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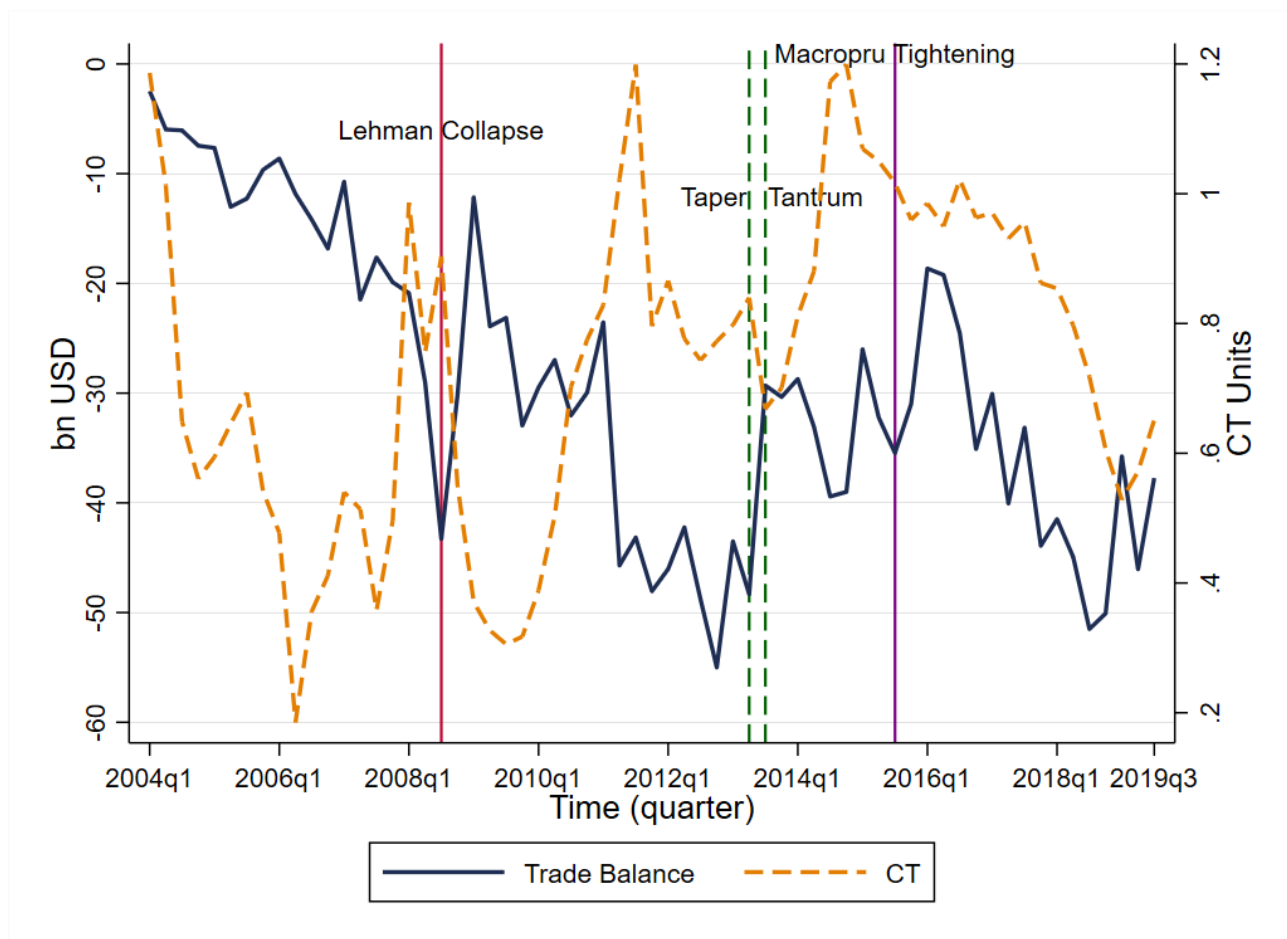
Online Appendix

