China's Currency Market Shocks and Corporate Bond Issuance

by

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Contents

1. **Abstract** 3
2. **Acknowledgements** 4
3. **Introduction** 5
4. **Literature Review** 8
5. **Data** 11
6. **Methodology** 12
8. **Descriptive Evidence for and Against Carry Trade-Like Activities** 15
9. **Time Series Analysis of Domestic Issuance** 18

China and Russia's Currency Regime Shocks 22

Reflection on Countries Included 23

10. **Synthetic Control Approach** 23
11. **Firm-Level Approach** 27

Implications 32

12. **Conclusions** 33
13. **Works Cited** 36
14. **Appendices** 40

1. Abstract

Using corporate bond data from 10 countries over the time period 2010-2018, I find evidence for China's 2015 failed currency regime liberalization increasing the likelihood of new RMB-denominated corporate bond issuance and contributing to the decrease in the quarterly variance of new issuance composition by currency. I use data from Bloomberg, and Thomson One Banker, as well as macroeconomic data from The Federal Reserve and the World Economic Forum's *World Competitiveness Report* to examine this event through three lenses: (1) examining claims of carry trade-like financing behavior among Chinese firms; (2) time series and synthetic control analysis of the Chinese currency regime shock; (3) binary outcome analysis of the likelihood of the domestic-denomination of individual issuances. This paper finds preliminary evidence for carry trade-like financing before the regime shock, as well as a significant impact of the currency regime shock on domestic issuance in China.

2. Acknowledgements

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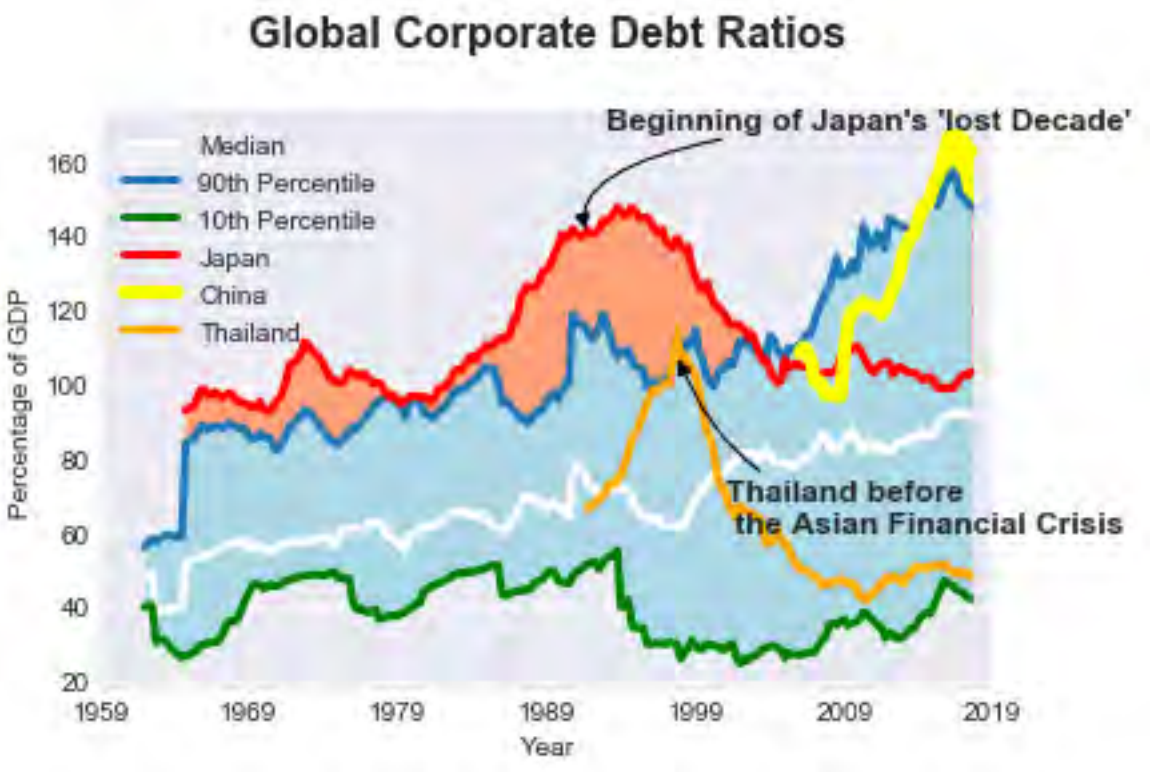
3. Introduction

Chinese debt has skyrocketed over the past ten years, rising to nearly 260% debt to GDP. The Chinese bond market has been a significant part if not the driving force of such growth. Chinese corporate bonds account for 13% of that total market cap (Furey, et al 2018). While corporate bond debt makes up a smaller proportion of the total financing of Chinese firms, there is still evidence of mechanisms through which instability in the nonfinancial corporate sector can be transmitted to the financial system (Acharya, et al 2015). As China weathered the global financial crisis and its aftermath relatively unscathed, Chinese corporate debt has approached levels reminiscent of Japan prior to the so called "lost decade".

Figure 1



Graph Source: Fournier, Jun, Wang 2018

Data Source: Bank of International Settlements, 2018

The typical response to concerns over China's debt load is that the Chinese central government plays the ultimate role in stabilizing any potential crisis. There are many levers that the Chinese government can pull to affect the accumulation of new debt, and to manage the economic costs associated with current debt. As China attempts to grapple with the implications of this debt burden via sporadic deleveraging campaigns and intermittently tighter monetary policy, it's important to understand whether the financing decisions of Chinese firms can be impacted by regulatory measures apart from those aimed directly at the corporate bond market. If firm's financing decisions are indeed impacted by other regulatory measures apart from those directly intended to govern financing decisions, then changes or liberalizations in one facet of the macroeconomy can have unintended, even undesirable consequences on another. This could be particularly impactful in situations where policy changes are not only unexpected but often, seemingly experimental.

Such could be the case for China's currency market. China's currency regime has undergone several changes since its initial peg in 1994. One of the most notable shocks, and the subject of this paper's discussion, occurred in August, 2015. At that time, the RMB had operated under a crawling peg, and the currency could trade within two percent above or below the People's Bank of China's official rate. For three days the RMB's reference rate was allowed to be determined by the market, an unexpected turn in an otherwise tightly managed exchange regime.

The Chinese bond market provides a strong mechanism through which analysis of the effects of exchange regime shocks can affect the issuance of Chinese corporate debt. Though Chinese corporate debt exists not only in the form of bonds but in the form of loans, the Chinese

bond market offers more transparent chance to examine the particular financing decisions of individual firms. The corporate bond market is admittedly likely to overweight private, foreign-owned, and joint venture companies relative to state-owned enterprises (Zhang, Liu 2017), a finding corroborated by IMF researchers recently (Cerutti, Obstfeld 2018).

It is fair to question why China's currency regime could have causal impacts on domestic corporate bond issuance. Why would firms (globally and within China) be motivated to invest by exchange rate fluctuations or shocks? Simply put, because these fluctuations affect the bottom line. From 1974-1986, for instance, the standard deviation of return on net worth of US manufacturers was 2.3%, while the standard deviation of currency fluctuations was 13.5% (Froot 1991). Thus, "even if the typical foreign company holds only a fraction of its net worth in nondollar form, the effects of currency shocks on the relative wealth of domestic and foreign companies can be much greater than the effects of profitability shocks" (Froot pg. 1195).

Firms seeking to avoid such negative effects during periods of currency volatility can invest, and finance investments, strategically. Take, for instance, the turmoil China's currency market experienced in 2015-2016. The pivotal moment in this period was China's aforementioned experiment with liberalizing its long-standing peg, allowing the currency to fluctuate fully within its 2 percent range for multiple days in a row, temporarily liberalizing the exchange rate by setting the benchmark rate equal to the prior day's exchange rate. After just three days of turmoil and devaluation, the Chinese authorities scrapped the liberalization attempt (Yu 2017). In February of 2016, authorities unveiled the new RMB central rate-setting parity rule, which would take the weighted average of the prior day's closing rate and the "theoretical RMB exchange rate", determined by a formula outlined in **Figure 2** (Yu, 318). The eventual exchange rate parity setting system was a piecemeal liberalization in which the market on a given day would have marginally

more say in the RMB's open price on the next day than before the attempted liberalization, but the market rate would be averaged arithmetically with the PBC-determined theoretical rate. This decision coincided with a prolonged, systemic devaluation of the RMB, from roughly 6.3 RMB to the dollar, to nearly 6.9 RMB to the dollar.

Figure 2[1]

$$CFETS = \frac{100.02}{.2640 * \frac{\$}{¥}_{6.1190} + .2139 * \frac{€}{¥}_{7.4556} + \cdots}$$

This sustained devaluation has since been deemed a speculative attack. During a speculative attack, firms "try to convert dollar-denominated liabilities into domestic-currency denominated liabilities (Calvo 1998). Yet the nature of this devaluation sets it apart from traditional models of speculative attacks which model instantaneous devaluations based on frictionless, quick strike changes in the currency denomination of domestic holdings (Krugman 1978). This prolonged devaluation and its preceding regime shock open the door to examining the mechanisms through which Chinese firms dealt with or capitalized on this occurrence. This paper utilizes probabilistic regression analysis and the synthetic control methodology, and seeks to (1) identify whether firms participating in the Chinese bond market behave differently following the 2015 regime shock, and (2) establish a link between this shock and the post-shock composition of the Chinese corporate bond market.

