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Surges and Instability: The Maturity Shortening Channel*

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Abstract

Capital inflow surges destabilise the economy through a maturity shortening mechanism. The underlying reason is that firms have incentives to redeem their debt on demand to accommodate the potential liquidity needs of global investors, which makes international borrowing endogenously fragile. Based on a theoretical model and empirical evidence at both the firm and macro levels, our main findings are twofold. First, a significant association exists between surges and shortened corporate debt maturity, especially for firms with foreign bank relationships and higher redeployability. Second, the probability of a crisis following surges with a flattened yield curve is significantly higher than that following surges without one. Our study suggests that debt maturity is the key to understand the financial instability consequences of capital inflow bonanzas.

Keywords: capital inflow surges, corporate maturity structure, systemic financial crisis, term structure

JEL classification: F32, F34, F38, F65, G32

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1 Introduction

One of the open questions in the international finance literature is whether policymakers should restrict capital inflow windfalls. The benefits are apparent: foreign capital inflows can ease financial constraints (e.g., Laeven, 2003), promote productivity growth (e.g., Henry, 2003; Varela, 2018), and reduce domestic credit misallocation (e.g., Larrain and Stumpner, 2017). However, the potential costs are ambiguous. Although most capital inflow surges eventually end in a crisis (Ghosh, Ostry and Qureshi, 2016), it is unclear why this happens, as the existing literature has not established a consensus on the underlying mechanism. As pointed out by Aromí (2021), the ignorance of the mechanism of surges results in weak guidance to policymakers and financial market practice on preventing the accompanying fragility. In addition, the 2008 global financial crisis and the global imbalance that preceded it showed that capital inflow surges could bring instability even to advanced economies. In the existing literature, possible explanations are excessive lending (Caballero, 2016) and asset price bubbles (Calvo, 2012; Aizenman and Jinjarak, 2009). This study shows that capital inflow surges destabilize the economy through a maturity shortening channel.

Specifically, this study consists of a simple theoretical model and then accompanying empirical analyses. We employ the model to explain why firms prefer issuing short-term debt during capital inflow surges and how this behavior affects some macro indicators, such as the yield curve and the probability of crises. The model discusses the firm's optimal choice in an environment where it can choose to borrow from global banks in either long-term debt or short-term demandable debt. The key friction comes from the liquidity mismatch between the borrower's asset liquidation costs and the lender's liquidity needs. With demandable debt, even before a project matures, banks can demand the liquidation value of corporate assets. Our model shows that firms have strong incentives to make debt demandable for international borrowing, because it is more attractive to global banks that face liquidity shocks. In other words, firms choose to issue demandable and short-term debt, especially when borrowing from global banks with potential liquidity needs, because the price advantage of demandability increases corporate debt capacity (Donaldson and Piacentino, 2022). Consequently, capital inflow surges with an endogenous shortening of corporate maturity. However, the increased demandability of corporate debt exposes domestic firms to possible debt runs, thus increasing aggregate financial instability. Our model implies a deep connection between capital inflow bonanzas and economic instability through the endogenous corporate maturity structure mechanism, which has three testable implications. First, capital inflow surges are associated with the shortening of corporate debt maturity. Second, cross-sectionally, firms with higher asset liquidation values and/or foreign bank relationships are more likely to borrow short-term debt from global investors. Third, surges with flattening yield curves are strong predictors of future financial crises.

Guided by these model predictions, we conduct an empirical study at both firm and macro levels to test whether the maturity shortening channel actually holds. In line with the literature, throughout our main analysis, surges are defined as episodes in which the detrended net capital inflows in real per capita terms are larger than one standard deviation.[1] First, we use a cross-country firm-bank matched dataset to examine the effects of surges on corporate maturity structure and instability. Specifically, using a large sample of over one million firm-year observations, which mainly consists of private and small enterprises in seven European countries during surge episodes in the 1990s and the 2000s, we find that surges are significantly associated with an increase in the use of short-term debt, and this maturity shortening effect is significantly more pronounced for firms that have foreign bank lending relationships and higher redeployability. We document these findings by employing a difference-in-differences (DID) specification to compare corporate debt maturity structures for firms with and without foreign bank relationships in the six-year window around inflow surges. In addition, we conduct propensity score matching (PSM) to mitigate the concern that firms with and without foreign banks are endogenously different, and then provide DID results based on the matched sample. We find that firms with foreign bank relationships are significantly more likely to be affected by surges than firms with only domestic bank relationships. We further examine the impact on firm insolvency probability proxied by Z-score and find a significant decrease in soundness for firms with a shortened debt maturity after surges, compared to those with a lengthened maturity. We also provide robust checks using firm-level and loan-level data based on an alternative sample consisting mainly of listed firms, which allows the identification of time-variant firm-bank relationships and specific debt maturity length, and the results are robust. These firm-level empirical findings are consistent with the model's predictions. Furthermore, we discuss the heterogeneous impacts across different categories of credits and capital inflows.

Second, to test the macro implications, we turn to historical surge events to ascertain whether the debt maturity shortening channel can explain the heterogeneous responses of the aggregate probability of financial crisis across countries. Specifically, we exploit a long-run macrohistory dataset covering twelve countries from 1870 to 2016 compiled by Jordà, Schularick and Taylor (2017). We find that the combination of a surge and a flattened yield curve is a strong predictor of

[1] Section 3.1 explains the surge measurement in greater detail. Our main findings hold when we use alternative definitions of surges based on criteria of two standard deviations, on top 20th percentile inflows, on inflows in GDP ratio terms instead of real per capita terms, and on gross instead of net inflows.

future systemic financial crises. We use a conventional logit model to test whether surges increase the probability of systemic financial crises and distinguish between surges with and without a flattened yield curve. The unconditional probability of crises in Jordà, Schularick and Taylor (2017)'s data sample is 3.4%, and we find that surges alone can increase the likelihood of a crisis to 11.0%. More importantly, the probability of crises significantly increases to 32.6% if surges are accompanied by a flattened yield curve. These findings prove the external validity of our argument that debt maturity shortening is important in the transmission of surges to financial instability.

Our maturity shortening story of international capital flows dates back to Rodrik and Velasco (1999), who also examined the impact of short-term capital flows on financial instability. They built a model using simultaneous determination of debt maturity and the term structure of interest rates to explain that short-term debt leaves borrowing countries vulnerable to sudden shifts in lender expectations. Our study is similar to that of Rodrik and Velasco (1999) in that it links short-term debt with vulnerability and crises; however, our study is different in the following ways. First, theoretically, our model shows that international borrowing is associated with maturity shortening because foreign investors need to bear more liquidity shocks. In contrast, in Rodrik and Velasco (1999)'s model, the costs of long-term debt depend on the expected probability of runs in the intermediate stages. However, whether firms actually use excessive short-term debt is unclear in their model because it depends on the extent to which lenders can distinguish among investors in the same country and the extent to which local investors internalize their behavior. Second, we use firm-level data to provide evidence of shortened corporate debt maturity and increased instability and further examine the heterogeneous effect based on redeployability. In contrast, Rodrik and Velasco (1999) utilized only country-level data on short-term capital flows and crises to test their theoretical model. Third, using matched firm-bank data, we focus on the role of relationships with foreign banks, which is the key characteristic we choose to identify the impacts of foreign credit booms compared with domestic ones. Another closely related study is that of Broner, Lorenzoni and Schmukler (2013), who argued that that emerging countries tend to borrow short-term debt because it is cheaper. However, our study differs from theirs in three aspects. First, they investigate sovereign debt, whereas we are interested in corporate debt. Second, their explanation is from the asset pricing perspective: emerging countries need to pay a higher risk premium on long-term than on short-term bonds. In contrast, our underlying model is based on the relationship between liquidity needs and short-term debt in the banking theory literature. Third, their model implies that the government issues shorter maturities during crises. However, we argue that debt maturity shortens during capital inflow surges, and the root of financial crises lies in these booms.

Considered together, our findings have important implications for policy and research. For policymakers concerned with the impacts of capital inflows on financial stability, our study reveals that the shape of the interest rate term structure is an important indicator that requires attention. International borrowing is likely to be associated with substantial changes in corporate maturity structure as global investors face an entirely different liquidity condition from local investors; therefore, policymakers should pay serious attention to capital inflow bonanzas with a flattening yield curve, which is a strongly informative predictor of future financial crises. Thus, we also contribute to the growing literature on optimal capital flow management policies (e.g., Korinek and Sandri, 2016; Das, Gopinath and Kalemli-Özcan, 2022). Moreover, it is important for future theoretical studies attempting to investigate the macro-finance consequences of large capital inflows to consider the interest rate term structure and introduce endogenous debt maturity to the existing small open economy framework à la Uribe and Schmitt-Grohe (2017) and Croce, Jahan-Parvar and Rosen (2020).

Related literature Our study is closely related to several branches of literature. First, we build on the literature that investigates the relationship between international capital surges and crises. Although the literature has reached a consensus that large capital inflows are not just scaled-up normal flows and surges are significantly associated with a higher likelihood of economic crises (Reinhart and Reinhart, 2009; Caballero, 2016), the underlying mechanism is ambiguous. The common hypothesis is that surges are linked to future crises through excessive lending booms; however, empirical findings are inconclusive. Furceri, Guichard and Rusticelli (2012) show that the domestic credit-to-GDP ratio increases substantially in the early years following a capital inflow surge but the effect reverses in the long term. Amri, Richey and Willett (2016) document that countries with independent currencies can keep surges from generating credit booms by at least partially sterilizing capital inflows. In addition, many studies, including those by Gourinchas, Valdés and Landerretche (2001) and Elekdag and Wu (2013), failed to find a robust relationship between inflow surges and credit booms. Instead of the excessive lending channel, our study explores the innovative maturity shortening channel to explain the destabilizing effect of surges on the financial system.

Second, our study is related to the global financial cycle literature. Since Rey (2018)'s seminal idea, there has been a growing interest in exploring the impacts of global financial market conditions on local economic performance. For instance, Baskaya et al. (2017) document a strong and positive relationship between international capital inflow and local credit supply. Many studies (e.g., Eickmeier, Gambacorta and Hofmann, 2014; Miranda-Agrippino and Rey, 2020; Jorda et al., 2019; Born et al., 2020; Chari, Dilts Stedman and Lundblad, 2021; Asis, Chari and Haas, 2021) show that monetary policy from the core economy and global liquidity can generate strong comovements in international financial variables such as asset price, global credit, capital inflows, the leverage of financial intermediaries, risk premia, and distress risk. Bruno and Shin (2015) formulate a model linking exchange rates and financial stability through the endogenous build-up of leverage in the banking sector. Our study contributes to the existing literature by investigating how booms in global financial conditions bring both capital inflow surges and instability to local economies.

Third, our study adds to the interdisciplinary research on international finance and corporate finance. In terms of theoretical works, Jeanne (2009) shows that due to incomplete contract friction, the prevalence of short-term debt induces the government to choose policies that meet foreign creditors' interests, but it makes the country vulnerable to crises. In addition, Tirole (2003) explains the excessive foreign borrowing phenomenon from a dual- and common-agency perspective, and Broner and Ventura (2016) use an imperfect contract enforcement channel to argue that the effects of financial globalization are heterogeneous with respect to the level of development and quality of institutions. In terms of empirical studies, Schmukler and Vesperoni (2006) investigate the impact of capital account liberalization on corporate debt maturity and find that the results differ between firms with and without access to the international financial market. Reinhart and Smith (2002), De Gregorio, Edwards and Valdés (2000), and Cárdenas and Barrera (1997) use the policy event in a single country to find that capital inflow controls shift the composition toward longer maturity. In addition, by using a firm-bank-sovereign matched database, Kalemli-Özcan, Laeven and Moreno (forthcoming) demonstrate that firms with a higher leverage ratio and shorter debt maturity reduce their investment by a larger magnitude after the European crisis. In contrast, our study attempts to investigate the effects of international capital inflow surges on the corporate maturity structure and shows that shortened debt maturity is a mechanism that leads to financial instability.

Finally, we refer to several recent studies that attempt to re-evaluate the benefits and costs of financial globalization and rethink international financial architecture reform.[2] For instance, Furceri, Loungani and Ostry (2019) find that financial globalization has contributed to the global decline in labor share and the increase in inequality; Larrain (2015) shows that capital account liberalization increases domestic wage inequality; Teimouri and Zietz (2018) document that surges significantly affect the output and employment shares of manufacturing; and Shen (2020) dis-

[2] Erten, Korinek and Ocampo (2021) provide a systemic literature review on capital controls and financial globalization.

cusses an interesting "double adverse selection channel" when firms can borrow from both global and local banks. In contrast, our study points out the importance of actively managing capital inflow bonanzas when there is a flattening yield curve, as it is a powerful informative predictor of future financial crises.

The remainder of this paper is organized as follows. Section 2 outlines a simple model to derive some testable empirical predictions. Section 3 describes the data source and the variable construction for our empirical analysis. Sections 4 and 5 present the findings based on firm-level and macro-level data, respectively. Finally, Section 6 concludes.

2 An Illustrative Model

We now use a simple model to illustrate the main idea of this study. Our model is closely related to the discussion on the dark side of short-term debt in corporate finance and international finance literature. However, earlier studies (e.g., Diamond and Dybvig, 1983; Goldstein and Pauzner, 2005) mainly focused on coordination-based bank runs with an exogenously determined maturity structure. Recently, a growing body of literature has investigated why financial institutions and countries have incentives to shorten their debt maturity (e.g., Donaldson and Piacentino, 2022; He and Milbradt, 2016; Aguiar et al., 2019). Our study is based on new research that establishes that endogenously excessive use of short-term debt exposes countries to financial instability. Another difference is that we show that the global financial cycle could contribute to changes in the corporate debt maturity structure in emerging markets. Specifically, we demonstrate that during the global market boom, firms choose to issue more demandable debt to increase their debt capacity. This money-like characteristic of corporate debt is the fundamental reason that we should expect a positive link between capital inflow surges and financial fragility.

2.1 Model setup

Consider a discrete-time infinite-horizon economy populated by a unit-measure continuum of domestic firms borrowing from global investors such as international banks.[3] Firms are heteroge-

[3] For simplicity, we only consider the endogenous maturity of the lending and borrowing between domestic firms and international banks. As we will see later, maturity is mainly determined by changes in the global financial cycle. If we assume that domestic banks have limited exposures to these global cycles, then, debt maturity between domestic banks and domestic firms is always long-term and will not change over the global financial cycle. Under this condition, our main conclusions still hold if we introduce both domestic and foreign banks.

neous in their asset liquidity l.[4] All agents in this economy are risk-neutral and have a discount rate of zero. Each firm has a profitable investment project that pays off $\bar{Y} \geq 1$ when the project matures, but it needs to borrow an upfront fixed amount of money $\bar{B}$ to finance externally. Without losing generality, we normalize $\bar{B}$ to be 1. There is no asymmetric information on the project profitability $\bar{Y}$, but the project's exact finishing time is uncertain and arrives with an exogenous intensity $\zeta \in (0, 1]$. Before the project matures, firm i can choose to liquidate its projects early with a liquidation ratio of $l_i = \frac{L_i}{\bar{Y}} \in [0, 1]$, where l_i can also be interpreted as the (scaled) firm-specific asset redeployability (Shleifer and Vishny, 1992).

We assume that global banks need to bear liquidity shocks. This assumption is consistent with the growing literature showing that liquidity shocks are the primary driver of business fluctuations (e.g., Farhi and Tirole, 2012; Bigio, 2015). Specifically, global banks are assumed to have a Diamond-Dybvig preference (Diamond and Dybvig, 1983), where their liquidity needs might arrive at each period with an intensity of χ. Therefore, the key friction in this economy is from borrowers' asset liquidation costs (or technological illiquidity) and lenders' possible liquidity needs.

In this economy, the endogenous choice that firms can make is the maturity of debt. Specifically, each firm can choose one of the following two debt instruments to borrow from global investors. The first is nontradable long-term debt, which means that the lenders can only receive a payoff when the project matures. Before that, even if a liquidity shock hits investors, they cannot receive anything back in return. Here, the long-term debt can be interpreted as long-term nontradable loans. The second borrowing instrument is short-term debt. Similarly, global banks can get payoffs when the project matures. In addition, the key advantage of short-term debt is that even before the project matures, investors can receive some money back by choosing either to resell debt to other investors or to not roll over outstanding debt. With the former choice, investors can receive an endogenous reselling price of p; meanwhile, if investors stop rolling over the short-term debt, it will force firms to liquidate their assets so that investors can obtain the liquidation value. When the second scenario occurs, there is a debt run in this economy. Therefore, compared to long-term debt, the benefits of short-term debt are its tradability and demandability; meanwhile, its costs are possible debt runs and hence liquidation losses.

To formally establish the selection between the debt-run equilibrium and the non-run equilibrium, we follow the standard literature (e.g., Azariadis and Guesnerie, 1986; Cole and Kehoe, 2000) and introduce a sunspot coordination variable $\theta \in \{0, 1\}$, i.e., a commonly observed random variable unrelated to the firm's fundamental condition. Thus, we can fully characterize the

[4]To obtain closed-form solutions, we assume one-dimensional heterogeneity. But our main conclusions can be extended to firms with other types of heterogeneity such as time-to-build and asset tangibility.

existence of short-term debt runs in equilibrium. Without losing generality, we assume that there is a debt run when $\theta_t = 1$ and no debt run when $\theta_t = 0$. The value of this sunspot variable is public information to all global investors and thus can serve as a way to coordinate beliefs. The transition matrix between different states **P** can be expressed as follows:

$$\mathbf{P} \equiv \begin{array}{c} \\ \theta = 0 \\ \theta = 1 \end{array} \begin{array}{cc} \theta = 0 & \theta = 1 \\ \left| \begin{array}{cc} \lambda & 1-\lambda \\ 1-\lambda & \lambda \end{array} \right| \end{array} \tag{1}$$

Here, we assume that λ could be different at a different period t and the fluctuations in λ can be interpreted as the global financial cycle. As Rey (2018) and many other related works argue, there is a global financial cycle in international capital flows and the activities of global banks. More importantly, this cycle mainly comes from exogenous global factors such as risk, liquidity, and the core economy's monetary policy and policy uncertainty. Throughout this study, we assume that the global market environment can be summarized as a simple indicator λ, and its changes are outside the model and exogenous to the economy in which we are interested. To obtain closed-form solutions, we also assume that λ follows a martingale process and focus on comparative statics. If λ is high, we interpret it as a good global financial market environment. Otherwise, it represents a bad situation. We first look at how variations in λ affect corporate choice between short- and long-term debt and, then, investigate the aggregate implications of endogenous corporate debt maturity on the shape of the yield curve and financial instability.

2.2 Firm-level implications

First, we investigate how the value and cost of debt differ when firms choose different maturities. At any time t, if a firm with liquidation value l chooses to borrow from global banks with a long-term debt contract, the value of its debt v^l can be written in the following recursive form:

$$v_t^l = \zeta R^l + (1-\zeta)(1-\chi)\, v_{t+1}^l \tag{2}$$

This equation indicates that if the project matures at time t with an ex-ante probability of ζ, investors can get R^l in return. The value of R^l is determined by the non-profitability condition of firms, i.e., $v_t^l = \bar{B} = 1$. If the project does not mature during this period, then, global investors can get a discounted value of the next period's debt value v_{t+1}^l. With long-term debt, the investment project continues only when the project does not mature $(1-\zeta)$ and global investors do not face a liquidity shock $(1-\chi)$. In addition, as long-term debt is neither demandable nor tradable, Equation (2) shows that the long-term debt value does not depend on the global market condition λ or the sunspot coordination variable θ_t.

