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Borrowing in the Shadow of China[†]

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PRELIMINARY AND INCOMPLETE

Abstract

Emerging economies' debt to China is large, non-marketable, and opaque. We study the impact that such borrowing from China—which is almost completely official debt—has on the equilibrium quantities and prices for *marketable* sovereign debt. We use a standard sovereign debt model with long-term debt and find that following a positive inflow from China our model economy chooses to re-balance its debt portfolio by delevering from market debt. In the process it pays lower spreads and faces less volatile consumption. On the other hand, when facing a capital outflow vis-à-vis China, the economy taps international debt markets, levers up on defaultable debt, and ends up paying higher and more volatile spreads in equilibrium. We contrast the model dynamics with panel-data evidence from emerging and low-income economies, and discuss its welfare implications.

KEYWORDS: Sovereign Debt, Defaults, Chinese Overseas Lending.

JEL CLASSIFICATION CODES: F34, F41.

[†]The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1 Introduction

We study the impact that borrowing from China (which is almost completely official debt) has on the equilibrium quantities and prices for *marketable* sovereign debt. Is having debt vis-à-vis China a good or a bad signal for private international investors? Does it mean the country has a “trusted partner” on whom to rely during bad times? Or is it an additional vulnerability?

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 re-balance its debt portfolio by delevering from market debt. In the process it pays lower spreads and faces less volatile consumption. On the other hand, when facing a capital outflow vis-à-vis China, the economy taps private markets, levers up on defaultable debt and ends paying higher and more volatile spreads in equilibrium. Most of these model dynamics are in line with panel-data evidence from emerging and low income economies.

As recent work has made clear (e.g. the work of [Horn, Reinhart, and Trebesch, 2020](#)), Chinese lending to emerging economies is (i) massive, (ii) non-marketable, and (iii) noisy (data is scarce and terms are opaque). Putting together different datasets (focusing mostly on emerging and developing economies) we have suggestive evidence on a positive and significant “China debt event” premium: on average, after a Chinese-debt restructuring episode countries face larger spreads on their market debt (i.e. less favorable borrowing terms) in the order of 50 basis points. We also uncover a significant effect on market borrowing: a “China debt event” is associated with a market debt deleveraging, in the order of 10 to 30 percent (depending on the particular specification).

Related literature. The official reporting of China’s international financing terms and arrangements can be characterized as being vague and sporadic. A wide array of literature shed light on particular features of China’s massive lending. [Horn et al. \(2020\)](#) construct a comprehensive dataset to identify that China lent \$1.5 trillion to more than 150 countries worldwide which previously were unidentified by official sources. To investigate the same issue, [Morris, Parks, and Gradner \(2020\)](#) investigate this issue on AidData to find that China’s lending terms has some degree of concessionality. [Bräutigam and Gallagher \(2014\)](#) bring an evidence of resource-secured financing from China to African and Latin American countries. The research also focuses on the effects of the funding inflows on the economies of recipient countries. [Onjala \(2018\)](#) and [Hurley, Morris, and Portelance \(2019\)](#) identify that getting

funding from China puts countries under the risk of debt distress. [Bandiera and Tsiropoulos \(2020\)](#) assess the debt sustainability of countries which 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. \(2020\)](#) highlight that there should have been an additional 15 to 20 “missing” defaults in the post 2010 period that pose a great risk to debt sustainability analysis in loan recipient countries and challenge the market pricing of the sovereign risk. [Mkhitarian \(2021\)](#) develops and quantitatively evaluates a sovereign debt model to explore China’s overseas lending arrangements and predict the periods of unidentified defaults. In contrast, [Dreher, Fuchs, Parks, Strange, and Tierney \(forthcoming\)](#) show that China’s funds boost the country’s economic growth in the short-term and with additional funding projects the economy grows even two years after the commitment.

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 model in [Hatchondo and Martinez \(2009\)](#) to allow for official, non-defaultable flows with China. These flows 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 ([Hatchondo, Martinez, and Sosa-Padilla, 2016](#)) is key to understanding the mechanisms at play. Other papers in the literature that relate to our work are [Hur and Kondo \(2016\)](#), [Johri, Khan, and Sosa-Padilla \(2019\)](#), [Bianchi, Hatchondo, and Martinez \(2015\)](#), among many others.

Layout. The rest of the paper is organized as follows: Section 2 summarizes the stylized facts that motivate the theoretical model presented in the rest of the paper. Section 3 introduces the model. Section 4 explains the parametrization of the model. Section 5 presents the quantitative results, discusses the properties of the optimal policies, and studies the welfare effects of being ‘under the Shadow’ of China. Section 6 concludes.

2 Motivating facts

2.1 Data description

In this section, we assemble a dataset to document new facts on the effects of Chinese lending on the amount and the pricing on marketable external public debt.