4. Literature Review

[1] Yu 2018

This paper finds itself at the intersection of existing literature regarding exchange rate controls and currency regimes in emerging market economies, macroeconomic imbalance (Knight, Wang 2011), corporate leverage, and capital structure theory, and relies on a wide swath of existing literature regarding the Chinese macroeconomy and its corporate bond market. It seeks to contribute to this literature by providing evidence of a link between shocks in China's currency regime and the evolution of China's corporate bond market.

Central to this paper is Yongding Yu's 2018 account of the Chinese currency regime's evolution over the past ten years. Yu's insight into the impact the 2015 regime shock had on the Chinese currency market allow for a thorough examination of how these changes could transmit to the financial side of China's economy. This paper further extends Yu's theoretical claims regarding the uncertainty caused by the regime shock and eventual piecemeal liberalization, and illustrates that the effects of such uncertainty may have spread to the Chinese bond market. Likewise, this paper's claims for the mechanisms by which firms respond or anticipate shocks rely on an established signaling model by which interventions in the foreign exchange market can signal credibility in maintaining a currency peg (Alesina, Wagner 2006). This paper further extrapolates from this model to conjecture that the sudden removal of a long-standing currency regime via an unanticipated regulatory shock can upend established practices in how firms decide to finance investments.

To better contextualize China's corporate bond market, this paper also includes data from nine other countries, including several emerging markets. As such, this paper relies on a bed of existing literature regarding the characteristics of emerging markets and their corporate bond markets. There is evidence that as onshore domestic bond markets gain depth, firms in emerging markets increasingly issue domestic currency in the onshore market (Martins 2002, Mizen, et al

2012). Given China's bond market's size relative to that of other emerging markets, its high rates of domestic issuance may be less surprising, even when accounting for the country's relative financial underdevelopment and propensity to rely on bank-loans rather than bond-financing. Subsequent analysis found that while USD-denominated issuances grew over the course of the period, the RMB-denominated market still grew at a much faster rate (Frank, Shen 2016), a finding consistent with prior literature (Mizen, et al 2011) regarding the depth of the domestic market and its impact on the propensity to issue domestically.

Further, these examinations of China's domestic and foreign corporate bonds have focused on the period from 2005-2015, intersecting with much of the control period for this analysis (Frank, Shen 2016). Such research particularly focused on the determinants of relative rates of issuance of domestic and USD-denominated bonds over the period. Operating under the hypothesis that a relaxation in capital controls under an undervalued fixed-exchange regime would lead to higher rates of USD-denominated issuance (Caballero, et al 2016), this research has nevertheless provided little evidence for a widely theorized issuance pattern that could resemble carry trade (Frank, Shen 2016), even when controlling for firm and industry effects (Huang, et al 2018).

These findings were contradicted however by subsequent analysis of a broader set of 47 economies from 2002-2014 (Bruno, Shin 2016). By focusing on the international corporate debt issued in these economies, they found evidence of carry-trade-like actions by firms issuing USD-denominated bonds (Bruno, Shin 2016). This carry-trade-like financing decision allowed firms to benefit from significant appreciations in the domestic currency relative to the USD, as the real value of the outstanding debt would decline. As illustrated later in this paper, the relative proportions of both RMB- and USD-denominated issuances in China in the period leading up to the currency market shock of August 2015 provide preliminary evidence to support these findings

of issuance patterns that mirror carry trade. Further considering the size and composition of China's corporate bond market in the periods before and after the failed RMB liberalization allows an examination of the effect that such a regime shock had on the financing decisions of Chinese firms in the corporate bond market.

A crucial component of this paper is its use of a synthetic control approach in examining the effect of China's RMB liberalization as a treatment for China's bond market. The synthetic control approach has its most useful application in examining the effects of treatments in which a counterfactual is not readily available. In recent years, it has been applied to examine the effects of structural reforms (Marrazzo, et al 2017), financial crises (Iasonidou 2016), currency market shocks (Aregger, Leutert 2017), and to firm-specific capital allocation decisions (Zeidan, Shapir 2017). The application of this approach will be used to supplement any findings from the accompanying regression analysis. An added benefit of a successful synthetic control approach is the readily apparent illustration of the effect of a relevant treatment.

5. Data

This paper's analyses rely primarily on two main sources for data: Bloomberg and Thomson One Banker. From each source, I pulled corporate bond data for ten countries from January 1st, 2010, to November 20th, 2018 (the initial day data was collected). The Bloomberg data set contained monthly aggregated (contemporary USD equivalent) values for the amount of bonds issued in all currencies. These monthly values were then aggregated into quarterly values to allow for more robust analysis of financing trends in a set of markets where the proportion of issuances denominated in a given currency can be highly variable. In total, approximately 234,000 bond issuances were aggregated into quarterly issuance values. The largest proportion of these issuances were Chinese bonds, of which the majority were denominated in RMB. Bloomberg's data

download limits prevented a thorough examination of each of the bond issuances while controlling for firm specific effects, but the aggregate nature of the data combined with the significant sample size allows for this dataset to be used for analysis of changes in the currency composition of the ten country's corporate bond markets.

The Thomson One dataset focuses on corporate bond issuances in nine of the ten countries examined in the Bloomberg dataset.[2] As it contains issuance-specific data, this data set is used for a micro-level analysis of the factors that affect the likelihood that a given bond would be issued in domestic currency or foreign. This data set consisted of just under 60,000 bond issuances, downloaded in February, 2019. For consistency, the bonds examined were over the same time period as the Bloomberg dataset. This download yielded an unbalanced panel data set, and as such, only variables in which all relevant bond data was available were included for control purposes.

Lastly, additional control variables were included from the World Economic Forum's annual *Global Competitiveness Index* report, and from the Federal Reserve Economic Database. This index has historically been a strong predictor of macroeconomic stability (Petrylė 2017). These variables are a measure to control for a set of factors that might influence a decision to seek financing through a domestic bond market as opposed to other financing opportunities, as well as broader macroeconomic indicators. I've provided further information on how this data was acquired and formatted in **Appendix VI**, and can provide more detailed information upon request.

6. Methodology

I divide this paper's findings into four sections: one descriptive and three regression analyses. The initial descriptive section attempts to validate the hypothesis that Chinese firms engaged in

[2] Excluding Russia because of its contemporary currency regime change

carry trade through the corporate bond market. This paper's regression analyses take three primary forms: (1) fixed and random effects analysis of the determinants of the quarterly proportion of bonds issued in domestic currency from 2010-2018; (2) synthetic control analysis of the impact of the 2015 currency regime shock; (3) binary outcome analysis of the likelihood of domestic denomination for a given corporate bond issuance. The initial two approaches utilize the Bloomberg aggregate market dataset, while the latter approach uses the Thomson One dataset.

(1) The fixed effects and random effects analyses were used to illustrate potentially systemic differences between China's bond market behavior post-treatment and that of other countries. This section also examines the Russian currency regime shock in conjunction with the Chinese shock to postulate systemic differences between the effects of the two shocks on their respective corporate bond markets. Given the significant variability of the bond markets, and that heteroskedasticity in bond and other financial markets is an established phenomenon during periods of instability (Bruno, Shin 2016), robust standard errors were used unless otherwise stated.

(2) The synthetic control analysis utilized the *synth* (Abadie, et al 2014) package available for Stata. The approach optimizes a synthetic control that minimizes the mean squared error between the average control variable values for the synthetic and treated unit. Control variables included for the synthetic control should be econometrically relevant for inclusion. Likewise, synthetic control "donors" should not experience a treatment similar to that of the treated unit, or else the results of the synthetic control in the treatment period are likely understated. I address this point with reference to Russia in the ***Synthetic Control*** section.

(3) The binary outcome analysis for the issuance level data from Thomson One banker utilizes both logit (logistic) and probit (probability unit) analyses to determine the relative likelihood that a given bond issuance, conditional on its regressors, is issued in domestic currency. As binary variable probabilistic analysis is inherently heteroskedastic, robust standard errors are not calculated for this section.