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. 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 $[\beta_1]$	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 $[\beta_2]$	(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.
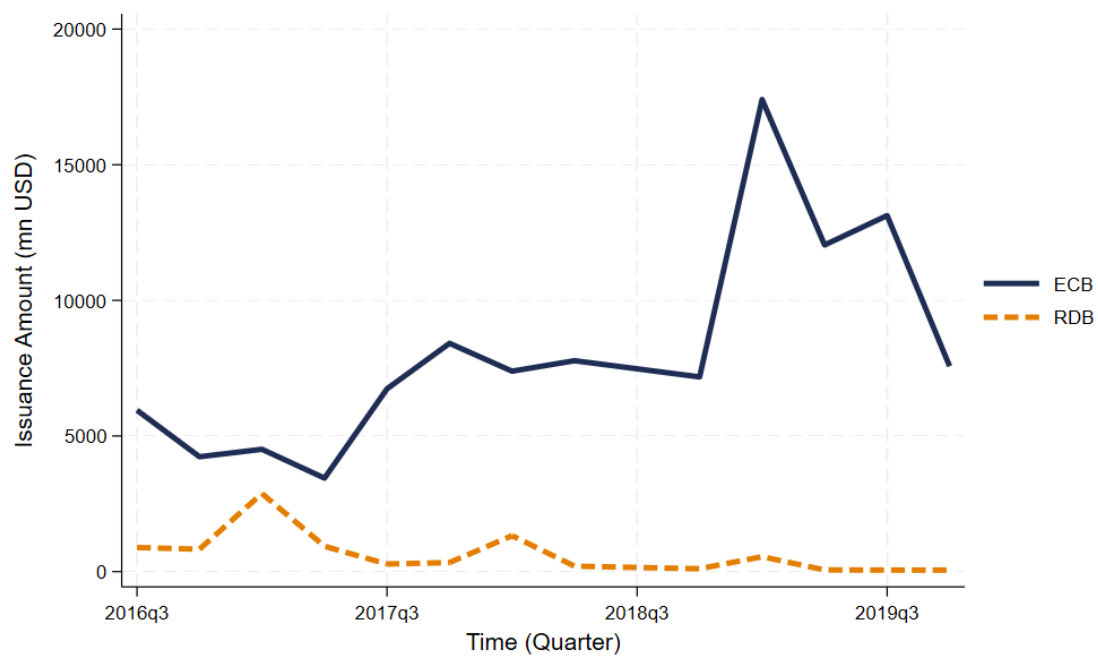
Figure B.1: **Foreign Currency Debt and Rupee-Denominated Bonds**
The figure shows the evolution of the issuance of foreign currency debt and rupee-denominated bonds from September 2016 to December 2020.

(a) Foreign Investment in Domestic Debt and Maximum Limits
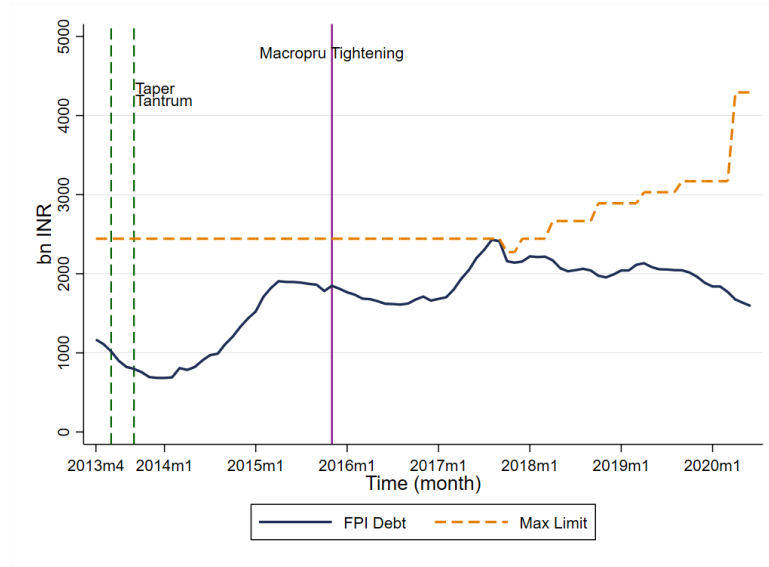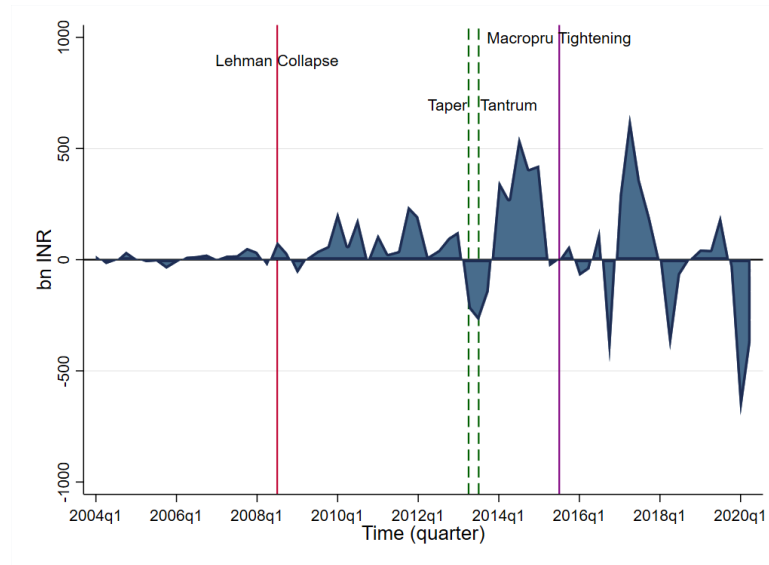