As noted by [Horn et al. \(2020\)](#), Chinese lending terms and amounts are difficult to

measure. We build on their extensive work and supplement it with data sources on the amount and the timing of Chinese lending relationships from [Acker, Bräutigam, and Huang \(2020\)](#), [Kratz, Feng, and Wright \(2019\)](#), and [Hurley et al. \(2019\)](#). For each country, using these data sources, we construct: (i) annual debt stock positions with China, (ii) annual indicators of new China funding event, as well as (iii) monthly indicators of restructuring events on outstanding debt with China. We collect annual measures of external public debt from the World Bank International Debt Statistics (IDS) along with standard macroeconomic variables such as output and foreign reserves. Finally, we collect monthly 5-year Credit Default Spreads (CDS) data from Bloomberg to assess the pricing implications on debt relations with China.

We therefore have an annual country-level dataset on China funding events and Chinese debt stocks, and a monthly country-level dataset on sovereign spreads and restructuring events on outstanding debt with China.

Annual data on China funding events. Our annual dataset covers all China funding events between 2000 and 2017 across more than 100 emerging and developing economies. On average, a country in the data has 7.1 years with new China funding events and an average Chinese debt to GDP ratio of 8 percent. For instance, the number years with new Chinese funding is 16 for Angola, 8 for Argentina, 4 for Algeria, 8 for Ecuador, 11 for Ethiopia, 2 for Mexico, 8 for Nigeria, 4 for Russia, 5 for South Africa, 14 for Vietnam.

Monthly data on China restructuring events. The monthly dataset on spreads covers all documented cases of Chinese restructuring data with sovereign spreads information in Bloomberg in order to conduct an event study on the pricing impact of Chinese restructurings. The countries with restructuring events in our dataset are: Angola, Botswana, Cameroon, Ecuador, Ethiopia, Fiji, Ghana, Iraq, Kazakhstan, Sri Lanka, Uganda, Ukraine, Venezuela, and Zambia. We only have spreads data for Angola, Cameroon, Ecuador, Ethiopia, Iraq, Kazakhstan, Sri Lanka, and Ukraine.¹

2.2 Empirical Strategy

Using the annual dataset on Chinese funding events, Chinese debt stocks, and external public debt, we estimate the effects of Chinese lending events on total external public debt. To do so we estimate the following regression on our annual data:

¹We are currently collecting detailed bond-level data in both DataStream and Bloomberg in order to extend our coverage and to obtain more accurate estimates changes in outstanding market debt.

$$\begin{aligned}
\Delta \log \text{external debt}_{i,t} = & \alpha + \beta \text{CHN funding}_{i,t-1} \\
& + \theta \text{CHN funding}_{i,t} \times \log \text{CHN debt}_{i,t-1} \\
& + \gamma X_{i,t} + \varepsilon_{i,t}
\end{aligned} \tag{1}$$

where i represents a country, t denotes a year, $\text{CHN funding}_{i,t-1}$ indicates whether a China funding has occurred for country i in period $t - 1$, and $X_{i,t}$ are additional controls including GDP growth, foreign reserves, time fixed effects, and country fixed effects.

In the regression above, we control for the outstanding debt stock with China given the fact that most countries have multiple China lending events in our sample. Obviously, the dependent variable may contain the debt vis-à-vis China if debtor countries choose to report it accurately. [Horn et al. \(2020\)](#) suggest that is certainly noisy and probably under-reported. We think that will bias our estimates of β upward. To overcome that problem, we report our estimates under various specifications. The bond-level data we are collecting to measure new external debt issuances will alleviate this problem.

We turn to our monthly dataset to conduct an event-study on Chinese debt restructurings. Using the monthly dataset on Chinese restructurings and spreads on market debt, we estimate the following regression:

$$\Delta \text{sovereign spreads}_{i,mm} = \alpha + \beta \text{CHN restructuring}_{i,mm-1} + \gamma X_{i,mm} + \varepsilon_{i,mm} \tag{2}$$

where i represents a country, mm denotes a year-month period, $\text{CHN restructuring}_{i,mm-1}$ indicates whether a China restructuring has occurred in period mm for country i , and $X_{i,mm}$ are additional controls including annual GDP growth, lagged external debt, the VIX volatility index, and country fixed effects.

2.3 Empirical findings

We document our empirical results in Table ?? for external debt stocks and in Table 1 for spreads. We document three main stylized facts:

1. external public debt is lower following new China lending events
2. spreads on marketable debt rise following Chinese lending
3. spreads on marketable debt increase after Chinese restructuring events

The external debt reduction effect of new China lending. Let us first discuss the evidence on the effect of Chinese lending on external public debt presented in Table ?? . We estimate the debt flow equation in log changes as specified in equation 1 in columns (2), (4), and (6). We also estimate a lagged specification in log levels of the debt equation 1 in columns (1), (3), and (5).

