Corporate Cross-border Borrowing and Macroprudential Policy

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Abstract

This paper present both empirical and theoretical analyses about the effects of macroprudential policy measures (MPMs). I first examine the effectiveness of MPMs in mitigating the response of corporate loans to a US monetary expansion, using panel data constructed from Dealscan database, IMF macroprudential policy index (MPI), and other macro variables. I find that MPMs can effectively attenuate the increase in corporate loans responding to a US monetary expansion, but the effects are dampened as the country's share of foreign loans goes up. This is because firms borrow more across borders with a decrease in the US rate but MPMs cannot regulate the international borrowing. The introduction of capital flow management measures (CFMs) can help MPMs in managing corporate loans since they regulate capital inflows directly. My findings from a two-period model are consistent with the empirical evidence. I find that a special case of MPM, concentration limits, can effectively reduce the level and the growth of corporate loans when there is a decrease in the world interest rate. However, the effects of the MPM are dampened when firms are allowed to increase foreign borrowing, which can be resolved with the introduction of CFMs. An additional constraint imposed by a CFM can set a lower bound for a measure of the effectiveness of MPMs by limiting firms from borrowing overly from abroad.

I. Introduction

Many countries, especially emerging markets, have adopted macroprudential measures (MPMs) and capital flow management measures (CFMs) that go beyond conventional monetary policy and financial regulations. MPMs build buffers that can keep agents from increasing leverage excessively during booms and from being vulnerable to adverse exogenous shocks. The buffers can be relaxed during a financial crisis, helping the transmission of monetary policy in the event of such stress. CFMs are measures that limit capital inflows. If CFMs are applied to address financial risk stemming from capital inflows, those measures are also regarded as MPMs.[1]

In this paper, I will provide both theoretical and empirical analysis on the effectiveness of

[1]These classifications can be found in Arora et al. (2015).

macroprudential policy when firms are allowed to borrow directly from abroad and the economy is hit by a decrease in the world interest rate. In response to US monetary expansion, overseas firms may increase their total loans because the borrowing rate goes down. However, an excessive increase in corporate loans can leave the economy more vulnerable to subsequent currency shocks or financial crises, because agents are exposed to more default risk. Therefore, overseas central banks may adopt macroprudential policies to keep agents from increasing their loans excessively. I show that macroprudential policies are effective in mitigating the growth in corporate loans in response to US monetary expansion, but a higher share of foreign borrowing dampens these effects of MPMs. Since MPMs are not able to regulate capital inflows from abroad, firms can increase cross-border loans, which are not restricted by macroprudential policies, in response to a decrease in the world interest rate. The introduction of capital flow management measures in addition to MPMs can help deal with these leakages, since the CFMs can directly limit capital inflows through corporate cross-border loans.

In the empirical part, I study the effects of MPMs and how they are affected by a higher foreign loan share. In addition, I study how the effectiveness of MPMs differs when they are coordinated with CFMs. Constructing panel data using loan-level information provided in *Thomson Reuters Dealscan* and other macro variables, I show that macroprudential policies can significantly attenuate both the level and the response of non-US corporate loans to a US monetary expansion. However, the effects of MPMs are significantly dampened as the country's share of foreign loans goes up, unless CFMs are conducted simultaneously. These results hold for macroprudential policies targeting either borrowers or lenders. When MPMs are applied with CFMs in place, these policy measures can significantly reduce corporate loans and the response of the loans to a US monetary expansion, while a higher share of foreign loans does not dampen this effect. Thus, when firms are able to borrow more from abroad, it is more efficient for the central bank to adopt CFMs in addition to MPMs to tame the increase in total corporate borrowing. However, when the sample countries are divided into two groups, advanced and emerging markets, I find that this is the case only for emerging market countries. In advanced countries, MPMs are sufficient to manage corporate loans, which indicates that CFMs are not needed to regulate firms' leakages toward the international market. In fact, advanced countries have not conducted CFMs as much as emerging markets have done.

Next, I provide a simple two-period model extended from Cespedes et al. (2017) to study the impact of macroprudential policy on corporate loans when the world interest rate is decreased by US monetary expansion. In the model, firms finance loans from both domestic banks and the foreign market. Considering that most domestic markets are financially less stable than the international market, savers may require a higher risk premium domestically (see Bocola & Lorenzoni (2017)). Therefore, I assume that firms face lower borrowing rates when they borrow from abroad. This corporate cross-border borrowing is constrained to be less than some multiple of their expected revenue. Banks finance their lending to firms by borrowing from the international market at rate R^{**}. They also lend to foreign borrowers at interest rate R^*, which is less than or equal to the domestic rate R. Banks have financial constraints that limit the total borrowing from abroad to a fraction of their expected revenue. Banks can borrow across borders at a lower rate than firms (i.e., $R^{**} < R^* \leq R$) since they are commonly regarded more stable than firms.

I provide analytic solutions for the case in which there is a decrease in international rates and the central bank adopts macroprudential polices. When there is a decrease in the world interest rate, there is a possibility of firms increasing their total loans because of the decrease in the borrowing rate and the increase in their net worth. I find that the introduction of a macroprudential policy can mitigate this response of corporate loans, focusing on a special type of MPM, "*Concentration Limits*," which limits the amount of exposure a bank has to a limited number of borrowers. In my model, the policy limits the amount of the bank's domestic lending to a fraction of their own net worth, to cap the fraction of assets held by domestic borrowers. This policy can effectively attenuate the response of corporate loans to a decrease in the world interest rate, but the effect can be dampened when firms are allowed to borrow more from abroad. This dampening effect can be complemented with the introduction of CFMs together with MPMs. CFMs that limit the amount of corporate cross-border borrowing can increase the effectiveness of macroprudential policies because they prevent an excessive increase in firms' cross-border borrowing. This theoretical finding is consistent with the empirical evidence obtained using loan-level information on non-US firms.

In sum, I first offer empirical evidence that macroprudential policies can mitigate the response of corporate loans to US monetary expansion, that this effect is dampened as the share of foreign borrowing goes up, and that the effects of MPMs need not be dampened by corporate cross-border borrowing if MPMs are conducted together with CFMs. I then provide a simple theoretical model to show the mechanism behind these effects. In the model, I show that macroprudential policies that limit the amount of bank assets held as loans to domestic firms can mitigate the response of corporate loans to a decrease in the world interest rate. In addition, when firms are borrowing more across borders, the overall effectiveness of macroprudential policies can be dampened, which can be solved by the introduction of CFMs.

Related Literature There is a growing literature studying the effects of macroprudential policy. Lim et al. (2011) is one of the first studies to analyze the links between macroprudential policy and credit booms. They suggest that MPMs such as limits on LTV (Loan-to-Value ratio) and DTI (Debt-to-Income ratio) can be effective in mitigating cyclical responses of credit and leverage. Their work was followed by empirical literature such as Bruno et al. (2017), Cerutti et al. (2015), Claessens et al. (2013), Dell'Ariccia et al. (2012), and Zhang & Zolit (2014). Based on micro-level data analysis, Aiyar et al. (2014) and Jiménez et al. (2012) also find a role for macroprudential policy in taming credit supply cycles. This paper contributes to this strand of literature by examining how the effects of macroprudential policy depend on the share of foreign borrowing in total corporate borrowing. Using loan-level information provided in the Dealscan database, I show how the effects of macroprudential policy can be dampened when the country's share of foreign borrowing is higher.

This paper also adds to the strand of literature analyzing the effects of macroprudential policy in an open economy setup (Aoki et al. (2016), Cespedes et al. (2017), Dedola et al. (2013), Nuguer (2016), Ueda (2012)), by suggesting that macroprudential policy effects are dampened when a significant share of loans occur across borders. Based on the open economy models with financial intermediation by Gertler & Karadi (2011) and Gertler & Kiyotaki (2010), these papers study the implications of MPMs theoretically. I adopt and modify the simple two period model suggested by Cespedes et al. (2017), who discuss the effects of unconventional policies when lenders have occasionally binding collateral constraints. I modify their setup by allowing firms to borrow across borders while banks also lend to the international markets. This model allows me to study how corporate cross-border loans affect macroprudential policies in an open economy.

Previous work that studies corporate borrowing in foreign currency (Bianchi (2011), Mendoza (2010), Korinek (2011)). Salomao & Varela (2018) and Hardy (2018)) analyzes firms' decisions on the mixture of borrowing in local currency and in foreign currency. However, there are few papers that study firms' decisions over borrowing from different countries. Instead of focusing on firms' borrowing in different currencies, I study the importance of firms' decisions whether to borrow domestically or across borders. Corporate cross-border loans can significantly affect macroprudential policies because those loans cannot be directly regulated with MPMs.

The last stand of literature that is related to this paper studies the effects of CFMs in regulating agents' borrowing decisions. There have been some papers that discuss costs of capital controls (Chari & Henry (2004), Gourinchas et al. (2010), Maggiori (2017)). Keller (2019) argues that capital controls can induce banks to lend more to firms in foreign currency. Nevertheless, many authors have demonstrated benefits of capital controls in managing financial stability and overborrowing (Bianchi (2011), Brunnermeier & Sannikov (2015), Korinek & Sandrii (2016), Mendoza (2010), Ostry et al. (2012), Schmitt-Grohe & Uribe (2012)). This paper adds to this literature, emphasizing the benefits of CFMs in preventing the effects of MPMs from being dampened by corporate cross-border loans. Bengui & Bianchi (2014) argue that agents borrowing from sectors other than recognized domestic markets are regarded as capital leakages, which limit the effectiveness of CFMs. In this paper, agents can borrow from abroad, but these are not unregulated leakages in terms of capital flow mangagement because agents are subject to constraints on cross-border borrowing.

Layout The rest of this paper proceeds as follows. Section II provides empirical evidence on the effectiveness of MPMs and how it differs depending on the presence of CFMs. Section III presents a model to explain the mechanism behind the findings in Section II. Section IV provides analytical solutions and studies the impact of MPMs and CFMs, and Section V concludes.

II. Empirical Analysis

This section provides empirical evidence on the impact on non-US firms of macroprudential policy during US monetary expansions. I show how macroprudential measures (MPMs) can help in mitigating the increase in total corporate loans in response to US monetary expansions. In addition, I examine a measure of the share of foreign loans in total corporate loans and show that the effectiveness of macroprudential policy is dampened as the foreign loan share goes up. This is because MPMs can only regulate domestic loans, not foreign capital inflows. This dampening is observed for both lender- and borrower-targeted policy measures. However, when MPMs are conducted simultaneously with capital flow management measures (CFMs), the effects of the MPMs in attenuating corporate loans become more significant. Furthermore, there is no dampening impact on the effectiveness of macroprudential policy as the share of foreign loans goes up. Finally, I study the effectiveness of MPMs separately in advanced and emerging countries. The dampening impact of higher foreign loans and the need for CFMs exist only in emerging countries, while MPMs can sufficiently manage corporate loans in advanced countries.

1. Data Construction

My data includes information about corporate loans from Dealscan, the Macroprudential Policy Index (MPI) from Cerutti et al. (2015), and other macro variables taken from FRED. Total corporate loans and the share of foreign loans by country and year are calculated by aggregating loan-level data on deal amount, lender type, lender shares, currency and the exchange rate provided in Dealscan. Dealscan contains rich balance-sheet information and covers large listed firms in a number of countries. I only use the international part of the database, excluding borrowing firms from the United States.[2] The database provides information about loan packages in which multiple lenders participate to lend to a single firm. I calculate total corporate loans for each country in each year in dollars by first multiplying the loan amount by the exchange rate and then adding across loans. Using lender shares and information about lenders' locations, I can separately calculate the amount of corporate loans from domestic and foreign lenders, respectively. Using these numbers, I obtain the annual level and the growth of corporate loans in a country over the period 2000-2014. In addition, I calculate the share of foreign loans in total corporate loans in each country, averaged over the period 1990 to 1999.

[2]The data covers 40 countries including Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Croatia, Denmark, Egypt, Finland, France, Georgia, Germany, Greece, India, Indonesia, Ireland, Italy, Luxembourg, Malaysia, Mexico, Netherlands, New Zealand, Norway, Peru, Philippines, Poland, Portugal, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Tailand, Turkey, United Arab Emirates, and United Kingdom.

MPI measures the number of macroprudential policy buffers that a country imposes in a certain period. The index is constructed by Cerutti et al. (2015) using a comprehensive IMF survey, called Global Macroprudential Policy Instruments (GMPI). The MPI measures cover 12 different instruments, which can be divided into two groups: borrower-targeted and lender-targeted.[3] The MPI index does not measure the intensity of the policies but simply counts the number of the instruments that were in place in a particular country in a given period since it is difficult to capture the degree of intensity without subjectivity. In addition, I construct an indicator of CFMs based on the "IMF 2019 taxonomy of CFMs," which provides data starting in 1991. The taxonomy records whether certain types of CFMs for capital inflows or outflows were conducted during a certain period. Since my paper studies the effects of policies that aim to mitigate the increase in corporate loans in response to US monetary expansion, I focus only on CFMs that regulate capital inflows, which can be classified into 6 different types.[4] The CFM indicator is a binary measure that takes a value of 1 when there is at least one CFM in place.

US monetary expansions are measured as a decrease in the Wu-Xia shadow rate estimated by Wu & Xia (2016) since the Federal Funds rates reached their zero lower bound (ZLB) after 2007-08 financial crisis.[5] The shadow rate incorporates the Fed's easing through unconventional policies as well as monetary policies to help understand the effects of quantitative easing on the economy. Therefore, I assume that there is a US monetary expansion when the shadow rate is lower than in the previous period. To control for country-specific economic fluctuations, I also use macroeconomic variables such as policy rates and the growth in real GDP for each country. The data I use covers the period 2000 - 2014 at a yearly frequency, for which I have information about corporate loans, MPMs, CFMs, US monetary policy, and other macroeconomic variables.

2. Empirical Strategy

I analyze how the usage of various macroprudential policies affects corporate loans when there is a US monetary expansion. In addition, I estimate how a country's predetermined share of foreign loans in total corporate loans affects the impact of macroprudential policy instruments. I estimate

[3] Debt-to-Income Ratio (DTI); Time-Varying/Dynamic Loan-Loss Provisioning (DP); General Countercyclical Capital Buffer/Requirement (CTC); Leverage Ratio (LEV); Capital Surcharges on SIFIs (SIFI); Limits on Interbank Exposures (INTER); Concentration Limits (CONC); Limits on Foreign Currency Loans (FC); Limits on Domestic Currency Loans (CG); Levy/Tax on Financial Institutions (TAX); Loan-to-Value Ratio Caps (LTV_CAP); FX and/or Countercyclical Reserve Requirements (RR_REV). Debt-to-Income Ratio (DTI) and Loan-to-Value Ratio Caps (LTV_CAP) are classified as borrower-targeted policies, and the others are regarded as being aimed at financial institutions in Cerutti et al. (2015).

