Internationalizing Like China

Christopher Clayton* Amanda Dos Santos† Matteo Maggiori‡ Jesse Schreger§

March 2022

We empirically characterize how China is internationalizing the Renminbi by selectively opening up its domestic bond market and propose a dynamic reputation model to understand China's internationalization strategy. While previously closed to foreign investors, China has recently allowed major increases in foreign investment in its domestic bond market. China carefully controlled the entrance of foreign investors into its market, first allowing in relatively stable long-term investors like central banks before allowing in flightier investors like mutual funds. Foreign investors increasingly treat Renminbi denominated assets as a substitute for safe developed-market government bonds. Our framework explains these patterns as the result of a government strategy to build its reputation as an international currency issuer while minimizing the cost of potential capital flight as it gains credibility. We analyze optimal two-way liberalization: gradually letting more domestic capital flow abroad as foreigners increase their participation in domestic markets.

Keywords: International Currency, Reserve Currency, Safe Assets, Reputation, Capital Controls, Chinese Financial Markets, Renminbi.
JEL Codes: E01, E44, F21, F23, F32, F34, G11, G15, G32.

*Yale School of Management; christopher.clayton@yale.edu.
†Columbia Business School; adossantos24@gsb.columbia.edu.
‡Stanford University Graduate School of Business, NBER, and CEPR; maggiori@stanford.edu.
§Columbia Business School, NBER, and CEPR; jesse.schreger@columbia.edu.

We thank the NSF (1653917) and the Sloan Foundation for financial support. We thank Antonio Coppola, Darrell Duffie, Brent Neiman, and Andreas Schaab for helpful comments and discussion. We thank Giovanni Bonfanti, Sergio Florez, Jialu Sun, and William Stukas for outstanding research assistance. We offer particular thanks to Steve Kaplan for his generous help with the project. Our analysis makes use of data that are proprietary to Morningstar and/or its content providers. Neither Morningstar nor its content providers are responsible for any of the views expressed in this article.

1 Introduction

With the third largest domestic bond market in the world behind the United States and the Euro Area, China is often described as a possible future international currency provider. However, unlike the US and Eurozone bond markets, the Chinese bond market has been largely closed to foreign investors, severely limiting the use of the Chinese Renminbi as an international store of value. Over the last decade, that has begun to change and China has progressively opened its domestic bond market to foreign investment. While the internationalization process remains at relatively early stages, the size of the market and the accelerating speed of its opening process make it a unique and important dynamic at the core of international monetary system. This paper makes two key contributions. First, it empirically characterizes the Renminbi's internationalization and the changing nature of foreign investment. Second, it provides a tractable framework to shed light on the strategy that the Chinese government is pursuing in the internationalization of the Renminbi.

We begin our analysis by providing a comprehensive characterization of foreign investment in China's domestic bond market.[1] While the initial foreign flows into Renminbi (RMB) bonds were driven by central banks, a large share of the growth over the last few years has been coming from private sector investors. We show that private investment has been widespread, with significant investment coming from the U.S., Euro Area, Japan, and Taiwan. By contrast, official ownership is dominated by a major shift by the Central Bank of Russia to move a large portion of its reserves into RMB and out of US Dollars in the wake of financial sanctions in the mid-2010s.

We document that this changing investor composition was a deliberate policy choice of the Chinese government. In particular, by introducing a series of different foreign investment schemes with varying quotas, lock-up periods, and registration requirements, China was able to stagger the entry of different investor types into its market. China began by allowing in more stable, long-term investors, such as central banks, sovereign wealth funds, and non-profits. After creating this stable investor base, China gradually loosened its array of restrictions to increasingly allow in flightier foreign investors such as passive and active mutual funds, exchange traded funds, and even some hedge funds.

These actions raise the question of what China hopes to gain by selecting its investor base. We provide evidence that by the time China allowed in relatively flighty foreign investors, RMB bonds were treated by foreign investors as a closer substitute for developed market currency debt than riskier emerging market debt. This can be surprising as under many economic and institutional-quality metrics China would be considered an emerging market. To demonstrate this substitutability, we use micro data at the security level for private foreign investors like mutual funds, exchange traded funds (ETFs), and insurance companies to understand the portfolios shifts corresponding to the increase in holdings of RMB bonds. We find that, especially in the most recent years, funds

[1]The domestic bond market of China, currently at nearly $20 trillion U.S. Dollars, is dominated by Renminbi-denominated bonds, so that we use the word domestic and Renminbi bonds interchangeably unless further clarity is necessary.

purchasing RMB bonds are generally substituting away from developed currency bonds, such as the U.S. Dollar, Euro and Japanese Yen, rather than emerging market currencies like the Brazilian Real or Mexican Peso. Zooming further into the data, we find that flows into China are dominated by purchases of the safest bonds, in particular Chinese Government Bonds (CGBs) and policy-banks' bonds. These purchased are financed by sales of holdings of developed countries' government debt.

Foreign inflows are heavily influenced by China's entry into major global bond market indices. Quantitatively, an important event is China's inclusion and subsequent growth in weight in the Bloomberg Global Aggregate index, a world bond market index. In this index, the entrance of RMB-bonds largely displaced developed market currencies.[2] We identify the causal effect of indexation on foreign holdings by exploiting heterogeneity in the timing of index inclusion decision by major bond index providers like Bloomberg and FTSE combined with heterogeneity in which funds benchmark to which index.

In addition to portfolio quantities, we also analyze bond return dynamics in China compared to other markets. Overall, we find that the risk properties of China's government bonds are far closer in-sample to safe developed country government debt than the riskier debt issued by emerging market governments. Chinese government bonds betas with indices of volatility or cross-country bond returns are closer in line with those of Germany and Japan than those of Brazil and South Africa.

We develop a simple theoretical framework to make sense of the above stylized facts. We interpret the policy choices of China as trading off building reputation as a country capable of providing the global store of value and risking a disruptive foreign capital flight. Letting in foreign investors helps build reputation for the issuer in global capital markets, but letting in too many foreign investors, particularly flighty ones, can be counterproductive by causing crises as the investors pull out in times of stress. Crises are costly both directly because they lead to inefficient liquidations, and also indirectly because attempts to limit a flight of capital via ex post capital controls on outflows lead to a loss of reputation. In our model, the reputation of a government in the eyes of foreign investors is the perceived probability that the government will not impose capital controls ex post, so that they can "get their money out of the country" undisturbed.

To capture the gradual opening up of markets to different type of investors, we introduce two classes of investors in the model. One class, stable investors, provides cheaper debt and is less flighty in a crisis, in the sense of requiring less collateral in a crisis to roll over the debt. We view this class as capturing the behavior of central banks, sovereign wealth funds, but also some private investors that have particularly long-horizon and stable funding (e.g. endowments and other non-profit institutions). We model stable investors as having a finite debt capacity; they are possibly large, but only one part of the world investment pool. The other class, flighty private investors, provides more expensive debt and is flightier, but has a very large debt capacity compared to the

[2]Some emerging market local-currency bond indices, most notably the JP Morgan Government Bond Index, have also included China and these indexations choices have generated part of the substitution away from (other) emerging markets and into China.

country's borrowing needs. We view this class as capturing the behavior of mutual funds, ETFs, and hedge funds.

We develop a dynamic reputation model in the spirit of Phelan (2006) and Amador and Phelan (2021) in which a country, like China, chooses which classes of foreign investors to allow into its domestic bond market and how much to borrow from each type it lets in. Following negative aggregate shocks, foreign investors demand high collateral to roll over existing debt, forcing some assets to be liquidated to repay debt that cannot be rolled over due to insufficient collateral. Liquidating assets is inefficient, and the government is tempted to introduce ex-post capital controls to limit the flight by foreigners. However, the expectation that these controls might be imposed is precisely the reputational problem of the country: the more foreigners expect the country to impose the controls ex-post, the worse the terms of credit are ex-ante.

Consistent with our empirical findings, the government only gradually opens the domestic bond market to foreigners. At low levels of reputation, the government chooses to only borrow from stable investors. At this stage of the internationalization process, the flighty private investors are too costly to allow into the domestic market. If the government does not institute ex-post capital controls on existing stable investors following a bad shock, then reputation increases and the interest rate schedule subsequently offered by foreigners becomes more attractive, increasing the government's desire to borrow more from foreigners. As reputation builds, the value of letting more foreigners in becomes sufficiently high that the government allows flighty private investors into the domestic market. Interestingly, the action of letting in private flighty investors itself increases the government's reputation, since it is a disproportionately expensive action to take for a government intending to impose ex-post controls.

Establishing the credibility of being an international currency issuer, like the strong reputation the US currently has in global markets, is a slow and arduous process. The model captures this dynamic in several ways. First, reputation can only be built in the fire of a crisis. In normal times, when foreigners do not flee from the country's debt, the government is not tempted to tamper with foreign debt holdings. The lack of temptation also means that no reputation is built. Since crises are infrequent, so are opportunities to build reputation. In this respect, the behavior of governments during crises is a salient moment for investors to update their beliefs on the type of government they are facing. This updating is particularly strong for a country like China at the beginning of the internationalization process. As reputation builds, it becomes more difficult to build it further and many governments decide that further gains in reputation are too small to justify not imposing capital controls in the next crisis. Those governments that trigger the controls lose their reputation with investors, thus resetting their reputation cycle.

In the model, opportunistic governments of high reputation eventually trigger the controls when the debt is at its highest and the interest rate at its lowest because investors are nearly convinced that they are facing a committed government. In this sense, some major crises for countries of high reputation occur when markets are very optimistic. Similarly, we documented empirically that

foreign investors are currently treating Chinese debt as very safe, but this is no guarantee that investors are pricing these risks properly.

The core theoretical framework is simple and tractable and can be taken in different directions: allowing two-way capital flows, investor behavioral biases in reputation updating, and multiple issuers and reserve currency competition.

Related Literature. The internationalization of the Renminbi is an important global macroeconomic development that has attracted much policy attention but surprisingly little formal analysis, either empirically or theoretically. In a similar spirit to this paper, Song, Storesletten and Zilibotti (2011) documented a number of stylized facts about the nature of China's economic growth strategy and provide a theoretical framework consistent with the observed patterns. Our focus is more directly related to the literature on China's bond market reforms like Cerutti and Obstfeld (2018), Song and Xiong (2018), Mo and Subrahmanyam (2020) and papers included in the handbook by Amstad, Sun and Xiong (2020). Brunnermeier, Sockin and Xiong (2017) and Brunnermeier et al. (2022) focus on China's gradualistic approach to financial markets reforms.

There is a recent theoretical literature on the international monetary system, mostly focusing on established international currencies like the the US dollar and euro (Farhi and Maggiori (2018), He, Krishnamurthy and Milbradt (2019), Gopinath and Stein (2021), Chahrour and Valchev (2021), Drenik et al. (2021)). An important exception is Bahaj and Reis (2020) who focus on the early process of jump-starting the Renminbi as an international currency. They focus on the unit of account and payments role of a currency and examine the role of the introduction of PBoC swap lines in leading the Chinese Renminbi to be adopted in the global payments system.[3]

Our model of dynamic reputation is related to foundational work by Kreps and Wilson (1982), Milgrom and Roberts (1982), and Barro and Gordon (1983), and in particular to papers that consider changes in the commitment types over time (Phelan (2006), Amador and Phelan (2021)).[4]

Finally, our focus on the temptation that a government faces in imposing ex-post capital controls and the presence of stable and flighty investors is related to the literature studying asset fire sales, liquidity, and heterogeneous investor bases (Caballero and Simsek (2020), Clayton and Schaab (2022), Coppola (2021)).

2 Background on China's Bond Market

We begin by providing a brief overview of China's bond markets. For more comprehensive introductions to the market, see Amstad and He (2020) in Amstad et al. (2020), or Schipke and Zhang (2019). Today, China's market is the third largest in the world, behind only the United States and the Euro Area. Figure 1 shows the remarkable growth in China's bond market over the last

[3]See Eichengreen (2011) and Eichengreen et al. (2017) for the history of the international monetary system.

[4]See also Cripps et al. (2004), Tadelis (1999), and Mailath and Samuelson (2001).

15 years, the value approaching nearly $20 trillion at the end of 2020. China's central government had long been the largest issuer in domestic bond markets, with China Government Bonds (CGBs) used as the de facto risk-free rate in bond markets. The second most important category had long been policy-bank bonds, the bonds of the large Chinese state-affiliated policy banks (Agricultural Development Bank of China, China Development Bank, and the Export-Import Bank of China). The bonds of these banks are generally assumed to be implicitly guaranteed by the central government. Recently, both of the categories were supplanted by local-government bonds. The rest of the market, which is much smaller than the above three governmental or quasi-governmental set of issuers, is composed of bonds issued by firms, either State Owned Enterprises (SOEs) in the form of enterprise bonds, corporate bonds by private firms, or bonds issued by commercial banks.

Through much of its development, China's bond market was essentially closed to foreign investors. That began to change in the early 2000s. Rather than open its domestic bond market to all foreign investors at once, China instead pursued a gradual liberalization policy. China's policy of opening up began by allowing in foreign investors with strict limits on the size of investment via quotas and regulating the type of investors that could enter via special programs with demanding application processes and often lengthy lock-up periods. Over the last 20 years, China reduced each of these barriers gradually, allowing larger investment scale, a greater variety of foreign investors, and increasingly allowing investors to quickly take their money out of the country.

The liberalization process took a major intiial step in 2002 with the introduction of the Qualified Foreign Institutional Investor (QFII) program.[5] Under this system, following a fairly onerous registration and application process, investors could gain access to domestic stock and exchange-traded bond markets. However, the exchange-traded bond market is a small share of the overall bond market, and it was not until 2013 that QFII and RQFII members could access the domestic interbank bond markets in which the bulk of domestic bond trading occurs (Kai (2019)). In these early stages, the quotas were quite small and only a narrow range of investors actually gained access to the market. Amstad and He (2020) note that 90% of foreign investment through these programs went to the stock market, with the small remaining share going to bonds. Importantly, QFII investment was originally subject to a one-year lock up period. In 2009, this was lowered to three months for "pension funds, insurance funds, mutual funds, charitable funds, endowment funds, government and monetary authorities and open-ended funds." (ASIFMA (2021))

In 2010, China significantly broadened direct access to the domestic bond market via a program called China Interbank Bond Market (CIBM) Direct. The primary participants were central banks and other official investors like sovereign wealth funds, and they could directly access the interbank market. In 2015, the People's Bank of China (PBoC) allowed full access without a quota to the interbank bond market for long-term investors such as central banks and sovereign wealth funds (Amstad and He (2020)). These reforms helped meet the requirements for the Renminbi's inclusion

[5]The Renminbi Qualified Foreign Institutional Investor (RQFII) was introduced in 2011, allowing investors to use RMB to enter the market rather than foreign currency. The programs were merged in 2020.

in the SDR basket in 2016. Quota restrictions through CIBM Direct were removed for all investors in 2016 (Kai (2019)), but this form of access still required direct access to China's bond markets with its accompanying regulatory and registration hurdles (Schipke et al. (2019)).

These hurdles were significantly lowered in 2017 with the introduction of Bond Connect. Unlike earlier programs, Bond Connect is based offshore in Hong Kong and can be accessed via standard trading platforms like Bloomberg without the registration requirements of QFII or CIBM Direct. The ease of access into the Chinese market via Bond Connect was seen as an important reform to facilitate China's inclusion in global bond indices such as the Bloomberg Global Aggregate Index and the JP Morgan Government Bond Index - Emerging Markets (GBI-EM). In order to be included in these indices, bonds must be freely tradable, there cannot be substantial capital controls, and in some cases hedging instruments need to be available. While these criteria could arguably have already been met for official sector investors investing through CIBM Direct prior to Bond Connect, it was only recently private investors were deemed to reach that level of access. Indeed, whether the Chinese bond market is freely investable for most foreign investors today is still a matter of contention. FTSE only added Chinese bonds to its World Government Bond Index (WGBI) in October 2021 and following this decision, for instance, Japan's Government Pension Investment Fund (the largest tracker of the WGBI) subsequently decided to track a version of the WGBI index excluding China, arguing that market access was still too incomplete for them to invest.[6]

While each step of these reforms has its own intricacies, one can understand China's bond market liberalization as beginning by allowing in a narrow subset of long-term investors with restrictions on investment amounts and withdrawals, loosening these restrictions for subsets of investors over time, before moving to nearly free access to a range of global investors. As we document below, these reforms have been accompanied by substantial inflows of foreign investment in Chinese bond markets, starting with official foreign investors and, more recently, fast-growing amounts of private investment.

3 The Rise of the Renminbi in International Portfolios

In this section, we document and characterize the remarkable rise of the renminbi in international investment portfolios. Figure 2 displays the level of foreign investment in RMB denominated bonds from 2014 to 2020, rising from under $100 billion in 2014 to nearly $500 billion in 2020. The largest increase comes in 2020, with foreign holdings increasing nearly $200 billion from 2019 to 2020.[7] Figure 2 further decomposes foreign ownership of RMB into three components: reserve holdings,

[6]See: Reuters Article. The President of the GPIF, Masataka Miyzono, explained "Chinese government bonds cannot be settled in an international settlement system that can be used for other major government bonds. The market's liquidity is still limited compared with the size of GPIF's investment scale. Trading of futures is not allowed for foreign investors."

[7]Recent reporting indicates that private inflows to China were very large in 2021 (FT). IMF COFER data indicates foreign reserve holdings of RMB denominated bonds increased nearly $50 billion from $272 billion in the fourth quarter of 2020 to $319 billion in the third quarter of 2021.

private holdings, and unknown. The initial rise in foreign investment is largely driven by central bank holdings.[8]

In Figure 3, we plot the amounts of reserves for which we can identify the country of holder. By far, the largest disclosed holder is the Central Bank of Russia. In 2017 and 2018, Russia dramatically cut its holdings of USD reserves and moved into RMB and EUR, apparently in response to U.S. sanctions and general wariness of relying on the dollar-based financial system. While many countries report their reserve holdings to COFER, COFER only reports the currency composition of the pooled global total of reserves, and the vast majority of RMB holdings are not disclosed by the individual central banks.[9] Therefore, even after hand-collecting the RMB holdings for all central banks we could find currency disclosure information for, the exact holders of the bulk of RMB reserve assets is unknown (see also Liu and Chan (2019)).

The second component of foreign holdings is private sector investment. While still smaller than reserve holdings, this component has seen a rapid increase over the past few years. To measure the private holdings, we combine two data sources. First, we use data on the "Currency Breakdown of Portfolio Investment Assets" (Table 2) from the IMF Coordinated Portfolio Investment Survey (CPIS).[10] The reporting of currency breakdowns of foreign investment in CPIS is more incomplete than other parts of the survey.[11] For countries that do not report to CPIS, we rely on data on holdings of mutual funds and ETFs from Morningstar previously used in Maggiori et al. (2020) and Coppola et al. (2021). The three most important additions from Morningstar are Ireland, Luxembourg and Taiwan, where we directly observe $13.8, $13.7, and $5.0 billion of investment in RMB denominated assets.[12] Putting these different datasets together, we find that the largest private foreign holders of RMB are the Euro Area, United States, Japan, and Taiwan (Figure 5).

To give a sense of China's place in private international portfolios, Figure 4 compares the scale of investment in Chinese RMB bonds to that of the other BRICS (Brazil, Russia, India, China, South Africa) currencies. The top panel uses data from Morningstar for global mutual fund and ETF investors and the bottom panel uses data on the universe of US portfolio investors investment in long-term bonds from the Treasury International Capital (TIC) data.[13] In both cases, as recently

[8]The currency composition of reserve holdings comes directly from the IMF Currency Composition of Official Foreign Exchange Reserves (COFER), which includes data on foreign reserve holdings of RMB since the fourth quarter of 2016. Prior to that date, holdings of RMB were aggregated into "Other Currencies".

[9]Even for reserve holdings that we can account for, for the majority of countries we are unable to collect a full time series and instead rely on collecting a variety of official statements and disclosures.

[10]While countries do not report the country in which an investment is made, given the very small size of the international RMB market, and the small degree of foreign issuance onshore in China in RMB (Panda bonds), total foreign investment in RMB is likely to be nearly identical to total investment in RMB. In addition, CPIS is not limited to private investment and will include public investment in the form of sovereign wealth funds, government pension funds, and state-owned enterprises (while excluding central banks' reserve holdings). In this sense it may be more accurately described as all non-central bank holdings.

[11]Appendix Table A.I lists the reporting countries.

[12]Our benchmark estimates in Figure 2 include only the positions we can directly observe in Morningstar. These are a lower bound because the investment of mutual funds and ETFs are only a fraction of total foreign currency.

[13]We focus on the US using TIC rather than CPIS because even when countries report the currency com-

as 2018, Chinese RMB accounted for only a small fraction of investment in these major emerging market currencies. However, by 2020, investment in RMB was by far the largest category in global mutual fund and US portfolio investment.

After combining this data on private holdings of RMB with reserve holdings from COFER, we are left with nearly $150 billion unaccounted for. There are a number of reasons for this. First, the RMB reserves reported by IMF COFER are only a lower bound on total RMB foreign reserve holdings, because some major reserve holders do not report to COFER.[14] For example, in 2020, the five largest reserve holders that did not report to COFER were Taiwan ($530 billion), Saudi Arabia ($454 billion), Thailand ($258 billion), Indonesia ($136 billion), and Malaysia ($108 billion). If these countries put a similar fraction of their reserves in RMB as do the countries for which we have information (on average 2.3%), they would account for another $30 billion of reserve holdings. Given that many of these countries are close trading partners of China, it seems likely their holdings would be significantly higher than this conservative back of the envelope calculation. Second, there are a number of countries which report large holdings of Chinese bonds in CPIS but do not report the currency composition of their assets to CPIS and for which Morningstar does not cover a significant share of mutual fund investment. For instance, while Hong Kong and Singapore report $181 and $68 billion of investment in Chinese bonds to CPIS, all of their RMB holdings would show up in the unknown category because we cannot observe their currency composition. If a significant share of these investments are in renminbi, as they are for countries for which we have data, this would account for a significant share of the investment recorded in Figure 2 as unknown.

These aggregate investment figures raise the question of what investors are actually purchasing within the class of RMB bonds. Using data from China Central Depository and Clearing, the top panel of Figure 6 shows that China Government Bonds (CGBs) account for 67% of of foreign investment in China, with 30% of investment in Policy Bank Bonds (PBBs), even though these two classes only account for a combined 62% of the total bond market. Importantly, these are the two categories that are either direct liabilities (CGBs) or assumed to be implicitly guaranteed (PBBs) by the Central Government.[15] By contrast, only 3% of foreign investment goes to the 38% of the market with significant private credit risk. These patterns highlight that conditional on investing in RMB, foreign investors mostly hold the safer assets denominated in that currency.

position of their investment to CPIS, they do not report emerging market currencies, making this comparison infeasible for more countries.

[14]Reserve holdings themselves may also understate the importance of the renminbi as a reserve asset. As discussed in Bahaj and Reis (2020) and Bahaj and Reis (2021), China has opened a number of swap lines with central banks around the world. Therefore, even if central banks don't hold renminbi in their current reserves assets, they may be counting on renminbi liquidity in a crisis.

[15]While we focus on understanding the nature of investment into China, see Horn et al. (2021) and Gelpern, Horn, Morris, Parks and Trebesch (2021) for studies on the nature of China's foreign investment.

3.1 Selecting the Foreign Investor Base

In the previous subsection, we documented which countries are holders of RMB bonds. Here, we turn to understanding the type of investors that access the Chinese bond market at each point in time. To do so, we create a new monthly dataset of the investor composition of the four access methods for the Chinese bond market discussed in Section 2: QFII, RQFII, CIBM Direct, and Bond Connect. For each of the programs, the regulatory agency either directly reports the investor name and the month the particular investor gained access to the program, or they release a series of monthly reports of investors with access, and we infer the month of access based on the first appearance on the regulatory filing. Based on investor name, we merge these investor lists with Factset to collect investor information, such as country of residency, nationality, and industry classification. We then classify funds as "Stable" investors, "Flighty" investors, or "Banks."[16]

Figure 7a displays the cumulative distribution function (CDF) of investors' entry into the Chinese bond market by type from 2003 to 2021. It shows a striking difference between the entry pattern of Stable investors and Flighty investors, with Stable investors generally entering earlier in the sample period followed by a rapid increase in Flighty investors over the most recent years. Figure 7b repeats the exercise for each of the underlying categories. It shows the heterogeneous process followed by different types of investors in entering this market. In particular, the stable non-profit sector is welcomed into the market relatively early on in the liberalization process, whereas the relatively flightier portfolio management sector sees the overwhelming share of entry during the latest Bond Connect period.

These patterns are the result of conscious policy choices by the Chinese government that selected and grew its foreign investor base over the last two decades. As discussed above, the early entry and growth of the stable investors was engineered via quota programs in which each investor separately applied for market access, while the later entry and growth of the flighty investors is largely the result of more open and lightly regulated access programs like Bond Connect that allows access without any lock-up period. Our model, introduced in Section 5, both draws from this evidence in featuring two different classes of foreign investors, one stable and the other flighty, and provides an explanation of why China has followed this sequential opening-up strategy to internationalize its bond market.

4 Global Portfolio Shift into RMB

Having documented who has been purchasing RMB assets and how China selected the set of foreign investors that can access the market, we now dig deeper to understand the behavior of private-sector

[16] "Stable" investors include central banks, legislative bodies, international organizations like the IMF, university endowments, non-profits, pension funds, and insurance companies. "Flighty" investors are those in the investment advice or portfolio management industry. "Banks" include investment banks, commercial banks, and broker dealers.

foreign investors. In particular, we use micro data on portfolio investment from foreign investors from Morningstar to ask whether investors entering the Chinese markets treat their purchases as a substitute for safe developed market currencies or riskier emerging market bonds.