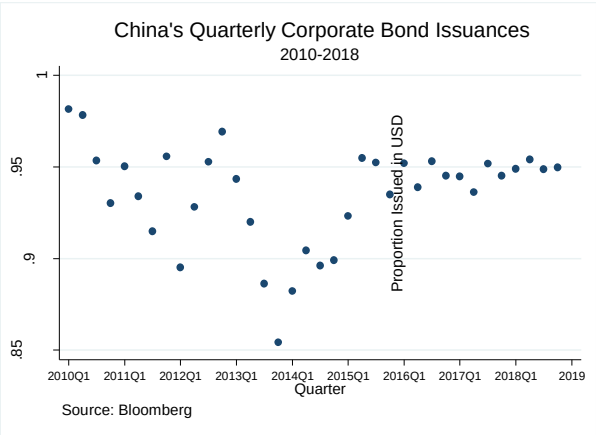
7. Potential Confounding Variables

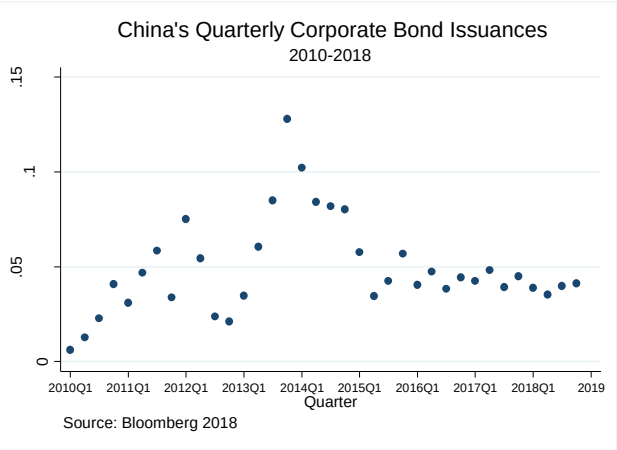
It's crucial to acknowledge the potentially relevant variables for which this analysis cannot fully account. Chief among these potential confounding variables are the regulatory changes to the corporate bond market over the period examined in this analysis. Certain regulatory changes like the *NDRC Circular on Promoting the Reform of the Filing and Registration Regime for Issuance of Foreign Debt by Enterprises* would make the issuance of USD- and foreign currency-denominated debt easier, and potentially more prevalent, and thus do not seem to influence significantly the post-treatment significance of the observed results discussed later. In 2015 the issuance of *the Corporate Bond Issuance and Trading Regulations, file No. 113,* however, may have altered the characteristics of the firms issuing Chinese corporate bonds, and could thus be a confounding variable in this analysis. I attempt to remedy this issue in the **Firm-Level Approach** section of this paper by controlling for certain firm and issuance specific characteristics, but without access to crucial information regarding the ownership status/structure, leverage ratios, and size of each of the companies whose issuances are included in this analysis, it is difficult to fully eliminate the potential effects of this particular regulatory change on the treatment cohort examined. Additionally, the pre-treatment period control dummy variable included in these analyses will help address any significant immediate (within the first two quarters of this announcement) effects of this regulatory change.

8. Descriptive Evidence for and Against Carry Trade-Like Activities

This section seeks to contribute to the debate surrounding the conflicting evidence for carry trade activities within China's corporate bond market by more firmly establishing a link between the likelihood of such activities and the occurrence of the 2015 currency regime shock. The graphs below illustrate the proportion Chinese corporate bonds issued in RMB-denominated debt as a percentage of the total value of the bond market in the given quarter. Q1 is 2010Q1, with the final quarter being 2018Q4.[3] For reference, the 2015 currency market shock came first on August 12, 2015 (Q23 in the sample). If the speculative attack on the Chinese yuan and the currency liberalization were truly concurrent with an uptick in carry-trade speculation, it would be expected that the Chinese bond market would see a higher proportion of domestic bond issuance in the time leading up to the liberalization. As **Figure 3** illustrates, however, that is not the case. In fact, the clustering of RMB-denominated issuances at a steady, high level occurs only in the periods surrounding and after the 2015Q3 liberalization.

Figure 3





[3] 2018Q4 is not the full quarter, as the data analyzed stops at 11/20/2018. Thus, Q36 data is less reliable than Q1-Q35.

The graphs in **Figure 3** illustrate the proportion of bond issuances denominated in RMB, with 2015Q3 being the treatment period. This graph demonstrates significant variability in the quarters leading up to the treatment period. This would seem to suggest that in the period leading up to the RMB liberalization, there is little evidence of anti-RMB carry-trade activities. Given China's macroeconomic conditions during this time period, and that the speculative attack did not begin until late 2014-2015, this is not surprising. It is helpful then to further examine the relationship between domestic issuance and the strength of the RMB to determine whether evidence of carry trade exists.

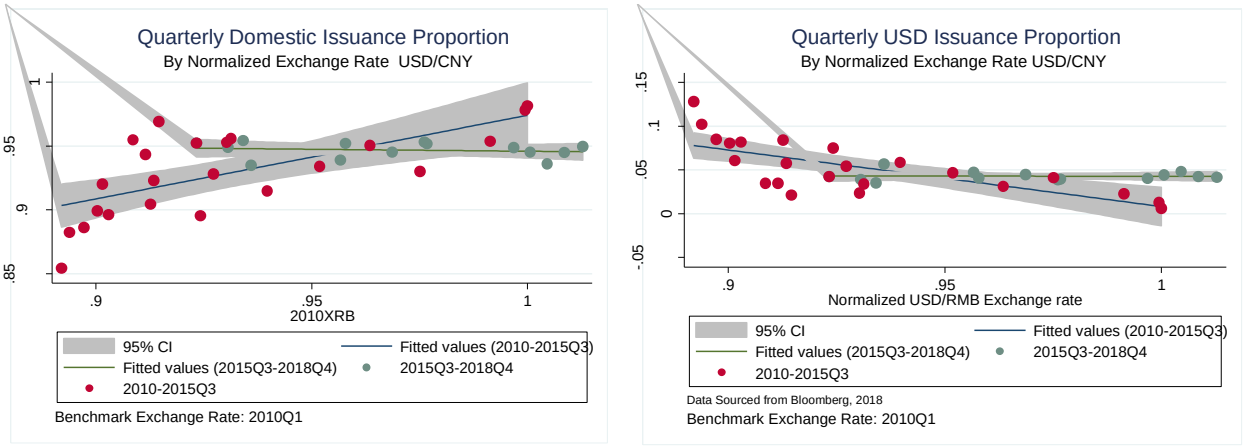
Figure 4 illustrates a fundamental shift in the relationship between relative the relative strength of the RMB and the proportion of bonds issued domestically before and after the exchange rate liberalizations. Prior to the 2015Q3 liberalizations, periods of relative strength of the RMB coincided with lower RMB-denominated issuance rate, and periods of relative weakness in the RMB were met with higher rates of domestic issuance. This relationship, however, disappears following the exchange rate liberalization, as RMB-denominated issuance rates are persistently high irrespective of the relative strength of the currency.

A similar trend can be observed in the proportion of USD-denominated bond issuances, but with the inverse relationship of relative periods of RMB strength coinciding with higher rates of USD-denominated issuance. The trend prior to the exchange rate liberalization could be evidence of attempted carry trade on the part of Chinese bond issuers—issuing significant positions of RMB-denominated debt on the anticipation of the value of the debt devaluing in real terms along with the currency. Likewise, given the RMB was undervalued until late 2014, when China's foreign currency reserves began to deplete, there's potential evidence that, in periods when the RMB was particularly strong, Chinese firms were engaging in carry trade-like financing by

issuing more debt in USD under the assumption the RMB's appreciation would leave less of a liability in real terms. Under an established exchange regime, market interventions to defend a peg or crawling peg can be viewed as a "signal" that the institutions maintaining the peg are credible, and thus that the rate will remain stable (Alesina, Wagner 2006). Given the crawling peg whose daily opening value was set by the PBC, sustained devaluations or appreciations in the RMB came directly either with the consent of the regulators or the inability and/or unwillingness to prevent the change. Under China's relatively stable currency regime prior to the shock, exchange interventions may have sent more of a predictable signal than in the period following the shock. Notably, the significant relationship between RMB strength and foreign issuance disappears following the exchange rate liberalization.

An understanding of the economic climate and regulatory environment immediately following the regime shock can help account for the disappearance of this trend. In the fallout of the surprise August reform and then rollback, the PBC frequently intervened into the market when sentiments seemed low, leading to appreciations when sentiments were lowest, and depreciations when concerns abided (Yu 2018). This intervention came through the fervent use of what amounted to nearly $1 trillion in foreign exchange reserves. These apparent overcorrections came seemingly in an attempt to punish potential speculators (Yu 2018). Thus, firms seeking to enact carry trade-like financial decisions would be facing both an uncertain regulatory environment and repeated, albeit mixed, signals regarding the intentions of Chinese regulators. Given the risks inherent in corporate foreign currency speculation (Froot 1991), it is reasonable to conjecture that firms would be less likely to sustain engagement in such activities, particularly in the time period between the August 2015 liberalization shock, and the February 2016 implementation of the current central parity rate-setting rule.

Figure 4



Analysis by Yu (2018) further supports this conjecture, as the "increased uncertainty can to some extent curb the shorting activities and reduce depreciation pressure on the renminbi". In all, "more risks" are posed to speculators under this regime than that prior to the liberalization attempt (Yu 2018).

