Transmission of Global Financial Shocks: Which Capital Flows Matter?*

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Abstract

In this paper, I study channels through which risk-appetite shocks to global investors, i.e., global financial shocks, are transmitted to emerging market economies (EMEs). I focus on how transmission channels have changed as EMEs have become able to borrow abroad in equity and local currency debt and accordingly have reduced their currency exposures. First, I empirically show that much of the transmission of global financial shocks to EMEs is reflected in equity and local currency bond portfolio investment capital flows. I then develop a small open economy model which, augmented with leverage constrained banks and foreign investors who purchase equities and bonds, can replicate these empirical findings qualitatively. Finally, I calibrate the model to the Korean economy in which corporations and the government have no significant net foreign currency debts, but most of the external liabilities of the country are Korean won-denominated equities and debts. Quantitative analysis of the model suggests that global financial shocks can account for 50% of the equity price volatility and 30% of the investment volatility in Korea. In short, all the analysis in this paper implies that to a substantial extent, risk-appetite shocks to global investors are transmitted to EMEs via fickle portfolio capital flows to equity and local currency bond markets in EMEs.

Keywords: Global Financial Cycle, Capital Flows, Local Currency Debts
JEL Classification: E32, F36, F41, F62, G15

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1 Introduction

Disruptive effects of cross-border capital flows in Emerging Market Economies (EMEs) have been thoroughly explored in recent international macroeconomic and financial research. The seminal papers by Rey (2013, 2016) coined the term "Global Financial Cycle", saying shocks to risk-appetite of global investors, measured by Chicago Board Options Exchange Volatility Index (Cboe VIX),[1] generate comovements of risky asset prices over the world.[2] In the context of EMEs, as it is shown in figure 1, we can see certain correlations between VIX and EME financial market variables; a higher VIX is associated with falls in EME stock indices and with EME local currency depreciation, and vice versa for lower VIX. Furthermore, when an early draft of this paper was written (2020 March), we clearly saw another big shock to risk-appetite of global investors, instigated by COVID-19 pandemic, resulting in historically large falls in stock indices and currency values in EMEs. This paper aims at improving our understanding of the mechanism by which the risk-appetite shocks, "Global Financial Cycles",[3] impact financial markets and the real economy in small open economies and, in particular, Emerging Market Economies (EMEs).

This paper focuses on the global financial shock implications for EMEs because, first, EMEs are usually considered more fragile to sudden reversals in capital flows than advanced economies (AEs) and therefore EME policy makers are more concerned about the capital flows. Second, this paper reviews our understanding of the key channel through which capital flows disrupt EMEs. Traditionally, it has been thought that EMEs must borrow in foreign currencies when they borrow abroad, and the resulting currency mismatches of external liabilities with domestic assets are the source of the fragility; the "Original Sin" hypothesis as espoused by Eichengreen and Hausman (2002). However, there have been important changes in International Investment Positions (IIPs) of EMEs over the last twenty years, which brings into question about the continued validity of the Original Sin hypothesis. As it is documented in recent papers such as Du and Schreger (2016) and Perez and Ottonello (2019), currently substantial parts of external debts of EMEs are local currency (LC) denominated debts. Furthermore, in a companion paper Han (2021), I constructed a dataset, which shows EMEs have increasingly borrowed abroad in local currency equities and debt, and have reduced their currency mismatches. This suggests that we may no longer rely on solely the currency mismatch channel to explain the vulnerability of EMEs to global financial shocks.

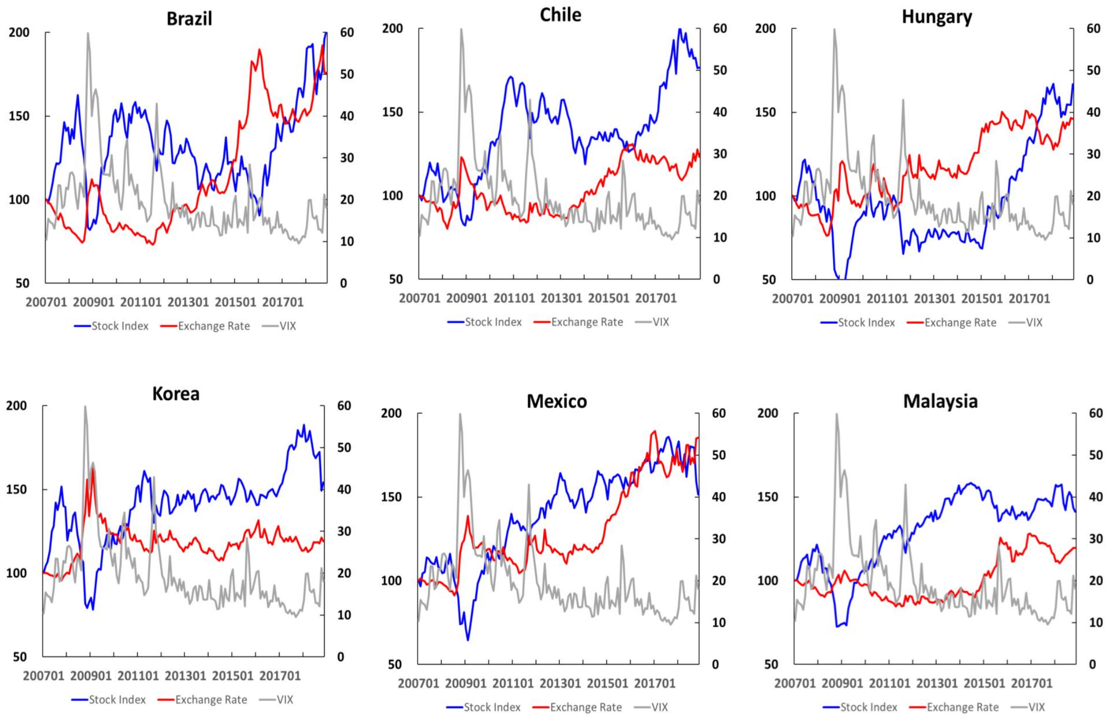
In this paper, I first empirically evaluate how different types of external liabilities are associated with different sensitivities to global financial shocks. Deploying the dataset in the compan-

[1] Throughout this paper, VIX indicates Cboe VIX

[2] Another important and even more famous claim in Rey (2013) is that monetary policies in peripheral economies can be autonomous only if the capital accounts are controlled, and moreover, it is almost regardless of the exchange regime: hence the traditional trilemma has morphed into dilemma. Such a provocative claim ignites the debate of whether the peripheral economies are in the state of trilemma or dilemma. Throughout this paper, I do not try to answer whether EMEs are currently in the state of trilemma or dilemma. However, this paper contributes to the debate by elucidating more precise channels through which the risk-appetite shocks to the global investors propagate into financial markets and real economies in EMEs. For more details of the debate, see Obstfeld (2015), Edwards (2015), and Cerutti et al. (2017). Also, see the excellent survey by Aizenman (2018).

[3] Throughout this paper, risks appetite shocks refer to the shcosk to risk appetite of global financial intermediaries, which derive the global financial cycle. I interchangeably use risk-on/off shocks, risk appetite shocks, and global financial cycles.

Figure 1: VIX and Financial Markets in Selected EMEs



Note: 1) Monthly data, Jan. 2008 to Dec. 2018. 2) I normalize the stock price indices and nominal exchange rates at a basis of the values at the beginning of 2007 equal to 100. 3) Exchange rates are price of US dollar in local currencies. Hence, higher exchange rates mean depreciation of the local currencies.

ion paper Han (2021) and strategies similar to papers that studied financial market responses in EMEs to tapering tantrum in 2013 (Aizenman et al., 2014; Eichengreen and Gupta, 2014), I estimated how financial market variables in the EMEs—stock indices and exchange rates—respond to the risk appetite shocks, measured by changes in VIX, conditional on different types of external liabilities of each EME. Surprisingly, it turns out that more equity external liabilities and LC external debts are associated with higher sensitivities to global financial shocks at least in terms of financial market reactions in a short run at monthly frequency. By contrast, measures of currency mismatches, both in the aggregate and at the sectoral level, turn out to be much insignificant. The result is in line with a few earlier empirical studies (e.g., Dedola et al., 2017) that document no clear relationship between country responses and likely relevant fundamentals such as US dollar exposure, but countries with larger capital markets, equity and bond markets, seem to be more fragile. My empirical findings together with these prior results suggest that there are alternative channels for global financial shocks to impact EME financial markets other than currency mismatches.

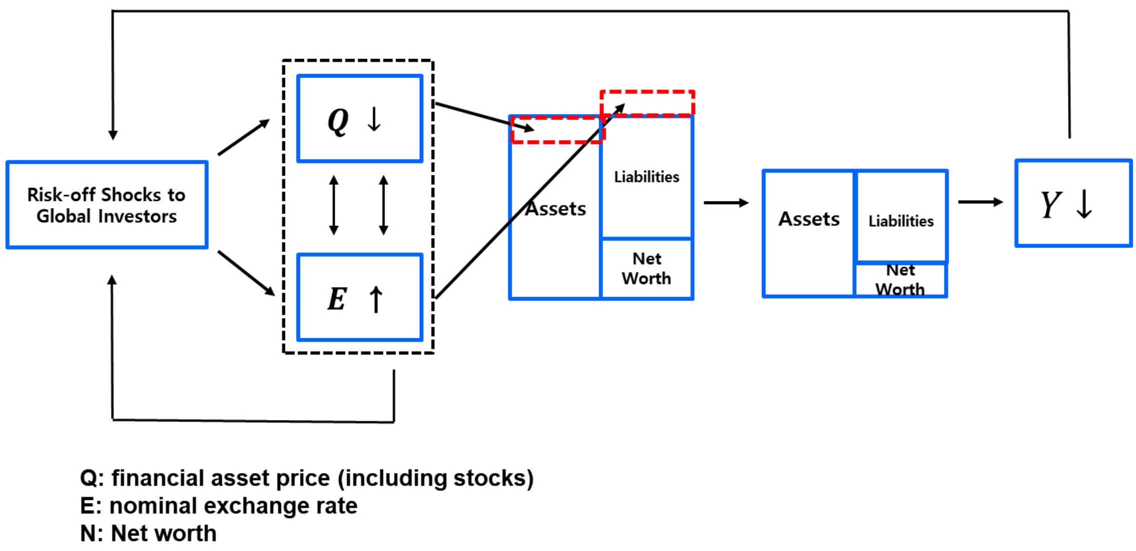
Motivated by these facts, I develop a small open economy (SOE) model augmented by three distinctive features. First, to model equity markets in the SOE, I adopt assumptions in Gertler and Kiyotaki (2010) that firms issue claims on capital every period, and the resulting equity-type securities must be purchased by leverage constrained domestic banks or global investors. Second, following Miranda-Agrippino and Rey (2019), I assume that global investors are risk-neutral, but face Value at Risk (VaR) constraints so that they behave like risk-averse agents. Third, government in the SOE can issue sovereign bonds denominated in the local currency of the SOE (LC bonds), which can be purchased by either global banks or domestic banks. The domestic banks finance their investments through either deposits from households or foreign currency borrowing in international loan markets.

