Regulating Carry Trades: Evidence from Foreign Currency Borrowing of Corporations in India

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Abstract

We establish that macroprudential controls limiting capital flows can curb risks arising from foreign currency borrowing by corporates in emerging markets. Firm-level data show that Indian firms tend to issue more foreign currency debt when the interest rate differential between India and the United States is higher. This "carry trade" relationship, however, breaks down once regulators institute more stringent interest rate caps on borrowing; in response, riskier borrowers cut issuance most. Prior to adoption of this macroprudential measure, stock price exposure of issuers to currency risk rises after issuance, as witnessed during the "taper tantrum" episode of 2013; this source of vulnerability is nullified by the measure, as confirmed during the October 2018 oil price shock and the COVID-19 outbreak. We find no evidence of the policy's efficacy being undermined by leakage or regulatory arbitrage.

Keywords: emerging markets; foreign currency debt; foreign exchange risk; taper tantrum; capital controls

JEL Codes: F31; F34; G15; G30

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Foreign currency borrowing is an increasingly popular source of funding for non-financial firms in emerging market economies (EMEs). According to Bank for International Settlements statistics, the stock of foreign currency debt securities of EME non-financial corporations grew more than tenfold between 2001 and 2019.[1] The traditional view has been that borrowing abroad allows firms with revenues in foreign currency to access deeper international funding markets while the sales provide a natural hedge for the debt. However, following the Global Financial Crisis (GFC), favorable funding conditions have prompted non-financial corporates, including those without foreign currency revenues, to engage in a form of "carry trade", where they borrow cheaply abroad and park those funds as short-term wholesale deposits in domestic banks (Bruno and Shin, 2017). This carry trade is profitable if firms are able to unwind, i.e., pay off the debt, before the currency depreciates.

However, the magnitude of this carry trade debt leaves the borrowing firms exposed to adverse exchange rate movements – such as during a "sudden stop" – especially since these liabilities are in foreign currency. As these borrowers tend to be large local firms, increased foreign currency borrowing has potentially adverse implications for domestic growth and stability of the local financial sector when external sector risks materialize.[2]

With a view to control these incipient risks, many EMEs significantly strengthened their capital flow management and other macroprudential tools (IMF, 2020). The International Monetary Fund recently revised its Institutional View to recognize the importance of these preemptive tools in ameliorating risks (IMF, 2022). Theoretical work including Brunnermeier and Sannikov (2015), Korinek (2018), and Acharya and Krishnamurthy (2019) analyze such tools and suggest that – in the spirit of Pigouvian taxation – firms contributing more to the fire-sale externality in the case of a sudden stop should be taxed more (e.g., be subjected to stronger capital controls).[3] However, the effectiveness of such tools may be limited if risky borrowers are able to evade them (Ahnert et al., 2021).

Ultimately, the efficacy of macroprudential policy in regulating carry trade borrowing is an empirical question. While existing work has focused on the causes (Gutierrez, Ivashina and Salomao (2023), di Giovanni et al. (2021)) and consequences (Bruno and Shin (2017), Bruno and Shin (2020)) of corporate carry trade borrowing, in this paper we seek to evaluate the regulatory response by analyzing the impact of a specific macroprudential policy tool targeted at limiting foreign currency borrowing. By regulation, Indian firms can only borrow in foreign currency if the all-in-cost interest rate of the borrowing is below a certain spread over the 6-month LIBOR rate. India's central bank, the Reserve Bank of India (RBI) sets the maximum

[1]See 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 (2022) for a discussion of the potential risks posed by increased corporate foreign currency borrowing.

[3]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.

allowable spread for the interest rate on the debt. Policy is tightened (loosened) by decreasing (increasing) the maximum interest rate spread. We focus on this specific policy lever since, as theory recommends, it explicitly targets riskier borrowers, and variation in the maximum rate during our sample period allows us to identify effects on firm borrowing, operations, and risk.

To carry out our analysis, we employ detailed borrowing, accounting, and market data on Indian firms from 2004 to 2020. We construct a comprehensive sample of firms that borrow in foreign currency, both through bonds and bank loans. This sample is unique in the literature since over 90% of the borrowing is through banks; in contrast, existing studies of foreign currency borrowing rely exclusively on bond issues (Bruno and Shin (2017), Bruno and Shin (2020)).

We start by confirming that the carry trade behavior of corporations plays an important role in explaining foreign currency borrowing. The *same* firm is more likely to issue debt in foreign currency when the difference in short-term interest rates between India and the United States is higher. In particular, the CT index, our proxy for the profitability of the carry trade, defined as the difference between Indian and U.S. 3-month interest rates scaled by the implied volatility of 3-month FX options (i.e., $\frac{3Mrate(IND)-3Mrate(US)}{IVof3MFXoptions}$), has a strong positive relationship with a firm's propensity to issue foreign currency debt even after controlling for firm fixed effects. This phenomenon is driven by the period immediately following the GFC.[4] 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,[5] it is these carry trade borrowers that perform the most poorly. Can this source of vulnerability be nullified or mitigated by regulation of carry trades?

To answer this, we turn to our primary contribution – an analysis of how macroprudential policy affects carry trade borrowing. We show that the relationship between foreign currency debt issuance and the CT index is positive only when macroprudential policy is loose. When policy is tightened, i.e., the maximum interest rate spread allowed in foreign currency borrowing is reduced below its sample median, the relationship is no longer positive. This correlation suggests that the CT index stops being relevant at the same time that controls are strengthened. The magnitude of the effect is large – a one standard deviation increase in the CT index is associated with a 38% lower probability of foreign currency debt issuance when policy is tight compared to when it is loose. While suggestive, these results are merely correlational; the change in the maximum interest rate spread may not be exogenous and can simply be a reaction to corporate borrowing in the foreign currency debt market. At the same time, firm demand for

[4]Prior research has documented that, globally, the carry trade explains foreign currency borrowing in the period of unconventional U.S. monetary policy following the GFC (Bruno and Shin, 2017). Hence, we focus on this period in the bulk of our analysis.

[5]The "taper tantrum" refers to a period of turmoil in financial markets in 2013 precipitated by U.S. Federal Reserve statements that were seen to increase the probability of the tapering of the quantitative easing program. Emerging markets, in particular, saw a surge of capital outflows and asset price declines (Sahay et al., 2014).

foreign currency debt might have declined overall, further complicating inference.

In order to pin down the causal role of the macroprudential policy in curtailing borrowing, we turn to a difference-in-differences (DID) analysis. In November 2015, the RBI undertook a major tightening of regulation around corporate foreign currency borrowing with the first reduction in the interest rate cap since the GFC. The cap was reduced from 500 basis points (bps) to 450 bps above 6-month LIBOR. We expect that firms who had previously borrowed at spreads between 450 and 500 bps over 6-month LIBOR should be the most affected. To identify these 'treated' firms and the other 'control' firms, we need marginal borrowing costs on foreign currency debt. While our base data does not contain this information, we collect interest rate spreads on a sub-sample of foreign currency debt and match it to our base sample. In cases where we do not have a marginal borrowing rate, we predict the borrowing rate from the firm's overall interest expense. We justify this based on the empirical observation that there is a strong, stable positive linear relationship between the overall interest expense and the marginal foreign currency borrowing rate for the borrowers for which we have the latter information.

Our DID analysis shows that 'treated' firms had a significantly lower (40-50%) propensity to issue foreign currency debt following the change in the interest rate cap, compared to control firms. This result holds whether we use all 'untreated' firms as control firms or just those that borrowed at rates below 450 bps in the period before the policy change. Importantly, an analysis of dynamic effects suggests that treated and control firms had parallel trends prior to treatment, a necessary condition for the validity of the DID research design. The negative effect on borrowing for treated firms manifests almost immediately after the change in interest rate cap, suggesting the cap is the binding constraint on borrowing.

The preceding results indicate that the macroprudential policy is successful in altering the composition of foreign currency borrowers from riskier to safer borrowers. However, a lingering concern with macroprudential regulation is that the risk is not eliminated but merely shifted elsewhere (Ahnert et al., 2021). We rule out three important ways in which firm actions might render the policy change less effective. First, the reduction in interest rate caps might push firms that are still able to borrow to shorten the maturity of their borrowing thereby increasing their rollover risk. We directly test if this is the case by looking at the effect of the interest rate caps on maturity of issuance. This intensive margin analysis shows that issuance maturity does not decline when policy is tightened.

Second, firms newly excluded from foreign currency bond and loan markets might turn to trade credit denominated in foreign currency instead. This is potentially harmful as trade credit is generally of a much shorter maturity than bank and bond debt leaving firms still exposed to sudden stops. We find that there are no statistically significant changes in overall trade credit outstanding for riskier borrowers following macroprudential tightening.[6] This result ameliorates

[6] Though we do not have the currency composition of trade credit, when we restrict our analysis to firms

the worry that the macroprudential policy pushes riskier borrowers to employ an even riskier source of financing – foreign currency trade credit.

Finally, we look at changes in domestic currency debt. Since this debt is often held by foreign portfolio investors, firms might be substituting away the foreign exchange risk with the risk of fickle capital flows. Our results indicate that debt in domestic currency does not increase following the policy change. This is consistent with the carry trade hypothesis as firms undertake foreign currency borrowing to take advantage of favorable financing costs (Du and Schreger, 2016) and not because of limited availability of domestic currency debt. Once macroprudential policy puts a brake on carry trade borrowing, these firms do not turn to domestic markets as an alternate source of financing.

In addition, we rule out the concern that macroprudential regulation only alters the source of risk rather than alleviating it by testing how macroprudential policy affects overall firm-level risk. We construct a stock market-based measure of a corporation's foreign exchange rate exposure, i.e., an FX β. A positive value indicates a positive correlation between the firm's stock market return and the Indian Rupee's performance relative to the U.S. Dollar, or conversely, a negative average reaction to a Rupee depreciation. When macroprudential policy is loose, the FX β of riskier firms – carry trade borrowers and high interest expense firms – rises immediately after they issue foreign currency debt, indicating that the firms do not totally hedge the new risk exposure. This effect is larger when the issuance is accompanied by a larger increase in the share of foreign currency debt in the firm's total debt. However, when policy is tightened, we find there is no longer a statistically significant increase in firm FX β following the issuance of foreign currency debt. This indicates that the issuance-driven increase in risk is alleviated, even nullified, when policy is tightened to allow access only to safer 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, 2021) during a time when capital controls were looser. The results of our event study show that carry trade borrowers are more adversely affected during the taper tantrum 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 the most vulnerable during times of stress.

We complement the taper tantrum event study with an analysis of two periods of market stress that arose when capital controls were tight. The first period of market stress was in October 2018 when there was a sudden depreciation in the Indian Rupee and a spurt of outflows due primarily to an increase in oil prices in anticipation of sanctions on Iran. The second period

with high imports, that is, firms more likely to have trade credit denominated in foreign currency, we again find no changes in trade credit utilization.

of market stress was in February 2020 when global markets were roiled by the uncertainty caused by the COVID-19 pandemic. Our analysis of market reactions to both these events suggests that carry trade borrowers are no longer more vulnerable than other issuers during stress periods.

The preceding results are robust to several alternate explanations and specifications. The pre-GFC period serves as a placebo time period for our analysis. Since the carry trade did not explain foreign currency borrowing in this period, we would not expect the interest rate caps to affect borrowing which is exactly what we find. Defining the CT index as the raw difference of short-term interest rates does not alter the significance of any results ruling out volatility in the foreign exchange market being spuriously responsible for our results. We include controls for size, leverage, exports, and cash holdings to control for time-varying firm-level demand for foreign currency debt.

Finally, we turn to the real effects of the foreign currency borrowing and ensuing policy action. A use-of-funds analysis indicates that carry trade borrowers use the raised funds to increase cash holdings, as predicted by the carry trade hypothesis Bruno and Shin (2017). Once macroprudential policy restricts these firms' access to the foreign currency debt market, the cash holdings decline. While return on assets are unaffected, the previously documented reduction in risk (FX β) points to an improvement in risk-adjusted outcomes. Though we do not attempt a complete welfare analysis, these results are overall supportive of the conclusion that policy changes to regulate financial carry trades by corporations in foreign currency borrowing worked as intended and mitigated attendant risks.

Our results are related to recent work by Das, Gopinath and Kalemli-Özcan (2021) who show that preemptive capital flow management measures reduced the vulnerability of emerging markets during the taper tantrum and COVID-19 market shocks. While the papers have similar objectives, the approaches are complementary. Das, Gopinath and Kalemli-Özcan (2021) use a cross-country panel approach and study the impact of capital flow management policies on external financing costs and exchange rates at the country level. We, on the other hand, undertake a micro-level analysis of firm issuance behavior to document the causal mechanism through which macroprudential policy works. Our results indicate, as suggested by theory, that the targeting of riskier corporate carry trade borrowers leads to a reduction in their debt issuance, making them less vulnerable to negative external shocks.

The rest of the paper proceeds as follows: Section 1 links our analysis to existing literature; Section 2 provides context on foreign currency borrowing by Indian corporations; Section 3 describes the data and summary statistics; Section 4 focuses on the carry trade motive for foreign currency borrowing; Section 5 studies the efficacy of macroprudential policy changes; Section 6 measures the change in market risks due to foreign currency borrowing; Section 7 analyzes the use of funds raised by corporations; and Section 8 concludes.

1 Related Literature

Our results fit into a burgeoning literature on the risks to local growth and financial stability from the worsening external debt position of the corporate sector in EMEs. Du and Schreger (2022) show, in a cross-country setting, that higher corporate foreign currency borrowing is associated with higher sovereign default risk. A set of related papers do firm-level analyses to distinguish between 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 when the (financial) carry trade is more profitable.[7] The profitability of the carry trade is a failure of the uncovered interest rate parity (UIP) condition. Potential explanations in terms of corporate dollar borrowing include household dollar deposit demand (Gutierrez, Ivashina and Salomao, 2023) and borrowing costs for banks (di Giovanni et al., 2021). Caballero, Panizza and Powell (2015) show that the corporate carry trade motive is concentrated in countries with higher capital controls on inflows, i.e., regulatory arbitrage is driving this behavior since non-financial firms are better able to circumvent capital controls. We contribute by analyzing the consequences of macroprudential policy targeted at these non-financial carry trade borrowers.

Most of the above papers focus on dollar bond issuance. We collect issuance data from India's central bank which allows us to study both bank and bond financing. The vast majority of issuance by firms in our sample is through bank loans. Since firms with access to bond markets tend to be larger, our study covers a more representative sample of 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 in large EMEs through the bank lending channel. Relatedly, Cao and Dinger (2022) analyze international bank lending of Norwegian banks and document the importance of global financial factors. We complement their analysis by documenting how recipients of these foreign currency bank loans are affected. Since the richness of our data allows us to incorporate firm fixed effects in all our tests, we can control for unobserved time-invariant firm heterogeneity. Our results show 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. Kaminsky and Reinhart (1999), Goldstein (2005), and Kalemli-Özcan, Kamil and Villegas-Sanchez (2016) study the causes and consequences 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

[7]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 (e.g., Brunnermeier, Nagel and Pedersen (2008), Lustig, Stathopoulos and Verdelhan (2019)).

experience higher stress in terms of market values. We find similar results when we examine stock market returns for Indian firms around the taper tantrum episode. Eichengreen and Gupta (2015), Chari, Stedman and Lundblad (2021), and Sahay et al. (2014) study the taper tantrum and its impact on asset prices, particularly in emerging markets. Sahay et al. (2014) find that the U.S. Federal Reserve's monetary policy announcement is strongly correlated with asset prices and capital flows in EMEs, and this phenomenon strengthened during the post-crisis phase of unconventional monetary policy. Our analysis goes a step further by comparing market reactions during periods of stress when domestic macroprudential policy was looser (taper tantrum) to when it was tighter (October 2018 oil price shock and COVID-19 crisis), and we show that market stress is reduced during the latter period.