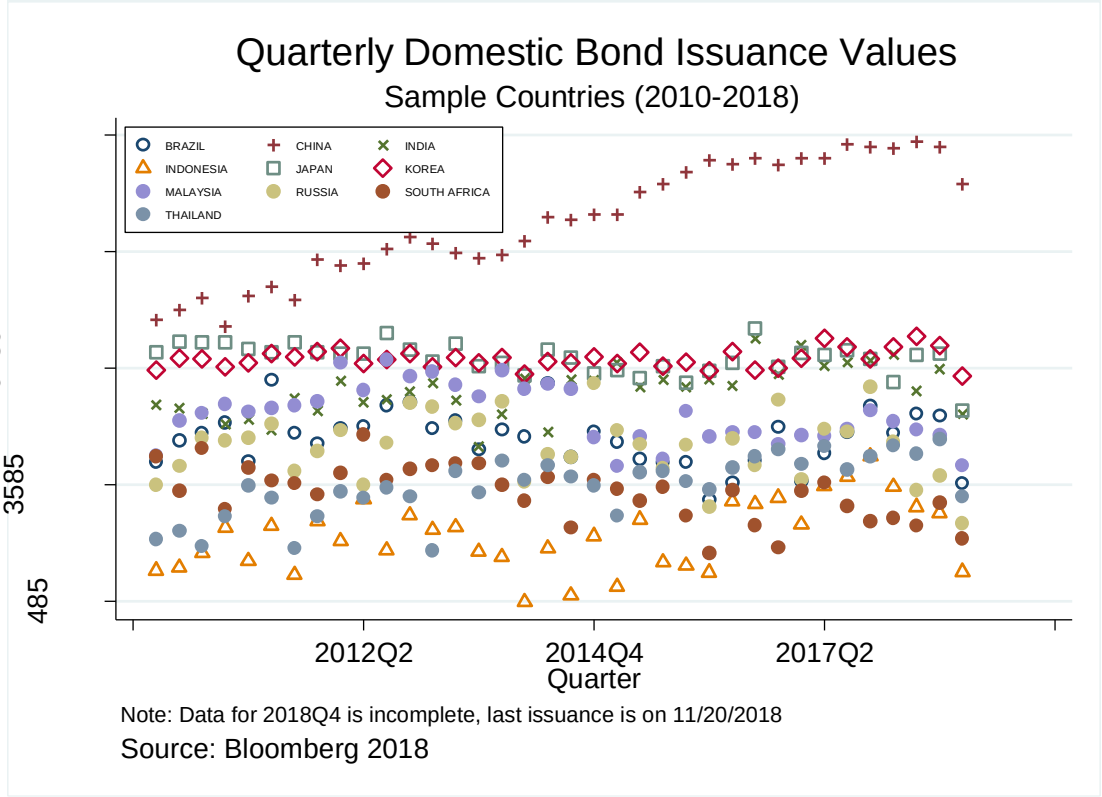
9. Time Series Analysis of Domestic Issuance

The Bloomberg aggregate quarterly dataset for the ten countries provides 36 quarterly observations per country, for 360 total observations. To examine China's bond market, it is helpful to contextualize it through comparisons to similar markets. As this paper seeks to identify the effects of a particular policy intervention on the Chinese bond market's currency denomination composition, potential structural breaks in the proportion of bonds issued domestically in each country were estimated, outlined with comments in **Figure 5**. Given a simple regression of percent issued in domestic currency and USD over the quarters sampled, initial estimates identify a potential structural break in the time series trend for China at 2014Q4. Given this estimated structural break, I will attempt to control for this "pre-treatment" period of nine months in the regression analysis to determine whether the treatment event actually occurred in 2014Q4.

Figure 5: Testing for Structural Breaks					
Country	Est. Dom. SB Period	Swald stat/p-value	Est. USD SB Period	Swald stat/p-value	Comments
Brazil	24 (2015Q4)	13.16/.025**	24 (2015Q4)	12.59/.032**	2015Q4, evidence of break
China	21 (2015Q1)	39.96/.000***	21 (2015Q1)	43.95/.000***	2015Q1, strong indication of an est. break
India	N/A	5.82/.436	N/A	6.27/.377	N/A
Indonesia	23 (2015Q3)	8.91/.146*	N/A	8.19/.191	Est. domestic break indicated at 15% level, not below
Japan	N/A	3.50/.811	N/A	3.40/.827	N/A
Korea	N/A	6.47/.353	N/A	6.68/.329	N/A
Malaysia	20 (2014Q4)	12.77/.030**	20 (2014Q4)	9.73/.105*	Domestic break indicated in 2014Q4, potentially due to October 2014 changes in tax treatment for Islamic fixed income instruments
Russia	N/A	6.71/.325	N/A	6.72/.324	N/A
South Africa	N/A	3.05/.882	N/A	3.46/.818	N/A
Thailand	19 (2014Q3)	11.83/.045**	19 (2014Q3)	13.28/.0241**	Evidence of break in 2014Q3, 2014 represented an all-time high in corporate bond issuance

Each country in the structural break analysis was examined for confounding variables, market shocks and regime shocks that could have contributed to a fundamental shift in the composition of their corporate bond market. The only country besides china to experience an explicit currency regime shift was Russia. This paper elaborates on such a shift later on in the paper.

Figure 6



Examining the aggregate trend over time for proportion of issuance denominated in domestic currency shows an insignificant negative trend towards a greater reliance on foreign currency overall (**Figure 7**). It seems then that, even as corporate debt levels have been rising globally, within these ten countries there is not a significant trend towards or away from an increased reliance on international debt. This aggregate finding can be contrasted with China's time series trends pre- and post-treatment, as illustrated in **Figure 8**.

Figure 7

Percent Issued in Domestic Currency Over Time: All Countries

VARIABLES	(1) Total Sample
Quarter	-0.00137
	(0.00101)
Constant	0.846***
	(0.0214)

Observations	360
R-squared	0.005

Figure 8

Percent Issued in Domestic Currency over Time: China

VARIABLES	(1) Before regime shock	(2) After regime shock
Quarter	-0.00286***	0.000394
	(0.000964)	(0.000420)
Constant	0.960***	0.935***
	(0.0127)	(0.0125)
Observations	22	14
R-squared	0.305	0.068

Figure 8 shows that dividing the periods up into two, before Q23 and after Q23, the time-series regressions demonstrate substantially different results. Before 2015Q3, the percent of bonds issued in RMB was decreasing quarterly, illustrating an increased reliance on non-RMB denominated debt. Afterwards, however, there is no clearly discernable effect over time. The initial results prior to treatment are statistically significant at the 5% level.

Fixed and Random Effects Analyses

Hausman tests for model specificity were run to examine the appropriateness of either random or fixed effects analyses, which in these regressions would control for country-wide variation in outcomes. For the panel data analysis of the proportion of the market issued in domestic-denominated currency, fixed effects analyses proved more robust, but random effects results have also been included for reference. Given the well-established nature of heteroskedasticity during market shocks in financial markets (Bruno, Shin 2016), robust standard errors have been reported. The fixed effects analyses reported in **Appendix I** demonstrate a

positive partial effect post-treatment on the proportion of bonds issued in domestic-denominated currency that is statistically significant at the 5% level, though not at the 1% level. Given China's unique regulatory and market characteristics, of which it is impossible to fully control for, these results could also simply reflect structural differences not in the baseline proportion for China's bond markets (which would be accounted for by fixed effects analysis) but in the sensitivity of the Chinese market's proportion of domestic currency to each of the regressors.

China and Russia's Currency Regime Shocks

The occurrence of Russia's currency regime shock additionally allows for a broader panel analysis of the impact of currency regime shocks on the composition of domestic financing in the corporate bond market. To expand the examination of the effects of currency regime shocks on the propensity to issue domestic debt, I've additionally examined the post-treatment effects of Russia's 2014Q4 exchange rate liberalization, in which the country abolished the trading band of the ruble of $\pm$15% of the prior day's value, and allowed the currency to float. This regression analyzes the effects of the two currency regime changes faced by China and Russia from 2014-2015. Results from this regression (**Appendix II**) indicate significant effects at the 5% level for both the post-treatment and nine-month pre-treatment periods. This finding runs contrary to the results from the fixed effects regressions that excluded Russia from the examination, potentially indicating (1) that the response of the Russian bond market to the currency regime shock was influenced either by foresight regarding the regime shift or (2) external factors have influenced these results.

A qualitative understanding of Russia's currency shock can help account for why the pre-treatment period may be significant for Russia but not for China. The Russian currency crisis occurred as a result of a prolonged financial crisis worsened by declines in global energy prices. Russia's currency regime shift then, though sudden and drastic, was likely not considered as

unexpected as the Chinese currency market shock. Similarly, in the post-treatment period, Russian firms faced additional sanctions that made accessing foreign financing significantly more difficult. Therefore, Russia's pretreatment significant effects likely paint Russia's currency regime shift in a different light than that of China's. That it could have different effects on the bond markets at different times is, then, not surprising.

Reflection on Countries Included

One issue that hampered the efficacy of the following section's synthetic control is the fundamental uniqueness of China's corporate bond market, in its scale, scope, and regulatory pressures. Though the nine countries included for control each share certain characteristics with China, few can replicate its market depth or, particularly recently, its dependence on domestic issuance. Additional examinations of China's (or more generally, any country's) corporate bond market through synthetic control analysis would be an expansion of the available donor pool.