To understand the mechanisms in the model, consider a “risk-off” scenario in which global investors face some negative shocks to their own capital. The damage to capital forces the global investors to dispose of their risky asset holdings in EMEs. Given initial conditions, the global investors sell off some of their EME equity and EME LC bonds. The other investors in EMEs, domestic banks, cannot absorb the sell-off because they are leverage constrained. The resulting insufficient asset demand reduces the price of capital, which in turn reduces the net worth of domestic banks and accordingly lowers the demand from the domestic banks. As a result, the sell-off by global investors generates a negative externality through the domestic capital price, dramatically weakening the total demand for the capital and resulting in a large fall in the asset price: Hence it is a form of fire sale mechanism ignited by sell-off by global investors. On the other hand, in foreign exchange markets, when the global investors sell off the assets in EMEs, they must also sell off their local currency proceeds and convert it to their own foreign currency. This depreciates the local currency. These impacts of the “risk-off shock” for stock prices and exchange rates, propagate to the real economy, resulting in lower investment in new capitals and higher net exports, which is typically observed in risk-off events. This describes the theoretical "capital market channel", for global risk appetite shocks to impact EME financial markets and the real economies, which is the main contribution of this paper.

If the domestic banks have net foreign currency debts, the local currency depreciation reduces the net worth of the banks even further, and this precipitates a fall in the domestic capital price: I call this "exchange rate channel." Facing the shrinking net worth, banks deleverage reducing both the capital purchases and the foreign currency borrowings as they need to borrow less when they invest less. As a result, the local currency depreciation causes a fall in capital price and the lower capital price depreciates the local currency further through the deleveraging of the banks. Such as negative loop mechanism magnifies the impacts of a risk-off shock, resulting in larger falls in investment in capital and steeper increases in net exports. The effects are illustrated in figure 2.

Based on the empirical and theoretical results, I build a medium-scale new Keynesian DSGE model for more quantitative studies. The model is designed for a quantitative study of the impacts of the risk-appetite shocks on small open economy, and the purpose of the exercise is to evaluate the importance of the capital market channel quantitatively in a more general environment. I model the leverage constraint, following Gertler and Kiyotaki (2010), and added several necessary ingredients such as incomplete exchange rate pass-through, which might be important for quantitative results. I calibrate the model to Korean economy where corporates and the government have no significant net foreign currency debts, and whose external liabilities are mostly Korean won denominated equities and bonds. I feed four different shocks into the calibrated model: TFP shock, trade shock—shock to foreign demand for Korean exports—, monetary policy shock, and global financial shock. The results of quantitative analysis illustrate that global financial shock is the most important and dominant force in financial markets in

Figure 2: The Loop Mechanism in the Model



Note: Balance sheets in the middle are the balance sheets of the financial intermediaries in EMEs

Korea. Approximately, it accounts for 50% of the volatility of capital price, as a proxy for equity price in reality, 40% of real exchange rate volatility, and 30% of the government bond price volatility. The importance of global financial shocks is relatively low for the real macroeconomic aggregates. The global financial shock accounts for approximately 30% of investment volatility, 20% of consumption, and 10% of GDP. These numbers are close to a recent estimate in Acalin and Rebucci (2020). The parts of GDP variations attributable to the risk appetite shocks are low, but it reflects that increases in net exports largely offset the negative impacts on investments during a risk-off event and vice versa for a risk-on event.

The model and quantitative studies above cannot accommodate rich institutional details in financial markets in reality. Since there is no direct evidence of the capital market channel in the literature, to the best of my knowledge, I test the validity of the channel, using more disaggregated data in Korea. Using the rich bank balance sheet data of Korean financial intermediaries, I empirically test the core mechanism. The model predicts the financial intermediaries holding more risky assets and having higher leverages are affected by global financial cycles more than others. The results of the panel regressions show that the financial intermediaries behave as predicted by the model.

Related Literature This paper is related to several strands of literature. First and foremost, this paper is a part of the literature that has studied mechanisms behind disruptive impacts of capital flows on EMEs. The literature has a really long history and backs to at least Calvo (1998). The preceding papers in the literature have focused on the potential risks from foreign currency external borrowings. Caballero and Krishnamurthy (2001) showed that the collateral constraints in EMEs generate the pecuniary externalities of foreign borrowings, which raise financial fragility in EMEs. After the Global Financial Crisis, there have been extensive studies on the pecuniary externalities from foreign currency external borrowings and related policies.

Noteworthy papers in the literature are Bianchi (2011), Mendoza (2010), Beningo et al. (2016), and Jeanne and Korinek (2010b). The central idea in these papers is that decentralized agents do not internalize the impact of their actions on prices, real exchange rates in most papers, and capital controls are desirable policies to handle the externalities. More recently, several papers emphasized the interaction between external shocks (e.g., sudden stops) and domestic banking sectors using a model based on Gertler and Kiyotaki (2010) or Gertler and Karadi (2013). Akinci and Queralto (2019), Aoki et al. (2018), and Jiang et al. (2019) belong to this fashion. This paper also constructs a small open economy model augmented with domestic banking sectors. The distinctive feature in this paper is that unlike the earlier papers, the mechanisms do not rely on currency mismatches. Based on the up-to-date empirical facts, I incorporate equity and local currency debt portfolio investments into the model and suggest a mechanism by which capital flows in the form of equity or LC debt portfolio investment generate large fluctuations in financial markets and the real economy. Handful recent papers have similar features with the model in this paper. Cavallino and Sandri (2019), Jeanne and Sandri (2019), and Caballero and Simpsek (2020) showed that sell-off of foreign investors in domestic financial markets can generate big falls in the market and a severe recession if domestic investors face a form of borrowing limit or collateral constraint. The model in this paper differs from Cavallino and Sandri (2019) and Jeanne and Sandri (2019) in that in my model, the asset price falls lower net worth of domestic investors so as to amplify the negative impacts. In this aspect, the model in this paper is close to Caballero and Simpsek (2020). However, despite the similarity, the model in this paper identifies different channels from different capital flows more precisely in richer environments. The model is also better grounded on empirical facts uncovered in this paper and more suitable for quantitative studies as the model has more realistic and richer features.[4] Another paper close to mine is Devereux and Yu (2019), which modeled different capital flows, equity and debt, and global investors who intermediate cross-border borrowing. Because of the similar features, this paper echoes one of key insights in Devereux and Yu (2019) that equity market participation of foreign investors transmits foreign shocks to the domestic markets, resulting in less severe but more frequent crises (or market turmoil). However, this paper emphasizes the role of asset price affected by fickle demands from foreign investors, which is absent in Devereux and Yu (2019).

This paper is also related to the literature of global financial cycle and monetary policy spillover. It was Rey (2013) that coined the famous term "Global Financial Cycle" and suggested a provocative claim that a small open economy loses its independent monetary policy as long as its capital account is open since the center economy monetary policy in fact determines the financial condition of the small open economy through the changes in risk appetite of global investors: therefore, the traditional trilemma has morphed into the dilemma. There are two main related questions in the literature. The first question is whether SOEs are in the state of the trilemma or the dilemma. The literature has yet to reach a consensus. Aizenman et al. (2016) and Cerutti et al. (2017) provide evidence for the trilemma. Han and Wei (2016) argued SOEs lie somewhere between the trilemma and the dilemma. I do not directly address

[4]In addition, the context of analysis in Caballero and Simpsek (2020) is on advanced economies, while this paper focuses on EMEs.

the question of the trilemma or the dilemma, but the findings in this paper imply that exchange rate regime does matter, but letting exchange rates float cannot be enough to insulate SOEs from global financial cycle: similarly with Han and Wei (2016), the state is between the trilemma and the dilemma.[5]

Another important question in the literature of global financial cycle is what are the mechanisms behind global financial cycles? and relatedly which countries are more vulnerable to the risk appetite shocks, according to the mechanisms? Few papers such as Akinci and Queralto (2019), Aoki et al. (2018), and Cavallino and Sandri (2019) listed above, using structural models, pioneered transmission mechanisms that risk appetite shocks transmit to EMEs.[6] Many more papers empirically examined different possible transmission channels using cross-country data or micro-level data in a specific EME. Papers worth mentioning here are Aizenman et al. (2016) and Eichengreen and Gupta (2014) that investigated the financial market reactions in EMEs during the tapering tantrum in 2013. Baskaya et al. (2017) document the transmission of the risk appetite shocks to local credit supplies, using Turkish bank-level data.[7] As explained above, this paper contributes to the literature by providing a novel transmission mechanism of global risk-appetite shocks to SOEs. I also provide evidence of the transmission channel from the bank balance sheet data in Korea. In addition, this paper contributes to the literature by providing information of the currency mismatches in EMEs. Using a constructed data set showing the states of IIPs of 20 major EMEs in terms of currencies (local versus foreign) and instruments, I show that for many EMEs, it is hard to explain the transmission of risk appetite shocks as a result of the exchange rate channel since in many EMEs, foreign currency external net foreign currency debts are small or external foreign currency assets exceed the foreign currency debts.

Finally, this paper shares some insights and features with papers that pioneered the implication of heterogeneous financial development among countries on risk sharing in the world and the global imbalance. The related influential papers are Gourinchas and Rey (2014), Mendoza et al. (2009), Caballero et al. (2008), and Maggiori (2017). The central idea in these papers is that in equilibrium, AEs with more developed financial markets will carry more risky assets than EMEs with less developed financial markets so that it generates higher income for AEs from the risky assets and the following current account deficits for AEs. For EMEs, vice versa. My contribution is I take the view to short run dynamics in EMEs and show how the changes in foreign investors' demand for financial securities in EMEs induce fluctuations in the EMEs: The underlying reason behind this is that domestic banks in the EMEs have limited capacity to hold risk assets.

Layout The rest of the paper is organized as follows. Section 2 conducts a simple empirical analysis using the data set and uncovers new facts. Section 3 introduces a small open economy

[5]This is also similar to Obstfeld (2016).