In contrast, if a firm chooses to borrow from global banks with short-term debt, its debt value v_t^d depends crucially on the global market condition λ and the current state of the economy θ_t. We look for a Markov equilibrium where the global investor's rollover decision σ_t depends only on the current global financial market condition, that is,

$$\sigma_t = \begin{cases} \sigma^1 & \text{if} \quad \theta_t = 1 \\ \sigma^0 & \text{if} \quad \theta_t = 0 \end{cases} \tag{3}$$

The equation above means that if there is a debt run belief ($\theta_t = 1$) and investors are hit by a liquidity shock, global investors will run their debt with a probability of $1 - \sigma^1$, and not run their debt with a probability of σ^1. If there is no debt run belief ($\theta_t = 0$), investors can choose between getting a liquidation value l and reselling debt with a value of p^0. As previously mentioned, p^0 is determined endogenously within the model. Thus, the short-term debt value, with different debt run beliefs, can be characterized by the following two equations:

$$v_t^d(\theta_t = 0) = \zeta R^d + (1-\zeta)\left\{\chi\left[\sigma^0 p^0 + \left(1-\sigma^0\right) l\right] + (1-\chi)\left[\lambda v_{t+1}^d(\theta_{t+1} = 0) + (1-\lambda) v_{t+1}^d(\theta_{t+1} = 1)\right]\right\} \tag{4}$$

$$v_t^d(\theta_t = 1) = \zeta R^d + (1-\zeta)\left\{\chi\left[\sigma^1 p^1 + \left(1-\sigma^1\right) l\right] + (1-\chi) v_{t+1}^d(\theta_{t+1} = 1)\right\} \tag{5}$$

Comparing Equations (4) and (5) with Equation (2), we can find that compared to long-term debt, short-term debt has both advantages and disadvantages. The benefits of issuing short-term debt come from the value of demandability and tradability when investors experience liquidity needs. However, there are also potential costs associated with issuing short-term debt. When there is a debt run belief in the economy, investors choose to run their short-term debt, even if they have no liquidity need. This debt rollover risk incurs additional costs for issuing short-term debt, which makes a short-term debt less attractive to investors. In summary, the debt capacity of long-term debt is not affected by global financial cycles, while that of short-term debt relies crucially on global financial market conditions and the current state of the economy. As we only look at international borrowing, the amount of capital inflow changes in this economy because short-term debt borrowing varies across the global financial cycle.

Following Donaldson and Piacentino (2022), throughout this study, we focus on the stationary equilibrium, where $v_t = v_{t+1}$.[5] In a steady state, the corporate optimal choice on debt maturity is

[5] The assumption of a martingale for λ process also allows us to focus on stationary equilibrium and the

summarized in the following lemma.

Lemma 1. *Firms with a liquidation value higher than threshold l^* will strictly prefer using short-term debt. The threshold l^* has the following closed-form solution:*

$$l^* = 1 - \frac{\zeta + (1-\zeta)(1-\lambda+\lambda\chi)}{1-\lambda} \tag{6}$$

l^* decreases in global financial market condition λ.

The detailed proof is provided in the appendix A1. The intuition behind Lemma 1 can be explained as follows. Given the global financial market environment, firms suffering less from illiquidity mismatch prefer to use more short-term debt as it is cheaper to do so. Therefore, in any period, given the market condition, firms with asset redeployability values higher than the threshold borrow from global investors in the short term. Simultaneously, fluctuations in global financial market conditions change the values of this threshold. When the global market condition is good (λ is high), i.e., the probability of having a short-term debt run crisis is low, the threshold for choosing short-term debt is also lower, as firms with lower liquidation values will also find short-term debt attractive. Similarly, when the market condition is bad (λ is low), the threshold increases. In other words, the global financial cycle will endogenously change the debt maturity composition and debt capacity in the economy and, in a good global market environment, firms can increase their debt capacity for international borrowing but at the cost of using more short-term debt. This endogenous choice of debt maturity builds a close link between capital inflows (or international borrowing capacity) and financial instability.

2.3 Macro implications

We then investigate the economy-wide impact of international short-term borrowing. More specifically, we examine the consequences of different global market conditions λ on the following two aspects: financial instability, defined as the fraction of firms exposed to possible debt runs in the next period, and term spread, defined as the average interest rate difference between long-term and short-term debt.

We assume that the distribution of a firm's liquidation value $l \in [0, 1]$ follows a probability density function of $g(l)$ and a cumulative density function of $G(l)$ with $G(0) = 0$ and $G(1) = 1$. With this general distribution assumption, Lemma 2 presents our two key findings regarding the macroeconomic impact.

following comparative statics.

Lemma 2. *A country's total exposure to possible debt runs* Ψ*, defined as the fraction of firms using short-term debt, has the following closed-form solution:*

$$\Psi = \int_{l^*}^{1} g(l)\, dl = 1 - G(l^*) \tag{7}$$

Ψ *is increasing in global financial market condition* λ*.*

A country's yield curve Ξ*, defined as the average difference between long-term and short-term interest rate, can be computed as follows:*

$$\begin{aligned} \Xi &= \frac{\chi(1-\zeta)}{\zeta} - \frac{\int_{l^*}^{1} \left\{ \frac{(1-\zeta)\chi(1-\lambda)}{\zeta[\zeta+(1-\zeta)(1-\lambda+\lambda\chi)]} (1-l) \right\} g(l)\, dl}{\int_{l^*}^{1} g(l)\, dl} \\ &= \frac{\chi(1-\zeta)}{\zeta} \left[1 + \frac{G(l^*)}{1-G(l^*)} - \frac{\int_{l^*}^{1} G(l)\, dl}{(1-l^*)(1-G(l^*))} \right] \end{aligned} \tag{8}$$

The relationship between Ξ *and* λ *depends on the shape of distribution* $G(l)$*.*

Our main conclusions from Lemma 2 are two-fold. First, it shows that the degree of financial instability is higher during good times than during bad times in the global financial market. The proportion of firms using short-term debt can be interpreted as exposure to possible debt runs and sudden stops; thus, an increase in this proportion indicates an increase in financial instability. More importantly, this measure increases during a good global financial cycle, as the threshold for international short-term borrowing decreases. For any given distribution function $G(\cdot)$, the fraction of firms exposed to possible debt runs increases in a good global market environment. In other words, our model implies that the root of economic instability builds up during the boom phase of the global financial cycle.

Second, changes in financial instability can be inferred from fluctuations in interest rate term spreads. In this simplified model, the long-term interest rate does not change over the global financial cycle because it is unaffected by global market environment λ. Consequently, all changes in the yield curve originate from changes in the short-term interest rate. However, as we can see from the lemma above, two opposing forces affect the average values of the short-term interest rate in this economy: *intensive margin* and *extensive margin*. On the one hand, an increase in λ can lower the short-term interest rate for all firms that have already used short-term debt. Thus, the average short-term rate decreases for these firms. This effect is consistent with the conventional view of cheap short-term international capital flows and, here, it represents the intensive margin effect of the global financial cycle. However, as Lemma 1 shows, an increase in λ can also lower the asset liquidation threshold for firms using short-term demandable debt. In other words, firms with lower asset liquidation values also choose short-term borrowing during a good financial cycle. However, these firms have a higher short-term rate as they are "riskier." In other words, the extensive margin effect reflects the composition effect and, hence, increases the average short-term interest rate. Therefore, whether the yield curve flattens or steepens during a good financial cycle depends on the underlying distribution of the firms. We present three examples in the appendix Section A1.3; with various relative importance of extensive margin effect and intensive margin effect, we could achieve different conclusions on the change in the term spread.

If the underlying distribution has a long left tail, which means that there is a significant number of firms with low asset liquidation values, the extensive margin effect outweighs the intensive margin effect, which makes the yield curve a decreasing function of global market conditions. Nevertheless, if the underlying distribution has a long right tail, which means that there is a significant number of firms with high asset liquidation values, the intensive margin effect outweighs the extensive margin effect, which makes the yield curve an increasing function of global market conditions. In addition, if the underlying distribution is symmetric, these two opposing effects cancel each other, and the yield curve is not related to the global market condition.

Notably, our model indicates that changes in the yield curve during capital inflow bonanzas can be informative regarding what is happening. For example, if the term spread flattens during capital inflow surges, it means that an increasing number of risky firms with relatively low liquidation values can be financed during capital inflow surges. As global banks face liquidity shocks, all these international borrowings are in the form of short-term debt, which significantly increases the average short-term interest rate while generating no sizable impact on the long-term end. Therefore, when the yield curve flattens during capital inflow surges, this indicates increasing financial instability in the country. In other words, the model implies that even when we are not able to observe changes in the underlying distribution of short-term international borrowing, whether term spreads flatten or steepen can be informative about the underlying mechanism.

Considered together, our model's macro implications are that policymakers should pay close attention to the shape of the interest rate term structure during massive capital inflows. The role of global capital flows should not be merely considered to equalize the interest rate differences between domestic and international financial markets, as international borrowing is likely to be associated with substantial changes in the corporate maturity structure and the shape of the yield curve, making the country more exposed to global market conditions and destabilizing the local economy. Therefore, the benefits of international borrowing may come from a reduction in financing costs, whereas the costs come from increasing financial and economic instability in the future.

2.4 Summary

We provide a model linking surges and financial instability through the endogenous maturity shortening channel.[6] Our model predictions at the firm and macro levels can be summarized as follows.

Empirical Prediction 1. *At the firm level, capital inflow surges are associated with the shortening of corporate debt maturity. Aggregate maturity shortening consists of two different effects:*

- *intensive effect: firms with higher asset liquidation values borrow more in short-term debt*
- *extensive effect: firms with lower asset liquidation values switch from long-term to short-term debt*

Empirical Prediction 2. *At the macro level, capital inflow surges with a flattened yield curve suggest a higher probability of future financial crises.*

3 Data and Variables

The remainder of this paper examines whether the predictions derived from the model hold in the data. Our empirical investigation consists of two parts: one using firm-level data and the other using macro-level data. First, we explain our data sources and the variable construction.

3.1 Surge identification

To identify capital inflow surges, we follow Caballero (2016) by defining surges as periods when detrended capital inflows in real per capita terms are one standard deviation above the long-run mean. First, we deflate the net capital inflows for each country and divide them by the total population to obtain the per capita real capital inflows. We then use the Hodrick-Prescott filter to obtain the cyclical component of capital inflows and calculate its standard deviations.[7] Finally, we define a surge episode as one in which the de-trended capital inflows are larger than its standard deviation. In terms of data sources, we use capital flow data from the International Monetary Fund

[6] Our model builds a close relationship between capital inflows and debt maturity. Although our model does not distinguish between normal capital flows and surges, the underlying mechanism here is closely related to changes in global financial cycles. As documented in the previous literature (e.g., Ghosh et al., 2014), compared to normal capital inflows, capital inflow bonanzas are mainly driven by these global factors. Therefore, when testing the implications of the model, we use international capital inflow surges.

[7] In this step, we require a minimum time span of ten years and set the smoothing parameter to 6.25 for annual data.

Financial Flows Analytics (IMF FFA) Database to identify surges for the countries used in the firm-level analysis and the current account balance from the Jordà-Schularick-Taylor (JST) Macrohistory Database (Jordà, Schularick and Taylor, 2017) for the countries used in the macro-level analysis. We report the identified surges and scale of capital inflows over time for each country used in this study in Figures A2 and A3 in the appendix.

Several aspects are worth noting in our definition of surges. First, there are debates in the existing literature on whether we should use net or gross capital inflows to measure surges (Forbes and Warnock, 2012*a*, 2021; Broner et al., 2013; Kumhof, Rungcharoenkitkul and Sokol, 2020). By definition, gross inflows refer to capital coming to the domestic economy through foreign residents, gross outflows refer to capital leaving the economy through domestic residents, and net inflows are the difference between them. In our baseline empirical investigation, we use net capital flows for three main reasons. First, most existing studies on surges and crises use net instead of gross capital flow data (e.g., Caballero, 2016; Benigno, Converse and Fornaro, 2015; Reinhart and Reinhart, 2009). We bring in the innovative channel of debt maturity shortening based on the same surge measurement. Second, the long-term macro-history dataset used in this study does not contain gross capital inflow information. Therefore, it is more consistent when we employ net capital inflows to conduct both firm- and country-level empirical exercises. Third, using the net inflow measure is more appropriate in this study because, compared to gross capital flows, net flows are more essential to changes in the shape of the yield curve. However, our main conclusions do not rely on the choice of net or gross capital inflows.

According to our definition, the choice of the one-standard-deviation criterion is relatively *ad hoc*. Therefore, we also use two standard deviations or the top-20th percentile as alternative criteria. Although these changes lead to fewer observations of surges, our main findings are still robust, and the estimated economic significance becomes even stronger. Finally, in addition to rescaling capital flows by population, we can also express capital flows in terms of the GDP percentage to identify surges, and the main findings still hold.

3.2 Firm-level data

Our firm-level investigation examines whether capital inflow surges cause firms to shorten their debt maturity. The firm-level data is obtained from *Orbis*, a database provided by the Bureau van Dijk (BvD). Other widely used cross-country firm-level databases, such as *Compustat* and *Worldscope*, mainly consist of large listed companies. In contrast, most firms in *Orbis* are small and medium-sized enterprises (SMEs). Many studies, including Kalemli-Özcan et al. (2015) and Gopinath et al. (2017), have shown that the *Orbis* dataset has good national coverage, especially for

European countries where such reporting is mandated even for small private firms. In our sample dataset, 98% of firms are SMEs, which are the primary drivers of employment and economic growth in these economies.

The main advantages of using *Orbis* in this study are threefold. First, SMEs are informationally opaque and more dependent on external financing. Therefore, these firms are more likely to be domestically constrained financially and thus greatly affected by capital inflow surges, and using an international dataset with good coverage of SMEs is important for evaluating the effects of surges. Second, *Orbis* has detailed information on corporate capital structure; thus, we can distinguish between long-term debt, short-term loans, and other types of short-term debt. Third, with *Orbis*, we can match firms with their related banks and determine whether a firm has a foreign bank relationship, which is extremely helpful for our empirical investigation of the underlying mechanism. Alternatively, we employ other datasets covering large and publicly listed firms to conduct robustness checks and report the results in the appendix Section A4.

We clean the *Orbis* data following the guidelines of Kalemli-Özcan et al. (2015) and Gopinath et al. (2017) along with some conventional accounting rules. The detailed steps are provided in the online appendix Section A2. To ensure cross-country comparability, we express all financial variables in real 2005 U.S. dollars. In addition, we exclude all firms in the financial sector and include only nonfinancial corporations. The data availability on debt maturity and bank relationship limits our final dataset to cover seven European countries with high data quality: three emerging countries in the east (Estonia, Hungary, and Latvia), two slow-growing countries in the south (Spain, and Portugal), and two core economies (France and Germany). In the appendix, we present the number of firms and observations and the summary statistics of the key variables country by country in Table A7.

To measure the corporate debt maturity structure, we mainly use debt maturity, defined as the share of long-term debt in total debt,[8] and the leverages of different maturities, i.e., the short-term debt-to-asset ratio, long-term debt-to-asset ratio, and total debt-to-asset ratio. With the *Orbis* database, our definition of long-term debt is financial debt (loans and credits) to credit institutions and bonds that mature in more than one year, and short-term debt is the sum of short-term loans, including financial debt to credit institutions and the part of long-term financial debt payable

[8] In the existing literature, there are two different approaches to measuring debt maturity: the first is to use the actual years to maturity of the debt issuance, and the second is to use the information from the corporate balance sheet and calculate the share of total debt that matures in the long term. As we do not observe the actual years of debt maturity in the *Orbis* database, we follow the second approach and use the ratio of long-term debt in total debt as the proxy for debt maturity. This measure is also widely used in the literature (Barclay, Marx and Smith Jr, 2003; Brockman, Martin and Unlu, 2010; Fan, Titman and Twite, 2012; Kim and Kung, 2016).

within a year, and current liabilities. We exclude trade credit in our short-term debt measure because it has very different characteristics from loans and other liabilities. However, we provide a separate analysis of the impact on trade credit in the extended discussion section. Columns (1)-(3) in Table 1 show that, on average, 34.66% of the total debt is long-term. The average short- and long-term leverage levels are 0.36 and 0.19, respectively, and the average total leverage is 0.55.

As shown in the theoretical model, capital inflows hinge on short-term borrowing from global banks. Thus, it is important to have information on firms' lending relationship with foreign banks and domestic banks so that we can investigate the impact of surges on corporate debt maturity depending on the firm-bank relationship. *Orbis* provides the names of the main banks that the firm has borrowed from, which enables us to match firm-level data in *Orbis* to bank-level data in either *Bankscope* or *BankFocus*. We manually identify time-invariant firm-bank relationships and generate a dummy variable to indicate that the firm has a foreign bank relationship if at least one of its associated banks is a foreign bank. Detailed descriptions of this procedure are provided in the appendix Section A3. Thus, 4.5% of the firms and 5.3% of the observations in our sample have a lending relationship with foreign banks.

As shown in Section 4, our identification strategy is based on comparing the outcome variables (i.e., debt maturity and instability) of firms with foreign bank relationships (treated) and those of firms without foreign bank relationships (control) during the capital inflow surge windows in a DID specification. Columns (1)-(3) in Table 1 report the summary statistics of the overall sample; columns (4)-(9) present those of the two groups of firms separately, and we observe that they are different in many dimensions. We focus on the following characteristics which are considered important determinants of the corporate capital structure: firm size, defined as the natural logarithm of total assets; the sales growth rate, calculated as the difference in log sales between the current and the previous year; cash flow, defined as the sum of current profits and depreciation divided by total assets; tangibility, defined as the ratio of tangible fixed assets to total assets; the SA index based on firm size and age, as a proxy of financial constraints (Hadlock and Pierce, 2010); and a dummy variable indicating publicly-listed status. These are also the firm-level controls used in the later regressions. On average, firms with foreign banks are larger and more likely to be publicly listed and have higher sales growth, smaller cash flow, less tangible assets, and looser financial constraints than those without foreign banks. In particular, the differences in size and financial constraints are statistically significant, as indicated by the normalized differences defined by Imbens and Wooldridge (2009).[9]

[9]Normalized differences are calculated as the difference in the means of two subsamples divided by the square root of the sum of the variances of the respective distributions. The differences are statistically

Table 1: Summary Statistics of Firm-level Data

	All			Raw Sample							Matched Sample						
				Treated			Control			Normalized	Treated			Control			Normalized
	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Difference	Mean	Standard Deviation	N	Mean	Standard Deviation	N	Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Panel A: Dependent Variable																	
Debt Maturity (%)	34.656	27.129	1284309	30.587	25.637	68358	34.885	27.192	1215951	-0.115	30.319	25.298	62113	31.808	26.025	62580	-0.041
Short-term Debt/Asset	0.360	0.234	1284309	0.418	0.250	68358	0.356	0.233	1215951	0.181	0.421	0.248	62113	0.393	0.246	62580	0.080
Long-term Debt/Asset	0.192	0.186	1284309	0.186	0.190	68358	0.192	0.186	1215951	-0.023	0.185	0.188	62113	0.185	0.189	62580	0.000
Total Debt/Asset	0.549	0.247	1284309	0.594	0.257	68358	0.546	0.246	1215951	0.135	0.596	0.256	62113	0.572	0.261	62580	0.066
Z-Score	0.692	0.629	1272115	0.704	0.630	67462	0.691	0.629	1204653	0.015	0.701	0.619	61375	0.685	0.630	61898	0.018
Panel B: Control Variable																	
Firm Size	0.342	1.382	1284309	1.040	1.438	68358	0.303	1.369	1215951	0.371	1.073	1.405	62113	1.029	1.384	62580	0.022
Sale Growth	0.029	0.372	1284309	0.045	0.392	68358	0.028	0.371	1215951	0.031	0.042	0.383	62113	0.036	0.391	62580	0.011
Cash Flow	0.093	0.105	1284309	0.087	0.107	68358	0.093	0.105	1215951	-0.040	0.086	0.104	62113	0.087	0.101	62580	-0.007
Tangibility	0.269	0.223	1284309	0.268	0.215	68358	0.269	0.223	1215951	-0.003	0.268	0.214	62113	0.268	0.216	62580	0.000
SA Index	-0.776	1.134	1284309	-1.261	1.130	68358	-0.749	1.128	1215951	-0.321	-1.300	1.100	62113	-1.249	1.057	62580	-0.033
Listed	0.001	0.029	1284309	0.002	0.046	68358	0.001	0.027	1215951	0.019	0.002	0.046	62113	0.001	0.029	62580	0.018

Note: This table presents the summary statistics of variables used in firm-level analysis. Detailed definitions and sources for each variable are shown in Table A1 in the online appendix.

