Cost	-0.229	0.231		
	(0.181)	(0.394)		
Int Cost			-0.020	0.049**
			(0.014)	(0.022)
High AIC Spread		-5.177***		-4.330***
		(0.463)		(0.524)
CT*Hi AIC		3.658***		2.799***
		(0.501)		(0.583)
CT*High Int Cost	0.102	-0.353		
	(0.206)	(0.470)		
CT*Int Cost			0.011	-0.064**
			(0.016)	(0.032)
Hi AIC*High Int Cost		-0.509		
		(0.441)		
Hi AIC*Int Cost				-0.120***
				(0.029)
CT*Hi AIC*High Int Cost		0.478		
		(0.521)		
CT*Hi AIC*Int Cost				0.120***
				(0.037)
Controls	Yes	Yes	Yes	Yes
Year and Firm FE	Yes	Yes	Yes	Yes
Observations	119045	119045	119045	119045
PseudoR^2	0.016	0.047	0.016	0.048

Table 5: **Carry Trade, Macroprudential Policies and Importers in the post-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB in the sample period of Sep 2008 to Mar 2019. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *High AIC* is a dummy that takes the value 1 if the All-in-cost spread was above its sample median for the post-crisis period. *CT*Hi AIC* is the value of *CT* interacted with *High AIC*. *Imp/Raw Mat* is the fraction of raw materials imported by the firm. The INRUSD and NIFTY market returns are included in all specifications. These independent variables are one-month lagged values. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			
	(1)	(2)	(3)	(4)
CT	0.374**	-1.931***	0.415**	-2.094***
	(0.182)	(0.611)	(0.166)	(0.556)
High Imp/RawMat	-0.146	2.084***		
	(0.174)	(0.461)		
Imp/RawMat			-0.002	0.039***
			(0.003)	(0.007)
High AIC Spread		-3.936***		-4.222***
		(0.617)		(0.547)
CT*Hi AIC		2.464***		2.676***
		(0.639)		(0.575)
CT*High Imp/RawMat	0.253	-2.025***		
	(0.194)	(0.529)		
CT*Imp/RawMat			0.005	-0.039***
			(0.003)	(0.009)
Hi AIC*High Imp/RawMat		-2.734***		
		(0.519)		
Hi AIC*Imp/RawMat				-0.052***
				(0.008)
CT*Hi AIC*High Imp/RawMat		2.660***		
		(0.576)		
CT*Hi AIC*Imp/RawMat				0.053***
				(0.009)
Controls	Yes	Yes	Yes	Yes
Year and Firm FE	Yes	Yes	Yes	Yes
Observations	135507	135507	135507	135507
PseudoR^2	0.014	0.046	0.014	0.046

Table 6: **ECB Issuance and other sources of funds**

This table shows results from a OLS regression relating the amount of funds raised through the ECB route to other sources of funds. All observations are at the firm-year level. The dependent variable is $Log(1 + \frac{ECBAmount}{TotalAssets})$ where $ECBAmount$ is the total amount (in INR) that the firm i raised through the ECB route in year t. The independent variable of interest is $Log(1 + \frac{OtherSources}{TotalAssets})$ where we measure other sources of funds as the difference between total sources and the amount raised through ECB in year t. Total sources is the sum of funds from operations, sale of fixed assets, long-term debt issuances, and sale of common and preferred stock. In columns (2) and (5), we include the interaction of $Log(1 + \frac{OthAmount}{TotalAssets})$ with *PostCrisis*, a dummy taking the value 1 in the period from September 2008 to September 2013.We also include the interaction of $Log(1 + \frac{OthAmount}{TotalAssets})$ with *PostTaper*, a dummy taking the value 1 in the period from October 2013 onwards. In columns (3) and (6), we include the interaction of $Log(1 + \frac{OthAmount}{TotalAssets})$ with *Hi AIC*, a dummy taking the value 1 if the max AIC borrowing cost is above its sample median. Year and firm fixed effects are included in all specifications. The sample in the last three columns is restricted to those firm-years in which ECB issuances were made. Standard errors clustered at the firm level are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Log(1+ECB Amt/Total Sources)					
	All firm-years			Issue firm-years only		
	(1)	(2)	(3)	(4)	(5)	(6)
Log(1+Oth Amt/Total Sources)	-0.076***	-0.087***	-0.089***	-0.145***	-0.207***	-0.194***
	(0.008)	(0.011)	(0.010)	(0.034)	(0.045)	(0.038)
Log(1+Oth Amt/Total Sources)*PostCrisis		0.037**			0.123**	
		(0.017)			(0.060)	
Log(1+Oth Amt/Total Sources)*PostTaper		-0.017			0.069	
		(0.019)			(0.070)	
Log(1+Oth Amt/Total Sources)*Hi AIC			0.028*			0.102**
			(0.015)			(0.049)
PostCrisis		-0.019*			-0.040	
		(0.011)			(0.025)	
PostTaper		-0.021			-0.034	
		(0.013)			(0.029)	
High AIC Spread			-0.014*			-0.011
			(0.008)			(0.029)
Year & Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14176	14176	14176	1782	1782	1782
R^2	0.198	0.201	0.200	0.605	0.609	0.609