[6]Another related strand of literature looks at how sovereign default risks evolve along with global financial cycle and how it affects EMEs. See Morelli et al. (2019) and Arellano et al. (2020)

[7]See also Georgiadis and Zhu, (2019), Fendoglu et al. (2019), Avdjiev and Hale (2019), and Cesa-Bianchi et al. (2018). Other related influential works are Bruno and Shin (2015a, b). Bruno and Shin (2015a) empirically and theoretically showed that risk appetites of the banks are closely linked through cross asset holdings among the banks. Bruno and Shin (2015b) showed that the US monetary policy is an important factor in determining the risk appetite of global investors.

model. I firstly will introduce a simple model by which I will derive some analytical results capturing the empirical findings. The model illustrates the new transmission channel that risk-appetite shocks to global investors impact EMEs through equity liabilities and LC debts. Section 4 introduces the results of more quantitative studies, using the medium-scale DSGE model based on the simple model. Section 5 concludes and discusses avenues for future researches.

2 Empirical Analysis

In this section, I conduct a simple empirical analysis to see how the fragility of EMEs to global financial shocks is associated with different types of external liabilities—equities, LC debts, and foreign currency debts. The data used in the regressions come from a companion paper Han (2021). In the paper, I hand-collected the data of currency compositions of different types of external liabilities. More precisely, by combining different national sources with International Investment Positions (IIP) dataset from IMF, I can identify seven different types of external liabilities of twenty EMEs[8] — Equity Foreign Direct Investments, Debt Foreign Direct Investments, Local Currency Equities, Foreign Currency Equities, Local Currency Bonds, Other Local Currency Debts (Deposits), and Foreign Currency Debts. In the companion paper, I showed that EMEs have increasingly borrowed abroad in LC equities and debts, and relatedly currency mismatches in the EMEs at the aggregate and the sectoral levels have greatly reduced.

Surprisingly, the simple regression analysis using the novel data shows that in contrast to the usual belief, financial markets in EMEs that have more equity external liabilities and LC external debts seem to be more sensitive to the risk appetite shocks.

2.1 Empirical Strategies

Broadly speaking, the main purpose of the analysis is to find what kind of fundamentals are related to higher fragilities to risk-appetite shocks so that from the information, I can guess specific channels of the transmission to EMEs. In particular, I examine which types of external liabilities— equities, LC debts, and FC debts— are associated with higher fragilities to the global financial cycles. For this purpose, I need a measure of fragility and another measure of the risk appetite shocks. For the risk appetite shocks, I can conveniently use VIX as a measure of it.[9] Therefore, a rise in VIX indicates a higher risk appetite (risk-on), and naturally, a fall in VIX indicates a lower risk appetite (risk-off). Henceforth, I use risk-on/off shocks for shocks to risk appetite of global investors, as the terminology is widely used in market participants and commentators. As measures of the fragility, I can use different variables; financial market prices such as stock indices or exchange rates, quantities in credit markets such as credit growth or real economy variables like GDP growth. Although none of these are perfect, I decide to use monthly percentage changes in financial market prices — stock indices and exchange rates — due to

[8] Argentina, Brazil, Bulgaria, Chile, Columbia, Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, and Turkey

[9] One alternative approach is to use Factor model to estimate co-factor of risky prices in the world. Careful estimation can reveal a more precise measure of global financial cycle, but may not provide a meaningfully different result. Other observable measures are US dollar index as argued in Shin (2016) and US monetary policy shocks. However, all these different measures are hardly much different from VIX.

the following considerations. The credit growth or real variables would adjust to global financial cycle with lags and the lags will be different among EMEs, which forces me not to use a simple and tractable approach.[10] Similarly, by taking responses of financial market prices in a relatively short run (in a month), I can suffer less from possible various endogeneities; for example, in a longer horizon policy authorities in EMEs that experienced bigger market falls take actions to boost the markets.[11] Hence, monthly data is a way to lessen the possible different endogeneities and avoid noises in daily or weekly data.

Another problem I encounter is that the data on external liabilities has a low frequency. While the IIP from IMF and some of local currency debt and equity are quarterly or even monthly, local currency debt and local currency equity data in some EMEs are annual. Furthermore, foreign currency deposits and loans are annual data in all the EMEs. Since the main interest in the regression is to identify different responses to a common risk on/off shock among the EMEs, I take the annual data of all different types of external liabilities; local currency bond, equity, net foreign currency debts, and so on,[12] except for reserves for which I have monthly data for all the sample EMEs. Therefore, in my monthly data, for example, net foreign currency debts of nonfinancial corporate sectors in 2012 are the same from January 2012 to December 2012. This is a little unsatisfactory. However, if I give different frequencies to different types of external liabilities in different EMEs, that might cause a bias toward certain EMEs or certain types of external liabilities. Therefore, taking the annual average is inevitable, although I admit the drawback in my regressions here. However, I would like to emphasize this is the best way to deploy all the available information, while not manipulating the data arbitrarily. Also, the external liabilities are stocks, not flows; hence it cannot change drastically in a month. Furthermore, taking the averages help me with handling possible endogeneities.

As a result, the regression is as in equation (1). The approach extends ideas in Aizenman et al. (2016) and Eichengreen and Gupta (2014) who studied the impact of the 2013 tapering tantrum shock on financial market variables in EMEs. I also borrow some features from Rey (2013).[13] Again, I would like to note that the main interest here is to see how the fragilities to the risk appetite shocks change along with the key variables, amounts of different types of external liabilities—equities, LC debts, and FC debts.

$$y_t^j = \alpha^j + \rho y_{t-1}^j + \delta_0 vix_t + \delta_1 ln\left(VIX_{t-1}\right) + \beta'\left(\Lambda_t^j * vix_t\right) + \Gamma_0'\left(\chi_t^j * vix_t\right) + \Gamma_1' X_t^j + \epsilon_t^j \quad (1)$$

where y_t^j is either of the percentage changes in the nominal bilateral exchange rates of country

[10] Moreover, estimation of the impacts on real economy variables or other quantities with some lags calls for the endogeneity of policy response, which poses another challenge.

[11] Another important benefit of monthly data is the number of observations. My data on local currency external debt has a relatively short time span (from 2011 to 2018), and hence using monthly data of stock indices and exchange rates has the advantage of more observations

[12] Another possible solution to the problem is to take the average over the whole sample, so $\Lambda_t^j = \overline{\Lambda}^j$. This is possible in the regressions without sectoral level currency mismatches since the aggregate level data is rather stable. The results of the whole sample average is introduced in the appendix and the results are similar to the annual averages.

[13] The use of interaction terms between country characteristics and global financial cycle variables like VIX is popular in empirical studies of US monetary policy spillover.

j,[14] denoted by ΔEx_t^j, or the percentage changes in the stock index in country j, denoted by $\Delta Stock_t^j$. Λ_t^j is the key variable in this regression equation. Λ_t^j is a vector of different types of external liabilities and assets to GDP ratios; LC equities to GDP ratio, and similarly for LC debts, FC debts, official reserves, and external assets by private sectors. For other terms, vix_t = *log difference of VIX*, X = the vector of controls,[15] and χ_t^j = the vector of variables representing country characteristics such as trade openness, financial openness, government debt to GDP ratio, and so on. I used Driscoll-Kraay standard errors to handle heteroskedasticity and cross-sectional dependence. However, the results I introduce below are robust to different methodologies to control heteroskedastic standard errors.[16]

In the regression equation (1), VIX is almost exogenous to emerging market stock indices and exchange rates so as to relieve concerns about possible endogeneities. However, another key explanatory variable Λ_t^j is endogenously determined equilibrium outcomes. A reasonable concern is what if Λ_t^j is related to fragilities to global financial cycles.[17] Because of limited data, I cannot rule out all the possible endogeneities, but at the end of this section, I show that a scenario that one easily comes up with does not correspond to the historical data.

2.1.1 Results

I first introduce the results of the exchange rate regressions. For brevity, I introduce only the estimated coefficients of the key variables. The results for other control variables are relegated to the appendix. I denote local currency debts, local currency bond portfolio, local currency equity portfolio, foreign currency debt, foreign currency asset of debt instrument, and foreign currency asset of equity by LCD, LCB, LCE, FCD, FCA_D, and FCA_E respectively.

Surprisingly, it turns out that local currency-denominated debts are highly associated with higher fragilities to the risk appetite shocks in terms of currency, and I get much stronger results once I replace LC debts with LC bonds; I extract LC deposits from LC debts. On the contrary, foreign currency debts are insignificant: no clear relationship between the amounts of foreign currency debts and the measured sensitivities of a currency to the risk appetite shocks. Regarding the asset sides, external assets by private sectors are mostly insignificant, while official reserves are significant in some specifications; more official reserves are associated with lower fragility to risk appetite shocks.

The results introduced above are only for nominal exchange rates and the sensitivities of the market variables to risk appetite shocks in short run. However, despite the limitation, considering that currency depreciation is often understood as a measure of the magnitude of the impact of an external shock on a small open economy, the results in the table must be unexpected and surprising. There are not many studies of the risk-sharing features of local currency-denominated

[14] Hence the higher exchange rate indicates a depreciation of the currency of country j

[15] The set of controls includes inflation, industrial production, monetary aggregates, short-term interest rates of country j, short-term interest rate differential between country j and US, a lag of real effective exchange rate.

[16] Since our main interest is to compare different responsiveness of different countries to common shocks, it is crucial to use methodologies controlling heteroskedastic standard errors.

[17] Since we take the annual data of Λ_t^j, changes in external liabilities in the short run due to risk on/off shocks do not seriously matter. Also, in the appendix, I introduce the results of using a lagged Λ_t^j following the idea of Bartik instrument. I obtain similar or even stronger results.