[4] Reserve requirement; Limit; Stamp duty; Tax; Approval requirement; Other. Details are described in "IMF 2019 taxonomy of CFMs."

[5] The Wu-Xia shadow funds rate was developed by Wu & Xia (2016) to understand the exact stance of monetary policy and other policy tools after the federal funds rate reached near zero.

Table 1: Summary Statistics of Main Regression Variables

	Mean	Median	Min	Max	Std. Dev.	Obs
Dependent Variables						
Total corporate loan growth (%)	18.99	17.96	-710.44	977.18	141.98	559
Total corporate loan level (logged)	1.27	1.38	-7.13	5.47	2.08	576
Independent Variables						
(Country-year level variables)						
MPI_all	2.58	2	0	12	2.16	600
MPI_lender	2.14	2	0	10	1.68	600
MPI_borrower	0.44	0	0	2	0.69	600
CFM	0.11	0	0	1	0.31	600
Policy rate (%)	4.37	2.98	-0.09	183.2	8.81	588
GDP growth (%)	2.76	2.91	-16.43	14.19	3.47	600
(Country level variables)						
Foreign Share	0.78	0.87	0.28	1.00	0.22	40
(Year level US variables)						
US expansion	0.67	1	0	1	0.47	15
US shadow funds rate (%)	1.46	1.35	-2.74	6.24	2.65	15

Notes: The table presents summary statistics for all observations from 2000-2014. The level of total corporate loans are denominated in billions of US dollars. Sources are Dealscan, the IMF database and FRED. "MPI_all" is an index of all macroprudential policies, "MPI_lender" indexes lender-targeted policies, and "MPI_borrower" indexes borrower-targeted policies. "CFM" is an index of capital flow management policies, constructed by the author based on the "IMF 2019 taxonomy of capital flow management measures." "Foreign Share" denotes the share of foreign loans in total corporate loans.

the following baseline regression model:

$$
\begin{aligned}
Y_{i,t} &= \beta \cdot Macropru_{i,t} \times USexp_{t-1} \times Share_i \\
&\quad + \alpha_1 \cdot Macropru_{i,t} \times USexp_{t-1} + \alpha_2 \cdot Macropru_{i,t} \times Share_i + \alpha_3 \cdot Share_i \times USexp_{t-1} \\
&\quad + \gamma_1 \cdot Macropru_{i,t} + \gamma_2 \cdot USSR_{t-1} + \lambda_1 \cdot PR_{i,t-1} + \lambda_2 \cdot GDP_{i,t-1} + \lambda_3 \cdot Y_{i,t-1} + \theta_i + \epsilon_{i,t} \quad (1)
\end{aligned}
$$

where $Y_{i,t}$ is the level or the growth rate of total corporate loans in country i at time t. $Macropru_{i,t}$ is a measure of the aggregate MPI. $Share_i \equiv (\frac{FB}{DB+FB})_i$ is the aggregate share of corporate loans from foreign markets in total corporate loans for country i, averaged from 1990 to 1999. FB is the amount borrowed from foreign banks while DB is the amount borrowed from domestic banks. I measure the foreign borrowing share using data from 1990 to 1999 to avoid endogeneity of this share with respect to credit shocks occurring after 2000. $USSR_{t-1}$ is the Wu-Xia shadow rate at time t-1 and $USexp_{t-1}$ is a dummy indicating US monetary expansion as measured by the shadow rate. $PR_{i,t-1}$ refers to the central bank policy rate and $GDP_{i,t-1}$ is the GDP growth rate in country i at time t-1. θ_i refers to country fixed effects included to capture country-specific conditions, and $\epsilon_{i,t}$ denotes the error terms. Standard errors are clustered at the country level.

The main coefficients of interest are α_1 and β, which measure the effects of macroprudential policies on the response of total corporate loans to US monetary expansions and the impact of a higher foreign loan share on these responses. After a US monetary expansion at time t-1, corporate loans may increase due to a decrease in the borrowing rate, and the central bank may conduct macroprudential policies to mitigate this response at time t. This is because an excessive increase in firms' leverage may expose the economy to more risks and make it vulnerable to unexpected crises. However, since MPMs can regulate only domestic loans, the effects of MPMs can be dampened when firms are allowed to borrow across borders. In extreme cases, when firms borrow only from foreign lenders, macroprudential policies will not have any impact on corporate loans.

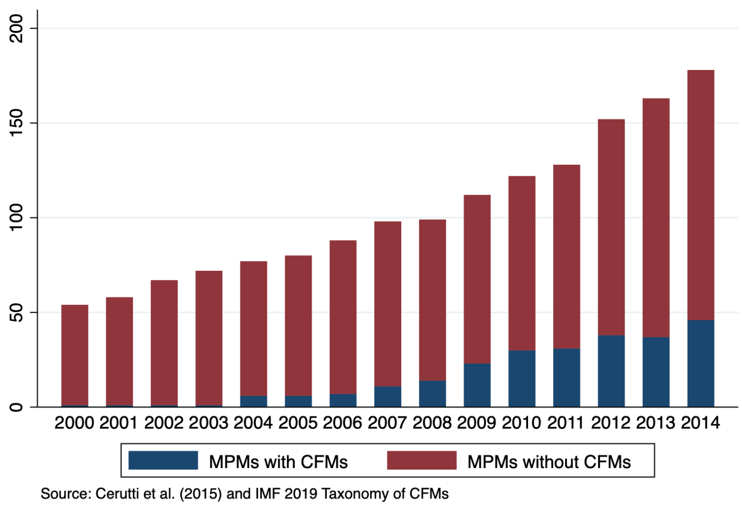

Figure 1: MPMs with/without CFMs

Descriptive Statistics Table 1 presents descriptive statistics for the main regression variables. I find large variation in the dependent variables, the growth and the level of corporate loans, which range from -710.44 to 977.18 percentage points and from -7.13 to 5.47, with a standard deviation of 141.98 and 2.08, respectively. The table also describes variation in the macroprudential policy index, which ranges from 0 to 12 with a standard deviation of 2.16 and a mean of 2.58. Among these policies, lender-targeted policies show more variation, ranging from 0 to 10 with a standard deviation 1.68 and a mean of 2.14, while the borrower-targeted policy index has a mean of 0.44 and a standard deviation of 0.69. In addition, the indicator of CFMs has a mean of 0.11 and a standard deviation of 0.31. Policy rates and GDP growth vary from -0.09 to 183.2 and from -16.43 to 14.19, respectively, with means of 4.37 and 2.76. The average share of foreign loans in total corporate loans is 0.78 across countries, with a standard deviation of 0.22. The dummy for US expansion and the US shadow funds rate also show ample variation, with standard deviations of 0.47 and 2.65.

Figure 1 shows changes over time in the number of MPMs adopted by sample countries with and without CFMs. "MPMs with CFMs" indicates the number of MPMs that are conducted when at least one CFM is in place. "MPMs without CFMs" counts the number of MPMs that are conducted without any CFMs in place. As depicted in the figure, the total number of macroprudential measures in place in the sample countries increased over time, starting with just above 50 in 2000 and ending at over 175 in 2014. The number of macroprudential measures conducted with CFMs also increased over the sample period after countries first introduced CFMs in 2004. However, more than 75 percent of MPMs are still adopted without any capital control management measures in place.

Table 2: The Effects of Macroprudential Policy

	(1) Growth	(2) Growth	(3) Level	(4) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i(\beta)$		0.520***		0.523***
		(0.177)		(0.144)
$Macropru_{i,t} \times USexp_{t-1}(\alpha_1)$	-0.083	-0.460***	-0.090	-0.436***
	(0.077)	(0.124)	(0.057)	(0.127)
$USSR_{t-1}(\gamma_2)$	-0.030	-0.060*	-0.078**	-0.131***
	(0.031)	(0.034)	(0.032)	(0.037)
$Macropru_{i,t} \times Share_i(\alpha_2)$		-0.312		-0.492**
		(0.271)		(0.230)
$Share_i \times USexp_{t-1}(\alpha_3)$		-0.445		-0.722***
		(0.290)		(0.199)
$Macropru_{i,t}(\gamma_1)$	0.033	0.257	0.324***	0.645***
	(0.085)	(0.189)	(0.064)	(0.178)
$PR_{i,t-1}(\lambda_1)$	-0.001	-0.004	-0.007**	-0.006*
	(0.002)	(0.003)	(0.003)	(0.003)
$GDP_{i,t-1}(\lambda_2)$	0.068***	0.059***	0.040*	0.022
	(0.019)	(0.020)	(0.020)	(0.020)
$Y_{i,t-1}(\lambda_3)$	-0.424***	-0.436***	0.336***	0.325***
	(0.036)	(0.035)	(0.059)	(0.055)
Countries	40	40	40	40
Country FE	Yes	Yes	Yes	Yes
Observations	547	547	547	547
R^2	0.238	0.255	0.337	0.355

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table 3: The Effects of Macroprudential Policy: Borrower- vs. Lender- targeted

	(1) Growth_Lender	(2) Growth_Borrower	(3) Level_Lender	(4) Level_Borrower
$Macropru_{i,t} \times USexp_{t-1} \times Share_i (\beta)$	0.649***	1.810**	0.584***	2.207***
	(0.193)	(0.914)	(0.160)	(0.774)
$Macropru_{i,t} \times USexp_{t-1} (\alpha_1)$	-0.524***	-1.773**	-0.459***	-1.938***
	(0.133)	(0.758)	(0.137)	(0.705)
$USSR_{t-1} (\gamma_2)$	-0.067*	-0.031	-0.123***	-0.157***
	(0.034)	(0.027)	(0.035)	(0.035)
$Macropru_{i,t} \times Share_i (\alpha_2)$	-0.391	-0.800	-0.591**	-1.854
	(0.312)	(1.082)	(0.252)	(1.118)
$Share_i \times USexp_{t-1} (\alpha_3)$	-0.548*	-0.292	-0.741***	-0.714***
	(0.288)	(0.229)	(0.205)	(0.177)
$Macropru_{i,t} (\gamma_1)$	0.240	1.015	0.802***	2.051**
	(0.222)	(0.854)	(0.187)	(0.939)
$PR_{i,t-1} (\lambda_1)$	-0.004	-0.003	-0.006*	-0.009***
	(0.003)	(0.002)	(0.003)	(0.003)
$GDP_{i,t-1} (\lambda_2)$	0.057***	0.066***	0.024	0.030
	(0.020)	(0.020)	(0.019)	(0.020)
$Y_{i,t-1} (\lambda_3)$	-0.435***	-0.433***	0.317***	0.371***
	(0.035)	(0.035)	(0.057)	(0.060)
Countries	40	40	40	40
Country FE	Yes	Yes	Yes	Yes
Observations	547	547	547	547
R^2	0.256	0.249	0.357	0.334

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

3. Macroprudential Policy Measures

Table 2 shows the baseline regression results. Columns (1) and (3) show that macroprudential policy is not significantly effective in reducing the growth or the level of corporate loans when there is expansionary monetary policy in the United States. However, when I include additional interaction terms as in Eq. (1), I find that macroprudential policies have significant mitigating effects on the response of corporate loans to US monetary expansion although these effects are dampened by a high foreign loan share. In column (2), macroprudential policy instruments negatively and significantly mitigate the increase in corporate loans in response to US monetary expansion. A one standard deviation increase in the MPI index reduces the response of corporate loans to US monetary expansion by 0.99 percentage points. However, this effect is dampened as the share of foreign loans in total corporate loans increases. For example, when firms in a country have a foreign loan share of 0.78, a one standard deviation increase in the MPI mitigates the increase in corporate loans only by 0.12 percentage points. This is because MPMs cannot regulate cross-border borrowing by firms. Therefore, a higher share of foreign loans in corporate loans implies higher leakages from the macroprudential policies. The results are similar when I study the effects on the level of corporate loans, as reported in column (4) of the table.

Table 3 reports qualitatively similar results when I focus separately on lender- and borrower-targeted policies. In column (1) of the table, a one standard deviation increase in the MPI index attenuates the response of corporate loans to a change in the US shadow funds rate by 0.88 and 1.2 percentage points when the macroprudential policy measures are lender- and borrower-targeted, respectively. A foreign loan share of 0.78 dampens the mitigating effects of these two types of policies by 0.85 and 0.96, respectively.