To better understand the inflows into the market, we begin by decomposing the change in investment positions into a number of economically interpretable components. The change in the dollar value of foreign investment $\Delta AO_{t,f,b}$ of a particular bond b between time t and $t-1$ by fund f, can be split into a valuation effect ($VE_{t,f,b}$), the within-fund portfolio shift towards the bond $\left(F_{t,f,b}^{Within}\right)$, the increase or decrease in investment in the bond driven by fund level inflows or outflows $\left(F_{t,f,b}^{Between}\right)$, the flow resulting from a new fund purchasing that bond ($F_{t,f,b}^{NewFunds}$) and a residual $\left(F_{t,f,b}^{Residual}\right)$.

$$\Delta AO_{t,f,b} = VE_{t,f,b} + F_{t,f,b}^{Within} + F_{t,f,b}^{Between} + F_{t,f,b}^{NewFunds} + F_{t,f,b}^{Residual} \tag{1}$$

These components can themselves be expressed in terms of the price of the individual asset $P_{t,b}$ and quantity owned by a given fund $Q_{t,f,b}$. The change in the amount owned by a fund is the change in market value between $t-1$ and t :

$$\Delta AO_{t,f,b} = P_{t,b}Q_{t,f,b} - P_{t-1,b}Q_{t-1,f,b} \tag{2}$$

Since we do not observe the actual transaction price at which funds buy or sell securities within a period, we need to make an assumption about the time at which the securities are purchased. Our baseline case assumes that all transactions occur at last period's prices. In this case, we can write the valuation effects on the portfolio as the price change times the quantity owned at time t:[17]

$$VE_{t,f,b} = \left(P_{t,b} - P_{t-1,b}\right) Q_{t,f,b}$$

The second term, $F_{t,f,b}^{Within}$, measures net purchases of a particular security, holding fixed the size of the investment portfolio. This term will be particularly important for our analysis because it captures a fund actively rebalancing its portfolio towards security b. We measure this component as

$$F_{t,f,b}^{Within} = \widetilde{AUM}_{f,t}\left(\widetilde{\omega}_{t,f,b} - \omega_{t-1,f,b}\right)$$

where $\omega_{t-1,f,b}$ is the share of asset b in fund f at time $t-1$: $\dfrac{P_{t-1,f,b}Q_{t-1,f,b}}{\sum_k P_{t-1,f,k}Q_{t-1,f,k}}$. The notation

[17] This total valuation effect can be split into two components

$$VE_{t,f,b}^{Legacy} = \left(P_{t,f,b} - P_{t-1,f,b}\right) Q_{t-1,f,b} \tag{3}$$

$$VE_{t,f,b}^{Trading} = \left(P_{t,f,b} - P_{t-1,f,b}\right)\left(Q_{t,f,b} - Q_{t-1,f,b}\right) \tag{4}$$

$VE_{t,f,b}^{Legacy}$ denotes how much the market value of holdings of security b by fund f would have increased if the portfolio was unchanged. $VE_{t,f,b}^{Trading}$ measures the valuation effects realized by the fund on any new trades, which are assumed to have occurred at price $P_{t-1,f,b}$.

$\widetilde{x}_t$ denotes a variable x_t measured using last period's prices.[18]

The within-fund component multiplies the change in the portfolio weight of an asset ($\widetilde{\omega}_{t,f,b} - \omega_{t-1,f,b}$) coming entirely from changes in asset holdings (Q) by the AUM of the fund measured at last period's prices. Importantly, the sum of all within-fund flows is zero by construction at the fund level. Therefore, if we observe positive within-fund flows to RMB bonds, then within-fund flows are negative for other asset types, indicating active rebalancing away from some assets and toward RMB bonds. This allows us to measure which assets funds are substituting away from when they purchase RMB bonds.

The next component is the between-fund component of flows, $F^{Between}_{t,f,b}$, the increase in holdings of security b by fund f that would occur for a given amount of overall portfolio inflows (positive or negative) at the fund level. We define this term as

$$F^{Between}_{t,f,b} = \omega_{t-1,f,b} \cdot Inflow_{t,f} \tag{5}$$

where $Inflow_{t,f}$ is the net inflow of new money to fund f between period $t-1$ and t. This term captures the market value of an asset a fund would be expected to purchase or sell in response to flows into or out of the fund if it chose to purchase assets in proportion to their existing portfolio weights and thereby keep the portfolio weights unchanged at constant prices.

Finally, $F^{NewFunds}_{t,f,b}$ measures the amount of RMB bonds held by funds at the end of the period that did not exist the previous period. This term is of particular interest in the case of investments in China since new specialist funds are being created with the sole investment objective of holding RMB bonds.

While the above decomposition holds at the security-fund level, we are most interested in flows at higher levels of aggregation. In particular, we define five currency groups: Renminbi bonds (RMB), emerging-market currencies bonds (EM), developed-market currencies bonds (DM), domestic-currency bonds (Dom), and all other assets (Oth).[19] We then aggregate security-level flows (e.g., within-fund flows) for a given currency class by summing that type of flow for all funds and securities in that currency class:

---

[18]The portfolio share at last period's prices can be written as $\widetilde{\omega}_{t,f,b} = \dfrac{P_{t-1,b}Q_{t,f,b}}{\sum_k P_{t-1,k}Q_{t,f,k}}$. $\widetilde{AUM}_t$ is defined equivalently. An alternative way to write $F^{Within}_{t,f,b}$ is

$$F^{Within}_{t,f,b} = P_{t-1,b}\left(Q_{t,f,b} - Q_{t-1,f,b}\frac{\widetilde{AUM}_{f,t}}{AUM_{f,t-1}}\right)$$

Intuitively, it measures the deviation in the growth rate of holdings of security $Q_{t,f,b}$ relative to the growth rate of total AUM, measured using constant prices.

[19]Domestic currency is defined to be the currency of the country in which the fund is domiciled. For example, the euro-denominated bond holdings of funds domiciled in Germany belong to the Dom caterory while they belong to the DM category if they are held by US-domiciled funds.

$$F^{i}_{t,Class} = \sum_{b \in B^{Class}} \sum_{f} F_{t,f,b}$$

where B^{Class} captures all securities in one of the currency classes defined above, and the summation over f indicates that we are summing over all funds in the data. Because the within-fund component is always zero when summed across all funds or all assets, we can write

$$F^{Within}_{t,CNY} = -\left(F^{Within}_{t,EM} + F^{Within}_{t,DM} + F^{Within}_{t,Oth} + F^{Within}_{t,Dom}\right) \tag{6}$$

This equation allows us to analyze whether funds that reallocate their portfolios towards China do so by selling bonds denominated in EM currencies, DM currencies, Domestic currency, or other assets.

In order to implement the decomposition in equation (1) we use three types of data. First, portfolio holding data from Morningstar give us the market value at the security level at the monthly, quarterly, or annual frequency.[20] Second, we use security prices for each of the holdings in the dataset, $P_{t,b}$. Presently, we collect the universe of prices of Chinese RMB securities and the universe of equity returns. We are in the process of supplementing this data with the prices of non-RMB assets and currently approximate the changes in the price of bonds with the exchange rate change against the dollar but omit the component coming from bond price changes in the local currency. Third, we use inflows data into funds at the same frequency as the holding data. We use $Inflow_{t,f}$ as directly reported at the fund level in Morningstar Direct.[21]

Under our assumption that all trading occurs at last period's prices $P_{t-1,k}$, an alternative measure of inflows is the change in asset quantities measured at constant prices:

$$\widetilde{Inflow}_{t,f} = \sum_{k \in K} P_{t-1,k} \left(Q_{t,f,k} - Q_{t-1,f,k}\right)$$

In practice, the two measures differ because trading is occurs at different points in time over each observation interval. Therefore, in our benchmark analysis, the residual captures the error induced by the assumption that all new purchases or sales occur at price P_{t-1} :

$$F^{Residual}_{t,f,b} = \omega_{t-1,f,b}\left(Inflow_{t,f} - \widetilde{Inflow}_{t,f}\right)$$

One should expect a sizable residual, especially when annual data is used.

[20] At present, we consider annual data because it increases fund coverage. However, this increases the measurement error coming from uncertainty on the timing of purchases. In ongoing work we are exploring using higher frequency measurement.

[21] We use the variable "estimated fund-level net flow."

4.1 Decomposing Flows to RMB

Figure 8 displays the flows into RMB bonds split into the five components as in equation (1). Before 2018-2019 private holdings are small, in 2018 the largest component is new funds that purchase RMB bonds, then in 2019 there is a major increase in holdings with the largest component of the flows coming from within-fund portfolio shifts and the second largest component coming from new funds launched that year. The new-funds component is largely accounted for by the creation of Taiwanese ETFs that invest solely in Chinese RMB.[22] In 2020, more than two-thirds of the observed increase in RMB positions comes from within-fund reallocation, with most of the remaining share coming from the between-fund component, meaning that funds that already invested in RMB attracted significant inflows during the year.

In order to understand the changing investor perceptions of the RMB bond market, we analyze each of the terms in equation (6) to figure out which assets are being sold by funds shifting their allocation towards RMB bonds. Figure 9 shows that in 2019 and 2020, funds that purchased RMB bonds tended to sell bonds denominated in the currencies of developed markets. If anything, they increase their holdings of emerging markets, highlighting that in the aggregate very little of the flows into renminbi came at the expense of emerging market currencies.

Figure 10 focuses on the pooled changes between 2018 and 2020. In the top panel, we examine which currencies investors sold in their foreign currency bond portfolio while purchasing RMB. We find that funds that purchased Renminbi sold USD assets, followed by JPY and GBP assets. The substitution out of EMs currencies is much smaller. The bottom panel splits the data along bond types (government, asset-backed, corporate) as well as developed and emerging market issuers. The single largest category that the investors shift away from is the sovereign bonds of developed markets. By contrast, flows into Renminbi bonds are concentrated in Chinese government bonds. Funds purchasing Renminbi bonds appear to treat them as a substitute for developed market government debt.

We turn next to exploring these portfolio shifts at the fund level. We focus on substitution of bonds in different foreign currencies (i.e. excluding domestic currency assets) as substitution out of domestic currency bonds is a different margin of adjustment than our focus. Figure 11 plots the change in the portfolio share of developed market currencies (panel A) and emerging market currencies (panel B) against the change in the share of RMB bonds in the portfolio of mutual funds and ETFs that own at least some RMB bonds. We find a strong negative relationship for DM currencies, but essentially no relationship for EM currencies. We confirm this finding in Table 1 by regressing the change in the RMB portfolio share on changes in the EM and DM share, respectively. Specifically, we run regressions of the form

$$\Delta CNYShare_{f,t} = \alpha_f + \beta \Delta CurrencyShare_{f,t} + \epsilon_{f,t} \tag{7}$$

[22] Liu and Chan (2019) describe how reforms in the Taiwanese insurance industry drove inflows into RMB bond ETFs.

where *CurrencyShare* can refer to either EM or DM currencies. Column 1 of Table 1 shows that there is no relationship between changes in the EM share and the RMB share of foreign currency bond investment, while Column 2 shows that that for each 1 percent decrease in the DM currency share of foreign currency bond investment, the RMB share increases by 0.5 percent. This univariate regression has strong explanatory power, with an R^2 of 37.2%. This finding is robust to controlling for fund-domicile-country fixed effects (Columns 3 and 4), and excluding outliers (Columns 5 and 6).[23] However, this table looks purely at share changes, which are potentially affected by exchange rate and price changes. In Table 2, we focus exclusively on the within-fund component of portfolio flows as a share of the AUM without price changes. Even with this more restrictive specification, we continue to find strong evidence that it is outflows from DM currencies that are strongly associated with inflows to RMB, rather than EM currencies. In this specification we find that for each 1 percentage point decrease in the DM currency share as percent of total AUM, the RMB substitution is approximately 0.04 percentage point.[24]

4.1.1 Index Inclusion and the Drivers of Shifting Portfolio Investment

The previous section demonstrates that much of the substitution towards RMB came as funds raised their RMB bond investments at the expense of developed market currencies bonds. Recall that Figures 2 and 4 show a clear jump in foreign participation in 2019. Here, we show that one of the key drivers of this increase in private investment was the inclusion of Chinese bonds in major bond indexes. In particular, in April 2019 Chinese RMB bonds were added to the Bloomberg Global Aggregate Bond Index and in February 2020 Chinese RMB bonds were added to the JP Morgan Government Bond Index - Emerging Markets (GBI-EM). These index inclusions were not sudden decisions of the index providers, but rather the result of a series of significant reforms to market access discussed in Section 2. Restrictions on entry and exit from Chinese bond markets for private investors had long meant that it would be uncertain whether foreign investors could actually achieve the returns of any potential bond index. For instance, if there were quotas and lockup periods, it was not certain whether a fund could make the investments need to follow any index, or whether it could liquidate the investments as needed to satisfy investor redemption demands. The decision of index provides to include Chinese RMB bonds in these indices came with an assessment that these barriers had been sufficiently removed. Indeed, Bloomberg wrote in its press release announcing the inclusion: "In order to be considered for inclusion in the Global Aggregate Index, a local currency debt market must be classified as investment grade and its currency must be freely tradable, convertible, hedgeable, and free of capital controls. Ongoing enhancements from the PBoC have resulted in RMB-denominated securities meeting these absolute index rules."[25]

[23] Outliers are defined as funds with a change in share of RMB assets greater than 30%.

[24] The difference in the magnitude of the coefficients arises because the within component takes into account the domestic substitution as shown in equation (6) whereas the share-change is restricted only to foreign currency bond investment.

[25] Bloomberg.

In Figure 12, we demonstrate the striking effect of index inclusion on holdings of RMB by funds benchmarked to various indices. Prior to 2019Q1, funds that benchmark to the Bloomberg Global Aggregate Index owned approximately no Chinese RMB bonds. There is a steady rise in holdings of RMB by funds that benchmark to this index over the subsequent years, consistent with Bloomberg's announcement of a 20-month phase-in period, with portfolio weights scheduled to increase 0.30% per month.[26] By contrast, the FTSE World Government Bond Index (WGBI), a major competitor for the Bloomberg index, did not include Chinese RMB bonds in the index until October 2021. Therefore, while one might be concerned that the increase in holdings of RMB bonds by funds that benchmark to the Bloomberg index might not be the causal effect of index inclusion (i.e. the funds were responding to a policy reform or demand shock for Chinese RMB bonds that also caused the index inclusion), in that case we would expect funds that benchmark to the FTSE WGBI to also increase their RMB bond holdings. The fact that they do not demonstrates that the increase in holdings by the funds that benchmark to Bloomberg is caused by the index inclusion decision.[27]

Aside from the benchmark driven rebalancing, the inclusion of China in benchmark indices appears to also account for a large extent of the other inflows. Table 3 lists the largest 25 fund holdings of RMB bonds at the end of 2020. The largest position at 6.32bn dollars is held by the iShares China Bond ETF. While this fund does not benchmark against the Bloomberg Global Aggregate, it actually tracks the Bloomberg China Treasury and Policy Bank Index. This index was introduced in November 2016, and the fund itself was launched in July 2019, shortly after the inclusion of China in the Bloomberg Global Aggregate. As of December 2021, it had nearly doubled its AUM to $12.1 billion, making it the second-largest European exchange traded fund.[28] This is one sense in which above and beyond the flows to China driven by index inclusion, since the creation of country-specific indices appears to be tied to inclusion in the broader world indices, the rise of ETFs and funds that specialize in investing in RMB bonds is also linked to China's inclusion in global bond indices.

4.2 Chinese, Emerging Markets, and Developed Countries Bond Returns: Exposures to Global Factors

The previous section documented that funds are increasing their exposure to RMB bonds as a closer substitute for developed-market currencies' bonds rather than emerging-market currencies bonds. Here, we provide evidence that RMB bond returnss are more closely aligned with safer developed-market currencies bond returns than with riskier emerging-market ones. It is important to emphasize that both the portfolio quantity and the price evidence are statements about the

[26] Pensions & Investments.

[27] We find a similar pattern for funds that benchmark to JP Morgan GBI-EM when the index starts to include China. Unlike our analysis above of the Bloomberg index inclusion, we could not identify a rival local currency EM bond index to the JP Morgan one to use as a control group.

[28] The Financial Times, "Bond ETF inflows slump to lowest level since start of pandemic", December 17, 2021.

market behavior over a short sample in which internationalization is starting to occur. As the model in the next Section emphasizes, market beliefs about safety of these assets might turn out to be quite wrong ex-post when crises will occur and China could decide to either directly or indirectly penalize foreign investors. Obviously, should those events were to materialize the return dynamics of the bonds will look dramatically different.

We estimate bond return loadings on risk factors that are commonly used in the literature. Specifically, we regress the returns of investing in each currency's bonds on select risk factors. We begin our sample in 2010, the year when China's peg against the USD was first relaxed.[29] In particular, we measure quarterly dollar returns of holding a bond in currency i as

$$R_{i,t+1} = i_t - i_t^* - \Delta e_{t+1} \tag{8}$$

We then regress the returns $R_{i,t}$ on a risk factor f_t to estimate the currency-specific loading on the factor, β_i:

$$R_{i,t} = \alpha_i + \beta_i f_t + \epsilon_{i,t} \tag{9}$$

Figure 13 reports the regression coefficient β_i for a range of countries. We consider two risk factors. The first factor, HML, follows the work of Lustig, Roussanov and Verdelhan (2011) and constructs the return of investing in the currencies in the top 25% of currencies in terms of their interest rate and shorting the bottom 25%. The bottom panel runs the same regression but uses the quarterly log change in the VIX as the factor. Since an increase in HML occurs in good times and a spike in VIX in bad times, the rankings in the top and bottom panels are roughly reversed. In both cases, we find that RMB bonds in sample are estimated to be among the safest, if not the safest, returns.

5 Reputation in the International Monetary System

To this point, we have documented several facts about the internationalization of China's currency and bond market. First, after having been closed to foreign investors, there has been a rapid increase in foreign participation. Second, the process of changing foreign participation was controlled by the Chinese government, with stable long-term investors like central banks welcomed first, and flightier private investors only able to invest later. Third, by the time private sector investment accounted for a sizable share of the market, the RMB was behaving as a closer substitute for safer developed market currencies rather than emerging market currencies, both in terms of price and quantity dynamics. In this section, we introduce a model that aims to help understand these patterns and the broader internationalization process of the RMB.

The model is infinite horizon and time is discrete time, $t = 0, 1, ...$ Each date t is divided

[29] Jermann et al. (2019) provide a detailed analysis of China's exchange rate regime.

into a beginning, middle, and end of the period. At the beginning of t, long-term investments are undertaken. These long-term investments mature at the end of period t and are financed with short-term debt maturing in the middle sub-period of period t. In the middle sub-period, a state $s \in \{H, L\}$ is realized, where H (high) corresponds to normal times and L (low) corresponds to a crisis. A crisis in this model is a flight of foreign investors who demand high collateral (a high haircut) to roll over the maturing short-term debt. Figure 14 provides a timeline of date t and the actions taken at each point in time are described in detail below.

The domestic economy has a government and a financial intermediation sector. At each date t, a new generation of entrepreneurs are born. Entrepreneurs run the intermediation sector, which they finance using a fixed endowment of inside equity and by borrowing from foreign investors. Entrepreneurs die at the end of t and consume the payoff from their investment.[30] Our focus is on raising financing from foreign investors, and we extend the framework to include domestic investors in the appendix. For expositional clarity, we refer to the intermediaries directly rather than the entrepreneurs that run them. For most of the paper we aggregate the intermediation sector and the government and think of actions at the country level. Particularly in the context of China, the boundaries between government and private actors can be blurry in practice with the presence of policy banks, state-owned firms, and in general high degree of control and influence of the government over private decisions. As the empirical sections of the paper documented, at this stage of internationalization of China's bond market, foreigners are concentrated in government debt and the debt of the policy banks, with limited but early investment of foreign investors in non-financial corporate and private financial debt. In the model, one can think the funds raised via this debt finance as being allocated by the government and financial system directly or indirectly to production.

There are two types of foreign investors: stable investors and flighty investors. These two categories aim to capture in a simple way the economics highlighted in the previous section on different investor characteristics and strategic choices on the part of the country on which investors to let into its bond market at each point in time in the internationalization process. The key distinction between the two types of investors will be the haircut they require to roll-over short-term debt, essentially capturing their flightiness during a crisis.

At the beginning of period t, the government can choose which types of investors are allowed to participate in the domestic bond market, that is whom the country borrows from. In the middle date, the government can impose ex-post capital controls on net outflows from foreigners, taxing them at rate $\bar{\tau}$ on any funds the foreign investors repatriate rather than refinancing in the middle sub-period. We consider two types of governments, committed or opportunitistic, that differ by their willingness to impose these controls. The committed type never imposes a capital control on outflows by assumption, whereas the opportunistic type chooses strategically each period when to do so. One can think of the two governments as differing by the direct utility loss they face

[30] Note that this means that intermediaries cannot build wealth across dates.

when they impose capital controls, with the committed type facing a much higher loss than the opportunistic type. As in the literature, one can think of this as a stand in for institutional quality.

We chose to model the willingness to impose ex-post capital controls as the defining characteristic of an opportunistic government because it captures a salient feature of foreigners' fears about investing in China: the ability to "get the money out" in a future crisis. Our model captures this notion that ex-post controls are reputationally costly for governments to use.

In each country, the government currently in power gets dissolved and replaced with a new one in the next period at an exogenous and constant rate. The current government puts no weight on the welfare of future new governments, meaning that this is akin to governments dying with some probability. We assume that if the low state is realized and the government dies, the new government might be of a different type. This exogenous type-switching, first introduced by Phelan (2006), plays an important role in the dynamics of reputation in our model even for small probabilities of type-switching. Formally, we assume that in both the high and low state, a fraction ϵ^O of opportunistic governments die, while a fraction ϵ^C of committed governments die. In the high state, governments are replaced by a new government of the same type. In the low state, governments that are replaced switch type, that is committed governments that die are replaced by opportunistic governments and vice versa. Deaths and replacements are not observable to investors. We assume $1 - \epsilon^C - \epsilon^O > 0$.

5.1 Foreign Investor Base and Capital Flights

At the beginning of period t, the representative intermediary finances investment using an endowment of inside equity $A > 0$ and D_t in short-term debt (due in the middle sub-period of t) from foreign investors at an interest rate R_t.[31] The interest rate R_t depends on which investors the country borrows from and how much it borrows. We denote R_t to be the promised yield and $\tilde{R}_t$ to be the actual return, which differs from the promised yield when when the government imposes capital controls in the middle of t. A debt roll-over problem arises because the project is long-term (maturing at the end of period t) and the debt is short-term (maturitng in the middle sub-period of t).

5.1.1 Foreign Investor Base

Both stable investors, indexed by $i = s$, and flighty investors, indexed by $i = f$, are risk neutral, valuing investment decisions on their expected returns. Investor types are assumed to be observable to the government, as they are driven by institutional features. For example, the Chinese government can observe which investors are official and likely to be stable, such as foreign central banks or sovereign wealth funds, and which are private and likely to be flighty, such as hedge funds or active mutual funds. Once access is granted to a class of investors, however, they all are able

[31] Appendix A.D.1 consider an extension that also allows borrowing from domestic savers at the same interest rate. In that extension domestic borrowing is a wash with inside equity, and we therefore take the simpler approach here of only considering inside equity.

to participate in the same domestic bond market and face the same interest rate and collateral provisions. Formally, we assume that the government can choose which types of investors are allowed to participate in the bond market, but the government cannot price discriminate investors it allows to participate. This means that investors of both types receive the same yield and return. We view this as capturing the spirit of the evidence in Section 2 and Section 3.1 documenting the gradual process by which China has progressively and selectively allowed different type of foreign investors into its domestic bond market, both by directly restricting the type of investors eligible for a given programs, and by adopting policies like a fixed lock-up period which only certain types of investors can realistically agree to.

Both classes of investors also have a quadratic cost of lending, modeled in reduced form as a bond in utility function. The lending decision at the beginning of date t by investor type $i \in \{s, f\}$ is given by

$$\max_{D_t^i} E[\tilde{R}_t - R^i]D_t^i - \frac{1}{4}b^i D_t^{i2}$$

where R^i is the outside option at date t of type i if supply is perfectly elastic ($b^i = 0$). The first order condition that determines the interest rate schedule of type i is

$$E[\tilde{R}_t] = R^i + \frac{1}{2}b^i D_t^i.$$

Investors of each class i are in an overlapping generation, whose second generation arrives in the middle sub-period of t. For simplicity, the second generation of investors has a perfectly elastic supply of funds regardless of the state. Their outside option in the high state has return R^H, meaning that R^H is the required interest rate for debt rollover in the high state. In the low state, the second generation of investors has an outside option $R^L < R^H$. We denote the amount of debt that the second generation provides as D_t^H and D_t^L in the high and low state, respectively.

To roll over debt, the two types of investors each require a different haircut on the inside equity value of the projects in the middle date if the low state is realized. We describe the haircut in more detail in the next subsection, but here we note that stable investors require a lower haircut, $h^s \in (0, 1)$, than flighty investors, that is $h^f > h^s$. This is the sense in which the two classes of investors are differentially flighty: flighty investors require higher collateral to be posted in a crisis to convince them to roll over debt. We assume that the country cannot discriminate between investors on collateral requirements. This means that if the country lets in flighty investors all investors must be offered the higher collateral rate.

We next turn to writing the ex-post return that investors realize as a function of the chosen ex-post capital outflow charge, τ.

$$\tilde{R}_t(\tau) = \frac{R_t D_t - \tau D_t^L - (R_t D_t - D_t^L)\tau}{D_t} = R_t(1 - \tau).$$

Intuitively, there are two costs to the first generation of investors when the country imposes an

ex-post capital control. The first is that the direct fiscal cost of the outflow tax on any repatriated capital, $(R_t D_t - D_t^L)\tau$. The second is the indirect cost that arises from the lower interest rate on rollover and the bargaining between the two investor generations. Because the second generation has an outside option of R^L but the domestic interest rate is $R^L - \tau$, the second generation would experience a loss τD_t^L from lending in the domestic economy. By contrast, the first generation loses an additional τD_t^L from the outflow tax applied if no foreign debt is rolled over. Our bargaining assumption therefore says the second generation agrees to roll over D_t^L of debt in exchange for a compensating transfer payment of τD_t^L from the first generation.[32]

We now turn to defining M_t, the probability that investors assign to the government not imposing capital controls, conditional on the low state being realized:

$$M_t = \Pr(\tau = 0 | s = L). \tag{10}$$

It is important to note that this is the probability over government types. This mean that it is a combination of the probability that the government is committed and so never imposes the capital control, and also the probability that the government is opportunistic but chooses not to impose the capital control. The probability M_t is a key endogenous object of the dynamic problem across dates t, but it is taken as given when solving the static date t problem. Conditional on this probability M_t, the expected return of the first generation of investors is given by

$$E[\tilde{R}_t] = \pi_H R_t + (1 - \pi_H)\Big(M_t R_t + (1 - M_t) R_t (1 - \bar{\tau})\Big) = \mathcal{M}_t R_t,$$

where we have defined $\mathcal{M}_t = 1 - (1 - \pi_H)(1 - M_t)\bar{\tau}$ to be one minus the expected loss per unit of debt from the introduction of ex post capital controls. Notice that $\mathcal{M}_t$ increases in M_t, and also accounts for the fact that the capital control is never imposed by any government in the high state. Given this characterization of expected returns, we can substitute back into the interest rate schedule of investor type i at the beginning of t to obtain the promised ex ante interest rate

$$R_t = \frac{R^i + \frac{1}{2} b^i D_t^i}{\mathcal{M}_t}.$$

Importantly, we find that the interest rate schedule both has a lower intercept and also is more inelastic the lower is the probability that capital controls will be imposed ex-post. These features will be important in the dynamic problems, as governments recognize that gaining a good reputation (as a government unlikely to impose capital controls) can lower its borrowing costs, even as it raises the amount it borrows.