Table 1: Exchange Rate Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta ln\,(VIX)_t$	0.044***	0.043***	0.040***	0.039***	0.041***	0.041***	0.059***	0.076*
	[0.012]	[0.012]	[0.014]	[0.013]	[0.012]	[0.012]	[0.022]	[0.045]
$\left(\frac{LCD}{GDP}\right)^j_t \times$ "		0.105**						
		[0.043]						
$\left(\frac{LCB}{GDP}\right)^j_t \times$ "				0.176***	0.175***	0.184***	0.254**	0.184**
				[0.066]	[0.053]	[0.069]	[0.112]	[0.080]
$\left(\frac{LCE}{GDP}\right)^j_t \times$ "			0.034			-0.022	-0.013	-0.056
			[0.033]			[0.071]	[0.068]	[0.052]
$\left(\frac{FCD}{GDP}\right)^j_t \times$ "	0.008				0.016	0.008	-0.012	-0.028
	[0.043]				[0.040]	[0.044]	[0.047]	[0.052]
$\left(\frac{FCA\_D}{GDP}\right)^j_t \times$ "					-0.092†	-0.095†	-0.074†	-0.088
					[0.062]	[0.064]	[0.048]	[0.084]
$\left(\frac{FCA\_E}{GDP}\right)^j_t \times$ "					0.010	0.019	0.006	0.026
					[0.019]	[0.038]	[0.031]	[0.028]
$\left(\frac{Reserve}{GDP}\right)^j_t \times$ "	-0.039	-0.071***	-0.041	-0.058**	-0.024	-0.017	-0.038	-0.053†
	[0.029]	[0.024]	[0.029]	[0.026]	[0.044]	[0.057]	[0.044]	[0.035]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	Yes
# of Obs.	1,660	1,660	1,660	1,660	1,660	1,660	1,660	1,660
R-squared	0.069	0.036	0.053	0.055	0.017	0.026	0.122	0.297

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, FCD: Foreign Currency Debt, FCA_D: Foreign Currency External Asset (Debt instrument), and FCA_E: Foreign Currency Asset (Equity). 3) Driscoll-Kraay standard errors. 4) Regression (6) and (7) adds more controls (e.,g oil price, commodity price index and related groups) to regression (5). 5) Time fixed effects are not two-way fixed effects, but time dummies (random effects), because one of the key explanatory variables, the VIX log difference is the time series variable.

debts, but it is straightforward that local currency-denominated bonds have some risk-sharing properties. If any negative shock to a small open economy results in depreciation of the local currency of the small open economy, then the depreciation will reduce the real debt burden, thereby limiting the local currency depreciation in turn.[18] Hence, the standard model predicts that we can see negative coefficients for local currency debt (or bonds), or smaller and less significant coefficients in terms of absolute value than foreign currency debts. A possible way to interpret the results looking seemingly counterintuitive is that LC bond portfolio investments, carry trades by another name, are more sensitive to risk on/off shocks than other types of capital flows such as foreign currency-denominated debts: local currency-denominated bonds are absolutely riskier for global investors. I will show more details using the model in this paper.

Next, I introduce the results of monthly stock indices regressions. It turns out that all the measures of GDP ratios – the type of liabilities to GDP ratios – are insignificant, except for foreign currency liabilities. On the contrary to the GDP ratios, the local currency equity external liabilities to total stock market capitalization ratios, hence foreign investor shares in domestic equity markets, are negative and all significant at least 10% level. That is, the higher the foreign investor shares in the stock market are, the more fragile the stock market is to global financial shocks. Same as the exchange rate regressions, foreign currency debt and asset are

[18] For the related mechanisms, see Fanelli (2018) and Korinek (2009).

Table 2: Stock Indices Regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta ln\,(VIX)_t$	-0.093***	-0.089***	-0.088***	-0.076***	-0.076***	-0.082***	-0.059***	-0.059**
	[0.016]	[0.014]	[0.015]	[0.014]	[0.014]	[0.015]	[0.016]	[0.025]
$\left(\frac{LCE}{GDP}\right)_t^j \times$ "			0.010					
			[0.037]					
$\left(\frac{LCB}{GDP}\right)_t^j \times$ "		-0.003			0.091	0.084	0.145*	0.183*
		[0.092]			[0.096]	[0.100]	[0.091]	[0.089]
$\left(\frac{LCE}{Mkt\ Cap}\right)_t^j \times$ "				-0.072*	-0.093**	-0.093**	-0.103**	-0.105**
				[0.037]	[0.038]	[0.039]	[0.043]	[0.051]
$\left(\frac{FCL}{GDP}\right)_t^j \times$ "	0.016					0.027	0.028	0.020
	[0.041]					[0.042]	[0.040]	[0.050]
$\left(\frac{FCA\_D}{GDP}\right)_t^j \times$ "						-0.015	-0.011	-0.012
						[0.082]	[0.085]	[0.093]
$\left(\frac{FCA\_E}{GDP}\right)_t^j \times$ "						0.003	-0.006	-0.012
						[0.016]	[0.015]	[0.017]
$\left(\frac{Reserve}{GDP}\right)_{t-1}^j \times$ "	0.070**	0.073***	0.071**	0.081***	0.074**	0.076*	0.056	0.027
	[0.030]	[0.029]	[0.030]	[0.030]	[0.030]	[0.043]	[0.044]	[0.047]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	Yes
# of Obs.	1,660	1,660	1,660	1,660	1,660	1,660	1,660	1,660
R-squared	0.070	0.077	0.048	0.060	0.059	0.049	0.083	0.244

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15, †† p<0.20. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, FCD: Foreign Currency Debt, FCA_D: Foreign Currency External Asset (Debt instrument), and FCA_E: Foreign Currency Asset (Equity). 3) Driscoll-Kraay standard errors. 3) Regression (6) adds more controls (oil and commodity price indices along with related groups, government debt) to regression (5). 4) Regression (6) adds trade openness and financial openness, whereas drops commodity prices. 5) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

much insignificant in all the specifications. Other noteworthy results are international reserves help the EME with reducing the impact of risk-on/off shocks on the stock markets, and local currency bond, which is highly correlated with more fragility of local currency in the exchange rate regressions, is positive and weakly significant.

This result looks puzzling as well, but interestingly the results are in line with several preceding papers. Eichengreen and Gupta (2014) documented that EMEs with higher stock market capitalization to GDP ratio or more opening capital markets suffered more from the tapering tantrum shock and Aizenman et al. (2016) also report a similar result; more developed EMEs, which have probably larger capital markets, were dampened more during the market turbulence due to the tapering tantrum; more developed EMEs tend to have larger capital markets and high foreign investor shares in their stock markets. Dedola et al. (2017) showed that there exists a great heterogeneity in terms of the responses of economic variables in EMEs to the US monetary policy shocks, and there is no clear-cut relation between country responses and likely relevant country characteristics, such as income level and the USD exposures.

In the regressions conducted above, foreign currency assets and liabilities are measured on the aggregate level. In a section in the appendix, I replace the aggregate level data with sectoral level currency mismatches. I add net foreign currency debts of the four different sectors—households, financial corporate sectors, nonfinancial corporate sectors, and government. Overall, the results are much the same as the regressions of the aggregate currency mismatch. The local currency bond portfolio is significant in all the regressions. All the net foreign currency assets in different sectors do not show strong enough significance although almost all signs are negative; more net foreign currency assets are associated with higher robustness of the local currency to risk-on/off shocks at least in terms of the sign. I relegate more details in the results and following interpretations to the appendix.

I also conducted various robustness checks; adding more control variables, taking the whole sample period averages of the different types of external liabilities, or one year lag of the external liabilities. All the different trials show similar results with the baseline model.

Discussion of endogeneity One possible interpretation of the results is that some EMEs issue more local currency-denominated securities to foreign investors because the EMEs are more fragile to global financial cycle. The idea follows from a typical risk sharing argument. Both equity and LC debt have properties that payments to foreign investors are counter-cyclical to global financial cycle; payments decrease when there is a negative shock to the risk-appetite of global investors. If there is an EME whose business cycles follow the Global Financial Cycle, then the EME, given other conditions, is incentivized to issue more equities or LC debts to global investors if the global investors are risk-neutral.

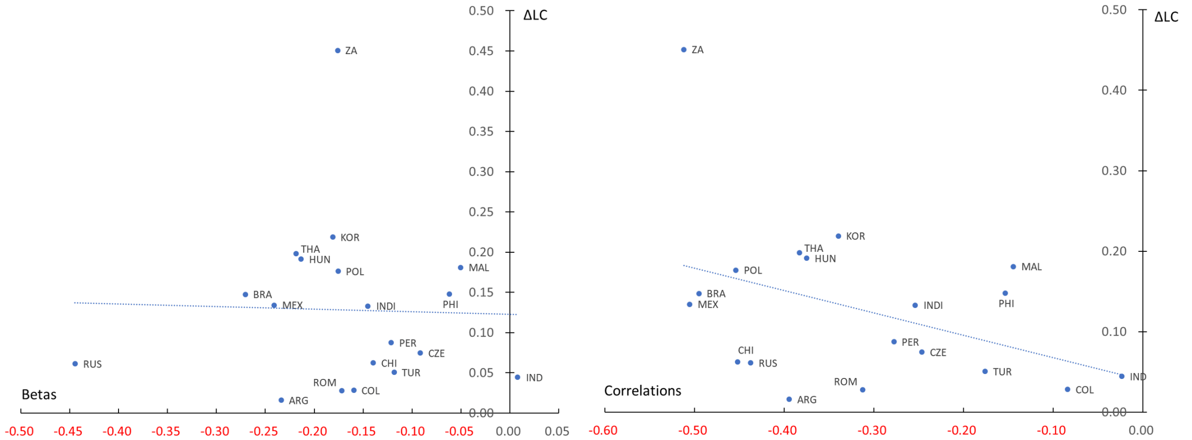
Although I cannot completely rule out the chance of such endogeneity since the data used is not rich enough, I show that at least the results above are unlikely to come from the endogeneity. The empirical results are not because some EMEs with higher exposures issue more equities and LC debts to foreign investors.

First of all, the interpretation that fragile EMEs sell more equities and LC debts to global investors misses the risk appetite shock is a global systemic shock. As typically argued, VIX is a measure of a cofactor of risky assets in the world. Hence, risks measured by VIX are the risks to every investor and it is the same for the global investors, who manage different assets in different countries all over the world. Therefore, assets in EMEs whose business cycles are positively correlated with risk appetite shocks are less attractive to global investors in terms of risk sharing. Then it is straightforward that such EMEs need to provide higher premiums if they want to sell equities and LC debts to global investors. On the other hand, the issuers in EMEs are indifferent between sharing country specific risks and sharing systemic global risks as long as both risks are their own risks. In contrast, global investors would not care much about country-specific risks. As a result, in the argument of frictionless risk sharing, EMEs whose fundamentals are less or negatively correlated with global financial cycle are more incentivized to issue more equities or LC debts to global investors because they can share their risks at lower costs. Altogether, if the risk sharing argument in a frictionless economy works, the signs of the coefficients must be opposite from the two tables. In the appendix, I explain my counter-argument more formally using a simple small open economy model.[19]

Second, historical evidence is unfavorable for the risk sharing argument that more fragile

[19]The overall argument here is related to Hassan et al. (2016) in that risk properties of a currency can attract more or less foreign capitals in the country.

Figure 3: Stock Index Betas and the increase in LC external liabilities



Note: 1) ΔLC=LC external liabilities (equities and LC debts) to GDP ratios in 2018 minus the same ratios in 2001. 2) Left panel includes all the EMEs in the sample, except for Romania and right panel excludes an outliner, Russia.