Table 4: The Effects of Macroprudential Policy: Together with CFMs

	(1) Growth	(2) Growth	(3) Level	(4) Level
$Macropru_{i,t} \times USexp_{t-1} \times CFM_{i,t}(\beta)$		-0.284**		-0.294***
		(0.116)		(0.101)
$Macropru_{i,t} \times USexp_{t-1}(\alpha_1)$	-0.083	-0.064	-0.090	-0.085
	(0.077)	(0.075)	(0.057)	(0.059)
$USSR_{t-1}(\gamma_3)$	-0.030	-0.030	-0.078**	-0.074**
	(0.031)	(0.031)	(0.032)	(0.034)
$Macropru_{i,t} \times CFM_{i,t}(\alpha_2)$		0.235		0.372***
		(0.139)		(0.102)
$CFM_{i,t} \times USexp_{t-1}(\alpha_3)$		0.450**		0.684**
		(0.251)		(0.323)
$Macropru_{i,t}(\gamma_1)$	0.033	0.020	0.324***	0.309***
	(0.085)	(0.086)	(0.064)	(0.065)
$CFM_{i,t}(\gamma_2)$		-0.349		-0.731**
		(0.357)		(0.279)
$PR_{i,t-1}(\lambda_1)$	-0.001	-0.001	-0.007**	-0.007**
	(0.002)	(0.003)	(0.003)	(0.003)
$GDP_{i,t-1}(\lambda_2)$	0.068***	0.066***	0.040**	0.034**
	(0.019)	(0.019)	(0.020)	(0.020)
$Y_{i,t-1}(\lambda_3)$	-0.424***	-0.425***	0.336***	0.329***
	(0.036)	(0.036)	(0.059)	(0.056)
Countries	40	40	40	40
Country FE	Yes	Yes	Yes	Yes
Observations	547	547	547	547
R^2	0.238	0.241	0.337	0.341

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

4. Capital Flow Management Measures

Since MPMs can regulate only domestic loans, central banks often adopt CFMs that limit capital inflows from foreign lenders. Under my hypothesis, the introduction of CFMs may help MPMs in mitigating the response of corporate loans to US monetary expansions by regulating corporate borrowing from the international markets. I use the following specification to study the effects of macroprudential policy with and without CFMs in place:

$$
\begin{aligned}
Y_{i,t} = {} & \beta \cdot Macropru_{i,t} \times USexp_{t-1} \times CFM_{i,t} \\
& + \alpha_1 \cdot Macropru_{i,t} \times USexp_{t-1} + \alpha_2 \cdot Macropru_{i,t} \times CFM_{i,t} + \alpha_3 \cdot CFM_{i,t} \times USexp_{t-1} \\
& + \gamma_1 \cdot Macropru_{i,t} + \gamma_2 \cdot CFM_{i,t} + \gamma_3 \cdot USSR_{t-1} \\
& + \lambda_1 \cdot PR_{i,t-1} + \lambda_2 \cdot GDP_{i,t-1} + \lambda_3 \cdot Y_{i,t-1} + \theta_i + \epsilon_{i,t}
\end{aligned} \tag{2}
$$

where $CFM_{i,t}$ is a binary measure of whether at least one CFM is in place in country i for period t. The interpretation of the main coefficients in Eq. (2) is as follows: β captures the effect of macroprudential policy when there is at least one CFM in place. α_1 shows the effect of MPMs in regulating the response (or level) of corporate loans when the central bank does not adopt CFMs. Standard errors are clustered at the country level.

Columns (1) and (3) of Table 4 revisit the results from columns (1) and (3) in Table 2. As discussed previously, the coefficient estimates of $Macropru_{i,t} \times USexp_{t-1}$ are not statistically significant, meaning that macroprudential policy is not effective on average in mitigating the response of corporate loans when there is expansionary monetary policy in the United States. However, when I take into account the implementation of CFMs, I observe an impact of MPMs on corporate loans. The first and second rows of columns (2) and (4) in Table 4 show that macroprudential policies are effective in attenuating corporate loans when they are conducted together with CFMs, although MPMs alone cannot significantly tame firms' borrowing.

To further investigate this empirical result, I extend the specification in Eq. (1) to a four-way interaction regression as:

$$
\begin{aligned}
Y_{i,t} = {} & \beta \cdot Macropru_{i,t} \times USexp_{t-1} \times Share_i \times CFM_{i,t} \\
& + \alpha_1 \cdot Macropru_{i,t} \times USexp_{t-1} \times Share_i + \alpha_2 \cdot Macropru_{i,t} \times Share_i \times CFM_{i,t} \\
& + \alpha_3 \cdot Macropru_{i,t} \times USexp_{t-1} \times CFM_{i,t} + \alpha_4 \cdot USexp_{t-1} \times Share_i \times CFM_{i,t} \\
& + \delta_1 \cdot Macropru_{i,t} \times USexp_{t-1} + \delta_2 \cdot Macropru_{i,t} \times Share_i + \delta_3 \cdot Macropru_{i,t} \times CFM_{i,t} \\
& + \delta_4 \cdot USexp_{t-1} \times Share_i + \delta_5 \cdot USexp_{t-1} \times CFM_{i,t} + \delta_6 \cdot Share_i \times CFM_{i,t} \\
& + \gamma_1 \cdot Macropru_{i,t} + \gamma_2 \cdot CFM_{i,t} + \gamma_3 \cdot USSR_{t-1} \\
& + \lambda_1 \cdot PR_{i,t-1} + \lambda_2 \cdot GDP_{i,t-1} + \lambda_3 \cdot Y_{i,t-1} + \theta_i + \epsilon_{i,t}
\end{aligned} \tag{3}
$$

where variables are defined as before. Standard errors are clustered at the country level.

Table 5: The Effects of Macroprudential Policy: with or without CFMs

	(1) Growth	(2) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i \times CFM_{i,t}(\beta)$	-72.72***	-136.5***
	(18.34)	(19.08)
$Macropru_{i,t} \times USexp_{t-1} \times Share_i(\alpha_1)$	0.497***	0.469**
	(0.180)	(0.187)
$Macropru_{i,t} \times USexp_{t-1}(\delta_1)$	-0.418***	-0.383**
	(0.142)	(0.170)
$USSR_{t-1}(\gamma_3)$	-0.060*	-0.130***
	(0.035)	(0.039)
$Macropru_{i,t}(\gamma_1)$	0.179	0.606***
	(0.224)	(0.212)
$CFM_{i,t}(\gamma_2)$	354.3***	664.0***
	(87.38)	(91.36))
$PR_{i,t-1}(\lambda_1)$	-0.005	-0.006*
	(0.003)	(0.003)
$GDP_{i,t-1}(\lambda_2)$	0.059***	0.017
	(0.021)	(0.020)
$Y_{i,t-1}(\lambda_3)$	-0.436***	0.318***
	(0.035)	(0.056)
Countries	40	40
Country FE	Yes	Yes
Observations	547	547
R^2	0.259	0.360

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table 5 reports estimates for the main coefficients from Eq. (3). The full results are described in table A.1 of the Appendix. The first three rows in the table show that the effects of MPMs are significantly dampened by a higher share of foreign loans when there is no CFM in place. In column (1), a one standard deviation increase in the macroprudential policy index significantly reduces the response of total corporate loans by 0.90 percentage points when a country does not borrow across borders. This effect is dampened as the share of foreign loans in total loans increases when no CFM is adopted. However, when there is at least one CFM in place, the effects of macroprudential policies are actually reinforced as the foreign loan share increases. The first row of the table shows that a one percentage point increase in the share of foreign loans reduces the growth of corporate loans further by 0.23 percentage points. This is because CFMs are able to regulate capital inflows from the international market, preventing firms from borrowing more when the US interest rate goes down. Thus, CFMs can complement MPMs in mitigating firms' increase in their borrowing in response to a decrease in the US rate.

Table 6: The Effects of Macroprudential Policy in Emerging Countries

	(1) Growth	(2) Growth	(3) Growth	(4) Level	(5) Level	(6) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i(\beta)$		0.895***			0.727***	
		(0.100)			(0.145)	
$Macropru_{i,t} \times USexp_{t-1} \times CFM_{i,t}(\beta')$			-0.392***			-0.281**
			(0.127)			(0.125)
$Macropru_{i,t} \times USexp_{t-1}(\alpha_1)$	-0.019	-0.719***	-0.004	-0.042	-0.587***	-0.025
	(0.098)	(0.074)	(0.089)	(0.074)	(0.141)	(0.072)
$USSR_{t-1}(\gamma_2)$	0.035	-0.038	0.042	-0.009	-0.077	0.016
	(0.054)	(0.061)	(0.057)	(0.040)	(0.046)	(0.040)
$Macropru_{i,t} \times CFM_{i,t}(\alpha_2)$			0.228			0.433***
			(0.158)			(0.131)
$Macropru_{i,t} \times Share_i(\alpha_2')$		-0.842***			-0.632***	
		(0.211)			(0.181)	
$Share_i \times USexp_{t-1}(\alpha_3)$		-0.855***			-0.826***	
		(0.335)			(0.257)	
$CFM_{i,t} \times USexp_{t-1}(\alpha_3')$			0.938***			0.594
			(0.225)			(0.364)
$Macropru_{i,t}(\gamma_1)$	0.022	0.679***	0.154	0.354***	0.833***	0.353***
	(0.098)	(0.098)	(0.095)	(0.084)	(0.130)	(0.074)
$CFM_{i,t}(\gamma_2)$			-0.180			-0.579*
			(0.379)			(0.306)
$PR_{i,t-1}(\lambda_1)$	-0.001	0.001	-0.0001	-0.005**	-0.005	-0.005**
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
$GDP_{i,t-1}(\lambda_2)$	0.055***	0.025*	0.048***	0.015	-0.009	-0.010
	(0.016)	(0.013)	(0.015)	(0.023)	(0.022)	(0.022)
$Y_{i,t-1}(\lambda_3)$	-0.346***	-0.376***	-0.354***	0.419***	0.403***	0.382***
	(0.069)	(0.056)	(0.069)	(0.072)	(0.062)	(0.069)
Countries	17	17	17	17	17	17
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	224	224	224	224	224	224
R^2	0.185	0.257	0.199	0.493	0.533	0.513

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

5. Advanced vs. Emerging Market Countries

In this section, I further analyze the effects of macroprudential policy, how these effects are dampened by a higher share of foreign loans, and the importance of adopting CFMs together with MPMs, comparing advanced countries with emerging markets. Tables 6 and 7 show that the results for emerging markets are similar to the results for all countries. The third row of columns (1) and (4) in Table 6 shows that macroprudential policies on average cannot significantly attenuate corporate borrowing when there is a decrease in the US rate. This is because a higher foreign loan share dampens the effects of these policies, as described in the first and third rows of columns (2) and (5). However, the second row of columns (3) and (6) show that MPMs can be effective in keeping firms from borrowing excessively when those policies are conducted with CFMs in place. The first row of Table 7 also indicates that when there is at least one CFM in place, the effects of MPMs in reducing corporate loans in response to a US monetary expansion are not dampened by a higher share of foreign loans.

Table 7: The Effects of Macroprudential Policy in Emerging Markets: with or without CFMs

	(1) Growth	(2) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i \times CFM_{i,t}(\beta)$	-36.25***	-26.62***
	(5.059)	(6.222)
$Macropru_{i,t} \times USexp_{t-1} \times Share_i(\alpha_1)$	0.969***	0.662**
	(0.108)	(0.288)
$Macropru_{i,t} \times USexp_{t-1}(\delta_1)$	-0.779***	-0.517*
	(0.095)	(0.292)
$USSR_{t-1}(\gamma_3)$	-0.035	-0.059
	(0.066)	(0.051)
$Macropru_{i,t}(\gamma_1)$	0.742***	0.815***
	(0.102)	(0.256)
$CFM_{i,t}(\gamma_2)$	179.4***	132.0***
	(24.06)	(29.20)
$PR_{i,t-1}(\lambda_1)$	-0.0001	-0.004*
	(0.002)	(0.003)
$GDP_{i,t-1}(\lambda_2)$	0.024	-0.018
	(0.0153)	(0.023)
$Y_{i,t-1}(\lambda_3)$	-0.372***	0.376***
	(0.057)	(0.066)
Countries	17	17
Country FE	Yes	Yes
Observations	224	224
R^2	0.275	0.547

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

However, when I analyze advanced countries only, the results are drastically different. The second row of columns (1) and (3) in Table 8 indicates significant and negative effects of macroprudential policies in mitigating corporate loans in response to expansionary policy in the United

States. When I extend the specification to include the foreign loan share, neither the effects of MPMs nor the impact of the foreign loan share appear to be significant. This means that the effects of MPMs in reducing firms' borrowing are not significantly dampened by a higher share of foreign loans. Since interest rates are not particularly high in advanced countries, borrowing from foreign lenders may not be a better alternative to domestic borrowing in those countries. Therefore, macroprudential policies are effective in regulating firms' total loans even if there are no CFMs in place. In fact, summary statistics listed in Table A.2 in the Appendix show that CFMs are adopted far less in advanced countries in comparison to emerging markets.

Table 8: The Effects of Macroprudential Policy in Advanced Countries

	(1) Growth	(2) Growth	(3) Level	(4) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i(\beta)$		-0.0574		0.186
		(0.338)		(0.251)
$Macropru_{i,t} \times USexp_{t-1}(\alpha_1)$	-0.152**	-0.102	-0.163***	-0.216
	(0.073)	(0.180)	(0.051)	(0.162)
$USSR_{t-1}(\gamma_2)$	-0.052	-0.055	-0.143**	-0.189**
	(0.042)	(0.044)	(0.063)	(0.075)
$Macropru_{i,t} \times Share_i(\alpha_2)$		0.428		-0.213
		(0.450)		(0.438)
$Share_i \times USexp_{t-1}(\alpha_3)$		–0.007		-0.602*
		(0.488)		(0.335)
$Macropru_{i,t}(\gamma_1)$	0.042	-0.282	0.318***	0.398
	(0.115)	(0.253)	(0.083)	(0.281)
$PR_{i,t-1}(\lambda_1)$	-0.075	-0.062	0.051	0.027
	(0.062)	(0.059)	(0.070)	(0.079)
$GDP_{i,t-1}(\lambda_2)$	0.092**	0.097*	0.077**	0.060*
	(0.044)	(0.048)	(0.035)	(0.035)
$Y_{i,t-1}(\lambda_3)$	-0.458***	-0.465***	0.275***	0.262***
	(0.039)	(0.039)	(0.081)	(0.079)
Countries	23	23	23	23
Country FE	Yes	Yes	Yes	Yes
Observations	323	323	323	323
R^2	0.279	0.284	0.248	0.255

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

6. Discussion

In this section, I have presented empirical evidence about the effects of macroprudential policies in different countries. The results show that MPMs by themselves cannot significantly affect the response of firm borrowing to a US monetary expansion. This is because the significant effects of MPMs in regulating corporate borrowing are dampened as the foreign loan share goes up. These results hold when I separately study the impacts of lender- and borrower-targeted MPMs. Since macroprudential policies are not designed to regulate capital inflows from abroad, firms' foreign loans appear as leakages from these policy measures. Therefore, MPMs are significantly effective only when they are implemented along with CFMs. CFMs complement MPMs by regulating the international borrowing of domestic firms.

When I study different subsamples of countries, the results differ. In emerging markets, the effects of MPMs are dampened when firms can borrow more internationally. Having CFMs in place can help MPMs in regulating corporate loans in response to expansionary monetary policy in the United States. On the other hand, advanced countries do not frequently use CFMs, because MPMs by themselves are sufficiently effective in attenuating the response of total corporate loans to a US monetary expansion. My findings suggest that future research should study the impacts of CFMs with richer dataset because, some countries have adopted CFMs as policy instruments only recently. CFMs recorded in the "IMF taxonomy of CFMs" do not generate sufficient variation in the indicator for CFMs in some countries, especially in advanced markets. In the next section, I provide a simple theoretical model with firms and banks to study the mechanism behind my empirical findings.