We also contribute to a wider literature on the centrality of dollar funding and U.S. monetary policy in driving cross-border flows (Rey, 2013; McCauley, McGuire and Sushko, 2015; Kalemli-Özcan, 2019; Miranda-Agrippino and Rey, 2020; Bräuning and Ivashina, 2020).[8] Within this broader framework, macroprudential regulations can mitigate the domestic effects of the global financial cycle of capital flows. Brunnermeier and Sannikov (2015), Korinek (2018), and Acharya and Krishnamurthy (2019) provide theoretical analyses of the potential benefits of these tools. In their models, corporate foreign currency borrowing creates a negative pecuniary externality since, when the risk of a sudden stop arises, firms scramble to make large dollar repayments, 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 interest rate policy regulating corporate foreign currency debt.

Other papers analyzing macroprudential regulations, in a cross-country panel setting, include Bergant and Forbes (2021), Ahnert et al. (2021), Ostry et al. (2012), and Bruno, Shim and Shin (2017). Erten, Korinek and Ocampo (2021) surveys the literature on capital controls. These policies often have leakages or unintended consequences (Reinhardt and Sowerbutts, 2015), such as increased foreign currency debt of non-financial firms (Keller, 2019), reduced firm exports (Jung, 2021), and increased inter-firm lending (Huang, Panizza and Portes, 2018). We investigate these mechanisms for possible leakage or arbitrage of macroprudential controls and find that the consequence of reducing carry trade-driven foreign currency borrowing seems to be as intended in the Indian case.

[8] Rey (2013) argues that surges and retrenchments in capital flows are driven by a common global factor that can be linked to U.S. monetary policy. This global financial cycle, intermediated by global banks, affects risky asset prices and leverage in recipient countries. Kalemli-Özcan (2019) argues that U.S. monetary policy spills over into other countries through global investors' risk perceptions and its effect can be undone by allowing exchange rate flexibility.

2 India's External Debt: Institutional Background

India's external debt at the end of March 2019 was $543 billion[9] of which 38% was made up of corporate borrowing. 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 corporate debt in the country's overall external borrowing has increased sharply since 2005. Between 1995 and 2005, it rose from 13.1% to 19.7% before escalating to 38% by the end of 2015. It has been around that level since then. Multiple factors have been suggested for the rise 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: (1) Corporate loans and bonds denominated in foreign currency; (2) foreign investment in domestic corporate bonds; and (3) Rupee-denominated bonds issued overseas. We focus on the first component since the latter two refer to domestic currency debt. Figure 1a shows the evolution of the stock of foreign currency debt outstanding as well as the evolution of the INR/USD exchange rate. As a share of GDP, the stock of debt outstanding started declining after the taper tantrum. The Indian Rupee has significantly depreciated against the U.S. Dollar since the GFC.

One of the features of the Indian market for foreign currency commercial debt is the relative scarcity of bond issuance compared to bank debt. Over 90% of issuance by volume is through banks. In Figure 2, we compare the number of bank loans to bonds. Though bonds were somewhat popular from 2005 to 2007, their number has become very small after the GFC. In our analysis, we show results from the overall sample with both bank loans and bonds as well as a sample restricted to loans.[10] Foreign currency debt is issued to facilitate the import of capital goods, rupee expenditures on local capital goods, overseas acquisitions, and refinancing.

Macroprudential Regulation

Foreign currency corporate debt issuance is regulated by India's central bank, the RBI. The goal of the regulations 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. In addition to aggregate limits on foreign currency borrowing by corporations, individual debt issues are also regulated. Limits exist on issue size, maturity, use of funds, and interest rate.[11] All issue sizes above $750 million need regulatory approval.

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

[10] A lack of sufficient bond issuances prevents us from utilizing a bond-only sample.

[11] Link to current policies: https://www.rbi.org.in/Scripts/BS_ViewMasDirections.aspx?id=11510.

The minimum maturity allowed is three years. On-lending or investment of proceeds in Indian capital markets is generally not permitted.

The RBI sets the maximum allowed interest rate on borrowing, as a spread over the 6-month LIBOR rate, with a view to controlling access to foreign currency debt markets. These all-in-cost (AIC) interest rate limits vary by maturity and over time. In Figure 1b, we plot how the AIC limits have changed over time for issues with more than five years. In October 2008, the maximum AIC limit for longer maturity issues was increased from 350 bps over 6-month LIBOR to 500 bps over 6-month LIBOR. In November 2015, the maximum AIC limit was reduced to 450 bps over 6-month LIBOR.[12] We use the variation of this limit in the post-crisis period as our measure of the stance of macroprudential policy. A higher (lower) AIC interest rate limit reflects looser (tighter) macroprudential policy.

We focus on the AIC interest rate limits in this paper since these introduce cross-sectional variation between firms. However, changes in interest rate limits are often accompanied by other changes such as on issue size and aggregate economy-wide issuance volume. The November 2015 policy change was significant since, in addition to lowering interest rate caps for the first time since the GFC, it also created a multi-track system of regulation. Borrowers borrowing from foreign subsidiaries of Indian banks, thought to be riskier borrowers, were subjected to tighter regulation in the form of lower issue size and longer required maturity. While we do not have lender identities in our base sample and so cannot pinpoint the effects of these changes, we point them out to emphasize that the raw change in interest rate caps should not be taken as a measure of the degree of tightening since other changes happened concurrently. Due to the overall significance of the November 2015 changes, we use that policy change in a difference-in-differences analysis to identify the causal effects of macroprudential policy action.

3 Data and Summary Statistics

Prowess Sample

The RBI maintains a public database on the foreign currency borrowing of Indian firms.[13] The data, from January 2004 onwards, has the following information on all instances of issuance: the identity of the borrower, issue size in U.S. dollars, maturity, and month and year of issue. Our sample covers debt issued between January 2004 and October 2019. Over this period, there were 12,452 instances of foreign currency borrowing by 5,353 distinct firms.

Accounting and stock price data are from the Prowess database which has annual financial statement data as well as daily stock price data. Since the financial year ends on March 31 for

[12] The AIC interest rate limit on issues with maturities of less than five years was also increased in November 2011. In the empirical tests, we use the AIC limit corresponding to the maturity of the issue. The vast majority of issues in our sample are of maturity five years or greater.

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

the vast majority of Indian firms, we use Prowess from March 2004 to March 2019. We also collect data on exchange rates and interest rates on government debt from Datastream.

No common identifier links firms in Prowess to those in the RBI data. In order to link the two data sources, we match names using a string-matching algorithm and supplement this with a manual match for verification and completeness. This process results in a match of 1,818 firms between the two databases. Although these 1,818 firms are only 34% of the firms in the RBI database, they account for 48.3% of the issuances and 86.6% of the total amount issued. The firms that are not matched are mainly financial firms, which we exclude from our analysis, and smaller private firms for which financial data are unavailable in Prowess. We refer to this matched sample as the *Prowess* sample. It forms the basis of the bulk of the analysis.

Panel A of Table 1 provides statistics for the issuance characteristics of the firms in the *Prowess* sample. From 2004 to 2019, these 1,818 firms issued 6,013 foreign currency debt claims. The median firm borrowed twice in the period, while the firm at the 95$^{\text{th}}$ percentile borrowed ten times. There is a significant positive skew in issue size as the median is \$13.2 million while the average is \$60.3 million. The median maturity is around five years since most of the debt is bank loans.

In Panel B of Table 1, we examine 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, the median firm-year has a debt-to-asset ratio of 0.353. Most of the debt is long-term, i.e., not due within the next year. The median long-term to total debt ratio is 0.729. Prowess also has some data on the outstanding foreign currency debt of firms. Their definition of foreign currency debt 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 0.293 for the median firm-year. There is a wide variance in this ratio, with the standard deviation being almost the same as the median. Interestingly, foreign currency borrowing is not dominated by export-dominated firms. While the average exports-to-sales ratio is 16%, the median firm-year in our sample of foreign currency debt issuers has an exports-to-sales ratio of less than 3%. 32.7% of firm-years show zero exports indicating they have no natural hedge through the channel of foreign currency revenues. Among firm-years with positive exports, the median export-to-sales ratio is 12% and the average is 24.2%.

Dealscan Sample

The public RBI data has no information on the interest rate at which the foreign currency debt was issued. For a subset of firm issuances, we collect this data manually from Dealscan (syndicated loans) and SDC New Issues (bonds). We call this the *Dealscan* sample and use it primarily for our difference-in-differences analysis. While Dealscan directly provides the interest rate spread, for the SDC bond issues, we translate the yield at issuance into the interest rate spread over 6-month LIBOR.[14] Ultimately, we have interest rate data on 505 issuances. This is 8.4% of the issuances in the *Prowess* sample but about 36% by amount. Panel C of Table 1 shows summary statistics for the *Dealscan* sample. The median issuance size is $166.8 million which is more than 10 times that in the *Prowess* sample. The median interest rate spread is 165 basis points over 6-month LIBOR.

The *Dealscan* sample also allows us to provide additional descriptive information about foreign currency borrowing that we are unable to using the *Prowess* sample. In Panel (a) of Figure 3, we see that about 90% of foreign currency borrowing by Indian firms, both by number and volume, is denominated in U.S. Dollars. Panel (b) shows that the lenders for the syndicated loans are from all over the world, with the largest fraction being non-Indian Asian banks.[15]

4 Carry Trade and Foreign Currency Debt 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, within our sample of Indian corporates, is affected by a carry trade motive. Our first hypothesis is that Indian firms issue more foreign currency debt 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:

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

The left-hand side variable takes the value 1 if firm i issues foreign currency debt in month t, and 0 otherwise. The main variable of interest is CT which measures the profitability of the carry trade. Following Bruno and Shin (2017), we define $CT = \frac{\text{3M rate(IND)}-\text{3M rate(US)}}{\text{IV of 3M FX options}}$, i.e., the difference in short-term interest rates between India and the U.S. 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 aggregate stock market return using the NIFTY index return and for the foreign exchange return using the INRUSD return defined as $\frac{P_t - P_{t-1}}{P_{t-1}}$ where P_t is the number of U.S. dollars required to buy 1 Indian rupee at the end of period t. A negative INRUSD return indicates depreciation of the Indian rupee relative to the U.S. dollar. To control for firm-level determinants, we include a set of accounting measures recorded at the previous fiscal year-end.

[14] We make a couple of assumptions for the interest rates. In a particular month, if an issuer has multiple issuances and we have interest rate data on a subset of those issuances, we assign the same rate to the issuances we do not have data on. Additionally, if we have an interest rate for a particular firm-month, and the same firm has another deal within two months of that month but without an interest rate, we assign the same interest rate to the latter deal. This accounts for any errors in recording the exact date for the issuance in Dealscan. For instance, Reliance Industries Limited has a deal recorded in Dealscan in August 2011. We assign the spread on that deal (150 bps) to all deals of Reliance from June 2011 to October 2011 since we have no other interest rate data for Reliance over that period.

[15] The total number of issuances in Figure 3 is greater than 505 because some deals in Dealscan do not have interest rate data.

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 which means our results reflect within-firm estimates of carry trade profitability on issuance. Standard errors are clustered at the firm level.

Results

Figure 4 shows 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 solid 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 foreign currency debt 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 U.S. 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 foreign currency debt issuance and the CT index is considerably weakened. The table below Figure 4 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 January 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. In the first four columns, we use an indicator for whether the firm issued in a given month as our dependent variable. In columns (5)-(8), we look at volumes by using the log of the amount of foreign currency debt issued in a month by a firm as our dependent variable and running OLS regressions.

The results in columns (1) and (5) show that a higher value of the CT index predicts higher foreign currency borrowing in the next month. The effect is statistically significant at the 1% level. Since the specifications include firm fixed effects, it means that the same firm is more likely to issue foreign currency debt in months immediately following those in which the carry trade is more profitable. Quantitatively, the effect is large. Using the estimated coefficient of 0.431 in column (1) of Table 2, a one standard deviation increase in the CT index (The CT index has a standard deviation of 0.258 during the sample period) would increase a firm's probability of issuing by 11.1%. On the size margin, the results are also significant indicating larger amounts borrowed when the carry trade is more profitable. A one standard deviation increase in the CT index would increase the amount borrowed by 3.6%. Larger magnitudes on the indicator compared to the volume indicates that the issuance decision is more sensitive to the carry trade than the amount of issuance. In columns (3) and (7), we do the same test but with the sample of issuances restricted to bank loans. The magnitudes of the coefficient on the CT index is slightly larger in this sample with similar statistical significance. Overall, these results strongly support 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? To test this, we re-estimate equation 1 but with a couple of additional variables included. The first is the interaction of CT index with a dummy 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 that takes the value 1 for the period after September 2013 ('Post-taper'). The coefficient on this interaction term is the differential probability of issuing in the post-taper tantrum period. The differential effect for both interaction terms is relative to the effect of the CT index in the baseline or pre-crisis period.

The results are in columns (2) and (6) of Table 2. The results are again consistent across specifications. In column (2), 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 1.302 implies that a one standard deviation increase in the CT index would increase a firm's probability of issuing by 33.6%. For the post-taper tantrum period, the coefficient on the interaction is small and insignificant suggesting the effect of the CT index on issuance is similar to that before the crisis. We find similar results when the amount issued is the dependent variable. The result in column (6) suggests that the amount of foreign currency borrowing is significantly related to the carry trade only during the post-crisis period. Once again, the sensitivity of the amount issued is smaller than the issuance decision itself. We find similar results for the bank loan sample (column (4) and (8)).

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 GFC. During this phase, the carry trade was not a determinant of corporate foreign currency debt issuance. In the second phase, during and immediately following the crisis, the carry trade became a strong predictor of issuance. Finally, following the taper tantrum, the carry trade again lost importance. The transition from the first to the second phase seems to be a result of the crisis and ensuing U.S. monetary policy expansion (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) interest rate of foreign currency borrowings. We hypothesize that this tightening, soon after the taper tantrum episode, prevented riskier firms from using foreign currency borrowing as carry trades. Figure 1b shows how the maximum AIC limits vary over time. The maximum AIC limits are specified as spreads are over the 6-month LIBOR rate.

To test our hypothesis, we estimate a variant of 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.[16] A *High AIC* spread signals looser macroprudential regulation. We also include a term which is the interaction of *CT* and *High AIC* spread. The coefficient on this interaction term is our coefficient of interest. We hypothesize that this coefficient 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.