In our baseline sample, we find in columns (1) and (2) that China lending events are associated with approximately 10 to 12 percent reduction in total external debt. As discussed above, this estimate maybe be biased upward to the extent that the external debt stock reported in the World Bank IDS contains debt vis-à-vis China.

In specifications (3) and (4), given that most countries experience multiple China lending events, we exclude from our sample the first funding event with China. The estimates of the impact on China lending on total external debt reduction doubles to nearly 20 to 25 percent. The larger reduction is driven by the fact that the onset China lending itself is not estimated to be associated with reductions in total external debts in the data.

We further confirm the total debt reduction effect of incremental China lending by restricting the sample in columns (5) and (6) to: (i) countries with at least 2 and less than 9 China lending events, and (ii) periods on or after the second funding event. The corresponding estimates continue to be large and negative, albeit only marginally significant. Altogether, we conclude that China lending events are associated with an overall reduction in the total public external debt of her debtors.

	(1) level	(2) change	(3) level	(4) change	(5) level	(6) change
	log total public external debt					
CHN funding event (lagged)	-0.115** (0.0476)	-0.100** (0.0487)	-0.251** (0.103)	-0.193* (0.109)	-0.250* (0.149)	-0.298* (0.157)
CHN funding \times CHN debt (lagged)	0.0079*** (0.0023)	0.0073*** (0.0024)	0.0141*** (0.0050)	0.0115** (0.0052)	0.0143** (0.0073)	0.0172** (0.00766)
GDP growth	-0.0521 (0.0430)	-0.0193 (0.0421)	-0.0876* (0.0477)	-0.0461 (0.0462)	-0.164* (0.0840)	-0.153 (0.0949)
log debt (lagged)	0.891*** (0.0165)		0.880*** (0.0193)		0.769*** (0.0636)	
adj. R^2	0.989	0.130	0.990	0.128	0.993	0.067
N	1581	1581	1333	1333	541	541

All regressions include country fixed effects and time fixed effects. Robust standard errors in parentheses. Regressions in levels include lagged debt values as controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The China restructuring premium. We now turn to Table 1 to document how spreads on *marketable* debt respond after restructuring events on debt vis-à-vis China.

To do so, we estimate how 5-year CDS spreads on international sovereign bonds respond to restructuring events using monthly data as specified in equation 2. We perform an event study and restrict our sample to countries that experienced a restructuring event. We assume that the timing of restructuring events on debt with China is exogenous to the past performance of a country’s outstanding bonds in international bond markets.

In our baseline specification, we restrict our sample to a six-month window around each China restructuring event. We use alternative definitions of the timing of the restructuring. We also estimate a lagged-dependent specification instead of the benchmark regression in differences. All the regression include country fixed effects and control for the VIX volatility index.

We find in columns (1), (2), (3), (4) and (5) that debt restructuring event with China is associated with 30 to 50 basis points increase in the spreads on the *marketable* international debt of the debtor. The estimates are significant, but standard errors are relatively large. This is partly due to the small sample size.

Table 1: Spreads and China Debt Events

	(1) change monthly	(2) change monthly	(3) change monthly	(4) level	(5) level	(6) level
	5-year CDS spreads on international sovereign debt					
CHN restructuring (current period)	33.38** (15.64)			49.80* (26.95)		
CHN restructuring (current or last period)		44.06** (19.64)				
CHN restructuring (change)			34.06** (13.92)		36.63*** (13.32)	
CHN funding event (change)			69.90*** (21.53)		52.66* (27.30)	
CHN funding era						253.7*** (73.66)
adj. R^2	0.079	0.070	0.094	0.858	0.897	0.567
N	79	83	70	79	73	377

Robust standard errors in parentheses. Regressions in levels include lagged values as controls.

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

Finally, we also ask whether the (annual frequency) China funding events we have documented are associated with significant changes in spreads. In columns (3), (4), and (6),

we estimate a version of the spreads-equation 2 augmented with the (annual) China funding information from our annual dataset. We also create a “China funding era” variable which is set to 0 before the first China funding event and 1 afterwards. We find that a China lending event is also associated with 50 to 70 basis points increase in sovereign spreads in international capital markets. With the ‘China funding era’ variable, we find that the onset of debt relations with China is associated with a significant increase in spreads, nearly 250 basis points, on average.

3 Model

We build from the simplest version of the sovereign default model with long-term debt. The main modification is to include a process for capital flows vis-a-vis China: this process captures both new Chinese funding as well as restructuring events.