Table 7: **Firm Outcomes and Carry Trade ECB Issuance in the post-crisis period**

This table shows results from a OLS regression relating firm outcomes to the firm's propensity to issue ECB when the CT index is high. All observations are at the firm-year level. The dependent variable, Y_{it}, can be (i) gross investment (Change in gross fixed assets from year t-1 to t) in year t, (ii) cash holdings at end of year t, (iii) debt at end of year t, and (iv) profits in year t. All dependent variables are scaled by year t assets. In Panel A, the independent variable of interest is the interaction of *PostTaper*, a dummy taking the value 1 in the period from October 2013 onwards with the weighted firm-level CT measure. In Panel B, the independent variable of interest is the interaction of *Hi AIC*, a dummy taking the value 1 if the max AIC borrowing cost is above its sample median with the weighted firm-level CT measure. We include only firms that issue at least 4 times. Industry-Year and firm fixed effects are included in all specifications. Standard errors clustered at the firm level are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

Panel A: Post-taper

	Investment		Cash		Leverage		ROA	
Post-Taper × Hi Firm CT	-0.038*		-0.025***		0.023		0.006	
	(0.020)		(0.008)		(0.020)		(0.010)	
Post-Taper × Firm CT		-0.145**		-0.071**		0.085		0.010
		(0.066)		(0.028)		(0.059)		(0.028)
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3007	3007	3191	3191	3190	3190	3021	3021
R^2	0.288	0.289	0.470	0.470	0.657	0.657	0.515	0.515

Panel B: Impact of Macroprudential policies

	Investment		Cash		Leverage		ROA	
Hi AIC × Hi Firm CT	0.032*		0.025***		-0.021		-0.006	
	(0.019)		(0.010)		(0.020)		(0.010)	
Hi AIC × Firm CT		0.113		0.087**		-0.108		-0.017
		(0.070)		(0.040)		(0.076)		(0.031)
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3007	3007	3191	3191	3190	3190	3021	3021
R^2	0.288	0.288	0.470	0.470	0.657	0.657	0.515	0.515

Table 8: **Forward looking β and ECB issuance**

The table has results from the OLS estimation of the following equation:

$$FX\beta_{it} = \alpha + \beta_1 Issue_{i,t-1} + \nu_t + \eta_i + \varepsilon_{it}$$

The dependent variable is the β estimated for firm i from the market model in a 60-month trading window starting in month t . The independent variable is a dummy that takes value 1 if firm i made an ECB issuance in month $t-1$. Fixed effects are as indicated. The sample period is from Jan 2004 to Sep 2019. Standard errors clustered at both firm and time level are reported in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	β (forward looking)					
	FX			NIFTY		
Issue	-0.026	-0.081**	-0.069**	0.010	0.026	0.024
	(0.020)	(0.035)	(0.030)	(0.012)	(0.017)	(0.015)
Issue*PostCrisis		0.118**			-0.030	
		(0.049)			(0.025)	
Issue*PostTaper		-0.051			-0.015	
		(0.166)			(0.067)	
Issue*Hi AIC			0.100**			-0.032
			(0.048)			(0.026)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.161	0.161	0.161	0.203	0.203	0.203
Obs.	62,431	62,431	62,431	62,431	62,431	62,431

