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# Borrowing in the Shadow of China[†]

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**Abstract**

China's lending to emerging economies has considerably risen since the early 2000s and its debt contracts feature exceptional lender privileges. We argue that China's unusual lender discretion and power are akin to rollover risk for the borrowing countries. In a long-term sovereign debt model, non-defaultable rollover-prone China debt exposes the recipient's market debt to dilution risks, which in turn makes the country's borrowing more disciplined: following a loan inflow from China, the borrower rebalances its debt portfolio away from market debt and enjoys lower spreads in the process. We find that market debt and bond yield dynamics in the data are consistent with this *disciplining effect*. Finally, we use the model to show how geopolitical shocks such as a China sudden stop or retrenchment alter the desirability of the subsidized loans it offers.

Keywords: Sovereign Debt, Default, China's Overseas Lending, Geopolitical Risk.
JEL classification codes: F34, F41.

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# 1 Introduction

In recent decades, the global landscape of sovereign debt has been reshaped by the rise of China as a major lender to emerging and developing economies. Table 1 illustrates the significant role China now plays in the global financial architecture for developing countries: Chinese overseas lending now rivals the scale of traditional official creditors or international capital market debt.

Table 1: Rising Chinese Debt Obligations

| | Number of Countries with | | Debt vis-à-vis China relative to | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | GDP (in pct.) | | External Bond Debt | | External Debt | |
| Year | Positive China Debt | China Inflow | Mean | Median | Mean | Median | Mean | Median |
| 2000 | 15 | 0 | 0.42 | 0.32 | 0.78 | 0.02 | 0.01 | 0.00 |
| 2005 | 59 | 18 | 1.01 | 0.36 | 1.14 | 0.06 | 0.03 | 0.01 |
| 2010 | 93 | 73 | 3.98 | 1.67 | 0.74 | 0.13 | 0.33 | 0.10 |
| 2015 | 100 | 97 | 8.47 | 5.08 | 1.99 | 0.69 | 0.69 | 0.27 |
| 2017 | 101 | 101 | 8.66 | 5.06 | 2.10 | 0.55 | 0.61 | 0.22 |

Note: We include countries with a positive debt stock vis-à-vis China using data from Horn, Reinhart, and Trebesch (2021) from 2000 to 2017, when their sample ends.

While Chinese loans may be subsidized like other of official debt (e.g., Paris Club debt or World Bank debt), China's overseas lending also differs in critical ways (Gelpern, Horn, and Trebesch, 2021; Horn et al., 2021): China often has unique seniority privileges and its debt repayment schedules may be opaque or uncertain through debt disclosure restrictions and debt acceleration rights. These features mean that borrowers cannot easily walk away from this debt obligations. In that sense, these lending practices may embody China's geopolitical power, exercised by deciding when or whether loans are offered or rolled over.

Yet, countries borrowing from China also have large debt obligations to other lenders, especially private lenders on international capital markets (see Table 1). Debt obligations vis-à-vis China therefore raise a central question: how does the presence of such rollover-prone, potentially non-defaultable loans affect a country's relationship with international debt markets?

On the one hand, subsidized inflows from China relax borrowing constraints and reduce reliance on costly private debt. On the other hand, when repayments or restructurings occur, countries may have to lever up on market debt under adverse conditions, generating higher and more volatile spreads. The asymmetric power dynamics in China's lending contracts —where China can retrench but the sovereign cannot default— turn rollover risk into a geopolitical friction that jointly shapes market borrowing, spreads, and default dynamics.

This paper makes two contributions. First, we develop a quantitative model that extends the workhorse sovereign debt framework to include Chinese-style loans: subsidized, non-defaultable, but subject to rollover risk determined outside the country's control. In this setup, China's lender "power" resides in its ability to enforce repayment and to decide when loans are rolled over, while the sovereign takes this process as exogenous. The model highlights a "disciplining effect" of Chinese loans: when the country receives an inflow it delevers from the market, anticipating that when the outflow comes it will need to tap private markets to help finance the repayment and maintain a smooth consumption path. This disciplining effect implies that inflows from China are associated with lower market issuance and reduced spreads, a feature we confirm in the data (using an extensive dataset on Chinese funding events and debt stocks combined with bond-level issuance and pricing data).

Second, we use our quantitative model to conduct welfare experiments and to study different risk scenarios. We show that access to Chinese lending generates state-dependent gains. The inability to walk away from Chinese debt is a double-edged sword: it is essential to ensure welfare gains from more disciplined borrowing, but it also exposes countries to sharper risks when inflows stop. Extending the model to include the possibility of a permanent "Chinese retrenchment," we demonstrate that ignoring this risk can lead to excessive market indebtedness, more frequent defaults, and heightened consumption volatility. Our model highlights how geopolitical rollover risk emanating from powerful lenders can significantly alter access to international debt markets.

**Related literature.** The disclosure of China's international financing terms and arrangements often remains vague and sporadic, which has propelled a substantial body of literature aimed at shedding light on the specific characteristics and implications of China's extensive overseas lending. Notably, Horn, Reinhart, and Trebesch (2021) assemble a comprehensive dataset revealing that China has lent approximately $1.5 trillion to over 150 countries worldwide, a figure largely unreported by official sources. Complementarily, using information from AidData, Morris, Parks, and Gardner (2020) examine these lending terms and find that China's loans exhibit varying degrees of concessionality.

Prior literature has also focused on the effects of the funding inflows on the recipient economies. Onjala (2018) and Hurley, Morris, and Portelance (2019) identify that the receipt of funding from China puts countries at risk of debt distress. Bandiera and Tsiropoulos (2020) assess the sustainability of the public debt of countries that have China's infrastructure financing projects and find that in the medium term, at least 50% of these countries will face elevated debt vulnerability. Horn et al. (2021) highlight that there should have been an additional 15 to 20 "missing" defaults in the post-2010 period, which creates challenges for the debt sustainability analysis in loan recipient countries and the market pricing of the sovereign risk. In contrast, Dreher, Fuchs, Parks, Strange, and Tierney (forthcoming) show that China's funds boost the recipient country's economic growth in the short term, with continued benefits extending up to two years following project commitments. Jiang (2025) finds that China's overseas lending mitigates developing countries' exposure to the global financial cycle.

Our paper builds on the quantitative literature on sovereign defaults, following Eaton and Gersovitz (1981), Aguiar and Gopinath (2006), and Arellano (2008). In particular, we extend the workhorse model of sovereign default with long-term debt (Hatchondo and Martinez, 2009) to allow for official, non-defaultable debt with China. Changes in the level of debt vis-à-vis China imply net flows that are sometimes positive (in which case the model behaves as if the country experienced a transitory windfall) and sometimes negative (in which case the economy faces adverse terms similar to sudden stops). Since we model long-term debt, the issue of debt dilution is key to understanding the mechanisms at play (Hatchondo, Martinez, and Sosa-Padilla, 2016).[1] Mkhitaryan (2021) develops and quantitatively evaluates a sovereign debt model to explore China's overseas lending arrangements and predict the periods of unidentified defaults.

Given the official nature of the Chinese loans, our paper is naturally related to the literature concerned with the interaction between official and private sovereign debt. Recent additions to this literature include the works of Arellano and Barreto (2025), Liu, Liu, and Yue (2025), and Roldán and Sosa-Padilla (2025). We differ from these studies in our focus on Chinese debt and our emphasis on rollover risk as a main characteristic of this debt.[2] Finally, our analysis of retrenchment risk connects us to the growing literature on geopolitical risk and fragmentation (e.g., Clayton, Maggiori, and Schreger, 2024, Moro and Landi, 2024, and Bianchi, Horn, Rosso, and Sosa-Padilla, 2025). We contribute by noting that the risks of overlooking changes in the geopolitical landscape can be significant.

[1] We are also related to other papers in this literature that study the impacts of rollover risk (e.g., Hur and Kondo, 2016, Johri, Khan, and Sosa-Padilla, 2022, Bianchi, Hatchondo, and Martinez, 2018, and Barbosa-Alves, Bianchi, and Sosa-Padilla, 2024, among many others).

[2] Boz (2011) and Hatchondo, Martinez, and Onder (2017) also study the implications of having non-defaultable debt in the standard sovereign debt model.

# 2 Model

Our starting point is the canonical model of sovereign default with long-term debt (e.g., Hatchondo and Martinez, 2009, 2017). We modify the income process to include capital flows that capture both new Chinese lending events and Chinese loan restructuring events. In our benchmark model, informed by the empirical evidence on Chinese debt contracts (Horn et al., 2021; Gelpern et al., 2021), these capital flows vis-à-vis China are subsidized, non-defaultable, and taken as given by the borrowing economy.

## 2.1 Environment

**Preferences and income process.** The preferences are given by

$$\mathbb{E}_t \sum_{j=t}^{\infty} \beta^{j-t} u\left(c_j\right) \ ,$$

where $\mathbb{E}$ denotes the expectation operator, $\beta$ stands for the subjective discount factor, and $c_t$ represents domestic consumption. The utility function is strictly increasing and concave.

The economy's endowment of the single tradable good is denoted by $y \in Y \subset \mathbb{R}_{++}$. This endowment follows a Markov process.

**Capital flows vis-à-vis China.** We assume the small open economy is a net borrower from China. We make the simplification that Chinese loans are subsidized and require no debt service until they are due. Thus, the economy's Chinese debt position $b_{c,t}$ fluctuates exogenously between low ($L$) and high ($H$) values, that is: $b_{c,t} \in \{L, H\}$, with $L < H$. These debt obligations with China are non-defaultable, in line with the reported seniority of Chinese debt (Horn et al., 2021).

We capture the uncertainty and opacity of Chinese debt contracts (Gelpern et al., 2021) by making the Chinese debt due dates and inflows dates random. We assume the transition $a_t \equiv \mathbb{1}\left\{b_{c,t+1} \neq b_{c,t}\right\}$ is drawn independently such that $\Pr(a_t = 1) = \pi$. The parameter $\pi$ effectively governs the maturity and rollover risk arising from Chinese loans.

Transitioning between low and high debt positions implies capital flows vis-à-vis China of size $z_t = H - L > 0$ during inflows and $z_t = L - H < 0$ during outflows. In our model, the risks and rewards associated with these subsidized, stochastic, and non-defaultable capital flows to/from China ultimately influence the government borrowing choices in international capital markets.

**Market debt.** The government borrows on capital markets using long-duration bonds. As in Hatchondo and Martinez (2009), we assume a bond issued in period $t$ promises an infinite stream of coupons, which decreases at a constant rate $\delta$. With this payment structure, all future payment obligations derived from past debt issuances map into a one-dimensional state variable: the payment obligations that mature in the current period, $b_t$. Hence, debt dynamics can be represented as follows:

$$b_{t+1} = (1-\delta)b_t + \ell_t,$$

where $b_t$ is the incoming debt level in period $t$, and $\ell_t$ is new long-term debt issued in period $t$. The government owes a coupon payment $\kappa b_t$ on the outstanding debt $b_t$ at date $t$.

**Market debt defaults.** The government cannot commit to future market debt repayment or future market borrowing decisions.[3] When the government defaults, it does so on all current and future market debt obligations. This is consistent with the observed behavior of defaulting governments and it is a standard assumption in the literature.[4]

A default event triggers exclusion from the debt market for a stochastic number of periods, but does not disrupt capital flows to or from China. Furthermore, every period in which the government is excluded from debt markets, income is lower and given by $y - \phi(y)$. Starting the first period after the default period, with a constant probability $\theta \in [0, 1]$, the government may regain access to debt markets and exit default without debt.

**Timing.** The timing of events within each period is as follows. First, the government learns the economy's income and the realization of $a$ (which controls the *net flows* and positions vis-à-vis China). Then, the government chooses whether to default on its market debt ($d = 1$) or not ($d = 0$) on its incoming debt $b$ to the market. Finally, the government chooses its market debt positions, subject to the constraints imposed by its default decision.

[3]Thus, one may interpret this environment as a game in which the government making decisions in period $t$ is a player who takes as given the (repayment and borrowing) strategies of other players (governments) who will decide after $t$.

[4]Sovereign debt contracts often contain an acceleration clause and a cross-default clause. The first clause allows creditors to call the debt they hold in case the government defaults on a payment. The cross-default clause states that a default in any government obligation constitutes a default in the contract containing that clause. These clauses imply that after a default event, future debt obligations become current.

## 2.2 Recursive formulation

There are four state variables: one endogenous and three exogenous. The endogenous state variable is the market debt level, $b$. The exogenous state variables are $y$ (the income level), $b_c$ (the Chinese debt level), and $a$ (the random variable triggering non-zero Chinese net flow). Let us denote $s \equiv (a, y)$.