10. Synthetic Control Approach

This paper seeks to analyze the impact of China's exchange rate liberalization on the propensity of Chinese firms to issue RMB-denominated debt. To do so, I've collected bond issuance data from both Bloomberg's Fixed Income database and Thomson One for ten countries. Nine of these countries were initially considered in the creation of the synthetic China.

The Bloomberg dataset aggregated approximately 230,000 bond issuances from January 1st, 2010, to November 20, 2018 into quarterly, USD-equivalent values issued in each currency for each country. Typically, the largest currency by issuance value in each country was its own domestic currency, followed by the US Dollar. **Figure 6** illustrates the uniqueness of China's domestic bond market by logged value issued each quarter. China's consistent growth sets it apart

from other nations included in the sample, and indeed, from most other markets globally. None of the countries included in the synthetic control except Thailand show the substantial, year to year growth of their corporate bond markets in the dataset. Brazil, for instance, does not see a substantial change in the logged value of its domestic issuances over time, but does see a statistically significant increase in total issuances over time. For the entire sample, there is not a statistically significant change in the percent of bond issuances issued in domestic currency, as is illustrated in **Figure 7**.

The figures below demonstrate a synthetic control examination of the impact of the exchange regime shock in 2015Q3, in China. The synthetic control approach optimizes a weighting of the observations of various control countries in order to best mimic the characteristics of China's corporate bond market pre-treatment. **Figures 9-12** compare the relative rate of domestically-denominated corporate issuance by value in the Chinese bond market, with 2015Q3 as the treatment period within which the reforms were implemented. Initial synthetic control analysis from this seems to illustrate a post-treatment deviation from the values predicted from the synthetic China—a strong indicator that a change during the treatment period is driving a systemic change in the composition of the Chinese bond market. Juxtaposing the synthetic control alongside the time-series trend of the donor countries' bond markets (**Figure 10**) illustrates that such a marked departure from the pretreatment norm is potentially less evident than is apparent in the graph of the synthetic control. The quarterly composition of new bond issuances—even one as large, deep, and heavily regulated as the Chinese market, still can vary substantially. Malaysia, in late 2014, early 2015, is one such example, as the country experienced a significant increase in USD denominated bond issuances that coincided with a brief market panic—the effects of the panic subsided and thus there was no long-standing impact of the shock. Such variability in the domestic

issuance propensity of firms in emerging markets is highlighted further by the significant historical variability evident in **Figure 11.**

Since Russia experienced a significant currency regime change during the current period, it is prudent to conduct a synthetic control in which Russia is not one of the control units. I include the results of that synthetic control analysis in **Figure 12**. An issue with this approach is in the synthetic control's inability to match the evolution of the bond market in China from 2010-2012. A second synthetic control analysis is included with a shortened control period, from 2012-2015Q3, in **Figure 12**(b). The weights on the relevant control units are available upon request. Excluding Russia from the synthetic control does have the effect of increasing the differential between the values observed pre-treatment for the Chinese and synthetic Chinese market.

As we can observe from **Figure 12**, Excluding Russia from the synthetic control analysis does not remove the differential between the observed values of China and its synthetic counterpart, post-treatment. If China and Russia had directionally similar post-treatment effects following their respective currency regime changes, then synthetic control results in **Figures 9-11** would understate the true effects of the policy intervention relative to the control period. They do, however, significantly worsen the pre-treatment fit between the two nations, preventing any strong conclusions regarding the specific effects of the 2015Q3 treatment. Because of this, the synthetic control results both including and excluding Russia are provided below.

Figure 9

Figure 10

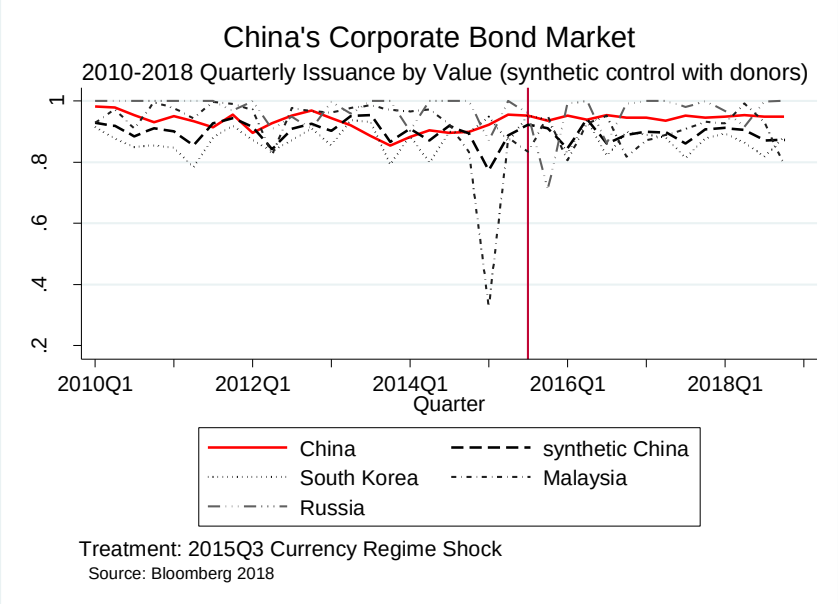


Figure 11

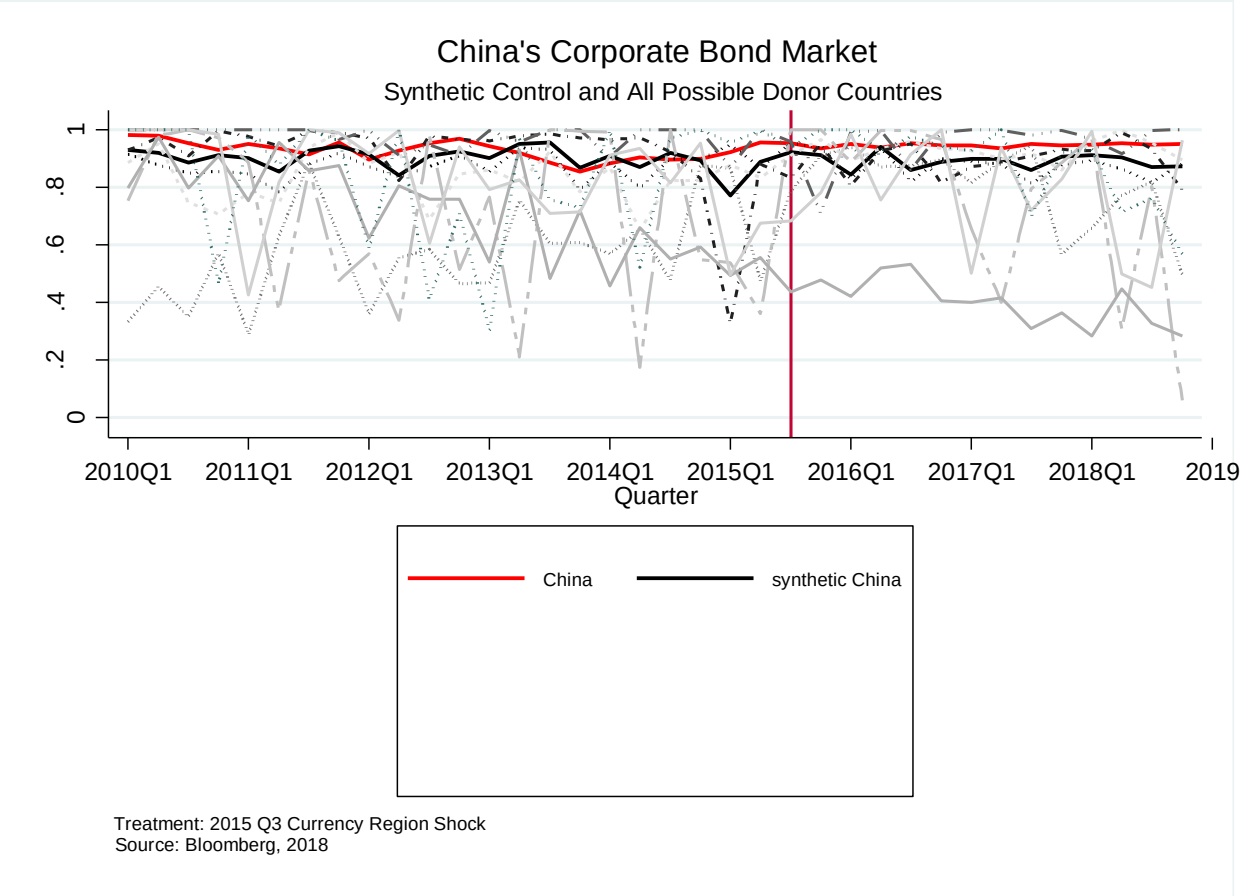
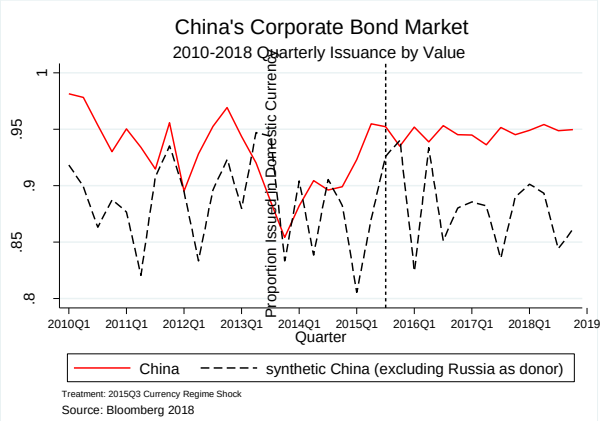
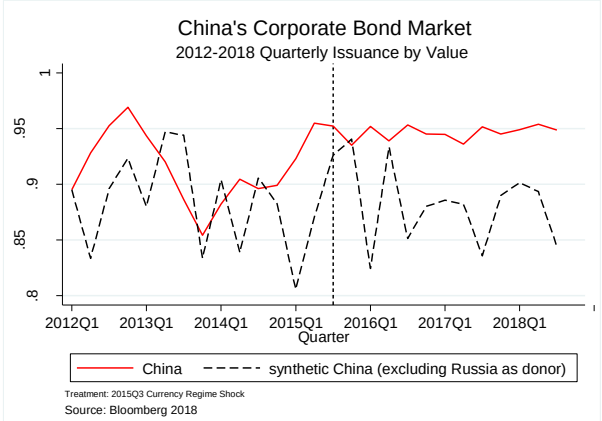