3.1 Environment

Preferences and income process. The preferences are give by

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

where \mathbb{E} denotes the expectation operator, β denotes the subjective discount factor, and c_t represents consumption of private agents. The utility function is strictly increasing and concave. The government cannot commit to future (default and borrowing) decisions.²

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 that the small open economy is a net borrower from China: its Chinese debt level can be either low ($b_c = L$) or high ($b_c = H$). Transitioning from low to high b_c implies a capital inflow (and transitioning from high to low implies a capital outflow). These transitions are governed by a random variable $a = \{0, 1\}$: most of the time $a = 0$ and the net flows vis-à-vis China are zero, when $a = 1$ the net flows are

²Thus, 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 (default and borrowing) strategies of other players (governments) who will decide after t .

non-zero.³

Market debt. The small open economy also borrows from a large pool of international investors by issuing long-duration bonds. As in Hatchondo and Martinez (2009), a bond issued in period t promises an infinite stream of coupons, which decreases at a constant rate δ . Hence, debt dynamics can be represented as follows:

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

where b_t is the initial debt level in period t , and ℓ_t is the number of long-term bonds issued in period t . The advantage of this payment structure is that it enables us to condense all future payment obligations derived from past debt issuances into a one-dimensional state variable: the payment obligations that mature in the current period. Bonds are priced in a competitive market inhabited by a large number of risk-neutral foreign investors that discount future payoffs at the risk-free rate, r .

Defaults. When the government defaults, it does so on all current and future 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. Furthermore, income is given by $y - \phi(y)$ in every period in which the government is excluded from debt markets. Starting the first period after the default period, with a constant probability $\theta \in [0, 1]$, the government may regain access to debt markets. The government exits default without debt (a standard assumption in the literature).

Timing. The timing of events within each period is as follows. First, the government learns the economy's income and the realization of the *net flows* vis-à-vis China. After that, the government chooses whether to default on its market debt. Before the period ends, the government may change its market debt positions, subject to the constraints imposed by its default decision.

³Note that we are assuming that debt obligations with China are non-defaultable. This is in line with the reported seniority of Chinese debt (Horn et al., 2020).

⁴Sovereign 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.

3.2 Recursive formulation

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

Let d denote the current-period default decision. 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. Let V denote the government's value function at the beginning of a period, that is, before the default decision is made. Let V_0 denote the value function of a sovereign not in default. Let V_1 denote the value function of a sovereign in default. For any bond price function q , the function V satisfies the following functional equation:

$$V(b, b_c, s) = \max_{d \in \{0,1\}} \left\{ dV_1(b_c, s) + (1-d)V_0(b, b_c, s) \right\}, \quad (3)$$

where

$$V_0(b, b_c, s) = \max_{b'} \left\{ u(c) + \beta \mathbb{E}_{s'|s} V(b', b'_c, s') \right\}, \quad (4)$$

subject to

$$c + \kappa b = y + q(b', b'_c, s)(b' - (1-\delta)b) + z(b_c, a) \quad (5)$$

$$z(b_c, a) = \begin{cases} H - L & \text{if } a = 1 \cap b_c = L \\ 0 & \text{if } a = 0 \\ L - H & \text{if } a = 1 \cap b_c = H \end{cases} \quad (6)$$

$$b'_c(b_c, a) = \begin{cases} H & \text{if } a = 1 \cap b_c = L \\ L & \text{if } a = 1 \cap b_c = H \\ b_c & \text{otherwise} \end{cases} \quad (7)$$

where κ represents the coupon, (6) represents the *net flows* vis-à-vis China, and (7) indicates how the debt level with China evolves. The value of default is:

$$V_1(b_c, s) = u(y - \phi(y) + z(b_c, a)) + \beta \mathbb{E}_{s'|s} \left[\theta V(0, b'_c, s') + (1-\theta)V_1(b'_c, s') \right], \quad (8)$$

subject to (6) and (7).

The bond price is given by the following functional equation:

$$q(b', b'_c, s) = e^{-r} \mathbb{E}_{s'|s} \left[1 - \hat{d}(b', b'_c, s') \right] \left[\kappa + (1 - \delta) q \left(\hat{b}(b', b'_c, s'), b''_c, s' \right) \right], \quad (9)$$

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 (9) equals the expected value of the next-period coupon payment promised in a bond. The second term in the right-hand side of equation (9) 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.

3.3 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 (9); and
- (b) the default rule \hat{d} and borrowing rule \hat{b} solve the dynamic programming problem defined by equations (3)-(8), when the government can trade bonds at q .

4 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 endowment process follows:

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

with $|\rho| < 1$, and $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$. As in Chatterjee and Eyigungor (2012), we assume a quadratic loss function for income during a default episode $\phi(y) = \max\{y[\lambda_0 + \lambda_1[y - \mathbb{E}(y)]] , 0\}$.

Table 2: Benchmark parameter values.