The results are presented in Table 3. The coefficient on the interaction term of *CT* and *High AIC Spread* is positive and highly significant in all specifications - with and without firm fixed effects, for both the issuance decision and amount, and whether we use the full sample or bank loans only. The results imply that, from 2008 onwards, the carry trade motive explains issuance only 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 1b), 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 due to macroprudential regulation.

Difference-in-Differences Analysis

To establish the macroprudential tightening of November 2015 as being the cause of the decline in foreign currency borrowing among riskier borrowers, we conduct a difference-in-differences analysis around that period.[17] To do so, we estimate the following model:

$$Issue_{it} = \alpha_i + \beta \text{Treat}_{it} \times \text{Post}_t + \gamma X_{it} + \varepsilon_{it} \tag{2}$$

[16] We restrict ourselves to this period as our interest is in the transition from the second to third phase.

[17] We also undertake a cross-sectional analysis where we look at effects using average interest costs. These results are consistent with the DID results and are presented in Appendix Table A.1

Here, *Treat* is an indicator that takes the value 1 if a firm borrowed at a spread of between 450 bps and 500 bps above 6-month LIBOR prior to November 2015, and 0 otherwise. We define these firms as treated because the policy change tightened the AIC cap from 500 bps to 450 bps. As such, firms that had borrowed between 450 bps and 500 bps before the policy change are the most likely to be affected. *Post* takes the value 1 for November 2015 onwards, and 0 otherwise. The DID coefficient, β, is the coefficient on the interaction of *Treat* and *Post*. The estimate β tells us how the issuance behavior of treated firms changes following the macroprudential tightening compared to control firms.

To identify treated firms, we use the *Dealscan* sample. However, that sample provides us with interest rate data for only 8% of the total sample. To extend the sample to the remaining firms, we model the marginal interest rate on the foreign currency debt as a linear function of the average overall interest cost:

$$\text{FC Debt Rate}_{it} = \alpha + \beta \text{Average Interest Cost}_{it} + \gamma X_{it} + \varepsilon_{it} \quad (3)$$

We base this specification on Acharya and Krishnamurthy (2019) who model the domestic currency interest rate as the sum of the foreign currency interest rate and an additional term which reflects sovereign risk, quality of bankruptcy institutions, and exchange rate premia. Since the average interest cost reflects borrowing costs from earlier vintages of debt (including pre-GFC), and includes both domestic and foreign currency debt, we expect the β to be less than 1. We estimate this relationship for several specifications such as: (a) with no controls or fixed effects; (b) with controls for total assets, debt-to-asset ratio, exports-to-sales ratio and the ratio of foreign debt to assets; (c) with year fixed effects but none of the additional controls; and (d) with year fixed effects and the full set of controls.

The results from these specifications are shown in Figure 5. Based on the specification used, we estimate a β between 0.135 and 0.167 with t-statistics in the range of 3.97-5.39. Of these, we use the estimate from the model with controls and fixed effects (5d) to predict the marginal borrowing rate for firm issuances for which we do not have the rate from the *Dealscan* sample. If the predicted rate is between 450 and 500 bps above 6-month LIBOR, we categorize the firm as a 'treated' firm. To the extent our predictive model is imprecise, our categorization of 'treated' firms is noisy. As long as this measurement error is not systematic, it should bias against us finding an effect. In later results, we describe a bootstrapping procedure we employ to account for the imprecision of this 'first stage' predictive model.

We now move to our DID estimation. The regression results are presented in Panel A of Table 4. We use both an indicator for issuance as well as the log of the borrowed amount as our dependent variables. In columns (1) and (5), we present the results for the *Dealscan* sample only, i.e., we do not use any predicted rates. In column (1), the coefficient on issuance propensity is negative and large in magnitude but statistically insignificant, pointing to a lack of power. However, in column (5), despite the smaller sample, the coefficient on borrowing volume is negative and statistically significant.

When we expand the sample by using the predicted rates, in addition to actual rates, to categorize 'treated' firms, we continue to find a large negative effect on issuance propensity of treated firms following the macroprudential tightening. The magnitude indicates a 41.5% decline relative to the control firms. This coefficient is significant at the 10% level. The DID coefficient is negative and significant at the 5% level when the dependent variable is the logged issuance amount (column (6)).

We attempt one more sample alteration wherein we exclude all issuances with a spread above 500 bps. Hence, the DID compares 'treated' firms solely to firms with borrowing costs below 450 bps. This more cleanly ensures that the control firms are unaffected by the treatment. Results from this 'trimmed' sample in column (3) and (7) of Panel A of Table 4 are consistent with the larger sample. The DID coefficients are negative and significant, with slightly larger magnitudes than for the bigger sample.

We use this trimmed sample to show that our results are robust to using a continuous measure of treatment instead. We define treatment intensity as *Spread-4.5* which is the difference between the spread on foreign currency borrowing (in %) and the policy threshold of 4.5% above 6-month LIBOR.[18] Using this continuous treatment measure helps to alleviate some of the concerns around our classification of firms into discrete treated and control firms on the basis of a predictive regression in the first stage. The coefficients on the DID term in columns (4) and (8) of Panel A of Table 4 are negative and significant at the 1% level, consistent with the earlier results. The magnitudes are also substantial. For a firm that moves from a borrowing cost of 3.75% to 4.75% above 6-month LIBOR, the decline in issuance propensity is 27.6% and the decline in volume is 4.7%.

To add further support to our causal interpretation of the DID results, we conduct a dynamic DID analysis around the period of the policy change. To do so we estimate the following model:

$$Issue_{it} = \alpha_i + \sum_{\tau \neq -1} \beta_\tau (D_t^\tau \times \text{Treat}_i) + \gamma X_{it} + \varepsilon_{it} \tag{4}$$

Here, D_t^τ is a dummy variable that takes a value 1 if quarter t is τ quarters after the macroprudential tightening of 2015, which happened in the fourth quarter. The DID method assumes that the treated and control firms were on parallel paths before the treatment. The inclusion of indicator variables for periods prior to the treatment allows for a visual examination of this parallel trends assumption. The point estimates and 90% confidence intervals are plotted in Figure 6 for issuance propensity (volume) in Panel (a) (Panel (b)). The graph indicates that in the quarters prior to the treatment, treated and control firms had parallel trends since none

[18] We use percentage points for the spread in order to make the regression coefficients easier to interpret.

of the coefficients are significant and are close to zero. Immediately after treatment, however, there is a statistically significant decline in issuance for the treated firms.

DID Robustness: Bootstrapping

As noted earlier, using a predictive sample for spreads which in turn determines treatment status in our DID has the potential to introduce error in the estimation process. In order to quantify the magnitude of this potential error and to show that our results are robust to accounting for it, we undertake a bootstrapping exercise. In our first stage (Equation 3), we estimate a coefficent of 0.167 on the *Prowess* interest cost with a standard error of 0.033. In the bootstrap, we make a random draw from a normal distribution with a mean of 0.167 and a standard deviation of 0.033. We use this randomly drawn value as the coefficient on *Prowess* interest cost in the first stage to calculate the predicted *Dealscan* spread. We categorize firms as treated if this predicted value is between 450 and 500 bps above 6-month LIBOR, and then implement our DID process for each of the specifications in Panel A of Table 4 that uses predicted spreads. We repeat this process 1000 times. For each specification, this gives us 1000 values of the DID coefficient. We take the standard deviation of these 1000 coefficient values to obtain the bootstrapped standard error. In Panel B of Table 4, we report our results using these bootstrapped standard errors. Across specifications, our inference does not change on using these standard errors. There remains a negative and significant relationship on issuance for treated firms following the November 2015 policy action.

In Figure 7a, we plot the empirical distribution of coefficients corresponding to the specification in column (1) of Panel B of Table 4. The distribution shows that the majority of estimated coefficients are smaller than the coefficient from our base sample. This is consistent with our intuition that adding noise to the first stage predictive regression biases the coefficients towards zero. The histogram also shows that zero is outside the 95% confidence interval for the estimated coefficients, lending further support to the policy having a significant negative effect.

We undertake a separate randomization procedure as well and show the result in Figure 7b. Here, we estimate the predicted spread using Equation 3 but then randomly allocate these spreads across our sample of firms. We then estimate our DID for the full sample with issuance propensity as the dependent variable. We repeat this process 1000 times and show the distribution of resulting DID coefficients in Figure 7b. The results show that the coefficients are centered around 0 and the probability of getting the same coefficient as we get by random chance is less than 2%. This indicates that our categorization of treated firms is informative.

Placebo Test: Pre-crisis period

We also implement a falsification analysis to provide additional support for our main hypotheses. We do this by analyzing 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. Although our difference-in-differences analysis using interest costs point against this explanation, we also conduct a placebo test to rule it out further. Since we have already shown that *CT* did not predict issuance in the pre-crisis period, we would not expect macroprudential tightening in this period to affect carry trade borrowing. The RBI did lower AIC limits on borrowing in 2007. In Tables A.2 and A.3, we report the results from the pre-crisis complements to Tables 3 and A.1, and find no evidence of the interaction of *CT* and *High AIC Spread* playing any role in issuance behavior.

Testing for Leakages and Unintended Consequences

The preceding results indicate that macroprudential tightening accomplished its direct objective of reducing carry trade borrowing by risky firms. However, prior literature has emphasized that the direct effects of macroprudential policy changes are often undone by risky activity shifting to other avenues, a form of regulatory arbitrage (Ahnert et al., 2021). In this section, we analyze whether the macroprudential policy targeting foreign currency borrowing had unintended consequences by testing effects on (i) the maturity of foreign currency borrowing, (ii) trade credit received, and (iii) domestic currrency debt.

First, we look at effects on the maturity of the issuance. It is possible that borrowers reduce the maturity of the borrowing in order to borrow under the tighter interest rate caps. This is potentially dangerous as lower maturities exposes firms to higher rollover risk in the case of a sudden stop. To test the effects on maturity, we use the same specifications as in Tables 3 and A.1 but with maturity of issuance as the dependent variable. The results are in the first two columns of Table 5. In the first column, we find that the maturity of issuance is actually lower during periods when the CT index is high and policy is loose. The triple difference coefficient in the second column is insignificant indicating that there is no statistically significant difference in maturity of issuance undertaken by riskier borrowers when policy is tight relative to when it is loose. Together, these results mean we find no evidence that on the intensive margin borrowing becomes riskier through maturity shortening.

Second, we turn our attention to trade credit. As the RBI's regulations target financial borrowing, carry trade borrowers might substitute foreign currency bank and bond debt with operational credit. In that case, an increase in foreign currency trade credit might be an unintended consequence of macroprudential tightening. This would be harmful as trade credit is normally of a much shorter maturity than bank or bond debt. To test the impact on trade credit, we use the same specifications as above but with the change in trade credit received (accounts payable scaled by assets) as the dependent variable. We get data on trade credit from the financial statements. Unfortunately, this data does not distinguish the trade credit received by currency. Since our focus is on trade credit in foreign currency, we restrict our analysis to firms with an above-median share of imports in their raw materials. These firms are more likely to have trade credit in foreign currency. The results are in columns (3) and (4) of Table 5. In the third column, we see an increase in trade credit when the CT index is higher and macroprudential policy is loose, suggesting that firms take advantage of the trade credit route as well to indulge in carry trade borrowing. However, this suggests that when policy is tightened, there is no unintended spillover into trade credit. This finds further support in the triple difference result in the fourth column – there is no significant difference in trade credit borrowing for riskier borrowers when policy is tight compared to when it is loose.

Finally, we study borrowing in domestic currency. If firms were using foreign currency debt for business needs, rather than for carry trades, we would expect borrowing in domestic currency to increase following the imposition of tighter norms on foreign currency debt. If this was the case, it would be an unintended consequence as firms were being forced to shift to a more expensive source of financing.[19] We test the effect on domestic INR debt by using the change in INR debt, from the financial statements, as the dependent variable. The results are in the last two columns of Table 5. The key coefficients in both columns are insignificant. The result in the fifth column indicates that even when foreign currency borrowing is higher, i.e., when CT index is high and policy is loose, there is no change in domestic currency outstanding indicating that the additional dollar borrowing is over and above local borrowing, and is not a substitute. The insignificant result in column (6) means that borrowers with higher interest costs do not change their domestic borrowing based on the stance of macroprudential policy.[20]

6 Firm Exposure to FX Risk

We now examine if foreign currency borrowing affects foreign exchange risk, and whether macroprudential policy can ameliorate this risk. A primary concern that regulators express about the rise in foreign currency debt issuance is that borrowers leave the resulting foreign currency exposure unhedged (Ministry of Finance, 2015). Two primary reasons are identified as to why companies might not hedge this exposure: first, the local derivatives market is illiquid and firms lack access to offshore markets; and second, firms imagine an implicit guarantee from the RBI that it will not let the currency depreciate outside a narrow band.[21] To measure the extent of exposure that is left unhedged, 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:

$$r_{it} = \alpha + \beta_M r_{Mt} + \beta_{FX} r_{FX,t} + \varepsilon_{it} \tag{5}$$

[19] For policymakers, this might still be preferable as firms would no longer be exposed to currency risk.

[20] While these tests include all domestic borrowing, in Appendix B we analyze aggregate changes in Rupee bonds issued in foreign markets, and show that the data do not support a substitution from foreign currency issuance to these bonds.

[21] 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

where r_{it} is the return for firm i in month t, r_{Mt} represents the return on the Indian stock market and is proxied by the NIFTY index return, and $r_{FX,t}$ is the INRUSD monthly return. The model is estimated using OLS with an estimation window of 60 months,[22] which allows us to obtain rolling estimates of β_{FX} for each firm. High (low) FX β firms are the ones that do poorly (well) when the Indian rupee depreciates against the U.S. dollar.

The FX β captures the net effect of a trade channel as well as a financial channel. Firms with positive net exports benefit when then currency depreciates and so they should have a lower FX β than net importers ceteris paribus. This is the trade channel. The financial channel arises due to a currency mismatch between the firm's assets and liabilities. Firms with higher net foreign currency liabilities have a higher FX β since they have larger balance sheet impairment on a currency depreciation. The median firm in our sample has an FX β of 0.11, indicating that it would lose value on a currency depreciation.

Motivated by concerns expressed by policymakers, we hypothesize that firms borrowing abroad do not fully hedge their currency exposure. This leads to the hypothesis that FX $\beta's$ increase following foreign currency debt issuance. To test this, we estimate the following:

$$FX\beta_{it} = \alpha + \gamma Issue_{i,t-1} + \nu_t + \eta_i + \varepsilon_{it} \tag{6}$$

The dependent variable is the β estimated for firm i from the market model in a 60-month trading window starting at the beginning of month t. The independent variable is a dummy that takes a value of 1 if firm i issued foreign currency debt in month $t-1$. We include firm and month fixed effects since the analysis is at the firm-month level.

The results from this estimation are presented in Table 6. In column (1), we see that the FX β does not change right after foreign currency debt issuance in the full sample. Our prior analysis indicated that macroprudential policy tightening soon after the taper tantrum changed aggregate borrowing behavior by restricting riskier firms from accessing foreign currency debt. We next introduce interaction terms to test whether the lack of a change in foreign exchange risk exposure after issuance depends on the stance of macroprudential policy. In column (2) of Table 6, 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. We find the coefficient on this interaction term to be positive and significant. The magnitude of 0.115 is large considering the median FX β is 0.11.