Table 9: β **and ECB issuance by CT measure and Interest Cost**

The table has results from the OLS estimation of the following equation:

$$FX\beta_{it} = \alpha + \beta_1 Issue_{i,t-1} + \nu_t + \eta_i + \varepsilon_{it}$$

The dependent variable is the β estimated for firm i from the market model in a 60-month trading window starting in month t . The independent variable is a dummy that takes value 1 if firm i made an ECB issuance in month $t-1$. In Panel A, the dependent variable of interest is based on the weighted average value of the CT measure at the time of issuance. The sample in this panel only includes firms with at least 4 issuances over the sample period. In Panel B, the dependent variable of interest is based on the firm's implied interest cost.Fixed effects are as indicated. The sample period is from Jan 2004 to Sep 2019. Standard errors clustered at both firm and time level are reported in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

Panel A: Firm CT

	β (forward looking)			
	Low CT Index Issuers		High CT Index Issuers	
	FX β	NIFTY β	FX β	NIFTY β
Issue	0.051	-0.009	-0.123**	0.043
	(0.037)	(0.020)	(0.053)	(0.031)
Issue*Hi AIC	-0.076	0.015	0.135	-0.087
	(0.071)	(0.035)	(0.088)	(0.059)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2	0.338	0.427	0.316	0.429
Obs.	13,157	13,157	9,092	9,092

Panel B: Interest Cost

	β (forward looking)			
	Low Int Cost Firms		High Int Cost Firms	
	FX β	NIFTY β	FX β	NIFTY β
Issue	-0.016	-0.020	-0.123***	0.061**
	(0.037)	(0.017)	(0.045)	(0.024)
Issue*Hi AIC	0.032	0.026	0.133*	-0.088
	(0.060)	(0.028)	(0.070)	(0.060)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2	0.442	0.516	0.132	0.145
Obs.	29,013	29,013	27,339	27,339

Table 10: **Event Study of taper and post-taper events: CT measure and Interest Costs**

The sample consists of companies which are present in the ECB issuance data and for which stock return data is available to estimate the model. A multivariate market model is used for estimation with the NIFTY return proxying for the market return while INRUSD return proxies for FX return. The estimation window is 180 calendar days and ends 5 calendar days before the announcement date. In the event study, cumulative abnormal return (CAR) is calculated over 5 trading days post the event date. June 19, 2013 is a date on which likelihood of tapering went up, October 03, 2018 is a date when the rupee fell sharply owing to a spike in oil prices and March 12, 2020 was the date after the US imposed travel restrictions from Europe owing to the COVID-19 pandemic. The returns are in percentage points. In Panel A, firms are sorted into terciles based on the weighted average value of the CT measure at the time of issuance. The sample in this panel only includes firms with at least 4 issuances over the sample period. In Panel B, firms are sorted into terciles based on their implied interest cost. Robust standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

Panel A: Firm CT

	CAR[0,3]		
	06/19/13	10/03/18	03/12/20
Low CT Issuer	-0.202	2.780*	-0.669
	(1.048)	(1.455)	(1.353)
Mid CT Issuer	-0.897	0.761	-0.837
	(0.606)	(0.907)	(1.403)
High CT Issuer	-2.154***	3.400***	-0.433
	(0.572)	(0.721)	(1.218)
Pr(H-L==0)	.0916	.6823	.8975
Observations	184	173	168
R^2	0.055	0.106	0.004

Panel B: Interest Cost

	CAR[0,3]		
	06/19/13	10/03/18	03/12/20
Low Int Cost	-0.500	1.805***	-2.614***
	(0.393)	(0.541)	(0.812)
Mid Int Cost	-0.472	3.314***	-0.432
	(0.532)	(0.545)	(0.802)
High Int Cost	-0.900**	3.522***	-1.707**
	(0.449)	(0.660)	(0.751)
Pr(H-L==0)	.502	.0451	.4133
Observations	439	474	474
R^2	0.013	0.142	0.033