**Value functions.** Let $V$ denote the government's value function at the beginning of a period–that is, before the default decision $d$ is made–and let $V_d$ denote the value function of a sovereign choosing the default option $d$. For any bond price function $q$, the government value function $V$ satisfies the following functional equation:

$$V\,(b, b_c, s) = \max_{d \in \{0,1\}} \Big\{ d\, V_1(b_c, s) + (1-d)\, V_0(b, b_c, s) \Big\}, \tag{1}$$

where the value of default is

$$V_1(b_c, s) = u\big(y - \phi(y) + z(b_c, a)\big) + \beta\, \mathbb{E}_{s'|s} \Big[ \theta V(0, b_c', s') + (1-\theta) V_1(b_c', s') \Big], \tag{2}$$

and the value of repayment satisfies

$$V_0(b, b_c, s) = \max_{b'} \Big\{ u(c) + \beta\, \mathbb{E}_{s'|s} V(b', b_c', s') \Big\}, \tag{3}$$

subject to

$$c + \kappa b = y + q(b', b_c', s)(b' - (1-\delta)b) + z(b_c, a) \tag{4}$$

with

$$z(b_c, a) = b_c' - b_c = \begin{cases} H - L & \text{if } a = 1 \cap b_c = L \\ L - H & \text{if } a = 1 \cap b_c = H \\ 0 & \text{if } a = 0 \end{cases} \quad \text{and} \quad b_c' = \begin{cases} H & \text{if } a = 1 \cap b_c = L \\ L & \text{if } a = 1 \cap b_c = H \\ b_c & \text{if } a = 0 \end{cases} \tag{5}$$

where $z(b_c, a)$ represents net flows vis-à-vis China.[5]

**Bond pricing.** The small open economy also borrows from a large pool of risk-neutral foreign investors that discount future payoffs at the risk-free rate, $r$. The bond price $q$

[5] Unlike the income process $y$, the net China flow process $z$ does not have a Markov process representation.

satisfies the following functional equation:

$$q(b', b'_c, s) = e^{-r}\, \mathbb{E}_{s'|s} \left[1 - \hat{d}\left(b', b'_c, s'\right)\right] \left[\kappa + (1-\delta)\, q\left(\hat{b}\left(b', b'_c, s'\right), b''_c, s'\right)\right], \tag{6}$$

where $\hat{d}$ and $\hat{b}$ denote the future default and borrowing rules that lenders expect the government to follow.

The first term in the right-hand side of equation (6) equals the expected value of the next-period coupon payment promised in a bond. The second term equals the expected value of all other future coupon payments, which is summarized by the expected price at which the bond could be sold next period.

### 2.3 Equilibrium definition

A Markov Perfect Equilibrium is characterized by

1. a default rule $\hat{d}$ and a borrowing rule $\hat{b}$,
2. a bond price function $q$,

such that:

(a) given $\hat{d}$ and $\hat{b}$, the bond price function $q$ is given by equation (6); and

(b) the default rule $\hat{d}$ and borrowing rule $\hat{b}$ solve the dynamic programming problem defined by equations (1)-(2), when the government can trade bonds at $q$.

## 3 Quantitative Analysis

**Functional forms and stochastic processes.** The utility function displays a constant coefficient of relative risk aversion, i.e.,

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma}, \text{ with } \gamma \neq 1.$$

The logarithm of the endowment follows an AR(1) process:

$$\log(y_t) = (1-\rho)\mu + \rho \log(y_{t-1}) + \varepsilon_t,$$

Table 2: Benchmark calibration parameter values.

| Parameter | Symbol | Value | Source |
|---|---|---|---|
| Default income cost - Intercept | $\lambda_0$ | 0.11 | Avg. market debt = 30% |
| Default income cost - Slope | $\lambda_1$ | 0.945 | Avg. spread = 3.55% |
| Risk aversion coefficient | $\gamma$ | 2.00 | Standard |
| Risk-free rate | $r$ | 0.04 | Standard |
| Discount factor | $\beta$ | 0.90 | Standard |
| Market re-entry probability | $\theta$ | 0.20 | $\mathbb{E}$(exclusion) = 5 years |
| Debt duration | $\delta$ | 0.168 | Debt duration = 5 years |
| Bond coupon | $\kappa$ | $(r+\delta)\,e^{-r}$ | Risk-free bond price = $e^{-r}$ |
| Income process - autocorrelation | $\rho$ | 0.784 | GDP fluctuations (PWT) |
| Income innovations - standard deviation | $\sigma_\epsilon$ | 0.033 | GDP fluctuations (PWT) |
| Income process - average | $\mu$ | $-\frac{1}{2}\sigma_\epsilon^2$ | $\mathbb{E}(y) = 1$ |
| Low China debt | $L$ | 0.00 | Normalization |
| High China debt | $H$ | 0.05 | Max. China debt flow = 5.0% |
| Rollover probability | $\pi_a$ | 0.10 | China financing frequency |

with $|\rho| < 1$, and $\varepsilon_t \sim N\left(0, \sigma_\varepsilon^2\right)$. As in Chatterjee and Eyigungor (2012), we assume a quadratic loss function for income during a default episode:

$$\phi\left(y\right) = \max\left\{y\left[\lambda_0 + \lambda_1[y - \mathbb{E}(y)]\right], 0\right\}.$$

We assume that $a \in \{0, 1\}$ follows an iid process such that $a = 1$ with probability $\pi$.

**Calibration.** A period in the model refers to a year. Table 2 presents the parameter values in our benchmark model calibration.

The parameters above the line are the ones that we set by simulating the model and matching certain moments in the data. The income cost of defaulting is governed by $\lambda_0$ and $\lambda_1$: these are calibrated to match the mean market debt (30%) and the mean spread (3.55%) in our data.[6]

The coefficient of relative risk aversion, the risk-free interest rate, and the discount factor $\beta$ take standard values. We assume an average duration of sovereign default events of five years ($\theta = 0.20$), a number in the range of estimates reported in Gelos, Sahay, and Sandleris (2011) and Uribe and Schmitt-Grohé (2017).

The parameters governing the endowment process are estimated using real GDP data for the countries used in our empirical analysis (see Section 4.5). We set the income process persistence and innovation volatility parameters to $\rho = 0.784$ and $\sigma_\varepsilon = 3.3\%$ using the

[6] We define the spread as follows. Let $y(\cdot) = \frac{\kappa}{q(\cdot)} - \delta$ denote the yield to maturity. Then the spread (in percent) is defined as $s(\cdot) = 100 \times \left(\frac{1+y(\cdot)}{1+r} - 1\right)$.

average of cross-country estimates in our data. These values are in the range of typical values used in studies focusing on emerging economies and low-income countries.[7]

We set $\delta = 0.168$. With this value, the risk-free duration of the debt is 5 years, which is close to the average duration found in previous literature.[8] The coupon is normalized to $\kappa = (r + \delta)e^{-r}$, which ensures that a default-free bond (with the same coupon structure as our sovereign bonds) trades at a price of $e^{-r}$.

The capital flows vis-à-vis China are characterized by three parameters: $L$, $H$, and $\pi$. Since we only have two levels of Chinese debt in our model, we normalize $L$ to zero and set $H = .05$, the maximum annual change in Chinese debt stocks relative to GDP.[9] Looking at funding and restructuring events (vis-à-vis China) in our dataset we find a frequency of approximately 10% per year, and so we set $\pi = 0.10$.[10]

# 4 Results

We start by presenting the simulated moments produced by the benchmark calibration of our model and show that it is a reasonable approximation to data from low-income countries. We then study how the country's borrowing opportunities (as captured by the debt-spread menus) are affected by the presence of Chinese lending. Third, we show the typical dynamics around these funding events. Finally, we analyze the welfare implications of borrowing 'in the Shadow of China.'

[7] We estimate the persistence and the volatility of the residuals from detrended annual real GDP series using the Hodrick-Prescott filter. We use real GDP data from the Penn World Table version 10.01 (Feenstra, Inklaar, and Timmer, 2015) for the countries borrowing both from China and in international capital markets.

[8] We use the Macaulay definition of duration that, with the coupon structure in this paper, is given by $D = (1 + r)/(\delta + r)$, where $r$ denotes the risk-free rate. Using a sample of 27 emerging economies, Cruces, Buscaglia, and Alonso (2002) find an average duration of 4.77 years, with a standard deviation of 1.52 years. Bai, Kim, and Mihalache (2017) report an average debt duration of 6.7 years in a panel of 11 emerging economies.

[9] $L = 0$ is a normalization in the sense that we can adjust the income process for the stream of payments associated with $L > 0$. We use two approaches to construct $H$: in the first approach, we compute the maximum of flows using changes in debt stocks reported in Horn et al. (2021). In the other approach, we use flows in Dreher et al. (forthcoming) constructed using micro-data on Chinese projects. These measures yield maximum inflow values of 3.8% and 5.8% of annual GDP. We set $H$ to 5%, close to their midpoint.

[10] Given the initial rise in Chinese loans disbursements, we focus on the period after 2005 to measure the frequency of inflow and restructuring events. Inflow events occur more often than restructuring events. Depending on how we define "large" inflows, we find inflow probabilities of 5% to 15%, whereas restructuring probabilities range between 3% and 6.5%. We set the symmetric probability $\pi$ to 10% and perform a robustness of our results using alternative values of $\pi$.

## 4.1 Simulations

Table 3: Simulated moments.

| Statistic | Baseline | Inflow | Outflow | $b'_c = H$ | $b'_c = L$ |
|---|---|---|---|---|---|
| Market Debt to GDP | 29.97 | 31.05 | 28.95 | 29.13 | 30.82 |
| Market Issuance to GDP | 5.99 | 2.72 | 8.96 | 5.53 | 6.45 |
| Consumption to GDP | 98.96 | 101.05 | 96.56 | 99.28 | 98.64 |
| Spread | 3.54 | 3.06 | 4.0 | 3.32 | 3.76 |
| S.D. Spread | 2.2 | 1.8 | 2.44 | 2.01 | 2.36 |
| Corr(Spread, GDP) | -0.63 | -0.62 | -0.67 | -0.65 | -0.63 |
| P(Default t+1) | 2.97 | 2.13 | 3.75 | 2.55 | 3.4 |
| Default Frequency | 2.59 | 2.9 | 2.24 | 2.31 | 2.87 |
| S.D. Consumption/S.D. GDP | 1.14 | 0.99 | 1.29 | 1.12 | 1.16 |

*Note*: Moments are computed for non-exclusion periods, except for the default frequency which uses all simulation periods. Units: percent (except for the correlations and relative volatilities).

The moments reported in Table 3 are chosen to illustrate the ability of the model to replicate distinctive business cycle properties of economies with sovereign risk as well as the dynamics emerging from the Chinese flows. The first column on this table (labeled 'Baseline') shows that our model approximates well the moments used as targets (average debt and spread levels) and is broadly consistent with non-targeted moments in the data. In both the model and data, consumption is more volatile than income and the sovereign spreads (computed as the difference in yields between the sovereign bonds and comparable default-free bonds) are volatile and countercyclical. Since we have long-term debt, it is not surprising that spreads are higher than the default frequency (which is approximately 2.5%).

The second and third columns in Table 3 report statistics conditioning on China 'funding events', i.e. conditioning on $a = 1$.[11] We can see that our model captures clear effects on both quantities and prices, which we later contrast with the empirical evidence in section 4.5. First, the issuance of market debt shows that the country actively changes its portfolio when hit by an $a$ shock. If experiencing a capital inflow, the economy chooses to rely less heavily on market debt, hence we see a decline in market issuances to roughly 3% (compared to an average of 6%). However, this decline in market debt is not one-to-one with the inflow from China: this implies that part of the Chinese inflow (coupled with the optimal issuance policy) is translating into higher consumption in those inflow periods (see also Figure 2). A similar behavior, with the opposite sign, is observed when the country undergoes a capital outflow vis-à-vis China: it taps private markets more heavily to offset the outflow but not fully –

[11] Recall, if $b_c = L \cap a = 1$ then the economy receives a capital inflow from China (second column of Table 3); if $b_c = H \cap a = 1$ then the economy experiences a capital outflow vis-à-vis China (third column of Table 3).

it also adjusts consumption down. Even though the average market debt issuance in these negative flow episodes is larger than the payments due to China, we see that consumption drops – this is due to the worse prices faced in these cases.[12]

With regards to sovereign spreads we see, as expected, that China outflow events are associated with higher and more volatile spreads than normal times. In the case of China inflows, we see the opposite behavior: the level and the volatility of the spreads are 50 and 40 basis points lower than in normal times, respectively. The price impact of Chinese inflows is a prediction of the model that we later on contrast with the data (see section 4.5).