III. The Model

I now provide a simple small open economy model with two periods and two goods, tradables and nontradables. The basic structure of the model is adopted from Cespedes et al. (2017). The difference is that firms can borrow directly from abroad as well as from domestic banks. Also, the banks lend not only to domestic firms but also to foreign borrowers. I define the real exchange rate as the relative price of tradables in terms of nontradables. The economy consists of capital producers, tradable goods firms and banks. The timeline of events is displayed in Figure 2. Time is discrete. In the first period, tradable goods firms (firms, hereafter) are endowed with tradables T_f and nontradables N_f, and banks are given tradables T_b and nontradables N_b. Capital producers produce capital by combining tradables I_T and nontradables I_N, and firms buy capital to use for production in the second period. Firms borrow L and D_f from domestic banks and the international market, respectively. In the second period, firms produce using capital purchased in the first period. Banks finance their loans by borrowing from international markets. The banks lend both to domestic firms (L) and foreign borrowers (F).

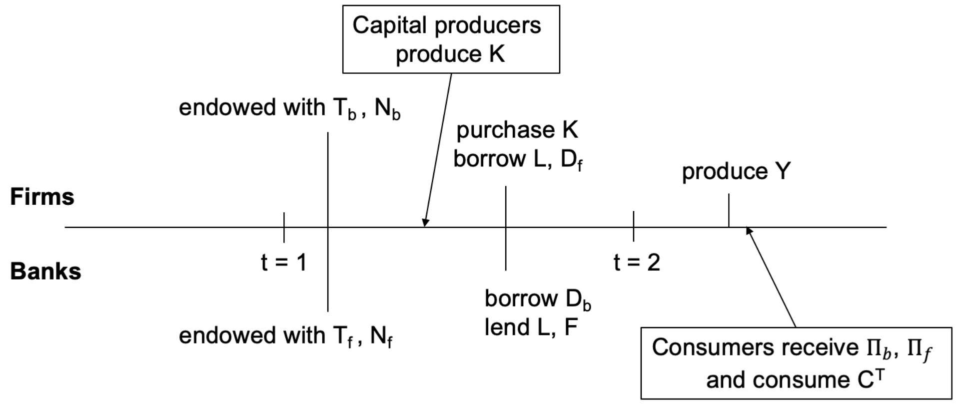

Figure 2: Timeline

Figure 3 shows the basic structure of the model. Firms can borrow both from domestic banks and from foreign markets, with interest rates R and R^*, respectively, where $R \geq R^*$. Domestic banks finance lending to firms by borrowing from international markets at rate $R^{**} < R^*$. The banks lend to domestic firms at rate R and to foreign borrowers at rate R^*. They are willing to do this because borrowing rates are low in the international markets. I assume that there are a large number of foreign borrowers and foreign lenders in the international market, so corporate cross-border borrowing and banks' cross-border lending is determined only by demand of firms and supply of banks. Interest rates R^* and R^{**} are exogenously given in this economy while R is determined by demand and supply for domestic loans.

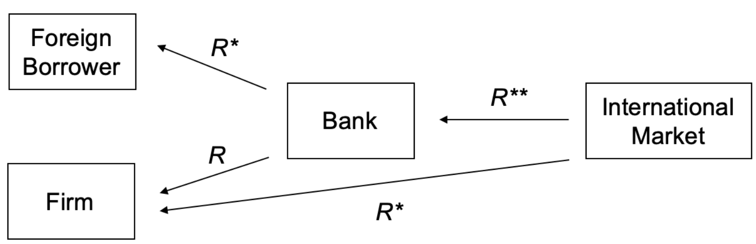

Figure 3: Structure of the Model

1. Baseline Setup

i. Households

The household consumes tradables in the second period only. Nontradables are used only for capital formation. Household consumption in the second period is funded by the profits of the representative bank and the representative firm.

$$C^T = \Pi^b + \Pi^f$$

ii. Capital Production

In the first period, capital producers combine tradables and nontradables to produce capital, using a Cobb-Douglas aggregator

$$K = \kappa I_N^{\gamma} I_T^{1-\gamma} \tag{4}$$

where I_N and I_T are inputs of nontradables and tradables, and $\kappa = \frac{1}{\gamma^{\gamma}(1-\gamma)^{1-\gamma}}$ where $\gamma \in (0, 1)$.

A representative capital producer's optimization problem is

$$\max_{I_N, I_T} \quad Q\kappa I_N^{\gamma} I_T^{1-\gamma} - I_N - SI_T$$

where Q is the price of capital and S is the price of tradables, both expressed in terms of non-tradables.

The first-order conditions are

$$\gamma\kappa Q I_N^{\gamma-1} I_T^{1-\gamma} = 1$$

$$(1-\gamma)\kappa Q I_N^{\gamma} I_T^{-\gamma} = S$$

Using these conditions, the prices of capital and tradables are related as follows:

$$Q = S^{1-\gamma} \tag{5}$$

where $S = P_T/P_N$ is defined as the real exchange rate.

If K is the aggregate demand for capital, from Eqs. (4), (5), and the first-order conditions, the optimal demand for nontradables will be

$$I_N = \gamma QK = \gamma S^{1-\gamma} K \tag{6}$$

iii. A Firm's Problem

In the first period, a firm purchases capital K to produce in the second period and is endowed with tradables T_f and nontradables N_f. The firm can borrow tradables from domestic banks at interest rate R, or from foreign banks at interest rate R^*. Since domestic markets are financially less stable, we assume that $R \geq R^* \geq 1$. Then the firm's resource constraint expressed in tradables is

$$\frac{QK}{S} = L + D_f + T_f + \frac{N_f}{S} \tag{7}$$

where D_f denotes the amount borrowed from international markets and L is the amount borrowed from domestic banks by firms. The firm's cross-border borrowing is limited to a fraction of its expected revenue.

$$R^* D_f \leq \xi Y \tag{8}$$

where $\xi \in (0,1)$ is a constant and the price of tradable output Y is normalized to 1.

Then given the prices $Q, R,$ and R^*, the representative firm's period 1 problem is

$$\max_{K,L,D_f} \quad \Pi^f = Y - RL - R^* D_f \tag{9}$$

$$\text{s.t.} \quad \frac{QK}{S} = L + D_f + T_f + \frac{N_f}{S}$$

$$R^* D_f \leq \xi Y$$

where $Y = AK^\alpha$ is tradable output with $A > 0, 0 < \alpha \leq 1$.

Suppose the firm's initial net worth is sufficiently small (i.e., $0 < T_f + \frac{N_f}{S} < \frac{QK^*}{S} - \frac{\xi}{R^*}AK^{*\alpha}$), where K^* denotes the optimal demand for capital defined below. For $R > R^*$, the firm prefers foreign loans because of the lower borrowing rate, so the constraint (8) binds. For $R = R^*$, a firm is indifferent between getting domestic loans and foreign loans. The firm's demand for domestic loans is

$$L = \begin{cases} \frac{QK}{S} - (T_f + \frac{N_f}{S}) - \frac{\xi}{R^*}AK^\alpha & \text{if} \quad R > R^* \\ \in [\frac{QK}{S} - (T_f + \frac{N_f}{S}) - \frac{\xi}{R^*}AK^\alpha, \frac{QK}{S} - (T_f + \frac{N_f}{S})] & \text{if} \quad R = R^* \end{cases} \tag{10}$$

Similarly, the demand for foreign loans is

$$D_f = \begin{cases} \frac{\xi}{R^*}AK^\alpha & \text{if} \quad R > R^* \\ \in [0, \frac{\xi}{R^*}AK^\alpha] & \text{if} \quad R = R^* \end{cases} \tag{11}$$

Now, suppose instead that the firm is given sufficient net worth at the beginning of period 1 (i.e., $T_f + \frac{N_f}{S} \geq \frac{QK^*}{S} - \frac{\xi}{R^*}AK^{*\alpha}$). Then, even for $R > R^*$, Eq. (8) is not binding. Then the firm's loan demands can be written as

$$L = \begin{cases} 0 & \text{if} \quad R > R^* \\ \in [0, \frac{QK}{S} - (T_f + \frac{N_f}{S})] & \text{if} \quad R = R^* \end{cases} \tag{12}$$

$$D_f = \begin{cases} \frac{QK}{S} - (T_f + \frac{N_f}{S}) & \text{if} \quad R > R^* \\ \in [0, \frac{QK}{S} - (T_f + \frac{N_f}{S})] & \text{if} \quad R = R^* \end{cases} \tag{13}$$

For any $R \geq R^*$ and any level of initial net worth $T_f + \frac{N_f}{S} > 0$, the firm's demand for capital satisfies

$$(1 - \xi + \frac{R}{R^*}\xi)\alpha A K^{*\alpha-1} = \frac{RQ}{S} \\ = RS^{-\gamma} \tag{14}$$

iv. A Bank's Problem

The bank lends L at interest rate R to domestic firms and lends F at R^* to foreign borrowers. It finances this lending by borrowing D_b from the international market at interest rate $R^{**}(< R^* \leq R)$ in the first period. The bank's resource constraint in terms of tradables is

$$L + F = D_b + T_b + \frac{N_b}{S} \tag{15}$$

The bank faces a collateral constraint on foreign loans. The constraint can be rationalized following Gertler & Kiyotaki (2010). Suppose banks can default and retain a fraction $1 - \theta$ of the payments made by their own borrowers. The international lenders want to prevent the banks' absconding by limiting the expected profit from default. The resulting constraint is

$$R^{**}D_b \leq \theta(RL + R^*F) \tag{16}$$

Since the bank can borrow from abroad at an interest rate lower than R and R^*, the constraint (16) is always binding.

The bank's optimization problem in the first period is

$$\max_{L,F,D_b} \quad \Pi^b = RL + R^*F - R^{**}D_b \tag{17}$$

$$\text{s.t.} \quad L + F = D_b + T_b + \frac{N_b}{S}$$

$$R^{**}D_b \leq \theta(RL + R^*F)$$

where $0 < \theta < 1$.

When $R > R^*$, the bank can earn more interest on domestic lending than on cross-border lending. Therefore, it will lend only domestically as long as there is a sufficient number of domestic borrowers. On the other hand, if $R = R^*$, then the bank is indifferent between lending to domestic firms and to foreign borrowers. Thus, the bank's supply of domestic and international loans will be

$$L = \begin{cases} \frac{R^{**}}{R^{**}-\theta R}(T_b + \frac{N_b}{S}) & \text{if} \quad R > R^* \\ \in [0, \frac{R^{**}}{R^{**}-\theta R^*}(T_b + \frac{N_b}{S})] & \text{if} \quad R = R^* \end{cases} \tag{18}$$

$$F = \begin{cases} 0 & \text{if} \quad R > R^* \\ \in [0, \frac{R^{**}}{R^{**}-\theta R^*}(T_b + \frac{N_b}{S})] & \text{if} \quad R = R^* \end{cases} \tag{19}$$

For any $R \geq R^*$, the bank's demand for cross-border borrowing will be

$$D_b = \frac{\theta R}{R^{**} - \theta R}(T_b + \frac{N_b}{S}) \tag{20}$$

2. Equilibrium

i. Nontradables Market and Interest Spread

Since nontradables are used only for producing capital, demand for nontradables is given by Eq. (6). The supply is given by the aggregate endowment of nontradables. Therefore, $N^d = \gamma S^{1-\gamma} K$ and $N^s = N_f + N_b$. The market clearing condition for nontradables, $N^d = N^s \equiv N$ implies

$$S^{1-\gamma} = \frac{N}{\gamma K} \tag{21}$$

Hence, the real exchange rate can be linked to the demand for capital. With Eqs. (14) and (21), I can obtain the following equilibrium relationship between the interest rate and the real exchange rate.

$$R = \frac{(1-\xi)\alpha A(\frac{\gamma}{N})^{1-\alpha} S^{(1-\gamma)(1-\alpha)+\gamma}}{1 - \frac{\xi}{R^*}\alpha A(\frac{\gamma}{N})^{1-\alpha} S^{(1-\gamma)(1-\alpha)+\gamma}} \tag{22}$$

Defining S_0 as the real exchange rate in the case of $R = R^*$, then

$$R^* = \alpha A(\frac{\gamma}{N})^{1-\alpha} S_0^{(1-\gamma)(1-\alpha)+\gamma} \tag{23}$$

Then I can define the interest spread as a function of the real exchange rate.

$$\phi = \frac{R}{R^*} = \frac{(1-\xi)(\frac{S}{S_0})^{(1-\gamma)(1-\alpha)+\gamma}}{1 - \xi(\frac{S}{S_0})^{(1-\gamma)(1-\alpha)+\gamma}} \equiv \phi(S) \tag{24}$$

where $\phi'(S) > 0$. The intuition behind this equilibrium relationship is that higher R reduces demand for capital, which reduces demand for nontradable goods. Then the price of nontradables, P_N, decreases and thus S goes up. Therefore, a higher interest spread is associated with real exchange rate depreciation.

ii. Loan Market

Case 0: Closed Economy Consider the case where the economy is closed. Both firms and banks cannot borrow across borders (i.e., $\xi = \theta = 0$). In this case, from the borrowing constraint (7) and

Eq. (21), the firm's loan demand will be

$$L^d = \frac{N}{\gamma S} - (T_f + \frac{N_f}{S}) \tag{25}$$

Since the bank cannot finance its domestic lending from abroad, it will lend to firms using their initial net worth. Therefore, the supply of domestic loans by banks will be

$$L^s = T_b + \frac{N_b}{S} \tag{26}$$

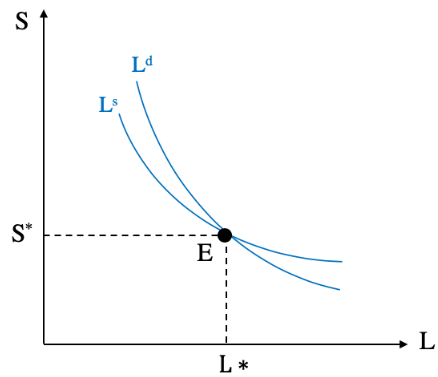

Figure 4: Equilibrium in the Loan Market in a Closed Economy

Figure 4 depicts the supply and demand of domestic loans for the closed economy case. The real exchange rate, S, is measured along the vertical axis while the quantity of domestic loans, L, is measured along the horizontal axis. Since $\frac{\partial L^d}{\partial S} = -\frac{1}{S^2}(\frac{N}{\gamma} - N_f)$, loan demand is a decreasing function of S for any $\gamma \in (0, 1)$. Since $\frac{\partial L^s}{\partial S} = -\frac{N_b}{S^2} < 0$, and $N_b < \frac{N_f + N_b}{\gamma} - N_f$ for $\gamma \in (0, 1)$, the loan demand function has a slope that is steeper than that of loan supply function. The real exchange rate and domestic loans in equilibrium are given by S^* and L^* in the figure.