To reduce the concern that the treated and control groups of firms are endogenously different, we perform a propensity score matching procedure (Abadie and Imbens, 2006, 2016) to find control firms that are similar to treated firms, except for the foreign bank lending relationship. Specifically, we match firms based on the average values of their observable characteristics in the three years prior to the surge. A probit model is used to estimate the propensity scores of having a foreign bank relationship, conditional on firm size, sales growth, cash flow, tangibility, financial constraints, and listed status.[10] For each treated firm, we identify one control firm with the nearest propensity score, while the matched control firms can be repeated. In this process, we require that the matched control firm is in the same country and sector, and the absolute difference in predicted propensity scores is not greater than 0.05. Of the 12,257 unique treated firms, 10,090 are matched to 9,309 control firms. Since treated firms take only a very small fraction of our sample, the propensity score-matched sample used in the later regressions is largely reduced. Thus, we report the estimates using both raw and matched samples.

The matching procedure performs well. First, the area under the receiver operating characteristic (AUROC) of the probit estimation is 0.65, suggesting a good fit of the model. Second, columns (11)-(17) in Table 1 and the left panel of Figure 1 demonstrate that the differences between treated and control firms are largely reduced, and there are no significant differences between their observable characteristics in the matched sample. Third, the middle and right panels of Figure 1 show the predicted scores in the raw and matched samples, respectively. We observe that the

significant when the absolute values are larger than 0.25.

[10]We present the probit estimation results in the appendix Table A8.

distribution of the predicted scores is very different for the treated and control groups before matching but becomes almost identical after matching.

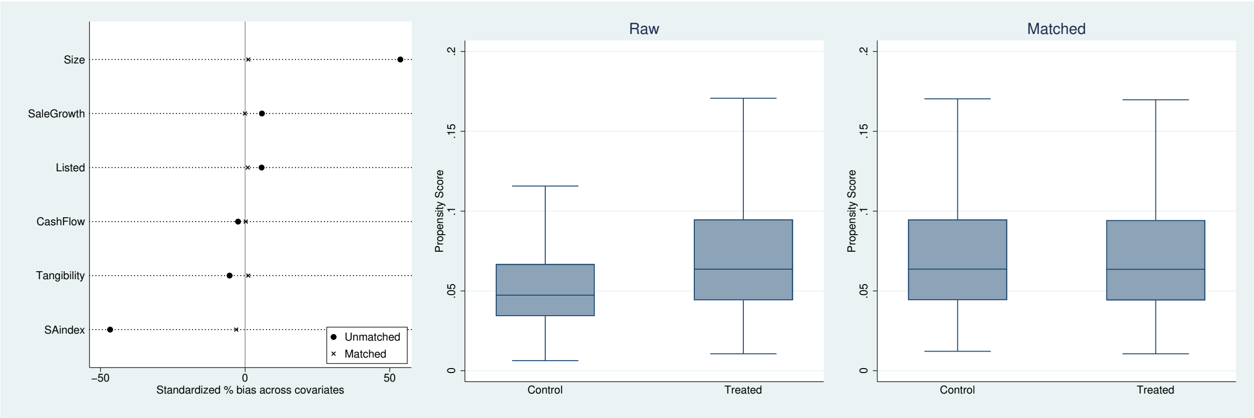

Figure 1: Performance of Propensity Score Matching

Note: The left panel presents the standardized bias of each covariate for the matched and unmatched sample; the middle and right panels present the distribution (median value, 25th and 75th percentile, and adjacent values) of the propensity scores obtained from the probit model for the control and treated firms, before (raw) and after matching (matched), respectively. Outside values are excluded.

3.3 Macro-level data

We use macro-level data to test our model prediction that surges lead to greater instability, captured by the probability of financial crises, through a flattened yield curve. Our main data source for macro-level analysis is the Jordà-Schularick-Taylor (JST) Macrohistory Database (Jordà, Schularick and Taylor, 2017). After excluding the US, UK, Japan, and Germany, as they are the countries that are likely to drive the global financial cycle, the dataset covers macro and financial variables in twelve countries for a very long period, from 1870 to 2016.[11] Since financial crises are relatively rare events, a long-term dataset with reasonable country coverage is necessary. In addition, the JST database contains all the three key variables for our empirical investigation, namely surges, term spread, and systemic financial crises.

[11]The twelve countries are Australia, Belgium, Denmark, Finland, France, Italy, Netherlands, Norway, Portugal, Spain, Sweden, and Switzerland. Canada is also excluded because some of its data are missing. Besides, note that we include Germany in the firm-level analysis, because its global economic impact is smaller in the post-1990s period than that in the long-run history of 1870-2016.

Table 2: Summary Statistics of Macro-level Data

	Mean	Standard Deviation	Min	Max	N
Surge	0.099	0.298	0.000	1.000	1236
Surge with Flattened Yield Curve	0.026	0.159	0.000	1.000	1236
Surge without Flattened Yield Curve	0.070	0.255	0.000	1.000	1236
Systemic Financial Crises	0.034	0.181	0.000	1.000	1236
Credit Boom	0.100	0.299	0.000	1.000	1236
Real GDP per capita Index	47.171	32.552	4.932	112.520	1236
GDP Growth	7.359	9.319	-27.360	124.336	1236
Trade Openness	50.818	34.180	5.678	297.395	1236
Strict Peg Dummy	0.540	0.499	0.000	1.000	1236
Depreciation	1.633	14.031	-40.451	194.745	1236
Private Credit to GDP	67.351	37.609	2.244	204.516	1236
Housing Return	11.452	10.786	-23.448	136.314	1236

Note: This table presents the summary statistics of variables used in macro-level analysis. Detailed definitions and sources for each variable are shown in Table A6 in the online appendix.

First, as mentioned before, surges are defined when real net inflows per capita are one standard deviation above the trend.[12] In the JST dataset, we use the opposite of the current account balance to capture capital inflows; therefore, only net inflow surges can be identified. Second, for the term structure, we construct the dummy variable *Surge with Flattened Yield Curve* to indicate that the country is experiencing a capital inflow surge and a much-flattened yield curve simultaneously, and the dummy variable *Surge without Flattened Yield Curve* to indicate that the country is experiencing a capital inflow surge but not a flattening of the yield curve. We use a method to identify a flattening in the yield curve similar to that for a surge, which means that we identify a yield curve flattening when there is a substantial reduction in the term spread.[13] It is because the average change in the term spread in the dataset is approximately zero, and it is necessary to distinguish between a small reduction in most cases and a large reduction associated with surges. Third, for systemic financial crises, we use a dummy variable based on the JST definition.[14] For

[12]To obtain the net inflow per capita using the JST database, we first deflate the current account amount using the CPI (1990=100) and then divide by the population.

[13]For term spread, we use the difference between the long-term interest rate and the short-term interest rate. The main indicator of short-term interest rates is the three-month interbank rate and that of long-term interest rates is the ten-year government bond yield. We treat the difference of these two rates as a good proxy of term spread of the corporate borrowing cost, as Neumeyer and Perri (2005) suggest a very strong co-movement between interest rates on government debt and those of the private sector. Moreover, the identification of the flattened yield curve is conducted country-by-country, like that of surges; therefore, the comparability of the level of term spread across countries is not a concern in this process.

[14]The authors define financial crises as "events during which a country's banking sector experiences bank runs, sharp increases in default rates accompanied by large losses of capital that result in public

other control variables, we employ GDP per capita, GDP growth rate, trade openness, pegged exchange rate dummy, and depreciation.

Table 2 presents the summary statistics of all variables used in the macro-level analysis. It shows that the probabilities of surges and systemic financial crises during the long-run history from 1870 to 2016 are 9.9% and 3.4%, respectively. In addition, the average term spread is 0.79 percentage points.

4 Firm-level Empirical Evidence

We first use the compiled *Orbis* firm-level dataset to test our model predictions. Specifically, we examine whether surges are associated with shortened debt maturity, whether this effect is stronger for firms with higher asset liquidation values, and whether surges lead to higher instability through the debt maturity shortening channel.

4.1 Surges and shortened corporate debt maturity

We adopt a difference-in-differences (DID) empirical strategy and test the impact of surges on firms with and without foreign bank relationships.[15] According to the model, we expect that firms with a lending relationship with foreign banks are more affected by surges, and they will show shorter debt maturity.

Specifically, we estimate the following specification:

$$Debt_{ijct} = \alpha + \beta Post\ Surge_{ct} \times Foreign\ Bank_i + \Gamma X_{ijct} + \gamma_i + \gamma_{jct} + \epsilon_{ijct} \tag{9}$$

where i, j, c, and t indicate firm, sector, country, and year, respectively. $Debt_{ijct}$ is one of the four variables representing a firm's debt maturity structure: the share of long-term debt in total debt (*Maturity*), short-term leverage (*Short*), long-term leverage (*Long*), or total leverage (*Total*). They are used together to test whether the shortening in maturity is driven by increased use of short-term borrowing or by decreased use of long-term debt but an insignificant change in short-term debt. $Post\ Surge_{ct}$ is a dummy variable indicating a post-surge period. The time window for our DID estimation is seven years centered around the surge year, i.e., three years before and three years after the surge. We only use surge episodes that are not followed by another surge episode

intervention, bankruptcy, or forced merger of financial institutions."

[15] The before- and after- comparison and event study approach is conventionally used in the surge literature (e.g., Benigno, Converse and Fornaro, 2015; Reinhart and Reinhart, 2009).

within three years or preceded by one within three years. If there are multiple consecutive surges for a country, we set the surge year as the earliest one and treat them as one surge episode.[16] Thus, we ensure a more clearly classified surge event shock. $Foreign\ Bank_i$ is a dummy variable indicating that firms are related to at least one foreign bank. X_{ijct} is an array of firm-level control variables that are shown relevant to the corporate maturity structure in the literature, including firm size, sales growth, cash flow, tangibility, and a financial constraint indicator (the SA index). We also include firm fixed effects γ_i and sector×country×year fixed effects γ_{jct} in the estimation to saturate unobserved factors at these levels; the sector is defined at the four-digit NACE code level. Throughout all firm-level estimations, we cluster the standard errors at the firm and country-year levels.

Table 3 presents the main results, in which panels A and B report the results using the raw and PSM samples, respectively. The key message is that capital inflow surges are significantly associated with a shortened corporate debt maturity, particularly the increased use of short-term debt. In columns (1)-(2), the estimated coefficients β are both negative and statistically significant, revealing that, compared to firms with domestic bank relationships only, having foreign banks is associated with a larger reduction in debt maturities after capital inflow surges. This finding holds in both panels, but the magnitudes of the effects are more than halved in the propensity score-matched sample. Based on the estimates in column (2), the reduction in debt maturity is larger for firms with foreign bank relationships by 0.62 percentage points in panel A and 0.28 percentage points in panel B, thereby implying that the matching procedure mitigates the concern about endogenous differences in borrowing behaviors between the two groups of firms. Considering that the average gap in debt maturity between these two groups of firms is 4.30 and 1.49 percentage points in the raw and matched samples, respectively, this impact of surges accounts for 14.43% and 18.80% of that. In addition, according to columns (3)-(8), the decrease in debt maturity is mainly due to the increasing use of short-term debt rather than the change in long-term debt. For instance, the estimates in columns (4) and (6) show that, the difference in the before-and-after

[16] For instance, foreign capital inflows surged in 2003, 2006, 2009, and 2011 in France, and in 2006, 2007, and 2008 in Estonia; thus, $Post\ Surge_{ct}$ in the case of France is 1 for 2003-2006 and 0 for 2000-2002 and in the case of Estonia is 1 for 2006-2009 and 0 for 2003-2005. As a result, we use the following surges in the DID specification: Estonia (surge year: 2006; pre-surge years: 2003-2005; post-surge years: 2007-2009), France (surge year: 2003; pre-surge years: 2000-2002; post-surge years: 2004-2006), Germany (surge year: 2000; pre-surge years: 1997-1999; post-surge years: 2001-2003), Hungary (surge year: 2008; pre-sure years: 2005-2007; post-surge years: 2009-2011), Latvia (surge year: 2006; pre-surge years: 2003-2005; post-surge years: 2007-2009), Portugal (surge year: 2008; pre-sure years: 2005-2007; post-surge years: 2009-2011), and Spain (surge years: 1996, 2007; pre-surge years: 1994-1995 and 2004-2006; post-surge years: 1997-1999 and 2008-2010). Some early or late years, e.g., 1993 or 2016, are excluded because of the start and end of the sample period.

Table 3: Surges and Debt Maturity: Baseline Results

	Maturity		Short		Long		Total	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Raw Sample								
Post Surge × D(Has Foreign Bank)	-0.827***	-0.615**	0.015***	0.014***	0.002	0.004**	0.018***	0.019***
	(0.277)	(0.265)	(0.004)	(0.004)	(0.002)	(0.001)	(0.004)	(0.004)
Observations	1284309	1284309	1284309	1284309	1284309	1284309	1284309	1284309
Adjusted R-Square	0.633	0.654	0.700	0.708	0.663	0.689	0.738	0.748
Firm Controls	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Panel B: Matched Sample								
Post Surge × D(Has Foreign Bank)	-0.271***	-0.276***	0.005***	0.005**	0.002	0.002	0.008***	0.007***
	(0.067)	(0.054)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	124321	124321	124321	124321	124321	124321	124321	124321
Adjusted R-Square	0.590	0.617	0.642	0.654	0.651	0.674	0.683	0.689
Firm Controls	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationship in the effect of surges on corporate debt maturity in a difference-in-difference specification. The dependent variables are debt maturity defined as the share of long-term debt in total debt in columns (1)-(2), the ratio of short-term debt to total asset in columns (3)-(4), the ratio of long-term debt to total asset in columns (5)-(6), and the ratio of total debt to total asset in columns (7)-(8). The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. Definitions of the other control variables are in Table A6 in the online appendix. Data used in this table is at firm-year level. Odd columns show the results without including firm-level control variables, and even columns show the results including them. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. Standard errors are clustered at firm and country-year level.

change in the long-term debt leverage between firms with and without foreign bank relationships is insignificant or negligible. In contrast, the effect on the short-term debt leverage is much higher and contributes to more than 70% of the increase in total leverage. In terms of the economic significance of the increased short-term debt, the estimated coefficients indicate a modest increase in the treated firms' short-term debt-to-asset ratio by 1.2%-3.3%, but holding the total asset at its average value, they suggest an increase in short-term debt by 34,797 to 94,779 U.S. dollars in 2005 real terms. Moreover, results based on collapsed data following Bertrand, Duflo and Mullainathan (2004) to address concerns on autocorrelation, that is, one observation before and one observation after the surge for each firm, are provided in the appendix Table A9, which suggests consistent and even more pronounced findings.

Subsequently, we extend the simple DID specification to a dynamic one to examine whether the impact of surges is at impact or persistent, and at the same time to test the parallel trend assumption. To do so, we estimate the following dynamic specification:

$$Debt_{ijct} = \alpha + \Sigma_{k=-3}^{-1}\beta^k D(k\ Year\ to\ Surge)_{ct} \times Foreign\ Bank_i + \Sigma_{k=+1}^{+3}\beta^k D(k\ Year\ to\ Surge)_{ct} \times Foreign\ Bank_i + \Gamma X_{ijct} + \gamma_i + \gamma_{jct} + \epsilon_{ijct} \quad (10)$$

where $D(k\ Year\ to\ Surge)_{ct}$ are dummy variables indicating that the distance to surge is k years. By construction, we have $k \in \{-3, -2, -1, +1, +2, +3\}$, and the dummy indicating the surge year, i.e., $D(0\ Year\ to\ Surge)_{ct}$ is omitted. Therefore, the coefficients β^k can be interpreted as the effects on the difference in maturity structure between the treated and control firms in each of the years relative to the surge year.

Figure 2 presents the results. First, the differences in debt maturity, short- and long-term leverage, and total leverage between firms with and without foreign bank relationships are all insignificant in each of the three years before the surge compared to the surge year. This finding validates the parallel trend assumption in the previous DID specification and is consistent with the existing studies that suggest that external factors, or push factors in the core economies instead of pull factors in the recipient countries, are the main driving force of surges (Reinhart and Reinhart, 2009; Forbes and Warnock, 2012*a*; Fratzscher, 2012). Moreover, the estimated coefficients on debt maturity, short-term debt, and total leverage become significant for each of the three years after the surge, whereas those on long-term debt leverage remain insignificant. These findings hold for both the estimates using raw and matched samples, although the magnitudes of the effect are again smaller in the matched sample. Using the more conservative results from the matched sample (shown in red), the relative debt maturity decreases by 0.44 percentage points in the first year after the surge and then stabilizes, and the impact remains at 0.49 percentage points three years after. For short-term and total leverage, the impact is also stable and persistent, which indicates that firms with foreign banks display a larger increase of around 0.01 in the post-surge years. These dynamic impacts are almost twice those of the baseline estimates. To sum up, Figure 2 clearly demonstrates that capital inflow surges are significantly and persistently associated with shortened corporate debt maturity, particularly for firms with foreign bank relationships.

According to the Empirical Prediction 1, at the intensive margin, maturity shortening incentives are stronger for firms with higher asset liquidation values. To test this prediction, we re-estimate the dynamic specification for subsamples of firms with high and low liquidation value, employing the sector-level redeployability as a proxy for asset liquidation value.