We use the one-period-ahead default probability to assess how the China funding events affect default incentives along the simulations. An outflow event is accompanied by an increase in the default probability of roughly 1%. After the typical outflow, the country ends the period with a debt level of around 38% of GDP, leaving it especially vulnerable to negative income realizations in the near future – hence, the spread and one-period-ahead default probability are close to each other. On the contrary, when the borrowing country receives an inflow from China, it borrows less from the market and its one-period-ahead default probability falls substantially (to roughly 2%). The spread, however, prices in all future default probabilities, and market participants, understanding that those funds the country obtained from China will need to be paid down later on, charge a spread that is 1% higher than the immediate default probability – this reflects the pricing of dilution risk (Hatchondo et al., 2016).[13]

## 4.2 Effects on borrowing opportunities and policy functions

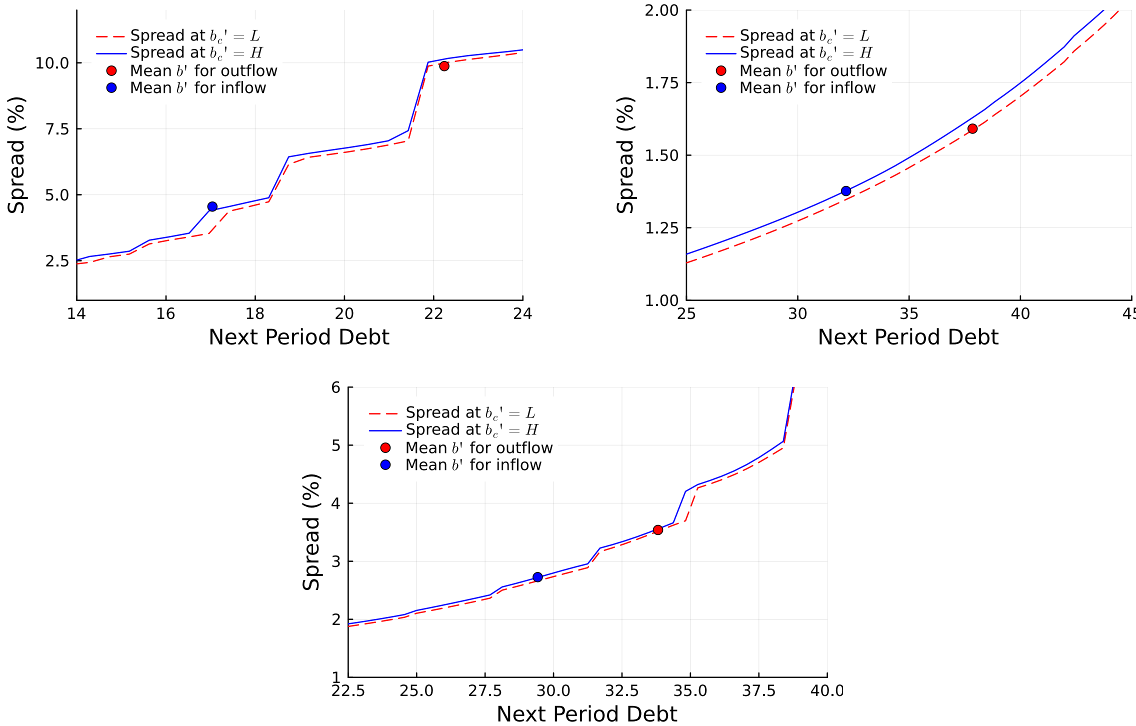
Figure 1 shows the borrowing opportunities faced by the small open economy. It presents the spread–debt menus for different values of current income (below, at, and above the median) and for the two possible values of $b'_c$, high or low.[14]

[12]Not only do consumption levels move with Chinese flows, but also the relative volatility changes: inflows make consumption less volatile while outflows make it more volatile than in normal times.

[13]The last two columns of Table 3 present the statistics of interest conditioning on the value of $b'_c$, but without conditioning on the realization of $a$. We discuss them in the next subsection.

[14]Notice that what matters for the price schedules is not the current level of $b_c$ nor period-t realization of $a$, but the end of period level of Chinese debt, $b'_c$.

Figure 1: Spread–debt menus

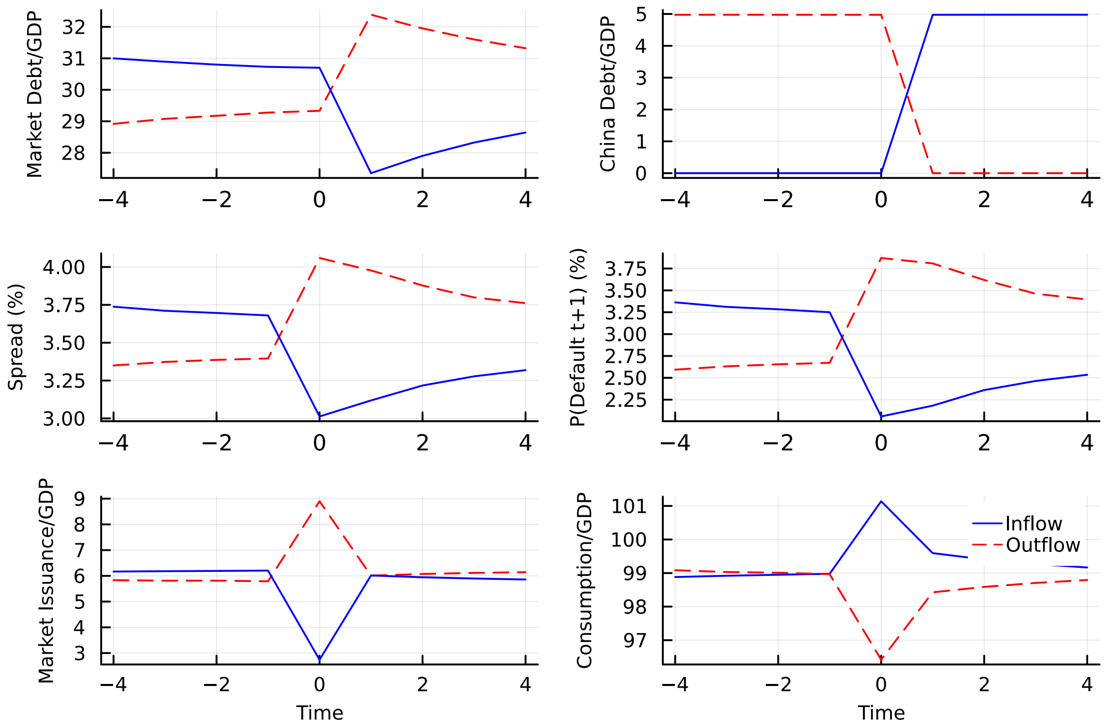



*Note*: The top left panel shows the spread–debt menu available to the economy when current income is approximately 10 percent below mean income ($y \approx 0.9$), the top right panel is for when current income is approximately 10 percent above mean ($y \approx 1.1$), and the bottom panel is for mean income ($y = 1$). The blue solid line is for the case when end-of-period Chinese debt is high ($b'_c = H$), and the red dashed line is for when it is low ($b'_c = L$). The dots denote the mean market debt chosen during an outflow (red) or an inflow (blue) in the simulation (during non-exclusion periods).

The panels in Figure 1 show that when the country carries a high level of Chinese debt into the next period (i.e., when $b'_c = H$) it faces worse borrowing terms, that is to say that for the same level of next-period market debt, the country needs to pay a higher spread. At the same time, the figure also shows that when the economy faces these worse price schedules, it endogenously chooses to rely less on market debt: the chosen portfolios (denoted with the dots in Figure 1) imply less market debt in these cases. This 'deleveraging' is such that, in equilibrium, the economy pays lower spreads on market debt when the end-of-period Chinese debt is high. The last two columns of Table 3 show that this is indeed the case in the simulations.

## 4.3 Dynamics around Chinese funding events

Figure 2: Dynamics around Chinese funding events




*Note*: The plots show the average dynamics for 4 years before and after a Chinese funding event (conditioning on no exclusion). Blue solid lines are for inflow events ($L \to H$) and red dashed lines are for outflow events ($H \to L$).

Figure 2 shows the dynamics of our model around China funding events, both inflows ($b_c$ moving from $L$ to $H$) and outflows ($b_c$ moving from $H$ to $L$). The clearest message comes from the behavior of market debt: we see that the economy rebalances its portfolio right after these events. In the case of a capital inflow from China, the country lowers its market debt (from roughly 31% to less than 28% of mean GDP), and therefore the equilibrium spreads also decrease on impact (by roughly 75 bps). In the case of a capital outflow from China, the economy increases its market debt (roughly from 29% to slightly over 32% of mean GDP), and it ends up paying higher spreads (roughly 50 bps higher).

Another feature observed in these dynamics is a slight asymmetry between a positive and a negative China flow: after an outflow consumption decreases slightly more (in absolute terms) than what it increases after a positive flow. This implies that the economy finances more the positive shock than the negative shock: this is due to the pricing of default risk. As the economy increases debt to finance the Chinese outflow the market price for its bonds moves against it which limits the equilibrium borrowing and triggers a larger consumption adjustment. Naturally, this asymmetric response is captured in the equilibrium spreads.

After the aforementioned portfolio re-balancing the market debt issuances move back to their mean and the debt levels slowly revert back to the mean. Spreads remain elevated for longer after an outflow: this is because the economy is more vulnerable to a bad income realization in the early periods after having to borrow to repay Chinese loans (as reflected in the higher one-period-ahead default probability). After inflows, spreads increase back to mean as the debt increases and the lenders also price in the probability of an outflow coming.

## 4.4 The disciplining effect

As hinted above, the presence of this official, non-defaultable and roll-over prone debt creates a "disciplining effect" for the borrowing country. This operates through the government's borrowing policy and then gets reflected in equilibrium prices and welfare.

**Debt choice probabilities.** We begin by using the the government's debt choice probabilities at different levels of income to illustrate the disciplining effect. Figure 3 displays these debt choice probabilities for three cases: (i) benchmark economy facing a CHN outflow, (ii) benchmark economy facing a CHN inflow, and (iii) a No-China economy.[15] In each of these cases, the government enters the period with a level of outstanding market equal to 30% of mean income.

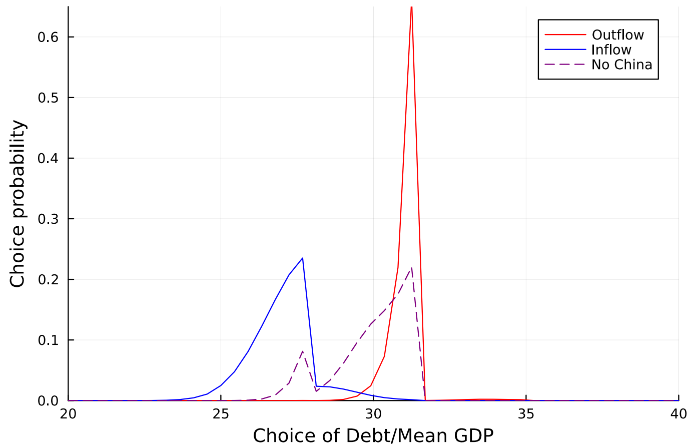
As we move across the panels (a)-(c), going from lower to higher income, a clear pattern emerges: when an outflow event happens, the economy levers up (in many cases borrowing more than in the No-China scenario); after an inflow event, the economy reduces its market debt exposure.

A second clear pattern is that the modal debt choice in the outflow state increases with income. This relates to how the price schedule reacts: for high income states, the debt price is less sensitive to the indebtedness level and so it is optimal to lever up more. At low income states, however, prices move against the country and become very sensitive to higher debt: we can see from panel (a) that the modal debt choice is the same as in the No-China case, even though the two economies have the same incoming levels of market debt and income.

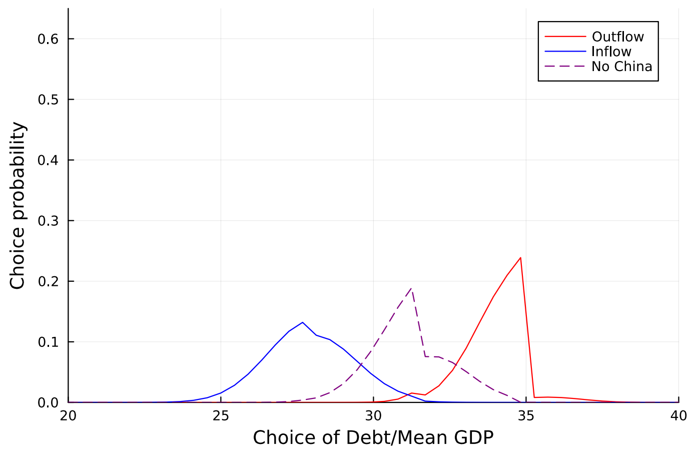
[15]The No-China economy is identical to our baseline model except that it is not a possibility to receive (nor pay) funds from (to) China. Parametrically, the No-China economy can be understood as setting the possible values of $b_c$ to $L = H = 0$.

Figure 3: Debt choice probabilities

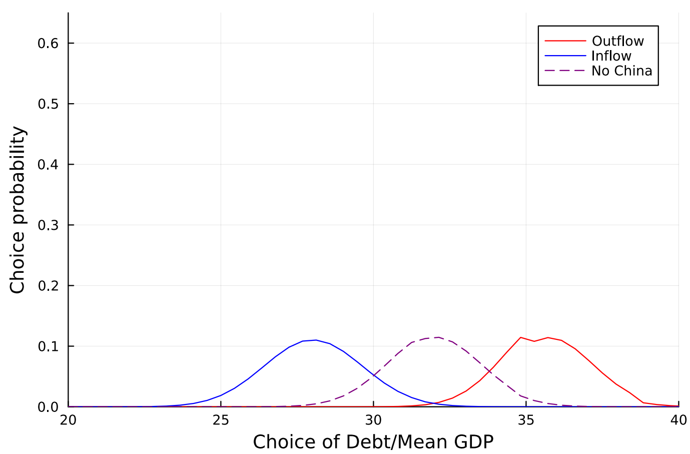
(a) Low Income: $\approx 0.95 \times \bar{y}$




(b) Mean Income: $\bar{y}$




(c) High Income: $\approx 1.05 \times \bar{y}$




*Note*: Each panel varies the level of initial income and presents debt choice probabilities for inflow and outflow events in the benchmark economy (blue and red solid lines, respectively) as well as for the No-China economy (dashed line). The incoming market debt level is set at 30% of mean income.