Case 1: No corporate cross-border borrowing Next, consider the case without corporate cross-border borrowing ($\xi = 0$), in which banks can borrow from abroad (i.e., $\theta > 0$) but cannot lend to foreign firms. Then, loan demand by domestic firms will be Eq. (25). Since there is no corporate cross-border borrowing, domestic banks also do not lend to foreign corporate borrowers ($F = 0$). Thus, the supply of domestic loans by banks is given by

$$L^s = \frac{R^{**}}{R^{**} - \theta R^* \phi(S)}(T_b + \frac{N_b}{S}) \tag{27}$$

Since banks are not lending abroad, S is not necessarily bounded below by S_0. The elasticity of L^s with respect to S can be expressed as below.

$$\frac{\partial L^s}{\partial S}\frac{S}{L^s} = -\frac{N_b/S}{T_b + N_b/S} + \frac{\theta(1-\xi+\xi\phi(S))}{R^{**}/R^{*} - \theta\phi(S)}\frac{(1-\gamma)(1-\alpha)+\gamma}{1-\xi} \tag{28}$$

The first term in the RHS corresponds to the net worth effect, in which changes in the real exchange rate affect the supply of loans via banks' net worth. This effect also appears in the closed economy case, in Eq. (24). When the exchange rate goes up, the value of banks' net worth decreases, which reduces the supply of loans. The second term can be interpreted as the leverage effect, which is affected by the interest spread ϕ, exogenous rates R^*, R^{**}, and the financial frictions parameter θ. An increase in the exchange rate implies an increase in the domestic interest rate, which induces banks to lend more domestically. This effect means that banks increase leverage in response to an increase in the exchange rate.

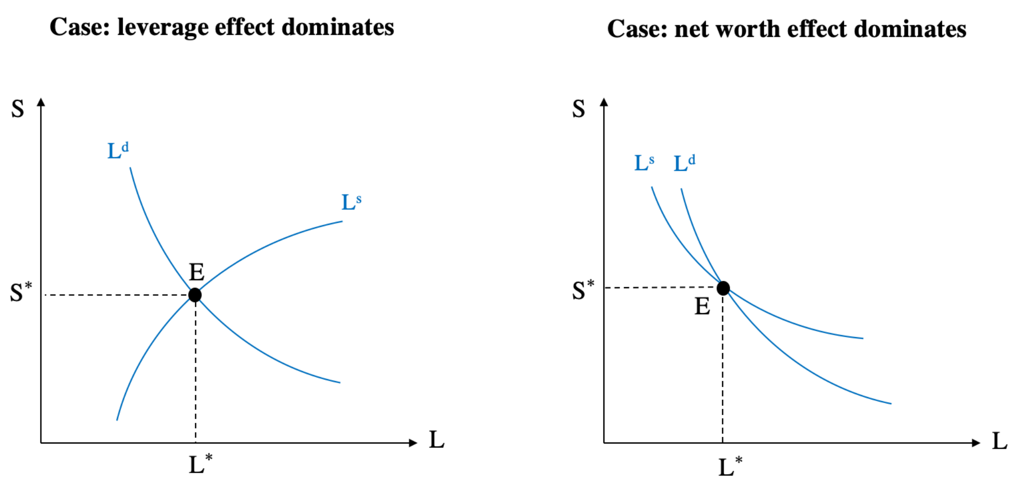

Figure 5: Equilibrium in the Loan Market w/o Corporate Cross-Border Borrowing

Figure 5 draws the loan supply and demand functions in this case. The left panel of the figure depicts the equilibrium in which the leverage effect dominates the net worth effect in the elasticity of loan supply. The loan supply function is increasing in S. L^d and L^s are the equilibrium levels of domestic loans and the exchange rate. The right panel of the figure shows the domestic loan market in which the net worth effect dominates the leverage effect of loan supply. The loan supply function is decreasing in S for $S \geq S_0$, and the supply and demand for domestic loans meet at the equilibrium point E.

Finally, the equilibrium levels of banks' cross-border borrowing is decided solely by their own demand. Therefore, the equilibrium level of banks' cross-border borrowing can be written as

$$D_b^* = \frac{\theta R^*\phi(S)}{R^{**} - \theta R^*\phi(S)}(T_b + \frac{N_b}{S}) \tag{29}$$

Figure 6 depicts the banks' demand function for cross-border loans. As the exchange rate goes up, the bank wants to lend more to domestic firms because the marginal revenue is larger. Therefore, the bank tries to borrow more across borders as S increases, which results in a demand function for foreign loans that is increasing in S.

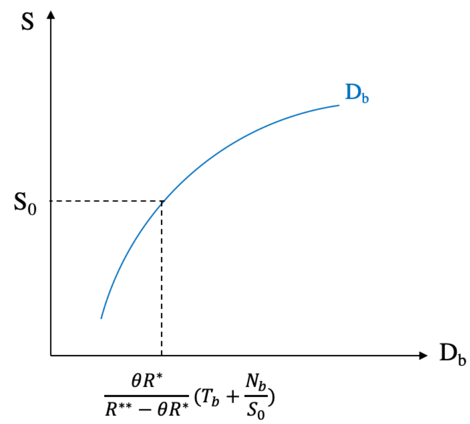

Figure 6: Demand Function for Foreign Loans by Banks

Case 2: With corporate cross-border borrowing Now consider the case in which cross-border borrowing and lending are allowed (i.e., $\xi > 0$ and $\theta > 0$). Then domestic firms borrow both from domestic banks and the international market, and banks can lend to both domestic and foreign firms. Combining Eqs. (5) and (10), for $0 < T_f + \frac{N_f}{S} < \frac{N}{\gamma S} - \frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha$, the domestic demand for loans by firms can be written as

$$L^d = \begin{cases} \frac{N}{\gamma S} - (T_f + \frac{N_f}{S}) - \frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha & \text{if} \quad S > S_0 \\ \in [\frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0}) - \frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha, \frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0})] & \text{if} \quad S = S_0 \end{cases} \tag{30}$$

where Eq. (24) means that $R > R^* \Leftrightarrow S > S_0$ and $R = R^* \Leftrightarrow S = S_0$.

For $T_f + \frac{N_f}{S} \geq \frac{N}{\gamma S} - \frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha$, loan demand can be written as

$$L^d = \begin{cases} 0 & \text{if} \quad S > S_0 \\ \in [0, \frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0})] & \text{if} \quad S = S_0 \end{cases} \tag{31}$$

Figure 7 shows the graphs for domestic loan demand. For $0 < T_f + \frac{N_f}{S} < \frac{N}{\gamma S} - \frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha$, if $S > S_0$,

$$\frac{\partial L^d}{\partial S} = -\frac{1}{S}(\frac{N}{\gamma S} - \frac{N_f}{S} + \alpha(1-\gamma)\frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha) < 0 \tag{32}$$

since $\frac{N}{\gamma S} - \frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha < \frac{N}{\gamma S} - \alpha(1-\gamma)\frac{\xi}{R^*} A(\frac{N}{\gamma S^{1-\gamma}})^\alpha$ for any $\alpha, \gamma \in (0, 1)$. Thus, demand for domestic loans increases as S goes down until $S = S_0$. For $S = S_0$, firm demand for domestic loans is between $\frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0}) - \frac{\xi}{R^*}A(\frac{N}{\gamma S_0^{1-\gamma}})^\alpha$ and $\frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0})$. For $T_f + \frac{N_f}{S} \geq \frac{N}{\gamma S} - \frac{\xi}{R^*}A(\frac{N}{\gamma S^{1-\gamma}})^\alpha$, a firm does not demand domestic loans when S is higher than S_0. This is because the firm can finance its capital investment using only foreign loans at lower borrowing rates. When $S = S_0$, the firm is indifferent between borrowing domestically and from abroad. Thus, the loan demand by firms ranges from zero to $\frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0})$.

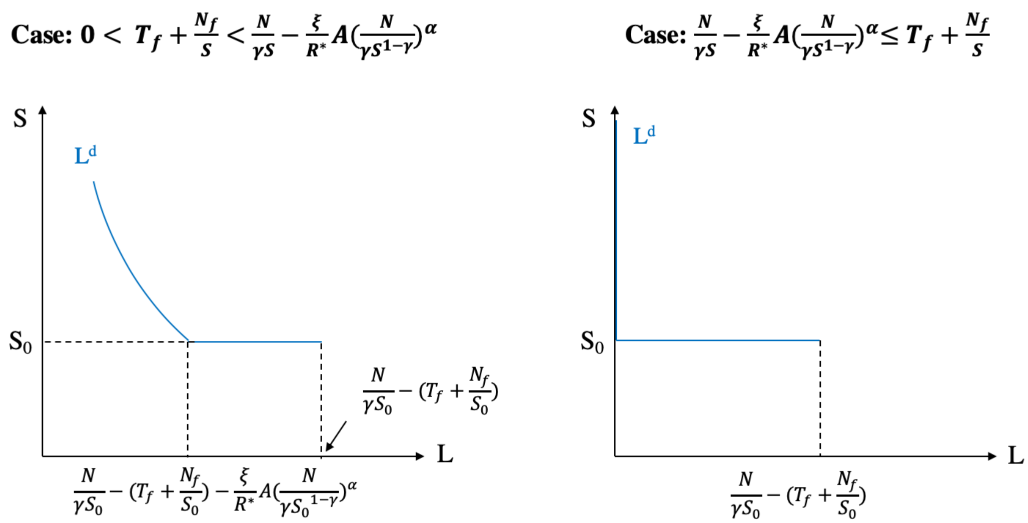

Figure 7: Demand Functions for Domestic Loans by Firms

The domestic supply for loans by banks will be

$$L^s = \begin{cases} \frac{R^{**}}{R^{**} - \theta R^* \phi(S)}(T_b + \frac{N_b}{S}) & \text{if} \quad S > S_0 \\ \in [0, \frac{R^{**}}{R^{**} - \theta R^*}(T_b + \frac{N_b}{S_0})] & \text{if} \quad S = S_0 \end{cases} \tag{33}$$

which is the same as Eq. (27) in Case 1 for $S > S_0$, while the bank is content with any amount of lending up to a multiple $\frac{R^{**}}{R^{**} - \theta R}$ of its own net worth for $S = S_0$. Assuming $S > S_0$, the elasticity of L^s with respect to S can be expressed as Eq. (28). Figure 8 depicts the supply function for domestic loans. When the leverage effect dominates the net worth effect, as shown in the left panel, the loan supply function is increasing in S for $S > S_0$ because an increase in the exchange rate raises the marginal revenue of domestic lending. When $S = S_0$, the bank is indifferent between lending to domestic firms and to foreign borrowers, so it lends any amount up to $\frac{R^{**}}{R^{**} - \theta R^*}(T_b + \frac{N_b}{S_0})$ domestically. When the net worth effect dominates, as shown in the right panel, banks' initial net worth is devalued as S increases, and this affects the banks' ability to borrow across borders. Therefore, loan supply decreases as S goes up for $S > S_0$. When $S = S_0$, the bank lends up to a multiple $\frac{R^{**}}{R^{**} - \theta R^*}$ of its own net worth.

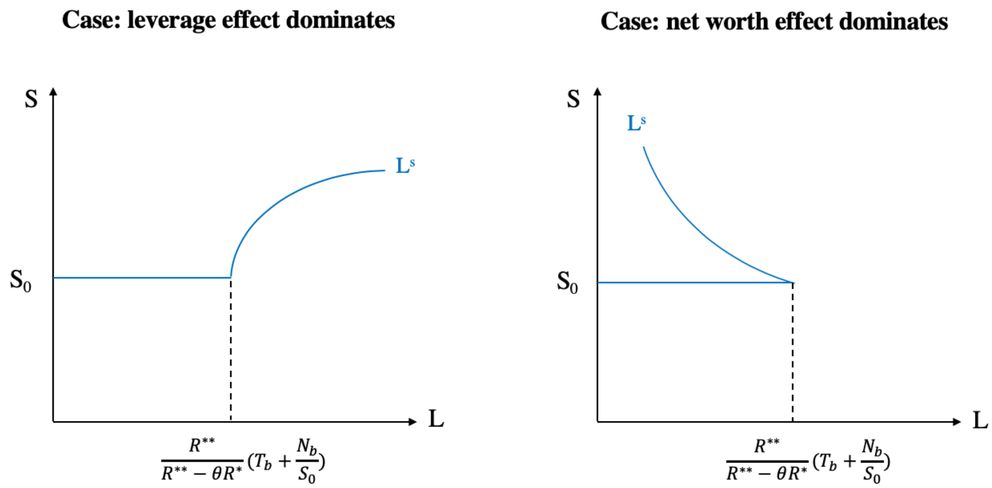

Figure 8: Supply Functions for Domestic Loans by Banks

The equilibrium level of corporate cross-border loans will be decided solely by the firm's demand, because there are a large number of competitive lenders in the foreign market and R^* is exogenous with respect to domestic firms. Hence, the equilibrium will be

$$D_f^* = \begin{cases} \frac{\xi}{R^*}A(\frac{N}{\gamma S^{1-\gamma}})^{\alpha} & \text{if} \quad S > S_0 \\ \in [0, \frac{\xi}{R^*}A(\frac{N}{\gamma S_0^{1-\gamma}})^{\alpha}] & \text{if} \quad S = S_0 \end{cases}$$

for $0 < T_f + \frac{N_f}{S} < \frac{N}{\gamma S} - \frac{\xi}{R^*}A(\frac{N}{\gamma S^{1-\gamma}})^{\alpha}$. Otherwise, when firms' net worth is sufficiently large, the equilibrium level of corporate cross-border loans can be written as

$$D_f^* = \begin{cases} \frac{N}{\gamma S} - (T_f + \frac{N_f}{S}) & \text{if} \quad S > S_0 \\ \in [0, \frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0})] & \text{if} \quad S = S_0 \end{cases}$$

Figure 9 shows the demand function for foreign loans by firms. The left panel shows the case in which firms' net worth is sufficiently small. When $S = S_0$, the firm borrows any amount of foreign loans up to the limit $\frac{\xi}{R^*}A(\frac{N}{\gamma S_0^{1-\gamma}})^{\alpha}$. When $S > S_0$, the demand for foreign loans increases as S goes down. This is because a decrease in the exchange rate increases the value of the firm's net worth, which loosens its constraint on foreign borrowing. When the firm's net worth is sufficiently large, the firm's borrowing constraint for foreign loans is not binding. Therefore, the firm borrows up to

$\frac{N}{\gamma S_0} - (T_f + \frac{N_f}{S_0})$ for $S = S_0$, and the demand is decreasing in S when $S > S_0$.