Figure 12





11. Firm-Level Approach

The prior dataset allowed for an analysis of the aggregate changes in the currency-denomination characteristics of China's and other emerging market's corporate bond markets, but did not allow for a more focused, firm-level approach to the topic. This section analyzes the macroeconomic and firm-specific factors influencing the likelihood of domestic-denominated corporate bond issuance.

The Thomson bond data set enables probabilistic analysis of likelihood to issue in Domestic currency given certain macroeconomic and firm specific characteristics (**Appendix III**). Probit and logit model analysis of these variables demonstrate significant positive partial effects of the post-August 12, 2015 currency regime shock on the likelihood of RMB-denominated issuance. The results regarding the August, 2015 liberalization in these probabilistic analyses are robust to inclusion/exclusion of industry-specific effects.

Thomson One Banker provides a wealth of data regarding corporate bond issuances, and allows us to control for issuance-specific characteristics, including coupon rate, issuance size (proceeds), and industry-specific effects. For this analysis I collected data for nine countries, China and eight of the nine control countries included in the Bloomberg dataset analysis. Given the currency regime change Russia experienced in 2014-2015, Russian corporate issuances were excluded from this analysis.

In total, 55,752 issuances were analyzed from these 9 countries, including 16,615 Chinese issuances, the largest portion of the sample collected. To conduct this binary analysis, I used probit and logit models to analyze the significance of any partial effects of the post-August 12, 2015 currency regime shock on the likelihood of RMB-denominated issuance, including and excluding industry-specific effects (**Appendix III)**.

Including industry effects allows an examination of which firms were systematically more likely to issue domestically and in USD. The base industry is the initial industry included in the sample, "Advertising/Marketing". Relative to this base industry, firms operating in financial sectors like banks, insurance, diversified financials, and real estate were more likely to issue in USD, a finding consistent with prior literature (Frank, Shen 2016). Notably, other internet-enabled industries not considered to be traditionally financial were also significantly more likely to issue USD-denominated debt throughout the period. These industries include internet software and services, internet and catalog retailing, and E-Commerce/B2B. In this regression, the industry classification system includes industries for the entire sample of the nine countries, thus certain industries without any or enough relevant bond issuances were omitted from the regression analysis.

The experimental variable in these estimations is the post-regime shock binary. It is preceded by the 3-quarters prior to shock binary control variable[4], included to address any concerns generated by the initial Bloomberg test for endogenous structural breaks indicating there may have been an endogenous structural break occurring during 2014Q4. If this variable's coefficient proved statistically significant, it could be evidence that the crucial event affecting China's corporate bond market actually occurred prior to the August 12, 2015 shock. In these regression findings, the logit and probit coefficients on this pre-treatment variable are not significant at the 5% level, regardless of the inclusion of industry-specific effects.

The control variables proving consistently significant as a determinant of the likelihood to issue in RMB included the issuance-specific factors proceeds and coupon rate, as well as the macro

[4] Also included in the Bloomberg data Analyses above

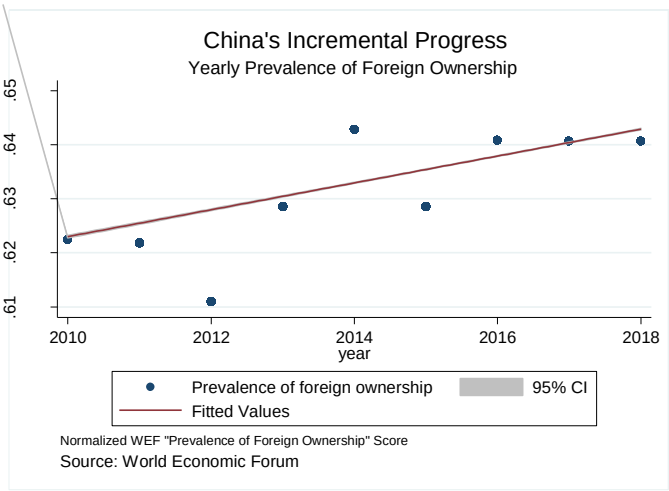
variables regarding ease of financing through the local equity market, the ease of access to loans, and the prevalence of foreign ownership. Not surprisingly given Chinese firms' preference to access debt financing through state bank-backed loans, the ease of access to loans has a significant negative effect on the likelihood of a firm issuing a bond in domestic-currency. Why go to the public markets when the banks will provide? Similarly, more favorable domestic conditions with regards to equity issuances may prompt firms looking to raise RMB denominated funds to first look towards initial or secondary equity offerings rather than the domestic bond market.

Both proceeds and coupon rate had negative logit and probit coefficients, indicating that in this sample, larger, higher interest bond issuances were less likely to happen in RMB and more in foreign currencies, typically the US Dollar. While an increasing prevalence in foreign ownership in China has been linked to increased profitability among Chinese firms, particularly joint ventures (Greenaway, et al 2009), there is no explicit explanation in the existing literature for why an increasing exposure of China's real economy to foreign ownership would have a causal impact in increasing likelihood of domestic issuance. There is evidence from existing literature, however, that as foreign participation in bond markets increases, domestic firms rely less on foreign-currency denominated debt (Burger, Warnock 2007).

On this point, I posit this increased prevalence of foreign ownership could serve as a weak proxy of foreign participation in financial markets and capital account openness, which could explain this relationship. Furthermore, Park, et al (2018) have argued that capital account liberalizations are a crucial feature of bond market development. Such development increases market scope, sophistication, and depth, increasing the propensity of firms to issue corporates

domestically (Mizen, et al 2011). As China's prevalence of foreign ownership has increased over time from 2010-2018[5], so has the size and sophistication of its corporate bond market.

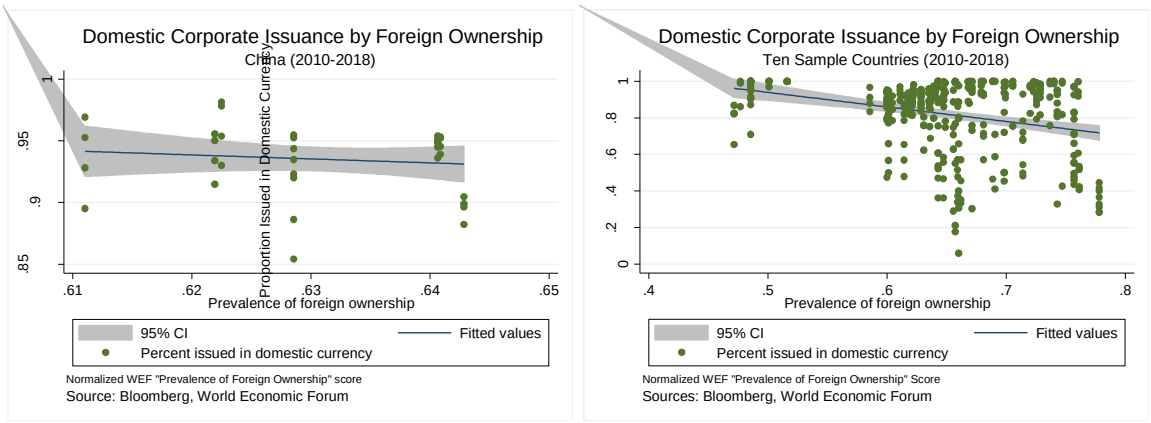
Figure 13



Despite the literature underpinning this hypothesis, cross-referencing with the Bloomberg dataset provides little evidence for its validity with respect to specifically China, or the other countries included in this analysis (**Figure 14**). Thus, there is little empirical or theoretical evidence supporting a significant partial effect of the prevalence of foreign ownership on the likelihood of domestic issuance within these ten countries.