A third pattern is that the modal debt choice in the inflow states remain largely unchanged as income increases. The fact that the country chooses to delever in low-income states (with high marginal utility) by roughly the same amount as in high-income states (with low marginal utility) is telling of the disciplining effect of CHN debt: the government understands that there is a non-defaultable outflow coming after an inflow, and it chooses to create "fiscal space" (by reducing debt) to cope better with that. These debt choices are what explain the fact observed in the simulations: even though after an inflow event the country exits the period with more CHN debt, its spreads are lower—this is due to the deleveraging.

**Welfare.** This 'disciplining effect' that Chinese debt has on the borrowing country's behavior has implications for welfare. We defined the consumption-equivalent welfare gain of having access to Chinese loans as:

$$\Delta w = \left(\frac{V^{\text{Bench}}}{V^{\text{NC}}}\right)^{\frac{1}{1-\gamma}} - 1$$

There are two key factors that may cause a government to prefer living in a world with Chinese debt. The first is the higher net present value (NPV) of resources afforded by the Chinese loans (they are, after all, subsidized loans). The second factor is the disciplining effect of Chinese debt: the government's behavioral response to the debt flows results in different borrowing behavior and therefore different (more favorable) spreads.
To separate these two effects, we compute the lifetime utility of a government in the benchmark economy who does not benefit from the NPV of the Chinese debt flows. This government has $\tau$ units less of consumption every period, where the NPV of $\tau$ equals the NPV of the Chinese debt flow.[16] We refer to the government's value function in this setting as $V^{\text{Bench.Net.NPV}}(\cdot)$. With this new value in hand, we decompose the welfare gain as follows:

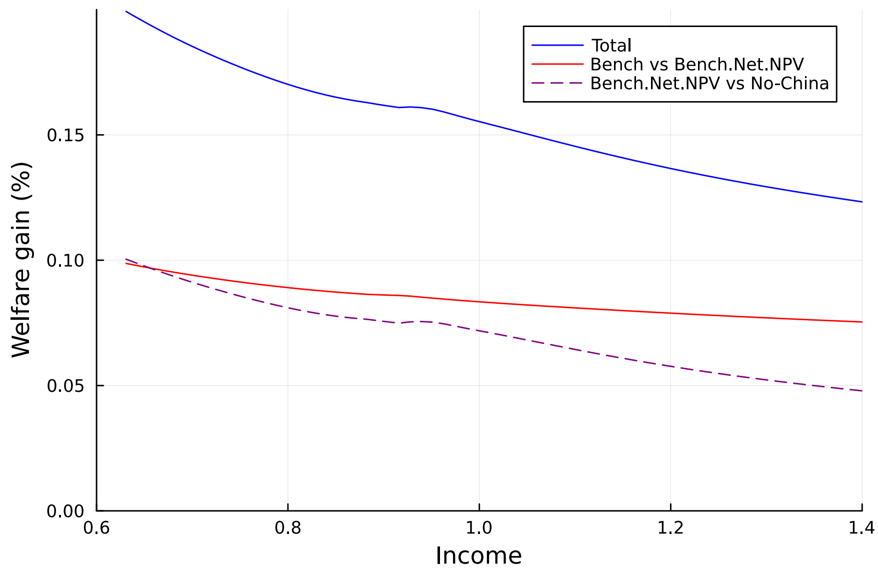
$$\Delta w = \left(\frac{V^{\text{Bench}}}{V^{\text{Bench.Net.NPV}}}\right)^{\frac{1}{1-\gamma}} \cdot \left(\frac{V^{\text{Bench.Net.NPV}}}{V^{\text{NC}}}\right)^{\frac{1}{1-\gamma}} - 1\,.$$

The term $\left(\frac{V^{\text{Bench}}}{V^{\text{Bench.Net.NPV}}}\right)^{\frac{1}{1-\gamma}}$ is what we refer to as the welfare gain resulting from the higher NPV of resources in the benchmark economy. Figure 4 below depicts these gains with the solid red line, and they account for roughly half of the total welfare gains. The other term, $\left(V^{\text{Bench.Net.NPV}}/V^{\text{NC}}\right)^{\frac{1}{1-\gamma}}$, is the welfare gain resulting from the disciplining effect of

[16]The NPV is computed using the discount factor of the international lenders and from the perspective of a government who has zero initial outstanding Chinese debt.

Chinese loans. It is denoted by the dashed line in Figure 4.

Figure 4: Welfare decomposition: disciplining effect and NPV of CHN loans




*Note*: The welfare gains are computed assuming zero initial Chinese debt and an initial level of market debt equal to 30% of mean income.

Notice the welfare gain associated with the disciplining effect declines faster with income than the gains resulting from NPV differences. This is consistent with the fact that the NPV of Chinese loans is constant across income levels, whereas the disciplining effect is less consequential as initial income grows: those 'good states of nature' are the ones in which the debt price is less sensitive to debt choices and therefore where the 'disciplined borrowing behavior' accrues lower returns.

## 4.5 Suggestive evidence: Bond yields and the disciplining effect

We now turn to the data for potential evidence of disciplining effects of China debt flows.[17]

**Data description.** Horn et al. (2021) note that China's lending terms and amounts are difficult to measure. They construct annual Chinese overseas lending stocks between 2000 and 2017 for more than 100 emerging and developing economies.

[17] Our results and approach here refine our initial findings in Kondo, Mkhitaryan, and Sosa-Padilla (2024). We also do not study the effects of debt restructuring events in this paper. Restructuring events with China are rather rare in our data. We refer the reader to the robustness section on retrenchment risk for an alternative theoretical interpretation of China debt restructuring events in the data.

For each country, we construct Chinese funding events as relatively large increases in the flow of funding from China. Specifically, for a country-year pair $(i, t)$, we set CHN $\text{funding}_{i,t} = 1$ if the change in reported debt vis-à-vis China in that year is above country $i$'s median value of positive debt changes vis-à-vis China.

For the subset of countries that issue debt in international capital markets, we construct bond yields on marketable international debt using bond-level data extracted from Bloomberg. We obtain annual measures of external public debt held by bondholders from the World Bank International Debt Statistics (IDS).

To illustrate our approach, Figure 5 shows a simple binscatter plot, with year fixed effects and country fixed effects, of bond yields and China debt relative to GDP. Similarly, Figure 6 shows a simple binscatter plot of bond yield changes and changes in China debt relative to GDP. Both figures suggest that bond yields may be lower with the larger the debt owed China. We explore this relationship – a potential sign of the disciplining effect – more systematically below.

**China debt inflows and sovereign bond yields.** Using our (unbalanced) annual panel dataset, we estimate the effects of Chinese lending events on bond yields and external debt held by bondholders using the following regressions:

$$\log \text{external debt}_{i,t} = \alpha_b + \beta_b \text{ CHN funding}_{i,t} + \theta_b \log \text{external debt}_{i,t-1} + \gamma_b X_{i,t} + \varepsilon^b_{i,t} \quad (7)$$

$$\text{sovereign yields}_{i,t} = \alpha_q + \beta_q \text{ CHN funding}_{i,t} + \theta_q \text{ sovereign yields}_{i,t-1} + \gamma_q X_{i,t} + \varepsilon^q_{i,t} \quad (8)$$

where $i$ represents a country, $t$ denotes a year, $\log \text{external debt}_{i,t}$ is the log of the external debt held by bondholders, CHN $\text{funding}_{i,t}$ indicates whether a China funding has occurred for country $i$ in period $t$, and $X_{i,t}$ are additional controls including lagged real GDP, lagged market debt as well as time fixed effects, country-specific time trends, or country fixed effects depending on the specifications.[18]

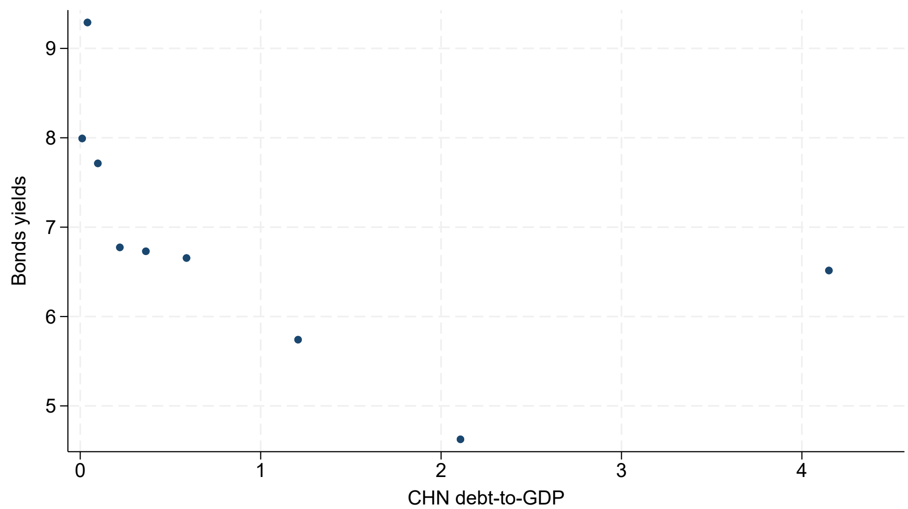
Our results further suggest that China debt inflows may have a disciplining effect on market debt prices and quantities: Chinese lending events are associated with (i) lower external public debt (held by private bondholders), and (ii) lower sovereign bond yields faced by the borrowing countries.

[18] We also construct an issuance indicator from the Bloomberg bond-level extract and estimate the following linear probability model:

$$\text{new bond issuance}_{i,t} = \alpha + \beta \text{ CHN funding}_{i,t} + \theta \text{ new bond issuance}_{i,t-1} + \gamma X_{i,t} + \varepsilon_{i,t}. \quad (9)$$

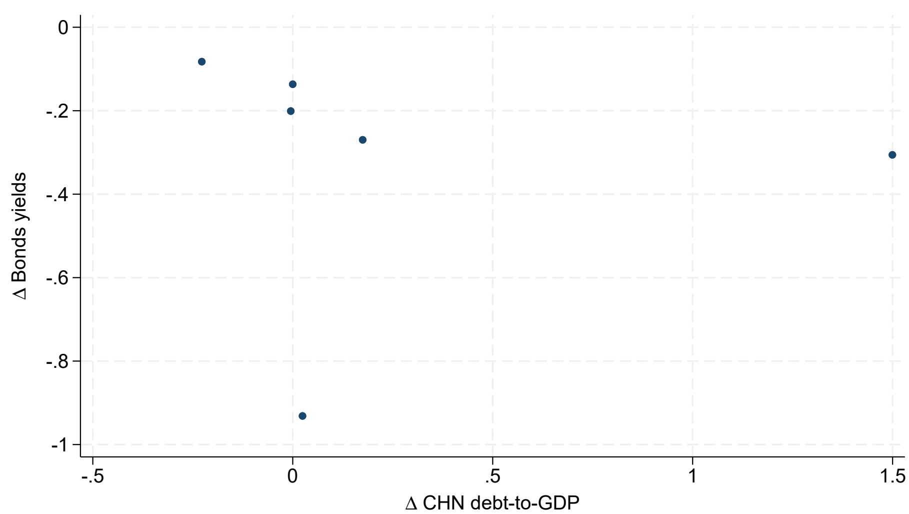
The new bond issuance estimates are noisier, probably due the more incomplete bond data coverage.

Figure 5: Bond Yields and China Debt Flows




Note: Bond yields with 5+ years maturity. Binscatter plot using BINSREG with year fixed effects and country fixed effects.

Figure 6: Changes in Bond Yields and China Debt Flows




Note: Bond yields with 5+ years maturity. Binscatter plot using BINSREG command.

We report our estimates in Tables 4 and 5, and discuss our various regression specifications in more details below. For both tables, we consider the following specifications: column (1) has year fixed effects, column (2) excludes consecutive inflow events, column (3) adds country-specific linear time trends, column (4) is estimated on log changes, column (5) includes both time fixed effects and country fixed effects, and column (6) uses a China Funding Era variable which is equal to 1 after the country's first China funding event.