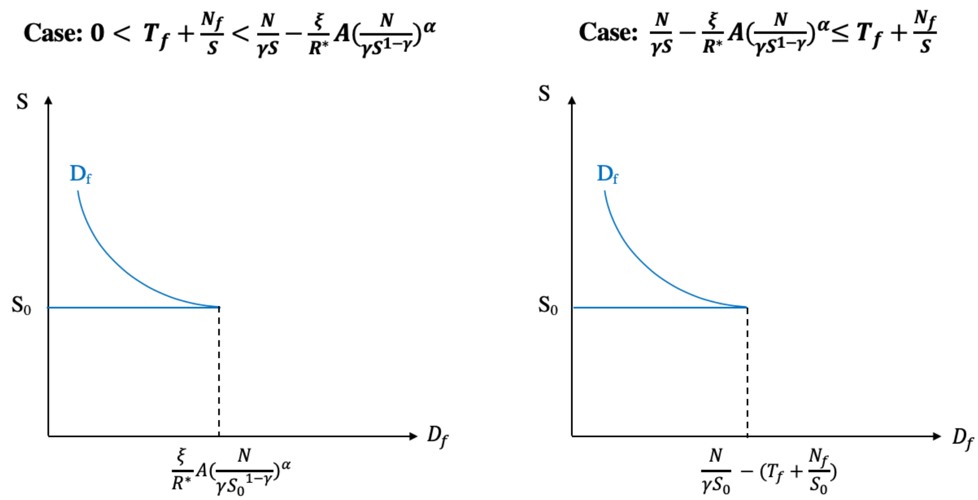

Figure 9: Demand Functions for Foreign Loans by Firms

The equilibrium level of banks' cross-border borrowing is the same as Eq. (29), while its cross-border lending can be written as

$$F^* = \begin{cases} 0 & \text{if} \quad S > S_0 \\ \in [0, \frac{\theta R^*}{R^{**} - \theta R^*}(T_b + \frac{N_b}{S_0})] & \text{if} \quad S = S_0 \end{cases}$$

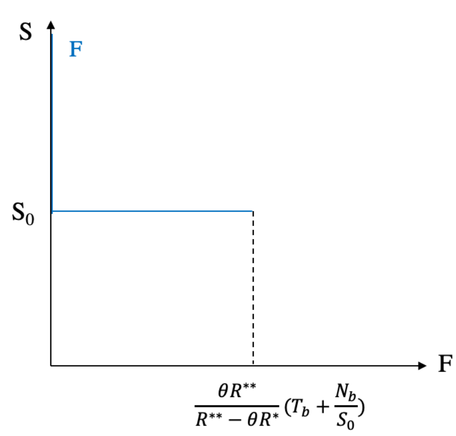

Figure 10: Supply Functions for Foreign Loans by Banks

Figure 10 shows the supply function for cross-border loans by banks. When $S > S_0$, the bank earns more when it lends to domestic firms because R is bigger than R^*. Therefore, it does not lend to international borrowers. On the other hand, when $S = S_0$, the bank is indifferent between lending to domestic borrowers and to international borrowers, so it is content with lending any amount up to a multiple $\frac{\theta R^*}{R^{**}-\theta R^*}$ of its own net worth.

IV. Analytic Solutions and Policies

In this section, I will provide analytic solutions for a specific case of the model. For simplicity, I assume that capital is produced only with nontradables, and that firms and banks are endowed only with nontradable goods ($T_b = T_f = 0$). In addition, I will focus on the case where firm's net worth is sufficiently small.

With the analytic solutions, I will study the effects of macroprudential policy measures (MPMs) and capital flow management measures (CFMs) when there is a US monetary expansion. The macroprudential policy is effective in reducing total corporate loans when the world interest rate goes down, but the effect is dampened when firms' share of foreign borrowing in total loans is higher. This theoretical analysis can be linked to the empirical evidence in Section 2 that the mitigating effects of macroprudential policy on corporate loans in response to the US monetary expansion are dampened with a high share of foreign loans in total corporate borrowing. In addition, I show that applying CFMs together with macroprudential policy can help in preventing the dampening effect, which coincides with the empirical finding that the attenuating effects of MPMs that are conducted together with CFMs are not significantly dampened by a higher foreign loan share.

1. Special case: No Domestic Tradeable Endowments

Assuming that capital producers use only nontradables in producing capital, the aggregator for capital production will be

$$K = I_N \tag{34}$$

By solving the representative capital producer's problem, the price of capital in terms of nontradables is $Q = 1$, and $I_N = K$ is the aggregate demand for capital.

Assume that firms and banks are endowed only with non-tradable goods (i.e., $T_f = 0, T_b = 0$). The representative firm's period 1 problem becomes

$$\max_{K,L,D_f} \quad \Pi^f = AK^\alpha - RL - R^* D_f$$
$$\text{s.t.} \quad \frac{K}{S} = L + D_f + \frac{N_f}{S}$$
$$R^* D_f \leq \xi A K^\alpha$$

where $A > 0, 0 < \alpha \leq 1$ and $\xi \in (0, 1)$.

Suppose firms' net worth is sufficiently small (i.e., $0 < \frac{N_f}{S} < \frac{K^*}{S} - \frac{\xi}{R^*} A K^{*\alpha}$). Firm's demands for domestic and cross-border loans are then

$$L^d = \begin{cases} \frac{K}{S} - \frac{N_f}{S} - \frac{\xi}{R^*} A K^\alpha & \text{if} \quad R > R^* \\ \in [\frac{K}{S} - \frac{N_f}{S} - \frac{\xi}{R^*} A K^\alpha, \frac{K}{S} - \frac{N_f}{S}] & \text{if} \quad R = R^* \end{cases} \tag{35}$$

$$D_f = \begin{cases} \frac{\xi}{R^*} A K^\alpha & \text{if} \quad R > R^* \\ \in [0, \frac{\xi}{R^*} A K^\alpha] & \text{if} \quad R = R^* \end{cases} \tag{36}$$

The firm's demand for capital is determined by

$$\alpha A K^{\alpha-1} = \frac{1}{1 - \xi + \frac{R}{R^*}\xi} \frac{R}{S} \tag{37}$$

Suppose $R^{**} = 1 + \sigma(R^* - 1) < R^*$ where $0 < \sigma < 1$. The bank's borrowing rate is smaller than the firm's borrowing rate across borders, but both rates are affected by US monetary expansion. Then, the bank's optimization problem in the first period is

$$\max_{L,F,D_b} \quad \Pi^b = RL + R^*F - (1 + \sigma(R^* - 1))D_b$$

$$\text{s.t.} \qquad L + F = D_b + \frac{N_b}{S}$$

$$(1 + \sigma(R^* - 1))D_b \leq \theta(RL + R^*F)$$

where $0 < \theta < 1$ and $0 < \sigma < 1$.

The bank's supply of domestic loans and demand and supply for cross-border loans is

$$L^s = \begin{cases} \frac{1+\sigma(R^*-1)}{1+\sigma(R^*-1)-\theta R} \frac{N_b}{S} & \text{if} \quad R > R^* \\ \in [0, \frac{1+\sigma(R^*-1)}{1+(\sigma-\theta)R^*-\sigma} \frac{N_b}{S}] & \text{if} \quad R = R^* \end{cases} \tag{38}$$

$$F = \begin{cases} 0 & \text{if} \quad R > R^* \\ \in [0, \frac{1+\sigma(R^*-1)}{1+(\sigma-\theta)R^*-\sigma} \frac{N_b}{S}] & \text{if} \quad R = R^* \end{cases} \tag{39}$$

$$D_b = \frac{\theta R}{1 + \sigma(R^* - 1) - \theta R} \frac{N_b}{S} \tag{40}$$

where $0 < \theta < 1$ and $0 < \sigma < 1$.

2. Equilibrium Solutions

The demand for nontradables, $N^d = I_N = K$, must equal the aggregate endowment of nontradables. The market clearing condition means

$$N \equiv N_f + N_b = K \tag{41}$$

Using Eqns. (37) and (41), the interest rate can be written as a function of the real exchange rate.

$$R = \frac{(1-\xi)\alpha A N^{\alpha-1} S}{1 - \frac{\xi}{R^*}\alpha A N^{\alpha-1} S} \tag{42}$$

Defining S_0 as the real exchange rate in the case of $R = R^*$, then

$$R^* = \alpha A N^{\alpha-1} S_0 \tag{43}$$

Then the interest spread can be defined as a function of the real exchange rate.

$$\phi(S) = \frac{R}{R^*} = \frac{(1-\xi)S}{S_0 - \xi S} \tag{44}$$

where $\phi'(S) = \frac{(1-\xi)S_0}{(S_0-\xi S)^2} > 0$.

In the domestic loan market, demand and supply for loans must be equal in equilibrium. Plugging in $K = N$, the firm's demand and the bank's supply for domestic loans are

$$L^d = \begin{cases} \frac{N_b}{S} - \frac{\xi}{R^*} A N^\alpha & \text{if} \quad S > S_0 \\ \in [\frac{N_b}{S_0} - \frac{\xi}{R^*} A N^\alpha, \frac{N_b}{S_0}] & \text{if} \quad S = S_0 \end{cases}$$

$$L^s = \begin{cases} \frac{1+\sigma(R^*-1)}{1+\sigma(R^*-1)-\theta R^* \phi(S)} \frac{N_b}{S} & \text{if} \quad S > S_0 \\ \in [0, \frac{1+\sigma(R^*-1)}{1+(\sigma-\theta)R^*-\sigma} \frac{N_b}{S_0}] & \text{if} \quad S = S_0 \end{cases}$$

Consider the case in which $S > S_0$. The loan supply $L^s = \frac{1+\sigma(R^*-1)}{1+\sigma(R^*-1)-\theta R^*\phi(S)} \frac{N_b}{S}$ is always larger than the loan demand $L^d = \frac{N_b}{S} - \frac{\xi}{R^*} A N^\alpha$ since $\frac{\xi}{R^*} A N^\alpha > 0$ and $\theta R^* \phi(S) > 0$. Therefore, the equilibrium level of the exchange rate is determined at $S = S_0$. Suppose a firm prefers to borrow from foreign lenders than from domestic banks when $R = R^*$ because foreign lenders are financially more stable. Then the equilibrium level of domestic loan will be $\frac{N_b}{S_0} - \frac{\xi}{R^*} A N^\alpha$.

Figure 11 depicts how the equilibrium in the domestic loan market is determined by demand and supply of loans. The left-hand-side of the figure shows the case where the leverage effect dominates the net worth effect so that the loan supply function is increasing in S for $S > S_0$. The right-hand-side of the figure shows the case in which the slope of the loan supply function is negative. In both cases, the equilibrium level of the exchange rate is S_0, and the equilibrium level of domestic loans is $\frac{N_b}{S_0} - \frac{\xi}{R^*} AN^\alpha$, which is point E in the figure.

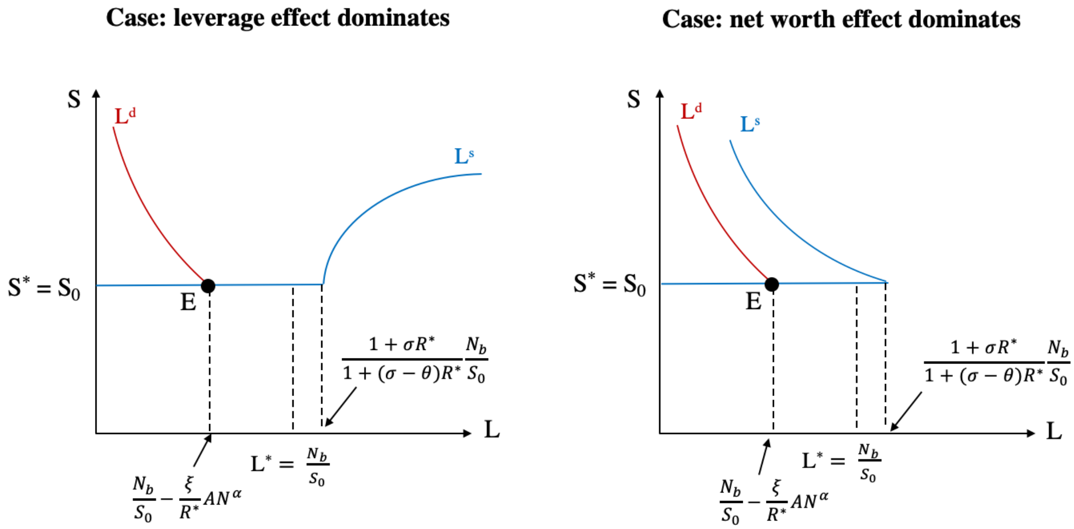

Figure 11: The equilibrium in the loan market: Special case

The levels of domestic and foreign loans in equilibrium are written as

$$L^* = \frac{N_b}{S_0} - \frac{\xi}{R^*} AN^\alpha = \frac{\alpha AN^{\alpha-1}}{R^*} N_b - \frac{\xi}{R^*} AN^\alpha$$
$$D_f^* = \frac{\xi}{R^*} AN^\alpha$$

where $S_0 = \frac{R^*}{\alpha AN^{\alpha-1}}$. The equilibrium levels of banks' cross-border borrowing and lending are:

$$D_b^* = F^* = \frac{\alpha AN^{\alpha-1}\theta N_b}{1+\sigma R^* - \theta R^*}$$

3. Changes in the world interest rates: US monetary expansion

Suppose there is a decrease in the world interest rate R^{**} due to a US monetary expansion. Since $R^* = 1 + \frac{1}{\sigma}(R^{**} - 1)$ is a function of R^{**}, it is also reduced. Define T^* as total corporate loans (i.e., $T^* = L^* + D_f^* = \frac{\alpha AN^{\alpha-1}}{R^*} N_b$). Then, I obtain

$$\frac{\partial T^*}{\partial R^*} = \frac{\partial L^*}{\partial R^*} = -\frac{\alpha AN^{\alpha-1}}{{R^*}^2} N_b < 0 \tag{45}$$

When R^* decreases, domestic firms increase foreign borrowing because the borrowing rate is lower than before. They also increase domestic borrowing because a decrease in the world rate induces R to fall, because supply is bigger than demand for domestic loans when $R > R^*$. Therefore, total corporate loans after the US monetary expansion will be

$$T^* - \frac{\partial T^*}{\partial R^*} = \frac{\alpha A N^{\alpha-1}}{R^*} N_b (1 + \frac{1}{R^*}) \quad > \quad T^* = \frac{\alpha A N^{\alpha-1}}{R^*} N_b \tag{46}$$

Since corporate loans increase in response to the decrease in R^*, the equilibrium level of loans after the US monetary expansion will be larger than before the change.