The preceding analysis uses an issuance dummy as the independent variable and so does not tell us the extent to which the firm's debt structure changes and how that is associated with a change in FX β. For instance, if the issuance of foreign currency debt is accompanied with an even larger increase in domestic debt, the change in the firm's FX exposure will be different from the case where it only issues foreign currency debt. To test the importance of

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

this phenomenon, we interact *Issue* with Δ *FC Debt* which is the one-year change in the ratio of foreign currency debt to total debt based on Prowess data. The result is presented in column (3). The coefficient on the interaction is as hypothesized - a larger increase in the proportion of foreign currency debt is associated with a larger increase in the firm's FX β.

In column (4), we introduce a triple interaction term, $Issue \times HiAIC \times \Delta FCDebt$, to test how the change in foreign currency debt interacts with the stance of macroprudential policy. The coefficient on the triple interaction is positive and significant, indicating that during periods of loose policy, firms which load up on foreign currency debt see large increase in FX risk exposure. The coefficient on $Issue \times \Delta FCDebt$ is small and insignificant which implies that during periods of tight policy, even large increases in the ratio of foreign currency debt are not accompanied by increases in FX β. This suggests that during periods of tight policy, issuance is undertaken by borrowers who hedge their new exposure, either operationally, such as through dollar sales, or through financial instruments.

Next, we conduct the same series of tests but use the market (or NIFTY) β as the dependent variable. In columns (5)-(8) of Table 6, we find that there is no significant change of the market β in either the full sample or during the different phases of macroprudential policy. These results serve as a placebo test and emphasize that the effects we detect are indeed due to the foreign currency debt issuance, not to some fundamental change in the firm's business risk.

Next, we test how the FX β post-issuance changes for different sets of firms. To identify carry trade borrowers, we define a *Firm CT* index which is a weighted average of the *CT* index in the months when the firm borrows abroad. The weights are the volume of foreign currency debt issued. We restrict ourselves in this analysis to those firms that borrow abroad at least four times in our sample. 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? The results in Table 7 suggest that both of these are true. All the increase in post-issuance FX β that we see in Table 7 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.

These results are consistent with models that emphasize that firms do not internalize the pecuniary externality created by their individual borrowing (Brunnermeier and Sannikov, 2015; Korinek, 2018). 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 additional downward pressure on the local currency, further stressing their balance sheets. A direct implication is that the local currency should depreciate more when more corporate foreign currency debt is due to be repaid analogous to carry trade unwinding by financial market participants leading to currency crashes (Brunnermeier, Nagel and Pedersen, 2008). We test this time series implication and present the results in Appendix Table C.1. Our issuance data tells us the month in which the bond or loan matures. We calculate the total amount of corporate foreign currency debt maturing in each month. This number is determined years in advance of the maturity date itself. But we find that the change in the log amount of foreign currency debt maturing negatively predicts the change in the logged exchange rate, i.e., it predicts a rupee depreciation. The effects are stronger for issuances that take place following the crisis and before macroprudential tightening.

Event Studies around Negative Shocks

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. However, was it 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'. We use U.S. Federal Reserve statements on the probability of tapering of the quantitative easing program 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 of 2013, the Indian rupee declined almost 14% against the U.S. dollar while the NIFTY market index fell about 2.35%. In fact, the RBI responded in August 2013 by imposing capital controls on outflows by residents.[23]

We use an event study to 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 identify taper tantrum effects, we focus on a single salient event that market participants identify as having significantly increased the probability of tapering:

- *June 19, 2013*: In a press conference following the FOMC meeting, Chairman Bernanke again suggested that asset purchases would be reduced later in 2013.[24]

Market reactions related to the taper were strongest around this event – the Indian rupee depreciated the next day by 1.69% and the NIFTY stock market index fell 2.86%.

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,

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

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

they were tightened. We complement our taper tantrum event study analysis with two events that took place in the post taper tantrum period, specifically in the period after the tightening of macroprudential policy in November 2015. 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.[25]
- *February 24, 2020*: Gormsen and Koijen (2023) point to February 20, 2020 as the start of the pandemic-related market drawdown in the U.S. due to intensifying COVID-19 effects in Italy, Iran, and South Korea. The Indian stock market was closed on Friday, February 21 due to a religious holiday, and so we take February 24, 2020 as the start of the COVID-19 event with respect to Indian financial markets.

With respect to each of the event dates, we estimate the market model (Equation 5) over a 150 calendar day window ending at $t = -6$ where $t = 0$ captures the event date. The estimated market and FX βs 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 five trading days following the event (CAR[0,4]).

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. For each firm that has at least four 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 measure 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 8 presents the event study results. Panel A presents the results based on the firm-specific CT measure; in Panel B, the results are based on the implied *Interest Cost*.

The results in column (1) 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 (6/19/13). Their CAR is smaller than -3%, almost 2% worse than low CT issuers. Figure 8 shows the difference in CAR for high and low CT issuers as it develops over the five 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), although we have a small sample of firms since we need firms that have issued at least four times over the sample period. Another interesting finding is that the entire sample of repeat foreign

[25] 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`

currency borrowers experiences large negative declines (1% -3% on average) following increase in taper risk (post June 19, 2013). Since we are controlling for the overall market reaction in the market model, this implies that foreign currency borrowers perform worse as compared to non-borrowers, who can be thought of as the omitted group.

The results in Panel B of Table 8 suggest that the abnormal reaction post event is sharpest for the firms with high interest costs. Over the three-day period following June 19, 2013, the CAR for high interest cost firms was 0.5% points more negative than that for low interest cost firms; however, this difference is statistically insignificant.

When we turn to our two post-taper events, the results in columns (2) and (3) suggest that high *CT* issuers now no longer react significantly worse to negative events. The magnitude of the difference across firms is significantly lower, 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.

7 Effects on Firm Outcomes

We now turn to the real outcomes of the carry trade borrowing and policy changes we analyze. The stated purpose of most foreign currency borrowing is capital expenditure. In our data, over 80% of the issuances state this as the rationale for the issue. The next most popular purpose is refinancing. 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 the proceeds from carry trade borrowing are being used in practice, we test how firm outcomes evolve for firms that borrow when the carry trade is more profitable. We compare outcomes 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 in the months when the firm borrows abroad. The weights are the volume of foreign currency debt issued. To construct *Firm CT*, we only use firms with at least four issuances in the sample. The independent variable of interest is the interaction of the *Hi AIC* dummy with the value of the *Firm CT* index. The coefficient β tells us how the outcome changes when policy is loose for a company which generally issues when the *CT* index is high compared to one which issues when the *CT* index is low.

The outcomes we analyze are: (i) gross investment (change in gross fixed assets from year the previous year to current), (ii) cash holdings, (iii) debt, and (iv) profits. All outcomes are scaled by end of year assets. Industry-year fixed effects are included in the regressions 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.

The results are in Table 9. When the AIC spread is high, i.e., policy is loose, issuers with high *Firm CT* index have higher cash holdings. This build-up of liquid assets is consistent with carry trade behavior (Bruno and Shin, 2017). On the flip side, when policy is tightened, cash holdings of carry trade borrowers are lower. This confirms that tighter macroprudential policy constrains issuers who take advantage of carry trade borrowing, and affects their liquidity.

8 Conclusion

In this paper, we examine the foreign currency borrowing of Indian firms from 2004 to 2020. We find that firms are more likely to borrow in foreign currency when the dollar carry trade is more profitable. Carry trade borrowers are riskier and significantly more likely to suffer poor stock market returns during periods of market stress. However, macroprudential regulation can play a role in alleviating the risk arising due to foreign currency borrowing. We show that the imposition of tighter capital controls, in the form of interest rate caps on foreign currency debt issues, was successful in restricting access to higher quality borrowers. Subsequently, during periods of market stress, carry trade borrowers were no longer harder hit than other borrowers. Our results indicate that macroprudential regulations that are focused on firms, just like the more commonly-studied bank-level policies, can also be an effective tool in curbing risky borrowing.

Our results have 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. We provide direct evidence supporting theoretical models on pecuniary externalities arising out of foreign currency borrowing, and the appropriate regulatory response of targeting the riskiest borrowers (Brunnermeier and Sannikov (2015), Korinek (2018), Acharya and Krishnamurthy (2019)). Given that we find favorable funding conditions to be a strong determinant of issuance, it is reasonable to conclude that these risks will re-emerge as U.S. monetary policy tightens following the easing in response to the COVID-19 pandemic.

While we do not study how external firm financing patterns influence trade, there is reason to believe that macroprudential policy and trade policy need to work in conjunction (see, in particular, Gopinath (2019)). Carry trade borrowing is particularly risky for importers as their revenues are in local currency and they have additional non-interest expenses in foreign currency. If these firms use the funds from foreign currency borrowing to boost imports, we would expect trade imbalances to widen. Preliminary analysis, shown in Appendix Figure A.1, supports this conjecture – India's trade balance had a *negative* correlation with the CT index in the period between the onset of the GFC and the macroprudential tightening in 2015. However, domestic macroprudential policy severs the negative link between global financing conditions and trade balances, with the correlation between India's trade balance and CT index turning positive after the macroprudential tightening. Other industries that may suffer include capital expenditure-intensive sectors like construction and real estate. The spillovers due to the financial distress of the Chinese property developer Evergrande is a case in point. We leave a more systematic analysis of these sectoral effects to future work.

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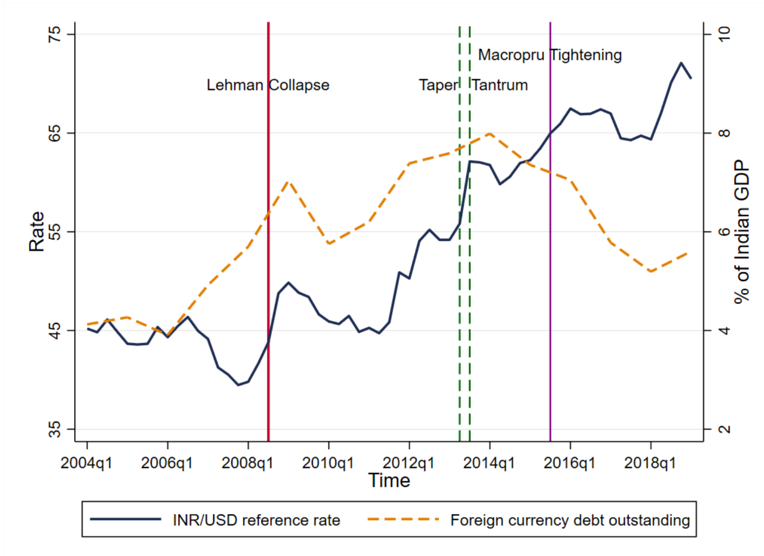
(a) INR/USD Exchange Rate and Foreign Currency Debt Outstanding



(b) Macroprudential Policies and Debt Issuance

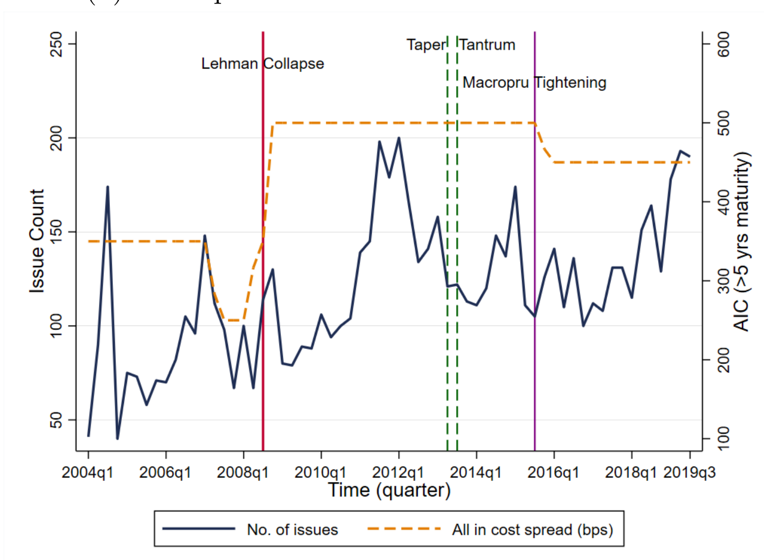


Figure 1: **Exchange Rate, Foreign Currency Debt, and Macroprudential Policy** Figure (a) shows the evolution of the INR/USD exchange rate and the ratio of the stock of foreign currency debt outstanding to Indian GDP. Figure (b) depicts the evolution of foreign currency debt issuance activity and the maximum permissible all-in-cost (AIC) spread over the 6-month LIBOR rate for issuances with maturity more than five years. A higher AIC spread is our proxy for looser macroprudential regulation. The sample period is from January 2004 to September 2019.

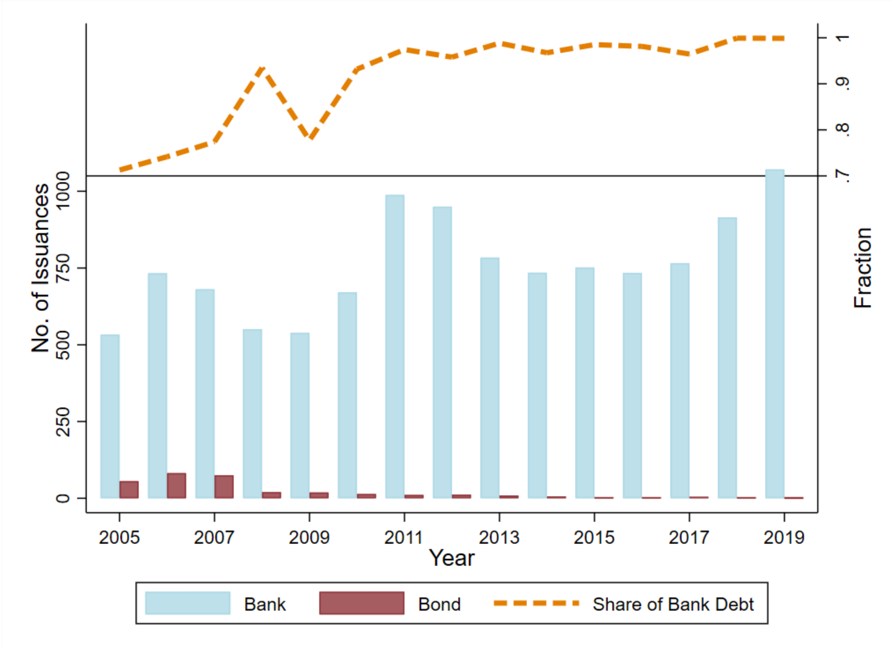


Figure 2: **Bonds vs. Bank debt**

The figure shows the relative importance of bond financing compared to bank debt in the foreign currency borrowing of Indian firms from January 2005 to September 2019. The bars are the number of issues of bank and bond debt in each year while the dashed line captures the percentage of total amount borrowed that is bank debt.