Figure 14

[5] **Figure 13**



Proportion Issued in RMB

Nonetheless, these binary outcome regression findings illustrate that the post-treatment period demonstrated significantly higher probabilities of domestically-denominated issuance, even when accounting for issuance size, the cost of capital, macroeconomic conditions that affect financing concerns, and industry-specific effects.

Implications

In the past three years, China's decreased reliance on foreign issuance poses potential challenges for China's broader deleveraging efforts. Such decreased relative reliance on dollar-denominated debt leaves Chinese firms, at the margins, less susceptible to financial losses from local currency depreciation (Bruno, Shin 2016) and the Chinese financial system less susceptible to banking distress heightened by strong foreign-currency-denominated debt inflows (Caballero 2014). Alternatively, the significant growth of RMB-denominated debt issuance coincided with exchange rate liberalizations that allow greater freedom in the trading movements of the RMB and further coincided with a systematic depreciation in the value of the RMB from 6.2 RMB/USD at the start of August, 2015, to 6.95 RMB/USD by November 20, 2018. Thus, firms issuing RMB-denominated debt, all else equal, stood to earn financial profits versus firms that issued USD-denominated debt during this period.

More broadly, if there exists a relationship between China's currency regime and its corporate bond market, that relationship could complicate the various aims that China seeks in its gradual path to reform. If evidence of carry-trade pre-2015 liberalization proved robust, this result would further complicate both China's intermittent deleveraging efforts, as the presence of a more stable currency regime may have prompted firms to engage in such speculation. As is, it appears China's bond markets will continue to be dominated by domestic issuances in a way dissimilar to other comparable Asian or emerging markets.

Furthermore, if increased liberalizations in China's bond market bring an increased international presence in the market, such interconnection could heighten China's market covariance with the global financial markets, a potentially undesirable outcome (Cerutti, Obstfeld 2018).

12. Conclusions

This paper sought to examine the relationship between China's currency regime and the nature of its corporate bond market, particularly the propensity of Chinese firms to issue in RMB-denominated debt. Both macro-level, aggregate analysis and issuance-level analysis provide evidence that Chinese firms were more likely to issue in domestic currency following the August 12th, 2015 exchange rate liberalization shock. Initial analysis indicated that a potential structural break in the market may have occurred at a time period 9 months earlier than the treatment period, coinciding with the discussion and eventual enaction of regulatory changes in the bond market but subsequent regression analysis indicate that this event, at least in the pre-treatment period, is not statistically significant, whereas the post-regime shock treatment variable was statistically significant at the 5% and 1% levels. In the firm-level analysis, these findings are robust to industry-specific effects.

The synthetic control analysis of this regime shock on the corporate bond market, however, proved inconclusive. Despite evidence that the post-treatment Chinese bond market maintained a quarterly proportion of domestic issuance consistently higher than that of the post-treatment synthetic Chinese market, the substantial variation in monthly and quarterly issuance values among the donor countries leaves such a finding far from definitive. Furthermore, examination of the monthly trend in this synthetic control leaves little evidence of a systematic effect of the treatment period.

In part due to the limitations of the dataset at hand, synthesizing a bond market with the near-identical characteristics of the Chinese corporate market proves difficult, and is increasingly so when Russia is excluded as a donor due to its own currency market changes. Subsequent analyses of this subject should focus on expanding the potential donor pool to include more countries to allow for a better approximation of the Chinese market pre-regime shock, and thus a more robust synthetic control.

Thus, this paper finds preliminary evidence of a link between China's 2015Q3 exchange rate liberalization and an increased reliance on RMB-denominated debt among Chinese firms issuing corporate bonds, though this reliance does not appear to be driven by attempted carry trade-like financing in the post-shock period.

Similarly, China's recent deleveraging efforts[6] may have affected the total corporate debt outstanding, but have not reversed the growth in the value of new RMB-denominated bond issuances over time. Additionally, this paper provides preliminary evidence for a pre-liberalization link between the relative exchange rate (RMB/USD) and the proportion of corporate bonds

[6] Considered "dead" since February, 2019, after the time period examined in this paper. Per *The Business Times*, 2019

denominated in RMB, a relationship that disappears following the currency regime shock in 2015. Given the PBC's response to this shock and the eventual implementation of the current RMB central-parity rate setting mechanism, this paper posits that the dissolution of the inverse relationship between the relative strength of the RMB and the propensity of Chinese firms to issue RMB denominated debt occurred not because anti-RMB carry trade (betting against the RMB) became substantially easier, but rather due to other factors; indeed, this paper poses evidence that, when examining the liability side of firms' financial behavior, carry trade in general became less prevalent, or even ceased to occur, as additional regulations were implemented, uncertainty regarding the currency regime flourished, capital controls tightened, and repeated PBC intervention sought to punish most forms of speculation.

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14. Appendices

Appendix I: All Country (excluding Russia) Panel Analysis: Chinese regime shock

VARIABLES	(1) Proportion Issued Domestically	(2) Proportion Issued Domestically
pretreatment	0.0261	0.0201
	(0.0351)	(0.0170)
Post-regulatory shock	-0.0514	0.203**
	(0.136)	(0.0743)
relative USD exchange rate (2010 normalized)	-0.176**	0.0498
	(0.0853)	(0.0820)
exchange rate post-regulatory shock	0.0704	-0.138*
	(0.0903)	(0.0627)
Institutions	-0.153	0.0944
	(0.256)	(0.437)
Availability of financial services	-0.751	-0.323
	(0.856)	(0.390)
Affordability of financial services	0.430	-0.306
	(0.526)	(0.391)
Prevalence of foreign ownership	-1.201**	-0.802
	(0.519)	(1.100)
Ease of access to loans	0.483*	-0.322*
	(0.267)	(0.160)
Constant	1.867***	1.804**
	(0.336)	(0.686)
Observations	324	324
R-squared		0.114
Number of CountryCode	9	9
Random Effects	YES	
Fixed Effects		YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix II: All Country Panel Analysis: Russian and Chinese regime shocks (effect on proportion issued in domestic currency)

VARIABLES	(1) Random Effects	(2) Fixed Effects
Quarter	-0.00509***	-0.00514**
	(0.00188)	(0.00195)
Pretreatment	0.0660***	0.0662**
	(0.0251)	(0.0254)
Post-regulatory shock	0.297***	0.310**
	(0.0980)	(0.0960)
relative USD exchange rate (2010 normalized)	0.110	0.121
	(0.0809)	(0.0888)
exchange rate post-regulatory shock	-0.203***	-0.214**
	(0.0683)	(0.0684)
Institutions	0.726**	0.769
	(0.321)	(0.458)
Availability of financial services	0.135	0.169
	(0.603)	(0.507)
Affordability of financial services	-0.649	-0.684
	(0.522)	(0.474)
Prevalence of foreign ownership	-1.166	-1.162
	(0.882)	(0.959)
Ease of access to loans	0.107	0.0842
	(0.107)	(0.124)
Constant	1.380***	1.351**
	(0.505)	(0.592)
Observations	360	360
R-squared		0.113
Number of Countries	10	10
Country FE	NO	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix III: China's Bond Market: Binary Outcome Analysis (likelihood of issuing in domestic currency)

VARIABLES	(1) Logit coeff	(2) Logit coeff	(3) Probit coeff	(4) Probit coeff
3 quarters prior to shock	0.305	0.262	0.161*	0.151
	(0.198)	(0.201)	(0.0895)	(0.0952)
Post-regime shock	1.027***	1.237***	0.487***	0.580***
	(0.288)	(0.288)	(0.123)	(0.130)
proceeds from issuance (size)	-0.000531***	-0.000340***	-0.000282***	-0.000197***
	(3.60e-05)	(4.03e-05)	(1.82e-05)	(2.10e-05)
Quarter	-0.00730	-0.0129	-0.00628	-0.0103
	(0.0166)	(0.0170)	(0.00777)	(0.00820)
Availability of financial services	-11.13	-10.46	-6.992	-7.229
	(10.53)	(10.91)	(4.747)	(5.071)
coupon rate (interest rate)	-0.219***	-0.139***	-0.0701***	-0.0397***
	(0.0287)	(0.0290)	(0.0115)	(0.0129)
Institutions	-6.063	-8.890*	-2.019	-3.800*
	(4.619)	(4.726)	(2.130)	(2.262)
Financing through local equity market	-12.24***	-12.39***	-5.715***	-5.034**
	(4.298)	(4.438)	(1.997)	(2.111)
Ease of access to loans	-9.214**	-7.293*	-4.268***	-3.714**
	(3.654)	(3.736)	(1.635)	(1.732)
Prevalence of foreign ownership	73.03***	63.58***	32.98***	29.34***
	(10.92)	(11.23)	(5.234)	(5.547)
industry = 2, Aerospace & Defense		-0.00765		-0.0439
		(1.131)		(0.436)
industry = 3, Agriculture & Livestock		0.611		0.218
		(1.126)		(0.419)
industry = 4, omitted		-		-
industry = 5, Alternative Financial Investments		-1.193		-0.479
		(0.892)		(0.413)

industry = 7, Asset Management	0.278	0.154
	(0.573)	(0.231)
industry = 8, Automobiles & Components	1.394	0.500
	(1.124)	(0.389)
industry = 9, Automotive Retailing	-0.945	-0.400
	(0.889)	(0.403)
industry = 10, Banks	-1.369***	-0.590***
	(0.522)	(0.213)
industry = 11, omitted	-	-
industry = 12, omitted	-	-
industry = 13, Brokerage	0.143	0.0695
	(0.599)	(0.240)
industry = 14, Building/Construction & Engineering	0.118	0.0588
	(0.542)	(0.218)
industry = 15, omitted	-	-
industry = 17, Chemicals	0.542	0.205
	(0.714)	(0.279)
industry = 18, omitted	-	-
industry = 19, Computers & Peripherals	-0.992	-0.358
	(1.150)	(0.545)
industry = 20, Construction Materials	-0.376	-0.118
	(0.681)	(0.285)
industry = 21, Containers & Packaging	-0.783	-0.316
	(1.141)	(0.506)
industry = 22, Credit Institutions	-1.164**	-0.422
	(0.592)	(0.258)
industry = 23, omitted	-	-
industry = 24, Diversified Financials	-4.435***	-2.263***