EMEs issue more equities and LC debts to global investors. If EMEs that were fragile to external financial shocks have issued more local currency-denominated external liabilities—equities and LC debts—to foreign investors, then we should see positive correlations between the fragilities in the past (from 1995 to 2001)[20] and local currency-denominated external liabilities in the present. To check this while avoiding possible complexities, I first estimate the "beta" of each currency and stock indices in the 1990s as follows.

$$y_t^j = \alpha^j + \beta^j vix + \epsilon_t^j \tag{2}$$

where y_t^j is monthly percentage changes in either exchange rates or stock indices, and vix is the percentage changes in Cboe VIX same as the regressions above. I run the regression for each country so that I have twenty betas of exchange rate for 20 EMEs and the same for the stock indices. Then I plot the betas against the amounts of local currency liabilities, including both equities and LC debts, in the 20 EMEs. For exchange rates, for most EMEs, the betas are not significant, reflecting on the fact that many of the EMEs were under fixed exchange rate regimes. Hence, I plot the stock index betas against the increase in local currency liabilities.

As one can easily see, there is no clear relationship between the two variables. Although the exercise is a little crude, upon investigations that have been done so far, there is no clear relationship between the fragility in the past and the current distribution of local currency-denominated external liabilities.

Then, what kind of fundamentals show a significant relationship with the distributions of the equity external liabilities and LC external debts? In the companion paper Han (2021), I show that the depth of capital markets — stock and bonds markets — are correlated with the external liabilities of LC equities and bonds. That is, EMEs having larger stock markets tend to borrow more abroad in the form of equity and similarly, EMEs having larger bond markets tend to borrow more in LC bonds. In a section in the appendix, I suggest a simple model to

[20]This time period is to avoid the eras of hyperinflation in Latin American countries and the time that relative LC external liabilities among the EMES are simialr with the present distribution.

explain the empirical regularities as the model in the appendix is actually a simple extension of the theoretical model in this paper. The interpretation of the theoretical results will also be given in the appendix. I will interpret the facts as results of the risk sharing desires of the global investors, not securities issuers in EMEs.

Summary of empirical findings Before I move on to the model section, I summarize the empirical findings that guide me to build a new model

1. Higher LC debt to GDP ratios are associated with higher sensitivity of nominal exchange rate to global financial shocks, changes in VIX
2. Similarly, higher foreign investor shares in stock markets in EMEs are associated with higher sensitivity of the stock indices to global financial shocks.
3. In both exchange rates and stock indices, no significant relationship is found between foreign currency debts and the fragility to global financial shocks.

3 Model

Having documented that the local currency liabilities are associated with higher fragilities to the risk appetite shocks in opposition to conventional wisdom, I now suggest a model to reveal the mechanisms by which risk appetite shocks to global investors result in large fluctuations in financial markets and the real economy in EMEs, through equity external liabilities and LC debts. To be more specific, the two main purposes of the model are 1) to capture the uncovered empirical regularities in the model, and 2) to study how the impact on the financial markets propagate into financial markets and the real economy in EMEs.

The key insight from the model is that sell-off from global investors cannot be absorbed by domestic investors and it generates a fire sale mechanism. To obtain the insight, I focus on deriving key analytical results and for this purpose, I maintain the minimum ingredients in the model. In the second subsection, in addition to the theoretical results, I provide evidence from bank-level data in Korea, which supports the existence of the new channel in the model.

3.1 Simple Model

The model has three main features, 1) Gertler and Kiyotaki type capital market in that producers issue securities of the claims on the capital like equities in reality, and the securities are purchased by other agents, 2) leverage constraints on domestic banks, and 3) global investors who invest in (LC denominated) domestic capital markets and governments bonds. Other features such as foreign currency debts will be added depending on the purpose. The model is a small open economy model in discrete time with infinite horizon.

3.1.1 Environments

There are six types of agents in the model: workers, goods producers, capital producers, domestic banks, government and global (foreign) investors. Workers supply labor to the goods producers and save in domestic banks in the form of deposits or invest in government bonds. Goods producers produce consumption goods to be consumed domestically or exported, and they issue securities of claims on capitals, which have to be purchased by either domestic banks or global investors. Capital producers supply (or disinvest) capitals depending on the demands from goods producers. Domestic banks take deposits from workers and supply the funds to the goods producers; buying the securities issued by the producers. Government provides fixed amounts of public services and, to fund the activities, collect taxes or issue government bonds. Global investors invest in the securities or government bonds.

The representative household consists of a continuum of bankers and workers with the total population size being normalized to be unity. Each banker member manages a bank (financial intermediary) until he/she retires with probability $1-\sigma$: retired bankers transfer their remaining net worth as dividends, to the household and are replaced by a given number of workers who become new bankers. New bankers receive ξ fraction of total asset from the household as start-up funds in total. Bankers will be described in detail later.

Workers in the model, as usual in the literature, consume both domestic and imported goods, and supply labors. My purpose in this subsection is to derive some intuitive and analytical results from the simple model. For this purpose, I abstract from the labor supply; there is no disutility of labor, and therefore workers supply all the labor endowments. The optimization of the representative household is formulated as follows.

$$\max_{\left\{c_{t+j}^d, c_{t+j}^m\right\}_{j=0}^{\infty}} \mathbb{E}_t \left[\sum \Lambda_{t,t+j} U\left(c_{t+j}^d, c_{t+j}^m\right)\right]$$

$$\textit{subject to } \; c_t^d + \varepsilon_t c_t^m + d_t + b_t^d + \tau_t \leq w_t L + R_t d_{t-1} R_t^g b_{t-1}^d + \pi_t$$

where c_t^d is the domestic consumption good, c_t^m is the imported consumption good, τ_t is the tax payments, b_t^d and d_t are the government bonds and deposits made at time t, R_t^g and R_t are the returns to the bonds and the deposits respectively, from date $t-1$ to date t, and ε_t is the price of imported goods in terms of domestic goods, the terms of trade. Since there is no inflation in the model in this section, the terms of trade is the same as nominal exchange rates. I find it is convenient to take it as a proxy of real exchange rates, whose changes are qualitatively the same as the terms of trade as I implicitly assume foreign price is fixed to 1. Henceforth, I call ε_t real exchange rate.

The per period utility function of the consumptions is given by

$$U\left(c_{t+j}^d, c_{t+j}^m\right) = (1-\omega)\, ln\left(c_{t+j}^d\right) + \omega ln\left(c_{t+j}^m\right)$$

where $\omega \in (0,1)$

Notice that every term in the budget constraint of the works is denominated in local (home) currency. I follow the convention that the exchange rate of a country is the price of the foreign currency in units of the domestic currency, so an increase in the exchange rate is a depreciation in the local currency. β is the discount rate. π_t is the profits from the capital producers and bankers.

The optimality conditions for the workers are characterized by the standard Euler equations.

$$\mathbb{E}_t\left[\beta\frac{U_{c^d_{t+1}}}{U_{c^d_t}}R_{t+1}\right]=1 \tag{3}$$

$$U_{c^d_t}=\varepsilon_t^{-1}U_{c^m_t} \tag{4}$$

Producers As noted earlier, there are two types of producers. Before describing the different types of producers, it is important to clarify that I do not impose any financial frictions on producers: producers can borrow as much as they want. This simplification is consistent with the papers based on Gertler and Kiyotaki (2010) and Gertler and Karadi (2011), which focus on the frictions in financial intermediations.

Goods producers operate in perfectly competitive markets. For simplicity, I assume constant returns to scale Cobb-Douglas production with capital and labor as inputs. That is,

$$Y_t=A_tK_{t-1}^{\alpha}L^{1-\alpha}$$

where K_{t-1} is the total capital stock from the last period and L is the time-invariant labor endowments. The optimization conditions for the producers are as follows.

$$A_t\left(1-\alpha\right)\left(\frac{K_{t-1}}{L}\right)^{\alpha}=w_t \tag{5}$$

Capital producers supply new capitals or divest existing capitals using final goods subject to the adjustment cost of investment. The adjustment cost is characterized as $\Phi\left(I_t\right)$ where $\Phi\left(I_t\right)'$ >0 and $\Phi\left(I_t\right)''>0$. The capital producers' problem is defined as

$$\max_{\{I_{t+j}\}}\mathbb{E}_t\left[\sum\Lambda_{t,t+j}\left(Q_{t+j}I_{t+j}-\left(I_{t+j}+\Phi\left(I_{t+j}\right)\right)\right)\right]$$

where $\Lambda_{t,t+j}$ is the stochastic discount factor and Q_{t+j} is the capital price; of course, it is the Tobin's Q. For tractability, I use the simplest form of the adjustment cost; actually, the capital producer problem is static.

$$\Phi\left(I_t\right)=\frac{\varphi}{2}\left(\frac{I_t}{K_{t-1}}\right)^2K_{t-1}$$

Domestic banks The banks[21] in this paper purchase capital goods in each period by issuing deposits to households and using own net worth. We can think the purchases as channeling funds from households to firms in all available forms in reality: it includes bank loans, bonds, outside equities, and others. Hence, the value of the capitals purchased by the banks must equal the sum of the banks' net worth and the deposits. That is,

$$Q_tk_t^d=N_t+d_t \tag{6}$$

where Q_t is the capital price, N_t is the net worth of the bank, and d_t is the deposit.

[21] The bank here refer to all kinds of financial intermediaries in reality.

The net worth of the bank evolves in the following way.

$$N_t = \sigma\left(\left(z_t + Q_t\right)k^d_{t-1} - R_t d_{t-1}\right) + \xi\left(z_t + Q_t\right)k^d_{t-1} \tag{7}$$

where z_t is the dividends to the capital holdings[22]. For notational convenience, I define $R^k_{t+1} = \frac{z_{t+1}+Q_{t+1}}{Q_t}$. Then the value of the bank net worth is

$$N_t = (\sigma + \xi) R^k_t Q_{t-1} k^d_{t-1} - \sigma R_t d_{t-1} \tag{8}$$

As already noted, the banks are managed by the bankers who were workers in the past; In each period, ξ of workers become bankers and in the other way, σ bankers retire; retired bankers become workers. This retirement eliminates the possibility that banks accumulate retained earnings so that they will eventually nullify all the financing constraints.

Most importantly, domestic banks face leverage constraints. We assume

$$N_t \phi_t \geq Q_t k^d_t \tag{9}$$

ϕ_t is the leverage ratio of the banks and generally, it can be a function of the expected profitability and risks in the future. In this section, I let ϕ_t be a constant ϕ. More general specifications will be used in the next section and I also discuss different specifications in the appendix.