We next turn to the differences between types of investors. In addition to the lower haircut,

[32] We assume that revenues from the capital controls are either thrown away or remitted lump sum to all foreigners, including non-participants. This eliminates the direct revenue motive from imposing capital controls and lets us focus on the interest rate channel.

we assume that stable investors are also preferable to flighty investors from the perspective of investor borrowing costs. However, stable investors are capacity constrained and can only lend $D_t^s \leq \overline{D}^s$. We express the preferability of stable investors by the assumption that they always provide debt at a cheaper rate than the flighty investors, up to their debt capacity. Formally, we assume $R^s + \frac{1}{2}b^s\overline{D}^s \leq R^f$. This means that the country chooses to borrow from flighty investors only if it wishes to borrow more than the stable investors' capacity. If it borrows more than $\overline{D}^s$, it borrows the full investment capacity of the stable investors, $D_t^s = \overline{D}^s$, and the rest from flighty investors, $D_t^f = D_t - \overline{D}^s$. As a result, we can express the promised interest rate schedule as

$$R_t = \begin{cases} \frac{R^s + \frac{1}{2}b^s D_t}{\mathcal{M}_t}, & D_t \leq \overline{D}^s \\ \frac{R^f + \frac{1}{2}b^f(D_t - \overline{D}^s)}{\mathcal{M}_t}, & D_t > \overline{D}^s \end{cases} \tag{11}$$

The interest rate schedule is discontinuous at $\overline{D}^s$ if $R^s + \frac{1}{2}b^s\overline{D}^s < R^f$, and has a kink in the slope at $\overline{D}^s$ if $b^f \neq b^s$. This interest schedule, together with the assumptions made above on haircuts, means that opening up to flighty investors behaves as if it has a "fixed cost" component in that it makes the interest rate schedule and collateral requirements jump up on all debt when flighty investors are allowed to participate in domestic markets.

5.1.2 Financial Intermediation and Collateral Constraints

We next turn to describing intermediation in our framework. Our modeling of intermediation aims to be streamlined so that it can capture crucial features of foreign capital flights and inefficient liquidation while remaining sufficiently tractable to be analyzed jointly with the dynamic reputation game. The model combines elements of the liquidity shocks literature (Holmstrom and Tirole 1997, Farhi and Tirole 2012) and of collateral constraints models (Kiyotaki and Moore 1997). The intermediary at the beginning of date t invests its endowment of inside equity A and proceeds for its debt financing D_t in an illiquid long-term project. The long-term project has a scale I_t and a unit cost, so that the financing constraint of the intermediary is $I_t \leq A + D_t$.

The project has a gross return per unit $Q \geq 1$ in the middle of the date, which does not depend on the state, transforming its scale to QI_t.[33] The project yields no payoff at the middle of t, but yields 1 unit of the consumption good per unit of remaining scale at the end of t, so that the final payoff is QI_t. We think of Q as the return on investment that is maintained to maturity. The intermediary can liquidate the project prior to maturity in the middle of t at a constant price of $\gamma \in (0, 1)$, which does not depend on the state. As a result, γQI_t is the maximum value of liquidation in the middle of the date. Although the payoff of the initial project does not depend on the state, the investment opportunities and credit conditions in the middle of t depend on the state.

[33] Nothing is lost by normalizing Q to 1, but a value higher than one is more in line with observed positive rates of return and interest.

In the high state, $s = H$, the economy is in a boom. The intermediary has valuable new opportunities and credit markets are frictionless. The intermediary can roll over any debt at the interest rate R^H. The intermediary also gains access to a more valuable investment project, which converts 1 unit of the consumption good in the middle of t into R^H units of the consumption good at the end of t. We assume that $\gamma R^H > 1$, which means that the intermediary finds it optimal to (voluntarily) redeploy all of its existing assets to the new project in the high state. As a result, its payoff in the high state is given by

$$V_t^H = R^H\Big(\gamma QI_t - R_t D_t\Big), \tag{12}$$

which does not depend on its debt rollover choice since the borrowing rate and return on the new project are both R^H. As a result, we assume that $R_t D_t$ is rolled over without loss of generality. In the high state, roll-overs and liquidations are all voluntary and driven by the presence of attractive new projects. The model gets most of its action from the crisis state described below.

In the low state, $s = L$, the economy is in a recession. The intermediary does not have a valuable new investment opportunity, and credit markets are constrained. Define L_t to be assets that are (forcibly) liquidated prior to maturity in the low state. Forced liquidations occur because a collateral constraint limits debt rollover, meaning that the intermediary has to repay part of its initial debt by liquidating assets in the middle of t. Formally, the intermediary faces a collateral constraint on debt rollover, given by

$$(R^L - \tau)D_t^L \leq (1 - h_t)(QI_t - L_t)$$

where $h_t = h^s$ if the only investors present are stable ($D_t^f = 0$) and $h_t = h^f$ if both stable and flighty investors are present ($D_t^f > 0$). Recall that flighty investors require a higher haircut than do stable investors, $h^f > h^s$. A higher haircut means that less of the remaining value of the projects (i.e. the part that was not liquidated) can be used as collateral for new short-term debt. The way in which we formulated the constraint also implies that imposing ex-post capital controls slackens the constraint by depressing interest rates on new debt in the middle date. Intuitively, countries are tempted to impose capital controls ex-post in a roll-over crisis to capture existing foreign savings and alleviate the rollover problem. This formulation of the constraint is a tractable and convenient way to convey these economics. We solve the model assuming the constraint (in the low state) always binds, and then verify it does so.

In the middle of t, the intermediary must repay debt either by rolling it over or liquidating assets, yielding a budget constraint $D_t^L + \gamma L_t = R_t D_t$. Combining the collateral constraint and budget constraint and substituting into final payoff, $QI_t - L_t - (R^L - \tau)D_t^L$, of the intermediary, we obtain the value in the low state as

$$V_t^L = \underbrace{\frac{h_t}{\gamma - \frac{1-h_t}{R^L-\tau}}}_{\text{Net Worth Multiplier}} \quad \underbrace{\Big(\gamma Q I_t - R_t D_t\Big)}_{\substack{\text{Liquidation Value of} \\ \text{Inside Equity}}}, \tag{13}$$

which differs based on whether or not the intermediary exercises the capital control, $\tau \in \{0, \overline{\tau}\}$. As in the high state, the value of intermediation in the low state depends on the inside equity of the intermediary evaluated at the liquidation value: $\gamma Q I_t - R_t D_t$. Intuitively, these are the funds at the intermediary's disposal entering the middle date. In the high state, equation 12 shows that the value of intermediation is a multiple R_H of inside equity because all long-term projects are (voluntarily) liquidated in favor of new investment opportunities that return R_H. In the low state, equation (13) shows that the multiple is a function $\frac{h_t}{\gamma - \frac{1-h_t}{R^L-\tau}}$ of the haircut h_t and of the whether or not the capital control is imposed, τ. The numerator of this multiple, h_t, measures the collateral value of the inside equity of the intermediary if projects were all liquidated. The denominator, $\gamma - \frac{1-h_t}{R^L-\tau}$, grosses up this value for the effect of liquidations. On the one hand, liquidating one unit of the long-term project raises resources γ that can then be used to repay due debt. On the other hand, a liquidated investment lowers the collateral that can be used to raise new debt and tightens the debt roll over constraint by $\frac{1-h_t}{R^L-\tau}$. For (forced) liquidations to occur in equilibrium, we assume $\gamma - \frac{1-h^s}{R^L-\overline{\tau}} > 0$. Observe that imposing the capital control, $\tau = \overline{\tau}$ reduces the denominator by reducing the interest rate $R^L - \tau$, and so leads to a larger net worth multiplier.

Putting V_t^H and V_t^L together, we have the total expected value of intermediation given by:

$$E[\tilde{V}_t] = \pi_H V_t^H + \pi_L V_t^L = \left(\pi_H R^H + \pi_L \frac{h_t}{\gamma - \frac{1-h_t}{R^L-\tau}}\right)\Big(\gamma Q I_t - R_t D_t\Big),$$

which depends on whether or not the government imposes the capital control in the low state, $\tau \in \{0, \overline{\tau}\}$. As will become clear below, the tractability of the model arises in good part from the above equation: the ability to summarize the subgame value of intermediation as a multiple of inside equity.

5.1.3 Optimal Policy of the Committed Type and Flow Indirect Utility

The solution of the model can be analyzed by first determining what the committed type optimally chooses to do in each date. Opportunistic types will then decide to either mimic the committed type, or deviate. Therefore, we start here by analyzing the problem of debt issuance at the beginning of date t by the committed type. Recall that the type is not known to the investors and consider the case of a belief $M_t \in [0, 1]$ that the government will not exercise the capital control in the low state in that date. The decision problem of the committed government is to choose a debt issuance D_t to maximize the expected value $E[\tilde{V}_t]$ with $\tau = 0$, subject to the interest rate schedule in equation (11).

While the committed type is optimally chooses issuance given the beliefs of the investors, we

do not allow the committed type to strategically use its choices to alter investor beliefs in either the current or future periods. In essence, the committed type does not choose actions under the knowledge that opportunistic types might endogenously react to those choices and thereby cause investors to update their beliefs about the government that they are facing. This simplification is common in the literature on dynamic reputation.

We make a single crossing assumption on debt issuance to simplify the analysis. In particular, we assume that there exists a crossing point $M^* \in (0,1)$ such that optimal debt issuance $D_t(M)$ satisfies $D_t(M) \leq \overline{D}^s$ for $M \leq M^*$ and $D_t(M) > \overline{D}^s$ for $M > M^*$. Under this assumption there is a single crossing point at M^* where the government shifts from borrowing from only stable investors to also borrowing from flighty investors. The general intuition is that as the probability of ex-post capital controls decreases (M_t increases), the interest rate schedule becomes more favorable, shifts downwards and flattens, and the country's desired borrowing increases. At some point this shift is large enough that the country is willing let in the flighty investors due to the capacity constraint of stable investors. The single crossing assumption imposes a regularity condition on this intuition by making sure that the tipping point exists and is unique. Single crossing is generally easily satisfied by the types of linear interest rate schedules that we consider.[34]

Given single crossing, the policy rule of the committed government as a function of M_t can be determined by maximizing the liquidation value of the intermediary: $\gamma Q I_t - R_t D_t$. In Appendix A.A, we show that the optimal issuance decision is

$$D(M_t) = \begin{cases} \frac{\mathcal{M}_t}{b_0^s}\left[\gamma Q - \frac{R^s}{\mathcal{M}_t}\right], & M_t \leq M_* \\ \overline{D}^s, & M_* < M \leq M^* \\ \frac{\mathcal{M}_t}{b_0^f}\left[\gamma Q - \frac{R^f}{\mathcal{M}_t}\right] + \frac{1}{2}\overline{D}^s, & M > M^* \end{cases},$$

where $M_* \leq M^*$ is the point at which the capacity constraint begins to bind. Note that $\mathcal{M}_t(M_t)$ depends on M_t, but that we have suppressed the dependence for notational clarity. The associated interest rate is

$$R(M_t) = \begin{cases} \frac{1}{2}\frac{R^s}{\mathcal{M}_t} + \frac{1}{2}\gamma Q, & M_t \leq M_* \\ \frac{R^s + \frac{1}{2}b_0^s \overline{D}^s}{\mathcal{M}_t}, & M_* < M \leq M^* \\ \frac{1}{2}\frac{R^f - \frac{1}{2}b_0^f \overline{D}^s}{\mathcal{M}_t} + \frac{1}{2}\gamma Q, & M > M^* \end{cases}$$

These optimal policy rules are intuitive. Consider first the case of $M_t \leq M^*$, where the committed type only borrows from stable investors. If the committed type acted as a competitive borrower, taking the interest rate as given, then the interest rate would equal the liquidation value of the project $R_t = \gamma Q$. Instead, the committed type accounts for the impact of its borrowing on the interest rate: it equates marginal benefit and marginal cost of borrowing. As a result, it borrows less than in the competitive case and faces lower interest rates. As is common in monopolist prob-

[34] Diamond (1991) analyzes a model in which private borrowers start by borrowing via bank loans and then switch at higher reputations to bonds.

lems of this (functional form) type, it borrows half as much as in the competitive case (up to the capacity constraint) and the equilibrium interest rate is an arithmetic average of the competitive rate γQ and the rate that would have been paid on the first unit of debt $\frac{R^s}{\mathcal{M}_t}$.[35]

Allowing the committed type to take into consideration its market impact has two advantages for us. First, it connects to the economics of reserve currencies as special assets whose issuers receive an exorbitant privilege via monopoly rents and opens up the possibility of studying competition among issuers (Farhi and Maggiori (2018)), something we return to in Section 7. Second, it allows for some degree of ex-ante macro-prudential policy to have already taken place in the model, sharpening the difference between ex-ante prudential measures and ex-post capital controls. Intuitively, a competitive intermediary sector would issue too much debt and reach the competitive interest rate, not internalizing its impact on the equilibrium borrowing rate. The government behaves as a monopolist and imposes ex-ante controls on intermediary borrowing in order to force them to internalize the price impact of borrowing (Schmitt-Grohé and Uribe (2016); Farhi and Werning (2016); Bianchi and Lorenzoni (2021)).

Optimal debt issuance generally features an *upward* discontinuity at M^*. The reason for the upward discontinuity is the fact that stable investors dominate flighty investors in both the interest rate schedule and the collateral haircut. This combination acts as a fixed cost, implying that a country would always prefer to borrow exactly $\overline{D}^s$ entirely from stable investors, rather than borrow a small amount more than $\overline{D}^s$ with some capital coming from flighty investors. Consequently, the equilibrium borrowing rate declines in M_t, except at the point M^* where it may jump upward due to the jump in debt issuance.

It is helpful to define $V(M_t)$ to be the flow indirect utility of the committed type in the low state, that is to say

$$V(M_t) = \frac{h_t}{\gamma - \frac{1-h_t}{R^L}} \Big(\gamma Q I(M_t) - R(M_t) D(M_t) \Big),$$

where $I(M_t)$, $R(M_t)$, and $D(M_t)$ are the optimal policy rules described above. An opportunistic government chooses the same rules at the beginning of date t, since not doing so would reveal the government type before any debt is even raised in the date.[36] However, the opportunistic government might deviate ex-post in the middle sub-period by imposing capital controls. Since the value of exercising ex-post capital controls in the low state for the opportunistic government is $V_t^L(\overline{\tau}, M_t) = \frac{h_t}{\gamma - \frac{1-h_t}{R^L - \overline{\tau}}} \Big(\gamma I_t(M_t) - R_t(M_t) D_t(M_t) \Big)$, we can now see that the gain induced by imposing a capital control is a proportional increase in indirect utility for the opportunistic type.

[35] Choi, Kirpalani and Perez (2022) quantify the monopoly rents or market power of the US as an international currency provider.

[36] For example, we can impose the off-path beliefs that investors ascribe the lowest possible reputation $M_t = 0$ to governments that do not mimic the committed type's debt issuance decision. If an opportunistic type reveals itself at the beginning of t by choosing a different issuance strategy, it can be assigned a reputation lower than ϵ^O because its type cannot switch to being committed until the end of t – that is, investors know for sure it is opportunistic. We could also impose further punishments, such as a sharp nonlinearity in the interest rate schedule at reputations below ϵ^O.

In particular, we can define $V_t^L(\overline{\tau}, M_t) = g(h_t)V(M_t)$, where

$$g(h_t) = \frac{\gamma - \frac{1-h_t}{R^L}}{\gamma - \frac{1-h_t}{R^L - \overline{\tau}}}. \tag{14}$$

Observe that we have $h_t(M_t) = h^s$ when $M_t \leq M^*$ and the economy is only open to stable investors, but we have $h_t(M_t) = h^f$ when $M_t > M^*$ and the economy is also open to flighty investors. We will express g as a function of h_t, rather than M_t, to maintain exposition clarity.

In the main body of the paper, we make the following simplifying assumption: $R^H = \frac{h_t}{\gamma - \frac{1-h_t}{R^L - \overline{\tau}}}$. This means that the return on the new project in the high state depends on whether the government has opened up to flighty investors. This assumption means that the flow utility of the committed type in the high state can be written as a scaled version of its flow utility in the low state,

$$V_t^H = g(h_t)V(M_t).$$

This simplification carries a lot of tractability at little economic cost.[37] It is relaxed in Appendix A.D.2.

6 The Dynamics of Reputation Building

Section 5.1 solved the date t subgame of a committed type government who faces investor beliefs M_t that the government will impose the capital control. Because there will always be a static gain of imposing capital controls, we now turn to the dynamic problem to understand the problem of the opportunistic government.

The opportunistic government discounts the future at the effective discount factor $\beta^*(1-\epsilon^O) = \beta$, which accounts for both its subject discount factor and its probability of being replaced. We define π_t to be investors' prior belief entering date t that the government is the committed type, with $\pi_0 = \epsilon^O$ being the prior belief at date 0. This prior belief at date 0 means that investors enter into the game believing all governments start as opportunistic except for an initial fraction ϵ^O who switched to being committed.[38] If an opportunistic government wants to avoid revealing its type before raising debt, it needs to mimic the debt issuance strategy of the committed government at the beginning of period t. However, it has a strategic choice of whether or not to impose capital controls on outflows if the economy enters the low state. If the low state is realized and the opportunistic government does not impose capital controls, investors' posterior belief that the government is committed rises. This occurs because, as we will show, only a fraction of opportunistic types forgo capital controls

[37] In terms of the committed type optimal policy rules, this simplifying assumption only affects M^*. It does, however, simply considerably the problem of the opportunistic type to which we turn next.

[38] We can initialize the model from other prior belief π_0. In these cases, the model will feature one different transition path to an initial graduation date, at which point all opportunistic governments will have reverted to beliefs ϵ^O and will continue on the cycle described below.

conditional on a low state occurring. No updating of beliefs occurs in the high state since there is no temptation for a weak government to impose capital controls and governments that are replaced following the high state are known to be succeeded by governments of the same type. The model of dynamic reputation in the presence of exogenous type switching is the spirit of Phelan (2006) and Amador and Phelan (2021).

The model is designed to capture the idea that reputation as reserve currency issuer can only be built in the "fire" of severe crisis. In normal times, there is little (in fact nothing) that investors learn about the government type and how it would behave in a future crisis. One can think of the low state as rare, thus emphasizing that building reputation as a reserve currency issuer is a slow process in calendar time, with long-spells of tranquil markets and no reputation building, and short but intense episodes of crisis when issuers are tested by the markets.

We denote by $m_t \in [0,1]$ the endogenous fraction of opportunistic governments that do not impose the capital control at date t if the low state is realized. Following the low state occurring, investors' beliefs evolve according to Bayes' rule. If a total fraction $M_t = \pi_t + (1-\pi_t)m_t$ of all governments do not exercise capital controls in the low state, then the posterior belief of investors that a government that did not impose the capital control in the low state is the committed type is given by

$$\pi_{t+1} = \epsilon^O + (1 - \epsilon^C - \epsilon^O)\frac{\pi_t}{M_t}. \tag{15}$$

This accounts for the fact that a fraction ϵ^O of remaining opportunistic types switch to being committed at the end of the period, while a fraction ϵ^C of committed types switch to being opportunistic. Because $0 \leq m_t \leq 1$, then $\pi_t \leq M_t$ and the highest possible posterior belief is $\pi_{t+1} = 1 - \epsilon^C$, which happens only when $m_t = 0$ and all opportunistic governments choose to impose capital controls. The posterior belief is bounded below one due to the fact that a committed government is replaced and is succeeded by an opportunistic government with probability ϵ^C.

If the government does impose the capital control, then its type is revealed to be opportunistic. The posterior belief reverts to $\pi_0 = \epsilon^O$, which is the probability that the opportunistic government is replaced by a committed government. If the government faced the high state, then priors and posteriors coincide, that is $\pi_{t+1} = \pi_t$.

In our model, the belief M_t that the government will impose the capital control turns out to be a natural variable in which to express solutions, rather than the belief π_t that the government is the committed type. This is because the interest rate schedule depends on M_t, rather than directly on π_t. We will refer to M_t as the "reputation" of the government, and will refer to π_t as "beliefs" about the government's type. Under this terminology, a government having a good reputation means investors think it is less likely that the government will impose capital controls on them.

Dynamics of Reputation in Equilibrium. We conjecture and solve for a Markov equilibrium of a particular form. The conjectured Markov equilibrium consists of a cycle defined by two dates, T^* and T. Because the model features a cycle and because no reputation updating occurs in

the high state, there is a difference between model dates and calendar dates. A date t of the model is best thought of as step t in the cycle, in which progress to the next step can only occur if the low state is realized. Resetting the cycles corresponds to returning to date $t = 0$ and occurs when a government imposes capital controls and reveals itself to be opportunistic.

The date T^* is the first date at which the government lets in flighty investors in addition to stable investors. As such, we refer to it as the "opening up date" of the domestic bond market. More formally, for dates $t < T^*$ we have $M_t < M^*$, meaning that the economy is closed to flighty investors. For dates $t \geq T^*$ we have $M_t > M^*$ and the economy is open to flighty investors.

At all dates $t < T$, a fraction $0 < m_t < 1$ of opportunistic governments choose not to impose the capital control and continue to the next date of the cycle. The remaining fraction $1 - m_t$ choose to impose capital controls and revert to the beginning of the cycle. At date T, all opportunistic governments impose the capital control, $m_T = 0$, and revert to the beginning of the cycle. As in the previous literature, we refer to T as the "graduation date," at which a *committed* type government gains the highest possible beliefs and reputation. Committed types that continue to each date $t > T$ either switch types and graduate, or remain committed and continue at the constant beliefs and reputation, $\pi_{T+1} = M_{T+1} = 1 - \epsilon^C$.

6.1 Strategic Choices of Opportunistic Governments

Given the conjectured equilibrium, we need to determine the policy rule of the opportunistic government. Define W_t to be the value function of the opportunistic government at date t. In our conjectured Markov equilibrium, an opportunistic government at date t of the cycle that does not impose the capital control in the low state achieves value

$$W_t^0 = \pi_H \Big(g(h_t)V(M_t) + \beta W_t \Big) + (1 - \pi_H) \Big(V(M_t) + \beta W_{t+1} \Big).$$

Recall that if the high state is realized, then no governments impose the capital control and there is no change in beliefs. In this case, the continuation value is just the (lifetime) value function at date t of the cycle. By contrast if the low state is realized, then a government that does not impose a capital control progresses to the next date of the cycle and receives the continuation value from the date $t + 1$ value function.

If instead the government chooses to impose the capital control in the low state, then it achieves value

$$W_t^{\overline{\tau}} = \pi_H \Big(g(h_t)V(M_t) + \beta W_t \Big) + (1 - \pi_H) \Big(g(h_t)V(M_t) + \beta W_0 \Big).$$

In the high state, the government does not impose the capital control and receives exactly the same value. By contrast in the low state, the choice to impose the capital control affects government value. By imposing the control, the government achieves an increase in flow utility to $g(h_t)V(M_t)$, rather than only $V(M_t)$. However, this comes at the cost of loss of reputation, meaning the government

resets to the beginning of the cycle and achieves continuation value W_0, rather than W_{t+1}.[39]

Notably, there is no dynamic inconsistency within a date between the beginning of the date issuance decisions and the middle of the date imposition of capital controls. Intuitively, this is because investors know the probability that a government will impose the capital control, but not whether a specific government will impose the capital control. This means that a government can be thought of as having made a decision regarding capital controls at the beginning of the date. The value function at date t is therefore given by

$$W_t = \max_{\tau \in \{0,\overline{\tau}\}} \left\{ W_t^0 \ , \ W_t^{\overline{\tau}} \right\}.$$

In our conjectured equilibrium, opportunistic governments play (identical) mixed strategies such that a fraction m_t of opportunistic governments do not impose the capital control at dates $t < T$ while a fraction $1 - m_t$ impose the capital control. For this to occur, it must be the case that opportunistic governments are indifferent between imposing and not imposing the capital control, that is for $t < T$ we have

$$W_t = W_t^0 = W_t^{\overline{\tau}}.$$

Using that $W_0 = W_0^{\overline{\tau}}$, we obtain the expression for W_0

$$W_0 = \frac{1}{1-\beta} g(h_0) V(M_0). \tag{16}$$

This condition says that the lifetime value of a (single) mixing opportunistic government at the beginning of the cycle is equal to the value it would achieve if it followed the strategy of imposing the capital control at every date forever. Although the value function of the opportunistic type grows in the cycle date as reputation builds, that is $W_1 > W_0$, the indifference condition ensures that this growth is perfectly balanced by the excess value of imposing the capital control today.

Similarly, we can use the indifference condition $W_t = W_t^0 = W_t^{\overline{\tau}}$ and the Bellman equation $W_{t+1} = W_{t+1}^{\overline{\tau}}$ at date $t < T$ to characterize the transition path.[40] Combining these, we obtain

$$V(M_{t+1}) = \frac{g(h_t)}{g(h_{t+1})} \rho(h_t) V(M_t) + \frac{g(h_0)}{g(h_{t+1})} V(M_0) \tag{17}$$

where we have defined $\rho(h_t) = \frac{1-\pi_H \beta}{\beta} \frac{g(h_t)-1}{g(h_t)}$. Equation (17) characterizes the indifference path of our conjectured equilibrium in terms of flow utility $V(M_t)$, rather than in terms of the value function W_t. It tells us – given an initial reputation M_0, opening up date T^*, and graduation date T – what

[39] An alternative modeling tool to dynamic reputation has been to study optimal mechanisms and sustainable plans under limited commitment in macro (Chari and Kehoe (1990); Athey et al. (2005); Amador et al. (2006); Halac and Yared (2014)).