Risk aversion	γ	2
Risk-free rate	r	1%
Discount factor	β	0.98
Probability exclusion ends	θ	0.083
Debt duration	δ	0.03
Bond coupon	κ	$(r + \delta)e^{-r}$
Income autocorrelation coefficient	ρ	0.94
Standard deviation of innovations	σ_ε	1.5%
Mean log income	μ	$(-1/2)\sigma_\varepsilon^2$
Income cost of defaulting	λ_0	0.18
Income cost of defaulting	λ_1	1.30
High China debt	H	0.4
Low China debt	L	0.0
Probability of $a = 1$	π	5%

We assume that a follows an iid process and takes a value of 1 with probability π and a value of 0 with probability $1 - \pi$.

Parametrization. Table 2 presents the benchmark values given to all parameters in the model.⁵ A period in the model refers to a quarter. The coefficient of relative risk aversion, the risk-free interest rate, and the discount factor β take standard values. We assume an average duration of sovereign default events of three years ($\theta = 0.083$), following Dias and Richmond (2007).

The parameters that govern the endowment process are set to common values in the literature. These values, $\rho = 0.94$ and $\sigma_\varepsilon = 1.5\%$, are typical for studies that focus on emerging economies and low-income countries, as we do. The parameters of the income cost of defaulting λ_0 and λ_1 are parametrized as in Hatchondo and Martinez (2017).

We set $\delta = 3.3\%$, which is also the value used in Hatchondo and Martinez (2017). With this value and the mean sovereign spread observed in our simulations (roughly 4.4%), sovereign debt has an average duration of 5 years in the simulations, which is close to the average duration found in previous literature.⁶ The coupon is normalized to $\kappa = (r + \delta)e^{-r}$, which ensures that a default-free bond (with the same coupon structure of our sovereign

⁵Our parametrization follows closely the one in Hatchondo and Martinez (2017).

⁶We use the Macaulay definition of duration that, with the coupon structure in this paper, is given by $D = (1 + i^*)/(\delta + i^*)$, where i^* denotes the constant per-period yield delivered by the bond. 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.

bonds) trades at a price of e^{-r} .

The capital flows vis-à-vis China are characterized by three parameters: L , H , and π . We normalize L to be zero, and use H to target an average level of Chinese debt to GDP of roughly 10%. The frequency of Chinese financing events is set to once every twenty quarters ($\pi = 0.05$).

5 Results

We start by presenting the simulated moments produce by our model, and show that it is a reasonable approximation to data from low-income countries. We then study the effect that the types of China funding events ($H \rightarrow L$ and $L \rightarrow H$) have on the market bond price schedule and on the borrowing decisions. Third, we show the typical dynamics around these funding events. Finally, we analyze the welfare implications of borrowing ‘in the Shadow of China.’

5.1 Simulations

Table 3: Simulated moments.

	Unconditional	Inflow from China	Outflow from China
Market debt/GDP	38.37	42.88	34.05
China debt/GDP	5.12	0.00	9.99
Market issuance/GDP	1.34	-8.55	10.87
Avg. net flow from China/GDP	-0.01	9.96	-9.98
Spreads	1.93	1.52	3.64
S.D. spreads	2.44	1.09	10.91
Corr(spreads, GDP)	-0.49	-0.69	-0.39
S.D. consumption/ S.D. GDP	1.17	0.98	2.24
Avg. consumption/GDP	0.99	1.02	0.92
Default frequency	1.65	1.48	7.22

Note: Moments are computed for non-exclusion periods (except for the default frequency which uses all simulation periods). Units: percent.

As Table 3 shows, our model was parametrized to feature an average China debt ratio of 10 percent of GDP (conditioning on non-zero Chinese debt), a number in between the estimates provided by [Horn et al. \(2020\)](#). We also see that market debt is roughly 38 percent of GDP, in line with the evidence in emerging economies. Regarding spreads, computed as the difference

in yields between the sovereign bonds and comparable default-free bonds, we see that they are moderately high, volatile and countercyclical. On average the economy pays 200 basis points over the risk free rate, with a standard deviation of 240 basis points. Since we have long-term debt, it is not surprising that spreads are higher than the default frequency (which is roughly 1.65% annually).

The last two columns in Table 3 report statistics conditioning on China ‘funding events’, i.e. conditioning on $a = 1$.⁷ We can see that our model captures clear effects on both quantities and prices, reminiscent of the facts documented in section 2. 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 delever on market debt (over and above the geometric decline implied by our coupon structure, hence the observed negative issuances). However, this decline in market debt is not one-to-one with the inflow from China: this implies that part of the Chinese inflow is going to be consumed (see also Figure 2). A similar behavior, with opposite sign, is observed when the country undergoes a capital outflow vis-à-vis China: it taps private markets to offset the outflow but not fully – it also adjusts consumption down. Even though the nominal issuance in this 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.

With regards to sovereign spreads we see, as expected, China outflow events are associated with higher and more volatile spreads than ‘normal times.’ The premium paid during outflow events is consistent with the positive and significant of Chinese debt restructuring on CDS spreads (see section 2). In the case of China inflows, we see the opposite behavior but to a much lesser extent: the level and the volatility of the spreads are only 40 and 140 basis points lower than in normal times, respectively. So, the effect on spreads is *asymmetric*.