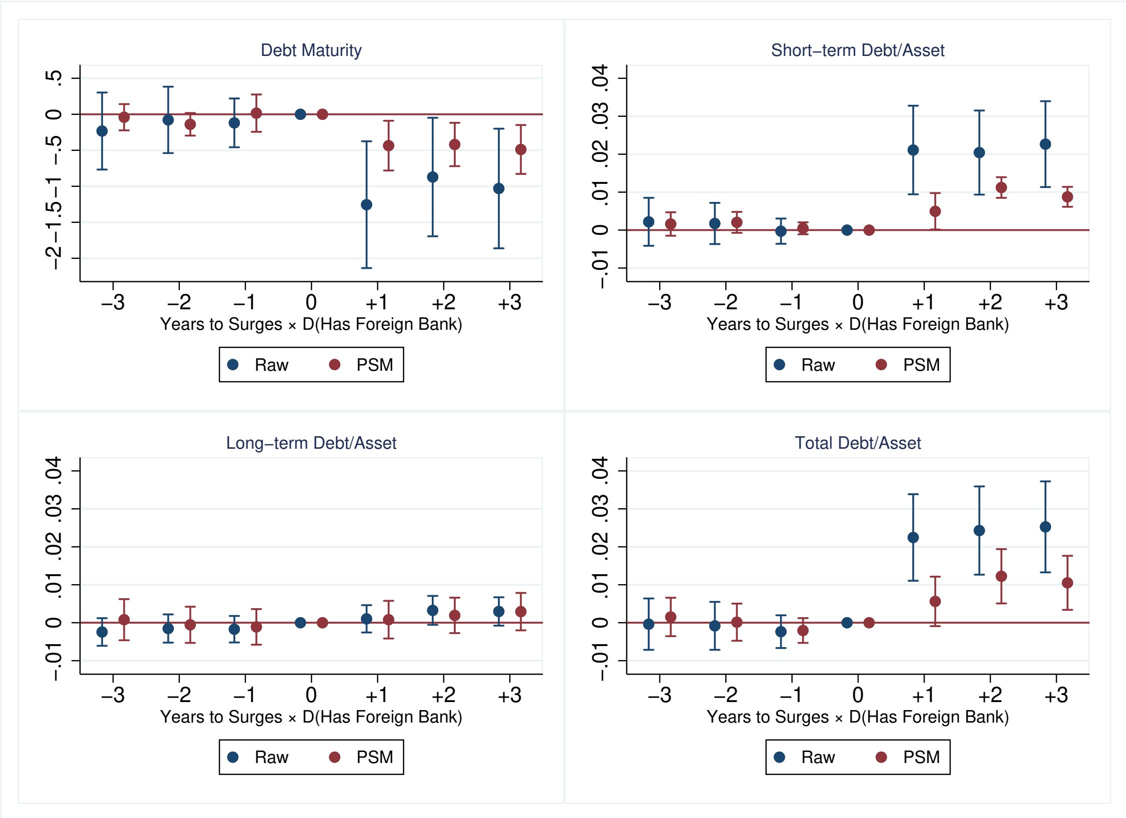

Figure 2: Surges and Corporate Debt Maturity: Dynamic Effects

Note: This figure plots the results regressing the firm-level debt maturity defined as the share of long-term debt in total debt, the short-term debt to asset ratio, the long-term debt to asset ratio, or the total debt to asset ratio on the interaction term between the years to surge and the dummy indicating the firm has a lending relationship with foreign banks. By limiting the sample to the three years before and the three years after the surge, the estimates are the relative effects compared with the surge year. The solid line are the estimated coefficients of the difference between firms with and without foreign bank relationship compared to that in the surge year, and the dashed lines are the 95% confidence intervals.

Specifically, we adopt the redeployability measure from Kim and Kung (2016), which use the Bureau of Economic Analysis (BEA) capital flow table that breaks down capital expenditures into various asset categories for a broad cross-section of industries to construct a variable indicating the extent to which assets have alternative uses. A higher redeployability value indicates that firms' assets in this sector are used more by firms in the economy. The construction of this measurement is based on U.S. data, and we apply it to European firms in our sample by matching the sectors. This practice is consistent with a broad literature that treats the external finance dependence constructed from U.S. data as a sector-level characteristic and applies it to other countries (Rajan and Zingales, 1998). Then, we divide the full sample dataset into low- and high-redeployability based on the median value and then re-estimate the dynamic DID specification for each subsample.

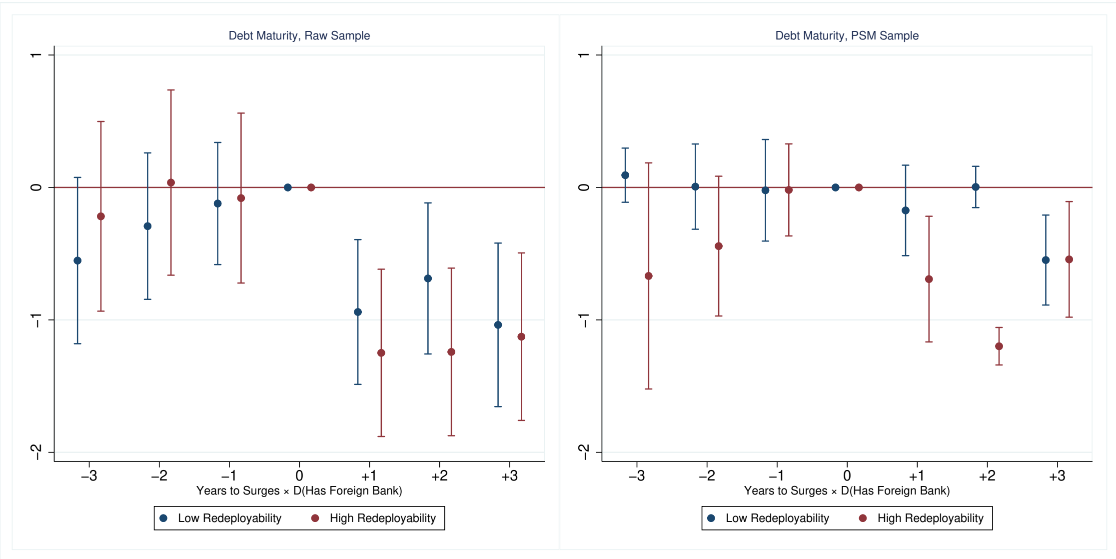

Figure 3: Surges and Corporate Debt Maturity: By Redeployability

Note: This figure plots the results using the low- and high-redeployability subsamples to regress the firm-level debt maturity defined as the share of long-term debt in total debt, the short-term debt to asset ratio, the long-term debt to asset ratio, or the total debt to asset ratio on the interaction term between the years to surge and the dummy indicating the firm has a lending relationship with foreign banks. By limiting the sample to the three years before and the three years after the surge, the estimates are the relative effects compared with the surge year. The solid line are the estimated coefficients of the difference between firms with and without foreign bank relationship compared to that in the surge year, and the capped spikes are the 95% confidence intervals. Lines in maroon present the results of the high-redeployability subsample and lines in navy present that of the low-redeployability subsample.

We present the results in Figure 3, in which the left and right panels correspond to estimates from the raw and matched samples, respectively.[17] They show that the maturity shortening effect after the surge is present for both high- and low- redeployability firms; however, both panels demonstrate that the reduction in debt maturity after the surge is more pronounced for firms with high redeployability. Specifically, our estimates from the matched sample reveal that in the post-surge years, for firms with higher redeployability, debt maturity becomes significantly smaller by 0.69, 1.20, and 0.54 percentage points in the first, second, and third years after the surge, re-

[17]To save space, here we only show the results using debt maturity as the dependent variable, while results for short- and long-term leverage are reported in the appendix Figure A4.

spectively, which accounts for 36%-81% of the average maturity gap between treated and control firms. Meanwhile, the impact is insignificant in the first two post-surge years for firms with lower redeployability and only becomes similar in the third year. Such heterogeneous impacts of surges are consistent with our model prediction and imply that surges are associated with exacerbated corporate maturity mismatch problem. Note that the firm-level data do not allow observing the composition change of firms borrowing short-term debt, thus the results here can not capture the change in the extensive margin regarding firms' liquidation value.

4.2 Surges and instability at the firm level

We use the firm-level dataset to test the argument that the maturity shortening associated with surges leads to higher economic instability. We revise the baseline DID specification in Equation (9) by changing the dependent variable to $Instability_{ijct}$, a firm-level instability measurement proxied by the Z-score. The Z-score is calculated as a function of five financial ratios based on seminal papers by Altman (1968) and Altman (1983), and it is widely used in the literature as an insolvency predictor.[18] We use the natural logarithm form because of its high skewness. A higher Z-score indicates greater soundness and a lower likelihood of firm insolvency. Then, we estimate Equation (11) separately for firms that show shortened or lengthened debt maturity after surges. Specifically, for each firm, we compute the average debt maturity in the three years before the surge ($Maturity_i^{before}$) and in the three years after the surge ($Maturity_i^{after}$) and obtain the difference ($Maturity_i^{after} - Maturity_i^{before}$). We assign the firm to the maturity-shortened subsample if the difference is negative; otherwise, we assign it to the maturity-lengthened subsample.

$$Instability_{ijct} = \alpha + \beta Post\ Surge_{ct} \times Foreign\ Bank_i + \Gamma X_{ijct} + \gamma_i + \gamma_{jct} + \epsilon_{ijct} \tag{11}$$

Table 4 presents the results. The odd and even columns report the estimates for the raw and matched samples, respectively. The first two columns show that surges are associated with higher instability for firms with foreign bank relationships, as the estimated coefficients are significantly negative. Moreover, comparing columns (3)-(4) with columns (5)-(6), we find that the increased instability is only present for firms that show shorter maturities after surges. In other words, if the firm does not display a shortened maturity after the surge, it would also not show an association with increased instability. Specifically, based on the estimates using the matched sample, firms

[18]For private firms, $Z\text{-}score = 0.717 \times \frac{Working\ Capital}{Assets} + 0.847 \times \frac{Retained\ Earning}{Assets} + 3.107 \times \frac{EBIT}{Assets} + 0.420 \times \frac{Book\ Value\ of\ Equity}{Book\ Value\ of\ Liability} + 0.998 \times \frac{Sales}{Assets}$.

with foreign bank relationships show a greater increase in instability by 0.01 after the surge than those without foreign bank relationships. In addition, the impact is doubled to 0.02 when the firm with foreign bank relationships shortens maturity after the surge, and becomes insignificant when it does not shorten maturity. The coefficient of 0.02 indicates an increase in instability for the treated firms by 2.2%, but given that, on average, the treated firms have greater soundness than the control firms by 2.3%, the impact of maturity shortening is not modest. These results provide strong evidence that surges are associated with increased instability through the shortening of debt maturity.[19]

Table 4: Surges and Instability

	Full		Maturity Shortened		Maturity Lengthened	
	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	PSM	Raw	PSM	Raw	PSM
Post Surge × D(Has Foreign Bank)	-0.012**	-0.010*	-0.022***	-0.022***	-0.008	-0.003
	(0.005)	(0.006)	(0.004)	(0.006)	(0.005)	(0.007)
Observations	1063975	118811	426787	49966	637188	68295
Adjusted R-Square	0.764	0.759	0.772	0.761	0.762	0.762
Firm Controls	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationship in the effect of surges on instability in a difference-in-difference specification. The dependent variables are firm soundness proxied by Z-score following (Altman, 1968, 1983). A lower Z-score indicates higher instability. The subsamples of maturity shortened firms and maturity lengthened firms are identified by calculating the average debt maturity before and after surges for each firm and assigning the firm to the former (latter) group if the after-before difference is negative (positive). The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. Definitions of the other control variables are in Table A6 in the online appendix. Data used in this table is at firm-year level. Odd columns show the results without including firm-level control variables, and even columns show the results including them. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. Standard errors are clustered at firm and country-year level.

4.3 Discussion

Recent literature highlights the importance of distinguishing between different types of capital flows (e.g., Forbes and Warnock, 2012*b*; Ghosh, Ostry and Qureshi, 2016; Avdjiev et al., forthcoming). Here we further discuss the heterogeneous impacts of different categories of surges on

[19]To mitigate the concern on reverse causality that riskier firms are more likely to get short-term debt, we split the firms into high- and low-riskiness based on the median value of Z-scores before surges and test the change in debt maturity in these two subsamples. Results are present in Table A11.

different types of firm credits.

Specifically, we distinguish between five types of capital inflow surges: foreign direct investment (FDI), portfolio equity, portfolio debt, other investment in the corporate sector, and other investment in the banking sector. These detailed categorical capital flow data are also obtained from the IMF FFA Database, and we apply the same methodology of surge identification as before.[20] Moreover, we distinguish between four types of firm credit: long-term debt, short-term loan, other short-term debt, and trade credit. We express all of them as the ratios of total assets. As explained in Section 3, our measure of short-term debt is the sum of short-term loan and other short-term debt. Trade credit is excluded in our definition of (short-term) debt.

We repeat the baseline DID specification in Equation (9) using each of the five categories of capital inflows to construct *Post Surge*$_{ct}$, and we adopt each of the four different firm credits as *Debt*$_{ijct}$. This process means twenty regressions, and we summarize the estimated coefficients of the interaction term *Post Surge*$_{ct}$ $\times$ *D(Has Foreign Bank)* using the matched sample in Figure 4.

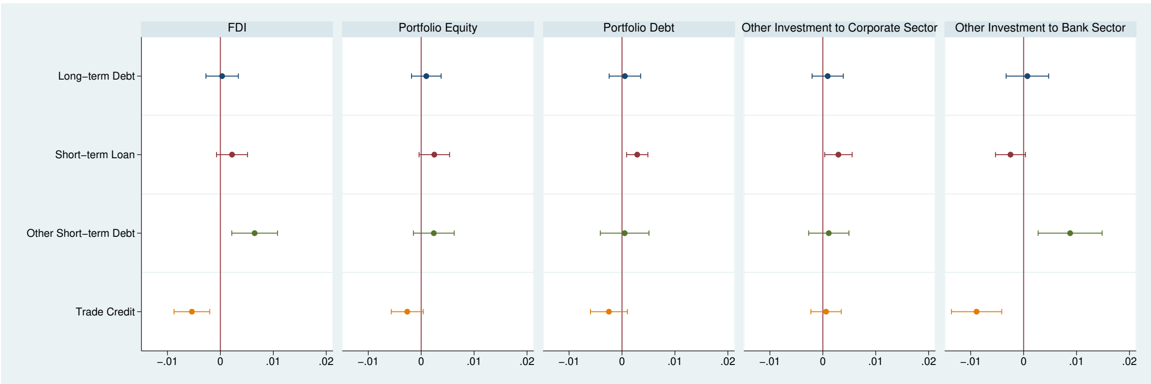

Figure 4: Further Discussion by Categories of Surges and Credits

Note: This figure summarizes the estimates of the interaction term between surge and having foreign bank relationship in DID specifications. The dependent variables are long-term debt to asset ratio, short-term loan to asset ratio, other short-term debt to asset ratio, and trade credit to asset ratio as shown in the yaxis labels. The five panels refer to five categories of surges, and the dummy variable *Post Surge* is equal to one if a capital inflow surge, in FDI flow, portfolio equity flow, portfolio debt flow, other investment to corporate sector flow, or other investment to bank sector flow for each panel respectively, has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years.The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. The estimates shown here include a full set of firm-level control variables and are based on the matched sample. The capped spikes correspond to the 95% confidence intervals. Standard errors are clustered at firm and country-year level.

[20] We do not use flows of financial derivatives and other investment flows to the official sector because of the small scale of the former and the different nature of the latter. In addition, we present the average scale of different categories of flows during surge and nonsurge episodes in Figure A1 in the appendix.

The key message is that the impacts of surges differ when they arise from different categories of capital inflows for different types of credit. Our main findings are threefold. First, debt-creating inflow surges are more strongly associated with short-term borrowing in firms with foreign bank relationships. All categories of surges are insignificantly associated with changes in long-term debt. However, compared to non-debt-creating flows such as FDI and portfolio equity, which are usually long-term financing or aim to gain ownership, debt-creating surges such as portfolio debt, other investments in the corporate sector, and other investments in the banking sector are more significantly correlated with an increase in short-term loans or other short-term debts if the firm has a foreign bank. This finding is consistent with that of Forbes and Warnock (2012*b*) regarding the different natures of debt- and equity-led capital flows.

Second, the substantial increase in short-term borrowing is due to the increase in other current liabilities. In contrast, the impact on short-term loans is very limited. Surges in the other investment in the banking sector, which can be generally interpreted as bank sector flows, are associated with the largest increase in other short-term debts compared with other surges, but they are associated with an insignificant change in short-term loans. Meanwhile, surges in other investment in the corporate sector are associated with the largest increase in the use of short-term loans but an insignificant impact on other short-term debts. Our interpretation is that surges in the banking sector are largely composed of capital flows to domestic banks, whereas surges in the corporate sector are largely composed of capital directly flowing to the private sector, which is plausibly channeled by foreign banks (Samarina and Bezemer, 2016). Thus, the impact of surges in the banking sector on short-term loans is likely to be stronger for firms with only domestic bank relationships, as the funding is channeled through domestic banks. Meanwhile, the impact of surges in the corporate sector on loans is likely to be weaker for firms with only domestic banks, as this funding needs to be channeled through foreign banks.

Third, the last row of Figure 4 shows that the impacts of surges on trade credit are quite different from those on corporate debt. For FDI and banking inflow surges, the estimated coefficient is significantly negative, which means that these surges are associated with reductions in firms' use of trade credit. This result is in fact consistent with our model's implication that international borrowing is more likely to be in the form of liquid demandable debt. In practice, trade credit is usually considered an easy and important source of short-term finance for firms; therefore, the negative coefficients capture the effect of firms' tendency to substitute their use of trade credit with international short-term borrowing during surge episodes.

5 Macro-level Empirical Evidence

We then turn to macro-level data to test our second prediction that capital inflow surges are associated with a higher probability of crises if it is accompanied by a more flattened yield curve. As mentioned earlier, we mainly use Jordà, Schularick and Taylor (2017)'s long-run macrohistory data covering twelve countries from 1870 to 2016.

Specifically, we examine whether a surge's predictive power for a crisis is affected by the shape of the term structure. Following Caballero (2016), we adopt the following logit model to estimate the likelihood of a systemic financial crisis:

$$Crisis^*_{ct} = \alpha + \gamma_1 \textit{Surge with Flattened Yield Curve}_{ct} + \gamma_2 \textit{Surge without Flattened Yield Curve}_{ct} + \beta\prime X_{ct} + \xi_c + \delta_{ct} \quad (12)$$

In this equation, $Crisis^*_{ct}$ is a continuous latent variable for the binary response variable $Crisis_{ct}$, which indicates the start of a crisis in country c and year t. If equal to one, the dummy variable $\textit{Surge with Flattened Yield Curve}_{ct}$ indicates that the country is experiencing a capital inflow surge and a much-flattened yield curve at the same time. In contrast, if its value equals one, the dummy variable $\textit{Surge without Flattened Yield Curve}_{ct}$ indicates that country c is experiencing a capital inflow surge in year t but not a flattening of the yield curve.[21] Finally, X_{ct} is a set of control variables including real GDP per capita, GDP growth rate, trade openness, a pegged exchange rate dummy, depreciation, private-credit-to-GDP ratio, and housing returns.

We are interested in coefficients γ_1 and γ_2, which show the likelihood of a systemic financial crisis during surges with and without a flattened yield curve relative to the likelihood in non-surge periods. According to the model's prediction, we expect γ_1 to be significantly positive and, more importantly, $\gamma_1 > \gamma_2$. Following Caballero (2016) and references therein, we employ random effects estimation with country means of all covariates, i.e., Mundlak (1978)'s adjustment, to address the possible endogeneity issues between covariates and country-specific intercepts.

We report the main results in Table 5, where the coefficients are all exponentiated and the corresponding z-statistics are provided in parentheses. We calculate the AUROC to measure the

[21] Here we consider a world with three states: (i) surge with a flattened yield curve; (ii) surge without a flattened yield curve; (iii) no surge. In (iii) no surge, we can further separate two states: no surge but with a flattened yield curve and no surge and no flattened yield curve. We consider this more granular classification and investigate the role of the flattened yield curve as a robustness check. Results are shown in the appendix Table A12, where we include the dummy *Flattened Yield Curve without Surge*. Results show that a flattened yield curve is also significantly associated with a higher probability of crises; however, our main finding that surges with a flattened yield curve are stronger than surges without a flattened yield curve in predicting crisis remains.