Table 4: External Debt (log Bonds) and China Inflows

| | (1) with Year FE | (2) without Long Spells | (3) with Country Trends | (4) using Changes | (5) with Country FE | (6) pre/post China Era |
|---|---|---|---|---|---|---|
| CHN funding event | -0.122*** | -0.114** | -0.111** | -0.122*** | -0.111** | |
| | (0.038) | (0.048) | (0.044) | (0.038) | (0.044) | |
| (lag) CHN funding event | 0.133*** | 0.137** | 0.099** | 0.133*** | 0.098** | |
| | (0.046) | (0.058) | (0.041) | (0.046) | (0.041) | |
| CHN funding era | | | | | | -0.152** |
| | | | | | | (0.066) |
| adj. $R^2$ | 0.971 | 0.970 | 0.975 | 0.095 | 0.975 | 0.985 |
| $N$ | 444 | 418 | 444 | 444 | 444 | 642 |

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Bond Yields and China Inflows

| | (1) with Year FE | (2) without Long Spells | (3) with Country Trends | (4) using Changes | (5) with Country FE | (6) pre/post China Era |
|---|---|---|---|---|---|---|
| CHN funding event | -0.332 | -0.269 | -0.527** | -0.332 | -0.529** | |
| | (0.220) | (0.264) | (0.254) | (0.220) | (0.254) | |
| (lag) CHN funding event | -0.045 | 0.025 | -0.105 | -0.045 | -0.106 | |
| | (0.215) | (0.258) | (0.232) | (0.215) | (0.232) | |
| CHN funding era | | | | | | -1.364** |
| | | | | | | (0.615) |
| adj. $R^2$ | 0.816 | 0.819 | 0.814 | 0.346 | 0.814 | 0.822 |
| $N$ | 319 | 297 | 319 | 319 | 319 | 422 |

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**External debt reduction following Chinese lending events.** Across specifications (1)–(5), we find that China funding events are associated with 10 to 12 log points reduction in the borrowing countries external public debt help by private debt holders.[19] The pre/post China Funding Era estimates in column (6) are not significantly larger, perhaps due to the offsetting effect of past China inflows events that tend to push up the debt (see lagged China funding event effect). Overall, China lending events are associated with an overall reduction in the external debt of the recipient country to private bondholders.

**The China funding discount: A sign of discipline?** Table 5 more closely mirrors the data in Figures 5 and 6 on the correlation between sovereign bond yields dynamics and China funding events. While the framework is similar to the one used for external debt dynamics, the sample size is smaller. This is because (i) few countries issue bonds in international capital markets, and (ii) bond-level coverage in Bloomberg is incomplete for emerging and frontier economies. We use the yield-to-maturity on long term bond with 5+ years of remaining maturity as our yield measure in equation (8).[20]

In specifications (1)–(5), the point estimates are negative, but statistically significant only after teh inclusion of country-specific time trends (3) or country fixed effects (5). We find in column (5) that China lending events are associated with a reduction of around 50 basis points in the country's sovereign bond yields. When we estimate the effect of the advent of Chinese loans in specification (6), we find a larger effect: a reduction of around 135 basis in bond yields once countries have access to China lending.

We view these various estimates of a significant borrowing discount around China lending events as potential evidence of the disciplining effect highlighted in our model. In the next section, using an extension of the model with the option to default on China, we confirm that such lower spreads and the disciplining effect are indeed a consequence of the recipient country's inability to default on its debt obligations vis-à-vis China. We also consider the possibility of a permanent sudden stop in China funding as a model extension.

[19]The year fixed effects sample includes : AGO, ALB, ARG, ARM, BGR, BIH, BLR, BOL, BRA, CIV, CMR, COD, COG, COL, CRI, DMA, ECU, EGY, ETH, FJI, GAB, GHA, IDN, IND, JAM, JOR, KAZ, KEN, LAO, LBN, LKA, MAR, MEX, MKD, MNE, MNG, MOZ, NGA, PAK, PER, PHL, RUS, RWA, SEN, SRB, TUR, UKR, VEN, VNM, ZAF, ZMB. The pre/post China Era sample includes : AGO, ALB, ARG, ARM, AZE, BGR, BIH, BLR, BOL, BRA, CIV, CMR, COD, COG, COL, CRI, DMA, ECU, EGY, ETH, FJI, GAB, GHA, GUY, IDN, IND, JAM, JOR, KAZ, KEN, LAO, LBN, LKA, MAR, MEX, MKD, MNE, MNG, MOZ, NGA, PAK, PER, PHL, RUS, RWA, SEN, SRB, TUR, UGA, UKR, VEN, VNM, ZAF, ZMB, ZWE.

[20]The year fixed effects sample includes : AGO, ARG, ARM, BGR, BLR, BOL, BRA, CIV, CMR, COG, COL, CRI, ECU, EGY, ETH, GAB, GHA, IDN, JAM, JOR, KAZ, KEN, LAO, LBN, LKA, MAR, MEX, MKD, MNE, MNG, MOZ, NGA, PAK, PER, PHL, RUS, RWA, SEN, SRB, TUR, UKR, VEN, VNM, ZAF, ZMB. The pre/post China Era sample includes : AGO, ARG, ARM, AZE, BGR, BLR, BOL, BRA, CIV, CMR, COG, COL, CRI, ECU, EGY, ETH, GAB, GHA, IDN, JAM, JOR, KAZ, KEN, LAO, LBN, LKA, MAR, MEX, MKD, MNE, MNG, MOZ, NGA, PAK, PER, PHL, RUS, RWA, SEN, SRB, TUR, UKR, VEN, VNM, ZAF, ZMB.

## 4.6 The disciplining effect and the no-default assumption

Our benchmark model does allow the borrowing country to default on Chinese loans. This assumption reflects the significant geopolitical influence that China has over borrowing countries. As it turns out, the non-defaultable nature of Chinese debt is an important driver of the disciplining effect. Here we show how this comes to be and study further implications of this assumption.

**Introducing default on market and China debt.** We relax the non-defaultability of Chinese loans in the following way. We now assume instead that the government can default on all of its outstanding debt ($b$ and $b_c$) in a non-discriminatory way.[21] This implies that a country in default repay no coupons and receives no funding from China. In other words, the government is excluded from both funding sources for as long as it is in the default state.[22]

In this setting, the level of Chinese debt and the flows within a period significantly alter the incentive to default. When a government has outstanding Chinese debt at the beginning of a period, its incentive to default is higher relative to an identical government in the baseline economy. These higher default incentives come from two sources. The primary benefit is that the government can consume more from its income given that (i) it does not need to repay $H$, and (ii) the income costs of default are independent of the 'size' of the default. A second, less obvious benefit is that the government no longer faces the risk of an outflow when they lack market access being in the default state. The reduced volatility of consumption in default makes this option more attractive. Altogether, we should see higher spreads when $b_c = H$ relative to the benchmark economy.

In contrast, default is relatively more costly when the government has no outstanding Chinese debt at the beginning of the period. This is because defaulting results in a temporary exclusion from Chinese loans. When $b_c = L$, the government is either receiving an inflow today ($a = 1$), or is expecting to receive an inflow sometime in the future ($a = 0$). Regardless of the status of the inflow in the current period, defaulting implies that a new inflow will get delayed at least until financial exclusion ends. Since Chinese loans are subsidized and the government is relatively inpatient, this is costly. A clear prediction in this case is that spreads will be lower in periods with $b_c = L$.

[21] This inability to discriminate across lenders is a common assumption in the sovereign debt literature: see, e.g., Broner, Martin, and Ventura, 2010 and Gennaioli, Martin, and Rossi (2014).

[22] The recursive formulation of this modified model is in the Appendix A.1.

**Default on China and spreads.** Figure 7 displays the spread-debt menu in this environment (dashed lines) compared to the menu in the baseline model (solid lines). When $b'_c = H$, spreads are significantly higher at all debt levels in an environment where the government can default on Chinese debt. Interestingly, when $b'_c = L$, spreads are higher for low levels of $b'$ and lower for high levels of $b'$.

Figure 7: Spreads: Defaulting on the market and China

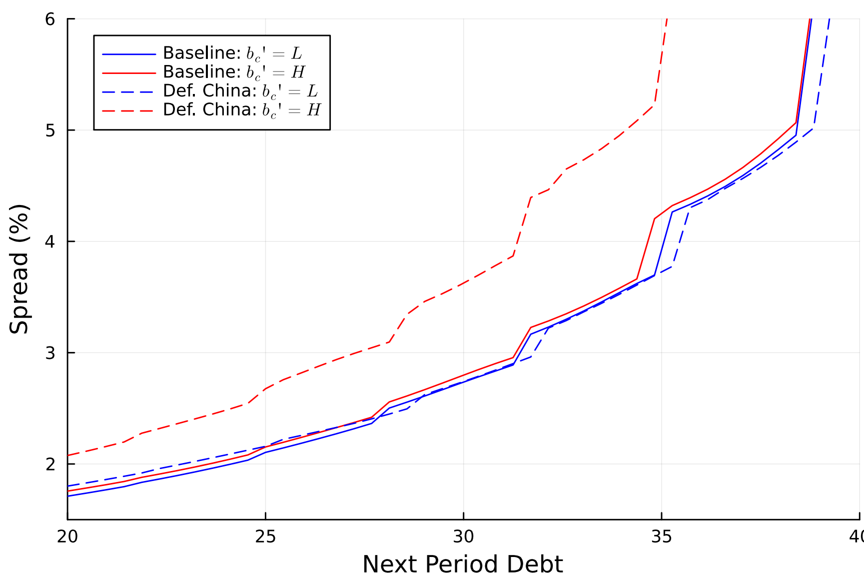



Table 6 displays the simulated statistics from this modified economy. First, note that across all simulation periods, market debt to GDP is lower and average spreads are higher relative to the benchmark economy. Lower borrowing and higher spreads reflects a higher probability of default. Comparing the "Inflow" and "Outflow" columns with those in Table 3, we see that our predictions regarding differences in spreads are confirmed.[23] Note that a government that receives an inflow today begins the next period w with outstanding Chinese debt. In the baseline economy, the average spread during inflow periods is just above 3 percent. In an environment with defaultable Chinese debt, the average spread during an inflow period is nearly 4.2 percent. The higher default probability in the following period is reflected in the spread the period of the inflow. The corresponding figures for outflow periods is 4 percent in the baseline economy and 3.43 percent in this modified environment. As we predicted, spreads are lower in outflow periods when the government is excluded from China during default periods.

In terms of market debt issuance we see a behavior similar to the benchmark economy:

[23]Note that in this extension, the "Inflow" and "Outflow" columns are conditioned on periods with *realized* inflows or outflows; i.e. periods where default did not occur.

Table 6: Simulated statistics: Defaulting on the market and China

| Statistics | Unconditional | Inflow | Outflow |
|---|---|---|---|
| Market Debt to GDP | 29.03 | 29.13 | 28.95 |
| Market Issuance to GDP | 5.82 | 2.38 | 9.22 |
| China Debt to GDP | 2.12 | 0.0 | 4.93 |
| Net Flow from China to GDP | 0.08 | 4.99 | -4.93 |
| Consumption to GDP | 99.08 | 101.1 | 96.91 |
| Spread | 3.71 | 4.17 | 3.43 |
| S.D. Spread | 2.38 | 3.73 | 1.53 |
| Corr(Spread, GDP) | -0.64 | -0.57 | -0.8 |
| P(Default t+1) | 3.09 | 4.28 | 2.22 |
| Default Frequency | 2.61 | 0.0 | 0.0 |
| S.D. Consumption/S.D. GDP | 1.15 | 1.02 | 1.26 |

the country engages in debt substitution, deleveraging from the market when receiving a Chinese inflow; leaning on the market when it is time to pay back to China. However, the effect on equilibrium spreads, as previewed above, is the opposite: the country ends up paying higher spreads on inflows. This is inconsistent with the findings in Section 4.5. In other words, the disciplining effect is gone.[24]

# 5 The Risk of Chinese retrenchment

Having established how Chinese debt impacts the equilibrium price and quantities of market debt, we use the model to study the effects of alternative risk scenarios related to Chinese funding. In particular, it has been a recent concern that countries borrowing heavily from China may suffer a "Chinese retrenchment," and be faced with a sudden and permanent exclusion from Chinese funding. We study the implications of this form of geopolitical risk for market debt, prices, and welfare in this section.[25]

## 5.1 Simulation Results under 'Retrenchment risk'

Table 7 shows the main moments of interest when the economy is living under the risk of a Chinese retrenchment. We find that for a (modest) 1% probability of the economy exogenously cutting ties with China, the moments before the retrenchment look similar to the baseline economy. The period of the retrenchment is a turbulent time: it is characterized

[24]Appendix A.1 also presents a welfare decomposition analysis confirming that there is evidence of positive welfare gains stemming from the disciplining effect of non-defaultable Chinese debt.

[25]See the appendix for the model description and the recursive formulation.

by repayment of the Chinese debt, lower consumption, a higher issuance of market debt, and a higher level of spreads than in the median years before or after the retrenchment.

Table 7: Simulated Moments for the Chinese Retrenchment Risk Model: $p_{SS} = 0.01$

| Statistic | Pre-Retrenchment | | | Retrench. | Post |
|---|---|---|---|---|---|
| | Average | Inflow | Outflow | Period | Retrench. |
| Market Debt to GDP | 30.02 | 31.08 | 28.96 | 30.05 | 30.08 |
| Market Issuance to GDP | 5.98 | 2.71 | 8.96 | 7.28 | 5.97 |
| Consumption to GDP | 98.95 | 101.03 | 96.57 | 97.45 | 98.94 |
| Spread | 3.54 | 3.06 | 3.98 | 3.8 | 3.52 |
| S.D. Spread | 2.21 | 1.81 | 2.46 | 2.33 | 2.16 |
| Corr(Spread, GDP) | -0.64 | -0.63 | -0.67 | -0.66 | -0.66 |
| P(Default t+1) | 2.96 | 2.11 | 3.75 | 3.46 | 2.97 |
| Default Frequency | 2.51 | 2.84 | 2.18 | 2.7 | 2.52 |
| S.D. Consumption/S.D. GDP | 1.16 | 1.01 | 1.31 | 1.25 | 1.15 |

*Note*: Moments are computed for non-exclusion periods, except for the default frequency which uses all simulation periods.