Regarding default frequencies, we see that a positive inflow from China is associated with less frequent defaults than in both ‘normal times and outflow events. The fact that defaults are much more frequent during China-outflow periods is expected: these are periods in which the country *has* to repay to China (recall this debt is non-defaultable) and more frequently chooses to finance part of this repayment with a default on other creditors.

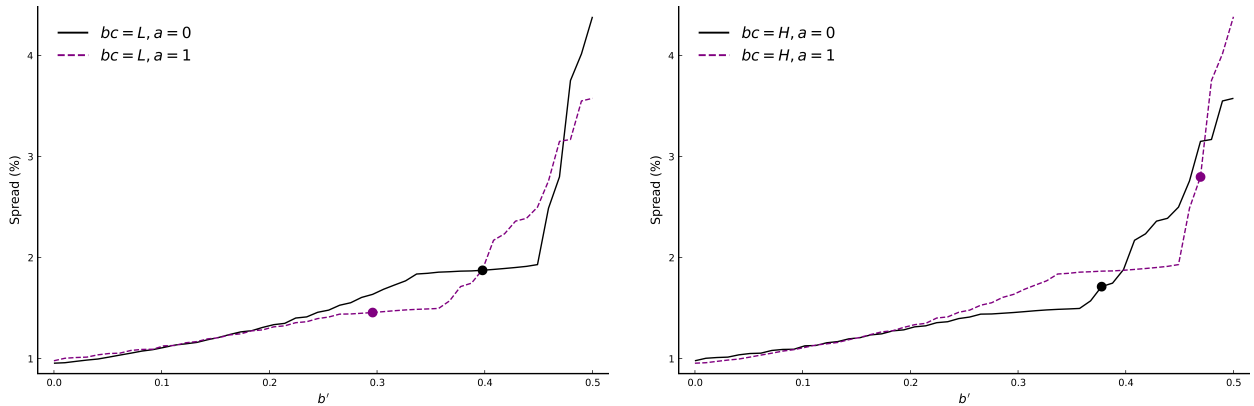
⁷Recall, if $b_c = L \cap a = 1$ then the economy receives a capital inflow from China (second column of Table 3); if $b_c = H \cap a = 1$ then the economy experiences a capital outflow vis-à-vis China (third column of Table 3).

5.2 Effects on borrowing opportunities and policy functions

Figure 1 shows the borrowing opportunity set faced by the small open economy. It presents the spread–debt menus for the case of $b_c = L$ (on the left) and $b_c = H$ (on the right). Consider first the case of $b_c = L$: in it we can see that if the economy faces a funding event from China ($a = 1$) then it *has* to be a positive inflow ($L \rightarrow H$) and the country reacts by delevering (choosing lower level of next-period market debt, as denoted by the purple dot on the menu) and paying lower spreads. The opposite results is observed when $b_c = H$: if a funding event occurs, then it *must* be a capital outflow, to which the economy reacts by borrowing more form the private lenders and paying higher spreads. The overall effect on debt is in line with our findings in section 2.

One other feature of our model is that what matters for the price schedule is not b_c nor a themselves but what they imply for b'_c .