Table 5: Macrohistory Evidence of the Maturity Shortening Channel

	Sample Period: 1870-2016				Sample Period: 1946-2016			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Surge	2.685***	3.500***			9.719***	8.557***		
	(2.579)	(2.973)			(4.517)	(3.882)		
Surge with Flattened Yield Curve			10.170***	13.755***			39.683***	30.689***
			(5.718)	(5.565)			(6.608)	(5.674)
Surge without Flattened Yield Curve			0.403	0.528			1.482	1.281
			(-0.893)	(-0.617)			(0.369)	(0.227)
Obs	1236	1236	1236	1236	814	814	814	814
Countries	12	12	12	12	12	12	12	12
Crises	42	42	42	42	17	17	17	17
Loglik	-180.475	-153.952	-171.951	-146.079	-73.980	-61.592	-66.630	-54.833
WaldTestChi2	0.580	7.752	0.508	6.964	1.193	3.249	2.193	4.671
WaldTestPval	0.446	0.458	0.776	0.641	0.275	0.918	0.334	0.862
AUROC	0.572	0.808	0.585	0.808	0.793	0.883	0.583	0.549
seAUROC	0.034	0.036	0.036	0.034	0.047	0.037	0.037	0.052
Control	NO	YES	NO	YES	NO	YES	NO	YES
Unconditional Probability	3.4%	3.4%	3.4%	3.4%	2.1%	2.1%	2.1%	2.1%
Probability Conditional on Surge	8.6%	11.0%			17.2%	15.4%		
Probability Conditional on Surge with Flattened Yield Curve			26.3%	32.6%			45.8%	39.6%
Probability Conditional on Surge without Flattened Yield Curve			1.4%	1.8%			3.1%	2.7%

Note: This table shows the effects of surge and the role of flattened yield curve on the probability of systemic financial crisis. The dependent variable is the dummy which is equal to one if a systemic financial crisis occurs in the JST macrohistory database. The dummy variable *Surge* is equal to one if the net capital inflow in real per capita terms is one standard deviation above the trend. The dummy variable *Surge with Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread, which calculated as the difference between long-term and short-term interest rates, is one standard deviation below its trend. The dummy variable *Surge without Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread is not largely flattened, i.e., is above the one-standard-deviation-below-the-trend line. Control variables include real GDP per capita, GDP growth rate, trade openness, pegged exchange rate dummy, depreciation, private credit to GDP ratio, and housing return. Definitions of the control variables are in Table A6 in the online appendix. Data used in this table is at country-year level. We exclude US, UK, Japan and Germany as these countries are potentially drivers of the global financial cycle. Columns (1)-(4) show the results using the sample period from 1870 to 2016, and columns (5)-(8) show the results using the post WWII sample period from 1946 to 2016. The estimates shown here are exponentiated, and z statistics are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively.

model's predictive power. For better interpretation, at the bottom of the table, we also report the computed probability of a financial crisis under different scenarios. In the first four columns, we present the estimates for the full sample period from 1870 to 2016. In the last four columns, we provide the results for the post-World War II subsample.

Two findings are worth noting. First, with this long-term macrohistory dataset, the results in columns (1)-(2) and (5)-(6) confirm a conventional finding in the existing literature that surges are significantly associated with a higher probability of crises (Reinhart and Reinhart, 2009; Caballero, 2016). Across various specifications, the estimated coefficients are robustly positive and significant. More importantly, international capital inflow surges have substantial economic significance. For instance, in the full sample, the unconditional probability of a financial crisis is 3.4%

in the long run, but during an inflow surge episode, the likelihood of a financial crisis increases to 11.0% based on the results shown in column (2). The magnitude of the effects is even more pronounced if we focus on the post-World War II subsample. As shown in column (6), inflow surges are associated with an increase in the likelihood of crisis from 2.1% to 15.4%.

Second, the shape of the interest rate term structure plays a significant role in predicting a financial crisis. With different specifications and sample choices, the estimated coefficient γ_1 is consistently different from zero, thus indicating that inflow bonanzas with a very flat yield curve are associated with a greater probability of a systemic financial crisis. Column (4) shows that the probability of a systemic financial crisis is 32.6% if a country experiences a surge and a flattening yield curve simultaneously. This number is almost ten times the unconditional probability of 3.4% and triples the likelihood conditional on surges without separating the change in the term spread, which stands at 11.0%. Meanwhile, if surges occur without a flattened yield curve, the probability of a crisis is only 1.8%. Columns (7)-(8) indicate that the above findings also hold when using the post-World War II subsample. The probability of a crisis now becomes 39.6% if a country experiences capital inflow surges together with a flattening yield curve. In contrast, the likelihood of a crisis is only 2.7% if a country experiences inflow surges but does not witness a large decrease in term spread. These findings are consistent with the theoretical prediction and are in line with the conclusions of Parker and Schularick (2021), who document that the decreased term spread is an important predictor of financial instability and its predictability is mainly driven by the increase in the short-term rate, whereas the long-term rate does not play a significant role. These results indicate that our proposed maturity shortening channel could be an important underlying mechanism behind surges and crises.

In addition, our key findings are robust when we account for the role of credit booms (Schularick and Taylor, 2012). It is a plausible concern that credit booms drive the importance of term spread. Therefore, in Table 6, we repeat the investigations shown in Table 5 but additionally consider the impacts of credit booms on crises. Our approach here is to introduce interaction terms between credit booms and all the variables of interest.[22] The empirical specification can be written as follows:

[22] Another way to account for the role of a credit boom is to test whether surges with a flattened yield curve are associated with a higher probability of credit booms. Thus, we replace the dependent variable in Equation (12) with credit booms and report the results in the appendix Table A13. Results show that surges with a flattened yield curve are twice likely to be associated with a credit boom than surges without a flattened yield curve.

$$
\begin{aligned}
Crisis^*_{ct} = \alpha' \quad &+ \quad \gamma_1' Surge\ with\ Flattened\ Yield\ Curve_{ct} \times Credit\ Boom_{ct} \\
&+ \quad \gamma_2' Surge\ without\ Flattened\ Yield\ Curve_{ct} \times Credit\ Boom_{ct} \\
&+ \quad \gamma_3' No\ Surge_{ct} \times Credit\ Boom_{ct} + \beta' X_{ct} + \xi_c + \delta_{ct} \qquad (13)
\end{aligned}
$$

Table 6: Macrohistory Evidence of the Maturity Shortening Channel with Credit Boom

	Sample Period: 1870-2016				Sample Period: 1946-2016			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Surge × Credit Boom	9.655***	15.732***			69.921***	40.061***		
	(5.454)	(4.932)			(6.798)	(5.367)		
No Surge × Credit Boom	2.803**	5.029***	2.889**	4.998***	9.381***	4.990**	10.890***	5.019**
	(2.252)	(2.848)	(2.320)	(2.833)	(3.296)	(2.178)	(3.502)	(2.184)
Surge with Flattened Yield Curve × Credit Boom			30.381***	38.017***			293.914***	374.262***
			(7.688)	(6.043)			(8.320)	(5.914)
Surge without Flattened Yield Curve × Credit Boom			1.568	3.034			8.639*	3.075
			(0.436)	(1.003)			(1.897)	(0.916)
Obs	1236	1236	1236	1236	814	814	814	814
Countries	12	12	12	12	12	12	12	12
Crises	42	42	42	42	17	17	17	17
Loglik	-171.920	-146.789	-165.608	-142.379	-60.003	-53.799	-52.639	-45.478
WaldTestChi2	0.168	3.790	0.019	6.856	1.976	3.420	4.020	4.195
WaldTestPval	0.920	0.925	0.999	0.739	0.372	0.945	0.259	0.938
AUROC	0.570	0.849	0.601	0.853	0.876	0.904	0.860	0.910
seAUROC	0.043	0.031	0.043	0.031	0.048	0.036	0.059	0.036
Control	NO	YES	NO	YES	NO	YES	NO	YES
Unconditional Probability	3.4%	3.4%	3.4%	3.4%	2.1%	2.1%	2.1%	2.1%
Probability Conditional on Surge and Credit Boom	25.4%	35.6%			59.9%	46.1%		
Probability Conditional on Surge with Flattened Yield Curve and Credit Boom			51.7%	57.2%			86.2%	88.9%
Probability Conditional on Surge without Flattened Yield Curve and Credit Boom			5.2%	9.6%			15.6%	6.2%
Probability Conditional on No Surge but Credit Boom	9.0%	15.0%	9.2%	15.0%	16.7%	9.6%	18.8%	9.7%

Note: This table shows the effects of surge and the role of flattened yield curve on the probability of systemic financial crisis, after taking account into the credit boom. The dependent variable is the dummy which is equal to one if a systemic financial crisis occurs in the JST macrohistory database. The dummy variable *Surge* is equal to one if the net capital inflow in real per capita terms is one standard deviation above the trend. The dummy variable *No Surge* is equal to one if a surge does not occur. The dummy variable *Surge with Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread, which calculated as the difference between long-term and short-term interest rates, is one standard deviation below its trend. The dummy variable *Surge without Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread is not largely flattened, i.e., is above the one-standard-deviation-below-the-trend line. The dummy variable *Credit Boom* is equal to one if the total loans to non-financial private sector in per capita real terms is one standard deviation above the trend. Control variables include real GDP per capita, GDP growth rate, trade openness, pegged exchange rate dummy, depreciation, private credit to GDP ratio, and housing return. Definitions of the control variables are in Table A6 in the online appendix. Data used in this table is at country-year level. We exclude US, UK, Japan and Germany as these countries are potentially drivers of the global financial cycle. Columns (1)-(4) show the results using the sample period from 1870 to 2016, and columns (5)-(8) show the results using the post WWII sample period from 1946 to 2016. The estimates shown here are exponentiated, and z statistics are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively.

We are interested in determining whether γ_1' remains positively significant after considering the effects of credit booms. Again, we use a similar method to identify a credit boom, and the dummy variable *Credit Boom*$_{ct}$ equals one if the total loans to the non-financial private sector in real per capita terms is one standard deviation above the trend. The results in Table 6 echo the findings in the literature that credit booms are a strong predictor of systemic financial crises. Across different model specifications, the conditional probability of a crisis with a credit boom and no surge varies from 9.0% to 18.8%, which means that a credit boom indicates a possible overheating of the economy. More importantly, the estimated γ_1' remains highly significant. This result means that, even after considering the presence of a credit boom, there is still a robust association between surges with a flattening yield curve and crises. The economic significance is the following based on the results shown in columns (2) and (4). In the full sample, the unconditional probability of a financial crisis is still 3.4%. The conditional probability of a crisis with surges and credit booms is 35.6%; that with surges, credit booms, and no large decrease in term spread is 9.6%; and that with surges, credit booms, and a flattened yield curve increases substantially to 57.2%. These results demonstrate that the independent effect of yield curve changes during surges can substantially increase the probability of a crisis.

Relating to the classical literature that links crises to excessive optimism (Minsky, 1977; Kindleberger, 1978) and recent studies that reveal inadequate assessments of vulnerabilities following expansions in the financial system (Baron and Xiong, 2017; Baron, Verner and Xiong, 2021; Greenwood et al., 2022), the predictability that we document favors macro-financial policies that "lean against the wind" of credit market booms.

6 Conclusion

This study argues for an association between capital inflow surges and the probability of financial crises through a maturity shortening mechanism. Based on a theoretical model and empirical tests of the model's implications at both the firm-level and macro-level, our main findings are twofold. First, surges are significantly associated with an increase in the use of short-term debt and a reduction in the corporate debt maturity. Specifically, this maturity shortening effect is substantially more pronounced for firms with foreign bank relationships and in sectors with higher redeployability. Second, the flattened yield curve is significantly associated with an increase in the likelihood of a systemic financial crisis, conditional on surges.

Our findings have important implications for both academic research and policymaking. For theorists, we highlight the importance of accounting for the endogenous term spread and debt maturity in the small open economy framework. Future studies could consider conducting theoretical research on introducing the interest rate term structure and endogenous debt maturity to the existing framework à la Uribe and Schmitt-Grohe (2017) and Croce, Jahan-Parvar and Rosen

(2020). For policymakers, our study highlights the importance of maturity structure during surges. They should pay close attention to the windfalls of capital inflows and restrict foreign capital inflows when the yield curve becomes strongly flattened in recipient countries. In this sense, we advocate the use of capital flow management or macroprudential policy tools that target the maturity structure directly and curb short-term debt when observing large capital inflows. These policy tools have not gained wide attention in academic discussions, but emerging economies such as Chile, Colombia, and Turkey have already put them into practice. For instance, Chile imposed the unremunerated reserve requirements (URRs) in the 1990s, which mandates that a fraction of capital inflows be deposited with the central bank for a certain period of time, and studies find that URRs can help lengthen the maturity of inflows (Gallego, Hernández and Schmidt-Hebbel, 2002) and reduce financial vulnerability (Edwards, 1999). In terms of macroprudential tools, Turkey announced in June 2009 that local firms are allowed to borrow in foreign currency under the condition that the average maturity of foreign currency loans is longer than a year; Colombia imposed a cap of 20% of Tier 1 capital for foreign exchange market intermediaries at the end of 2016 if the financing matures within a year, while there are no such limits for foreign currency loans with maturities of more than one year. Notably, the timing of these policy announcements is when capital inflows started to increase sharply. We believe that our findings can push the discussions further and help to understand and mitigate some policy challenges for international capital flow management.

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Internet Appendix

A1 Theoretical Model

A1.1 Proof of Lemma 1

Proof. The stationary long-term debt values can be easily calculated as follows:

$$v^l = \frac{\zeta R}{\zeta + \chi - \chi\zeta} \tag{A1}$$

According to the break-even condition $v^l = \bar{B} = 1$, we can get the equilibrium R as $R = 1 + \frac{\chi(1-\zeta)}{\zeta}$. Therefore, the net interest rate of long-term debt is

$$\frac{R^l - \bar{B}}{\bar{B}} = \frac{R^l - 1}{1} = \frac{\chi (1-\zeta)}{\zeta} \tag{A2}$$

As for solving the equilibrium short-term debt values in good and bad global conditions, we adopting the following three steps. First, we guess the optimal strategy is $\sigma^0 = 1$ and $\sigma^1 = 0$ and then solve the equilibrium short-term debt values given this strategy. Second, we show that these strategies are indeed best responses. Third, we calculate the optimal repayment R^d by using the break-even condition.

To begin with, we assume that $\sigma^0 = 1$ and $\sigma^1 = 0$. With these two values, we can easily calculate the short-term debt value when the global financial market condition is bad:

$$v^d (\theta = 1) = \frac{\zeta R^d + (1-\zeta)\chi l}{\zeta + (1-\zeta)\chi} \tag{A3}$$

The prices are pinned down by the expected values of debt when there is no debt run:

$$p^0 = \lambda v^d (\theta = 0) + (1-\lambda) v^d (\theta = 1) \tag{A4}$$

$$p^1 = v^d (\theta = 1) \tag{A5}$$

With $\sigma^0 = 1$, we can compute the equilibrium short-term debt value in good global financial market condition:

$$v^d (\theta = 0) = \frac{\zeta R^d + (1-\zeta)(1-\lambda) v^d (\theta = 1)}{1 - (1-\zeta)\lambda} = \frac{\zeta R^d + (1-\zeta)(1-\lambda) \frac{\zeta R^d + (1-\zeta)\chi l}{\zeta + (1-\zeta)\chi}}{1 - (1-\zeta)\lambda} \tag{A6}$$

As long as $R^d > \bar{B} = 1$, we can easily check that $v^d(\theta = 0) > v^d(\theta = 1)$ holds for sure. As a result, it is always optimal for global investors to resell their value in good financial market condition instead of choosing to run debt.

Now we turn to solve the equilibrium repayment R^d. According to the break-even condition, i.e., $1 = \lambda v^d(\theta = 0) + (1 - \lambda) v^d(\theta = 1)$, we can pin down the equilibrium R^d as follows:

$$R^d = 1 + \frac{(1-\zeta)\chi(1-\lambda)}{\zeta[\zeta + (1-\zeta)(1-\lambda+\lambda\chi)]}(1-l) \tag{A7}$$

Therefore, the net interest rate of short-term debt is

$$\frac{R^d - \bar{B}}{\bar{B}} = \frac{R^d - 1}{1} = \frac{(1-\zeta)\chi(1-\lambda)}{\zeta[\zeta + (1-\zeta)(1-\lambda+\lambda\chi)]}(1-l) \tag{A8}$$

Therefore, the net interest rate of short-term debt is decreasing in liquidation value l. The firm with liquidation value l^* finds indifferent between long-term and short-term debt and l^* satisfies the following condition:

$$l^* = 1 - \frac{\zeta + (1-\zeta)(1-\lambda+\lambda\chi)}{1-\lambda} \tag{A9}$$

□

A1.2 Proof of Lemma 2

Proof. The fraction of firms exposed to debt runs can be calculated as follows:

$$\Psi = \int_{l^*}^{1} g(l)\, dl = 1 - G(l^*) \tag{A10}$$

Lemma 1 shows that $\frac{dl^*}{d\lambda} < 0$, then we can easily show that Ψ is increasing in λ.

Average long-term interest rate is $\frac{\chi(1-\zeta)}{\zeta}$, which does not depend on the liquidation value and global market condition.

With the assumed distribution function $g(l)$, the average short-term interest rate can be calculated as follows

$$\frac{\int_{l^*}^{1}\left\{\frac{(1-\zeta)\chi(1-\lambda)}{\zeta[\zeta+(1-\zeta)(1-\lambda+\lambda\chi)]}(1-l)\right\}g(l)\,dl}{G(1)-G(l^*)} = \frac{\chi(1-\zeta)}{\zeta}\frac{1}{1-l^*}\left(1-\frac{\int_{l^*}^{1} lg(l)\,dl}{1-G(l^*)}\right)$$
$$= \frac{\chi(1-\zeta)}{\zeta}\frac{1}{1-l^*}\frac{G(l^*)(l^*-1)+\int_{l^*}^{1}G(l)\,dl}{1-G(l^*)}$$
$$= \frac{\chi(1-\zeta)}{\zeta}\left[\frac{\int_{l^*}^{1}G(l)\,dl}{(1-l^*)(1-G(l^*))}-\frac{G(l^*)}{1-G(l^*)}\right] \tag{A11}$$

As a result, the term spread Ξ can be computed as follows:

$$\Xi = \frac{\chi(1-\zeta)}{\zeta}\left[1+\frac{G(l^*)}{1-G(l^*)}-\frac{\int_{l^*}^{1}G(l)\,dl}{(1-l^*)(1-G(l^*))}\right] \tag{A12}$$

□

A1.3 Three examples of the impact on term spread

In order to better illustrate our main idea with closed form solutions, we assume that the distribution of firm's liquidation value l follows the following three different types of distributions:

A. left-tailed distribution

$$g(l) = \begin{cases} 2 & \text{if} \quad 0 \le l \le \frac{1}{2} \\ 0 & \text{if} \quad \text{elsewhere} \end{cases} \tag{A13}$$

B. symmetric distribution

$$g(l) = \begin{cases} 1 & \text{if} \quad 0 \le l \le 1 \\ 0 & \text{if} \quad \text{elsewhere} \end{cases} \tag{A14}$$

C. right-tailed distribution

$$g(l) = \begin{cases} 2 & \text{if} \quad \frac{1}{2} \le l \le 1 \\ 0 & \text{if} \quad \text{elsewhere} \end{cases} \tag{A15}$$

In this way, how Ξ changes with respect to λ depends on the distribution of firms with different liquidation values l:

1. if $g(l)$ follows a symmetric uniform distribution as in (A14), then $\Xi = \frac{(1-\zeta)\chi}{2\zeta}$ and it does not depend on global market condition λ

2. if $g(l)$ follows a left-tailed distribution as in (A13), then $\Xi = \frac{(1-\zeta)\chi}{2\zeta} - \frac{(1-\zeta)\chi(1-\lambda)}{4\zeta[\zeta+(1-\zeta)(1-\lambda+\lambda\chi)]}$ and it is decreasing in global market condition λ

3. if $g(l)$ follows a right-tailed distribution as in (A15), then $\Xi = \frac{(1-\zeta)\chi}{2\zeta} + \frac{(1-\zeta)\chi(1-\lambda)}{2\zeta[\zeta+(1-\zeta)(1-\lambda+\lambda\chi)]}$ and it is increasing in global market condition λ

Two conclusions are worth noting from our three simple exercises above. First, whether surges will change yield curve depends on the underlying distribution. If the underlying distribution has a long left tail, which means that there is a significant amount of firms having low asset liquidation values, then the extensive margin effect will outweigh the intensive margin effect, which makes the yield curve become a decreasing function of global market condition. At the same time, if the underlying distribution has a long right tail, which means that there is a significant amount of firms having high asset liquidation values, then the intensive margin effect will outweigh the extensive margin effect, which makes the yield curve become an increasing function of global market condition. In addition, if the underlying distribution is symmetric, then these two opposing effects cancel out, and the yield curve is not related to the global market condition.