(a) Currency of Issuance

(b) Region of Lender Parent

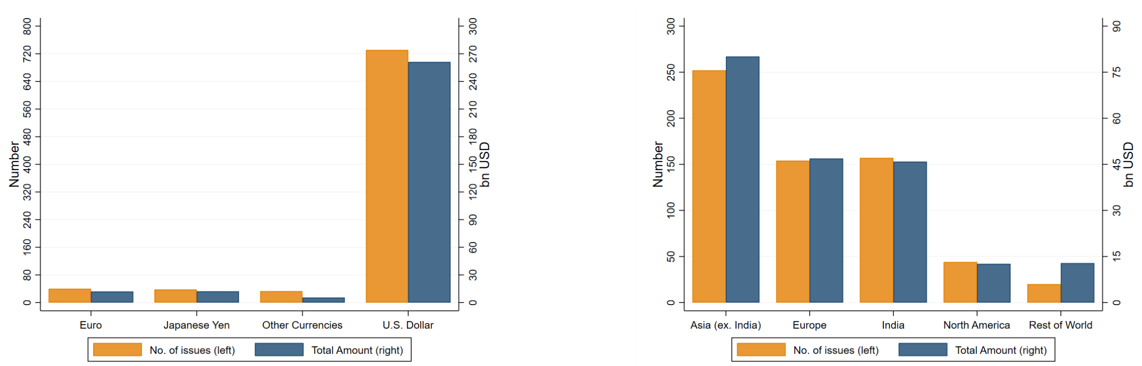


Figure 3: **Characteristics of foreign currency debt issuance: Dealscan sample**

The figure depicts the salient characteristics of foreign currency borrowing of firms using data in Dealscan and SDC. The sample period is from January 2004 to September 2019. Figure (a) shows the currency composition of the borrowing both by number of issues and the aggregate volume of issuance. Figure (b) shows the region to which the parent organization of the lead arranger of the syndicated loans in Dealscan belongs.

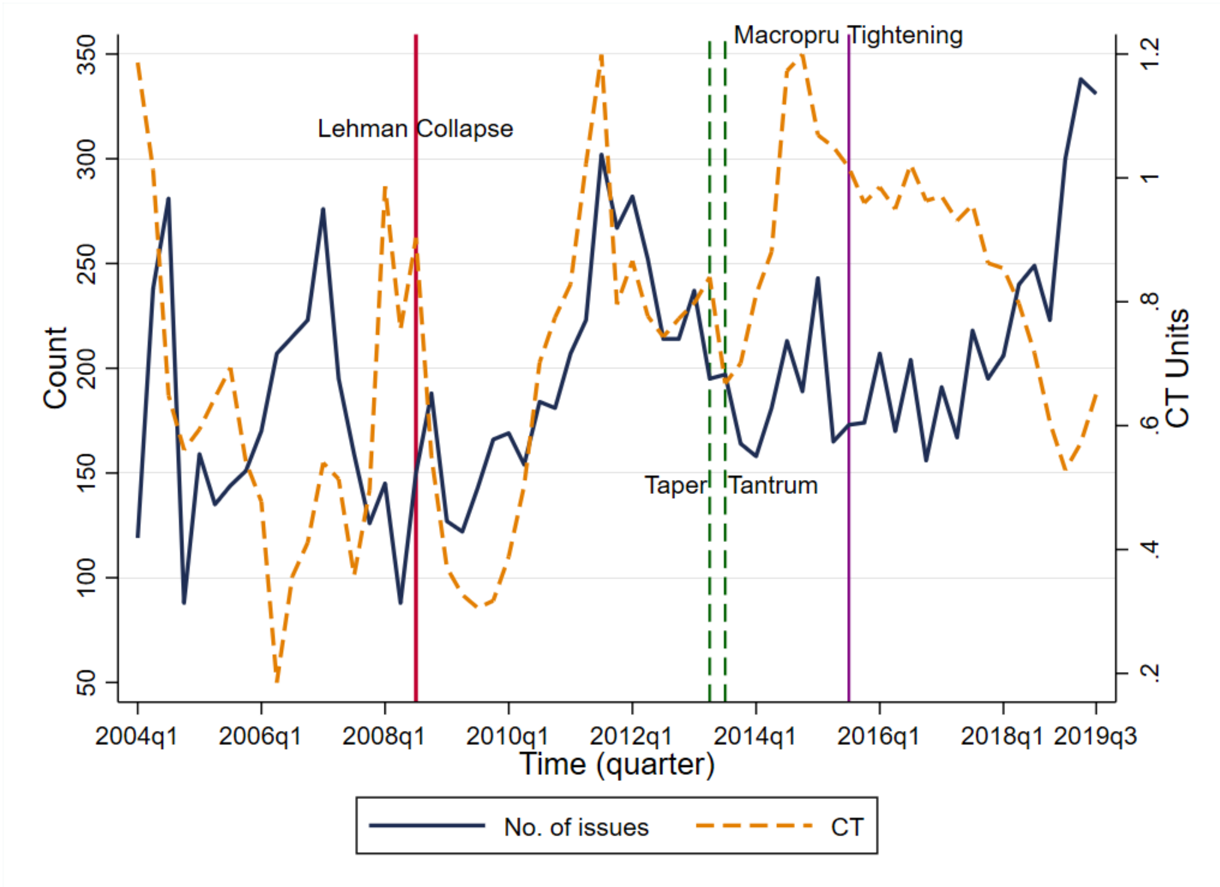


Figure 4: **Carry Trade and Aggregate Issuance**
The figure plots the total number of foreign currency debt issues each quarter against *CT*, a proxy for the difference in short-term rates between India and the US. *CT* is the difference in 3-month interest rates between India and the U.S. scaled by the implied volatility of 3-month FX options. The sample period is from January 2004 to September 2019.

The table below lists the correlation between the monthly *CT* index and the monthly issuance count and total amount issued. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01).

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)	0.080	-0.173	0.559***	0.461**	-0.684***
ρ(Amount, CT)	0.003	-0.298**	0.454***	-0.197	-0.540***

(a) No controls and no fixed effects

(b) With Controls but no fixed effects

(c) With fixed effects but no controls

(d) With Controls and fixed effects

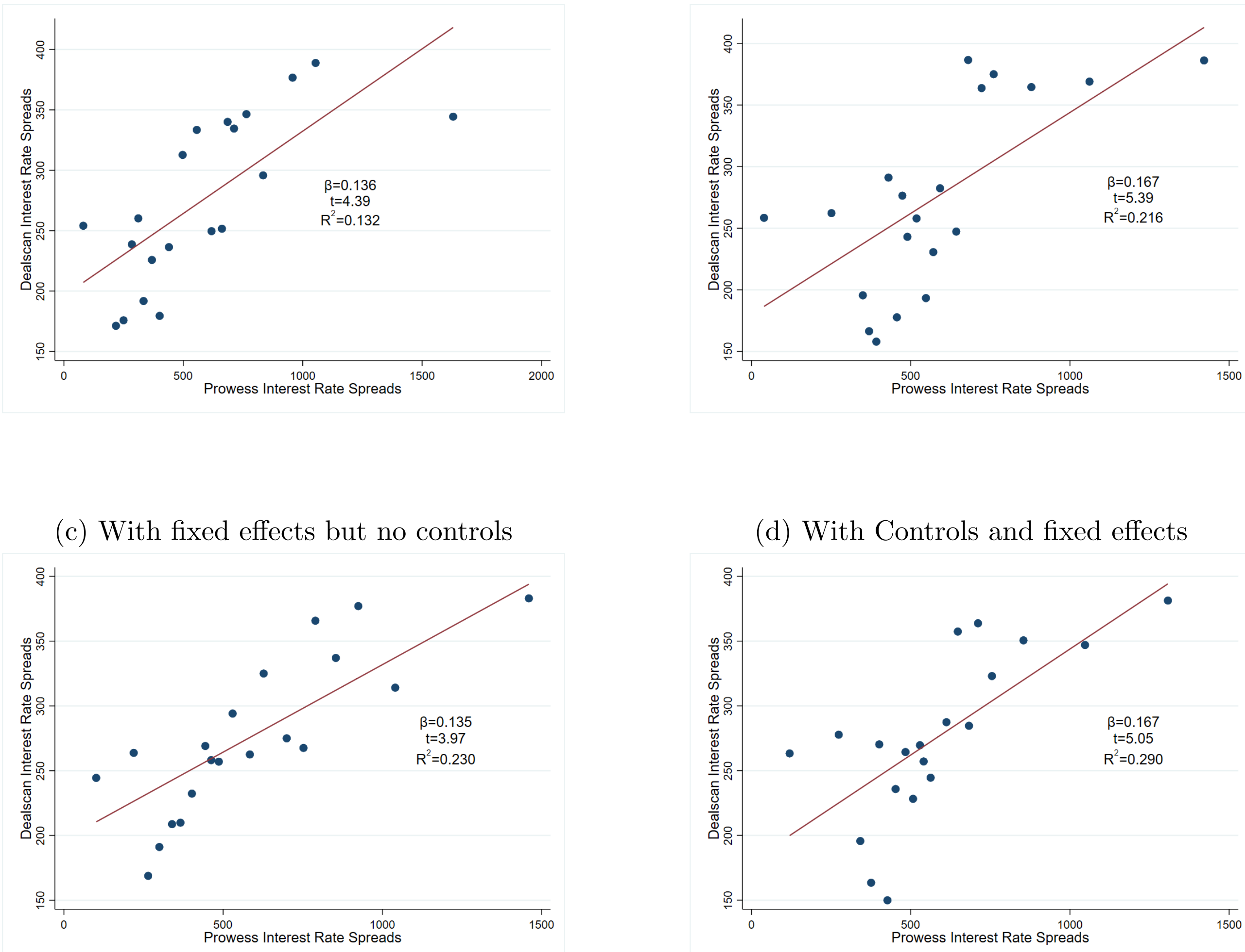
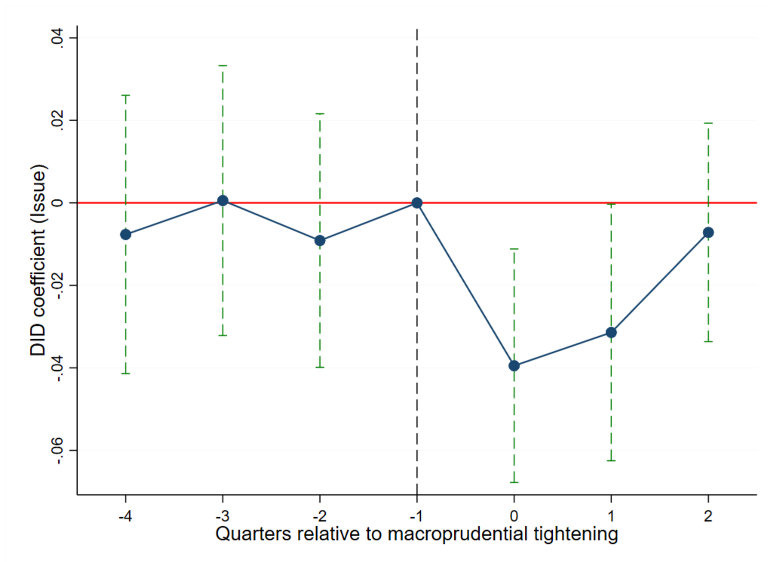


Figure 5: **Relationship between Dealscan spreads and Prowess spreads**
The figure shows binscatter plots from regressions relating the actual spreads on foreign currency debt obtained from the *Dealscan* sample to the overall firm interest rate spread obtained from the *Prowess* sample. In figure (a), the regression is estimated with no controls and no fixed effects. In figure (b), controls are present but no fixed effects. Figure (c) has fixed effects but no controls while figure (d) has both fixed effects and controls. The relevant fixed effects are year fixed effects and the controls are assets, debt-to-asset ratio, exports-to-sales ratio and the ratio of foreign debt to assets. The β coefficient and t-statistic from each regression are reported in each figure.

(a) Dependent variable: Issue (0/1)



(b) Dependent variable: Log(1+FC Borr)

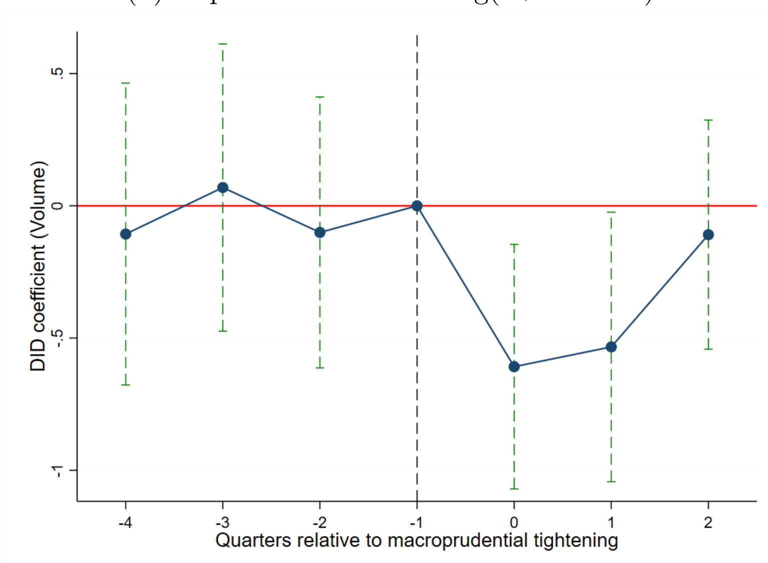
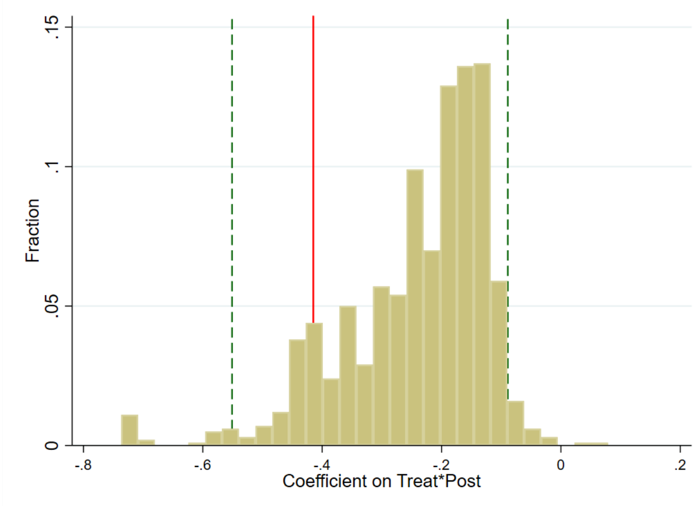


Figure 6: **Issuance around Macroprudential Tightening: Dynamic DID**
The figure depicts the coefficients from a dynamic difference-in-difference regression. All observations are at the firm-quarter level. In figure (a), the dependent variable takes the value 1 if a firm makes at least one issuance in the quarter, and 0 otherwise. In figure (b), the dependent variable is the log of the amount borrowed. The treatment is the macroprudential tightening of November 2015. Treated firms are those that borrowed at an interest rate spread between 450 and 500 bps over 6-month LIBOR any time before November 2015. For firms for which we do not have the borrowing cost from *Dealscan*, we predict the borrowing cost using the average interest expense in *Prowess* and the relationship between *Dealscan* and *Prowess* spreads. Firm-level controls include total assets, 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. Standard errors are clustered at the firm level and 10% confidence intervals are shown. The quarter before the treatment is the omitted base level.