Global investors Global investors are international financial intermediaries who purchase local currency-denominated equities and bonds in the small open economy. Like other components in the model, I model the global investors in a simple way, but also aim to capture key features in reality. Since this paper studies impacts of risk appetite shock on global investors, the global investors in the model need to be risk-averse. While there are different ways, I model global investors as international financial intermediaries under "Value at Risk" (VaR) constraint, following Miranda-Agrippino and Rey (2019) and Zigrand et al. (2010). The key idea in their model is that financial intermediaries are risk-neutral in terms of their preference, but act as they are risk-averse as they face a VaR constraint.

For detailed steps of the derivation, I refer readers to appendix B. The investments of global investors in the equities and local currency bonds in the small open economy are characterized by the following equations.

$$p^k_t = Q_t k^f_t \varepsilon^{-1}_t = \frac{1}{\Gamma e^{v_t}}\left[\chi^0_k + \chi^1_k \mathbb{E}_\mathrm{t}\left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R^k_{t+1} - R^m_{t+1}\left(v_t\right)\right]\right] \tag{10}$$

$$p^b_t = b^f_t \varepsilon^{-1}_t = \frac{1}{\Gamma e^{v_t}}\left[\chi^0_b + \chi^1_\mathrm{b} \mathbb{E}_\mathrm{t}\left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R^b_{t+1} - R^m_{t+1}\left(v_t\right)\right]\right] \tag{11}$$

where both χ^0_k and $\chi^0_b \in (0,1)$. The terms in brackets, $\mathbb{E}_\mathrm{t}\left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R^k_{t+1}\right] - R^m_{t+1}$ are the expected excess returns to the investment in the assets in the small open economy, in which R^m_{t+1} is the

[22]For simplicity, I set the capital depreciation rate as zero.

return to the global market portfolio denominated in foreign currency,[23] like yields on BAA grade corporate bonds in the US, and $\mathbb{E}_t\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R^k_{t+1}\right]$ and $\mathbb{E}_t\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R^b_{t+1}\right]$ are expected returns in foreign currency to equities and local currency bonds in the small open economy. The return to the global market portfolio R^m_{t+1} can, of course, reacts to the risk appetite shocks and thus I let it be a function of the risk appetite shocks. χ_i measures the amounts that the global investors allocate to asset i, regardless of the return, due to the risk management.[24]

The constant terms χ_i are important in deriving sensible quantitative results, but qualitatively do not matter. Hence, depending on the analytical purposes, I assume $\chi^0_i = 0$ or $\chi^1_i = 0$ in this simple version of the model.

$\frac{1}{\Gamma e^{v_t}}$ is a measure of the risk appetite of the investors. As one can easily expect, a lower $\frac{1}{\Gamma e^{v_t}}$ indicates lower risk appetite; i.e., higher Γe^{v_t} indicates lower risk appetite. e^{v_t} captures the time-varying risk appetites of the investors. Thus a positive shock to v_t means a shrink of the risk appetite, as VIX does so in reality; thus v_t is an analogy to VIX. I assume v_t follows an AR (1) process as below.

$$v_t = \rho_v v_{t-1} + \nu_t \tag{12}$$

where $\nu_t \sim N\left(0, \sigma^2_\nu\right)$ and $\rho_v \in (0,1)$. Henceforth, I call $\nu_t > 0$ "risk-off" shock and $\nu_t < 0$ "risk-on" shock.

ν_t is modeled as shocks to the net worth of global investors, who are large international financial intermediaries, adopting the interpretation in Miranda-Agrippino and Rey (2019). Of course, the driving force behind the changes in the risk appetite is not necessarily a shock to the capitals of the global investors. It can be some abrupt changes in the beliefs of the investors or can even be behavioral; for example, changes in the market sentiment. In the context of this paper, adopting a different microfoundation does not alter the specification in this paper or following economic interpretations.

To summarize the discussion, investments of the global investors—local currency equity and bond capital flows to the small open economy— are determined by the two factors: the expected excess return and the risk-appetite.

Government Government in the small open economy has to make an expenditure at the amount of G every period. To make the expenditure, the government collects taxes from households by the amount of τ_t. The tax must be not enough to make the expenditure of G, and hence the government issues one period short-term government bonds B_t, denominated in local

[23]The characterizations in equations (10) and (11) are identical to Gabaix and Maggiori (2015) if I let $\chi_i = 0$ and replace R^* with R^f, the return to the safe asset like the US treasury bills. Gabaix and Maggiori (2015) posits an investor who arbitrage between Japanese Yen denominated government bonds and US dollar goverment bonds, while the investor in my model is arbitraging between different risky assets. Since the benchmark for the investors is a risk asset, the asset, which the global investors in the model compare to the assets in the small open economy should a risky asset.

[24]The forms in equations (10) and (11) are approximations from the result of the optimal portfolio of the global investors who want to maximize the sharpe ratio of her portfolio. Then is it intuitive that the investors allocate some of her funds to some assets despite low returns if the assets have good risk hedging properties. Another possible interpretation is the constant term reflects some stickiness in the portfolio, due to some informational frictions or gravities in capital flows.

currency. The budget constraint is as below.

$$G = \tau_t + B_t - R_t^g B_{t-1} \tag{13}$$

Also, I assume that there is no constraint on holding government bonds. This condition imposes that the return on the government bonds, R_t^g,must be the same as the interest rates on the deposits. That is, $R_t^g = R_t$ by no-arbitrage conditions. In addition, I fix the government bond stock at $\overline{B}$. Therefore, $B_t = \overline{B}$ for all t.

3.1.2 Market Equilibrium

To have market clearing conditions for goods in this model, we need a specification of the exports of the small open economy. I assume that the export demand for goods by foreigners, EX_t, is a decreasing function of the relative price of the export and an increasing function of foreign income. That is,

$$EX_t = \varepsilon_t^{\gamma-1} Y_t^* \tag{14}$$

where $\gamma - 1 > 1$.

The market clearing condition for the capital market, bond market and foreign exchange market are characterized as

$$K_t = k_t^d + k_t^f = K_{t-1} + I_t \tag{15}$$

$$B_t = b_t^d + b_t^f \tag{16}$$

$$NX_t + CF_t = 0 \tag{17}$$

where $NX_t = \varepsilon_t^{\gamma-1} Y_t^* - c_t^m$ and $CF_t = \varepsilon_t^{-1} \left[-R_t^k k_{t-1}^f - R_t b_{t-1}^f \right] + \left[p_t^k + p_t^b \right]$.

The other market clearing conditions – deposits market, imported consumptions goods market, and labor market – are characterized by equations (3), (4), and (5), respectively. The resource constraint is as usual.

$$Y_t = C_t^d + \Phi\left(I_t, K_{t-1}\right) + I_t + G + Ex_t \tag{18}$$

3.1.3 Inspecting the Mechanism

Using the constructed simple model, I illustrate the two different transmission mechanisms by which risk-on/off shocks cause large fluctuations in financial markets and the real economy in EMEs. The first channel is the "capital market channel that changes in domestic capital prices, driven by risk-on/off shocks, impact the asset side of domestic bank balance sheets, and impact the real economy subsequently. The second channel is the rather conventional "exchange rate channel" that local currency depreciation or appreciation impact the liability of the banks. What is new in the exchange rate channel is that the shocks to the foreign exchange market are ignited by LC debt capital outflows and the impacts are amplified by the deleveraging of the domestic banks, if the domestic banks have some net foreign currency debts. The analytical results introduced below match the empirical findings in the last section, and provide ways to "interpret" the correlations observed in the empirical exercise.

Mechanism without foreign currency debt: Capital market channel Now I illustrate the mechanism in the model by which risk-on/off shocks cause fluctuations in financial markets and the real economy in small open economies. In particular, I exclude foreign currency debts in the model so that I can separately describe the channel of how capital flows disrupt the economy without currency mismatches. Since the channel has not extensively been pioneered in the literature despite few recent works of similar mechanisms such as Caballero and Simsek (2020) and Devereux and Yu (2019), I name the channel "capital market channel."

To describe the mechanism, at first I need to explicitly solve the market clearing condition for the capital; $\frac{N_t\phi}{Q_t}\left(=k_t^d\right)+\frac{p_t\varepsilon_t}{Q_t}\left(=k_t^f\right)=K_{t-1}+I_t$. Plugging into the first order condition of the capital producer to the market clearing condition, I can solve for the equilibrium price of the capital.

$$Q_t=\frac{(1-\varphi)+\sqrt{(1-\varphi)^2+4\varphi\frac{N_t\phi+p_t^k\varepsilon_t}{K_{t-1}}}}{2} \tag{19}$$

where $N_t=\sigma\left(\left(z_t+Q_t\right)k_{t-1}^d-R_td_{t-1}\right)+\xi\left(z_t+Q_t\right)k_{t-1}^d$. Since the RHS includes Q_t, the equilibrium capital price is the fixed point of equation (19). Taking the derivative of Q_t with respect to ν_t, the risk-on/off shocks gives

$$\frac{\partial Q_t}{\partial \nu_t}\Big|_{\varepsilon_t}=\underbrace{\left(\frac{\varepsilon_t}{\sqrt{\left(\frac{1-\varphi^{-1}}{K_{t-1}^{-1}}\right)^2+4\varphi\frac{N_t\phi+p_t^k\varepsilon_t}{K_{t-1}^{-1}}}}\frac{dp_t^k}{d\nu_t}\right)}_{First\ Foreign\ Demand\ Shock}\underbrace{\left(1-\frac{(\sigma+\xi)\,k_{t-1}^d\phi}{\sqrt{\left(\frac{1-\varphi^{-1}}{K_{t-1}^{-1}}\right)^2+4\varphi\frac{N_t\phi+p_t^k\varepsilon_t}{K_{t-1}^{-1}}}}\right)^{-1}}_{Second\ Fire\ Sale}<0 \tag{20}$$

If $\frac{dp_t^k}{d\nu_t}<0$ as it should be.[25]

With other conditions that I impose in proposition 1, I can show the risk-off (on) shocks result in falls (booms) in the capital market. To understand the mechanism, notice that there are two types of different investors; domestic banks and global investors. Given other states, risk-off shocks derive down the demand for the capitals from the global investors. For the price to be maintained, the other investor, domestic banks should increase their demands, but it is not possible due to the leverage constraint. Hence, for the capital market to be cleared, the capital price must fall: the foreign demand shock in the first term in RHS in equation (20).

The lower capital price in turn hurts the balance sheet of the domestic banks. To see it, notice the numerator in the second term in RHS in the equation (20) is

$$(\sigma+\xi)\,k_{t-1}^d=\frac{dN_t}{dQ_t}$$

[25] The risk appetite shocks change the expected return $\mathbb{E}_t\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^k\right]$,but if only consistent change along with the directions in the risk appetite shock is $\frac{dp_t^k}{d\nu_t}<0$. For example, if $\frac{dp_t^k}{d\nu_t}>0$ due to the changes in the expected return $\mathbb{E}_t\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^k\right]$,more foreign capitals will inflow into the domestic equtiy market, which raises the current capital price; equivalently raise the capital price so lower the expected return, which is a contradiction.