[40] Note that for all dates $t+1 < T$, both $W_{t+1} = W_{t+1}^{\overline{\tau}}$ and $W_{t+1} = W_{t+1}^{\overline{\tau}}$ are valid Bellman equations due to indifference. However, at date T graduation occurs, and hence $W_T^{\overline{\tau}} \geq W_T^0$ in our conjectured equilibrium. Therefore, $W_T = W_T^{\overline{\tau}}$ is the valid Bellman equation at T.

the path of reputation $M_1, ..., M_T$ must be to maintain indifference up until the graduation date. This path is characterized by an AR(1) process in flow utility $V(M_t)$. However, as we describe in detail below, the coefficients of the AR(1) process change when the economy opens up due to the change in investor composition. We build more intuition for this equation as we decompose it into its dynamics in the different regions.

To simplify notation, we will denote $\rho^s = \rho(h^s)$ and $\rho^f = \rho(h^f)$. Notice that $\rho^f < \rho^s$ since $g(h^f) < g(h^s)$.

6.2 A First Pass At Solutions: One Investor Class Model

To build intuition for the model dynamics, we consider first the simpler case in which there is a single investor class, the flighty private investors.[41] Formally, we set $\overline{D}^s = 0$. We then trivially have $M^* = 0$ and $T^* = 0$, meaning that flighty investors are allowed in at $T = 0$ for any investor beliefs. Moreover, the single investor type means that the haircut is constant over time: $h_t = h^f$ for all t. The transition dynamics of equation (17) simplify to:

$$V(M_{t+1}) = \rho^f V(M_t) + V(M_0). \tag{18}$$

In the one investor case, the transition path of flow utility $V(M_t)$ follows an AR(1) with a constant coefficient, $\rho^f = \frac{1-\pi_H\beta}{\beta}\frac{g(h^f)-1}{g(h^f)}$. The rate of convergence decreases in the discount factor β, reflecting that as opportunistic governments become more patient they require smaller increases in reputation to be willing not to impose the capital control. It increases in the value $g(h^f)$ of imposing the capital control, reflecting that a higher value increases the foregone benefits of imposing the control today and so requires a larger increase in reputation to maintain indifference. Finally, the rate of convergence falls as the low state becomes less likely, since a higher probability of the high state means a government gets a higher expected value in continuation for a given reputation.

Finally, the opportunistic government in our conjectured equilibrium must be willing to graduate at date T. This requires that $W_T^{\overline{\tau}} \geq W_T^0$. We know that after graduation, $M_{T+1} = 1-\epsilon^C$. Therefore, graduation requires that

$$V(1-\epsilon^C) \leq \rho^f V(M_T) + V(M_0). \tag{19}$$

Intuitively, this equation states that graduation occurs because the flow utility that would be required to maintain indifference, $\rho^f V(M_T) + V(M_0)$, exceeds the maximum flow utility $V(1-\epsilon^C)$ that can be achieved at the highest possible beliefs and reputation. Once the transition path would exceed this threshold, indifference can no longer be maintained and graduation occurs. Notably, graduation cannot occur at a prior point on the indifference path. To understand why, if graduation occurred at a date with $V(1-\epsilon^C) > \rho^f V(M_T) + V(M_0)$, then an opportunistic government is

[41] This is without loss of generality, since we can always relabel the flighty investor as the safe investor and make $\overline{D}^s$ sufficiently large so that the economy never opens up. For expositional purposes, we focus on an economy that is always open to the flighty investor.

indifferent between imposing the capital control and continuing to a reputation $M_{T+1} < 1 - \epsilon^C$. But this means the opportunistic government strictly prefers continuing to reputation $1-\epsilon^C$, rather than graduating at T. In our conjectured equilibrium, the graduation date T is determined, starting from the initial reputation M_0, as the first date T at which (19) is satisfied.

The conjectured equilibrium of this model consists of a graduation date T, a path of reputation $M_0, ..., M_T$, and a path of beliefs $\pi_0, ..., \pi_T$ such that: (i) reputation evolves by the indifference condition (18); (ii), beliefs evolve according to Bayes' rule, (15); (iii) all opportunistic governments are willing to graduate at T, (19); (iv) $\pi_t \leq M_t$ for $t < T$; and, (v) $M_T = \pi_T$, consistent with all types graduating at date T. We refer to this type of equilibrium as a graduation date Markov equilibrium.[42]

Proposition 1 *There exists a unique graduation date Markov equilibrium.*

Proposition 1 (see proof in the Appendix) verifies that a graduation date Markov equilibrium does in fact exist, and that it is the unique equilibrium of this form. Intuitively, uniqueness arises because the path of reputation described by equation (18) and the path of beliefs described by equation (15) have different responses to a change in the initial government reputation M_0. An increase in initial reputation M_0 also means all future reputations M_t must be higher to maintain the indifference condition. By contrast, a higher initial reputation means that posterior beliefs π_1 are lower, as more opportunistic governments are not imposing the capital control. This means that the future path of beliefs is also everywhere lower. In other words, the path of reputation M_t increases at every t in the initial reputation M_0, whereas the path of beliefs π_t determined by Bayes' rule falls at every t in the initial reputation M_0. This gives rise to a crossing point of these two paths at any conjectured graduation date T. The terminal condition of graduation, (19) then pins down the date T at which these two paths not only cross, but also graduation is feasible, giving rise to existence. At this point, a lower initial reputation would be required to graduate at a later date, due to the indifference path. However, a lower initial reputation implies that beliefs build faster, and so overshoot reputation. This gives rise to uniqueness.

Numerical Illustration. Figure 15 presents a numerical example illustrating the equilibrium. Because the economy only has a single investor, the opening up date is $T^* = 0$ by definition. In this example, graduation occurs at $T = 10$. The upper left panel plots the evolution of reputation M_t and beliefs π_t. Beliefs and reputation are close to each other at $t = 0$ because, at this point, investors' are almost certain the government is opportunistic; in this example, prior beliefs at $t = 0$ are $\pi_0 = \epsilon^O = 0.01$. Intuitively, most governments at $t = 0$ are those that exercised capital controls last period, thus revealing themselves to be opportunistic, and the only uncertainty about their type this period is due to the exogenous switching probability. At $t = 0$ there is no reputational

[42] If $\rho^f > 1 - \frac{V(\epsilon^O)}{V(1-\epsilon^C)}$, the proof of Proposition 1 additionally shows that it must be the case that $T < \infty$.

cost to imposing the capital controls because the posterior belief would coincide with the prior, and a large increase in reputation is required for opportunistic governments to be willing to forgo imposing capital controls. Furthermore, since the belief that the government is the committed type is very low, a small fraction of opportunistic governments mimicking generates a large increase in posterior beliefs and future reputation. This can be seen in the top left panel of Figure 15 in which a large gain in reputation M_t occurs moving from $t = 0$ to $t = 1$. The top right quadrant shows that this is supported by a relatively low value of the mimicking probability m_0. As beliefs build, reputation exceeds beliefs as more opportunistic governments are willing to defer employing capital controls to capitalize on the higher reputation and higher future benefits of imposing capital controls. This willingness declines as graduation approaches, reflecting the exponential convergence of the reputation building process.

The bottom left panel of Figure 15 shows the decline in the equilibrium borrowing rate R_t as reputation of the government improves. The bottom right panel shows the corresponding increase in foreign debt as the reputation improves. At higher reputation the government contemporaneously sustains more foreign debt and lower interest rates which is intuitive since higher reputation is a shift downward in the interest rate schedule.

6.3 Model Equilibrium with Stable and Flighty Investors

We now analyze the full the model with both investor types. We assume that $\epsilon^O < M^* < 1 - \epsilon^C$, so that a government with reputation ϵ^O would not open up whereas a government with reputation $1-\epsilon^C$ would open up. A number of different combinations are possible, with opening up preceeding or following graduation, as well as different timing for both events. Formally, our conjectured equilibrium has an opening up date $0 \leq T^* \leq T + 1$ and a graduation date T. If $T^* = 0$ then the economy opens up immediately, whereas if $T^* = T + 1$ then the economy only opens after graduation.

If $T^* = 0$, then the transition dynamics are the same as in Section 6.2. If $T^* = T + 1$, the economy follows the transition dynamics of Section 6.2 up to a change in the definition of the graduation condition in equation (19).[43] Therefore, we focus attention here on characterizing the transition dynamics when $0 < T^* \leq T$: the cycle starts with only official safe investors, reputations builds up for some time, then the government opens up to flighty private investors, reputation builds up for more time until eventually the government imposes capital controls and the cycle restarts.

When $0 < T^* \leq T$, the transition dynamics of the model from equation (17) can be divided into two regions: a region with only stable investors and one with both investors. At the boundary between these two regions, a jump occurs in the dynamics.

The first region is the time before the economy opens up to flighty investors. When $t + 1 < T^*$

[43] Since the economy is closed at T but open at $T+1$, the graduation condition in this case is $V(1-\epsilon^C) \leq \frac{g^s}{g^f}(\rho^s V(M_T) + V(M_0))$, where the RHS is the required promised flow utility to maintain indifference at the opening up date (see equation 21).

(if nonempty), the economy has not yet opened up at either t or $t+1$. In this case, the haircut is that demanded by the stable investors, $h_0 = h_t = h_{t+1} = h^s$, and the transition dynamics in equation (17) reduces to the transition dynamics governed by the stable investors:

$$V(M_{t+1}) = \rho^s V(M_t) + V(M_0). \tag{20}$$

The dynamics in this region carry the same intuition as the dynamics in the one investor model.

At the point of opening up to flighty investors, the economy is not open to them at $t = T^* - 1$ but is open to them at $t+1 = T^*$. This means that $h_0 = h_{T^*-1} = h^s$ but $h_{T^*} = h^f$. Therefore, the transition dynamics of equation (17) generate

$$V(M_{T^*}) = \frac{g(h^s)}{g(h^f)}\Big(\rho^s V(M_{T^*-1}) + V(M_0)\Big). \tag{21}$$

The opening up date T^* has the same transition dynamics as before opening up, but is scaled by the relative value $g(h^s)/g(h^f)$ of imposing the capital control before and after opening up. We have that $g(h^s) > g(h^f)$: for a given inside equity, imposing capital controls before rather than after opening up increases the government utility more. Intuitively, this occurs because flighty investors are more inelastic (require higher haircut) in their debt rollover decisions in the crisis state, thus making imposing capital controls ex-post less advantageous for the government. Opening up is a disproportionately expensive action for the opportunistic types compared to the committed types. In reputation games, taking this type of expensive actions leads to a jump up in reputation. Our model captures the notion that investors welcome these "opening up" decisions from China, with them leading to an increase in reputation and more foreign participation in local bond markets. Formally, this manifests as a larger increase in the flow value $V(M_{T^*})$ relative to the dynamics before opening up. This is because the lower proportional value of exercising the capital control must be offset by a larger increase in the baseline value $V(M_{T^*})$ which that proportional increase is weighed against. Because the proportional value of imposing the capital control falls by $g(h^f)/g(h^s)$, flow utility must increase by the same proportion $g(h^s)/g(h^f)$ in order to maintain indifference. In other words, the transition dynamics of the value of the opportunistic government of imposing capital controls, $g(h_t)V(M_t)$, are the same at and before opening up.[44]

The second region is the time after opening up but before the graduation date, $T^* < t+1 \leq T$ (if nonempty). In this region, the economy is open at both t and $t+1$, so that $h_0 = h^s$ and $h_t = h_{t+1} = h^f$. As a result, the transition dynamics of equation (17) are

$$V(M_{t+1}) = \rho^f V(M_t) + \frac{g^s}{g^f} V(M_0). \tag{22}$$

[44] In other words, we can alternatively express the transition dynamics of the problem as $g(h_t)V(M_t) = \rho^s g(h_t)V(M_t) + g(h_0)V(M_0)$, which expresses them in terms of the value $g(h_t)V(M_t)$ to the opportunistic government of imposing the capital control.

Intuitively, a government that imposes the capital control at t also benefits from the higher proportional value of imposing the capital control when it resets to reputation M_0. This leads to the scaling of $V(M_0)$ by $g(h^s)/g(h^f)$. The rate of convergence also shifts from ρ^s to ρ^f, reflecting that the smaller proportional value of imposing the capital control slows the required increases in reputation needed to make the government willing not to impose the capital control today. This captures the notion that building reputation as a reserve currency issuer gets progressively more difficult later in the game, once reputation is already high, since the large stock of reputation acts as a commitment device. The presence of the flightier class of investors accentuates this dynamic by decreasing the gains further from imposing capital controls.

Finally, opportunistic governments must be willing to graduate at T, that is they must find imposing the capital control to be preferable. The required condition for graduation at date T is given by[45]

$$V(1-\epsilon^C) \leq \rho^f V(M_T) + \frac{g(h^s)}{g(h^f)} V(M_0). \tag{23}$$

The intuition is the analogous intuition as in the one investor model (equation 19). Maintaining indifference requires an increasing path of reputation M_t. Graduation occurs at the date T where the reputation implied by the indifference path (22) exceeds the highest possible reputation $1-\epsilon^C$. At this point, opportunistic governments cannot be given a large enough benefit from continuing to be willing to refrain from imposing the capital control. As a result, all opportunistic governments impose the capital control and graduation occurs.

The conjectured equilibrium of this model consists of a graduation date T, an opening up date T^*, a path of reputation $M_0, ..., M_T$, and a path of beliefs $\pi_0, ..., \pi_T$ such that: (i) reputation evolves by the transition dynamics (20, 21, 22); (ii), beliefs evolve according to Bayes' rule, (15); (iii) all opportunistic governments are willing to graduate at T, (23); (iv) $\pi_t \leq M_t$ for $t < T$ (that is, $0 \leq m_t \leq 1$); and, (v) $M_T = \pi_T$ (that is, $m_T = 0$). As before, we refer to this as a graduation date Markov equilibrium.

Proposition 2 *There is at most one graduation date Markov equilibrium associated with a an opening up date T^*.*

The model with two classes of investors might feature multiple equilibria with different opening up dates, but given an opening up date there is at most one equilibrium of this form associated with that date. In some sense, the logic of uniqueness of the equilibrium in the restricted case of a single class of investors carries over to this set-up with multiple classes once the opening up date is fixed. The multiplicity, if present, arises from setting two different opening up dates. Technically the

[45]Note that equation (23) is correct even if $T^* = T$, that is opening up and graduation coincide and the transition dynamics of equation (22) never apply on the equilibrium path. This is because graduation is governed by the evolution of reputation that would be required to maintain indifference, and hence by equation (22).

possibility of multiple equilirbria arises from the fact that reputation grows faster before opening up, but the jump up of reputation upon opening up is smaller the longer opening up is postponed. Intuitively, at a conjectured opening up date there might be two possible outcomes. The first is that the economy opens up and reputation experiences a larger jump according to (21), carrying it to $M_{T^*} > M^*$. This then rationalizes the decision of committed governments to open up at T^*. However, it can also be possible that if there were no jump and (20) remained the relevant dynamics, we would have $M_{T^*} < M^*$. This in turn rationalizes the decision of committed governments not to open up.

Numerical Illustration. Figure 16 provides a numerical example illustrating the equilibrium. In this case, the economy opens up at $T^* = 2$ and graduates at $T = 5$. The dynamics before opening up are similar to those in the one investor class case. At low level of reputations letting in the flighty private investors is sub-optimal since total desired borrowing is small. In period 0 the desired borrowing can be satisfied entirely with the stable investors. In period 1 desired borrowing has increased so much, given the increase in reputation, that the stable investors' debt capacity has been maxed out, but the flighty investors would be too expensive for rolling over debt in a possible crisis. Indeed, the bottom right quadrant of Figure 16 shows that in period 1 the issuer borrows $\bar{D}^s$, the max that it can borrow only from the stable investors.

As reputation builds further and consequently the interest rate schedule shifts downwards, desired borrowing increases to the point that the government decides to let in the flighty investors. As discussed above, the decision to open up endogenously causes a jump up in reputation since it is disproportionally expensive for the opportunistic governments to mimic this decision. Reputation build-up slows down substantially after opening up as seen is the top left panel of Figure 16.

Opening up to flighty investors has a particularly interesting implication for the shift in the interest rate schedule. Two different forces are at play: letting in the flighty private investors worsens, all else equal, the credit conditions for the government since they require (weakly) higher rates and higher haircuts on rollovers in crisis. However, letting them in endogenously makes the interest rate curve shift down and flatten (become more inelastic) because of the jump up in reputation. The bottom right panel of Figure 16 confirms the intuition that the government upon opening up to flighty investors wants to borrow a lot more (it would not let them in for a small amount of incremental borrowing). The bottom left panel shows that the equilibrium interest rate falls together with this debt increase.

After opening up, foreign debt continues to increase and interest rates continue to fall, but the movements are much less pronounced since further builds up of reputation occur slowly. Eventually, much like in the one investor case, the economy reaches a level of debt and reputation at which further gains would be too small and all opportunistic governments decide to impose capital controls if a crisis occurs, thus restarting the reputation cycle.

7 Two-Way Flows and Reserve Currency Competition

The Chinese government is one of the largest holders of U.S. Treasuries and a large foreign direct investor in everything from infrastructure projects to loans to emerging market economies. At the same time, it is letting foreigners participate in its domestic bond markets. We documented in Section 2 that foreigners primarily buy Chinese government bonds when they invest in the domestic bond market. In the model considered so far, we have focused on the decision to borrow from foreigners. We now focus on the interrelated decision of letting domestic savers invest abroad. These two-way capital flows are important in understanding China's motivation for internationalizing its currency because they distinguish the current account and net foreign asset position (net borrowing at the country level) from the gross assets and liabilities positions and changes in gross positions.

7.1 Two-Way Capital Flows

We now extend the model to incorporate two-way flows. We show that as reputation builds, increased investment by foreigners in the domestic bond market coincides with increased foreign investment by domestic households (savers).

The government may encourage capital outflows by domestic savers to be higher or lower than the private optimum. On the one hand, the government values investments that increase demand for the Renminbi as a global currency more so than individual households do, internalizing the benefits of a liquid market for its currency. The benefits might come in the form of a shift downward in the demand curve of foreign investors, who have higher incentives to invest in Renminbi as a result of Chinese foreign investment. The benefits might also arise from gains in geopolitical importance or independence arising from building an international payment system in which the Renminbi is an accepted store of value and means of payment.

On the other hand, individual savers value exporting capital more than the government if they fear that capital held domestically will be captured by the government for its own private benefits. The government may have perverse incentives to restrict private outflows of capital if it can divert part of that capital to its private benefit.

We extend the model from the previous section to capture, at least in reduced form, the above intuition. Households in the domestic economy have an amount W of liquid wealth at each date t. Households also own the intermediation sector, where $E_t = E[\tilde{V}_t]$ is the total value of the intermediation sector. Thus, their total wealth position is $W + E_t$. At the beginning of each date, households can invest an amount K_t in illiquid foreign assets, which pay out R^K at the end of the date. Households invest the remainder $W - K_t$ in illiquid non-intermediary investments, and we normalize the return of these assets to 1 for simplicity. Shares in the intermediaries cannot be traded, since inside capital A is fixed and domestically held.

Households have an adjustment cost for sending capital abroad based on their total wealth, given by $\Psi(k_t)(W + E_t)$, where $k_t = \frac{K_t}{W+E_t}$ is the fraction of their total wealth that they send

abroad and where Ψ is increasing and convex. Given that households send a fraction k_t of their wealth abroad, their total welfare, including the value E_t of their intermediary equity, is given by:

$$\Big(R^K k_t - \Psi(k_t) + (1 - k_t)\Big)(W + E_t).$$

The optimal private allocation of domestic savings to foreign investment k_t is constant, that is households always allocate a constant fraction of their total wealth to international investment. This optimal household allocation is given by $\Psi'(k) = R^K - 1$.

To capture the wedge between private and government incentives, we assume that the government obtains a proportional benefit B from all savings kept at home, which yields a total benefit to the government of $B(1-k_t)(W+E_t)$. A value of $B > 0$, can stand in for government corruption, or more benignly benefits from keeping the savings domestic that are not internalized by households. A value of $B < 0$, help us capture the extra value attributed by the government compared to households to investments abroad that help build the currency globally (e.g., payment systems, liquidity effects, geopolitical considerations). Given the government's objective, its optimal allocation is

$$\Psi'(k_t) = R^K - (1 + B).$$

If $B > 0$, then the government chooses to send less capital abroad than households would have privately chosen, and it imposes limits on domestic capital flowing abroad concurrently with the limits on inflows by foreigners (this latter part has been the focus of our model so far).

In practice the government might simultaneously limit some forms of domestic capital outflows and incentivize others. For example, it might limit private holdings of foreign assets and, at the same time, invest abroad via a state owned entity projects that the government selects. In the case of China, for example, there are tight controls on private holdings of foreign securities, but at the same time entities like SAFE and AIIB make large investments abroad using domestic savings. This could be accommodated in our framework by introducing two types of foreign investments, one over which B is positive and one over which it is negative.

Solving the extended model with two-way asset holdings follows the same steps as the previous model. Since k_t is constant over time, the government's objective function is an affine transformation of $E[\tilde{V}_t]$. Therefore, the dynamics of this model are very similar to the baseline model. The only addition is that the flow value is affected by the endogenous amount of capital, $k(W + E_t)$, that is sent abroad, where capital sent abroad increases in linear proportion to the equity value of the intermediation sector. Intuitively, as reputation builds, the equity value of the intermediation sector also builds, and so does household net worth, making it more attractive to send more wealth abroad.

Figure 17 provides a numerical illustration of two-way capital flows using the multiple investor calibration from Figure 16. We set Ψ, R^K, and B so that 10% of domestic wealth is invested abroad ($k_t = 0.1$). Figure 17 shows that as reputation builds, gross flows happen simultaneously: foreigners hold more of the domestic bond market and domestic capital flows abroad. In this numerical

illustration, it is not surprising that foreign inflows are more sensitive in terms of percent changes as a country progresses through the reputation cycle. This is because inflows here are tied to the intermediation sector, and so rise sharply as reputation rises. By contrast domestic households conduct foreign investment out of their entire portfolio, which includes fixed non-intermediary wealth. This means that inflows tend to increase more in percentages as reputation builds. In an economy in which total domestic wealth reacts more strongly to government reputation, the sensitivity of capital outflows would be more similar to that of inflows.

As reputation builds, the economy borrows more from the rest of the world in net terms. Intuitively, the reputation of a country is like an asset that the country can borrow against. The higher the reputation, the more this asset is valued, the better the credit terms, the more in net the country borrows against it. This model also rationalizes capital retrenchments (Forbes and Warnock (2012)), the idea that in a crisis both gross assets and liabilities shrink. Consider a country that somewhere along its reputation cycle (i.e. not at the start point of the cycle) is hit by a crisis and imposes ex-post capital controls. Its reputation is reset to the beginning of the cycle. Over the episode, the country would experience a contraction in foreign borrowing, a reduction of its foreign assets, a movement of its current account toward surplus, and a spike in its bond yields.

Opening-Up Date and Two-Way Flows. In our initial formulation of two-way flows above, the intermediation sector inside equity is fixed and capital sent abroad is drawn from other domestic investments. Foreign assets are a constant percent of domestic wealth. When the country opens up to flighty foreign investors there is a jump up in the total value of the intermediation sector which increases foreign assets via its effect on wealth. Here we explore a modification that leads to a more than proportional increase in foreign assets when the country lets in flighty investors. This dynamic arises when households can extract some of the intermediation sector inside equity and redeploy that capital abroad. To focus solely on this effect, we assume, for simplicity, that any money kept in the domestic economy is invested in the intermediation sector.

The household now allocates its resources W each period between bank equity, A_t, and foreign investment, K_t, that is to say $A_t + K_t = W$. We define the wealth of the household to be $K_t + E_t$, accounting for its equity wealth and its foreign investment wealth. Given the adjustment cost of sending capital abroad, the welfare of the household can now be written as

$$R^K K_t - \Psi(k_t)\Big(K_t + E_t\Big) + E_t,$$

where $k_t = \frac{K_t}{K_t+E_t}$ is the fraction of wealth invested abroad. Notice that E_t depends on inside equity, $A_t = W - K_t$, and so is endogenous to K_t. Taking the optimality condition of the committed type

government for foreign investment, we obtain the solution

$$\frac{\Psi'(k_t) - (R^K - 1)}{\Psi'(k_t)k_t - \Psi(k_t) + 1} = 1 - \underbrace{\left(\pi_H \frac{h_t}{\gamma - \frac{1-h_t}{R^L - \bar{\tau}}} + \pi_L \frac{h_t}{\gamma - \frac{1-h_t}{R^L}}\right)}_{\text{Marginal Return on Inside Equity}}. \tag{24}$$

Observe that if the (marginal) return on inside equity is one, then the RHS is zero and we obtain the same first order condition as before. This is the equivalent scenario from before, where the domestic alternative investment had a return of one. More generally, equation (24) shows that k_t is a constant that depends only on the marginal return on intermediary inside equity. The LHS increases in k_t, meaning that a *decrease* in the return on inside equity leads to an increase in foreign investment in percent terms, k_t. Since the marginal return on inside equity *falls* at opening up due to the higher haircut h_t, this means that foreign investment is a constant k^s before opening up and is a constant k^f at and after opening up, with $k^s < k^f$ indicating that there is a disproportionately large increase in outflows from the domestic economy after opening up.

Intuitively, opening up to flighty investors increases the overall value of the intermediation sector by increasing its scale, but the increase in scale also decreases its marginal returns. Domestic capital moves abroad for two distinct reason: a wealth effect and a rebalancing effect. The wealth effect we described in the model above. Here, we added a marginal decision for domestic households between investing domestically in the intermediation sector or investing abroad. Since the marginal returns at home decrease, the households optimally rebalance by investing more of their savings abroad as a fraction of total wealth.