(a) Bootstrapping Predicted Spreads



(b) Randomizing Treatment Assignment

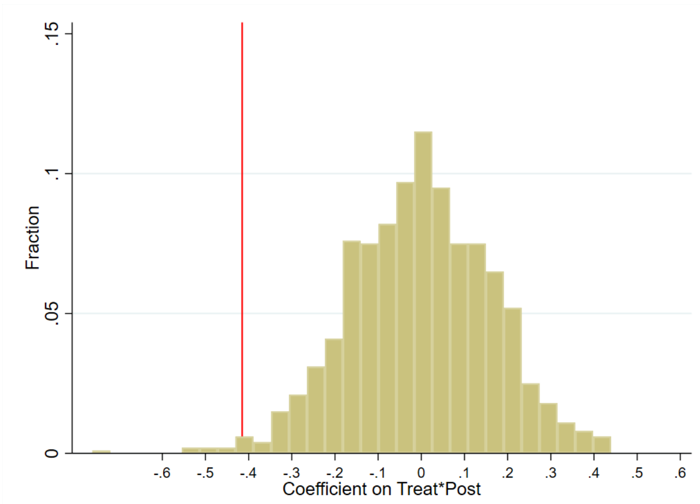


Figure 7: **DID Robustness: Bootstrapping**

The figure depicts the distribution of coefficients obtained from 1000 difference-in-difference regression samples. In Panel (a), for each sample, we randomly draw from N(0.167,0.033). The mean (standard deviation) of this distribution is the coefficient (standard error) of the estimated relationship between the marginal Dealscan spread and the average Prowess spread. We use this randomly selected value as the coefficient on the Prowess spread to predict the Dealscan spread. We then characterize treated firms based on these predicted spreads, and undertake our DID process. We repeat this randomization process 1000 times with issuance propensity as the dependent variable and plot the distribution of the coefficients. The solid red line is the coefficient value from our sample (column (2) in Table 5A) while the dashed green lines indicate the 95% confidence intervals obtained from this process. In Panel (b), we randomize the distribution of predicted spreads across our sample of firms. The fraction of treated firms remains the same as in our base sample. Treated firms are now those who have a randomly assigned spread between 450 bps and 500 bps. We repeat this randomization process 1000 times with issuance propensity as the dependent variable and plot the distribution of the coefficients. The solid red line is the coefficient value from our sample (column (2) in Table 5A).

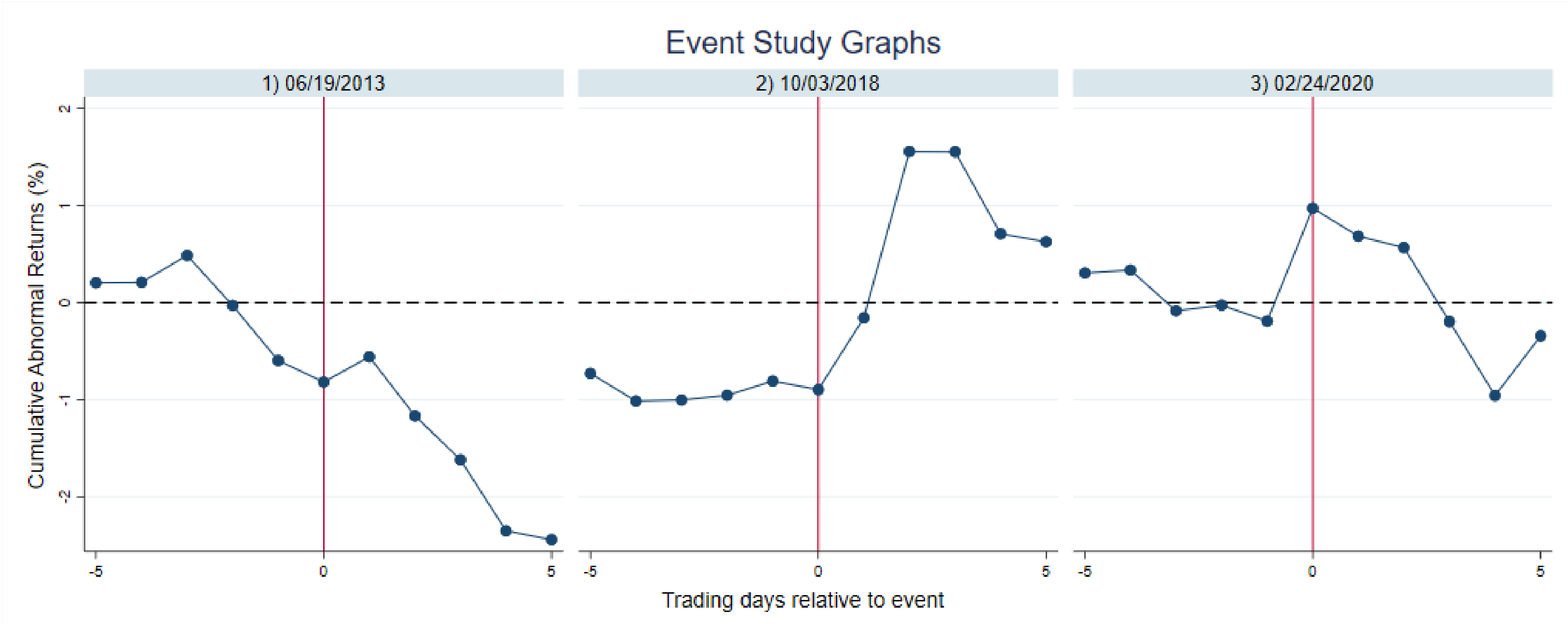


Figure 8: **Event Study: CAR of high CT issuer (top tercile) relative to low CT issuer (bottom tercile)** The figure shows the cumulative abnormal return (CAR) for high CT issuer stocks relative to low CT issuer stocks, for three event dates, from five days prior to the event date to five days after. June 19, 2013 is a date on which the likelihood of tapering went up; October 3, 2018 is a date when the rupee fell sharply owing to a spike in oil prices and February 24, 2020 corresponds to the start of the market downturn due 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 150 calendar days and ends five trading days before the event date.

Table 1: **Summary Statistics**

Panel A provides statistics on foreign currency debt issuance by Indian corporates as per data from the Reserve Bank of India (RBI). The sample has the 1,818 firms that can be matched to the Prowess database and is from January 2004 to September 2019. Panel B provides summary statistics on the balance sheet of firms that appear in the *Prowess* sample. The foreign currency borrowing is as per Prowess. Panel C provides statistics from the *Dealscan* sample, including interest rate spreads. Panel D has monthly returns data and the CT index.

Panel A: Foreign Currency Debt Facilities

	N	Mean	Median	St. Dev.	P5	P95
Amount (mn USD)	6,013	60.286	13.200	154.900	0.852	300.000
Maturity (Years)	6,013	6.341	5.417	2.873	3.000	11.417
No. of facilities (per firm)	1,818	3.307	2	4.712	1	10

Panel B: Firm Balance Sheets

	N	Mean	Median	St. Dev.	P5	P95
Total Assets (bn INR)	17,706	26.88	4.62	77.48	0.19	118.65
Cash/Assets	17,700	0.051	0.00	0.31	0.00	0.09
Fixed/Total Assets	17,438	0.354	0.341	0.204	0.037	0.723
Current/Total Assets	17,657	0.377	0.370	0.209	0.044	0.739
Total Debt (bn INR)	16,750	10.52	1.469	31.332	0.036	48.357
Foreign Currency Debt (bn INR)	7,544	4.93	0.739	14.438	0.035	20.475
Long-Term/Total Debt	16,748	0.670	0.729	0.298	0.050	1.000
Foreign Currency/Total Debt	7,544	0.373	0.293	0.292	0.029	0.992
Debt/Assets	16,749	0.372	0.353	0.232	0.038	0.756
Dividends/Total Assets	8,351	-0.016	-0.010	0.020	-0.050	-0.001
Return on Assets	15,718	0.149	0.141	0.132	-0.023	0.367
Exports/Sales (%)	17,589	16.330	2.958	25.674	0.000	80.686

Panel C: Interest Rate Data

	N	Mean	Median	St. Dev.	P5	P95
Amount (mn USD)	505	257.956	166.774	282.272	15.000	800.000
Maturity (Years)	505	6.517	5.333	3.459	2.500	11.667
Spread over 6-month LIBOR (bps)	505	201.765	165.000	133.222	45.000	456.025

Panel D: Returns Data

	N	Mean	Median	St. Dev.	P5	P95
NIFTY Monthly Return (%)	192	1.287	1.345	6.304	-8.814	9.916
INRUSD Monthly Return (%)	192	-0.206	-0.030	2.317	-4.419	3.326
CT Index	192	0.739	0.780	0.258	0.322	1.158

Table 2: **Determinants of Issuance: Carry Trade and the Post-crisis Period**

This table shows results from logistic and OLS regressions used to predict the issuance of foreign currency debt. All observations are at the firm-month level. The dependent variable in the first four columns takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. In the next four columns, the dependent variable is the log of 1 plus the amount borrowed by a firm in a given month. In columns (1), (2), (5), and (6), the sample includes all issuances while in the other columns, the sample is comprised only of bank loans. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the U.S. 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 total assets, 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 parentheses. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)				Log(1+FC Borr)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CT	0.431***	-0.281	0.499***	-0.185	0.139***	-0.103	0.166***	-0.047
	(0.105)	(0.182)	(0.110)	(0.199)	(0.035)	(0.070)	(0.036)	(0.067)
CT*Post-crisis		1.302***		1.235***		0.476***		0.455***
		(0.227)		(0.242)		(0.085)		(0.084)
CT*Post-Taper		-0.052		-0.135		0.032		-0.028
Tantrum		(0.316)		(0.330)		(0.088)		(0.088)
FX Return	0.007	0.008	0.005	0.005	0.003	0.003	0.002	0.002
	(0.010)	(0.010)	(0.010)	(0.010)	(0.003)	(0.003)	(0.003)	(0.003)
NIFTY return	-0.001	-0.001	-0.000	0.001	-0.001	-0.000	-0.000	0.000
	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)	(0.001)	(0.001)
Post-crisis	-0.112	-0.936***	0.017	-0.766***	-0.046	-0.339***	0.009	-0.272***
	(0.079)	(0.163)	(0.087)	(0.179)	(0.028)	(0.057)	(0.031)	(0.059)
Post-Taper	-0.876***	-0.566**	-0.796***	-0.415	-0.252***	-0.190**	-0.221***	-0.112
Tantrum	(0.115)	(0.285)	(0.126)	(0.300)	(0.033)	(0.076)	(0.036)	(0.079)
Sample	All	All	Bank	Bank	All	All	Bank	Bank
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	124008	124008	116947	116947	133913	133913	123254	123254
PseudoR^2	0.016	0.018	0.014	0.017				
Adj.R^2					0.029	0.029	0.029	0.029

Table 3: **Carry Trade and Macroprudential Policies in the Post-crisis Period**

This table shows results from logistic and OLS regressions used to predict the issuance of foreign currency debt between September 2008 and March 2019. All observations are at the firm-month level. The dependent variable in the first four columns takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. In the next four columns, the dependent variable is the log of 1 plus the amount borrowed by a firm in a given month. In columns (1), (2), (5), and (6), the sample includes all issuances while in the other columns, the sample is comprised only of bank loans. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the U.S. scaled by the implied volatility of 3-month FX options. *High AIC* is a dummy that takes the value 1 if the maximum All-In-Cost interest rate spread was above its sample median for the post-crisis period, indicating looser policy. *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 total assets, 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 parentheses. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)				Log(1+FC Borr)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CT [β_1]	-1.983***	-2.014***	-1.719***	-1.748***	-0.617***	-0.630***	-0.528***	-0.541***
	(0.304)	(0.302)	(0.311)	(0.310)	(0.106)	(0.106)	(0.108)	(0.108)
High AIC	-2.059***	-2.044***	-1.809***	-1.793***	-0.617***	-0.626***	-0.533***	-0.543***
Spread	(0.267)	(0.283)	(0.274)	(0.293)	(0.097)	(0.101)	(0.099)	(0.103)
CT*Hi AIC	2.415***	2.401***	2.141***	2.129***	0.720***	0.728***	0.635***	0.644***
Spread [β_2]	(0.317)	(0.325)	(0.323)	(0.333)	(0.109)	(0.112)	(0.111)	(0.114)
FX Return	-0.007	-0.008	-0.008	-0.009	-0.001	-0.001	-0.001	-0.002
	(0.010)	(0.010)	(0.010)	(0.010)	(0.003)	(0.003)	(0.003)	(0.003)
NIFTY return	-0.004	-0.004	-0.005	-0.005	-0.002	-0.002	-0.002	-0.002
	(0.004)	(0.005)	(0.004)	(0.005)	(0.001)	(0.001)	(0.001)	(0.001)
$Pr(\beta_1 + \beta_2 = 0)$	0	.0001	0	.0001	0	.0002	.0001	.0003
Sample	All	All	Bank	Bank	All	All	Bank	Bank
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	181865	135928	168239	133285	181865	181865	168239	168239
PseudoR^2	0.012	0.007	0.010	0.006				
Adj.R^2					0.003	0.029	0.002	0.027

Table 4: **Issuance around Macroprudential Tightening: DID Estimates**

Panel A: Base results

This table shows results from logistic and OLS regressions used to predict the issuance of foreign currency debt between September 2008 and March 2019. All observations are at the firm-month level. The dependent variable in the first four columns takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. In the next four columns, the dependent variable is the log of 1 plus the amount borrowed by a firm in a given month. The independent variable, *Treat*Post*, is the interaction of *Treat* and *Post*. *Treat* takes the value 1 if a firm borrowed at a spread of between 450 bps and 500 bps above 6-month LIBOR prior to November 2015, and 0 otherwise. *Post* is 1 for all months from November 2015 onwards. The independent variable, *(Spread-4.5)*Post*, is the interaction of *(Spread-4.5)* and *Post*. *(Spread-4.5)* is a continuous variable which is the difference between the average all-in-cost spread for a firm and 450 bps above 6-months LIBOR. We convert this variable to % by dividing by 100 . In columns (1) and (5), the sample is restricted to firms for which we have borrowing costs from the *Dealscan* sample. In columns (2) and (6), we have the entire sample. In columns (3), (4), (7) and (8), we have the entire sample but we exclude firms with borrowing cost above 500 bps. For firms for which we do not have the borrowing cost from *Dealscan*, we predict the borrowing cost using the average interest expense in *Prowess* and the relationship between *Dealscan* and *Prowess* spreads. *Post* takes the value 1 for months starting from November 2015, and 0 otherwise. Firm-level controls include total assets, 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 parentheses. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)				Log(1+FC Borr)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat*Post	-0.351	-0.415*	-0.648*		-0.555**	-0.084**	-0.101*	
	(0.471)	(0.224)	(0.343)		(0.279)	(0.039)	(0.054)	
(Spread-4.5)*Post (%)				-0.276***				-0.047***
				(0.094)				(0.017)
Sample	Dealscan	All	All-Trim	All-Trim	Dealscan	All	All-Trim	All-Trim
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9022	132173	118641	118641	11224	176712	156436	156436
PseudoR^2	0.032	0.016	0.018	0.018				
Adj.R^2					0.062	0.030	0.027	0.027