(b) Net Foreign Investment Flows in Domestic Debt

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.

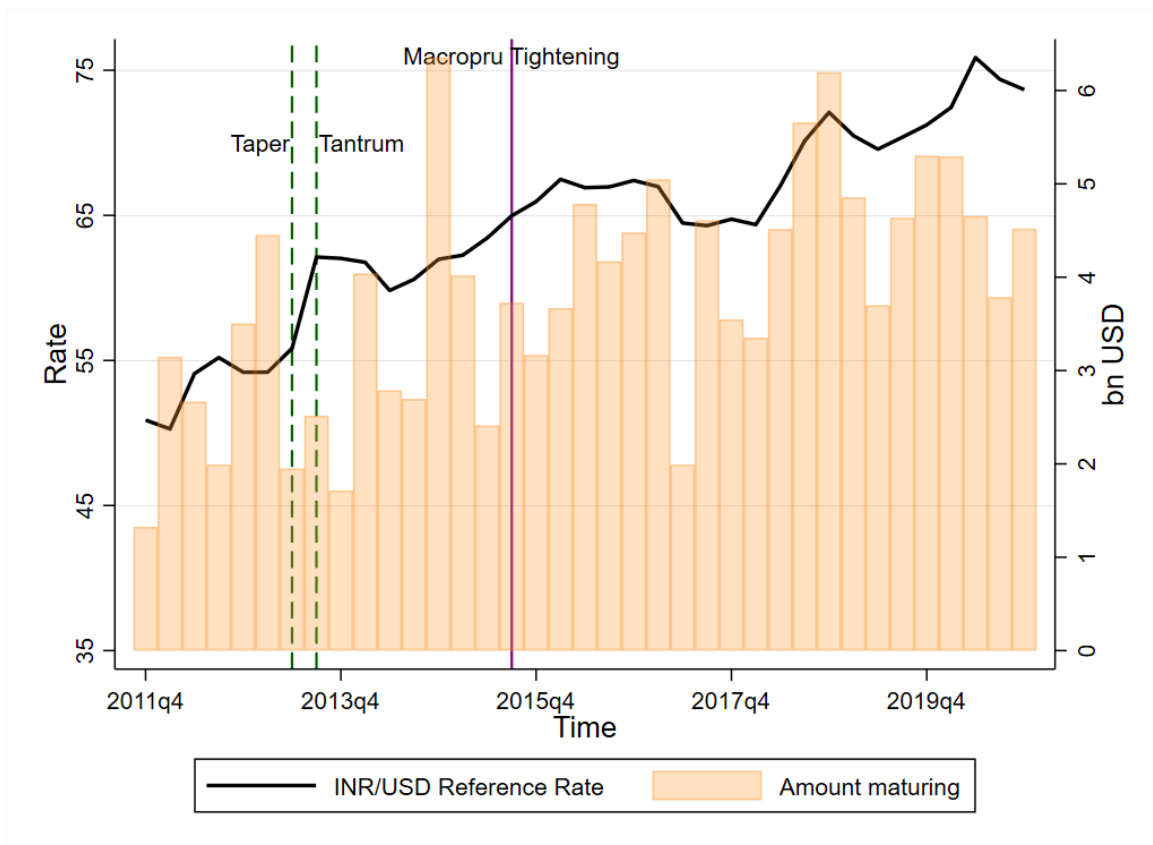# C Foreign Currency Debt Maturity Dates and Exchange Rates

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