We discuss below how this affects the full dynamics of the reputation model. The opportunistic type must send the same amount K_t of capital abroad to mimic the committed type, and retains the same inside equity stake $A_t = W - K_t$.[46] In particular, we show in the appendix that the new transition dynamics can be written as

$$V(M_{t+1}) = \frac{g(h_t)}{g^*(h_{t+1})}\rho(h_t)V(M_t) + \frac{g^*(h_0)}{g^*(h_{t+1})}V(M_0)$$

where we have defined $g^*(h_t) \equiv \frac{R^K k_t - \Psi(k_t)}{1-k_t}\left(\pi_H g(h_t) + \pi_L\right) + g(h_t)$. The transition dynamics are the same as before, except for replacements of $g(h_t)$ with $g^*(h_t)$.[47] This change has two effects. The first effect is that it further dampens the slope of the AR(1) process both before and after opening up, since $g^*(h_t) > g(h_t)$ due to the added value from sending a fraction of wealth abroad. Intuitively, as the country begins deriving more value from sending wealth abroad, it needs smaller increases in the value of inside equity to compensate for greater reputation.

[46] For simplicity, we assume that the adjustment cost for the opportunistic type is determined based on the market value E_t that arises if the capital control is not imposed.

[47] Notice that the component $g(h_t)\rho(h_t)$ in the slope of the AR(1) is correct as before, because it comes from the indifference condition which depends only on the low state and hence on g. By contrast, the other terms come from the Bellman equation, which depends on g^*.

The second effect comes from the change in the coefficient on $V(M_0)$ to $\frac{g^*(h_0)}{g^*(h_{t+1})}$ from $\frac{g(h_0)}{g(h_{t+1})}$. This coefficient is still equal to one before opening up. After opening up, there are two competing effects that determine whether the intercept is amplified or muted relative to before. The first effect is that the value of imposing the capital control falls after opening up, which lowers not only net worth but also the gains from sending capital abroad. This pushes the constant further towards zero and inserts a negative wedge in the transition dynamics at and after opening up. This reflects the intuition that a country resets its reputation also benefits from a higher proportional value of inside equity in the good state. The second effect arises from the increase in capital sent abroad, $k^f > k^s$, after opening up. This effect is ambiguous on the constant. On the one hand, it dampens the constant because the average return on foreign capital, $R^K - \frac{1}{k_t}\Psi(k_t)$, falls as capital is sent abroad. On the other hand, it amplifies the constant because as more capital is sent abroad, less is retained at home, and so larger higher reputation changes are required to maintain indifference.

Reserve Currency Competition and Imperfect Substitutability. In the benchmark model issuers make strategic choices but do not compete in the bond market for investment. An interesting avenue of research could consider Cournot competition among issuers and analyze the extent to which bonds issued by countries with different levels of reputation are substitutes for each other. In this light, it is relevant that our model generates a stationary distribution of issuer types that approximately declines in reputation. One can think of a world with very few committed types and plenty of opportunistic types. Endogenously opportunistic types spend most of their reputation cycle at very low levels of reputation and few are close to graduation. Intuitively, in a Cournot game this might help generate lots of competition among issuers with low reputation, but close to monopoly outcomes for issuers with very high reputation (or the committed types after graduation) that are special issuers of the world safe assets.

Investor Behavioral Biases In our benchmark model investors update their beliefs about the type of government they are facing using Bayes rule in equation (15). The model can also accommodate behavioral biases in the updating of reputation in the form of wedges in equation (15). In particular, it is interesting to consider a set-up in which investors, conditional on not observing ex-post capital controls in a crisis, become overly optimistic about the government being the committed type. Historically, countries at the core of the international monetary system, like the U.K. in the 1920s and the U.S. at present, enjoy extremely high reputation in financial markets up to the very moment of their reputation collapse. The U.K. for example unexpectedly and abruptly abandoned the gold-exchange standard in 1931 and depreciated the pound thus inducing losses on foreign bond holders. Particularly for rare events like major crisis, investors often do not see them coming until they occur: once they observe a country being a safe investment for a while, they think it will always be safe.

8 Conclusion

This paper characterizes China's strategy for internationalizing its currency through controlling the set of investors that can access its bond market. While the renminbi has a long way to go to rival the dollar as an international currency, with China's economy approaching the size of that of the United States and its bond market undergoing rapid growth, the integration of its capital market into global financial markets is a major shift in the international monetary system. We explain China's gradual approach to liberalizing capital inflows as balancing the desire to gain international currency status against the risks of sudden capital outflows that comes with foreign investment. By beginning with allowing investment from more stable investors and only later allowing in flightier ones, China has put itself on a path towards becoming an international currency while trying to minimize the risks it faces on the transition path.

References

Amador, Manuel and Christopher Phelan, "Reputation and sovereign default," *Econometrica*, 2021, *89* (4), 1979–2010.

Amador, Manuel, Iván Werning, and George-Marios Angeletos, "Commitment vs. flexibility," *Econometrica*, 2006, *74* (2), 365–396.

Amstad, Marlene and Zhiguo He, "Chinese bond markets and interbank market," *The Handbook of China's Financial System*, 2020, pp. 105–150.

Amstad, Marlene, Guofeng Sun, and Wei Xiong, *The Handbook of China's Financial System*, Princeton University Press, 2020.

ASIFMA, "Foreign Institutional Investment in China: Various Access Channels," January 2021.

Athey, Susan, Andrew Atkeson, and Patrick J Kehoe, "The optimal degree of discretion in monetary policy," *Econometrica*, 2005, *73* (5), 1431–1475.

Bahaj, Saleem and Ricardo Reis, "Jumpstarting an international currency," 2020.

Bahaj, Saleem and Ricardo Reis, "Central bank swap lines: Evidence on the effects of the lender of last resort," *Review of Economic Studies*, 2021.

Barro, Robert J and David B Gordon, "Rules, discretion and reputation in a model of monetary policy," *Journal of monetary economics*, 1983, *12* (1), 101–121.

Bianchi, Javier and Guido Lorenzoni, "The Prudential Use of Capital Controls and Foreign Currency Reserves," Technical Report, National Bureau of Economic Research 2021.

Brunnermeier, Markus K, Michael Sockin, and Wei Xiong, "China's gradualistic economic approach and financial markets," *American Economic Review*, 2017, *107* (5), 608–13.

Brunnermeier, Markus K, Michael Sockin, and Wei Xiong, "China's model of managing the financial system," *Review of Economic Studies*, 2022.

Caballero, Ricardo J. and Alp Simsek, "A Model of Fickle Capital Flows and Retrenchment," *Journal of Political Economy*, dec 2020, *128* (6), 2288–2328.

Cerutti, Mr Eugenio M and Mr Maurice Obstfeld, *China's Bond Market and Global Financial Markets*, International Monetary Fund, 2018.

Chahrour, Ryan and Rosen Valchev, "Trade Finance and the Durability of the Dollar," *Review of Economic Studies*, 2021.

Chari, Varadarajan V and Patrick J Kehoe, "Sustainable plans," *Journal of political economy*, 1990, *98* (4), 783–802.

Choi, Jason, Rishabh Kirpalani, and Diego J Perez, "The Macroeconomic Implications of US Market Power in Safe Assets," 2022.

Clayton, Christopher and Andreas Schaab, "Multinational Banks and Financial Stability," *The Quarterly Journal of Economics*, 2022.

Coppola, Antonio, "In Safe Hands: The Financial and Real Impact of Investor Composition Over the Credit Cycle," 2021.

Coppola, Antonio, Matteo Maggiori, Brent Neiman, and Jesse Schreger, "Redrawing the map of global capital flows: The role of cross-border financing and tax havens," *The Quarterly Journal of Economics*, 2021, *136* (3), 1499–1556.

Cripps, Martin W, George J Mailath, and Larry Samuelson, "Imperfect monitoring and impermanent reputations," *Econometrica*, 2004, *72* (2), 407–432.

Diamond, Douglas W, "Monitoring and reputation: The choice between bank loans and directly placed debt," *Journal of political Economy*, 1991, *99* (4), 689–721.

Drenik, Andres, Rishabh Kirpalani, and Diego Perez, "Currency choice in contracts," *The Review of Economic Studies*, 2021.

Eichengreen, Barry, *Exorbitant Privilege: The rise and fall of the Dollar and the Future of the International Monetary System*, Oxford University Press, 2011.

Eichengreen, Barry, Arnaud Mehl, and Livia Chitu, *How global currencies work*, Princeton University Press, 2017.

Farhi, Emmanuel and Iván Werning, "A theory of macroprudential policies in the presence of nominal rigidities," *Econometrica*, 2016, *84* (5), 1645–1704.

Farhi, Emmanuel and Jean Tirole, "Collective moral hazard, maturity mismatch, and systemic bailouts," *American Economic Review*, feb 2012, *102* (1), 60–93.

Farhi, Emmanuel and Matteo Maggiori, "A model of the international monetary system," *The Quarterly Journal of Economics*, 2018, *133* (1), 295–355.

Forbes, Kristin J and Francis E Warnock, "Capital flow waves: Surges, stops, flight, and retrenchment," *Journal of international economics*, 2012, *88* (2), 235–251.

Gelpern, Anna, Sebastian Horn, Scott Morris, Brad Parks, and Christoph Trebesch, "How China lends: a rare look into 100 debt contracts with foreign governments," 2021.

Gopinath, Gita and Jeremy C Stein, "Banking, trade, and the making of a dominant currency," *The Quarterly Journal of Economics*, 2021, *136* (2), 783–830.

Halac, Marina and Pierre Yared, "Fiscal rules and discretion under persistent shocks," *Econometrica*, 2014, *82* (5), 1557–1614.

He, Zhiguo, Arvind Krishnamurthy, and Konstantin Milbradt, "A model of safe asset determination," *American Economic Review*, 2019, *109* (4), 1230–62.

Holmstrom, B. and J. Tirole, "Financial intermediation, loanable funds, and the real sector," *Quarterly Journal of Economics*, aug 1997, *112* (3), 663–691.

Horn, Sebastian, Carmen M Reinhart, and Christoph Trebesch, "China's overseas lending," *Journal of International Economics*, 2021, *133*, 103539.

Jermann, Urban J, Bin Wei, and Zhanwei Yue, "The Two-pillar policy for the RMB," *Available at SSRN 3360617*, 2019.

Kai, Guo, "Opening up China's bond market: Some considerations," *The Future of China's Bond Market*, 2019, p. 197.

Kiyotaki, Nobuhiro and John Moore, "Credit Cycles," *Journal of Political Economy*, apr 1997, *105* (2), 211–248.

Kreps, David M and Robert Wilson, "Reputation and imperfect information," *Journal of economic theory*, 1982, *27* (2), 253–279.

Liu, Becky and Terry Chan, "Foreign investment in China bonds – Who buys what," *Standard Chartered Global Research*, October 2019.

Lustig, Hanno, Nikolai Roussanov, and Adrien Verdelhan, "Common risk factors in currency markets," *The Review of Financial Studies*, 2011, *24* (11), 3731–3777.

Maggiori, Matteo, Brent Neiman, and Jesse Schreger, "International currencies and capital allocation," *Journal of Political Economy*, 2020, *128* (6), 2019–2066.

Mailath, George J and Larry Samuelson, "Who wants a good reputation?," *The Review of Economic Studies*, 2001, *68* (2), 415–441.

Milgrom, Paul and John Roberts, "Predation, reputation, and entry deterrence," *Journal of economic theory*, 1982, *27* (2), 280–312.

Mo, Jingyuan and Marti G Subrahmanyam, "What Drives Liquidity in the Chinese Credit Bond Markets?," *NYU Stern School of Business*, 2020.

Phelan, Christopher, "Public trust and government betrayal," *Journal of Economic Theory*, 2006, *130* (1), 27–43.

Schipke, Alfred, Markus Rodlauer, and Zhang Longmei, "China's Bond Market: Characteristics, Prospects, and Reforms," *The Future of China's Bond Market*, 2019.

Schipke, Alfred, Rodlauer Markus and Longmei Zhang, *The future of China's bond market*, International Monetary Fund, 2019.

Schmitt-Grohé, Stephanie and Martin Uribe, "Downward nominal wage rigidity, currency pegs, and involuntary unemployment," *Journal of Political Economy*, 2016, *124* (5), 1466–1514.

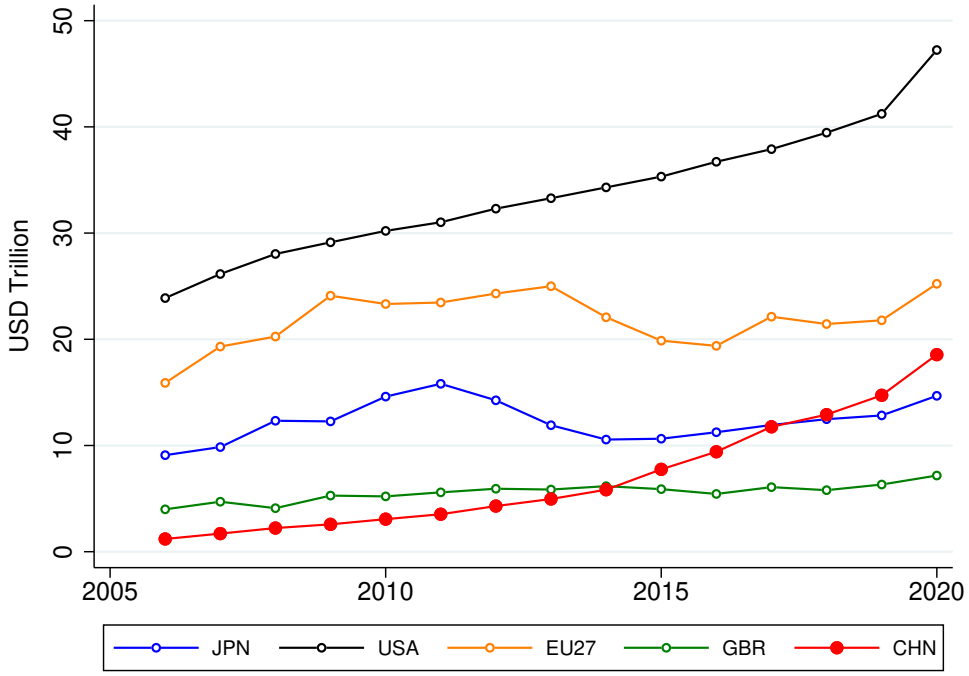
Song, Zheng and Wei Xiong, "Risks in China's financial system," *Annual review of financial economics*, 2018, *10*, 261–286.

Song, Zheng, Kjetil Storesletten, and Fabrizio Zilibotti, "Growing like china," *American economic review*, 2011, *101* (1), 196–233.

Tadelis, Steven, "What's in a Name? Reputation as a Tradeable Asset," *American Economic Review*, 1999, *89* (3), 548–563.

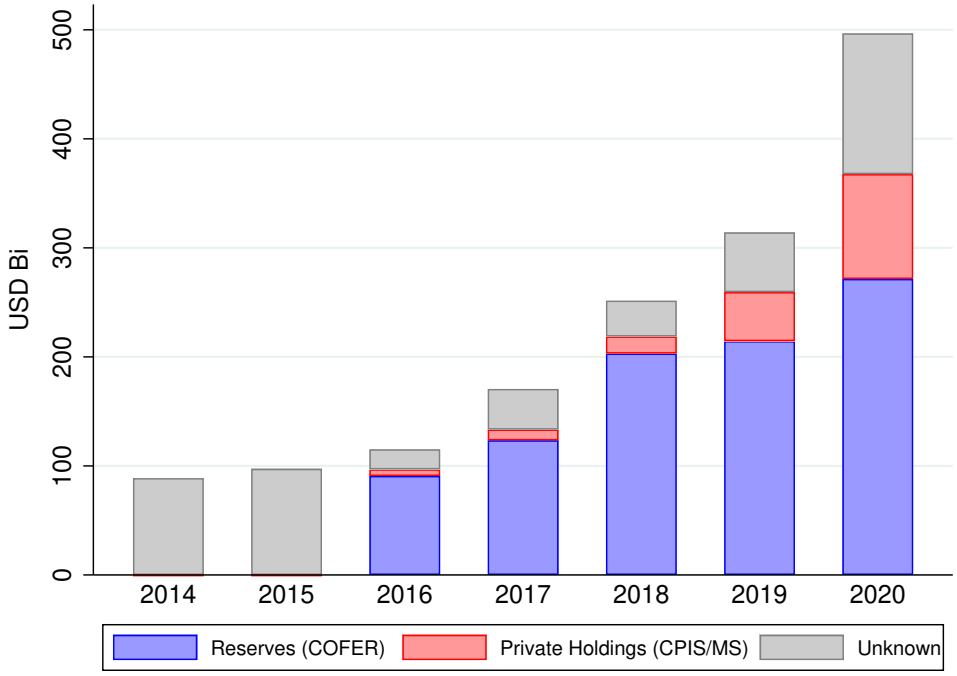
Figures

Figure 1: The World's Largest Bond Markets



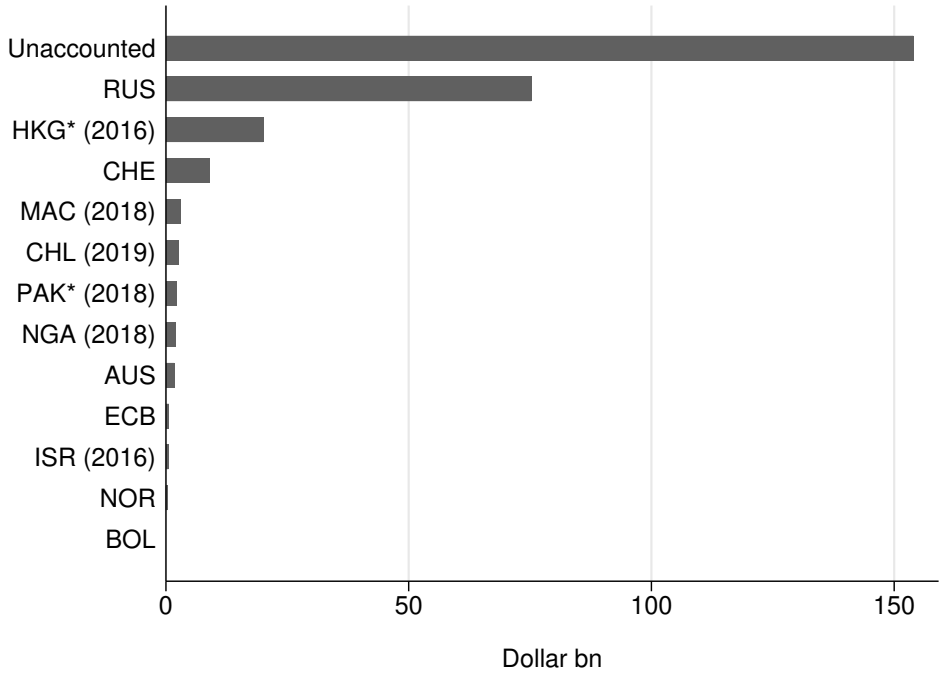
Note: Global Bond Market Outstanding from 2021 SIFMA Capital Markets Fact Book.

Figure 2: Total Ownership of RMB Bonds by Foreign Investors



Note: Data on total foreign holdings of RMB are from Bond Connect. Data on total foreign reserve holdings from the IMF COFER database. Data for private holders from CPIS Table 2 (when available) or Morningstar Fund Holdings. "Unknown" is calculated as the total net of identified reserves from COFER and private holdings in CPIS and Morningstar.

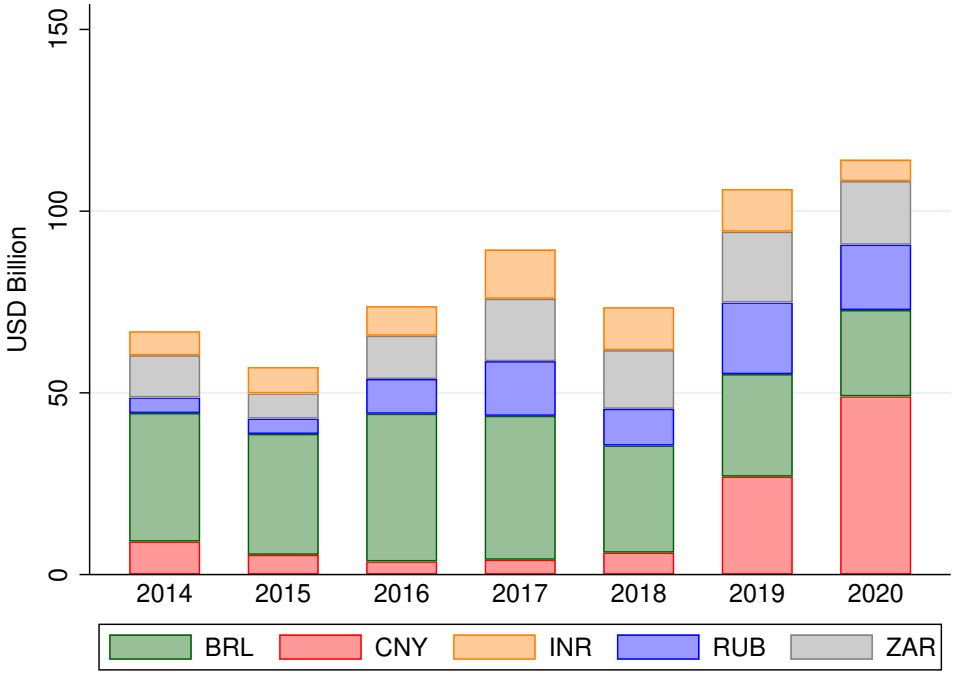
Figure 3: Reserve Holdings of Renminbi, 2020



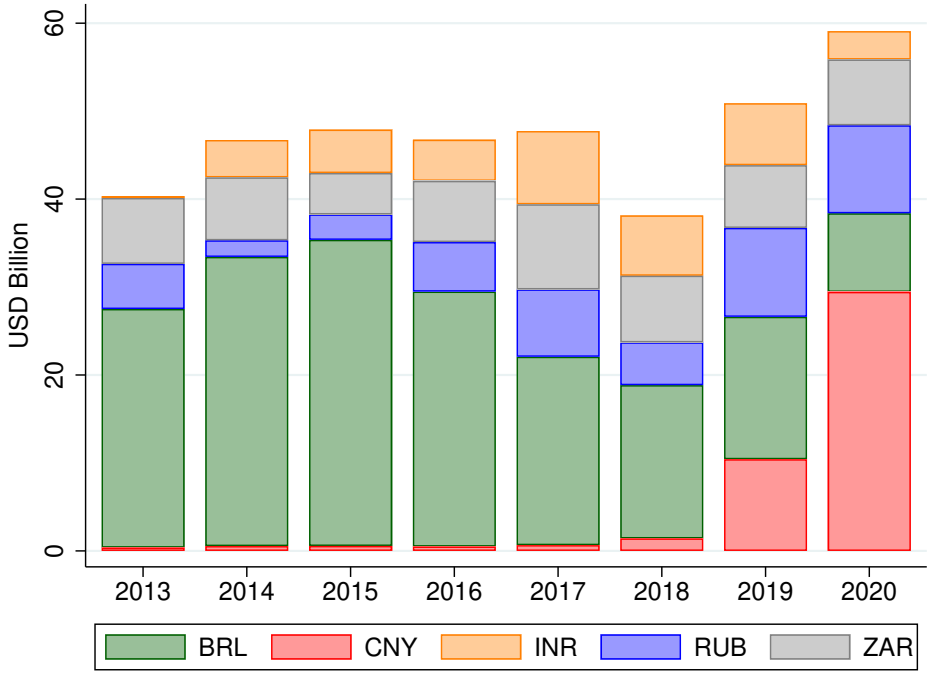
Notes: This figure reports total identified foreign currency reserve holdings. The data comes from a variety of national sources, detailed in the Appendix. An asterisk indicates that the data source used only provided a rough estimate. When 2020 data is not available, the date of the most recent available data is reported in parentheses.

Figure 4: Foreign Investment in BRICS Currencies

(a) Global Mutual Fund and ETF Investment

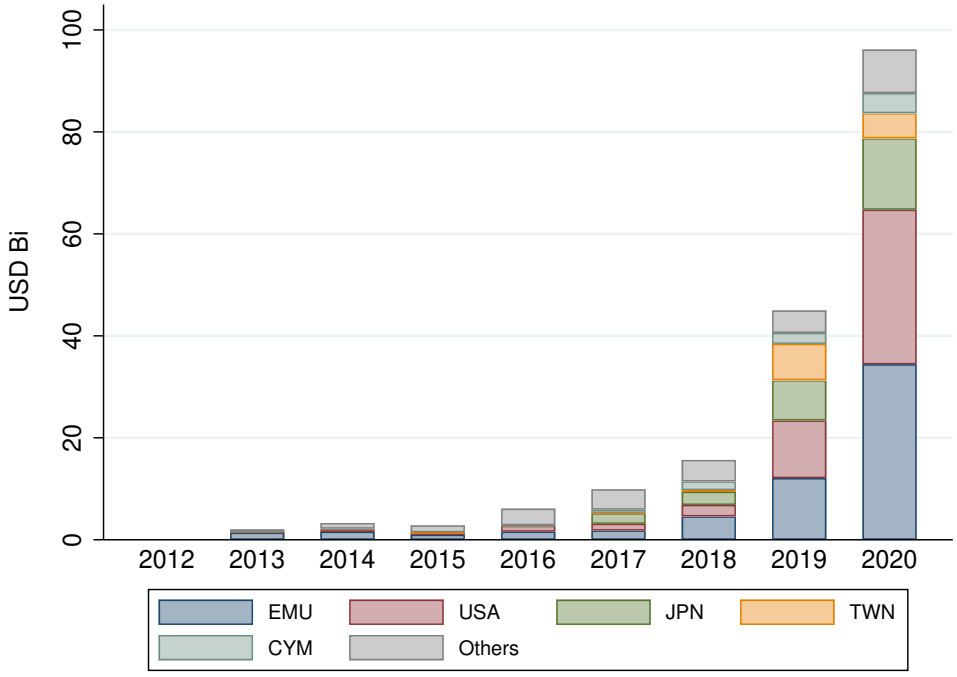


(b) Total US Investment



Notes: The top panel uses all ETF, mutual fund, and money market fund-level holdings from Morningstar. All domestic currency holdings are dropped. The bottom panel includes all U.S. investment in long-term bonds from the Treasury International Capital (TIC) data, reported in Table A6. All data is for end of year.