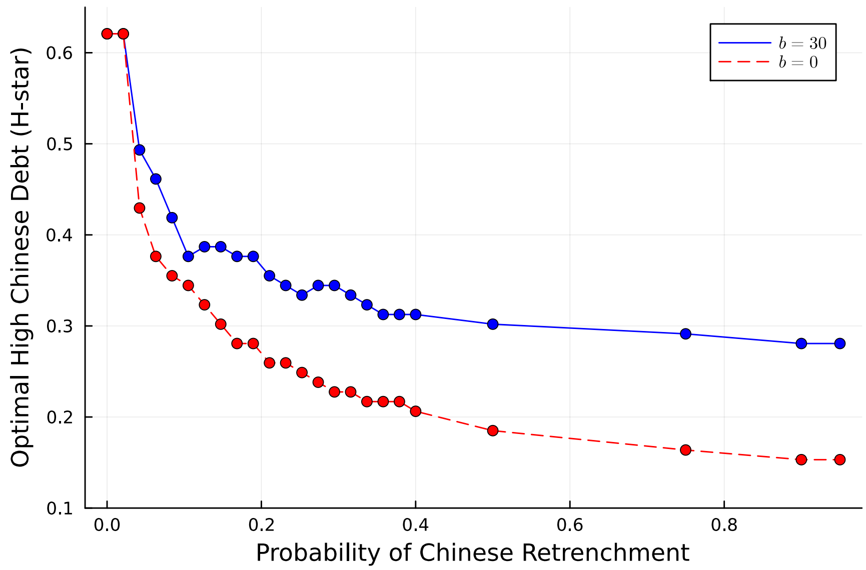
## 5.2 Ex-Ante Optimal Exposure to Chinese Debt

So far, we have treated the level of high Chinese debt ($H$) as exogenous. We now ask, given this new risk of China going away, how much should a country 'expose' itself to China?

To answer this question, we define $H^*(b, p_{SS})$ as ex-ante optimal the level of high Chinese debt a country would choose, as a function of its market debt ($b$) and the probability of a Chinese retrenchment ($p_{SS}$). Figure 8 tells a clear story: (a) other things equal, if a country has a higher level of market debt, it prefers a higher level of Chinese loans, pointing to the importance of the substitution between these two funding sources; (b) regardless of the market debt level, the higher is $p_{SS}$ the lower is the optimal exposure to China, pointing to the undesirability of this additional source of 'rollover' risk.

All in all, the findings in this section suggest the possibility of boom-bust cycles fueled by China's evolving role in the international financial system. Changes in geopolitical alignments (captured by changes in $p_{SS}$) can trigger sharp changes in the optimal level of exposure a given country wants to take. It is entirely possible that a country like Argentina (for example), which went through a long period of close geopolitical proximity to China with successive Peronist governments, increases its exposure and then a sudden (and unanticipated) domestic political shock (like the swing to right-wing policies under the Milei presidency) leaves it exposed to the material risk of having to pay down non-trivial Chinese loans. This case exemplifies the nuanced risks that countries face when they rely 'too much' on Chinese lending.

Figure 8: Optimal Chinese Debt by Market Debt Level




*Note*: This figure shows $H^*$ given the sovereign has outstanding debt of 30% (blue) and 0% (red/dotted) of outstanding debt as a percent of mean income.

## 5.3 Interpreting Sources of Rollover Risk

We think the rollover and retrenchment risks in our model may arise from other frictions associated with China's loans to emerging countries. In particular, harder-to-quantify features such as: contract opacity, asymmetric bargaining power, or geopolitical shocks.

Consider, for example, opacity in the form of uncertainty around the duration of the debt. Suppose the Chinese debt is due in $n$ periods, and the markets know the size of the loan $b_C \in \{L, H\}$ but not $n$. In this case, the random nature of the repayment date is (in a way) already captured by the $a$ process in our model and its implications for dilution risk and the pricing of market debt in the shadow of imperfectly known commitments to China. Similarly, if the amount $b_C$ itself is not known, we think our key insight about significant dilution risk and the disciplining effect remain.

# 6 Conclusion

We use a standard sovereign debt model with long-term debt to rationalize a set of facts about emerging economies borrowing from private markets and the impact that Chinese official lending has on it. We find that following a positive inflow from China our model economy chooses to rebalance its debt portfolio by deleveraging from market debt. In the process, it pays lower spreads and faces less volatile consumption. We call this, the 'disciplining effect' of Chinese debt. On the other hand, when facing a capital flow vis-à-vis China, the economy taps private markets, levers up on defaultable debt, and ends up paying higher and more volatile spreads in equilibrium. All these model dynamics are in line with panel data evidence from emerging and low-income economies. Furthermore, we use the model to study the welfare gains from having access to Chinese loans and find that these are mostly driven by disciplining effect.

We use our model to compute the ex-ante optimal level of exposure to Chinese funding and find that it is increasing in the market indebtedness of the country and decreasing in the probability of a Chinese retrenchment (i.e., decreasing in the probability that China severs ties with the borrowing country). In an increasingly uncertain geopolitical context, these results are a cautionary tale for emerging economies that have volatile political environments and that have so far relied heavily on Chinese official lending.

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# A Robustness

## A.1 Default on market and China - Recursive formulation

We extend the baseline model to incorporate default on outstanding Chinese debt in addition to market debt. In this extension, a government in default does not receive Chinese inflows nor do they have to pay outflows. Upon exiting default, the government reenters with no market debt and no Chinese debt. The distinguishing feature of this extension is that the government can not receive Chinese inflow or outflows while in default. This is reflected in Table 6, where the "Inflow" and "Outflow" columns display a default frequency of zero.

As in the baseline model, there are four state variables. The market debt level $b$ is the sole endogenous state variable. The income level $y$, Chinese debt level $b_c$, and the realization of a Chinese net flow $a$ (conditional on not defaulting). To simplify notation, let $s \equiv (a, y)$. For this extension, the only modification to the recursive formulation relative to the baseline is the value function for a government in default.

Denote $d \in \{0, 1\}$ as the government's default decision in the current period. Let $V_1(y)$ denote the value of defaulting and $V_0(b, b_c, s)$ denote the value of repaying market debt. The government's value function that beginning of a period is:

$$V\left(b, b_c, s\right) = \max_{d \in \{0,1\}} \Big\{ dV_1(y) + (1-d)V_0(b, b_c, s) \Big\}, \tag{10}$$

where the value of default satisfies

$$V_1(y) = u\big(y - \phi(y)\big) + \beta\, \mathbb{E}_{s'|s} \Big[ \theta V(0, b_c', s') + (1-\theta) V_1(y') \Big], \tag{11}$$

and where $b_c' = L$ since a government exits default with no outstanding Chinese debt.

The value of repayment and the pricing functions are unchanged relative to the baseline model. Refer to Section 2.2 to see these functional equations.

### A.1.1 Welfare decomposition

Figure 9 displays a welfare decomposition comparing the benchmark model, defaulting on the market and China, and the model without Chinese debt. In the body of the paper, we defined the consumption-equivalent welfare gain as:

$$\Delta w = \left( \frac{V^{Bench}}{V^{NC}} \right)^{\frac{1}{1-\gamma}} - 1 \tag{12}$$

To better understand the sources of this welfare gain, we perform a decomposition exercise. There are two key factors that cause the government to prefer living in a world with Chinese debt. The first is the higher net present value of resources in the Chinese debt economy. The second factor is the disciplining effect of Chinese debt: the government's behavioral response to the debt flows results in different borrowing behavior and therefore different spreads. We attempt to isolate the welfare gains that come from the disciplining effect of Chinese debt. To do this, we compare lifetime utility in the benchmark economy to utility an economy where the government can default on Chinese debt.

We decompose the total welfare gain into two components:

$$\Delta w = \left(\frac{V^{Bench}}{V^{DefChina}}\right)^{\frac{1}{1-\gamma}} \cdot \left(\frac{V^{DefChina}}{V^{NC}}\right)^{\frac{1}{1-\gamma}} - 1$$

$V^{Bench}$ is the lifetime utility of a government in the benchmark model and who has outstanding market debt of approximately 30 percent of mean income. $V^{DefChina}$ is the corresponding utility for a government in an economy where default and exclusion is on both market and Chinese debt. The term $\left(V^{Bench}/V^{DefChina}\right)^{\frac{1}{1-\gamma}}$ is what we refer to as the welfare gain from the disciplining effect of Chinese debt. It is represented by the solid red line in Figures 9 and The other term, $\left(V^{DefChina}/V^{NC}\right)^{\frac{1}{1-\gamma}}$, is the welfare gain resulting from other factors and is represented by the dashed purple line. 10.

First, consider Figure 9. This figure displays the welfare decomposition when the government starts with no outstanding debt ($b_c = L$) and does not receive an inflow this period ($a = 0$). Thus the government is expecting to receive an inflow in the near future. The discontinuity just above 0.9 is a consequence of an important assumption in the defaulting on China model: the government does not receive Chinese inflows (or outflows) while in default. For values of income below this discontinuity, the government optimally chooses to default. Since defaulting in this economy results in temporary retrenchment from China, a government in default has higher utility in the baseline economy (all else equal). This assumption blurs the true value of the disciplining effect for low values of income. For values of income above the discontinuity, the disciplining effect accounts for around 15 percent of the welfare gain. This welfare measure is positive for all values of income, indicating that the government prefers to reside in the benchmark economy.

Figure 10 displays the welfare decomposition when the government begins the period with outstanding Chinese debt ($b_c = H$) and does not have an outflow the current period ($a = 0$).[26] As expected, the solid blue line - which portrays our main welfare measure (equation 12) - is negative for all values of income. I.e. a government would rather occupy an economy with no Chinese debt than an economy where it immediately holds outstanding debt. The solid red and dashed purple lines, on the other hand, both take positive and negative values. As in the previous figure, there is a sharp discontinuity just above 90 percent of mean income. For the lowest values of income, the government would prefer to default on the outstanding Chinese debt. Therefore the red solid line is negative - it is preferable to reside in an economy with defaultable Chinese debt compared to one with nondefaultable debt - and the purple dashed line is positive - the government would rather default on Chinese debt today and still have the positive NPV of future flows than live in an economy without any Chinese debt. For income values above 95 percent of mean income, default is not optimal in any of the three economies. At these income levels, the government would prefer to reside in the benchmark economy compared to the economy with defaultable Chinese debt. This

[26] As in the previous figure, we also assume the government possesses market debt of approximately 30 percent of mean income.

Figure 9: Welfare decomposition: Defaulting on the market and China when $b_c = L$

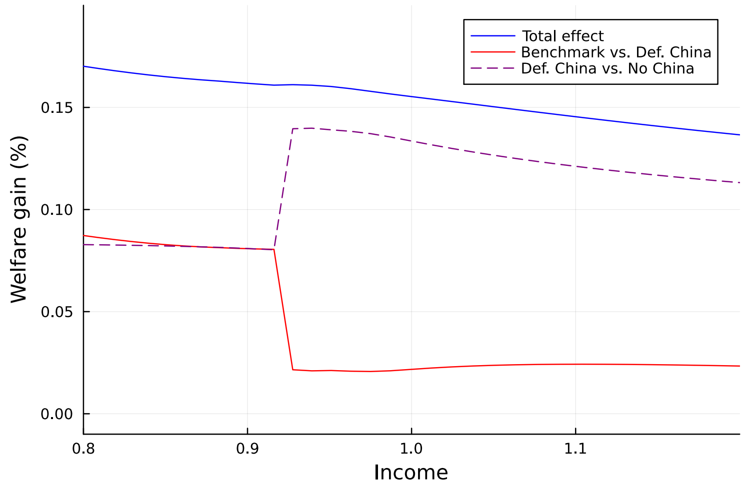
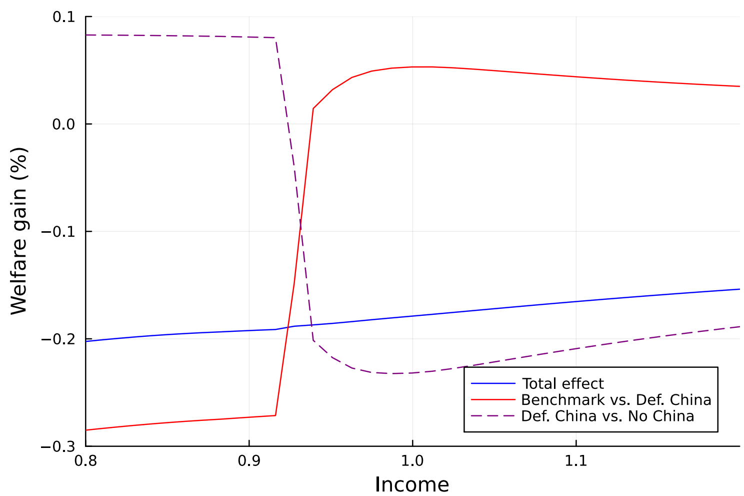



Figure 10: Welfare decomposition: Defaulting on the market and China when $b_c = H$




is substantial evidence for the welfare gains stemming from the disciplining effect of non-defaultable Chinese debt. The source of the welfare gains are clearly reflected in Figure 7. Conditional on $b'_c = H$, Spreads are significantly higher when Chinese debt is defaultable.