4. Introduction of macroprudential policy

As discussed in the previous section, a US monetary expansion can induce total corporate loans to increase. An excessive increase in corporate loans may cause problems because agents could be exposed to more default and currency risk, making the economy more vulnerable to subsequent currency shocks or financial crises. Hence, many central banks conduct macroprudential policies to limit the increase in corporate borrowing. Since it is difficult to regulate domestic firms, central banks often use lender-targeted policy measures that intervene in the decisions of financial institutions. In this section, I study the effects of macroprudential policy that limits banks' concentration of credit to domestic borrowers. In addition, I demonstrate that the effects of macroprudential policy can be dampened when firms' cross-border loans are less restricted. In turn, this dampening can be mitigated with the introduction of capital flow management policy measures.

Concentration Limits In this section, I study a special case of macroprudential policies, called "*Concentration Limits*." The policy limits the fraction of bank assets held held as loans to specific borrowers. In my model, if R is larger than R^*, a bank supplies loans only to domestic borrowers because it can earn more revenue by lending domestically. However, domestic borrowers may be more risky than international borrowers because the domestic market is less stable than foreign markets. Therefore, the central bank may limit the fraction of the bank's assets held as loans to domestic borrowers. To study the effects of this policy, I impose an additional restriction on domestic lending on the representative bank's problem. Other assumptions will be the same as in Section IV.1.

Modified bank's problem Consider an additional constraint on bank lending that limits the amount of lending to domestic borrowers to a fraction of the bank's own initial net worth. This constraint operates to keep banks from lending too much to domestic firms, and induces them to lend to international borrowers as well. The constraint on the bank's lending is

$$L \leq \lambda \frac{N_b}{S} \tag{47}$$

where $0 < \lambda < 1$.

Then, the bank's problem can be rewritten as

$$\max_{L_m, F_m, D_{b,m}} \quad \Pi^b = RL_m + R^*F_m - (1 + \sigma(R^* - 1))D_{b,m}$$

$$\text{s.t.} \qquad L_m + F_m = D_{b,m} + \frac{N_b}{S}$$

$$(1 + \sigma(R^* - 1))D_{b,m} \leq \theta(RL_m + R^*F_m)$$

$$L_m \leq \lambda \frac{N_b}{S}$$

where L_m, F_m, and $D_{b,m}$ denote bank lending to domestic borrowers, lending to international borrowers, and the amount borrowed from international markets. Also, $0 < \theta < 1$, and $0 < \lambda < 1$.

The optimal supply of domestic loans, and banks' demand and supply for cross-border loans will be

$$L_m^s = \begin{cases} \frac{\lambda N_b}{S} & \text{if} \quad S > S_0 \\ \in [0, \frac{\lambda N_b}{S_0}] & \text{if} \quad S = S_0 \end{cases} \tag{48}$$

$$F_m = \begin{cases} \frac{(1-\lambda)(1+\sigma(R^*-1)) + \theta R^* \phi(S) \lambda}{1+\sigma(R^*-1) - \theta R^*} \frac{N_b}{S} & \text{if} \quad S > S_0 \\ \in [\frac{(1-\lambda)(1+\sigma(R^*-1)) + \theta R^* \lambda}{1+\sigma(R^*-1) - \theta R^*} \frac{N_b}{S_0}, \frac{1+\sigma(R^*-1)}{1+\sigma(R^*-1) - \theta R^*} \frac{N_b}{S_0}] & \text{if} \quad S = S_0 \end{cases}$$

$$D_{b,m} = \frac{\theta R^*(1-\lambda) + \theta R \lambda}{1 + \sigma(R^* - 1) - \theta R^*} \frac{N_b}{S_0} \quad \text{for} \quad S \geq S_0$$

The firm's problem is the same as in the case without macroprudential policy. I denote $D_{f,m}$ as the amount borrowed from the international market by firms.

Equilibrium Note that $\frac{\partial L_m^s}{\partial S} = -\frac{\lambda N_b}{S^2} < 0$, which means that the net worth effect dominates the leverage effect in the elasticity of loan supply. Since $0 < \lambda < 1$, $|\frac{\partial L_m^s}{\partial S}| = \frac{\lambda N_b}{S^2} < |\frac{\partial L_m^d}{\partial S}| = \frac{N_b}{S^2}$, which means that the slope of the loan demand function is steeper than that of the loan supply function. Therefore, in the presence of macroprudential policy that imposes a limit on bank lending to domestic firms, multiple equilibria arise as in Figure 12 (points E and E'). I will focus on the equilibrium at point E because it is plausible that the domestic rate is higher than the world interest rate.

In the domestic loan market, demand and supply for loans are equalized as at point E in Figure 12, implying

$$\frac{N_b}{S} - \frac{\xi}{R^*} AN^\alpha = \frac{\lambda N_b}{S} \tag{49}$$

Solving the above equation, the equilibrium levels of the interest rate and the exchange rate are

$$R_m = \frac{(1-\xi)(1-\lambda)\alpha N_b}{\xi(N-(1-\lambda)\alpha N_b)} R^*, \quad S_m^* = \frac{(1-\lambda)N_b}{\xi A N^\alpha} R^*$$

The equilibrium levels of corporate loans be expressed as follows:

$$L_m^* = \frac{\lambda}{1-\lambda}\frac{\xi A N^\alpha}{R^*}, \quad D_{f,m}^* = \frac{\xi A N^\alpha}{R^*}$$

Defining total corporate loans in the presence of concentration limits as $T_m^* = L_m^* + D_{f,m}^*$, the equilibrium level of total corporate loans is

$$T_m^* = \frac{1}{1-\lambda}\frac{\xi A N^\alpha}{R^*} < T^* = \frac{\alpha A N^{\alpha-1}}{R^*} N_b$$

since $R > R^* \Leftrightarrow (1-\lambda)\alpha N_b > \xi N$. Thus, the equilibrium level of total corporate loans is reduced when macroprudential policy limits the amount of domestic loans.

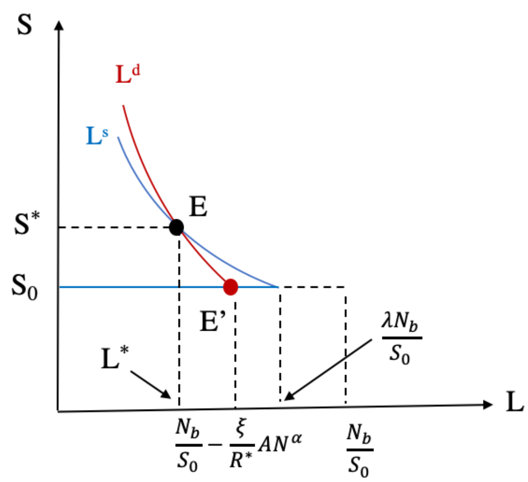

Figure 12: The Equilibrium in the Loan Market: Macroprudential Policy

US monetary expansion The responses of loans to changes in the world interest rate can be now written as

$$\frac{\partial L_m^*}{\partial R^*} = -\frac{\lambda}{1-\lambda}\frac{\xi A N^\alpha}{R^{*2}}, \quad \frac{\partial D_{f,m}^*}{\partial R^*} = -\frac{\xi A N^\alpha}{R^{*2}}$$

$$\frac{\partial T_m^*}{\partial R^*} = -\frac{1}{1-\lambda}\frac{\xi A N^\alpha}{R^{*2}} < 0 \tag{50}$$

Then the equilibrium level of total corporate loans after the US monetary expansion will be

$$T_m^* - \frac{\partial T_m^*}{\partial R^*} = \frac{1}{1-\lambda}\frac{\xi A N^\alpha}{R^*}(1+\frac{1}{R^*}) < T^* - \frac{\partial T^*}{\partial R^*} = \frac{\alpha A N^{\alpha-1}}{R^*} N_b (1+\frac{1}{R^*}) \tag{51}$$

since $R > R^* \Leftrightarrow (1-\lambda)\alpha N_b > \xi N$. Thus, the equilibrium level of corporate loans after US monetary expansion is lower when the central bank introduces macroprudential policy that limits the concentration of credit.

The effectiveness of the policy I can measure the effectiveness of macroprudential policy in affecting the level of corporate loans as

$$\frac{T^* - \frac{\partial T^*}{\partial R^*}}{T^*_m - \frac{\partial T^*_m}{\partial R^*}} = (1-\lambda)\frac{\alpha N_b}{\xi N} \equiv M_1 \tag{52}$$

which is larger than 1.

Alternatively, I can measure the effectiveness of MPM in attenuating the response of corporate loans to monetary expansion as with

$$\frac{\partial T^*}{\partial R^*} - \frac{\partial T^*_m}{\partial R^*} = -\frac{1}{1-\lambda}\frac{\xi A N^\alpha}{R^{*2}} + \frac{\alpha A N^{\alpha-1}}{R^{*2}} \equiv M_2 \tag{53}$$

which is larger than 0. Since the purpose of the macroprudential policy is to reduce the equilibrium level of total corporate loans and its responses to the US monetary expansion, the policy is more effective as M_1 and M_2 are larger.

Note that both measures of effectiveness of the macroprudential policy, M_1 and M_2, are decreasing in ξ:

$$\frac{\partial M_1}{\partial \xi} = -(1-\lambda)\frac{\alpha N_b}{\xi^2 N} < 0, \quad \frac{\partial M_2}{\partial \xi} = -\frac{1}{1-\lambda}\frac{A N^\alpha}{R^{*2}} < 0$$

Since a firm can borrow from abroad up to a fraction ξ of its expected revenue, an increase in ξ means that the firm is allowed to borrow more from international lenders. Therefore, the above equation means that the effects of the macroprudential policy are dampened when firms can borrow more from international markets. This is because the macroprudential policy on credit concentration cannot control capital flows incurred by corporate cross-border borrowing. This is shown in the equilibrium levels of corporate loans across borders:

$$\frac{\partial D^*_f}{\partial R^*} = \frac{\partial D^*_{f,m}}{\partial R^*} = -\frac{\xi A N^\alpha}{R^*}$$
$$D^*_f - \frac{\partial D^*_f}{\partial R^*} = D^*_{f,m} - \frac{\partial D^*_{f,m}}{\partial R^*} = \frac{\xi A N^\alpha}{R^*}(1 + \frac{1}{R^*})$$

Firms borrow more from the international market in response to a decrease in the US rate but macroprudential policy cannot regulate this response. This means that the effectiveness of MPMs will be dampened as the firm's constraint on foreign loans is loosened (i.e., $\xi \Uparrow$). Thus, there are leakages from macroprudential policy in reducing corporate loans and mitigating their responses to US monetary expansion.

5. Capital flow management policy

I have shown that macroprudential policy that limits credit concentration reduces the equilibrium level of total loans and mitigates the response of those loans to a decrease in the world interest rate. However, the effects are dampened when firms are able to finance loans from abroad, because they can shift toward the international market when domestic loans are limited. An additional introduction of capital flow management policy measures can minimize these leakages from the effects of macroprudential policy. The CFM policy can be conducted together with the macroprudential policy, imposing an additional constraint on corporate foreign loans that is occasionally binding.

Since an increase in ξ induces firms to shift more toward foreign loans when domestic loans are restricted, it can dampen the effects of macroprudential policy in attenuating the increase in total corporate loans in response to US monetary expansion. Therefore, suppose the central bank decides to directly limit firms' foreign borrowing to some multiple of its expected revenue. The constraint will be

$$D_f \leq \rho A K^{\alpha} \tag{54}$$

where $0 < \rho < 1$. When ξ is small enough (i.e., $\xi \leq \rho R^*$), the constraint is not binding. However, when ξ becomes larger than ρR^*, it will bind.

The firm's problem with the additional constraint imposed by the CFM will be

$$\begin{aligned} \max_{L_c, D_{f,c}, K} \quad & \Pi^f = AK^{\alpha} - RL_c - R^* D_{f,c} \\ \text{s.t.} \quad & \frac{K}{S} = L_c + D_{f,c} + \frac{N_f}{S} \\ & R^* D_{f,c} \leq \xi A K^{\alpha} \\ & D_{f,c} \leq \rho A K^{\alpha} \end{aligned}$$

where $A > 0$, $0 < \alpha \leq 1$, $0 < \xi < 1$, and $0 < \rho < 1$.