Figure 1: Spread–debt menus

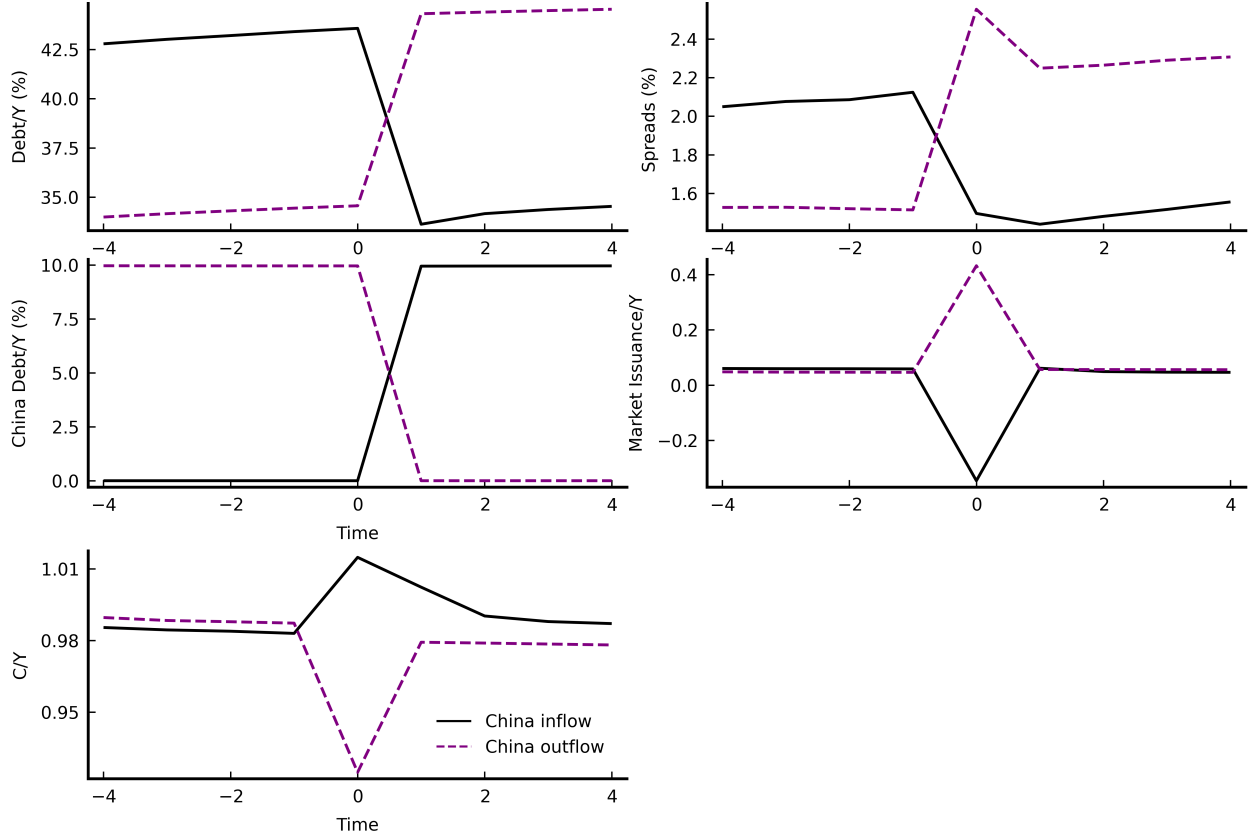


Note: The left panel shows the spread–debt menu available to the economy when $b_c = L$, and the right panel when $b_c = H$. The solid (dashed) line is for the case $a = 0$ ($a = 1$). The dots denote the optimal choices for the corresponding case, when the initial debt level is equal to the mean in the simulations. All lines and panels assume income at its mean.

5.3 Dynamics around Chinese funding events

Figure 2 shows the dynamics of our model around China funding events, both inflows and outflows. The most clear message comes from the behavior of market debt: we see that the economy re-balances its portfolio right after these events. In case of an capital inflow from China, the country lowers its market debt (from roughly 42% to less than 35% of mean GDP) and therefore the equilibrium spreads also decrease (by roughly 50 bps). In case of a capital outflow vis-à-vis China, the economy increases its market debt (roughly from 35% to

Figure 2: Dynamics round Chinese funding events



Note: The plots show the average dynamics for 4 quarters before and after a Chinese funding event (conditioning on no exclusion). Solid black lines are for ‘inflow’ events ($L \rightarrow H$) and dashed purple lines are for ‘outflow’ events ($H \rightarrow L$).

43% of mean GDP) and ends up paying higher spreads (roughly 100 bps higher).

The other clear feature observed in these dynamics is the asymmetry between a positive and a negative China flow: after an outflow consumption decreases by more (in absolute terms) than what it increases after a positive flow. This implies that 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 decreases sharply which limits the equilibrium borrowing and triggers a large consumption adjustment. Naturally, this asymmetric response is captured in the equilibrium spreads.

After the aforementioned portfolio re-balancing the model exhibits somewhat of an inertia: market issuances are close to zero, the debt stocks are fairly constant and so are the spread and consumption levels.

Once more, we see that our simple model produces spread and debt dynamics that are consistent with the empirical evidence obtained from our panel of emerging and low-income

economies.

5.4 Welfare

We next study the welfare implications of having access to Chinese funding. To do this we define a ‘No-China’ model, which is identical to the benchmark except that it is not a possibility to receive (nor pay) funds from (to) China.

We measure welfare gains as the constant proportional change in consumption that would leave a consumer indifferent between continuing living in the No-china economy and moving to the benchmark economy (where China lending exists). The welfare gain of moving to the benchmark economy (or the welfare gain of ‘China financing’) is given by

$$\left[\frac{V^{\text{Bench}}}{V^{\text{No-China}}} \right]^{1/(1-\gamma)} - 1.$$

As Table 4 documents, having access to Chinese lending lowers the default frequency, and with that it reduces the deadweight losses caused by defaults. Accordingly, the benchmark economy pays lower and less countercyclical spreads. Interestingly, having access to China funding the benchmark economy features a lower market debt to GDP ratio, but a larger total debt to GDP ratio.

Table 4: Simulated moments: Benchmark and No-China models.