## A.2 Retrenchment risk - Recursive formulation

We augment the baseline model with the possibility that the country has to repay the debt owed to China (if any) and permanently lose access to Chinese flows. We denote by $p_{SS}$ the probability of this sudden and permanent stop.

There are four state variables: one endogenous and three exogenous. The endogenous state variable is the market debt level, $b$. The exogenous debt variables are $y$ (the income level), $b_c$ (the Chinese debt level), and $a$ (the realization of a Chinese net flow). Let us denote $s \equiv (a, y)$. The recursive representation of this problem follows:

Let $d$ denote the current-period default decision prior to a Chinese retrenchment. We assume that $d$ is equal to 1 if the government defaulted in the current period, and is equal to 0 if it did not. Below, we will denote with $\tilde{d}$ the default decision after the retrenchment has occurred.

$$V(b, b_c, s) = \max_{d \in \{0,1\}} \Big\{ dV_1(b_c, s) + (1-d)V_0(b, b_c, s) \Big\}, \tag{13}$$

where

$$V_0(b, b_c, s) = \max_{b'} \Big\{ u(c) + \beta(1-p_{SS})\,\mathbb{E}_{s'|s} V(b', b_c', s') + \beta p_{SS}\,\mathbb{E}_{y'|y} W(b', b_c', y') \Big\}, \tag{14}$$

subject to

$$c + \kappa b = y + q(b', b_c', s)(b' - (1-\delta)b) + z(b_c, a) \tag{15}$$

with

$$b_c' = \mathcal{B}_c'(b_c, a) = \begin{cases} H & \text{if } a = 1 \cap b_c = L \\ L & \text{if } a = 1 \cap b_c = H \\ b_c & \text{otherwise} \end{cases} \tag{16}$$

and

$$z(b_c, a) = \mathcal{B}_c'(b_c, a) - b_c = \begin{cases} H - L & \text{if } a = 1 \cap b_c = L \\ L - H & \text{if } a = 1 \cap b_c = H \\ 0 & \text{if } a = 0 \end{cases} \tag{17}$$

where $\kappa$ represents the coupon, $z(b_c, a)$ in (17) represents the *net flows* vis-à-vis China, and $\mathcal{B}_c'(b_c, a)$ in (16) indicates how the debt level with China evolves. The value of default is:

$$\begin{aligned} V_1(b_c, s) = u\big(y - \phi(y) + z(b_c, a)\big) & \\ + \beta(1-p_{SS})\mathbb{E}_{s'|s}\Big[\theta V(0, b_c', s') + (1-\theta)V_1(b_c', s')\Big] & \\ + \beta p_{SS}\mathbb{E}_{y'|y}\Big[\theta W(0, b_c', y') + (1-\theta)W_1(b_c', y')\Big], & \end{aligned} \tag{18}$$

subject to (17) and (16).

The value functions $W, W_0, W_1$ satisfy:

$$W(b, b_c, y) = \max_{\tilde{d} \in \{0,1\}} \Big\{ \tilde{d}W_1(b_c, y) + (1-\tilde{d})W_0(b, b_c, y) \Big\}, \tag{19}$$

where

$$W_0(b, b_c, y) = \max_{b'} \Big\{ u(c) + \beta\,\mathbb{E}_{y'|y} W(b', 0, y') \Big\}, \tag{20}$$

subject to

$$c + \kappa b = y + \tilde{q}(b', y)(b' - (1-\delta)b) - b_c \tag{21}$$

The value of default is:

$$W_1(b_c, y) = u\big(y - \phi(y) - b_c\big) + \beta \mathbb{E}_{y'|y}\Big[\theta W(0, 0, y') + (1-\theta) W_1(0, s')\Big]. \tag{22}$$

The bond prices $q$ and $\tilde{q}$ are jointly given by the following functional equations:

$$\begin{aligned} q(b', b_c', s) = {} & e^{-r}(1 - p_{SS})\, \mathbb{E}_{s'|s}\left[1 - \hat{d}\,(b', b_c', s')\right]\left[\kappa + (1-\delta)\, q\left(\hat{b}\,(b', b_c', s')\,, b_c'', s'\right)\right] \\ + \quad & e^{-r} p_{SS}\, \mathbb{E}_{y'|y}\left[1 - \hat{\hat{d}}\,(b', b_c', s')\right]\left[\kappa + (1-\delta)\, \tilde{q}\left(\hat{\hat{b}}\,(b', b_c', y')\,, y'\right)\right], \end{aligned} \tag{23}$$

and

$$\tilde{q}(b', y) = e^{-r}\, \mathbb{E}_{y'|y}\left[1 - \hat{\hat{d}}\,(b', 0, y')\right]\left[\kappa + (1-\delta)\, \tilde{q}\left(\hat{\hat{b}}\,(b', 0, y')\,, y'\right)\right], \tag{24}$$

where $\{\hat{d}, \hat{\hat{d}}\}$ and $\{\hat{b}, \hat{\hat{b}}\}$ denote the future default and borrowing rules that lenders expect the government to follow. The price in (24) is equivalent to the one observed in a standard sovereign model with long-term debt: this is because the 'retrenchment shock' induces a permanent loss of Chinese funding.

## A.3 Asymmetric Chinese debt flows

In the baseline model, the probability of a Chinese debt flow is the same whether the government has low or high debt. In this robustness exercise, we make the debt flow probabilities asymmetric. That is, the probability of a Chinese flow is higher (lower) when the government has high (low) Chinese debt. Specifically, when the government has outstanding Chinese debt, the probability of an outflow is now 0.25 (compared to 0.1 in the baseline model). Simulated statistics from this economy are in Table 8.[27]

[27] It is important to note that by changing the rollover probabilities, we are changing the aggregate resources in the economy.

Table 8: Simulated moments: Asymmetric Chinese Debt Flows

| Statistics | Unconditional | Inflow | Outflow | No Flow: $b_c = L$ | No Flow: $b_c = H$ |
|---|---|---|---|---|---|
| Market Debt to GDP | 29.96 | 30.83 | 27.79 | 30.85 | 27.78 |
| Market Issuance to GDP | 5.99 | 2.37 | 9.11 | 6.16 | 5.64 |
| China Debt to GDP | 1.45 | 0.0 | 4.98 | 0.0 | 4.98 |
| Net Flow from China to GDP | -0.01 | 4.97 | -4.98 | 0.0 | 0.0 |
| Consumption to GDP | 98.96 | 100.8 | 96.96 | 98.91 | 99.17 |
| Spread | 3.54 | 3.03 | 3.79 | 3.69 | 3.2 |
| S.D. Spread | 2.21 | 1.74 | 2.32 | 2.31 | 1.91 |
| Corr(Spread, GDP) | -0.63 | -0.62 | -0.67 | -0.63 | -0.65 |
| P(Default t+1) | 2.97 | 1.96 | 3.4 | 3.29 | 2.21 |
| Default Frequency | 2.6 | 2.86 | 1.93 | 2.87 | 1.91 |
| S.D. Consumption/S.D. GDP | 1.14 | 0.98 | 1.29 | 1.13 | 1.11 |

*Note*: Moments are computed for non-exclusion periods, except for the default frequency which uses all simulation periods. Units: percent (except for the correlations and relative volatilities).

# B Computational appendix

## B.1 Baseline model with preference shocks

We utilize i.i.d. Type 1 Extreme Value preference shocks to ensure convergence of the pricing schedule and value functions, similar to the method used by Dvorkin, Sanchez, Sapriza, and Yurdagul (2020) and several other quantitative sovereign default papers. The basic computational strategy is described in Mihalache (2025).

Conditional on choosing to repay their outstanding debt, the sovereign receives an additive preference shock $\epsilon(b')$ for every possible value of debt $b'$.[28] Let $\mathbb{B} \equiv \{\underline{b}, b_1, ..., b_{N-1}, \bar{b}\}$ where $\underline{b} < b_1 < ... < b_{N-1} < \bar{b}$, the nodes are equally spaced, and positive values indicate borrowing. This grid represents all debt positions the sovereign could take on.

The cumulative density function of the vector of preference shocks, $\epsilon$, is distributed according to the Type 1 Extreme Value distribution:

$$F(\epsilon) = \exp\left[-\sum_{b'\in\mathbb{B}} \exp\left(-\frac{\epsilon(b') - \mu_\eta}{\rho_\eta}\right)\right]$$

where $\mu_\eta$ is the location parameter, $\rho_\eta$ is the scale parameter, and $\tilde{\gamma}$ is the Euler-Mascheroni constant. We choose $\rho_\eta$ so that it is small enough to maintain the economic content of the sovereign's borrowing decision but large enough to ensure that computation of the value and price functions occur in a timely manner.[29] We fix $\rho_\eta = 0.0005$ and $\mu_\eta = -\tilde{\gamma}\rho_\eta$.[30]

The sovereign's problem in the baseline model is given by:

$$V(b, b_c, s) = \max_{d\,\in\,\{0,1\}} \Big\{ dV_1(b_c, s) + (1-d)EV_0(b, b_c, s) \Big\}, \tag{25}$$

where the ex-ante value of not defaulting is

$$EV_0(b, b_c, s) = \int V_0(b, b_c, s, \epsilon) dF(\epsilon) \tag{26}$$

with $\epsilon$ representing a vector of i.i.d. preference shocks; one for each value of $b' \in \mathbb{B}$. That is, $\epsilon \equiv (\epsilon(\underline{b}), \epsilon(b_1), ..., \epsilon(b_{N-1}), \epsilon(\bar{b}))$. The value function conditional on a particular realization of the preference shock vector $\epsilon$ is

$$V_0(b, b_c, s, \epsilon) = \max_{b'\in\mathbb{B}} v_0^{b'}(b, b_c, s) + \epsilon(b') \tag{27}$$

with

$$v_0^{b'}(b, b_c, s) = u(c^{b'}(b, b_c, s)) + \beta\, \mathbb{E}_{s'|s} V(b', b_c', s'), \tag{28}$$

[28] Note that the default/repayment choice is not subject to preference shocks. It would be straightforward to extend the model to include default choice shocks, but it is not necessary to achieve convergence.

[29] All else equal, increasing the scale parameter makes the pricing function more well-behaved, which aids in computation. But this comes at the cost of infusing more noise into the sovereign's borrowing decision.

[30] This implies that the expectation of an individual $\epsilon(b')$ is equal to 0.

where $c^{b'}(b, b_c, s)$ denotes current period consumption given the incoming state $(b, b_c, s)$ and a particular value of $b'$. Thus $c^{b'}(b, b_c, s)$ equals

$$c^{b'}(b, b_c, s) = y + q(b', b_c', s)(b' - (1 - \delta)b) - \kappa b + z(b_c, a) \tag{29}$$

with

$$b_c' = \begin{cases} H & \text{if } a = 1 \cap b_c = L \\ L & \text{if } a = 1 \cap b_c = H \\ b_c & \text{otherwise} \end{cases} \tag{30}$$

and

$$z(b_c, a) = b_c' - b_c = \begin{cases} H - L & \text{if } a = 1 \cap b_c = L \\ L - H & \text{if } a = 1 \cap b_c = H \\ 0 & \text{if } a = 0 \end{cases} \tag{31}$$

where $\kappa$ represents the coupon, $z(b_c, a)$ in (31) represents the *net flows* vis-à-vis China, and $b_c'$ in (30) indicates how the debt level with China evolves.

With $v_0^{b'}(b, b_c, s)$ in hand, we know the analytic solution for the ex-ante[31] choice probabilities and the ex-ante value of not defaulting. For states where $d(b, b_c, s) = 0$, the probability the sovereign chooses debt position $b' \in \mathbb{B}$ is:

$$\mathbb{P}^{b'}(b, b_c, s) = \frac{\exp\left(\frac{v_0^{b'}(b, b_c, s)}{\rho_\eta}\right)}{\sum_{b' \in \mathbb{B}} \exp\left(\frac{v_0^{b'}(b, b_c, s)}{\rho_\eta}\right)} \tag{32}$$

In other words, conditional on choosing not to default, $\mathbb{P}^{b'}(b, b_c, s)$ is the probability that the sovereign chooses $b'$ given state $(b, b_c, s)$. The lenders take these choice probabilities as given and use them to price the bonds.

We can calculate the ex-ante value of not defaulting as:

$$EV_0(b, b_c, s) = \mu_\eta + \tilde{\gamma}\rho_\eta + \rho_\eta \log\left(\sum_{b' \in \mathbb{B}} \exp\left(\frac{v_0^{b'}(b, b_c, s)}{\rho_\eta}\right)\right) \tag{33}$$

The Bellman equation representing the value of defaulting is unchanged relative to that shown in the main body of the paper:

$$V_1(b_c, s) = u\big(y - \phi(y) + z(b_c, a)\big) + \beta \mathbb{E}_{s'|s}\Big[\theta V(0, b_c', s') + (1 - \theta)V_1(b_c', s')\Big], \tag{34}$$

subject to (31) and (30).