Internet Appendix

A1 FPI Debt and Rupee-Denominated Bonds

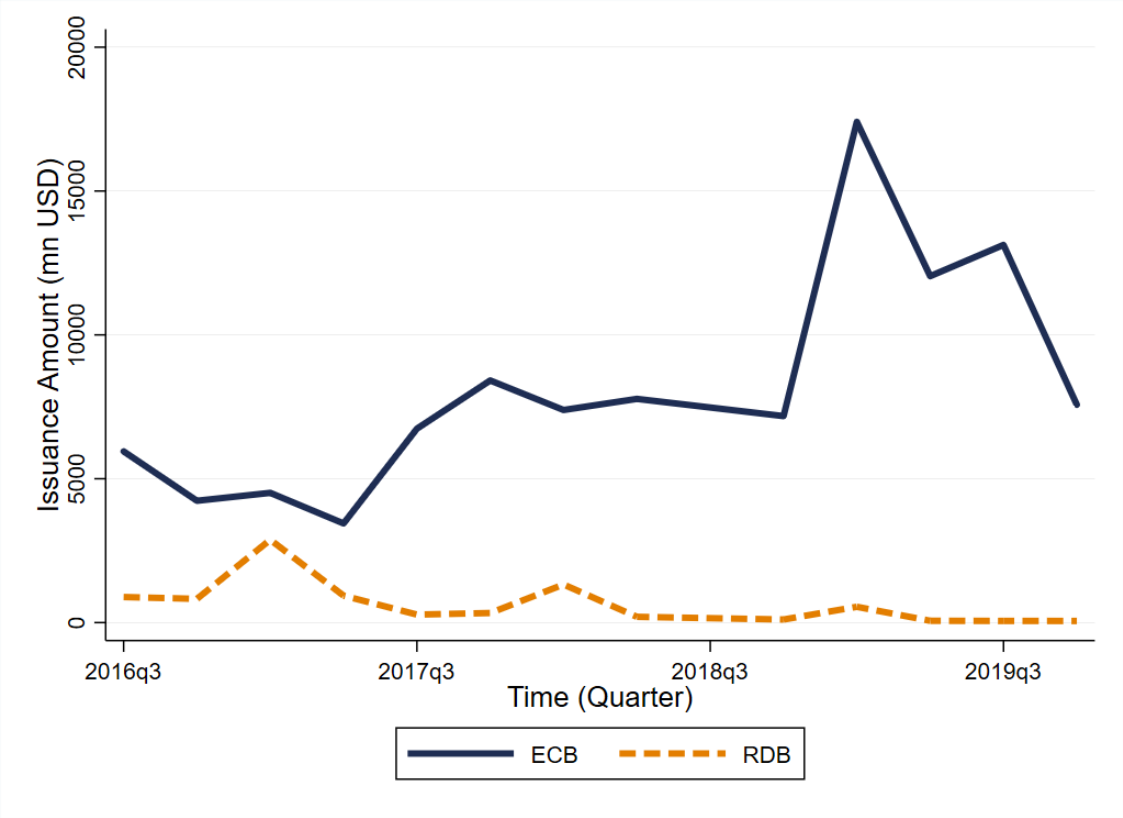
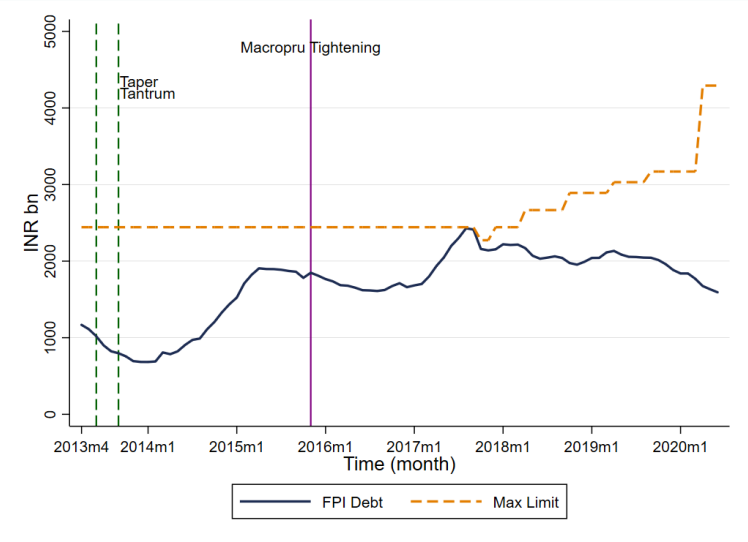