Thus, the term is the marginal impact of capital price changes on the net worth of the bank. The banks whose net worth get damaged are forced to deleverage and therefore the capital price falls even more, as it is revealed in the second term in the RHS in equation (2019): the negative effects of the risk-off shock are amplified through a form of fire sale mechanism.[26] Now I introduce the first proposition in this paper, summarizing the result above along with other analytical results.

Proposition 1. *(Capital market channel) Assume* $\chi_k^1 = \chi_b^1 = 0$*, then we have*

1) Risk-off (on) shocks cause falls (booms) in capital markets. That is, $\frac{dQ_t}{d\nu_t} < 0$.

2) If $(\sigma + \xi) z_t k_{t-1}^d < \sigma R_t d_{t-1}$*, then capital demands from domestic banks increase in the capital price. That is,* $\frac{dk_t^d}{dQ_t} > 0$*, and therefore* $\frac{dk_t^d}{d\nu_t} < 0$

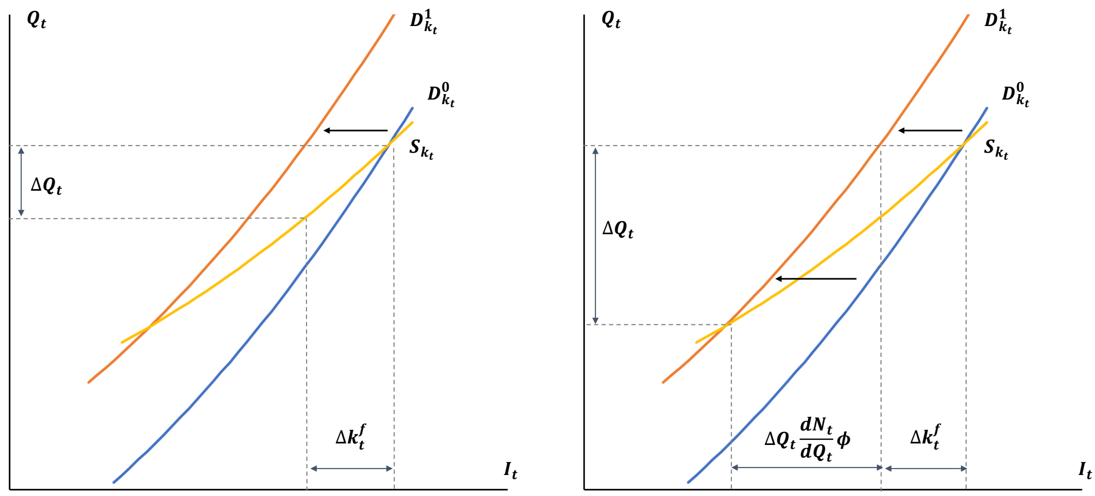
3) Assume $\varphi \left(\phi (\sigma + \xi) k_{t-1}^d + K_{t-1} \left(\varphi^{-1} - 1\right)\right)^2 > 4K_{t-1} \left(\sigma R_t d_{t-1} - (\sigma + \xi) z_t k_{t-1}^d\right)$*. Then impact of risk appetite shock increases in the share of global investors in the capital market* $\widehat{\theta}_t = \frac{p_t^k \varepsilon_t}{N_t L + p_t^k \varepsilon_t}$*, given exchange rate* ε_t*. That is,* $\frac{\partial^2 Q_t}{\partial \nu_t \partial \widehat{\theta}_t} \mid_{\varepsilon_t} < 0$*. Therefore, we have* $\frac{\partial^2 k_t^d}{\partial \nu_t \partial \widehat{\theta}_t} \mid_{\varepsilon_t} < 0$.

The first statement confirms the discussion above. The second statement describes the fire-sale mechanism. Capital price falls lower the net worth, but also increase the amounts of the capital the domestic banks can purchase given net worth. If the fixed amounts of payments to depositors are more than the net dividends from the capital, the "purchasing power" of the domestic banks always increases in the capital price. In other words, the capital demand curve is upward sloping. Then, any shift in the demands from the global banks generates amplification effects through the capital price. This is depicted in figure 4 below. The left panel in the figure shows the first impact of a risk-off shock on the market. A shrink of foreign investment shifts left the demand curve, putting downward pressures on the capital price. Then, as shown on the right panel, the falling capital price decreases the capital demands from the domestic banks, and so does the capital price, because the capital demand from domestic banks increases in the capital price; the demand curve is upward-sloping.

The comparative statics in the third statement matches the empirical results of the cross-country panel regressions. The marginal impacts of risk-on/off shocks on the equity markets increase in the shares of foreign investors in the markets. Intuitively, the risk appetite shocks are the shocks to the demand from global investors and then it is straightforward that the magnitude of the shocks depends on how many other domestic investors (banks in my model) exist in the market or how large the demands from foreign parties are compared to domestic investors: when there are more domestic investors compared to foreign investors in the same market, it must be easier for the domestic investors to absorbs the sell-off from global investors. As a result, the impacts of risk-on/off shocks on the capital price and accordingly the capital demands, investments, increase in the share of the global investors in the market. For more detailed and analytical analysis, I refer readers to the appendix.

[26] In a deeper level, a reason why the risk-off shock results in firs sales lies in the bahaviors of the banks. Banks finance by issuing debts and invest in risky assets and therefore any unexpected changes in the risky asset prices impact the net worth of the banks. Bocola and Lorenzoni (2020) pioneered the microfoundation of such a type of contract and its macroecnomic implications.

Figure 4: Capital Market Channel



Again I note that I deployed the simplest form of leverage constraints. Due to the simplest form, the domestic banks are purely static, which allows me to derive the analytical results. However, some readers may wonder whether the results still hold in an environment where decisions of the banks are more forward-looking, although the banks still face a different form of leverage constraint. The statements in the claim below provide an imperfect answer to the question.

Claim 1. Suppose the leverage ϕ in the model increases in the expected investment profitability, like Gertler and Kiyotaki (2010). Then under the leverage constraint,

1) Risk-off (on) shocks cause falls (booms) in capital markets. That is, $\frac{dQ_t}{d\nu_t} < 0$.

2) Risk-off (on) shocks lower (raise) the net worth N_t, but raises (lowers) the leverage ϕ_t. That is, $\frac{dN_t}{d\nu_t} < 0$ and $\frac{d\phi_t}{d\nu_t} > 0$

3) If the risk appetite shock is persistent enough, that is ρ is large enough, then risk-off (on) shocks lower (raise) the capital demand from domestic banks. That is, $\frac{dN_t}{d\nu_t}\phi_t + N_t\frac{d\phi_t}{d\nu_t} < 0$.

The statements in the claim are hard to prove analytically in a robust way and I discuss more details in appendix. However, the statements are intuitive.

First, it is intuitive that capital demand shocks from foreign investors cause similar results with the simple model as long as domestic banks cannot adjust their demands enough due to a form of leverage constraint. One difference from the simple model is the leverage ratio ϕ_t changes in the opposite to the net worth N_t. In the models in the papers mentioned above and many others, the leverage ratio is a function of the profitability of the investments or underlying risk of it. Since the risk-on/off shock follows an AR(1) process, the capital demands from global investors will be gradually recovered. That makes the domestic banks expect the capital price will gradually rise, which makes the banks able to raise leverage.

The third statement in the claim suggests the condition where the fire-same mechanism is preserved in the sense that the risk-off (on) shocks lower the capital demands from domestic banks as well.[27] Intuitively, if the risk-off shock is persistent, i.e., the demands from global banks will be low in the near future, then it lowers the expected profitability of the investment in the future. The capital price will eventually rise, but the recovery will be delayed as the shock becomes more persistent. Expected profit in a more distant future will be discounted more so that the bank cannot raise her leverage enough to increase capital demands.

We have analyzed the capital market equilibrium while taking exchange rates as given. The exchange rates will be also heavily affected by the risk appetite shock. Before I illustrate the results, I remind readers that I have not introduced foreign currency debts in the model so that local currency depreciation does not induce negative effects by itself. In addition, in the analysis of exchange rate, I assume $\chi_i^0 = 1$ for the analytical purpose, in contrast to what I assumed in proposition 1. Of course, the qualitative results and the underlying intuition are not altered depending on the different assumptions.

Recall $p_t^k = \frac{1}{\Gamma(\theta^i)e^{v_t}}\left[\mathbb{E}_t\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^k\right] - R_{t+1}^m(v_t)\right]$ as I assumed $\chi_k^0 = \chi_b^0 = 0$. I find it is convenient to formulate p_t^k and p_t^b as below.

$$p_t^i = \frac{1}{\Gamma e^{v_t}} S_t^i$$

where $i \in (k, b)$ and $S_t^i = \mathbb{E}_t\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^i - R_{t+1}^m\right]$. Then $\frac{dp_t^k}{d\nu_t}$ is as follows.

$$\frac{dp_t^k}{d\nu_t} = -p_t^k + \frac{1}{\Gamma e^{v_t}}\left(\frac{dR_t^{k^*}}{d\nu_t} - \frac{dR_{t+1}^m}{d\nu_t}\right)$$

where $R_t^{k^*} = \frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^k$ and see $\frac{dS_t^k}{d\nu_t} = \frac{dR_t^{k^*}}{d\nu_t} - \frac{dR_{t+1}^m}{d\nu_t}$. For the simplicity, I assume as follows.

Assumption 1. $\frac{dR_t^{k^*}}{d\nu_t} > \frac{dR_{t+1}^m}{d\nu_t} > \frac{dR_t^{b^*}}{d\nu_t}$ *and therefore* $\frac{dS_t^k}{d\nu_t} > 0 > \frac{dS_t^b}{d\nu_t}$

This assumption allows me to have a nice closed form without concerns about the expectation. Intuitively, although the return to the risky capitals rises following a risk-off shock, if expected returns to all risky assets in the world rise, then global investors will not allocate more funds to the capitals in the small open economy. However, the rise in the global portfolio return is not necessarily lower than the rise in the return to the capital investment in the small open economy. Hence, the assumption is adopted to derive a clean result conveniently, and of course, I will remove the assumptions in a more general model in the next section.