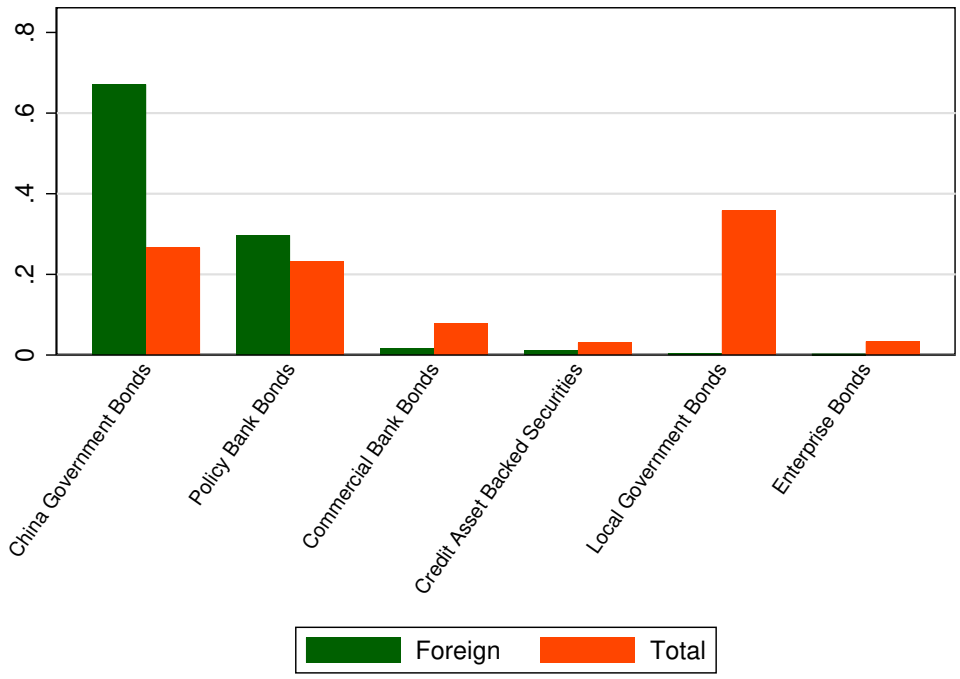
Figure 5: Private Holdings of Renminbi Bonds



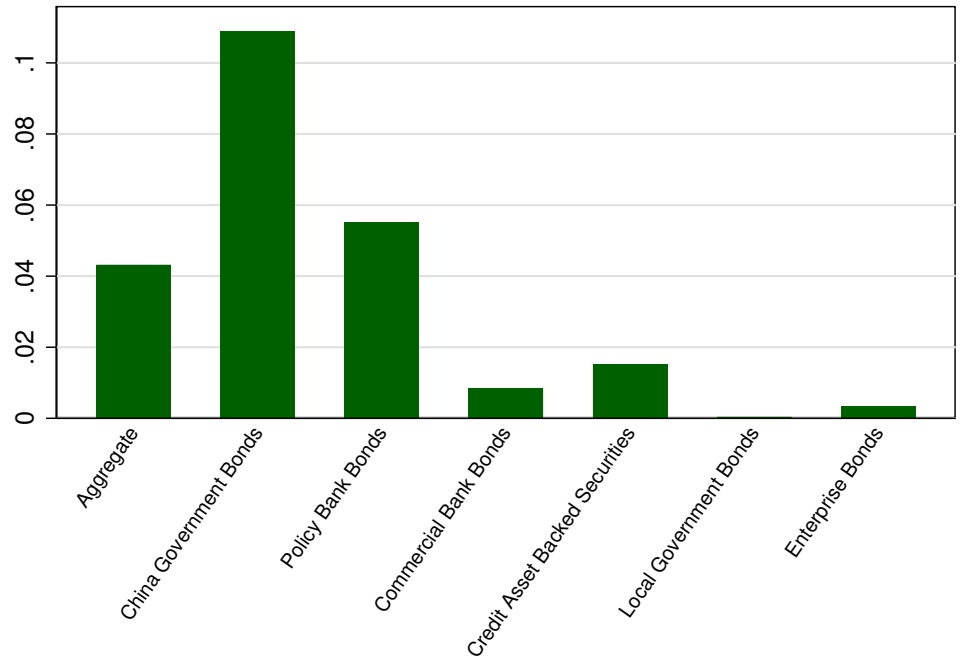
Notes: This figure reports identified private holdings of RMB by investor country. When available, data from CPIS or TIC is used. When countries do not report the currency composition of their bond investment, data on fund holdings from Morningstar are used. The reporting dates of each country are report in Appendix Tables A.I and A.II.

Figure 6: The Composition of Foreign Ownership of RMB Bonds

(a) Share of Foreign-Owned and Total Debt, 2021Q4



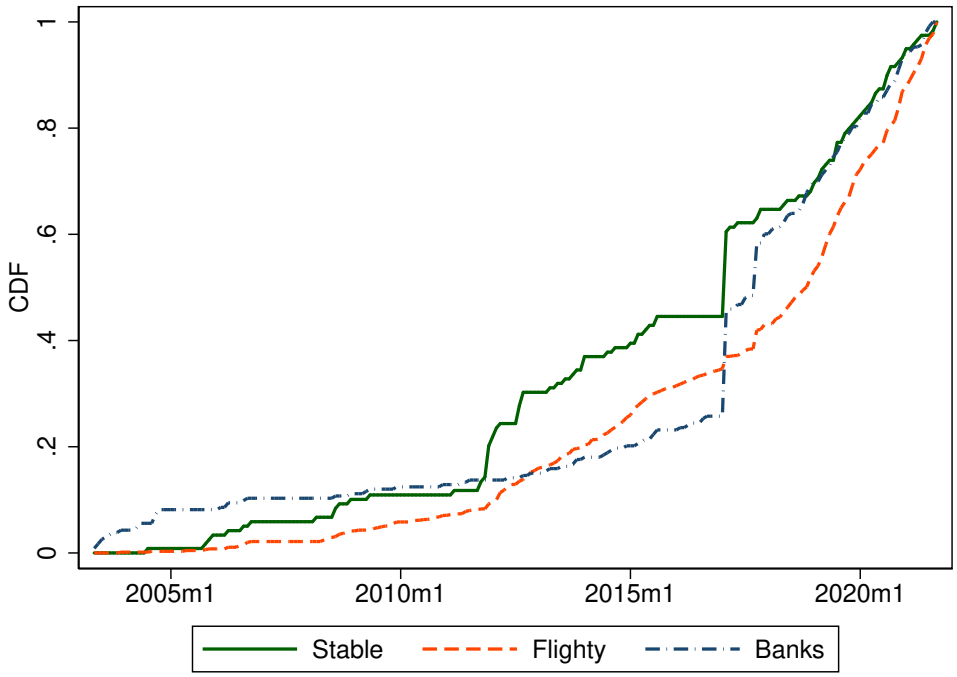
(b) Share of Outstanding Bonds Owned by Foreign Investors



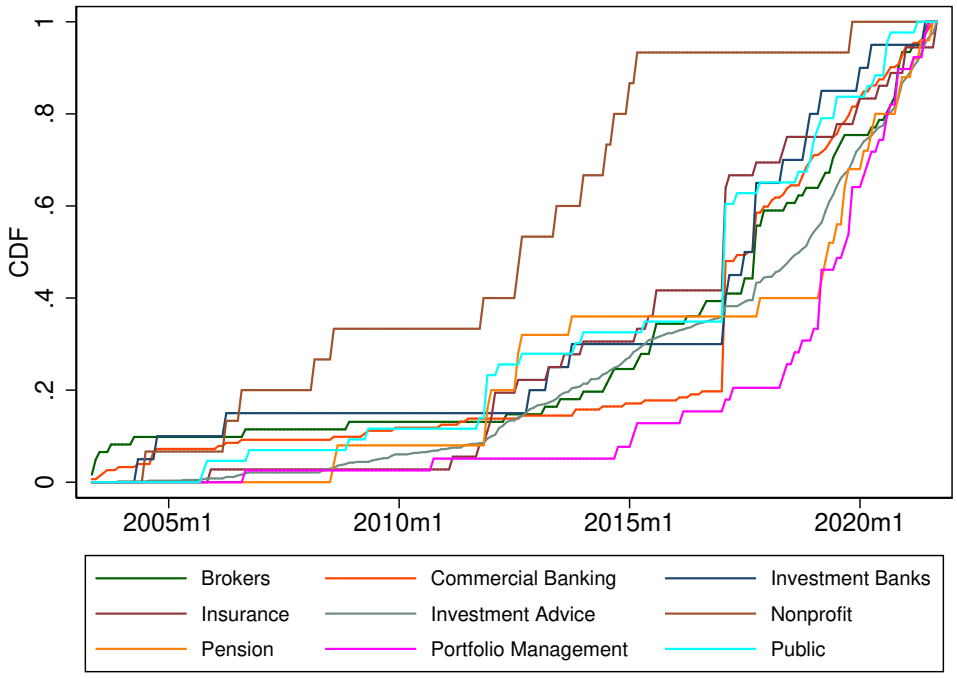
Notes: Data from CCDC. Top panel calculates the share of the foreign and total investment portfolio in each of the various categories of bonds. The bottom panel reports what share of each bond type is owned by foreign investors.

Figure 7: Entry into Domestic Markets

(a) Stable Investors, Flighty Investors, and Banks

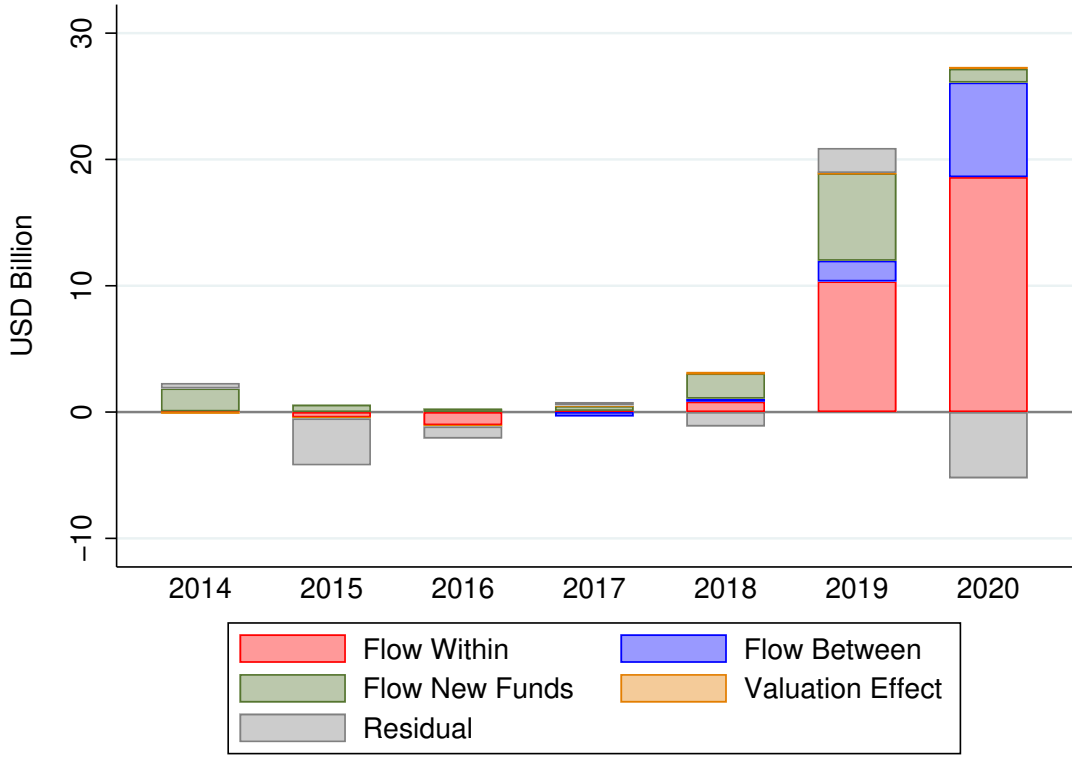


(b) Investor Industry Categories



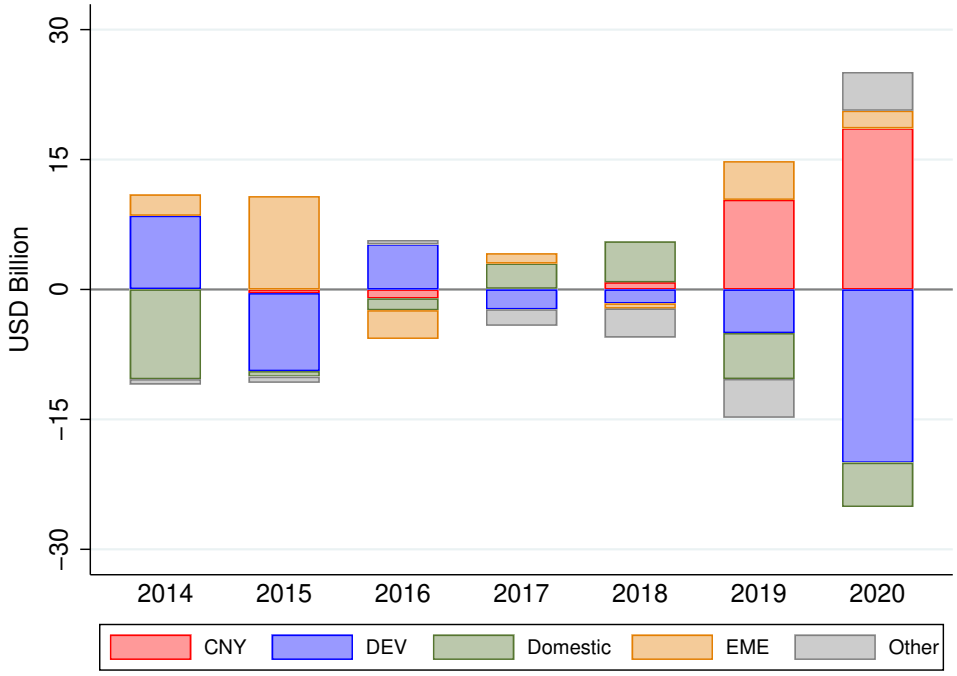
Notes: These figures plots what share of each investor type that had entered by the market by 2021 had entered by a given data.

Figure 8: Decomposition of Change CNY Holdings by type of Flow



Notes: This figure implements the decomposition of flows into RMB bonds in Equation 1. Flow Within refers to increases in holdings of RMB assets holding fixed the size of funds. Flow Between refers to increases in holdings of RMB assets generated by inflows into funds that own RMB, holding prices and portfolio shares fixed. Flow New Funds indicates RMB assets purchased by funds that were created in a given year. Valuation Effect denotes in the increase in the market value of holdings coming via price and exchange rate changes. Residual denotes the residual component coming from the fact that we do not observe actual transaction prices.

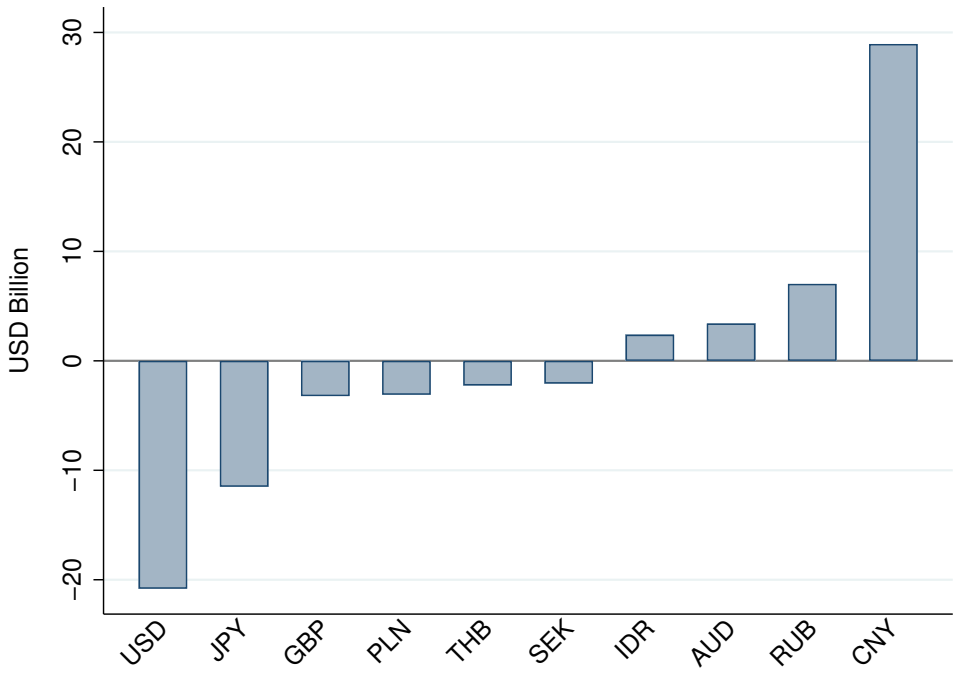
Figure 9: Decomposition of Change CNY Holdings by Currency Group



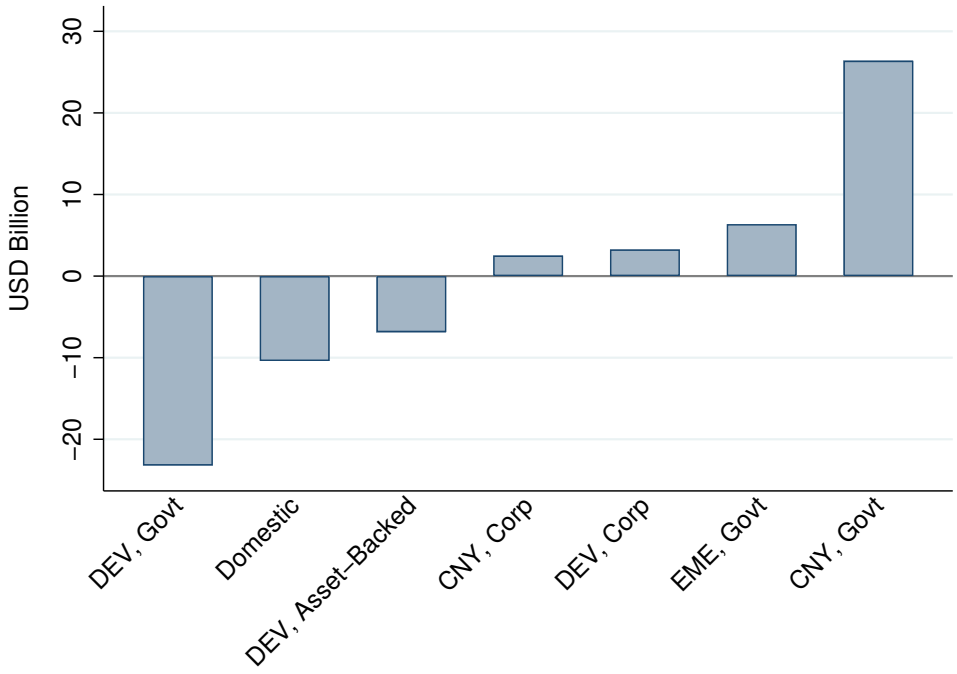
Notes: This figure implements the decomposition of the Within component of flows in Equation 6. "CNY" refers to all assets denominated in Chinese Yuan. "DEV" refers to cross-border holdings of developed market currencies. Domestic refers to assets in the domestic currency of the fund. "EME" refers to cross-border holdings of emerging market currencies. "Other" refers to other currencies and equities. This figure only consider funds that own some RMB assets.

Figure 10: Decomposition of Within Flows to RMB Holdings by Currency and Asset Group

(a) Within Flows by Currency



(b) Within Flows by Currency Group and Asset Type

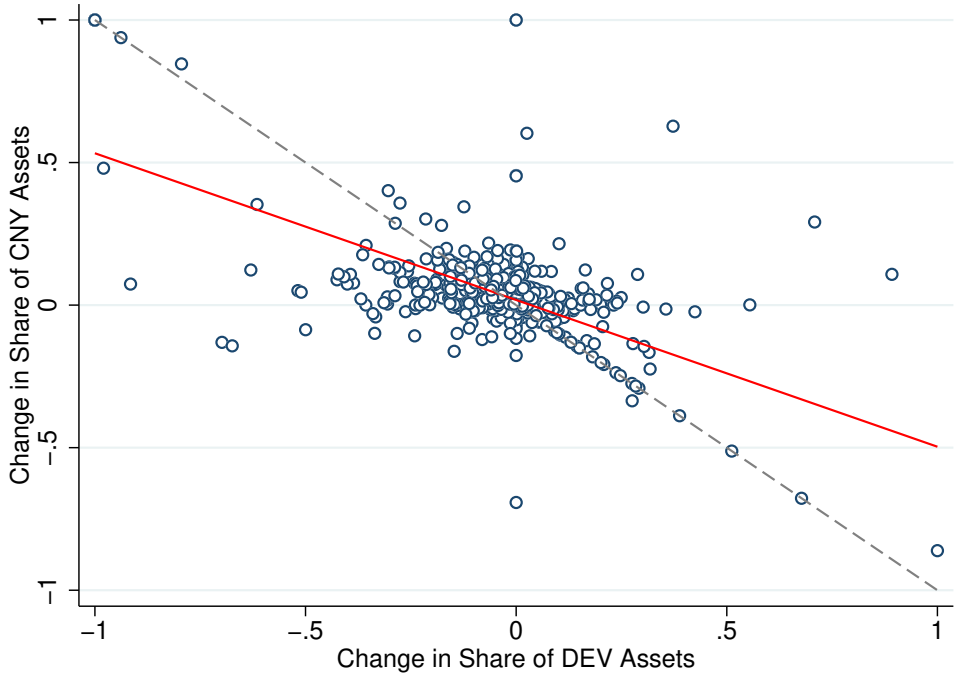


Notes: Both figures report the Within flows for funds that invest in some RMB assets between 2018 and 2020. The top panel reports results split by individual currencies. The bottom panel reports results for currency group by asset type.

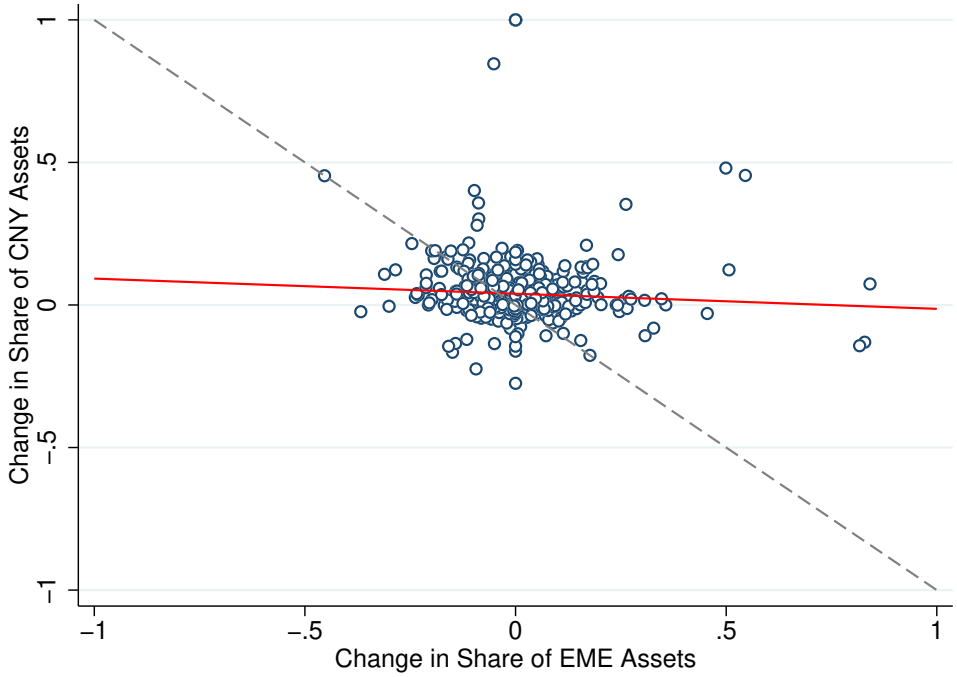
Figure 11: Fund-Level Substitution

[h!]

(a) Developed Country Currencies

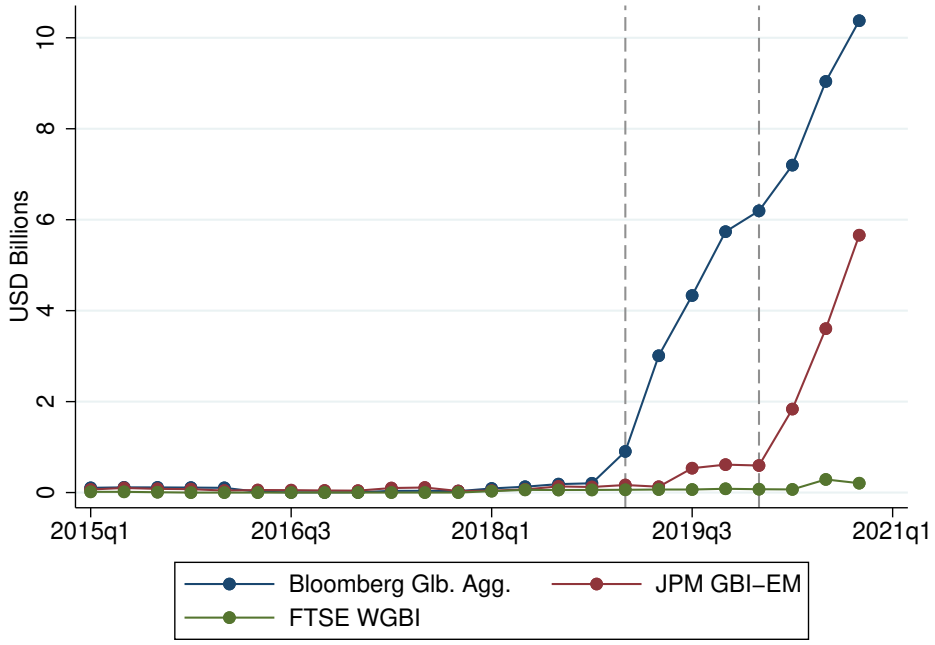


(b) Emerging Market Currencies Type



Notes: This figure plots the change in the share of cross-border developed country currency (top panel) and cross-border emerging market currency (bottom panel) investment against the change in the share of the portfolio invested in Renminbi. Each observation is fund-year level change.