Figure A.1: **External Commercial Borrowings and Rupee-Denominated Bonds** The figure shows the evolution of the issuance of External Commercial Borrowings (ECB) and Rupee-Denominated Bonds (RDB) for the period September 2016 to December 2020.

(a) FPI Debt Stock and Maximum Limits



(b) Net FPI Debt Flows

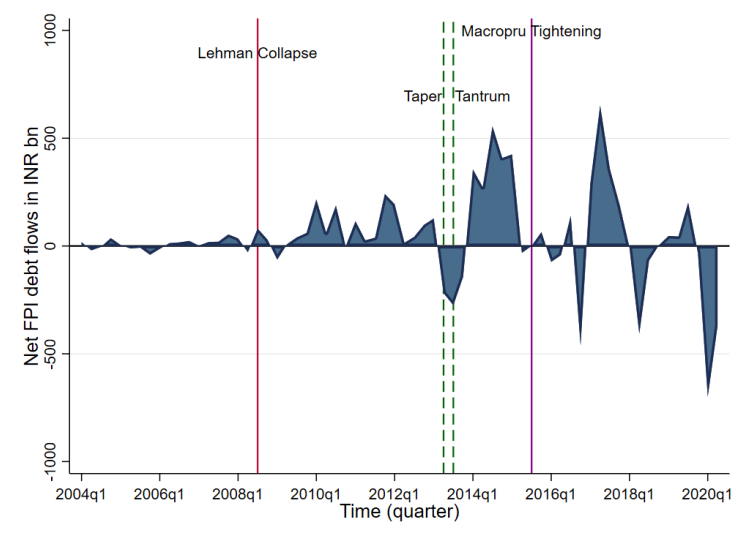


Figure A.2: **Foreign Portfolio Investor Debt Holdings and Flows**
The figure graphically depicts the evolution of the stock and flows of Foreign Portfolio Investor (FPI) positions in domestic corporate debt. Figure (a) depicts the stock of FPI debt holdings along with the maximum regulatory limits monthly from April 2013 to June 2020. Figure (b) depicts net FPI debt flows quarterly from January 2004 to June 2020.

A2 Macroprudential policies in the Pre-Crisis Period

Table B.1: **Carry Trade and Macroprudential Policies in the pre-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB in the sample period of Jan 2004 to Aug 2008. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *High AIC Spread (Pre-crisis)* is a dummy that takes the value 1 if the All-in-cost spread was above its sample median for the pre-crisis period from Jan 2004 to Aug 2008. *CT*Hi AIC* is the value of *CT* interacted with *High AIC Spread (Pre-crisis)*. The INRUSD and NIFTY market returns are included in all specifications. These independent variables are one-month lagged values. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			
	(1)	(2)	(3)	(4)
CT [β_1]	-0.041	-0.015	-0.043	-0.071
	(0.234)	(0.293)	(0.243)	(0.298)
High AIC	0.007	0.408*	0.007	0.209
Spread (Pre-crisis)	(0.174)	(0.228)	(0.180)	(0.238)
CT*Hi AIC	-0.221	-0.514	-0.228	-0.446
Spread [β_2]	(0.278)	(0.374)	(0.288)	(0.391)
FX Return	-0.015	0.015	-0.016	0.013
	(0.017)	(0.026)	(0.018)	(0.027)
NIFTY return	-0.002	-0.001	-0.002	-0.003
	(0.004)	(0.006)	(0.004)	(0.006)
$Pr(\beta_1 + \beta_2 = 0)$	.1038	.0298	.1031	.0446
Firm Controls	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes
Observations	87874	27092	37047	14486
PseudoR^2	0.001	0.039	0.001	0.003