Panel B: Results with bootstrapped standard errors

This panel shows results using the same specifications as in columns (2)-(4) and columns (6)-(8). However, the standard errors reported are from a bootstrapping procedure. In the bootstrapping process, we make 1000 random draws from N(0.167,0.033). The mean (standard deviation) of this normal distribution is the coefficient (standard error) of the estimated relationship between the marginal Dealscan spread and the average Prowess spread. For each draw, we use the randomly selected value as the coefficient on the Prowess spread to predict the Dealscan spread. We then characterize treated firms based on these predicted spreads, and undertake our DID process. We estimate the DID coefficient for both issuance propensity and volume. We repeat this randomization process 10000 times and take the standard deviation of the resulting coefficients as our bootstrapped standard error. This standard error is reported in parantheses below the coefficient (from Panel A). Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)			Log(1+FC Borr)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat*Post	-0.415***	-0.648***		-0.084*	-0.101**	
	(0.122)	(0.231)		(0.051)	(0.049)	
(Spread-4.5)*Post (%)			-0.276***			-0.047***
			(0.034)			(0.012)
Sample	All	All-Trim	All-Trim	All	All-Trim	All-Trim
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	132173	118641	118641	176712	156436	156436
PseudoR^2	0.016	0.018	0.018			
Adj.R^2				0.030	0.027	0.027

Table 5: **Maturity, Trade Credit, and Domestic Debt in the Post-crisis Period**

This table shows results from OLS regressions used to explain maturity of foreign currency borrowing, changes in trade credit, and changes in INR debt between September 2008 and March 2019. All observations are at the firm-month level. The dependent variable in the first two columns is the maturity (in years) of foreign currency debt issuances. In the next two columns, it is the difference in trade credit received between the end of fiscal year t and the end of fiscal year $t-1$. Trade credit received is defined as the ratio of accounts payable to total assets. In the last two columns, it is the difference in domestic currency (INR) debt (scaled by assets) between the end of fiscal year t and the end of fiscal year $t-1$. In the first two columns, the sample covers issuance months only while in the next two it only includes firms with above-median ratio of imports to raw materials. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the U.S. scaled by the implied volatility of 3-month FX options. *High AIC* is a dummy that takes the value 1 if the maximum All-In-Cost interest rate spread was above its sample median for the post-crisis period, indicating looser policy. *CT*Hi AIC* is the value of *CT* interacted with *High AIC*. *Int Cost* is the ratio of total interest expense to debt outstanding. Industry-year and firm fixed effects are included in all specifications. Firm-level controls include log of total assets, ratio of debt to assets, ratio of exports to sales, and cash to asset ratio measured at the end of the previous fiscal year. Firm clustered standard errors are in parentheses. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Dependent Variable					
	Maturity (years)		Δ TC Received		Δ INR Debt	
	(1)	(2)	(3)	(4)	(5)	(6)
CT	0.715	0.233	-0.010*	-0.017*	0.012	0.018
	(0.442)	(0.639)	(0.005)	(0.009)	(0.012)	(0.012)
Int Cost		-0.018		-0.001		0.001*
		(0.040)		(0.001)		(0.001)
High AIC Spread	1.719***	1.341*	-0.012**	-0.016*	0.019	0.042**
	(0.452)	(0.734)	(0.005)	(0.009)	(0.014)	(0.016)
CT*Hi AIC	-1.023*	-0.192	0.015**	0.020**	-0.017	-0.030*
	(0.546)	(1.026)	(0.006)	(0.009)	(0.014)	(0.017)
CT*Int Cost		0.038		0.001		-0.001
		(0.051)		(0.001)		(0.001)
Hi AIC*Int Cost		0.037		0.000		-0.003***
		(0.074)		(0.001)		(0.001)
CT*Hi AIC*Int Cost		-0.102		-0.001		0.002
		(0.098)		(0.001)		(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Ind-Year FE and Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2460	2244	80755	79326	176704	167458
Adj.R^2	0.500	0.460	0.272	0.271	0.411	0.328

Table 6: **Forward-looking FX β and Foreign Currency Debt Issuance**

The table has results from OLS regressions relating firm FX β to issuance of foreign currency debt. The dependent variable in the first (last) four columns is the FX (market) β estimated for firm i from the market model in a 60-month trading window starting in month t. *Issue* is a dummy that takes value 1 if firm i issued foreign currency debt in month $t-1$. Δ FC Debt is the difference in the ratio of foreign to total debt between month $t-1$ and the corresponding month in the previous year. *High AIC* is a dummy that takes the value 1 if the maximum All-In-Cost interest rate spread was above its sample median for the post-crisis period, indicating looser policy. Fixed effects are as indicated. The sample period is from January 2004 to September 2019. Standard errors clustered at both firm and month level are reported in brackets. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	β (forward looking)							
	FX				Market			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Issue	-0.021	-0.072**	-0.033	-0.081**	0.008	0.025	0.008	0.023
	(0.021)	(0.029)	(0.024)	(0.034)	(0.011)	(0.015)	(0.012)	(0.015)
Issue*Hi AIC		0.115**		0.114**		-0.038		-0.035
		(0.052)		(0.057)		(0.026)		(0.028)
Issue*Δ FC Debt			0.248**	0.044			-0.108*	-0.059
			(0.108)	(0.137)			(0.060)	(0.084)
Issue*Δ FC Debt*Hi AIC				0.719**				-0.181
				(0.324)				(0.123)
Δ FC Debt			0.018	0.017			0.014	0.014
			(0.084)	(0.084)			(0.034)	(0.034)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.161	0.161	0.162	0.162	0.203	0.203	0.197	0.197
Obs.	64,670	64,670	57,010	57,010	64,670	64,670	57,010	57,010

Table 7: β **and Foreign Currency Debt 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 issued foreign currency debt 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 month 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	
	(1)	(2)	(3)	(4)
	FX β	Market β	FX β	Market β
Issue	0.057	-0.012	-0.130**	0.045
	(0.036)	(0.019)	(0.053)	(0.031)
Issue*Hi AIC	-0.035	-0.002	0.133	-0.097*
	(0.074)	(0.033)	(0.090)	(0.058)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2	0.326	0.409	0.315	0.428
Obs.	13,915	13,915	9,435	9,435

Panel B: Interest Cost

	β (forward looking)			
	Low Int Cost Firms		High Int Cost Firms	
	(1)	(2)	(3)	(4)
	FX β	Market β	FX β	Market β
Issue	-0.017	-0.020	-0.123***	0.061**
	(0.036)	(0.017)	(0.046)	(0.024)
Issue*Hi AIC	0.059	0.022	0.106	-0.086
	(0.065)	(0.028)	(0.075)	(0.060)
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R^2	0.432	0.507	0.134	0.147
Obs.	29,913	29,913	28,329	28,329

Table 8: **Event Study of Taper and Post-taper Events**

The sample consists of companies that are present in the RBI data and that have stock return data 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 February 24, 2020 is start of the market drawdown due to 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 four issuances over the sample period. In Panel B, firms are sorted into terciles based on their implied interest cost. Robust standard errors are in parentheses. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

Panel A: Firm CT

	CAR[0,4]		
	06/19/13 (1)	10/03/18 (2)	02/24/20 (3)
Low CT Issuer	-1.354	2.012	-1.484*
	(1.216)	(1.477)	(0.764)
Mid CT Issuer	-1.564***	2.225*	-0.514
	(0.599)	(1.172)	(0.776)
High CT Issuer	-3.209***	3.394***	-2.204**
	(0.824)	(0.828)	(0.892)
Pr(H-L>0)	.0996	.8025	.2764
Observations	189	177	173
R^2	0.093	0.085	0.062

Panel B: Interest Cost

	CAR[0,4]		
	06/19/13 (1)	10/03/18 (2)	02/24/20 (3)
Low Int Cost	-1.166***	1.985***	-2.122***
	(0.438)	(0.608)	(0.568)
Mid Int Cost	-1.038*	3.394***	-1.570***
	(0.610)	(0.650)	(0.564)
High Int Cost	-1.627***	3.337***	-0.844
	(0.467)	(0.728)	(0.619)
Pr(H-L>0)	.2356	.9224	.9353
Observations	443	477	483
R^2	0.042	0.113	0.045

Table 9: **Firm Outcomes and Foreign Currency Debt Issuance in the Post-crisis Period**

This table shows results from a OLS regression relating firm outcomes to the firm's propensity to issue foreign currency debt 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. The independent variable of interest is the interaction of *Hi AIC*, a dummy taking the value 1 if the maximum All-In-Cost interest rate spread 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)

	Investment		Cash		Leverage		ROA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hi AIC × Hi Firm CT	0.199		0.027***		-0.035*		-0.007	
	(0.151)		(0.010)		(0.021)		(0.009)	
Hi AIC × Firm CT		0.772		0.096**		-0.146*		-0.018
		(0.591)		(0.040)		(0.077)		(0.030)
Ind-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3084	3084	3282	3282	3281	3281	3098	3098
R^2	0.301	0.301	0.443	0.443	0.658	0.658	0.521	0.521

Regulating Carry Trades: Evidence from Foreign Currency Borrowing of Corporations in India

Online Appendix

A Additional Results

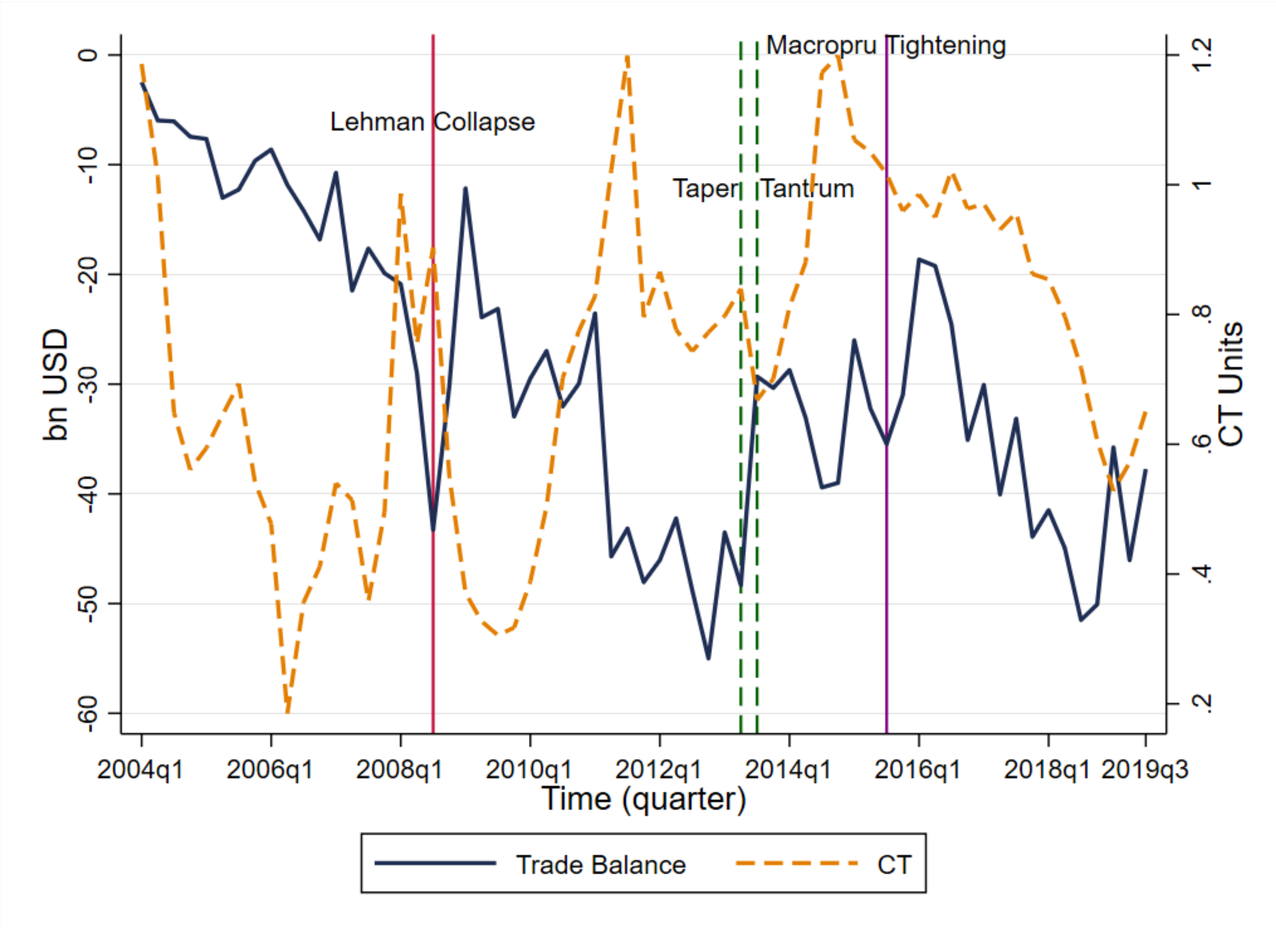


Figure A.1: **Carry Trade and Trade Balance**

The 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 U.S. *CT* is defined as the difference in 3-month interest rates between India and the U.S. scaled by the implied volatility of 3-month FX options. The sample period is from January 2004 to September 2019.

The following table shows the correlation between the monthly *CT* index and trade balance. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01).