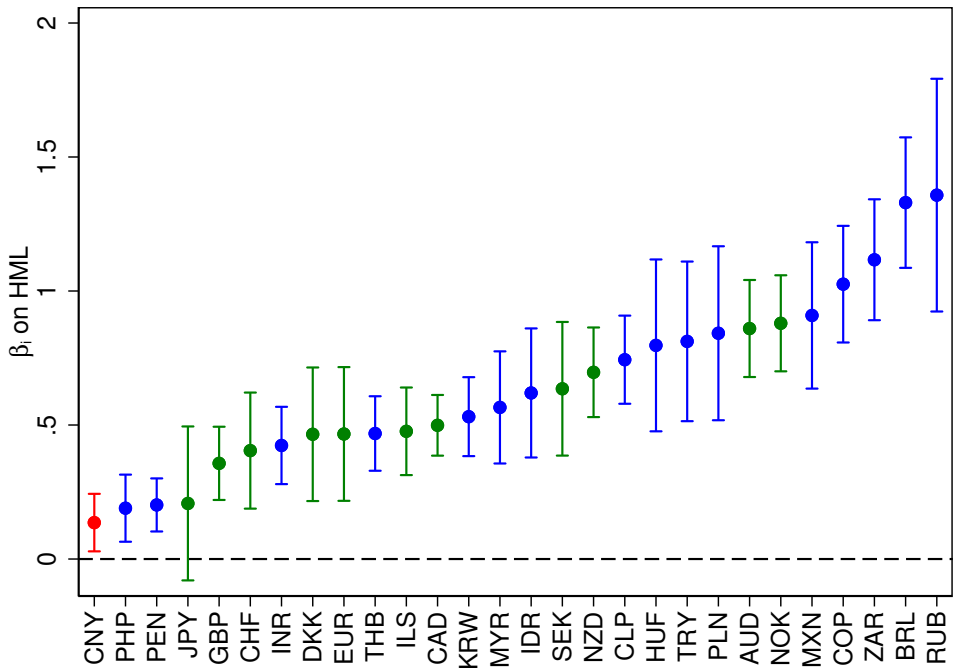
Figure 12: Index Inclusion and Foreign Investment in China



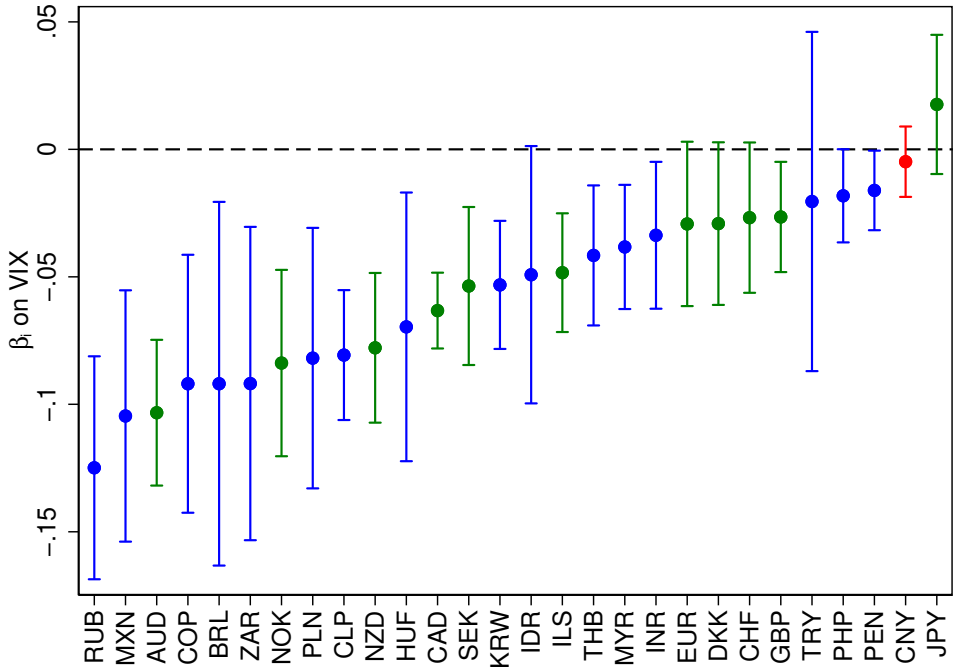
Notes: Figure shows the aggregate value of RMB holdings of funds benchmarked to the Bloomberg Global Aggregate Index, the JPMorgan GBI-EM Index, and the FTSE World Government Bond Index. Grey vertical lines denotes the dates of the inclusion of Chinese RMB bonds into the Bloomberg Global Aggregate (April 2019) and the JPMorgan GBI-EM (February 2020).

Figure 13: Returns on RMB relative to EM and DM Currencies

(a) HML



(b) VIX



Notes: 2010-Present. Quarterly returns based on 3m Government bond yields. β_i estimated via univariate country-specific regressions of quarterly bond returns on the factor (HML in the top panel, and the log change in the VIX in the bottom panel.

Figure 14: Model Timeline Within Each Date

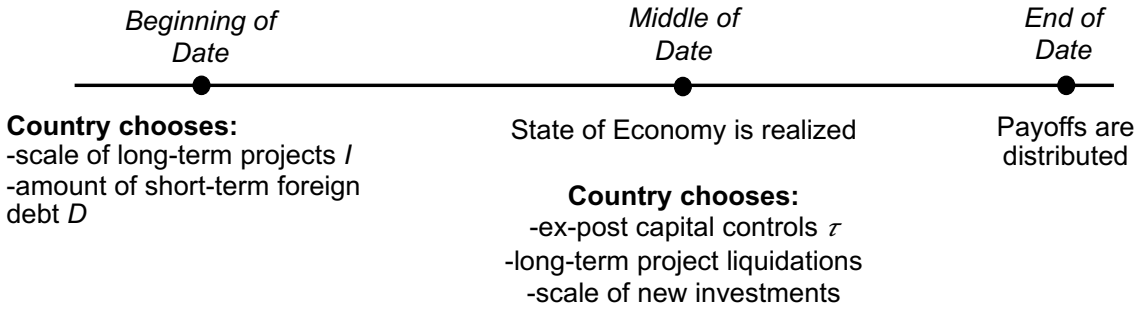
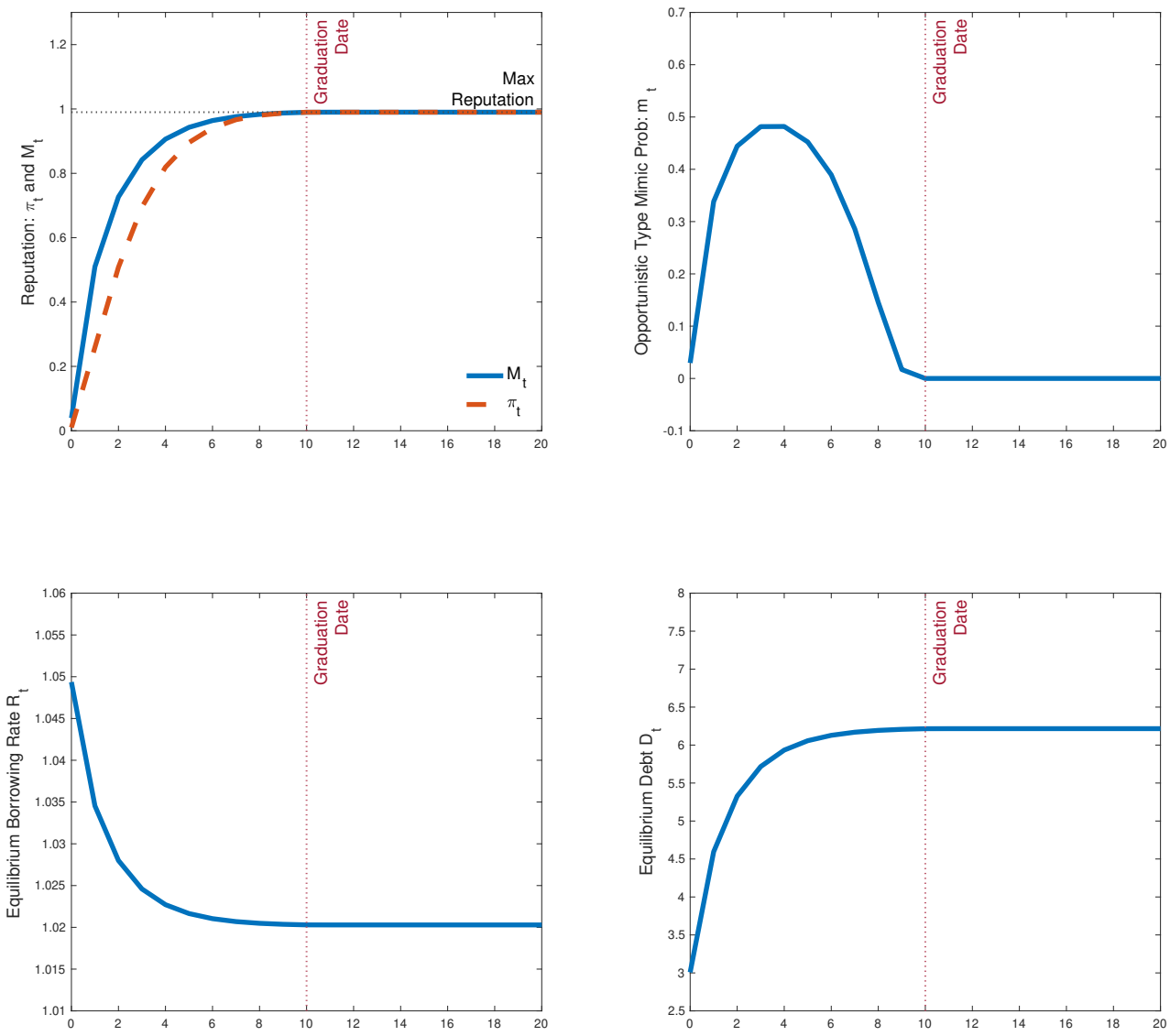
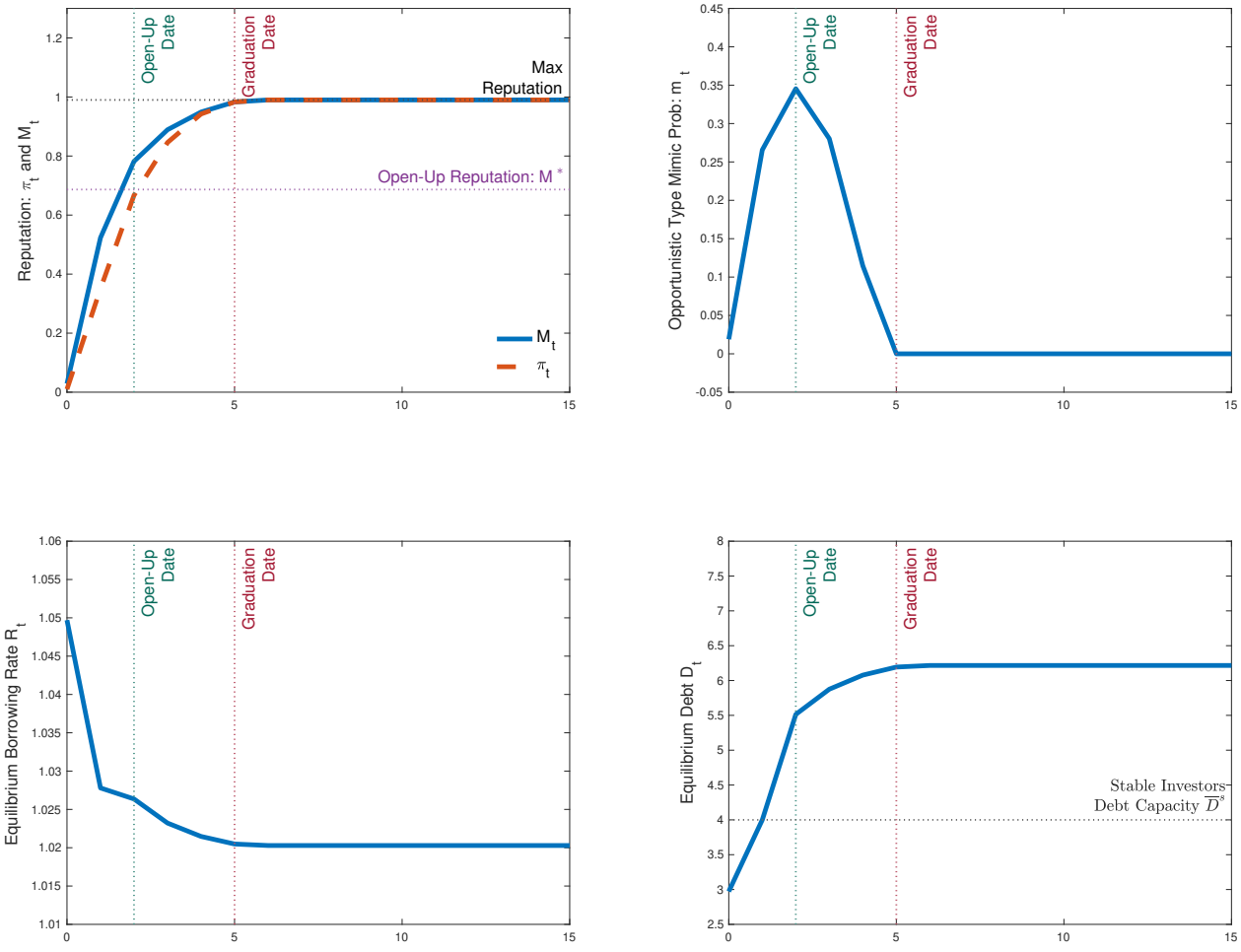


Figure 15: Equilibrium Reputation Cycle: One Investor Class



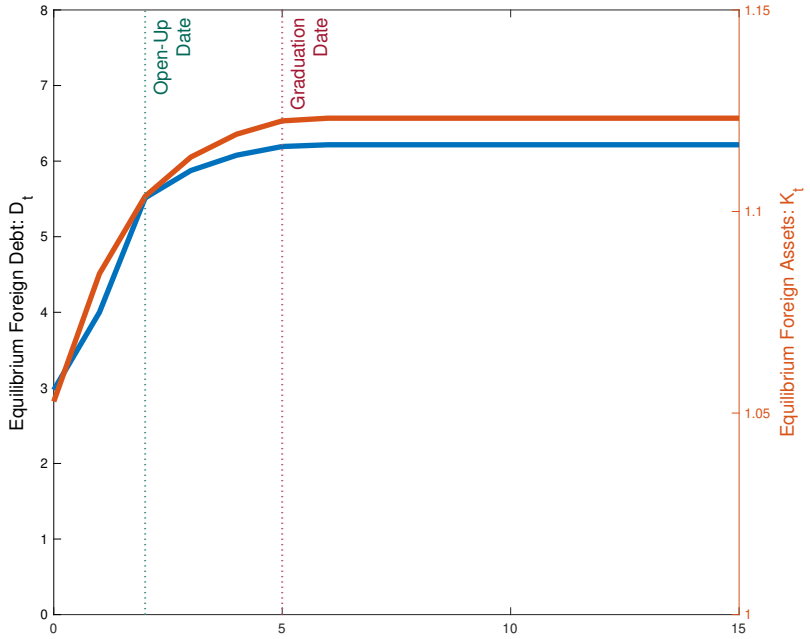
Notes: Numerical illustration of the equilibrium of the model when only one class of investors is present.

Figure 16: Equilibrium Reputation Cycle



Notes: Numerical illustration of the equilibrium of the model.

Figure 17: Two-Way Capital Flows



Notes: Numerical illustration of the equilibrium of the model with both capital inflows and outflows.

Tables

Table 1: Foreign Currency Investment: Share Change

	(1) Δ CNY	(2) Δ CNY	(3) Δ CNY	(4) Δ CNY	(5) Δ CNY	(6) Δ CNY
Δ EM Share	-0.017		-0.058		-0.058	
	(0.069)		(0.077)		(0.077)	
Δ DM Share		-0.507***		-0.452***		-0.454***
		(0.082)		(0.085)		(0.085)
Constant	0.047***	0.035***	0.046***	0.038***	0.046***	0.037***
	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)
Observations	792	870	789	868	789	867
R-squared	0.001	0.372	0.116	0.494	0.116	0.508
Residency FE	no	no	yes	yes	yes	yes
Excl Outliers	no	no	no	no	yes	yes

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

Notes: This table reports regression results from Equation 7. The regressions are restricted to 2019 and 2020 where a fund holds some RMB denominated assets. ΔCNY is the change in CNY as a share of foreign currency investment, $\Delta EMShare$ is the change in emerging market currencies as a share of foreign currency investment, and $\Delta DMShare$ is the change in developed market currencies as a share of foreign currency investment.

Table 2: Foreign Currency Investment: Within Flows

	(1) Δ CNY	(2) Δ CNY	(3) Δ CNY	(4) Δ CNY	(5) Δ CNY	(6) Δ CNY
Δ EM Share	0.015		-0.008		-0.011	
	(0.039)		(0.038)		(0.038)	
Δ DM Share		-0.041**		-0.031**		-0.015***
		(0.017)		(0.014)		(0.002)
Constant	0.045***	0.058***	0.045***	0.058***	0.044***	0.045***
	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
Observations	857	949	853	946	852	930
R-squared	0.001	0.098	0.115	0.307	0.130	0.170
Residency FE	no	no	yes	yes	yes	yes
Excl Outliers	no	no	no	no	yes	yes

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

Notes: This table reports regression results from Equation 7. The regressions are restricted to 2019 and 2020 where a fund holds or trades some RMB denominated assets. ΔCNY is the within flow to CNY scaled by AUM at last period's prices, $\Delta EMShare$ is the within flow to emerging market currencies scaled by AUM at last period's prices, and $\Delta DMShare$ is the within flow to developed market currencies scaled by AUM at last period's prices.

Table 3: Biggest Onshore RMB positions of Foreigners in Morningstar

Fund	Dom.	Benchmark (short)	RMB holdings (Bn USD) 2017	2018	2019	2020	Total % (2020)	(RMB hdgs) / (Total AUM), 2020
iShares China CNY Bond ETF	IRL	BBgBarc China Tsry+	0.000	0.000	0.170	6.320	13.10	1.00
Eurizon Bond Aggregate RMB	LUX	Bloomberg China Aggregate	0.000	0.547	0.938	2.448	5.07	1.00
PIMCO International Bond Fd (USD-Hedged)	USA	Bloomberg Gbl Agg	0.002	0.002	0.799	1.552	3.22	0.09
PIMCO Income Fund	USA	Bloomberg US Agg	0.000	0.000	0.000	1.381	2.86	0.01
Fuh Hwa China 5+ Yr Policy Bank Bond ETF	TWN	BBgBarc CHN Policy	0.000	0.000	1.418	1.174	2.43	1.00
Vanguard Total International Bd Idx Fund	USA	Bloomberg Gbl Agg	0.000	0.000	1.028	1.156	2.40	0.01
Cathay FTSE Chinese Policy Bk Bd5+YrsETF	TWN	FTSE Chinese Policy	0.000	0.000	1.453	1.083	2.25	1.00
PIMCO GIS Global Bond Fund	IRL	Bloomberg Global Aggregate	0.000	0.000	0.624	1.077	2.23	0.05
UBS (Lux) BS China Fixed Income (RMB)	LUX	Bloomberg China Aggregate	0.000	0.887	3.540	0.972	2.01	0.98
American Funds Capital World Bond Fund	USA	Bloomberg Global Aggregate	0.002	0.142	0.446	0.931	1.93	0.07
KGI China Policy Bank 3-10 Year Bond ETF	TWN	BBgBarc China Policy	0.000	0.000	0.869	0.894	1.85	1.00
Fubon China Policy Bank Bond ETF	TWN	BBgBarc China Policy	0.000	0.000	0.806	0.779	1.62	1.00
PIMCO GIS Income Fund	IRL	Bloomberg US Agg	0.000	0.000	0.000	0.742	1.54	0.01
PrivilEdge Income Partners RMB Debt	LUX	Bloomberg China Aggregate	0.000	0.009	0.011	0.679	1.41	0.91
iShares JPMorgan EM Local Govt Bond ETF	IRL	JPM GBI EM	0.000	0.000	0.000	0.663	1.37	0.10
BGF Fixed Income Global Opportunities Fd	LUX	Not Benchmarked	0.004	0.004	0.167	0.642	1.33	0.10
T. Rowe Price Intl Bd Fd (USD Hdgd)	USA	Bloomberg Gbl Agg	0.000	0.028	0.383	0.578	1.20	0.10
Shin Kong 10-Y China Trs Plc Bak Grn ETF	TWN	ChinaBond 10y Trsy&Plcy	0.000	0.000	0.827	0.499	1.04	1.00
American Funds Global Balanced Fund	USA	Composite with Bbg.Glb.Agg.	0.000	0.000	0.185	0.480	0.99	0.06
AB Global Bond Fund	USA	Bloomberg Global Aggregate	0.000	0.000	0.307	0.479	0.99	0.07
CSIF (CH) Bond Aggt Glb ex G4 ex CHF	CHE	Bloomberg Gbl Agg	0.000	0.000	0.188	0.469	0.97	0.43
iShares Core International Aggt Bd ETF	USA	Bloomberg Gbl Agg	0.000	0.000	0.161	0.429	0.89	0.13
Eastspring Inv China Bond Fund	LUX	Markit iBoxx ALBI	0.000	0.000	0.000	0.425	0.88	1.00
Western Asset Core Plus Bond Fund	USA	Bloomberg US Agg	0.065	0.064	0.066	0.408	0.85	0.01
SPDR® Blmbrg Bcly EM Lcl Bd ETF	IRL	Bloomberg EM Lcl	0.000	0.000	0.209	0.406	0.84	0.10

Notes: This table reports the funds with the largest investments in Morningstar in RMB in 2020Q4.

Appendix

A.A Deriving Optimal Debt and Interest Rate Schedules

Given the assumption of single crossing, we have that optimal policy maximizes $\gamma Q I_t - R_t D_t$ separately for $M_t \leq M^*$ and $M_t > M^*$.

First suppose that $M_t \leq M^*$ and so $D_t(M) \leq \overline{D}^s$. Then, we have $R_t = \frac{R^s + \frac{1}{2} b_0^s D_t}{\mathcal{M}_t}$, and therefore the FOC for optimal debt issuance is

$$0 = \gamma Q - R_t - \frac{\frac{1}{2} b_0^s}{\mathcal{M}_t} D_t$$

$$D_t = \frac{\mathcal{M}_t}{b_0^s} \left[\gamma Q - \frac{R^s}{\mathcal{M}_t} \right].$$

Substituting back into the interest rate schedule, we get

$$R_t = \frac{1}{2} \frac{R^s}{\mathcal{M}_t} + \frac{1}{2} \gamma Q.$$

Finally, note that this is applicable only as long as the debt cap does not bind, so we have a threshold such that if $M_* < M_0 \leq M^*$ then the cap binds. At the cap, the interest rate is instead given by

$$R_t = \frac{R^s + \frac{1}{2} b_0^s \overline{D}^s}{\mathcal{M}_t}.$$

Next, suppose that $M_t > M^*$ and so $D_t(M) > \overline{D}^s$. In this case, we have $R_t = \frac{R^f + \frac{1}{2} b_0^f (D_t - \overline{D}^s)}{\mathcal{M}_t}$, giving

$$0 = \gamma Q - R_t - \frac{\frac{1}{2} b_0^f}{\mathcal{M}_t} D_t$$

$$D_t = \frac{\mathcal{M}_t}{b_0^f} \left[\gamma Q - \frac{R^f - \frac{1}{2} b_0^f \overline{D}^s}{\mathcal{M}_t} \right]$$

Finally substituting back into the interest rate schedule, we obtain

$$R_t = \frac{1}{2} \frac{R^f - \frac{1}{2} b_0^f \overline{D}^s}{\mathcal{M}_t} + \frac{1}{2} \gamma Q.$$

A.B Proof of Proposition 1

We begin by making two observations about the behavior of a feasible candidate path $\pi_0, ..., \pi_T$ and $M_0, ..., M_T$. The first is that the transition dynamics 18 imply that M_t increases in t, and that $M_1, ..., M_T$ all increase in M_0. The second is that Bayes' rule implies that beliefs $\pi_1, ..., \pi_T$ decrease in $M_1, ..., M_T$, and so decrease in initial reputation M_0. As such, it is convenient to define a candidate equilibrium in terms of the initial reputation M_0, with the path $M_1, ...$ defined from the transition dynamics and beliefs $\pi_1, ...$ defined from Bayes' rule. Moreover, given a candidate initial reputation M_0, we can also pin down the required graduation date T as follows.

Lemma 1 *The graduation date T associated with an initial reputation M_0 is given by*[1]

$$T = \sup\left\{t \middle| \frac{1-(\rho^f)^{t+1}}{1-\rho^f} V(M_0) < V(1-\epsilon^C)\right\}$$

Proof of Lemma 1. *Suppose that we conjectured a graduation date $T' < T$. Then, at the conjectured graduation date T', the value of waiting one period and then imposing the capital control, rather than imposing it today, is*

$$\begin{aligned}
\frac{W^0_{T'} - W^{\bar{\tau}}_{T'}}{\pi_L} &= V(M_{T'}) - g^f V(M_{T'}) + \beta\left[W_{T'+1} - W_0\right] \\
&= \left(1-g^f\right)V(M_{T'}) + \frac{\beta g^f}{1-\pi_H\beta}\left[V(1-\epsilon^C) - V(M_0)\right] \\
&= \frac{\beta}{1-\pi_H\beta} g^f \left[V(1-\epsilon^C) - \rho^f V(M_{T'}) - V(M_0)\right] \\
&> 0
\end{aligned}$$

so that the opportunistic type prefers not to graduate. Note that the supremum representation simply expresses the solution to the equation (18) starting from M_0. QED

Lemma 1 implies that once we have a conjecture for M_0, we also have a path of reputation, beliefs, and a graduation date. We now show that if the terminal condition $m_T = 0$, that is $\pi_T = M_T$, holds, then all intermediate conditions $\pi_t \leq M_t \leq 1-\epsilon^C$ also hold.