Let $\hat{d}(b', b_c', s')$ denote the period-ahead default policy and $\hat{b}(b', b_c', s', \epsilon')$ the period-ahead borrowing policy. Note that while $\hat{b}(\cdot)$ depends on the realization of the preference shock vector $\epsilon'$, the period-ahead default policy $\hat{d}(\cdot)$ does not. This is because the preference

[31] Ex-ante as in prior to the realization of $\epsilon$.

shocks are only realized if the sovereign chooses not to default; that is $\hat{d}(b', b'_c, s') = 0$. The equilibrium pricing function then follows:

$$q(b', b'_c, s) = e^{-r}\, \mathbb{E}_{s'|s} \left[1 - \hat{d}\,(b', b'_c, s')\right] \left[\kappa + (1-\delta) \int_{\epsilon'} q\left(\hat{b}\,(b', b'_c, s', \epsilon')\,, b''_c, s'\right) dF(\epsilon')\right] , \tag{35}$$

Let $\mathbb{P}^{b'}(b, b_c, s)$ denote the probability a borrower will choose $b'$ given that it entered the period with states $(b, b_c, s)$ *and* chose to repay its current period debt. We can replace the integral in the second bracketed term with a summation because of the type 1 extreme value shocks:

$$q(b', b'_c, s) = e^{-r}\, \mathbb{E}_{s'|s} \left[1 - \hat{d}\,(b', b'_c, s')\right] \left[\kappa + (1-\delta) \sum_{\hat{b}'' \in \mathbb{B}} q\left(\hat{b}'', b''_c, s'\right) \times \mathbb{P}^{\hat{b}''}(b', b'_c, s')\right] , \tag{36}$$

## B.2 Chinese retrenchment risk model with preference shocks

To incorporate preference shocks, the retrenchment risk model needs to be amended in a similar manner as the baseline model.

The government's value function at the beginning of the period is:

$$V\,(b, b_c, s) = \max_{d\,\in\,\{0,1\}} \Big\{dV_1(b_c, s) + (1-d)EV_0(b, b_c, s)\Big\}, \tag{37}$$

The value of not defaulting, prior to the realization of $\epsilon$, is:

$$EV_0(b, b_c, s) = \int V_0(b, b_c, s, \epsilon) dF(\epsilon) \tag{38}$$

After $\epsilon$ is realized, the ex-post no-default value function is:

$$V_0(b, b_c, s) = \max_{b' \in \mathbb{B}} v_0^{b'}(b, b_c, s) + \epsilon(b') \tag{39}$$

where

$$v_0^{b'}(b, b_c, s) = u(c^{b'}(b, b_c, s)) + (1 - p_{SS})\beta \mathbb{E}_{s'|s} V(b', b'_c, s') + p_{SS} \beta \mathbb{E}_{y'|y} W(b', b'_c, y'), \tag{40}$$

where $c^{b'}(b, b_c, s)$ equals

$$c^{b'}(b, b_c, s) = y + q(b', b'_c, s)(b' - (1-\delta)b) - \kappa b + z(b_c, a) \tag{41}$$

with $z(b_c, a)$ defined above. The choice probabilities are denoted by $\mathbb{P}_V^{b'}(b, b_c, s)$.

The value of default is:

$$V_1(b_c, s) = u\big(y - \phi(y) + z(b_c, a)\big) + \beta(1 - p_{SS})\mathbb{E}_{s'|s}\Big[\theta V(0, b_c', s') + (1-\theta)V_1(b_c', s')\Big] + \beta p_{SS}\mathbb{E}_{y'|y}\Big[\theta W(0, b_c', y') + (1-\theta)W_1(b_c', y')\Big], \tag{42}$$

A new set of value functions and pricing schedules are required for the periods on and after retrenchment shock realization. The value functions $W, EW_0, W_0, W_1$ satisfy:

$$W\,(b, b_c, y) = \max_{\tilde{d}\in\{0,1\}} \Big\{\tilde{d}W_1(b_c, y) + (1-\tilde{d})EW_0(b, b_c, y)\Big\}, \tag{43}$$

where

$$EW_0(b, b_c, y) = \int W_0(b, b_c, y, \epsilon)dF(\epsilon) \tag{44}$$

with

$$W_0(b, b_c, y, \epsilon) = \max_{b'\in\mathbb{B}} w_0^{b'}(b, b_c, y) + \epsilon(b'), \tag{45}$$

where

$$w_0^{b'}(b, b_c, y) = u(c(b', b_c, y)) + \beta\,\mathbb{E}_{y'|y}W(b', 0, y') \tag{46}$$

subject to

$$c(b', b_c, y) = y + \tilde{q}(b', y)(b' - (1-\delta)b) - \kappa b - b_c \tag{47}$$

The $b'$ choice probabilities are denoted by $\mathbb{P}_W^{b'}(b, b_c, y)$.
The value of default post-retrenchment is:

$$W_1(b_c, y) = u\big(y - \phi(y) - b_c\big) + \beta\mathbb{E}_{y'|y}\Big[\theta W(0, 0, y') + (1-\theta)W_1(0, y')\Big]. \tag{48}$$

The bond prices $q$ and $\tilde{q}$ are jointly given by the following functional equations:

$$q(b', b_c', s) = e^{-r}(1 - p_{SS})\,\mathbb{E}_{s'|s}\Big[1 - \hat{d}\,(b', b_c', s')\Big]\left[\kappa + (1-\delta)\sum_{\hat{b}\in\mathbb{B}} q\left(\hat{b}, b_c'', s'\right) \times \mathbb{P}_V^{\hat{b}}(b', b_c'', y')\right] \tag{49}$$

$$+ \quad e^{-r}p_{SS}\,\mathbb{E}_{y'|y}\Big[1 - \hat{\tilde{d}}\,(b', b_c', s')\Big]\left[\kappa + (1-\delta)\sum_{\hat{\tilde{b}}\in\mathbb{B}} \tilde{q}\left(\hat{\tilde{b}}, y'\right) \times \mathbb{P}_W^{\hat{\tilde{b}}}(b', b_c', y')\right],$$

and

$$\tilde{q}(b', y) = e^{-r}\, \mathbb{E}_{y'|y}\left[1 - \hat{\hat{d}}\,(b', 0, y')\right] \left[\kappa + (1-\delta) \sum_{\hat{\hat{b}} \in \mathbb{B}} \tilde{q}\left(\hat{\hat{b}}, y'\right) \times \mathbb{P}_W^{\hat{\hat{b}}}(b', 0, y')\right], \tag{50}$$

where $b_c'' = \mathcal{B}_c'(b_c', a')$ and where $\{\hat{d}, \hat{\hat{d}}\}$ denote the period-ahead default rules the lenders expect the government to follow.

## B.3 Computational strategy

We discretize both the bond grid and the income grid. The bond grid has 225 equally-spaced nodes between 0 and 1. We use the Rouwenhorst method to approximate the log income process, and the income grid has 75 nodes. To compute the Markov Perfect Equilibrium, we utilize a strategy that is similar to the method outlined in Mihalache (2025).

## B.4 Computation of the baseline model

We will describe the solution method starting from arbitrary iteration $k \geq 1$. For $k = 0$ (i.e. at the beginning of the algorithm), we set the initial values of the pricing, value, and policy functions as follows:[32]

$$\begin{aligned}
V_1^0(b_c, s) &= \frac{u(y - \phi(y) + z(b_c, a))}{1-\beta} \\
\mathbb{P}^{0, b'=0}(b, b_c, s) &= 1 \\
q^0(b', b_c', s) &= 0 \\
EV_0^0(b, b_c, s) &= \frac{u(y - \kappa b - q^0(b', b_c', s)(b' - (1-\delta)b) + z(b_c, a))}{1-\beta} \\
V^0(b, b_c, s) &= \max\{V_1^0(y, b_c, a), EV_0^0(b, b_c, s)\} \\
d^0(b, b_c, s) &= \mathbf{1}_{\{V_1^0(\cdot) > EV_0^0(\cdot)\}}
\end{aligned}$$

At the start of an iteration, we enter with pricing schedule $q^k(\cdot)$, choice probabilities $\mathbb{P}^k(\cdot)$, default policy $d^k(\cdot)$, and value functions $V_1^k(\cdot)$, $EV_0^k(\cdot)$, $V^k(\cdot)$.

1. Use the choice probability $\mathbb{P}^k(\cdot)$ and default policy $d^k(\cdot)$ to calculate $q^{k+1}(\cdot)$ according to:

$$q^{k+1}(b', b_c', s) = e^{-r}\, \mathbb{E}_{s'|s}\left[1 - d^k\,(b', b_c', s')\right] \left[\kappa + (1-\delta) \sum_{\hat{b}'' \in \mathbb{B}} q^k\left(\hat{b}'', b_c'', s'\right) \times \mathbb{P}^{k, \hat{b}''}(b', b_c', s')\right] \tag{51}$$

[32] Models of long-term debt are known to suffer from multiple equilibria. Different initial guesses may lead to different equilibrium objects.

2. Use $q^{k+1}(\cdot)$ and the iteration $k$ value functions to compute $EV_0^{k+1}(\cdot)$, $\mathbb{P}^{k+1,b'}(\cdot)$, and $V_1^{k+1}(\cdot)$.

$$v_0^{b',k+1}(b,b_c,s) = u(c^{b',k+1}(b,b_c,s)) + \beta\,\mathbb{E}_{s'|s}V^k(b',b'_c,s')$$
$$\text{s.t } c^{b',k+1}(b,b_c,s) = y + q^{k+1}(b',b'_c,s)(b'-(1-\delta)b) - \kappa b + z(b_c,a)$$

$$EV_0^{k+1}(b,b_c,s) = \rho_\eta \log\left(\sum_{b'\in\mathbb{B}} \exp\left(\frac{v_0^{b',k+1}(b,b_c,s)}{\rho_\eta}\right)\right)$$

$$\mathbb{P}^{k+1,b'}(b,b_c,s) = \frac{\exp\left(\frac{v_0^{b',k+1}(b,b_c,s)}{\rho_\eta}\right)}{\sum_{b'\in\mathbb{B}}\exp\left(\frac{v_0^{b',k+1}(b,b_c,s)}{\rho_\eta}\right)}$$

$$V_1^{k+1}(b_c,s) = u\big(y-\phi(y)+z(b_c,a)\big) + \beta\mathbb{E}_{s'|s}\Big[\theta V^k(0,b'_c,s') + (1-\theta)V_1^k(b'_c,s')\Big]$$

3. Use $EV_0^{k+1}(\cdot)$ and $V_1^{k+1}(\cdot)$ to calculate $V^{k+1}(\cdot)$ and $d^{k+1}(\cdot)$.

$$V^{k+1}(b,b_c,s) = \max\{V_1^{k+1}(b_c,s), EV_0^{k+1}(b,b_c,s)\}$$

$$d^{k+1}(b,b_c,s) = \mathbf{1}_{\{V_1^{k+1}(b_c,s) > EV_0^{k+1}(b,b_c,s)\}}$$

4. Check for convergence: if $\max|q^{k+1}(\cdot)-q^k(\cdot)| < 10^{-9}$ and $\max|V^{k+1}(\cdot)-V^k(\cdot)| < 10^{-9}$, convergence is achieved. If not, return to step 1 with the updated functions.

## B.5 Computation of the retrenchment risk model

In the version of the model with retrenchment risk, the sovereign can be in one of three stages: (i) prior to the retrenchment shock, (ii) the period of the retrenchment shock, (iii) all periods after the retrenchment shock (post-retrenchment). To compute the Markov Perfect Equilibrium, we start with the last stage. We first compute the post-retrenchment equilibrium objects (stage (iii)). We then use these post-retrenchment functions to compute the retrenchment shock period objects (stage (ii)). Finally, we use the compute functions from stages (ii) and (iii) to compute the equilibrium objects prior to the shock.

We compute the retrenchment risk version of the Markov Perfect Equilibrium as follows:

1. Follow the steps described in section B.4 to compute the post-retrenchment (i.e. $b_c = 0$ for the rest of time) equilibrium objects: $W_1(0,y)$, $EW_0(b,0,y)$ $W(b,0,s)$, $\tilde{d}(b,0,y)$, $\mathbb{P}_W^{b'}(b,0,y)$, and $\tilde{q}(b',y)$.

2. Use the post-exclusion equilibrium objects from step (1) to compute these same functions but for $b_c > 0$. Use equations 37 through 42 to calculate these objects.

3. Given the already computed $W_1(b_c, y)$, $EW_0(b, b_c, y)$ $W(b, b_c, s)$, $\tilde{d}(b, b_c, y)$, $\mathbb{P}_W^{b'}(b, b_c, y)$,$\tilde{q}(b', y)$, use the strategy described in section B.4 to compute the pre-retrenchment equilibrium objects $V(\cdot)$, $EV_0(\cdot)$, $V_1(\cdot)$, $d(\cdot)$, and $\mathbb{P}_V^{b'}(\cdot)$.