Second, the three examples above also indicate that we should pay serious attention to surges with flattening yield curve as changes in yield curve during capital inflow bonanzas can be informative about what's happening behind. For example, if the term spread has become flattened during capital inflow surges, it means that more and more risky firms with relatively low liquidation values can get financed during capital inflow surges. As global banks face liquidity shocks, all these international borrowings are in the form of short-term debt, which significantly increases the average short-term interest rate while generates no sizable impacts on the long-term end. Therefore, when the yield curve becomes flattened during capital inflow surges, it indicates an increasing financial instability in this country. In other words, the model implies that even when we are not able to observe changes in the underlying distribution of short-term international borrowing, whether term spreads become flattening or steepening can be informative about the underlying mechanism.

A2 Orbis Data Clean Process

The original data are denominated in millions of current US dollars. In the following basic cleaning steps before deflation, we do not change the currency units because we use criteria based on ratios and do not rely on absolute values. However, in the deflation part, we convert all financial variables to local official currencies and then deflate using the country-sector-level or country-level price index. Finally, we convert them into millions of 2005 US dollars by multiplying by the 2005 exchange rate.

1. We limit the sample to unconsolidated accounts with or without a consolidated companion and deal with firm-year duplicates.

    - We require consolidation codes equal to U1 or U2 due to the double-counting problem when both a consolidated account of the parent (with all its subsidiaries) and an unconsolidated account of the parent (without subsidiaries) are reported.
    - Then, we address the firm-year duplicates using the following steps: (1) For duplicates in firm ID and the specific close date, we use the flow variable operating revenue to keep the observation with the largest values. (2) We generate the year from the close date by using the current year if the month is later than June and using the previous year if the month is earlier than June. (3) Then, for each firm-year, we keep the observation with the latest reporting date; if there are still duplicates, then we keep the one with the largest operating revenue.

2. We clean basic reporting mistakes.

    - We drop observations that have missing information on total assets, operating revenues, sales, and employment simultaneously.
    - We drop firms for which any one of the following variables is negative in any year: total assets, employment, sales, or tangible fixed assets.
    - We drop firms in which the number of employees exceeds two million in any year.
    - We drop observations with missing, zero, or negative values for operating revenue or total assets.

3. We check the internal consistency of the balance sheet information.

- We exclude extreme values by dropping observations that are below the 0.1 percentile or above the 99.9 percentile of the distribution of each of the following ratios: (1) fixed assets (the sum of tangible fixed assets, intangible fixed assets, and other fixed assets) to total fixed assets; (2) the sum of stocks, debtors and other current assets to total current assets; (3) the sum of fixed assets and current assets to total assets; (4) the sum of capital and other shareholder funds to total shareholder funds; (5) the sum of long-term debt and other noncurrent liabilities as a ratio of total noncurrent liabilities; (6) the sum of loans, creditors and other current liabilities to total current liabilities; (7) the sum of noncurrent liabilities, current liabilities and shareholder funds to total shareholder funds and liabilities.

4. We further check the data quality in the following ways.

    - We drop firms implying nonpositive age values in any year.
    - We calculate liabilities as the difference between total shareholder funds and liabilities and shareholder funds; then, we drop the observations if the value is negative or zero. In another way, liabilities can be computed as the sum of current liabilities and non-current liabilities. We generate the ratio of the two variables of liabilities and drop the observations if the ratio is greater than 1.1 or lower than 0.9.
    - We drop observations with negative current liabilities, noncurrent liabilities, current assets, loans, creditors, other current liabilities, or long-term debt.
    - We drop observations if their long-term debt is higher than the liability.
    - We construct net worth as the difference between total assets and liability and then drop the observations if the net worth does not equal shareholder funds.
    - We drop observations with missing, zero, or negative values for the wage bill variable.
    - We drop observations with negative values for intangible fixed assets and observations with missing or zero values for tangible fixed assets.
    - We calculate the ratio of tangible fixed assets to total assets and drop the observations if the ratio is greater than one.
    - We drop observations with negative depreciation values.
    - We calculate the capital-labor ratio, where capital stock is the sum of tangible and intangible fixed assets, and drop firms if they have a capital-labor ratio in the bottom

0.1 percentile and firm-year observations with a capital-labor ratio higher than the 99.9 percentile or lower than the 0.1 percentile.

- We drop observations with negative shareholder funds and observations with a ratio of other shareholder funds to total assets in the bottom 0.1 percentile.
- We calculate two leverage indicators–the ratio of tangible fixed assets to shareholder funds and the ratio of total assets to shareholder funds–and then drop extreme values in the bottom 0.1 or top 99.9 percentiles of the distribution of the two ratios.
- We calculate the value added as the difference between operating revenues and material costs and then drop observations with negative values of value added.
- We construct the ratio of wage bills to value added and drop extreme values in the bottom 1 percentile or the top 99 percentile if the ratio exceeds 1 at the 99th percentile or change the extreme threshold to the 0.1 percentile and 99.9 percentile if the ratio does not exceed 1 at the 99th percentile. We also drop observations with ratios higher than 1.1.

A3 Identifying Firm-Bank Relationship in *Orbis*

Orbis provides the names of main banks that the firm has borrowed from, which enable us to match firm-level data in *Orbis* to bank-level data in either *Bankscope* or *BankFocus*.

However, two issues are worth noting. First, unlike firm-level financial variables, which were compiled from different vintages of *Orbis*, we have only historical bank information by the end of the last year of our sample for each firm, so the firm-bank link is time-invariant. Second, bank names are the only information available, and there are no consistent identification codes for us to link different datasets. More importantly, the reported bank names in *Orbis* are not necessarily the same as those in *Bankscope* or the more up-to-date *BankFocus* database.

The first issue is less concerning, as many studies using the same database (e.g., Giannetti and Ongena, 2012; Kalemli-Özcan, Laeven and Moreno, forthcoming) have shown that bank-firm relationships are sticky and do not vary greatly over time. Therefore, most of the existing literature also uses these time-invariant firm-bank relationships. The second issue is more problematic and requires a great deal of manual work. More specifically, our matching process consists of three steps. First, we drop all the most common words in bank names, such as "Bank", "Corporation", "LTD", and "Group", to reduce these unnecessary distractions. Second, we use the fuzzy match program (*matchit*) in Stata to match the bank names in two different databases with the *bigram* approach and log weights. Finally, we manually review all the matching results to ensure that they are paired correctly. If not, we go through all the remaining unpaired bank names one by one manually. We mainly use the *Bankscope* dataset for bank name matches, but *BankFocus* is also used when we cannot find a successful match in *Bankscope*. Our final matching rate is quite high: 97% of the bank names reported in *Orbis* are successfully matched to their corresponding entries in the *Bankscope* or *BankFocus* database.

With the firm-bank matched dataset, the variable of greatest interest to us is whether one of the firm's main banks is a foreign bank. To identify a firm's foreign bank relationships, we extract the country codes for firms and their related banks using the first two letters in the firm identification code and the bank identification code, which is based on the firms' ultimate ownership, and classify banks as foreign banks if their country codes are different from those of the related firms. Then, we generate a time-invariant dummy to indicate that the firm has a foreign bank relationship if at least one of its associated banks is a foreign bank.

A4 Alternative Firm-level and Loan-level Evidence

As shown in Table 1, our sample is dominated by unlisted firms: 0.2% and 0.1% of the observations are publicly listed firms in the treated and control groups, respectively. We conduct a robustness check using the richer information of listed firms to investigate their behavior of debt maturity and riskiness during surges.

To do that, we extract the listed firms in the seven sample countries from Compustat and link the firms' financial variables with their syndicated loan borrowing history from DealScan using the link file from Chava and Roberts (2008). As a result of the data availability in both Compust and DealScan, the sample in this part of analysis is limited to 194 listed firms. Capital inflow surges and the $D(\textit{Post Surge})$ dummy are defined in the same way as described in the main analysis. For the dummy variable of foreign bank relationship, we reconstruct it based on the lender composition reported in the DealScan for these listed firms.[1] Specifically, we obtain the full syndicated loan history for each firm from 1988 to 2015 from DealScan and define that a firm has foreign bank relationships if it has ever been granted a syndicated loan from a foreign leading bank.[2] Similar to the main analysis, this dummy variable is also at the firm-level. As shown in Table A1, the share of observations with foreign bank lending relationship averages at 82.3% in this listed firms sample, which is much higher than that in the full *Orbis* sample, and the summary statistics of other variables are also different, implying the special characteristics of these publicly listed firms. We are interested to test whether our main findings hold in this different sample.

First, we check whether the finding of debt maturity shortening still applies to the listed firms. The definition of various debt maturity variables and the regression specification are the same as in the baseline.[3] Results are shown in Panel A of Table A2. We observe that capital inflow surges are associated with a significantly larger decrease in debt maturity and an increase in short-term leverage for firms with foreign banks, meanwhile insignificant differences in long-term and

[1] We do not limit the listed firm sample to those in the Orbis database but include all that are available in the Compustat and DealScan databases. The reasons are twofold: first, there is a lot of missing values of the ISIN numbers and Ticker symbols for listed firms in Orbis, thus we will lose substantial observations when matching variables such as stock prices from external databases; second, the related banks recorded in the Orbis database may fail to capture the actual financing relationships for listed firms who are less dependent on bank lending.

[2] We follow Berg, Saunders and Steffen (2016) and Bharath et al. (2011) in defining lead banks. Specifically, we identify a lead lender if at least one of the following conditions is met: (1) LeadArrangerCredit = "Yes" in the LenderShares table of Dealscan, (2) LenderRole = "Agent," "Admin agent," "Arranger," or "Lead bank" in the LenderShares table of Dealscan, and (3) the lender is the sole lender.

[3] In Compustat, short- and long-term debt also refer to debt maturing within and above one year, respectively.

total debt for the treated and control groups. Moreover, the economic impact of shortened debt maturity is larger in the listed sample compared to the full *Orbis* sample, indicating a 9.0% increase in the average debt maturity and a 19.4% increase in the average short-term leverage ratio.

Second, we examine the origins of instability using other riskiness measurements of public firms. Specifically, we use the logarithm of Z-score[4], the market beta obtained from year-by-year regressing the daily stock returns of the firm on the daily returns of the market in which it is listed, the ratio of debt to market equity, and the annual stock return. Panel B of Table A2 reports the results. Same as the findings in the main analysis, we see that surges are associated with a larger decrease in Z-score for firms with foreign bank relationships, implying a worsened soundness of those firms. Moreover, the instability is also reflected in a reduced correlation with the market movement and an enlarged debt-to-equity ratio; meanwhile, there is no significant impact on the annual stock return. These findings indicate that the stock market does not fully price in the instability associated with surges, thus raising more concerns for policy intervention during surges.

Table A1: Summary Statistics for the Listed Firms Sample

	Mean	Standard Deviation	Min	Max	N
Debt Maturity (%)	57.455	26.006	0.000	100.000	1129
Long-term Debt to Asset Ratio	0.150	0.121	0.000	0.500	1129
Short-term Debt to Asset Ratio	0.093	0.083	0.000	0.430	1129
Total Debt to Asset Ratio	0.245	0.152	0.000	0.672	1129
D(Has Foreign Bank)	0.823	0.382	0.000	1.000	1129
Size	7.449	1.871	3.153	10.654	1129
Cash Flow	0.110	0.064	-0.115	0.342	1128
Tangibility	0.226	0.163	0.008	0.875	1129
Sale Growth (%)	10.410	29.489	-51.409	154.319	1129
Ln(Z-score)	-0.106	0.824	-2.844	2.531	974
Beta	0.494	1.247	-4.639	7.559	974
Debt-Equity Ratio	2.650	5.125	0.058	33.218	974
Annual Stock Return (%)	11.955	73.167	-88.345	471.563	974

Next, we make use of the DealScan database and examine how surges are associated with changes in maturity at the loan level. In this way, we can mitigate two concerns in the main analysis: on one hand, one may worry that firms would switch to foreign banks from domestic banks during surges and this change in bank relationship status may not be captured by the time-

[4]The definition of Z-score for listed firms is different from that of private firms. Specifically, here $Z-score = 1.2 \times \frac{WorkingCapital}{Assets} + 1.4 \times \frac{RetainedEarnings}{Assets} + 3.3 \times \frac{EBIT}{Assets} + 0.6 \times \frac{MarketEquity}{Liabilities} + 1.0 \times \frac{Sales}{Assets}$.

Table A2: Robustness Check Using Listed Firms

Panel A: Debt Maturity

	(1) Maturity	(2) Long	(3) Short	(4) Total
Post Surge × D(Has Foreign Bank)	-5.160**	-0.017	0.018**	0.000
	(1.356)	(0.016)	(0.001)	(0.001)
Observations	1129	1129	1129	1129
Adjusted R-Square	0.441	0.721	0.575	0.788
Firm Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES

Panel B: Instability

	(1) Ln(Z-score)	(2) Beta	(3) Debt/Market Equity	(4) Stock Return
Post Surge × D(Has Foreign Bank)	-0.143*	-0.250*	1.564*	3.879
	(0.058)	(0.124)	(0.901)	(4.990)
Observations	974	974	974	974
Adjusted R-Square	0.701	0.450	0.425	0.242
Firm Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationships in the effect of surges on corporate debt maturity and instability in a difference-in-difference specification. This sample is constructed based on the Compustat database combined with the bank lending relationship from DealScan. In panel A, the dependent variables are debt maturity defined as the share of long-term debt in total debt, the ratio of long-term debt to total asset, the ratio of short-term debt to total asset, and the ratio of total debt to total asset, as shown in the column titles. In panel B, the dependent variables are the logarithm of Z-score, the market beta capturing the correlation between firm and market stock returns, the ratio of debt to market equity, and the annual stock return, as shown in the column titles. The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has ever had one foreign bank in its bank lending relationships shown in DealScan. The data used in this table is at the firm-year level. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. Standard errors are clustered at the firm and country-year level.

invariant dummy variable in the baseline specification; on the other hand, both the *Orbis* and *Compustat* databases are restrictive in providing more granular information of debt maturity as they only tell the debts which mature within and beyond one year. Thus, the loan(facility)-level contract details from DealScan, including whether the lender is a foreign bank and specific loan maturity measured as the number of months, can strengthen our identification. Table A3 reports the summary statistics of variables used in the loan-level analysis.

Specifically, we conduct a loan-level regression as specified in the following equation:

Table A3: Summary Statistics for Loan-level Analysis

	Mean	Standard Deviation	Min	Max	N
Maturity	60.653	46.011	10.000	227.000	46193
D(Has Foreign Bank)-Any Lender	0.645	0.479	0.000	1.000	46193
D(Has Foreign Bank)-Lead Lender	0.536	0.499	0.000	1.000	46193
Ln (Loan Amount)	4.362	1.522	-4.729	11.438	46193
D(Term Loan)	0.596	0.491	0.000	1.000	46193
D(Foreign Currency)	0.309	0.462	0.000	1.000	46193
Price-All In Spread Drawn	179.139	152.048	-370.000	5000.000	22469

$$Maturity_{lict} = \alpha + \beta_1 D(Post\ Surge)_{ct} \times D(Has\ Foreign\ Bank)_{lict} + \beta_2 D(Has\ Foreign\ Bank)_{lict} + \Gamma X_{lict} + \delta_i + \theta_{ct} \tag{A16}$$

where l, i, c, t indicate loan, firm, country, and year, respectively. $D(Post\ Surge)_{ct}$ is defined in the same way as the main analysis to indicate the three-year period after the capital inflow surge in country c and year t when it takes the value of one. Different from the baseline specification, here the regression is at the loan level, and the dummy variable $D(Has\ Foreign\ Bank)_{lict}$ varies with time and loan, indicating whether the loan is issued by a foreign lender. Since there are usually multiple lenders in a loan, we use two ways to construct a loan-level indicator of foreign lender: first, we set the variable to be equal to one when any one of the lenders in the loan is a foreign bank, alternatively, we limit the pool to lead banks and set the variable to one when any of the lead lenders are foreign. X_{lict} is a set of loan-level characteristics including the logarithm of the loan amount, a dummy variable indicating whether the loan is a term loan or a credit line, and a dummy variable indicating whether the loan is in foreign currency. We control both the firm fixed effect and the country-year fixed effect.

Table A4 presents the results. We observe that the loan maturity tends to be shorter by 3.5 to 4.4 months after capital inflow surges for the loans that are involved with foreign banks than the loans that are not. These findings confirm the main argument in this paper that surges are associated with shortened debt maturity, in particular for foreign borrowing.