Table B.2: **Carry Trade, Macroprudential Policies and Interest Costs in the pre-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB in the sample period of Jan 2004 to Aug 2008. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *High AIC Spread (Pre-crisis)* is a dummy that takes the value 1 if the All-in-cost spread was above its sample median for the pre-crisis period from Jan 2004 to Aug 2008. *Int Cost* is the ratio of total interest expense to debt outstanding. One-month lagged INRUSD and NIFTY market returns are included in all specifications. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			
	(1)	(2)	(3)	(4)
CT	1.662***	2.402***	1.789***	2.395***
	(0.381)	(0.479)	(0.415)	(0.486)
High Int Cost	0.644***	0.536		
	(0.249)	(0.366)		
Int Cost			0.043**	0.035
			(0.017)	(0.025)
High AIC Spread (Pre-crisis)		1.093***		0.990**
		(0.356)		(0.412)
CT*Hi AIC		-1.437***		-1.102*
		(0.553)		(0.668)
CT*High Int Cost	-0.612	-0.268		
	(0.384)	(0.525)		
CT*Int Cost			-0.050*	-0.017
			(0.028)	(0.030)
Hi AIC*High Int Cost		0.247		
		(0.434)		
Hi AIC*Int Cost				0.027
				(0.036)
CT*Hi AIC*High Int Cost		-0.655		
		(0.730)		
CT*Hi AIC*Int Cost				-0.079
				(0.061)
Controls	Yes	Yes	Yes	Yes
Year and Firm FE	Yes	Yes	Yes	Yes
Observations	19290	19290	19290	19290
PseudoR^2	0.014	0.017	0.013	0.016

Table B.3: **Carry Trade, Macroprudential Policies and Importers in the pre-crisis period**

This table shows results from a logistic regression used to predict the issuance of ECB in the sample period of Jan 2004 to Aug 2008. All observations are at the firm-month level. The dependent variable takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the US scaled by the implied volatility of 3-month FX options. *High AIC Spread (Pre-crisis)* is a dummy that takes the value 1 if the All-in-cost spread was above its sample median for the pre-crisis period from Jan 2004 to Aug 2008. *CT*Hi AIC* is the value of *CT* interacted with *High AIC*. *Imp/Raw Mat* is the fraction of raw materials imported by the firm. One-month lagged INRUSD and NIFTY market returns are included in all specifications. Firm-level controls include debt to asset ratio, ratio of exports to sales, and cash to asset ratio. These are measured at the end of the previous fiscal year. Firm clustered standard errors are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			
	(1)	(2)	(3)	(4)
CT	1.194***	2.080***	1.196***	2.182***
	(0.300)	(0.443)	(0.278)	(0.420)
High Imp/RawMat	-0.068	-0.126		
	(0.251)	(0.360)		
Imp/RawMat			-0.002	-0.000
			(0.005)	(0.007)
High AIC Spread (Pre-crisis)		0.772**		0.876***
		(0.332)		(0.306)
CT*Hi AIC		-1.179**		-1.323***
		(0.510)		(0.473)
CT*High Imp/RawMat	0.347	0.283		
	(0.305)	(0.501)		
CT*Imp/RawMat			0.009	0.002
			(0.005)	(0.010)
Hi AIC*High Imp/RawMat		0.088		
		(0.390)		
Hi AIC*Imp/RawMat				-0.003
				(0.007)
CT*Hi AIC*High Imp/RawMat		0.095		
		(0.620)		
CT*Hi AIC*Imp/RawMat				0.009
				(0.012)
Controls	Yes	Yes	Yes	Yes
Year and Firm FE	Yes	Yes	Yes	Yes
Observations	27794	27794	27794	27794
PseudoR^2	0.016	0.018	0.016	0.018