When $\xi \leq \rho R^*$, there is no effect of the CFM because the constraint (54) is not binding. For $\xi > \rho R^*$, the optimal demand for domestic and foreign loans by the firm will be

$$L_c^d = \frac{N_b}{S} - \rho A N^{\alpha}, \quad D_{f,c} = \rho A N^{\alpha} \tag{55}$$

The bank's problem does not change with the introduction of the CFM constraint, so the bank's decisions are the same as in section IV.4

In the domestic loan market, $L_c^d = L_c^s$ gives the equilibrium level of the exchange rate as

$$S_c = \frac{(1-\lambda)N_b}{\rho A N^{\alpha}}$$

Then the equilibrium levels of domestic, international, and total corporate loans will be

$$L_c^* = \frac{\lambda}{1-\lambda}\rho A N^\alpha, \quad D_{f,c}^* = \rho A N^\alpha, \quad T_c^* = \frac{1}{1-\lambda}\rho A N^\alpha$$

Since T_c^* is not a function of R^*, total corporate loans do not respond to a decrease in the world interest rate R^*. Hence, total corporate loans after the US monetary expansion will be

$$T_c^* - \frac{\partial T_c^*}{\partial R^*} = \frac{1}{1-\lambda}\rho A N^\alpha$$

Similarly to the case with only macroprudential policy, I can measure the effectiveness of CFM in conjunction with MPM in restricting the level of corporate loans as

$$\frac{T_m^* - \frac{\partial T_m^*}{\partial R^*}}{T_c^* - \frac{\partial T_c^*}{\partial R^*}} = (1 + \frac{1}{R^*})\frac{\xi}{\rho R^*} \equiv C_1 \tag{56}$$

which is larger than 1 for $\xi > \rho R^*$. The effectiveness of CFM together with MPM in regulating the response of corporate loans can be measured as

$$-\frac{\partial T_m^*}{\partial R^*} = \frac{1}{1-\lambda}\frac{\xi A N^\alpha}{{R^*}^2} \equiv C_2 > 0 \tag{57}$$

since $\frac{\partial T_c^*}{\partial R^*} = 0$. These measures show that imposing a CFM constraint on firms makes macroprudential policy more effective than in the case where macroprudential policy is conducted alone. Moreover, the effects of the additional CFM constraint are larger when ξ is higher. Defining CM_1 and CM_2 as measures of the effectiveness of the CFM in regulating the level and the response of corporate loans, respectively, these measures can be expressed as

$$\frac{T^* - \frac{\partial T^*}{\partial R^*}}{T_c^* - \frac{\partial T_c^*}{\partial R^*}} = \frac{(1-\lambda)\alpha N_b}{\rho R^* N}(1 + \frac{1}{R^*}) \equiv CM_1 \tag{58}$$

$$-\frac{\partial T^*}{\partial R^*} = \frac{\alpha A N^{\alpha-1}}{{R^*}^2} \equiv CM_2 \tag{59}$$

CM_1 is larger than 1, and is not affected by ξ. CM_2 is larger than 0, and also is not a function of ξ. Therefore, firms' leakages toward foreign loans are limited by the CFM constraint, which prevents the effects of macroprudential policy from being dampened. In sum, the effects of macroprudential policy with a CFM constraint can be written as

$$\text{Policy Effects}_{level} = \begin{cases} (1-\lambda)\frac{\alpha N_b}{\xi N} & \text{if} \quad \xi \le \rho R^* \\ (1-\lambda)\frac{\alpha N_b}{\rho R^* N}(1 + \frac{1}{R^*}) & \text{if} \quad \xi > \rho R^* \end{cases} \tag{60}$$

$$\text{Policy Effects}_{response} = \begin{cases} -\frac{1}{1-\lambda}\frac{\xi AN^{\alpha}}{R^{*2}} + \frac{\alpha AN^{\alpha-1}}{R^{*2}} & \text{if} \quad \xi \leq \rho R^{*} \\ \frac{\alpha AN^{\alpha-1}}{R^{*2}} & \text{if} \quad \xi > \rho R^{*} \end{cases} \tag{61}$$

Figure 13 depicts the policy effects as ξ changes. The left panel of the figure shows the effects of policies on the level of corporate loans while the right panel depicts the policy effects on the response of firm borrowing. For $\xi > \rho R^*$, the dotted line in the figure describes the effects of macroprudential policy without any capital flow management. The policy effects are shown to be severely dampened when the firm's borrowing constraint on foreign loans is loosened with an increase in ξ. The solid line depicts the effects of having a CFM constraint in addition to the macroprudential policy. The CFM is in effect when ξ crosses the threshold ρR^*. When the CFM constraint is binding, the macroprudential policy can have more effects than in the case without the CFM, and the effects are not dampened with a change in ξ.

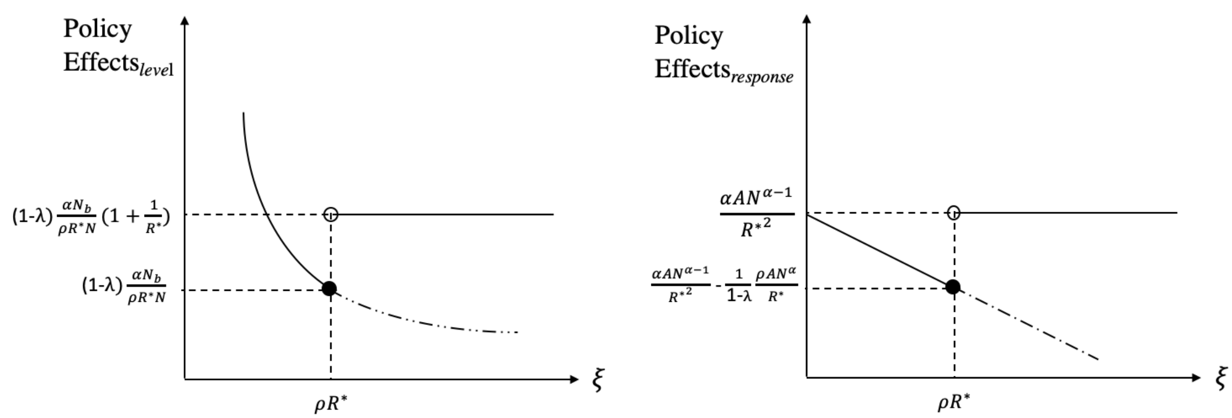

Figure 13: The Effectiveness of the Policy Measures

In my model, since firms can borrow from the international markets as well as domestic banks, macroprudential policy that limits domestic loans cannot fully manage the firms' total borrowing. As firms can finance their capital investment across borders instead of borrowing only from the domestic markets, there are leakages in the effects of macroprudential policy that limits domestic banks' credit concentration. This dampening impact can be mitigated by introducing an additional policy measure that limits capital flows. In this section, I have shown that CFMs that limit the amount borrowed from abroad can keep the effectiveness of macroprudential policy from being severely dampened by a loosening of firm's constraint on foreign loans, which is consistent with my empirical findings.

V. Conclusion

The purpose of my paper is to understand the effects of macroprudential policies on corporate loans in response to a US monetary expansion. The empirical evidence in the paper suggests that macroprudential policies alone cannot regulate the response of corporate loans effectively when there is expansionary monetary policy in the US. This is because the policy effects are dampened when firms can borrow more from abroad. However, MPMs can effectively regulate corporate loans when CFMs are in place, because CFMs can deal with foreign capital inflows incurred by firms' foreign borrowing. This finding is relevant for emerging countries, which have adopted several CFMs in recent years. In advanced countries, MPMs alone are effective in keeping firms from increasing their loans because domestic firms do not substantially leak toward the international markets. This can explain the fact that the advanced countries have not adopted CFMs frequently in recent decades.

The second contribution of my paper is to present a simple theoretical model that can help to interpret these empirical results. The model allows firms to borrow from the international market while banks can also lend to foreign borrowers. When a central bank introduces macroprudential policies, it can effectively reduce corporate loans and mitigate their response to a decrease in the world interest rate. However, the effects are dampened when firms' constraints for foreign borrowing are loosened. This dampening can be addressed with the introduction of CFMs together with MPMs, which can keep firms from increasing foreign loans excessively. The analytical solutions of a special case, in which firms and banks are endowed only with nontradable goods, show that the existence of CFMs can set a lower bound on the effects of MPMs.

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Appendix

Table A.1: The Effects of Macroprudential Policy: with or without CFMs

	(1) Growth	(2) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i \times CFM_{i,t} (\beta)$	-72.72***	-136.5***
	(18.34)	(19.08)
$Macropru_{i,t} \times USexp_{t-1} \times Share_i (\alpha_1)$	0.497***	0.469**
	(0.180)	(0.187)
$Macropru_{i,t} \times Share_i \times CFM_{i,t} (\alpha_2)$	72.68***	137.2***
	(18.05)	(18.89)
$Macropru_{i,t} \times USexp_{t-1} \times CFM_{i,t} (\alpha_3)$	70.77***	132.5***
	(17.78)	(18.54)
$USexp_{t-1} \times Share_i \times CFM_{i,t} (\alpha_4)$	361.5***	676.4***
	(90.76)	(94.58)
$Macropru_{i,t} \times USexp_{t-1} (\delta_1)$	-0.418***	-0.383**
	(0.142)	(0.170)
$Macropru_{i,t} \times Share_i (\delta_2)$	-0.214	-0.473*
	(0.304)	(0.208)
$Macropru_{i,t} \times CFM_{i,t} (\delta_3)$	-70.87***	-133.1***
	(17.55)	(18.39)
$USexp_{t-1} \times Share_i (\delta_4)$	-0.473	-0.765***
	(0.304)	(0.208)
$USexp_{t-1} \times CFM_{i,t} (\delta_5)$	-353.4***	-660.6***
	(88.51)	(92.37)
$Share_i \times CFM_{i,t} (\delta_6)$	-362.1***	-680.2***
	(89.30)	(93.29)
$Macropru_{i,t} (\gamma_1)$	0.179	0.606***
	(0.224)	(0.212)
$CFM_{i,t} (\gamma_2)$	354.3***	664.0***
	(87.38)	(91.36))
$USSR_{t-1} (\gamma_3)$	-0.060*	-0.130***
	(0.035)	(0.039)
$PR_{i,t-1} (\lambda_1)$	-0.005	-0.006*
	(0.003)	(0.003)
$GDP_{i,t-1} (\lambda_2)$	0.059***	0.017
	(0.021)	(0.020)
$Y_{i,t-1} (\lambda_3)$	-0.436***	0.318***
	(0.035)	(0.056)
Countries	40	40
Country FE	Yes	Yes
Observations	547	547
R^2	0.259	0.360

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$

Table A.2: Summary Statistics of Main Regression Variables

	Mean	Median	Min	Max	Std. Dev.	Obs
Dependent Variables						
Total corporate loan growth (%)						
Advanced Countries	17.07	18.74	-710.44	977.18	154.28	323
Emerging Markets	21.62	12.82	-532.78	567.80	123.46	236
Total corporate loan level (logged , USD)						
Advanced Countries	1.49	1.71	-713.18	546.86	209.85	333
Emerging Markets	0.98	1.05	-5.83	5.08	2.01	243
Independent Variables						
(Country-year level variables)						
MPI_all						
Advanced Countries	2.10	2	0	8	1.81	345
Emerging Markets	3.23	3	0	12	2.41	255
MPI_lender						
Advanced Countries	1.71	2	0	6	1.33	345
Emerging Markets	2.73	2	0	10	1.92	255
MPI_borrower						
Advanced Countries	0.39	0	0	2	0.65	345
Emerging Markets	0.51	0	0	2	0.74	255
CFM						
Advanced Countries	0.03	0	0	1	0.18	345
Emerging Markets	0.20	0	0	1	0.40	255
Policy rate (%)						
Advanced Countries	3.03	2.51	-0.09	13.5	2.55	345
Emerging Markets	6.27	3.32	-0.09	183.2	13.14	243
GDP growth (%)						
Advanced Countries	2.37	2.54	-9.58	10.65	2.87	345
Emerging Markets	3.28	3.81	-16.43	14.19	4.09	255
(Country level variables)						
Foreign Share						
Advanced Countries	0.78	0.86	0.28	1	0.21	344
Emerging Markets	0.78	0.93	0.28	1	0.23	255
(Year level US variables)						
US expansion	0.67	1	0	1	0.47	345
US shadow funds rate (%)	1.46	1.35	-2.74	6.24	2.65	345

Notes: The table presents summary statistics for all observations from 2000-2014. Sources are Dealscan, IMF database and FRED. "MPI_all" is an index of all macroprudential policies, "MPI_lender" indexes lender-targeted policies, and "MPI_borrower" indexes borrower-targeted policies. "CFM" is an index of capital flow management policies, constructed by the author based on "IMF 2019 taxonomy of capital flow management measures." "Foreign Share" denotes the share of foreign loans in total corporate loans.

Table A.3: The Effects of Macroprudential Policy in Emerging Markets: with or without CFMs

	(1) Growth	(2) Level
$Macropru_{i,t} \times USexp_{t-1} \times Share_i \times CFM_{i,t}(\beta)$	-75.77***	-97.84***
	(23.60)	(22.12)
$Macropru_{i,t} \times USexp_{t-1} \times Share_i(\alpha_1)$	0.972***	0.688**
	(0.105)	(0.271)
$Macropru_{i,t} \times Share_i \times CFM_{i,t}(\alpha_2)$	75.66***	98.74***
	(23.41)	(21.62)
$Macropru_{i,t} \times USexp_{t-1} \times CFM_{i,t}(\alpha_3)$	73.56***	95.10***
	(22.89)	(21.46)
$USexp_{t-1} \times Share_i \times CFM_{i,t}(\alpha_4)$	375.1***	485.0***
	(116.6)	(109.6)
$Macropru_{i,t} \times USexp_{t-1}(\delta_1)$	-0.781***	-0.541*
	(0.092)	(0.275)
$Macropru_{i,t} \times Share_i(\delta_2)$	-0.878***	-0.647**
	(0.197)	(0.274)
$Macropru_{i,t} \times CFM_{i,t}(\delta_3)$	-73.72***	-95.78***
	(22.70)	(21.07)
$USexp_{t-1} \times Share_i(\delta_4)$	-0.966**	-0.930***
	(0.404)	(0.290)
$USexp_{t-1} \times CFM_{i,t}(\delta_5)$	-365.8***	-473.7***
	(115.6)	(106.7)
$Share_i \times CFM_{i,t}(\delta_6)$	-375.0***	-489.4***
	(115.6)	(106.7)
$Macropru_{i,t}(\gamma_1)$	0.734***	0.837***
	(0.097)	(0.250)
$CFM_{i,t}(\gamma_2)$	366.7***	477.8***
	(112.8)	(104.6)
$USSR_{t-1}(\gamma_3)$	-0.039	-0.056
	(0.065)	(0.051)
$PR_{i,t-1}(\lambda_1)$	-0.0001	-0.005*
	(0.002)	(0.003)
$GDP_{i,t-1}(\lambda_2)$	0.024	-0.022
	(0.015)	(0.022)
$Y_{i,t-1}(\lambda_3)$	-0.373***	0.369***
	(0.057)	(0.065)
Countries	17	17
Country FE	Yes	Yes
Observations	224	224
R^2	0.268	0.548

Notes: Standard errors are in parenthesis. Standard errors are corrected for clustering of observations at the country level. Sample spans 2000 - 2014. $*p < 0.10, **p < 0.05, ***p < 0.01$