Lastly, benefiting from the price information in the loan-level data, we can further test whether the interest rates of short-term debt are increased relative to the long-term debt during surges. Specifically, we use the all-in-spread-drawn (AISD), which are the basis points above the reference rates for all drawn credits, as the interest rates, and then test whether the loans with shorter maturity become more expensive than those with longer maturity during surges. The regression specification is shown as the following:

Table A4: Robustness Check Using Loan-level Data: Maturity

	Any Lender is Foreign		Lead Lender is Foreign	
	(1)	(2)	(3)	(4)
Post Surge × D(Has Foreign Bank)	-4.018***	-3.627***	-4.419***	-3.525**
	(1.299)	(1.265)	(1.608)	(1.543)
D(Has Foreign Bank)	1.284	1.546	3.408***	3.429***
	(0.961)	(1.000)	(1.222)	(1.182)
Observations	46193	46193	46193	46193
Adjusted R-Square	0.296	0.355	0.296	0.355
Loan Characteristics Controls	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES
Country × Year FE	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationships in the effect of surges on corporate debt maturity in a difference-in-difference specification. This sample is constructed based on the loan-level data from DealScan. The dependent variable is the debt maturity measured as the number of months. The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if any lender of the loan is foreign in columns (1)-(2) and if any lead lender of the loan is foreign in columns (3)-(4). The data used in this table is at the loan level. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. Standard errors are clustered at the firm and country-year level.

$$\begin{aligned} Rate_{lict} = \alpha + \beta_1 D(Post\ Surge)_{ct} \times D(Has\ Foreign\ Bank)_{lict} \times Maturity_{ilct} + \\ \beta_2 D(Post\ Surge)_{ct} \times D(Has\ Foreign\ Bank)_{lict} + \beta_3 D(Post\ Surge)_{ct} \times Maturity_{lict} \\ + \beta_4 D(Has\ Foreign\ Bank)_{lict} \times Maturity_{ilct} + \beta_5 D(Has\ Foreign\ Bank)_{lict} + \\ \beta_6 Maturity_{ilct} + \Gamma X_{lict} + \delta_i + \theta_{ct} \end{aligned} \tag{A17}$$

The notations here are the same as in the previous specification but the dependent variable $Rate_{lict}$ is the AISD interest rates. Besides, we specify a triple interaction term to test how the loan interest rate varies with its maturity after surges, in addition to the lender being domestic or foreign banks. Table A5 shows the results. We see that the coefficients of the triple interaction term are significantly negative across different settings. The estimates in the first two rows suggest that compared to loans fully issued by domestic banks, surges are associated with a larger reduction in interest rates for those involving foreign lenders, and the cheaper lending effects are significantly stronger for longer maturity loans. Specifically, based on column (4), when the loan maturity is shorter by 12 months, the reduction in interest rates becomes less pronounced by 2.0 percentage points, which amounts to 10% of the total effects on the spread when maturity is not interacted. In other words, shorter-term loans are becoming relatively more expensive than longer-term loans when borrowing from foreigners after capital inflow surges, and this is suggestive evidence that surges are associated with a flattened yield curve.

Table A5: Robustness Check Using Loan-level Data: Interest Rates

	Any Lender is Foreign		Lead Lender is Foreign	
	(1)	(2)	(3)	(4)
Post Surge × D(Has Foreign Bank) × Maturity	-0.145**	-0.148**	-0.171**	-0.169*
	(0.057)	(0.064)	(0.086)	(0.095)
Post Surge × D(Has Foreign Bank)	-32.643***	-30.009***	-23.805***	-21.062**
	(5.468)	(6.491)	(7.500)	(8.215)
Post Surge × Maturity	0.158***	0.184***	0.169**	0.191**
	(0.052)	(0.059)	(0.069)	(0.075)
D(Has Foreign Bank) × Maturity	0.329***	0.256***	0.232***	0.185***
	(0.086)	(0.062)	(0.063)	(0.049)
D(Has Foreign Bank)	-25.039***	-6.886*	-15.539**	-1.656
	(7.070)	(3.550)	(6.136)	(3.634)
Maturity	0.128	0.038	0.222***	0.105**
	(0.080)	(0.061)	(0.058)	(0.047)
Observations	22469	22469	22469	22469
Adjusted R-Square	0.474	0.501	0.473	0.501
Loan Characteristics Controls	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES
Country × Year FE	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationships in the effect of surges on the cost of borrowing for loans with different maturities in a triple difference-in-difference specification. This sample is constructed based on the loan-level data from DealScan. The dependent variable is the all-in-spread-drawn (AISD) in the unit of basis points. The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if any lender of the loan is foreign in columns (1)-(2) and if any lead lender of the loan is foreign in columns (3)-(4). Maturity is measured as the number of months. The data used in this table is at the loan level. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. Standard errors are clustered at the firm and country-year level.

Finally, it is worth highlighting that the findings in this session are based on Compustat and DealScan databases and they have a strong drawback of selected firms being large and publicly listed, who are less dependent on bank financing as they can easily access bond and equity market compared to SMEs. Besides, the required availability in both Compustat and DealScan in the loan-level investigation results in a largely reduced sample. Therefore, we mainly rely on the results using *Orbis* in the main analysis and report the auxiliary results using the public firms here in the appendix.

A5 Additional Figures and Tables

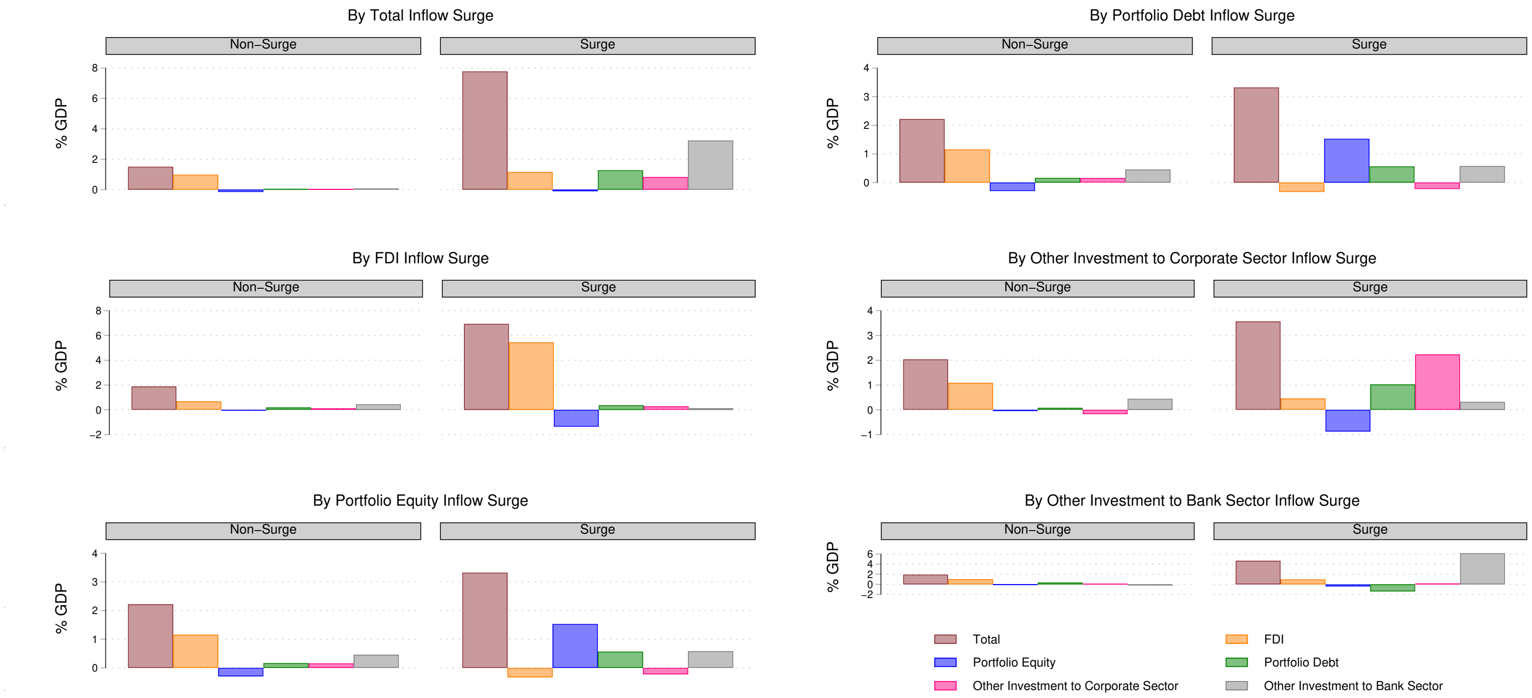


Figure A1: Capital Inflows During Surges and Non-surges

Note: This figure shows the net inflows of different categories of capital during non-surges (on the left) and surges (on the right) for the countries used in the firm-level analysis. From top to bottom, surges are defined when the net inflows of total capital, FDI, portfolio equity, portfolio debt, other investment to corporate sector, and other investment to bank sector (all in real per capita terms) is one standard deviation above the trend, respectively.

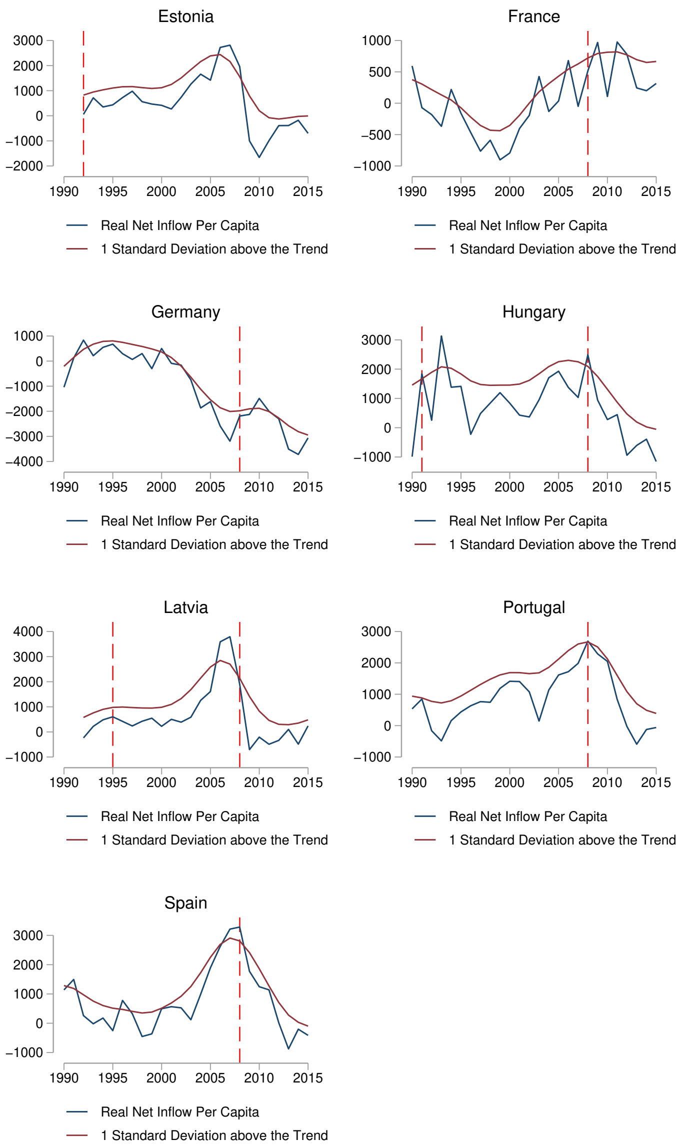


Figure A2: Time Series of Surge and Crises in Countries Used in Firm-level Analysis

Note: This figure shows the time series of the net capital inflow in real per capita terms in the blue line and the sum of its trend and one standard deviation of its cyclical component in the maroon line, for each country used in firm-level analysis. A surge is identified is the blue lines are above the maroon lines. The units of the y-axis are different across countries, as the capital inflows are in local currencies and expressed in different units. The red vertical lines indicate the occurrence of systemic financial crises. The capital flow data is from IMF Financial Flows Analytics Database, and the systemic crisis data is from Laeven and Valencia (2020).

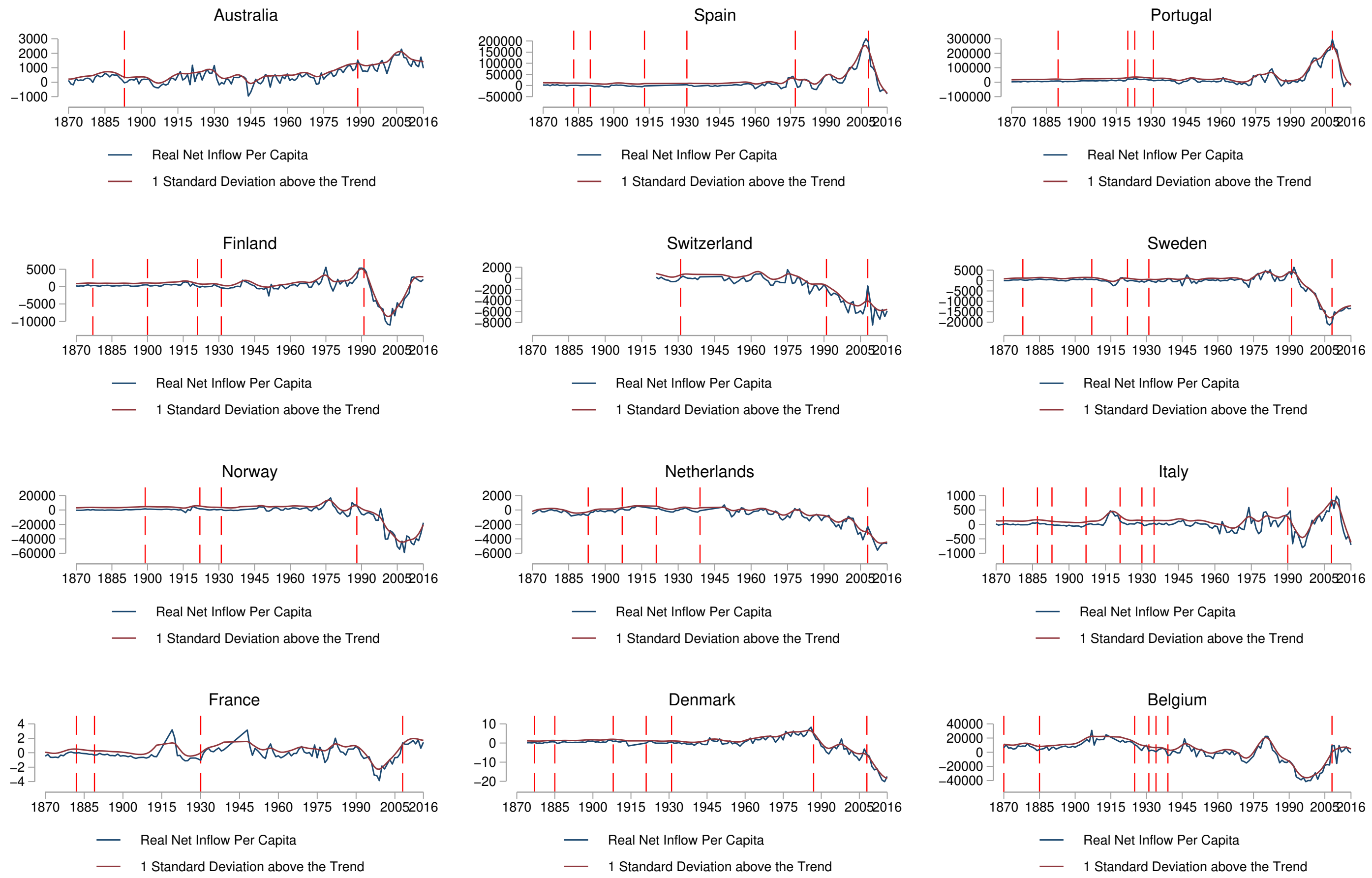
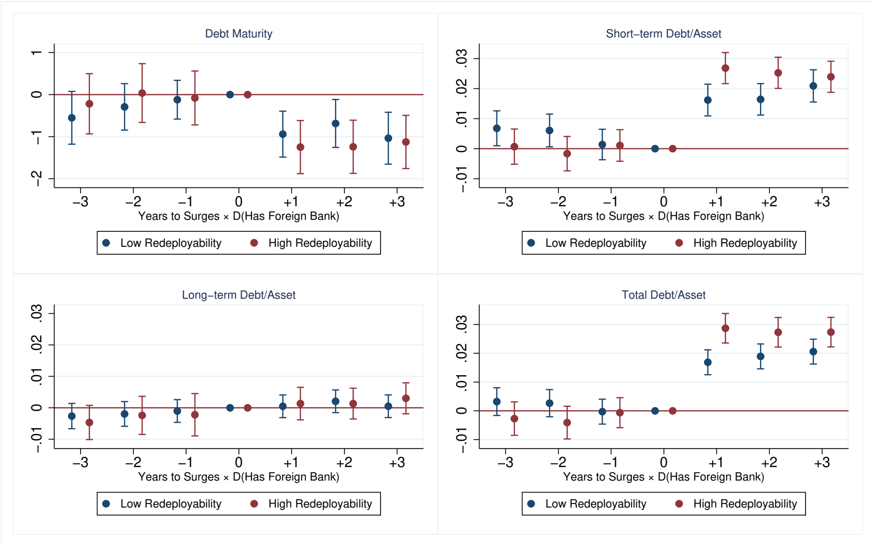


Figure A3: Time Series of Surge and Crises in Countries Used in Macro-level Analysis

Note: This figure shows the time series of the net capital inflow in real per capita terms in the blue line and the sum of its trend and one standard deviation of its cyclical component in the maroon line, for each country used in macro-level analysis. A surge is identified is the blue lines are above the maroon lines. The units of the y-axis are different across countries, as the capital inflows are in local currencies and expressed in different units. The red vertical lines indicate the occurrence of systemic financial crises. Both capital flow and crisis data is from the JST macrohistroy database (Jordà, Schularick and Taylor, 2017).

((A)) Raw Sample



((B)) Matched Sample

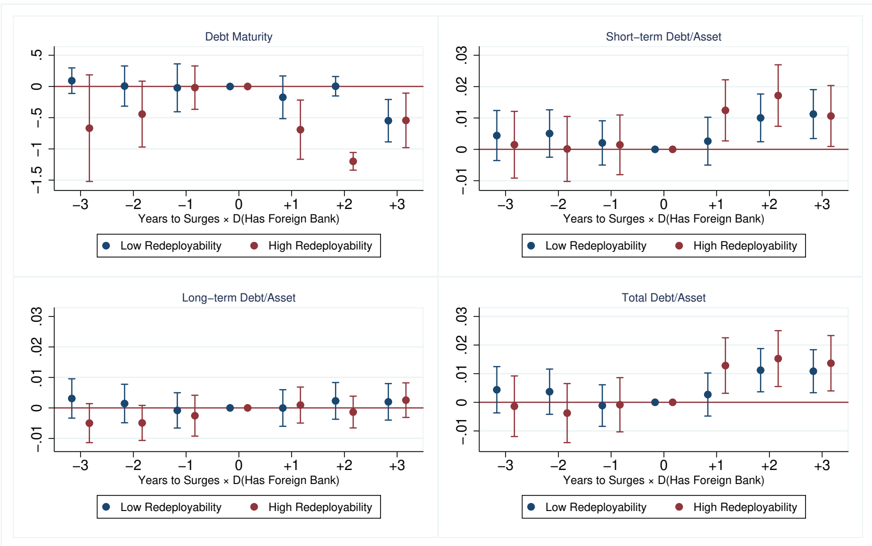


Figure A4: Dynamic Effect for Firms with High and Low Redeployability

Note: This figure plots the results using the low- and high-redeployability subsamples to regress the firm-level debt maturity defined as the share of long-term debt in total debt, the short-term debt to asset ratio, the long-term debt to asset ratio, or the total debt to asset ratio on the interaction term between the years to surge and the dummy indicating the firm has a lending relationship with foreign banks. By limiting the sample to the three years before and the three years after the surge, the estimates are the relative effects compared with the surge year. The solid line are the estimated coefficients of the difference between firms with and without foreign bank relationship compared to that in the surge year, and the capped spikes are the 95% confidence intervals. Lines in maroon present the results of the high-redeployability subsample and lines in navy present that of the low-redeployability subsample. Panel A shows the estimates using the raw sample and Panel B shows that using the matched sample.