A3 ECB Maturity Dates and Exchange Rates

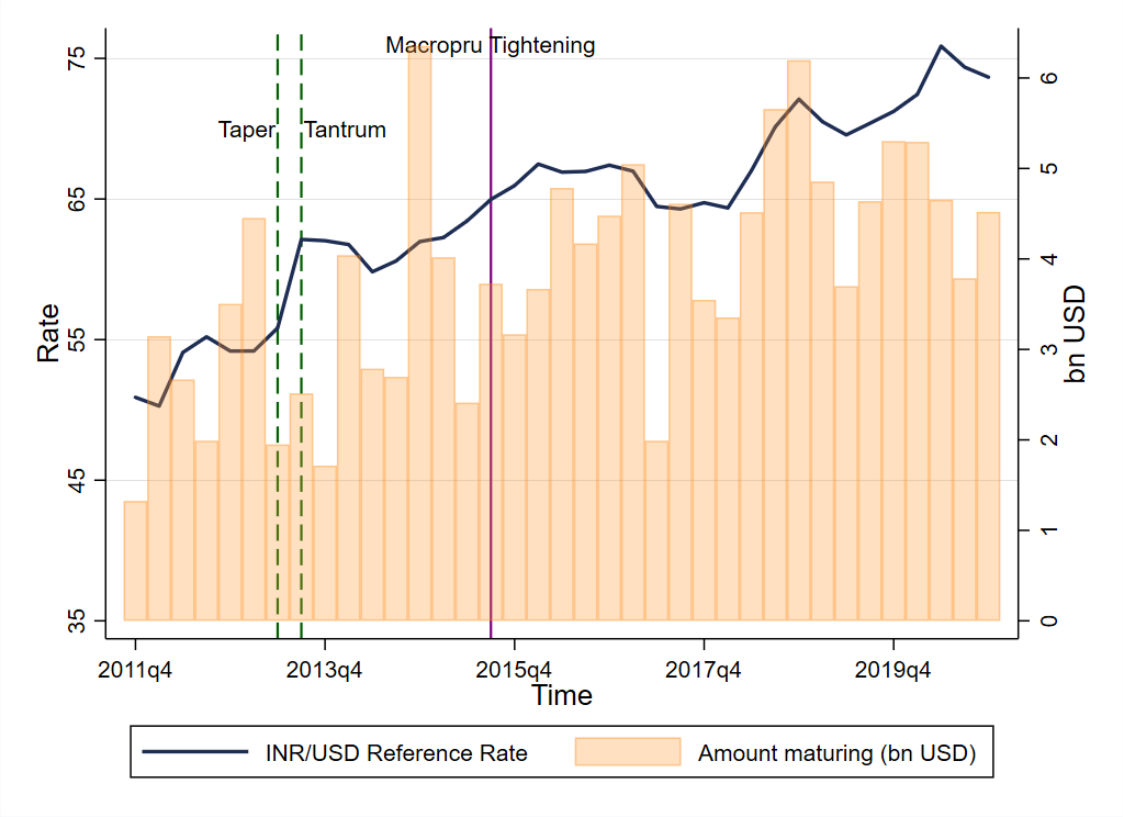


Figure C.3: **ECB Maturity Dates and INR/USD Exchange Rate**
The line shows the evolution of the INR/USD Reference Rate while the bars indicate the issuance volume of ECBs due to mature in that quarter. The figure covers the period from the third quarter of 2011 (three years after the financial crisis) to the fourth quarter of 2020.

Table C.4: **ECB Maturity Dates and Exchange Rates**

This table shows results from an ordinary least squares regression used to predict exchange rates. All observations are at the monthly level. The dependent variable is the change in the log of the USD/INR reference rate multiplied by 100. The independent variable is the change in the log of ECB issuances due to mature in that month. The sample period is from September 2011 (three years after the financial crisis) to September 2020. Newey-West standard errors with four lags are in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Δ Log (Exch Rate) ($\times$ 100)		
Δ Log (Amt. Maturing)	-0.419***		
	(0.156)		
Δ Log (Amt. Maturing issued Post-crisis)		-0.331*	
		(0.168)	
Δ Log (Amt. Maturing issued Post-taper)		-0.027***	
		(0.007)	
Δ Log (Amt. Maturing Issued Hi AIC)			-0.392**
			(0.157)
Δ Log (Amt. Maturing Issued Lo AIC)			-0.018
			(0.011)
Constant	-0.354**	-0.355**	-0.353**
	(0.175)	(0.176)	(0.176)
F-Stat	7.187	10.582	4.854
Obs.	109	109	109