Lemma 2 *If $M_T = \pi_T$ for $T < \infty$, then $\pi_t \leq M_t \leq 1-\epsilon^C$ for all $t < T$.*

Proof of Lemma 2. *The proof proceeds by induction. By Lemma 1, we have $\pi_T < 1-\epsilon^C$. Suppose that at date $t+1$, $\pi^c_{t+1} \leq M_{t+1}$. Then by Bayes' rule $\pi_{t+1} = \epsilon^O + \frac{1-\epsilon^O-\epsilon^C}{M_t}\pi_t$, we have*

$$\frac{M_t}{\pi_t} = \frac{1-\epsilon^O-\epsilon^C}{\pi_{t+1}-\epsilon^O} \geq \frac{1-\epsilon^O-\epsilon^C}{M_{t+1}-\epsilon^O} \geq \frac{1-\epsilon^O-\epsilon^C}{M_T-\epsilon^O} \geq \frac{1-\epsilon^O-\epsilon^C}{1-\epsilon^C-\epsilon^O} = 1.$$

The induction is then completed by the terminal condition $M_T/\pi_T = 1$, completing the proof. QED

Given these preliminary results, we can form a candidate equilibrium from an initial reputation M_0, which then has a graduation date, path of reputation, and path of beliefs as outlined. For it to consistitute and equilibrium, it must be the case that it also satisfies the terminal condition $\pi_T = M_T$ for graduation. We are now ready to prove uniqueness and existence. We begin with uniqueness, and then prove existence.

A.B.1 Uniqueness

Suppose that M^*_0 is an equilibrium with associated graduation date $T < \infty$. Any equilibrium of the model must satisfy $\Delta(T, M_0) = \pi_T(M_0) - M_T(M_0) = 0$. Notice that holding fixed T, then

[1] Note that this definition embeds a tiebreaking rule: if there is a date $T+1$ such that $\frac{1-(\rho^f)^{(T+1)+1}}{1-\rho^f}V(M_0) = V(1-\epsilon^C)$, then both T and $T+1$ are valid graduation dates of our model (i.e., a measure zero set of opportunistic governments can be incentivized to mimic at date T). We adopt the convention that T is defined by the graduation date. Note also that this finite series is well defined for $\rho^f > 1$. In the knife edge case of $\rho^f = 1$, we have to instead define the finite series by the usual sum.

$\Delta(T, M_0)$ is a decreasing function of M_0, since π_T decreases in M_0 whereas M_T increases in M_0 due to the transition dynamics and Bayes' rule. Therefore, there is no other equilibrium with the same graduation date. Thus any other equilibrium must have a different graduation date. It suffices to show that there cannot be an equilibrium with a higher graduation date.

Suppose that there were another equilibrium with a higher graduation date. At the candidate equilibrium M_0^{**} with graduation date $T^{**} > T$, note that we must have $M_0^{**} < M_0^*$ from Lemma 1. We also recall that π_t is a decreasing function of M_0 from Bayes rule. Thus, we have for $M_0^{**} < M_0^*$

$$\pi_{T+1}(M_0^{**}) > \pi_{T+1}(M_0^*) = \epsilon^O + (1 - \epsilon^C - \epsilon^O)\frac{\pi_T(M_0^*)}{M_T(M_0^*)} = 1 - \epsilon^c$$

where the last line follows since $\pi_T(M_0^*) = M_T(M_0^*)$, since M_0^* was an equilibrium with graduation date T. But then $\pi_{T+1}(M_0^{**}) > 1 - \epsilon^c$, contradicting that M_0^{**} is an equilibrium. Thus, if there is an equilibrium, it is unique.[2]

A.B.2 Existence

The proof strategy for existence will proceed as follows. We will partition the M_0 set into intervals associated with graduation dates. We will then show that for each possible graduation date, there must be a crossing point of M and π above $M_0 = \epsilon^W$. Finally, we will show that at one date, this solution must lie in the interval of graduation dates.

We begin with $M_0 = \epsilon^W$. If we have

$$\rho^f \geq \rho^{f*} \equiv \frac{V(1 - \epsilon^C)}{V(\epsilon^O)} - 1$$

then we have a trivial equilibrium with graduation at $T = 0$. Let us assume this is not the case.

We will now need to show existence in two separate cases. We define a threshold value $\overline{\rho}^f$ by

$$V(\epsilon^O) = (1 - \overline{\rho}^f)V(1 - \epsilon^C).$$

Note that $\overline{\rho}^f < 1$ necessarily.

Existence when $\rho^{f*} > \rho^f > \overline{\rho}^f$.

The first case is the case where $\rho^f > \overline{\rho}^f$, that is $V(\epsilon^O) > (1 - \overline{\rho}^f)V(1 - \epsilon^C)$. Given this, we know there is a graduation date $\overline{T} < \infty$ associated with ϵ^O.[3] In other words, $\overline{T}$ is the largest possible date such that

$$\frac{1 - (\rho^f)^{\overline{T}+1}}{1 - \rho^f}V(\epsilon^W) < V(1 - \epsilon^C).$$

We now define the following indifferent points for each $t \leq \overline{T}$. We define M_0^t for $t \leq \overline{T}$ by

$$\frac{1 - (\rho^f)^{t+1}}{1 - \rho^f}V(M_0^t) = V(1 - \epsilon^C),$$

[2]For completeness, note that the above argument rules out $T = \infty$ if a finite equilibrium exists, and also note that if there were hypothetically an equilibrium at $T = \infty$ it must be unique and associated with $\frac{1}{1-\rho^f}V_0(M_0) = V(1 - \epsilon^C)$.

[3]If $\rho^f \geq 1$ then this follows trivially, while if $\overline{\rho}^f < \rho^f < 1$ it follows since the limit of the finite series is $\frac{1}{1-\rho^f}V(\epsilon^O) > V(1 - \epsilon^C)$.

that is to say M_0^t is the highest value of M_0 such that graduation occurs at date t. Because we have analogously defined M_0^{t+1} as the solution to

$$\frac{1-(\rho^f)^{t+2}}{1-\rho^f}V(M_0^{t+1}) = V(1-\epsilon^C),$$

then we know that the interval $\mathbf{M}_t = [M_0^{t+1}, M_0^t]$ is the range of values M_0 such that graduation occurs at date t. By convention, $M_0^{\overline{T}+1} = \epsilon^O$, since all $M_0 \leq M_0^{\overline{T}}$ lead to graduation at $\overline{T}$.

We know there is not an equilibrium with graduation at $T = 0$ (given we assumed we are below that threshold case), and so we start directly at $T = 1$. Note that by definition, we have $M_1(M_0^1) = 1 - \epsilon^C$, since $V(M_1(M_0^1)) = V_0(1-\epsilon^C)$. However, because $M_0^1 > \epsilon^O = \pi_0$, we have

$$\pi_1(M_0^1) = \epsilon^O + \left(1 - \epsilon^C - \epsilon^O\right)\frac{\pi_0}{M_0^1} < 1 - \epsilon^C = M_1(M_0^1).$$

Given we know that M_1 increases in M_0, π_1 decreases in M_0, and $\pi_1(\epsilon^O) = 1 - \epsilon^C > M_1(\epsilon^O)$, then by continuity there exists $M_0^{1*} \in [\epsilon^O, M_0^1]$ such that $M_1(M_0^{1*}) = \pi_1(M_0^{1*})$. If $M_0^{1*} \geq M_0^2$, then $M_0^{1*} \in \mathbf{M}_1$ and so is a feasible graduation date. In this case, we have found an equilibrium.

Suppose instead that $M_0^{1*} < M_0^2$, and we have not found an equilibrium. Now we move to search for an equilibrium with graduation at $T = 2$. By construction, we have $M_2(M_0^2) = 1 - \epsilon^C$ since $V(M_2(M_0^2)) = V(1-\epsilon^C)$. Moreover, since $M_0^{1*} < M_0^2$, then we have

$$\pi_1(M_0^2) < \pi_1(M_0^{1*}) = M_1(M_0^{1*}) < M_1(M_0^2).$$

Therefore, we have $\pi_2(M_0^2) < 1 - \epsilon^C = M_2(M_0^2)$ from Bayes' rule. Because $\pi_1(\epsilon^O) = 1 - \epsilon^C > M_1(\epsilon^O)$, then we have $\pi_2(\epsilon^O) \geq 1 - \epsilon^C \geq M_2(\epsilon^O)$. Therefore, by continuity there exists a point $M_0^{2*} \in [\epsilon^O, M_0^2]$ such that $M_2(M_0^{2*}) = \pi_2(M_0^{2*})$. If $M_0^{2*} \geq M_0^3$, then we have $M_0^{2*} \in \mathbf{M}_2$ and we have found a valid equilibrium.

The proof proceeds iteratively from here. Suppose that at step T if we have not yet found an equilibrium for $t < T$. By definition, we have $M_T(M_0^T) = 1-\epsilon^C$. Taking the solution $M_0^{(T-1)*} < M_0^T$ from the previous step, we have

$$\pi_{T-1}(M_0^T) < \pi_{T-1}(M_0^{(T-1)*}) = M_1(M_0^{(T-1)*}) < M_1(M_0^T),$$

and therefore we have from Bayes' rule that $\pi_T(M_0^T) < 1 - \epsilon^C$. Since $\pi_2(\epsilon^O) \geq 1 - \epsilon^C \geq M_T(\epsilon^O)$, then there exists a crossing point M_0^{T*} at T. If $M_0^{T*} \in \mathbf{M}_T$ then we are done, and if not we continue. Finally, observe that at $T = \overline{T}$ we have $\mathbf{M}_{\overline{T}} = [\epsilon^O, M_0^{\overline{T}}]$. Thus if we find an equilibrium before $\overline{T}$ we are done. If we have not found an equilibrium at $\overline{T}$, then we have $M_0^{\overline{T}} \in \mathbf{M}_{\overline{T}}$ and we have found a valid equilibrium. Therefore, an equilibrium exists if $\rho^{f*} > \rho^f > \overline{\rho}^f$.

Case of $\rho^f < \overline{\rho}^f$

In this case, define the point M_0^∞ as the solution to $\frac{1}{1-\rho^f}V(M_0^\infty) = V(1-\epsilon^C)$. The point M_0^∞ is the starting point such that $M_t \to 1 - \epsilon^C$ as $t \to \infty$. Now, consider the infinite sequence generated by starting point M_0^∞. We have evolution of reputation

$$\pi_t = \epsilon^O + (1 - \epsilon^C - \epsilon^O)\frac{\pi_{t-1}}{M_{t-1}}.$$

Given the limiting behavior of M_t, the limiting fixed point of beliefs is

$$\pi_\infty = 1 - \epsilon^C.$$

This tells us that the sequence associated with M_0^∞ converges in limit according to $M_t(M_0^)) \to 1-\epsilon^C$ and $\pi_t(M_0^\infty) \to 1 - \epsilon^C$. We now prove a result on how this convergence happens.

Lemma 3 *Suppose that $M_0 = M_0^\infty$. Then if $\pi_t > M_t$ for some t, then $\pi_{t+s} > M_{t+s}$ for all $s \geq 0$.*

Proof of Lemma 3. *If $\pi_t > M_t$, then we have*

$$\pi_{t+1} > \epsilon^O + (1 - \epsilon^C - \epsilon^O)\frac{\pi_t}{M_t} > 1 - \epsilon^C > M_{t+1}$$

where the last line follows since M_{t+1} converges to $1 - \epsilon^C$ from below. From here the argument follows immediately for all $s > 1$ from the same step.

Lemma 3 tells us that there are only two possible manners of convergence of π_t to π_∞. The first is convergence from below, in which case $\pi_t \leq M_t$ for all t. If it happens to be the case that convergence happens from below, then we would have an equilibrium with $T = \infty$.

Otherwise, suppose that convergence is from above. We denote $\underline{T}$ to be the first date at which $\pi_{\underline{T}}(M_0^\infty) \geq M_{\underline{T}}(M_0^\infty)$. Note that this crossing point must satisfy $\pi_{\underline{T}}(M_0^\infty) < 1 - \epsilon^C$, since by definition of $\overline{T}$ we have $\pi_{\underline{T}}(M_0^\infty) < M_{\underline{T}}(M_0^\infty)$

First, we note that it is not possible for an equilibrium to occur at any $M_0 < M_0^\infty$. To understand why, for any such point the limiting behavior of the transition dynamics is $M_\infty(M_0) < M_\infty(M_0^\infty) = 1 - \epsilon^C$, but the limiting behavior of beliefs lies above $1 - \epsilon^C$. Thus, we can restrict attention to $M_0 \geq M_0^\infty$.

First, we note that it cannot be the case that graduation occurs for $T < \underline{T}$. To understand why, by definition of $\underline{T}$ we have we have $\pi_T(M_0) < \pi_T(M_0^\infty) \leq M_T(M_0^\infty) \leq \pi_T(M_0)$ for $T < \underline{T}$ and $M_0 \geq M_0^\infty$.

Now, let us take the date $\underline{T}$. Suppose first that we have a strict inequality, $\pi_{\underline{T}}(M_0^\infty) > M_{\underline{T}}(M_0^\infty)$. We know that $\pi_{\underline{T}}(1-\epsilon^C) < M_T(1-\epsilon^C)$, so we know there exists a crossing point $M_0^{\underline{T}*} \in [M_0^\infty, 1-\epsilon^C]$. We additionally know that this crossing point satisfies $M_0^{\underline{T}*} < M_0^{\underline{T}}$, where $M_0^{\underline{T}}$ is the threshold for graduation at $\underline{T}$ as defined in the previous part of the proof. To understand why this is the case, note that by definition $M_{\underline{T}}(M_0^{\underline{T}}) = 1 - \epsilon^C$ and $\pi_{\underline{T}}(M_0^\infty) < 1 - \epsilon^C$, so because $M_{\underline{T}}$ is increasing in M_0 and $\pi_{\underline{T}}$ is decreasing crossing must happen below $M_0^{\underline{T}}$. If $M_0^{\underline{T}*} \in \mathbf{M}_{\underline{T}}$, then we have found an equilibrium and are done. If $M_0^{\underline{T}*} < M_0^{\underline{T}+1}$, then we can proceed as follows. Define $\overline{T} > \underline{T}$ to be the graduation date associated with $M_0^{\underline{T}*}$, define $\mathbf{M}_t$ in the usual way for $\underline{T}+1 \leq t \leq \overline{T}-1$, and define $\mathbf{M}_{\overline{T}} = [M_0^{\underline{T}*}, M_0^{\overline{T}}]$. We have that $\pi_t(M_0^{\underline{T}*}) \geq 1 - \epsilon^C > M_t(M_0^{\underline{T}*})$ for all $\underline{T} \leq t \leq \overline{T}$. Because $M_0^{\underline{T}*} < M_0^{\underline{T}+1}$, then $\pi_{\underline{T}+1}(M_0^{\underline{T}+1}) < \pi_{\underline{T}+1}(M_0^{\underline{T}*}) = 1 - \epsilon^C = M_{\underline{T}+1}(M_0^{\underline{T}+1})$. Therefore, we have a single crossing point $M_0^{(\underline{T}+1)*}$ From here, the argument proceeds as in the previous case, where we note that the condition $\pi_{\overline{T}}(M_0^{\underline{T}*}) \geq 1 - \epsilon^C > M_{\overline{T}}(M_0^{\underline{T}*})$ tells us that if we have not found an equilibrium by date $\overline{T}$, then we must have $M_0^{\overline{T}*} \in \mathbf{M}_{\overline{T}}$, yielding a valid equilibrium.

It now remains only to handle the case where $\pi_{\underline{T}}(M_0^\infty) = M_{\underline{T}}(M_0^\infty)$. We note that although these paths cross, this is not a valid equilibrium because $\underline{T}$ is not the graduation date of M_0^∞. In this case, we know that $\pi_{\underline{T}+1}(M_0^\infty) = 1-\epsilon^C > M_{\underline{T}+1}(M_0^\infty)$. Therefore, let us consider a point $M_0^\epsilon = M_0^\infty + \epsilon$. For sufficiently small ϵ, by continuity we have $1 - \epsilon^C = M_{\underline{T}+1}(M_0^{\underline{T}+1}) > \pi_{\underline{T}+1}(M_0^\epsilon) > M_{\underline{T}+1}(M_0^\epsilon)$

and, since $M_0^\epsilon < M_0^{\underline{T}+1}$, we have $\pi_{\underline{T}+1}(M_0^{\underline{T}+1}) < \pi_{\underline{T}+1}(M_0^\epsilon)$. Therefore, we have a crossing point $M_0^{(\underline{T}+1)*} \in [M_0^\epsilon, M_0^{\underline{T}+1}]$. If $M_0^{(\underline{T}+1)*} \in \mathbf{M}_{\underline{T}+1}$ we are done. Otherwise, we define $\overline{T}$ as the graduation date associated with $M_0^{(\underline{T}+1)*}$ and define $\mathbf{M}_{\overline{T}} = [M_0^{(\underline{T}+1)*}, M_0^{\overline{T}}]$. From here the proof proceeds exactly as before.

Therefore, we also have an equilibrium for $\rho^f \leq \overline{\rho}^f$. This completes the existence proof.

A.C Proof of Proposition 2

The proof is essentially the same as that of Proposition 1. Fixing an opening up date $T^* \geq 0$, suppose that M_0^* is an equilibrium with associated graduation date $T \geq T^*$. As in the proof of Proposition 1, any equilibrium of the model must satisfy $\Delta(T, M_0) = \pi_T(M_0) - M_T(M_0) = 0$ and moreover π_T decreases in M_0 while M_T increases in M_0, meaning that there cannot be another equilibrium at T. It again suffices to show there cannot be another equilibrium with a higher graduation date.

We can construct the graduation date associated with a pair (M_0, T^*) as

$$T = T^* + \sup\left\{t \middle| \left(\frac{1-(\rho^f)^t}{1-\rho^f} + (\rho^f)^t \frac{1-(\rho^s)^{T^*+1}}{1-\rho^s}\right)\frac{g^s}{g^f} V(M_0) < V_0(0, 1-\epsilon^c)\right\}$$

where the proof follows from the same argument as Lemma 1. Therefore, higher M_0 is associated with a lower graduation date. Therefore, as in the proof of Proposition 1, a higher candidate graduation date $T^{**} > T$ has a candidate initial reputation $M_0^{**} < M_0^*$. From here, the contradiction proceeds from exactly the same steps as in the proof of Proposition 1.

A.D Appendix Extensions

A.D.1 Domestic Debt Issuance

Suppose that in addition to inside equity A, there is also an amount $D_t^d \leq \overline{D}^d$ available to borrow from domestic households. Households inelastically save domestically at the equilibrium interest rate R_t (equivalently, the government can apply a tax/subsidy on savings). Moreover, there is financial repression: domestic households are forced to maintain their investment in the bank at date 1 without collateral. It follows immediately that from the government's perspective, domestic household savings and inside equity are equivalent given financial repression, that is the model is equivalent to one where inside equity is $A^* = A + \overline{D}^d$. In the high state, banks earn $R^H(\gamma QI - R_t(D_t + \overline{D}^d)$ and households receive return $R_H \overline{D}^d$, so the total value to domestic intermediaries and households is $R^H(\gamma QI - R_t D_t)$. In the low state, financial repression forces households to roll over $\overline{D}^d$ at interest rate $R^L - \tau$, which gives final payoff to households of $(R^L - \tau)R_t\overline{D}^d$ and reduces final payoff to intermediaries by the same amount.

A.D.2 Transition Dynamics with R_H

We now relax the simplifying assumption on R_H we made in the main text. The indifference condition of the transition dynamics did not depend on the high state, so we have

$$V(M_t) + \beta W_{t+1} = g(h_t)V(M_t) + \beta W_0$$

$$W_{t+1} = \frac{1}{\beta}\Big(g(h_t) - 1\Big)V(M_t) + W_0$$

as before. However, the Bellman equation for W_t is now

$$W_t = \pi_H \Big(G(h_t)V(M_t) + \beta W_t \Big) + \pi_L \Big(g(h_t)V(M_t) + \beta W_0 \Big)$$

where we have $G(h_t) \equiv \frac{R_H}{\frac{h_t}{\gamma - \frac{1-h_t}{R^L}}}$ now in place of $g(h_t)$. Note that $G(h_t)$ is the proportional gain from realizing the high state relative to the low state. From here, we have

$$W_0 = \frac{\pi_H G(h_0) + \pi_L g(h_0)}{1-\beta} V(M_0)$$

$$W_{t+1} = \frac{\pi_H G(h_{t+1}) + \pi_L g(h_{t+1})}{1-\beta\pi_H} V(M_{t+1}) + \frac{\pi_L \beta}{1-\beta\pi_H} W_0$$

Thus, substituting back into the indifference condition, we obtain

$$\Big(\pi_H G(h_{t+1}) + \pi_L g(h_{t+1}) \Big) V(M_{t+1}) = g(h_t)\rho_t V(M_t) + \Big(\pi_H G(h_0) + \pi_L g(h_0) \Big) V(M_0)$$

which reduces to

$$V(M_{t+1}) = \frac{g(h_t)}{\pi_H G(h_{t+1}) + \pi_L g(h_{t+1})} \rho_t V(M_t) + \frac{\pi_H G(h_0) + \pi_L g(h_0)}{\pi_H G(h_{t+1}) + \pi_L g(h_{t+1})} V(M_0).$$

Let us now redefine the rate of convergence as

$$\varrho(h_t) = \frac{g(h_t)}{\pi_H G(h_t) + \pi_L g(h_t)} \rho(h_t)$$

and define the expected gain as

$$\overline{g}(h_t) = \pi_H G(h_t) + \pi_L g(h_t).$$

Then, the transition dynamic is

$$V(M_{t+1}) = \frac{\overline{g}(h_t)}{\overline{g}(h_{t+1})} \varrho(h_t) V(M_t) + \frac{\overline{g}(h_0)}{\overline{g}(h_{t+1})} V(M_0),$$

which is precisely the same form as in the main text up to the revised definitions. If there is a single investor, it is the same equation with the new definition of rate of convergence, and the rate of convergence is lower if $G^f > g^f$. It is notable that it is no longer trivial that $\overline{g}^f < \overline{g}^s$. The reason is that $G^f > G^s$ if R^H is a constant, i.e. the proportional gains from the good state are higher when the haircut is larger. As long as the effect of proportional gains from imposing capital controls dominates this latter effect, we have the same jump dynamics as in the baseline model.

Appendix Figures and Tables

Table A.I: RMB Investment in CPIS

	Reporting								RMB position 2020	
Country (ISO-3)	2013	2014	2015	2016	2017	2018	2019	2020	Value (USD mill.)	Share
1. JPN	0	0	0	0	1	1	1	1	14004.99	33.623
2. USA	0	0	0	1	1	1	1	1	12021.00	28.860
3. NLD (EMU)	1	1	1	1	1	1	1	1	4689.98	11.260
4. CYM	0	0	0	0	1	1	1	1	3937.00	9.452
5. KOR	0	0	0	1	1	1	1	1	2210.10	5.306
6. DEU (EMU)	0	0	0	1	1	1	1	1	2003.85	4.811
7. ZAF	0	0	0	0	1	1	1	1	703.12	1.688
8. FRA (EMU)	0	0	0	1	1	1	1	1	489.03	1.174
9. THA	0	0	0	1	1	1	1	1	399.60	0.959
10. MYS	0	0	0	0	1	1	1	1	362.66	0.871
11. PHL	0	0	0	1	1	1	1	1	285.40	0.685
12. AUT (EMU)	0	0	0	0	1	1	1	1	163.20	0.392
13. RUS	0	0	0	1	1	1	1	1	102.18	0.245
14. ITA (EMU)	0	0	0	1	1	1	1	1	94.57	0.227
15. IDN	0	0	0	0	1	1	1	1	65.82	0.158
16. BEL (EMU)	0	0	0	1	1	1	1	1	58.90	0.141
17. CAN	0	0	0	1	1	1	1	1	24.11	0.058
18. KWT	0	0	0	0	0	1	1	1	13.41	0.032
19. PRT (EMU)	0	0	0	1	1	1	1	1	11.67	0.028
20. MEX	0	1	1	1	1	1	1	1	8.12	0.019
Others									0.21	0.001
Total	3	5	6	22	38	41	42	40	41653.00	100.000

Notes: Table shows summary statistics for RMB portfolio investment reporting to CPIS. The series used in the analysis are the total debt securities denominated in RMB by country, reported in CPIS Table 2 (IMF). Each one of the columns under *Reporting* is a dummy that takes the value of 1 whenever the country reports in the given year. Column *Value (USD mill.)* is the dollar value of RMB investments for each of the listed countries in 2020, while column *Share* is the share of the country in the total RMB world position in that year.

Table A.II: RMB investment in Morningstar

	Reporting								RMB position 2020	
Country (ISO-3)	2013	2014	2015	2016	2017	2018	2019	2020	Value (USD mill.)	Share
1. IRL (EMU)	1	1	1	1	1	1	1	1	13808.65	28.618
2. LUX (EMU)	1	1	1	1	1	1	1	1	13715.18	28.425
3. USA	1	1	1	1	1	1	1	1	10761.81	22.304
4. TWN	1	1	1	1	1	1	1	1	4955.68	10.271
5. CHE	1	1	0	1	0	1	1	1	1588.88	3.293
6. CAN	0	1	1	1	1	1	1	1	1170.37	2.426
7. GBR	1	1	1	1	1	1	1	1	747.07	1.548
8. HKG	1	1	1	1	1	1	1	1	703.35	1.458
9. DEU (EMU)	1	1	1	1	1	1	1	1	150.77	0.312
10. AUT (EMU)	0	0	0	0	0	1	1	1	117.45	0.243
11. DNK	0	0	0	0	0	0	1	1	116.56	0.242
12. MUS	0	0	0	0	0	0	0	1	85.70	0.178
13. CYM	1	1	1	1	0	1	1	1	82.35	0.171
14. SGP	1	1	1	1	1	1	1	1	73.54	0.152
15. KOR	1	1	1	1	1	1	1	1	44.79	0.093
16. NZL	0	0	0	0	0	0	1	1	30.92	0.064
17. AUS	1	1	1	1	1	1	1	1	30.54	0.063
18. NLD (EMU)	0	0	0	0	0	0	0	1	23.50	0.049
19. JPN	0	0	0	0	0	0	1	1	19.84	0.041
20. SWE	0	0	0	0	0	1	1	1	13.17	0.027
Others									2.76	0.006
Total	19	21	15	17	15	18	23	24	48251.16	100.000

Notes: Table shows summary statistics for RMB portfolio investment in China showed in Morningstar, by investor country. Each one of the columns under *Reporting* is a dummy that takes the value of 1 whenever the country appears as having any Chinese holdings denominated in RMB in the given year. Column *Value (USD mill.)* is the dollar value of RMB positions in 2020 for each of the listed countries, while column *Share* is the share of the country in the total RMB world position seen in Morningstar for that year.