Table A6: Variable Definitions

Variable	Definition	Source
	A: Firm-level Analysis	
Surge	A dummy that has a value of 1 if the cyclical component of the net total capital inflows (in per capita real terms) is one standard deviation above the trend. For the annual data, the smoothing parameter is set to 6.25 to separate the cyclical and trend components of capital inflows	IMF Financial Flows Analytics (FFA) Database, 1994-2015
Surge-FDI	A dummy that has a value of 1 if the cyclical component of the net direct capital inflow (in per capita real terms) is one standard deviation above the trend	IMF Financial Flows Analytics (FFA) Database, 1994-2015
Surge-Portfolio Equity	A dummy that has a value of 1 if the cyclical component of the net portfolio equity capital inflow (in per capita real terms) is one standard deviation above the trend	IMF Financial Flows Analytics (FFA) Database, 1994-2015
Surge-Portfolio Debt	A dummy that has a value of 1 if the cyclical component of the net portfolio debt capital inflow (in per capita real terms) is one standard deviation above the trend	IMF Financial Flows Analytics (FFA) Database, 1994-2015
Surge-Other Investment to Corporate Sector	A dummy that has a value of 1 if the cyclical component of the net other investment to the private corporate sector (in per capita real terms) is one standard deviation above the trend	IMF Financial Flows Analytics (FFA) Database, 1994-2015
Surge-Other Investment to Bank Sector	A dummy that has a value of 1 if the cyclical component of the net other investment to the private bank sector (in per capita real terms) is one standard deviation above the trend	IMF Financial Flows Analytics (FFA) Database, 1994-2015
Debt Maturity(%)	The share of long-term debt in the sum of long-term debt and short-term debt	*Orbis*, 1994-2015
Short-term Debt to Asset Ratio	The ratio of short-term debt, i.e., sum of short-term loans (financial debt to credit institutions and the part of long-term financial debt payable within a year), and the current liabilities, to total asset	*Orbis*, 1994-2015
Long-term Debt to Asset Ratio	The ratio of long-term debt, i.e., financial debt (loans and credits) to credit institutions and bonds that mature in more than one year, to total asset	*Orbis*, 1994-2015
Total Debt to Asset Ratio	The ratio of total debt, i.e, the sum of short-term debt and long-term debt, to total asset	*Orbis*, 1994-2015
Firm Size	The natural logarithm of total assets	*Orbis*, 1994-2015
Sale Growth	The difference in log sales between the current and previous year	*Orbis*, 1994-2015
Cash Flow	The sum of the current profits and depreciation divided by total assets	*Orbis*, 1994-2015
Tangibility	The ratio of tangible fixed assets to total assets	*Orbis*, 1994-2015
SA Index	The Hadlock and Pierce (2010) Size-Age index of financial constraints	*Orbis*, 1994-2015
Foreign Bank Relationship	A dummy that has a value of 1 if one of the main banks the firm has lending relationship with is a foreign bank	*Orbis* and *Bankscope* (or *BankFocus*), 1994-2015
Number of Bank Relationship	The number of main banks the firm has lending relationship with	*Orbis* and *Bankscope* (or *BankFocus*), 1994-2015
	B: Macro-level Analysis	
Surge	A dummy that has a value of 1 if the cyclical component of the net capital inflow (in per capita real terms), measured by the opposite of current account balance, is one standard deviation above the trend	JST Macrohistory Database, 1870-2016
Term Spread	The difference between long-term and short-term interest rate, where long-term interest rate is mostly 10-year government bond yield and short-term interest rate is mostly 3-month interbank interest rate, different tenors might be adopted to ensure long-run coverage	JST Macrohistory Database, 1870-2016
Surges with Flattened Yield Curve	A dummy that has a value of 1 if (i) the surge dummy is 1 and (ii) the cyclical component of term spread is lower than one negative standard deviation	JST Macrohistory Database, 1870-2016
Surges without Flattened Yield Curve	A dummy that has a value of 1 if (i) the surge dummy is 1 and (ii) the cyclical component of term spread is higher than one negative standard deviation	JST Macrohistory Database, 1870-2016
Systemic Financial Crises	A dummy that has a value of 1 if the country is in a systemic financial crisis	JST Macrohistory Database, 1870-2016
Credit Boom	A dummy that has a value of 1 if the total loans to non-financial private sector (in per capita real terms) is one standard deviation above the trend	JST Macrohistory Database, 1870-2016
Real GDP per capita	An index with 2005=100 for the real GDP per capita	JST Macrohistory Database, 1870-2016
GDP Growth	Year-over-year GDP growth rates (in decimal)	JST Macrohistory Database, 1870-2016
Trade Openness	The sum of imports an exports divided by GDP	JST Macrohistory Database, 1870-2016
Strict Peg Dummy	A dummy that has a value of 1 if the country has a strictly pegged exchange rate	JST Macrohistory Database, 1870-2016
Depreciation	Year-over-year change in the exchange rate per US dollar	JST Macrohistory Database, 1870-2016
Private Credit	The ratio of the total loans to non-financial private sector to GDP	JST Macrohistory Database, 1870-2016
Housing Return	The nominal total return of housing assets	JST Macrohistory Database, 1870-2016

Table A7: Summary Statistics of Debt Maturity and Bank Relationships by Country

	(1) Firms	(2) Debt Maturity	(3) Short-term Debt/Asset	(4) Long-term Debt/Asset	(5) Total Debt/Asset	(6) Number of Bank Relationships	(7) Having Foreign Bank Relationship
Estonia	3165	43.99	0.204	0.191	0.394	1.402	0.0945
		(25.86)	(0.146)	(0.175)	(0.215)	(0.657)	(0.292)
France	74418	28.97	0.292	0.132	0.423	1.010	0.00354
		(23.29)	(0.159)	(0.142)	(0.184)	(0.101)	(0.0594)
Germany	1817	59.10	0.195	0.313	0.504	2.735	0.0387
		(32.06)	(0.195)	(0.246)	(0.243)	(1.661)	(0.193)
Hungary	5273	32.02	0.283	0.150	0.424	2.373	0.0852
		(26.04)	(0.193)	(0.178)	(0.227)	(1.046)	(0.279)
Latvia	82	57.83	0.160	0.254	0.415	1.610	0.331
		(27.70)	(0.142)	(0.197)	(0.213)	(0.819)	(0.471)
Portugal	42219	52.22	0.219	0.262	0.477	2.245	0.00188
		(28.55)	(0.171)	(0.204)	(0.210)	(1.427)	(0.0433)
Spain	150426	32.42	0.407	0.193	0.597	2.178	0.0730
		(26.29)	(0.245)	(0.186)	(0.252)	(1.314)	(0.260)
Total	277400	34.66	0.360	0.192	0.549	1.999	0.0532
		(27.13)	(0.234)	(0.186)	(0.247)	(1.291)	(0.224)

Note: This table shows the number of firms and firm-year observations and summary statistics of firms' key variables of debt maturity and bank relationship by country. Debt Maturity is the share of long-term debt in total debt. Short-term Debt/Asset, Long-term Debt/Asset, and Total Debt/Asset are the ratio of short-term, long-term debt, and total debt to total asset, respectively. Number of bank relationship is the count of main banks the firms have lending relationship with. Having foreign bank relationship is a dummy that has a value of one if at least one of the main banks are foreign banks.

Table A8: Probit Estimation of Foreign Bank Relationship

	D(Foreign Bank Relationship)
Size	0.322***
	(0.011)
Salegrowth	0.051***
	(0.016)
Cashflow	-0.144***
	(0.052)
Tangibility	-0.039*
	(0.023)
Saindex	0.192***
	(0.014)
Listed	0.467***
	(0.124)
Constant	-1.586***
	(0.012)
Observations	179879
AUROC	0.654
seAUROC	0.003

Note: This table shows the probit estimation of various firm characteristics on the probability of having foreign bank relationship. The dependent variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. Definitions of the control variables are in Table A1 in the online appendix. Data used in this table are the average values in the three years prior to the surge and there is one observation for each firm. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. The predicted values are the propensity scores of having a foreign bank relationship used in the later matching process.

Table A9: Surges and Debt Maturity: Baseline Results with Collapsed Sample

	Maturity		Short		Long		Total	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Raw Sample								
Post Surge × D(Has Foreign Bank)	-1.176***	-0.829***	0.024***	0.021***	0.002**	0.004***	0.027***	0.026***
	(0.099)	(0.114)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	336612	336612	336612	336612	336612	336612	336612	336612
Adjusted R-Square	0.669	0.692	0.704	0.728	0.710	0.732	0.740	0.760
Firm Controls	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Country × Sector × Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Panel B: Matched Sample								
Post Surge × D(Has Foreign Bank)	-0.334***	-0.353***	0.007***	0.005***	0.001	0.001	0.010***	0.008***
	(0.073)	(0.078)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	37804	37804	37804	37804	37804	37804	37804	37804
Adjusted R-Square	0.663	0.693	0.655	0.689	0.734	0.752	0.718	0.738
Firm Controls	NO	YES	NO	YES	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Country × Sector × Time FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationship in the effect of surges on corporate debt maturity in a difference-in-difference specification. The dependent variables are debt maturity defined as the share of long-term debt in total debt in columns (1)-(2), the ratio of short-term debt to total asset in columns (3)-(4), the ratio of long-term debt to total asset in columns (5)-(6), and the ratio of total debt to total asset in columns (7)-(8). The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. Definitions of the other control variables are in Table A1 in the online appendix. Following Bertrand, Duflo and Mullainathan (2004), data used in this table is collapsed into one observation before the surge and one observation after the surge for each firm, thus the data is at firm-time level. Odd columns show the results without including firm-level control variables, and even columns show the results including them. Standard errors are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively. Standard errors are clustered at firm and country-time level.

Table A10: Sectoral Heterogeneity: Redeployability

	Maturity		Short		Long		Total	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High	(7) Low	(8) High
-3 Years to Surge × D(Has Foreign Bank)	-0.552*	-0.218	0.007**	0.001	-0.003	-0.005*	0.003	-0.003
	(0.320)	(0.365)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
-2 Years to Surge × D(Has Foreign Bank)	-0.292	0.037	0.006**	-0.002	-0.002	-0.002	0.003	-0.004
	(0.282)	(0.357)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
-1 Years to Surge × D(Has Foreign Bank)	-0.121	-0.080	0.001	0.001	-0.001	-0.002	-0.000	-0.001
	(0.235)	(0.327)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
+1 Years to Surge × D(Has Foreign Bank)	-0.940***	-1.249***	0.016***	0.027***	0.000	0.001	0.017***	0.029***
	(0.279)	(0.322)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
+2 Years to Surge × D(Has Foreign Bank)	-0.687**	-1.242***	0.016***	0.025***	0.002	0.001	0.019***	0.027***
	(0.291)	(0.323)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
+3 Years to Surge × D(Has Foreign Bank)	-1.038***	-1.127***	0.021***	0.024***	0.000	0.003	0.021***	0.027***
	(0.315)	(0.323)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Firm Size	13.575***	9.091***	0.001	-0.014***	0.119***	0.079***	0.113***	0.064***
	(0.808)	(0.357)	(0.003)	(0.003)	(0.002)	(0.008)	(0.002)	(0.003)
Sale Growth	-0.971***	-0.917***	0.027***	0.027***	-0.001*	-0.003***	0.026***	0.024***
	(0.100)	(0.063)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Cash Flow	-8.148***	-5.686***	-0.121***	-0.143***	-0.094***	-0.068***	-0.223***	-0.215***
	(0.409)	(0.285)	(0.002)	(0.002)	(0.001)	(0.005)	(0.002)	(0.002)
Tangibility	29.047***	34.317***	-0.143***	-0.187***	0.188***	0.211***	0.043***	0.024***
	(0.661)	(0.221)	(0.002)	(0.002)	(0.001)	(0.015)	(0.001)	(0.002)
SA Index	8.925***	5.867***	0.018***	-0.020***	0.082***	0.055***	0.087***	0.032***
	(1.134)	(0.481)	(0.004)	(0.004)	(0.002)	(0.010)	(0.003)	(0.004)
Constant	23.646***	20.042***	0.421***	0.393***	0.144***	0.110***	0.557***	0.501***
	(0.638)	(0.250)	(0.002)	(0.002)	(0.001)	(0.007)	(0.002)	(0.002)
Observations	982680	675784	982680	675784	982680	675784	982680	675784
R-Square	0.746	0.767	0.765	0.790	0.767	0.782	0.816	0.825
Firm Controls	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationship in the effect of surges on corporate debt maturity in a dynamic difference-in-difference specification, for sectors with low and high redeployability separately. The dependent variables are debt maturity defined as the share of long-term debt in total debt in columns (1)-(2), the ratio of short-term debt to total asset in columns (3)-(4), the ratio of long-term debt to total asset in columns (5)-(6), and the ratio of total debt to total asset in columns (7)-(8). The dummy variables *-3 Years to Surge*, *-2 Years to Surge*, and *-1 Years to Surge* are equal to one if a capital inflow surge occurs in the next three, two, and one year, respectively.The dummy variables *+1 Years to Surge*, *+2 Years to Surge*, and *+3 Years to Surge* are equal to one if a capital inflow surge has occurred in the one, two, and three years ago, respectively. The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. Redeployability is from the measurement constructed by Kim and Kung (2016) with a higher value indicating that the assets of firms in this industry are used by more firms in the economy. The division of the low- and high-redeployability subsamples is based on the median value. Odd columns show the results in the low-redeployability subsample, and even columns show the results in the high-redeployability subsample. Definitions of the other control variables are in Table A6 in the online appendix. Data used in this table is at firm-year level. Standard errors are in parentheses. *, **,and *** represent results significant at the 10%, 5%, and 1% levels, respectively.

Table A11: Surges and Instability: Robustness Check on Reverse Causality

	High Z-score		Low Z-score	
	(1)	(2)	(3)	(4)
	Raw	PSM	Raw	PSM
Post Surge × D(Has Foreign Bank)	-0.661***	-0.296	-0.450*	-0.622
	(0.249)	(0.368)	(0.253)	(0.386)
Observations	554604	60009	508835	58360
Adjusted R-Square	0.585	0.564	0.654	0.632
Firm Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Country × Sector × Year FE	YES	YES	YES	YES

Note: This table shows the role of having foreign bank relationship in the effect of surges on corporate debt maturity in the subsamples of high and low Z-scores, separately. The dependent variables are debt maturity defined as the share of long-term debt in total debt. The dummy variable *Post Surge* is equal to one if a capital inflow surge has occurred in the current year or at most three years ago, and it is equal to zero if a capital inflow surge occurs in the next one to three years. The dummy variable *D(Foreign Bank Relationship)* is equal to one if the firm has at least one foreign bank in its main bank relationships. The division of the high- and low-Z-score subsamples is based on the median value of firms' Z-scores before surges. Odd columns show the results using the raw sample, and even columns show the results using the PSM matched sample. Data used in this table is at firm-year level. Standard errors are in parentheses. *, **,and *** represent results significant at the 10%, 5%, and 1% levels, respectively.

Table A12: Surges and Crisis: Robustness Check on Flattened Yield Curve

	Sample Period: 1870-2016		Sample Period: 1946-2016	
	(1)	(2)	(3)	(4)
Surge with Flattened Yield Curve	12.507***	23.185***	84.634***	60.009***
	(6.003)	(6.157)	(6.469)	(5.600)
Surge without Flattened Yield Curve	0.499	0.854	3.069	2.266
	(-0.679)	(-0.151)	(0.992)	(0.704)
Flattened Yield Curve without Surge	3.565***	7.376***	9.282***	7.787***
	(3.219)	(4.429)	(3.296)	(2.940)
Obs	1236	1236	814	814
Countries	12	12	12	12
Crises	42	42	17	17
Loglik	-167.323	-138.004	-61.062	-50.679
WaldTestChi2	1.876	9.846	4.426	5.235
WaldTestPval	0.598	0.454	0.219	0.875
AUROC	0.666	0.838	0.607	0.563
seAUROC	0.037	0.031	0.036	0.051
Control	NO	YES	NO	YES
Unconditional Probability	3.4%	3.4%	2.1%	2.1%
Probability Conditional on Surge with Flattened Yield Curve	30.6%	44.9%	64.4%	56.1%
Probability Conditional on Surge without Flattened Yield Curve	1.7%	2.9%	6.1%	4.6%
Probability Conditional on Flattened Yield Curve without Surge	11.1%	20.6%	16.5%	14.2%

Note: This table shows the effects of surge and the role of flattened yield curve on the probability of systemic financial crisis. The dependent variable is the dummy which is equal to one if a systemic financial crisis occurs in the JST macrohistory database. Compared to Table 5, here we additionally separate the case of no surges to (i) no surges but have flattened yield curve and (ii) no surges and no flattened yield curve, the latter of which is omitted as the base case. The dummy variable *Surge with Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread, which calculated as the difference between long-term and short-term interest rates, is one standard deviation below its trend. The dummy variable *Surge without Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread is not largely flattened, i.e., is above the one-standard-deviation-below-the-trend line. The dummy variable *Flattened Yield Curve without Surge* is equal to one if a surge does not occur and at the same time the change in term spread is one standard deviation below its trend. Control variables include real GDP per capita, GDP growth rate, trade openness, pegged exchange rate dummy, depreciation, private credit to GDP ratio, and housing return. Definitions of the control variables are in Table A6 in the online appendix. Data used in this table is at country-year level. We exclude US, UK, Japan and Germany as these countries are potentially drivers of the global financial cycle. Columns (1)-(2) show the results using the sample period from 1870 to 2016, and columns (3)-(4) show the results using the post WWII sample period from 1946 to 2016. The estimates shown here are exponentiated, and z statistics are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively.

Table A13: Surges and Credit Booms

	Sample Period: 1870-2016				Sample Period: 1946-2016			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Surge	5.167***	4.456***			4.658***	4.771***		
	(8.157)	(6.541)			(7.380)	(6.675)		
Surge with Flattened Yield Curve			7.349***	5.330***			6.717***	6.812***
			(6.496)	(4.927)			(6.092)	(5.377)
Surge without Flattened Yield Curve			4.816***	4.086***			3.886***	4.064***
			(6.711)	(5.394)			(5.447)	(5.113)
Obs	1236	1236	1236	1236	814	814	814	814
Countries	12	12	12	12	12	12	12	12
Booms	123	123	123	123	120	120	120	120
Loglik	-373.244	-275.952	-370.670	-275.265	-318.945	-258.966	-317.692	-258.035
WaldTestChi2	5.313	20.073	7.189	20.528	1.527	18.974	1.435	19.045
WaldTestPval	0.021	0.010	0.027	0.015	0.216	0.015	0.488	0.025
AUROC	0.674	0.880	0.671	0.882	0.615	0.825	0.658	0.882
seAUROC	0.026	0.012	0.026	0.012	0.028	0.017	0.025	0.012
Control	NO	YES	NO	YES	NO	YES	NO	YES

Note: This table shows the effects of surge and the role of flattened yield curve on the probability of a credit boom. The dependent variable is the dummy which is equal to one if a credit boom occurs in the JST macrohistory database. Credit boom is identified when the total loans to non-financial private sector in real per capita terms is one standard deviation above its trend. The dummy variable *Surge* is equal to one if the net capital inflow in real per capita terms is one standard deviation above the trend. The dummy variable *Surge with Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread, which calculated as the difference between long-term and short-term interest rates, is one standard deviation below its trend. The dummy variable *Surge without Flattened Yield Curve* is equal to one if a surge occurs and at the same time the change in term spread is not largely flattened, i.e., is above the one-standard-deviation-below-the-trend line. Control variables include real GDP per capita, GDP growth rate, trade openness, pegged exchange rate dummy, depreciation, private credit to GDP ratio, and housing return. Data used in this table is at country-year level. We exclude US, UK, Japan and Germany as these countries are potentially drivers of the global financial cycle. Columns (1)-(4) show the results using the sample period from 1870 to 2016, and columns (5)-(8) show the results using the post WWII sample period from 1946 to 2016. The estimates shown here are exponentiated, and z statistics are in parentheses. *, **, and *** represent results significant at the 10%, 5%, and 1% levels, respectively.

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