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)	-0.310***	0.004	-0.590***	-0.466**	0.546***

Table A.1: **Carry Trade, Macroprudential Policies, and Interest Costs**

This table shows results from logistic and OLS regressions used to predict the issuance of foreign currency debt between September 2008 and March 2019. All observations are at the firm-month level. The dependent variable in the first four columns takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. In the next four columns, the dependent variable is the log of 1 plus the amount borrowed by a firm in a given month. In columns (1), (2), (5), and (6), the sample includes all issuances while in the other columns, the sample is comprised only of bank loans. The independent variable, *CT*, captures the difference in 3-month interest rates between India and the U.S. scaled by the implied volatility of 3-month FX options. *High AIC* is a dummy that takes the value 1 if the maximum All-In-Cost interest rate spread was above its sample median for the post-crisis period, indicating looser policy. *CT*Hi AIC* is the value of *CT* interacted with *High AIC*. *Int Cost* is the ratio of total interest expense to debt outstanding. Fixed effects are as indicated. Firm-level controls include log of total assets, ratio of debt to assets, ratio of exports to sales, and cash to asset ratio measured at the end of the previous fiscal year. Firm clustered standard errors are in parentheses. Significance levels: *(p<0.10), **(p<0.05), *** (p<0.01)

	Issue (0/1)				Log(1+FC Borr)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CT	0.350*	-2.332***	0.268	-2.098***	0.117**	-2.303***	0.119**	-1.902***
	(0.205)	(0.557)	(0.202)	(0.589)	(0.052)	(0.417)	(0.056)	(0.430)
Int Cost	-0.026*	0.048**	-0.039***	0.045*	-0.003**	0.008	-0.005***	0.005
	(0.015)	(0.022)	(0.014)	(0.024)	(0.001)	(0.006)	(0.001)	(0.005)
High AIC Spread		-4.205***		-3.875***		-3.389***		-2.933***
		(0.530)		(0.576)		(0.496)		(0.514)
CT*Hi AIC		2.715***		2.449***		2.713***		2.281***
		(0.584)		(0.622)		(0.460)		(0.475)
CT*Int Cost	0.018	-0.064**	0.029*	-0.061*	0.003*	-0.008	0.004**	-0.006
	(0.016)	(0.032)	(0.015)	(0.034)	(0.002)	(0.007)	(0.002)	(0.006)
Hi AIC*Int Cost		-0.127***		-0.125***		-0.014**		-0.012**
		(0.029)		(0.031)		(0.006)		(0.006)
CT*Hi AIC*Int Cost		0.128***		0.125***		0.014*		0.012*
		(0.037)		(0.039)		(0.007)		(0.006)
Sample	All	All	Bank	Bank	All	All	Bank	Bank
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Year	Year	Year	Year	Ind-Year	Ind-Year	Ind-Year	Ind-Year
Observations	120015	120015	117535	117535	167615	167615	154441	154441
PseudoR^2 / Adj.R^2	0.017	0.048	0.018	0.043	0.032	0.039	0.031	0.036

Table A.2: **Carry Trade and Macroprudential Policies in the pre-crisis period**

This table shows results from logistic and OLS regressions used to predict the issuance of foreign currency debt between January 2004 and August 2008. All observations are at the firm-month level. The dependent variable in the first two columns takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. In the next two columns, the dependent variable is the log of 1 plus the amount borrowed by a firm in a given month. 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 Interest Rate 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 total assets, debt to asset ratio, ratio of exports to sales, and cash to assets 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)		Log(1+FC Borr)	
	(1)	(2)	(3)	(4)
CT [β_1]	0.079	0.035	0.025	0.010
	(0.259)	(0.265)	(0.084)	(0.083)
High AIC	0.466**	0.401*	0.145**	0.140**
Spread	(0.197)	(0.205)	(0.063)	(0.068)
CT*Hi AIC	-0.736**	-0.733**	-0.236**	-0.236**
Spread [β_2]	(0.330)	(0.341)	(0.106)	(0.108)
FX Return	0.008	0.010	0.002	0.002
	(0.023)	(0.023)	(0.007)	(0.007)
NIFTY return	0.002	0.001	0.001	0.001
	(0.005)	(0.005)	(0.002)	(0.002)
$Pr(\beta_1 + \beta_2 = 0)$	.002	.0015	.0022	.0014
Firm Controls	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes
Observations	45948	21417	45948	45948
PseudoR^2	0.043	0.009		
Adj.R^2			0.009	0.031

Table A.3: **Carry Trade, Macroprudential Policies and Interest Costs in the Pre-crisis Period**

This table shows results from logistic and OLS regressions used to predict the issuance of foreign currency debt between January 2004 and August 2008. All observations are at the firm-month level. The dependent variable in the first two columns takes the value 1 if a firm makes at least one issuance in the month, and 0 otherwise. In the next two columns, the dependent variable is the log of 1 plus the amount borrowed by a firm in a given month. 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 Interest Rates spread was above its sample median for the pre-crisis period from January 2004 to August 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 total assets, debt to asset ratio, ratio of exports to sales, and cash to assets 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)		Log(1+FC Borr)	
	(1)	(2)	(3)	(4)
CT	1.755***	2.309***	0.451***	0.676***
	(0.420)	(0.474)	(0.119)	(0.144)
Int Cost	0.029*	0.016	0.003	0.004
	(0.016)	(0.023)	(0.003)	(0.004)
High AIC Spread (Pre-Crisis)		0.906**		0.383***
		(0.399)		(0.128)
CT*Hi AIC		-1.025		-0.481**
		(0.654)		(0.188)
CT*Int Cost	-0.045	-0.007	-0.003	-0.002
	(0.028)	(0.026)	(0.004)	(0.005)
Hi AIC*Int Cost		0.034		-0.001
		(0.032)		(0.005)
CT*Hi AIC*Int Cost		-0.085		-0.003
		(0.057)		(0.007)
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Firm, Year	Firm, Year	Firm, Ind-Year	Firm, Ind-Year
Observations	19416	19416	39958	39958
PseudoR^2	0.018	0.021		
Adj.R^2			0.033	0.033

B Rupee-Denominated Bonds and Foreign Investment in Domestic Bonds

In this section, we look at changes in macroprudential policy targeting domestic currency debt. We focus on two key changes: guidelines on the issuance of rupee-denominated bonds in overseas markets and the relaxation of limits on foreign investment in domestic corporate bonds. The rupee bond guidelines were introduced in September 2015 and the first set of bonds were issued in the third quarter of 2016. To rule out the decline in foreign currency debt issuance we document is not just substitution to overseas rupee bonds, we collect data on the latter. Appendix Figure B.1 shows the evolution of rupee bond issuance since 2016, along with the foreign currency debt issuance over the same period. The figure shows that rupee bond issuance is significantly lower than foreign currency debt and the volume of rupee bonds has declined significantly over time. The volume of non-financial rupee bond issuance averages only 5% of the volume of foreign currency debt issuance from 2016 to 2019. Many rupee bond issuers are financial firms, a category we exclude in our analysis.

The RBI imposes capital controls through the imposition of limits on foreign investment in Indian debt and equity markets. In Appendix Figure B.2a, we plot foreign 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. Foreign investment in domestic 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 Appendix Figure B.2b, we plot net foreign investor flows in domestic debt 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 foreign currency borrowing in November 2015 is not accompanied by significant inflows. This enables us to rule out that the results we document are an artifact of foreign investors substituting foreign currency corporate debt with domestic currency debt.

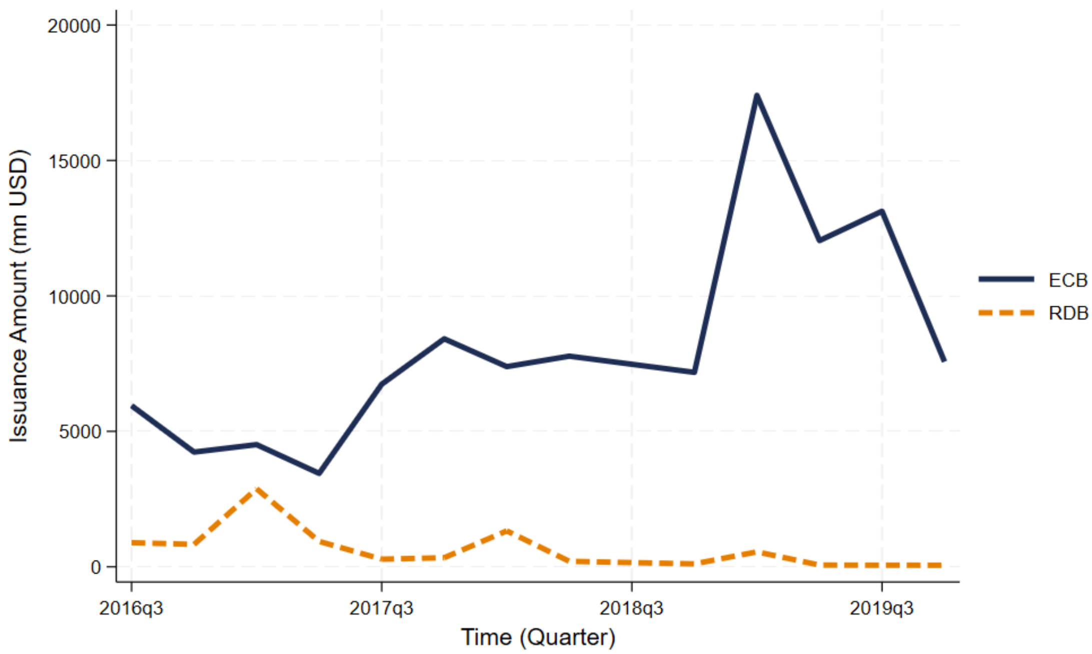
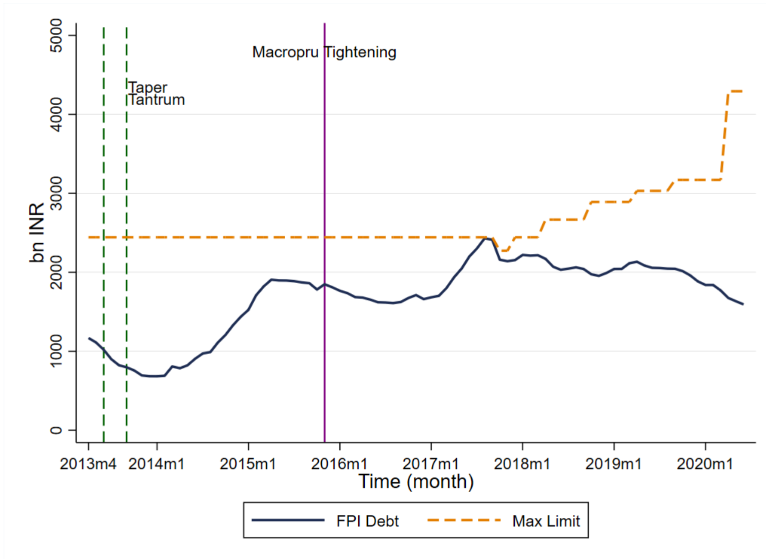


Figure B.1: **Foreign Currency Debt and Rupee-Denominated Bonds**
The figure shows the evolution of the issuance of foreign currency debt and rupee-denominated bonds from September 2016 to December 2020.

(a) Foreign Investment in Domestic Debt and Maximum Limits



(b) Net Foreign Investment Flows in Domestic Debt

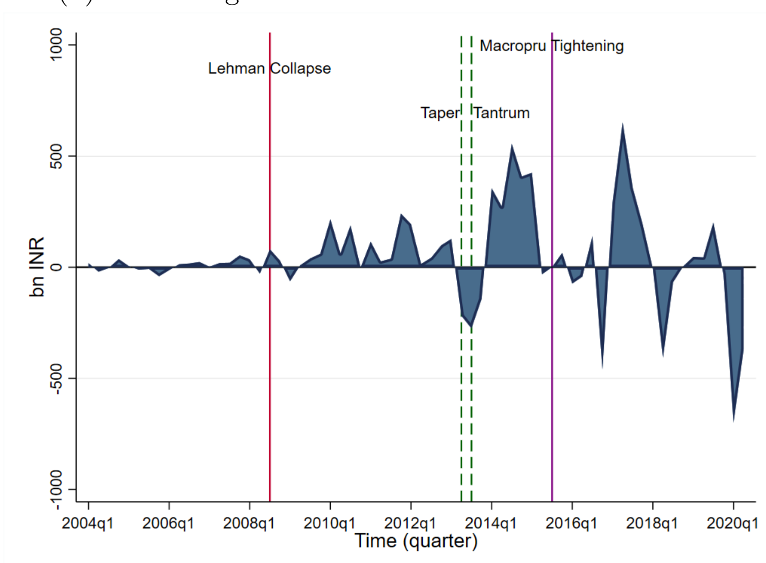


Figure B.2: **Foreign Investor Domestic Debt Holdings and Flows**
The figure depicts the evolution of the stock and flows of foreign investor positions in domestic corporate debt. Figure (a) depicts the stock of foreign investor holdings along with the maximum regulatory limits monthly from April 2013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

C Foreign Currency Debt Maturity Dates and Exchange Rates

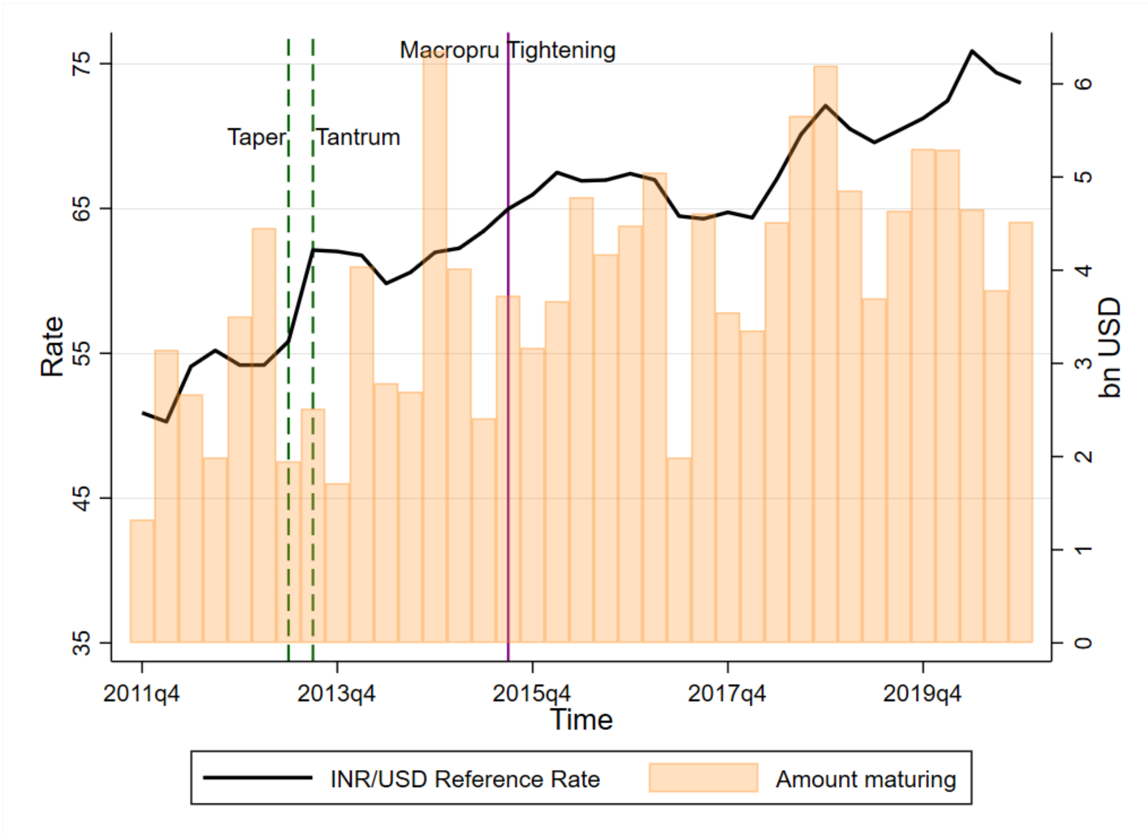


Figure C.1: **Foreign Currency Debt Maturity Dates and INR/USD Exchange Rate**
The line shows the evolution of the INR/USD Reference Rate while the bars indicate the issuance volume of foreign currency debt due to mature in that quarter. The figure covers the period from the third quarter of 2011 (three years after the global financial crisis) to the fourth quarter of 2020.

Table C.1: **Foreign Currency Debt Maturity Dates and Exchange Rates**

This table shows results from an OLS 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 foreign currency debt issuances due to mature in that month. The sample period is from September 2011 (three years after the global 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