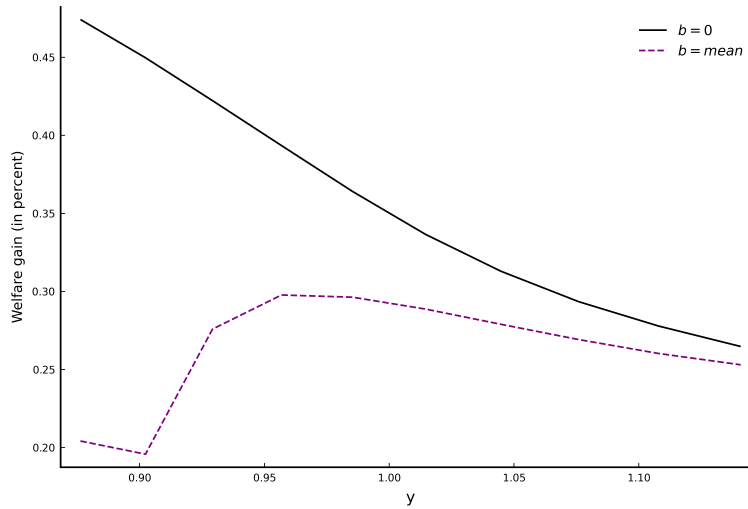
	Benchmark	No-China
Mkt. Debt/GDP	38.37	40.96
China debt/GDP	5.12	--
Average market issuance/GDP	5.35	5.91
Spreads	1.93	2.62
S.D. spreads	2.44	2.24
Corr(spreads, GDP)	-0.49	-0.70
S.D. consumption/S.D. GDP	1.17	1.13
Avg. consumption/GDP	0.99	0.99
Default frequency	1.65	2.12

Note: Moments are computed for non-exclusion periods (except for the default frequency which uses all simulation periods). Units: percent.

We find that, on average, having access to China funding produces a welfare gain of 0.35% of permanent consumption. Figure 3 plots the welfare gain as a function of initial income for two values of initial market debt: zero and the mean in the simulations (roughly 38%

of annual GDP). We can see that for zero initial debt the welfare gains are monotonically decreasing in income: even though the economy benefits unconditionally from having Chinese funding, this benefit is relatively higher if the current income level is low as these are the states of the world where Chinese lending becomes especially useful. For the case of positive initial debt we see a hump-shaped behaviour. At low income levels, the welfare gains are particularly low since default is more likely and the value of defaulting is not dramatically higher in the benchmark economy than in the No-China economy. However, as income improves having access to China funding is more valuable for a high initial debt economy since it creates the possibility of a positive inflow which can relax borrowing constraints.

Figure 3: Welfare gains



Note: The figure was constructed assuming that the initial debt level is equal to zero or to the mean debt level in the simulations of the benchmark economy (with China funding). A positive number means that agents prefer the benchmark economy.

6 Concluding remarks and future work

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 re-balance its debt portfolio by delevering from market debt. In the process it pays lower spreads and faces less volatile consumption. 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 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.

Future work includes (i) putting together a more granular dataset, constructed from bond-level data, in order to document in more detail the effect of a China funding event on issuance characteristics (maturity, in particular), and (ii) incorporating information asymmetries (regarding the China funding process) between the borrowing country and the international private lenders.

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A Data appendix

A.1 Country list

Annual public external debt. The annual total public external debt dataset includes data on the following countries: Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bahamas, Bangladesh, Barbados, Belarus, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Chile, Colombia, Comoros, Congo Democratic Republic, Congo Rep, Costa Rica, Côte d’Ivoire, Djibouti, Dominica, Ecuador, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, Ghana, Guinea, Guyana, India, Indonesia, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Laos, Lebanon, Lesotho, Liberia, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Niger, Nigeria, Oman, Pakistan, Papua New Guinea, Peru, Philippines, Romania, Russia, Rwanda, Samoa, Senegal, Serbia, Seychelles, Sierra Leone, South Africa, South Sudan, Sri Lanka, Sudan, Suriname, Tajikistan, Tanzania, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen, Zambia, Zimbabwe.

Monthly credit spreads and restructuring. The China restructuring events we documented are from existing sources are: AGO (2018m12), BWA (2018m10), CMR (2019m3), ECU (2018m12), ETH (2019m8), FJI (2006m5), GHA (2006m3), GHA (2007m3), IRQ (2010m6), KAZ (2010m11), LKA (2012m5), LKA (2017m7), LKA (2019m8), LKA (2019m10), TZA (2001m7), TZA (2007m9), TZA (2011m11), UGA (2001m3), UGA (2007m8), UKR (2014m2), VEN (2015m1), VEN (2016m1), VEN (2017m11), ZMB (2001m1), ZMB (2006m2), ZMB (2007m3), ZMB (2011m8), ZMB (2017m12), ZMB (2019m8), ZMB (2019m12).