	(0.789)	(0.415)
industry = 25, E-commerce / B2B	-2.556***	-1.235**
	(0.962)	(0.520)
industry = 26, omitted	-	-
industry = 27, Electronics	-0.451	-0.182
	(0.879)	(0.366)
industry = 29, omitted	-	-
industry = 30, Food and Beverage	0.0210	0.0477
	(0.772)	(0.316)
industry = 31, omitted	-	-
industry = 32, omitted	-	-
industry = 33, omitted	-	-
industry = 34, omitted	-	-
industry = 36, omitted	-	-
industry = 37, omitted	-	-
industry = 38, omitted	-	-
industry = 39, omitted	-	-
industry = 40, Insurance	-2.568***	-1.211***
	(0.616)	(0.282)
industry = 41, Internet Software & Services	-3.047***	-1.504***
	(0.557)	(0.248)
industry = 42, Internet and Catalog Retailing	-4.656***	-2.452***

	(0.982)	(0.515)
industry = 43, Machinery	-0.0123	0.0270
	(0.716)	(0.293)
industry = 44, Metals & Mining	-0.245	-0.0680
	(0.536)	(0.218)
industry = 45, Motion Pictures / Audio Visual	-0.648	-0.266
	(1.141)	(0.497)
industry = 46, Non Residential	-2.361***	-1.142***
	(0.614)	(0.285)
industry = 47, Oil & Gas	-1.260**	-0.538**
	(0.575)	(0.244)
industry = 48, Other Consumer Products	0.315	0.142
	(0.875)	(0.347)
industry = 49, Other Energy & Power	-0.311	-0.0933
	(1.135)	(0.484)
industry = 50, Other Financials	-0.907*	-0.364*
	(0.513)	(0.208)
industry = 51, omitted	-	-
industry = 52, omitted	-	-
industry = 53, Other Industrials	-0.938	-0.373
	(0.684)	(0.298)
industry = 54, Other Materials	-0.596	-0.238
	(1.138)	(0.496)
industry = 55, Other Real Estate	-1.849***	-0.835***
	(0.512)	(0.208)
industry = 56, omitted	-	-
industry = 58, Paper & Forest Products	-1.090	-0.460
	(0.784)	(0.353)
industry = 59, omitted	-	-

industry = 60, omitted	-	-
industry = 61, omitted	-	-
industry = 62, Power	-0.567	-0.188
	(0.547)	(0.224)
industry = 63, Professional Services	-0.609	-0.248
	(0.622)	(0.259)
industry = 64, omitted	-	-
industry = 65, omitted	-	-
industry = 66, REITs	-1.722**	-0.731*
	(0.792)	(0.375)
industry = 67, Real Estate Management & Development	-1.098	-0.449
	(1.148)	(0.527)
industry = 68, omitted	-	-
industry = 69, omitted	-	-
industry = 70, Semiconductors	-0.641	-0.306
	(0.778)	(0.327)
industry = 71, omitted	-	-
industry = 74, omitted	-	-
industry = 75, omitted	-	-
industry = 76, Textiles & Apparel	1.107	0.443
	(1.124)	(0.419)
industry = 78, Transportation & Infrastructure	0.0231	0.0309
	(0.544)	(0.220)

industry = 79, Travel Services		-0.171		-0.0396
		(0.877)		(0.364)
industry = 80, omitted		-		-
industry = 81, omitted		-		-
Constant	-18.90**	-12.30	-7.341*	-4.344
	(9.122)	(9.423)	(4.183)	(4.464)
Observations	16,615	15,678	16,615	15,678
Industry FX	NO	YES	NO	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix IV: Data Appendices

Bloomberg Corporate Bond Data

The data used in the portions described as using the Bloomberg data (**Sections 7-10**) were acquired in the following manner.

1. I acquired this data by using NYU Shanghai's Bloomberg Terminal to access the Fixed Income Worksheet and applying the following filters:
    a. All Corporate Bonds: yielded 1,870,346 securities
    b. Was not called (had a marginal impact on total securities): yielded 1740,838 securities
    c. Issue Date between 1/01/2010 and 11/20/2018[7]: yielded 857,768 securities
    d. Country of Incorporation including Brazil, China, India, Indonesia, Japan, Korea, Malaysia, Russia, South Africa, Thailand: yielded 234,490 securities
2. As these securities could not be individually accessed due to Bloomberg's data download limits, matrices were constructed for each country, detailing the USD-equivalent value of new corporate bonds issued in each currency for which records are available, at both the monthly and quarterly levels.
3. These country-level aggregate data were downloaded and then aggregated into one larger excel file for panel data analysis, and then imported into Stata

After the data was acquired, the quarterly proportion of issuance by currency denomination was calculated. This provided the key outcome variables pctdom and pctusd, which represented the quarterly proportion of the value of new corporate bond issuances denominated in the relevant domestic currency, and in US Dollars, respectively.

Thomson One Banker Data

The data used in the **Firm-Level Analysis** section of this paper by taking the following steps:

1. I used NYU Shanghai's access to Thomson One's database
    a. I accessed the *Screening & Analysis* section
    b. Then *Deals & League Tables*
    c. Then *Bonds*
    d. Then *Advanced Search*
2. From there, I applied the following filters to access Thomson One's Database, yielding 59,139 bond issuances
    a. Date Range: 01/01/2010 to 11/20/2018
    b. Issuer/Borrower Country of Incorporation (COUNTRY_OF_INCORP): Brazil, China, India, Indonesia, Japan, Korea, Malaysia, South Africa, Thailand; Russia was excluded as the country suffered a currency crisis, and including Russia would exceed the maximum download limit allowed (60,000) to excel.
3. The data procured for each of these individual issuances included:
    a. The date of issuance of the bond

[7] The first date that data was accessed

b. the issuing company's legal name
c. the target market by region
d. The country of incorporation of the Issuer
e. The currency-denomination of the issuance
f. the industry of the issuing firm
g. the coupon rate of the issuance
h. the total proceeds of the issuance (USD equivalence)
i. While other firm-specific variables including size, revenue, and leverage were also accessed, the panel data was not balanced, and less than 2% of the data collected had any of these variables included. As such, they were not a crucial part of this analysis, as opposed to several of the above variables.

4. These were then downloaded to Excel, and formatted to be imported into Stata.

From this point, a binary variable was created to indicate whether a particular bond issuance was denominated in the domestic currency of its country of incorporation. This variable Domestic (alternatively, domestic) formed the primary binary outcome variable for which the logit and probit analyses were carried out.

World Economic Forum Data

The data acquired from the World Economic Forum's Annual *Competitiveness Index* Report was gathered from this excel file, provided by the World Economic Forum.

1. The variables used for control were gathered on an annual basis, and are outlined below:
   A. Inflation, annual % change*
   B. Country credit rating, 0–100 (best)
   C. Institutions
   D. Availability of financial services
   E. Affordability of financial services
   F. Financing through the local equity market
   G. Ease of access to loans
   H. Prevalence of foreign ownership
2. Variables not expressed in annual % change were normalized by dividing the value by their max possible score (either 100, or 7).
3. After formatting by country, these values were merged with both the Thomson Stata file and the Bloomberg Stata file, separately.

Federal Reserve Data

Quarterly exchange rate data (USD-domestic currency) for each of the ten countries examined was downloaded from the Federal Reserve Economic Data (FRED) website. From there, each exchange rate was normalized as a proportion of its initial (2010Q1) value in an effort to normalize the exchange rates. This created the variable XRB (exchange rate benchmark; shown in regression results as "relative USD exchange rate (2010 normalized)"), and enables like-comparisons between the relative strength of each currency over time. This data was then merged

separately with both the Thomson data set and the Bloomberg data sets, though was not considered as a factor in the Thomson data set.