From the foreign exchange market clearing condition, we can derive the equilibrium exchange rate as below.

$$\varepsilon_t = \left(\frac{\varepsilon_t c_t^m + R_t^k k_{t-1}^f + R_t^b b_{t-1}^f - \varepsilon_t\left[p_t^k + p_t^b\right]}{Y_t^*}\right)^{\frac{1}{\gamma}} \tag{21}$$

Taking a derivative of ε_t with respect to ν_t and a manipulation gives

[27] This result is similar with Itskhoki and Mukhin (2019), which documents noise trade shocks in foreign exchange markets generate observed pattern in real eschagne rates provided that the noise trader shock is persistent enough.

$$\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} = \frac{Y_t^*\left[\left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right)\eta_t^b + \left(1-\frac{dS_t^k/d\nu_t}{S_t^b}\right)\eta_t^k + \frac{\varepsilon_{t-1}}{\varepsilon_t}\frac{dR_t^k}{d\nu_t}g_t^{Y^*}\eta_{t-1}^k\right] + \frac{dc_t^m}{d\nu_t}}{Y_t^*\left(\gamma\varepsilon_t^{\gamma-1}+\eta_t^k+\eta_t^b\right) - c_t^m} \tag{22}$$

where $\eta_t^k = \frac{p_t^k}{Y_t^*}$ and $\eta_t^b = \frac{p_t^b}{Y_t^*}$. Unlike the capital price Q_t where I take the exchange rate as given, I here take Q_t as a function of the ν_t on purpose. I can solve for $\frac{d\varepsilon_t}{d\nu_t}$ more explicitly and then I can easily show $\frac{d\varepsilon_t}{d\nu_t} > 0$ under the assumptions that I impose in the proposition.

The mechanism behind it is straightforward. For the risk-off shock, capital outflows driven by the shock reduce foreign currency liquidity in the foreign exchange market so that the price of the foreign currency, the exchange rate rises; local currency depreciates. What is also interesting is $\frac{d\varepsilon_t}{d\nu_t}$ decreases in Y_t^*, which is the base of foreign demands for exporting goods from the small open economy. Given the same trade openness, Y_t^* proxies the size of the economy, GDP. η_t^k and η_t^b measure (or proxies) the equity external liability to GDP ratio and the LC debts to GDP ratio respectively.

Note $\left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right) > 1$, but $\left(1-\frac{dS_t^k/d\nu_t}{S_t^b}\right) < 1$ because of the assumption 1. That is, the "coefficient" in front of η_t^b, $1-\frac{dS_t^b/d\nu_t}{S_t^b}$, is larger than 1, while the coefficient of η_t^k is smaller than 1. Recall $\frac{dp_t^b/d\nu_t}{p_t^b} = \left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right)$ and equivalently for $1-\frac{dS_t^k/d\nu_t}{S_t^b}$. Hence, the larger coefficient of η_t^b means $\frac{dp_t^b/d\nu_t}{p_t^b} > \frac{dp_t^k/d\nu_t}{p_t^k}$. In other words, during a risk-off event, the bond portfolio investments outflow more than the equity (capital) portfolio investments. It is directly driven by the assumption, but we can interpret the result intuitively. The increases in the return to the LC bond in foreign currency mostly come from local currency depreciation, whereas the increases in the return to the capital come from both capital price falls and local currency depreciation. Then in a risk-off event, the return to the LC bonds (in foreign currency) cannot increase as much as the capital, equity. More intuitively, higher expected return due to equity price falls incentivize the equity foreign investors to stay in the market.

Now, I can show the rate of marginal depreciation (appreciation) due to risk-off (on) shocks increases in η_t^b, but it is inconclusive for η_t^k. Intuitively, higher η_t^b means more bond portfolio investment capital outflows compared to the size of the economy. To explain more, the local currency sell-off of global investors in the foreign exchange market must be absorbed by the foreign currency suppliers in the market, exporters. If there is too much capital outflows for the exporters to take up, the local currency must depreciate; the price of local currency must fall. In contrast, whether the rate of marginal depreciation (appreciation) increases or decreases in η_t^k is subtle since the equity portfolio investment capital flows are less sensitive to the risk appetite shocks as I assume $\frac{dR_{t+1}^{k*}}{d\nu_t} > \frac{dR_{t+1}^m}{d\nu_t}$; the falls in the capital market attract more global investors by gifting them higher expected returns. This explains why we cannot see the significance of equity portfolio investment to GDP ratios in the exchange rate regressions.

Furthermore, capital price fall also reduces capital outflows; lower capital price lowers amounts of the capital outflows so as to give less local currency depreciations ($\frac{dR_t^k}{d\nu_t} < 0$). If $\eta_{t-1}^k \approx \eta_t^k$, as it should be in the data, then the equation (22) will be

$$\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} \approx \frac{Y_t^*\left[\left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right)\eta_t^b+\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}+\frac{\varepsilon_{t-1}}{\varepsilon_t}\frac{dR_t^k}{d\nu_t}\right)\eta_t^k\right]+\frac{dc_t^m}{d\nu_t}}{Y_t^*\left(\gamma\varepsilon_t^{\gamma-1}+\eta_t^k+\eta_t^b\right)-c_t^m} \tag{23}$$

Then it is even more clear why the equity-GDP ratio interaction terms are not significant in the exchange rate regression. The "coefficient" in front of η_t^k is much smaller than η_t^b or it can be even a negative number.

As a result, I have shown the transmission mechanism of how the risk appetite shocks change financial markets in EMEs in an environment where the external liabilities of the EMEs are equities or LC debts. I also provided comparative statics matching the results in the regressions. I summarize the theoretical findings in the proposition below.

Proposition 2. *Assumption 1 holds and assume further* $\frac{\gamma\varepsilon_t^{\gamma-1}}{1-\omega} > -\frac{dS_t^b/d\nu_t}{S_t^b}\eta_t^b$ *and* $p_t^b\left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right) > -p_t^k\left(1+\frac{dQ_t}{d(p_t^k\varepsilon_t)}\left(\frac{\omega}{1-\omega}\varphi^{-1}-k_{t-1}^f\right)\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right)$, *then we have*

1) For $\frac{dS_t^k/d\nu_t}{S_t^k}$ *small enough,* $\frac{dQ_t}{d\nu_t}<0$.

2) Risk-off (on) shocks depreciate (appreciate) the local currency. That is, $\frac{d\varepsilon_t}{d\nu_t}>0$.

3) Given ε_t*, impact of risk appetite shock increases in LC debts to GDP ratio, but the impact can either increase or decrease in the equity external liability to GDP ratio. In addition, the marginal impact is always larger for LC debts, . Thast is, if I define* $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}\equiv h_t\left(\eta_t^b,\eta_t^k\right)$

$$\frac{\partial h_t}{\partial \eta_t^b} > 0 > \frac{\partial h_t}{\partial \eta_t^k} \quad or \quad \frac{\partial h_t}{\partial \eta_t^b} > \frac{\partial h_t}{\partial \eta_t^k} > 0$$

The first statement is to assure the finding in proposition 1 and the other statements summarize the impacts of risk appetite shocks on foreign exchange markets. Of course, the impacts on the financial markets propagate into the real economy. Thanks to the simple structure in the model, we can easily characterize the impacts on the real economy in the corollary below.

Corollary 1. *Assume that* $\frac{dI_t}{d\nu_t}+\frac{\partial EX_t}{\partial\varepsilon_t}\frac{d\varepsilon_t}{d\nu_t}>0$. *Risk-off (on) shocks lower (raise) investments and raise (lower) net exports. That is,*

$$\frac{dI_t}{d\nu_t}<0 \quad \text{and} \quad \frac{d\left(NX_t\right)}{d\nu_t}>0$$

The assumption is made to rule out a peculiar case and it is stronger than necessary. The corollary captures typical reactions of small open economy to risk appetite shocks: risk-off shocks result in falls in investments, while raising net exports. In the case of risk-off shocks, weaker demands from global investors and idle financial intermediations of the domestic banks due to the lower asset prices altogether induce less funding from households and foreign investors to the domestic corporate sector, which subsequently diminishes investments of the corporates.

The impacts of the risk appetite shocks on net exports are less obvious. The easiest way to see the comparative statics is to look at the foreign exchange market equilibrium condition, $NX_t + CF_t = 0$. Also, it is easy to see that higher exchange rates reduce imports through the "intra-substitution" effects and elevate exports.[28] The relationship between exchange rate and net export here is based on the assumption of Producer Currency Pricing (PCP), and a more realistic assumption is Local Currency Pricing (LCP) or Dominant Currency Pricing (DCP). However, the impact on net export above is driven through the equality between the capital account balance and the current account balance. In the simple model, I maintain the PCP assumption to focus on the key insights and implications of the "pricing to market" in the context of risk appetite shock transmission will be pioneered in an extended model, which is introduced in appendix, and in a more general model in the next section.

Another important observation in corollary 1 is that the risk-on/off shocks cause two opposing effects on GDP. A risk-off shock decreases investments (lower aggregate demands), but at the same time, the shock increases net exports (higher aggregate demands). GDP in this simple model is invariant to the risk-on/off shock because of the absence of nominal rigidity, but the two opposing effects become more clear in a model with nominal rigidity, as I will show in the next section, limiting the impacts of risk-on/off shocks on GDP. This mechanism echos the findings in Blanchard et al. (2016) in that the paper also suggests two opposing effects of capital flows on small open economy. In their paper, non-bond capital inflows generate domestic booms through lower rates on the non-bond assets, but the inflows decrease exports of the small open economy as the inflows appreciate the local currency,[29] dampening the effects through the non-bond assets. It is important to be aware of the two opposing effects to adequately assess the quantitative importance of risk-on/off shocks for the real economy in EMEs. We will back to this point in the next section.

Exchange rate channel Now I study the traditional exchange rate transmission channel. In environments where financial corporates have sizable net foreign currency debts, risk-appetite shocks naturally lead to local currency depreciation so as to dampen the balance sheets of the corporates in EMEs. Such exchange rate channel has long been studied in the literature and is at the cores of recent influential papers.[30] Although the key mechanism is the same in this paper, the local currency depreciation, and subsequent deleveraging of domestic banks are initiated by capital outflows in the form of equities or LC debts. Also, the exchange rate channel interacts

[28] On the contrary, the intertemporal substitution effects and income effects are subtle. Whether the interest rate on the deposit R_{t+1} will rise or fall is subtle. The capital outflow from the government bond market pushes up the interest rate, while the savings by households given interest rate increase or decrease, depending on the income effects. In terms of income effect, the local currency depreciation and the drop in capital price generate positive income effects by reducing payments to global investors. However, the local currency depreciation and low capital price cause higher expected "rents" for the global investors so as to increase payments to global investors in the future; the mechanism is somehow similar to Fanelli and Straub (2019). On the other hand, low capital stocks in the future also generate negative income effects and the negative effects will be larger as the shock is more persistent, as we can reasonably assume.

[29] In fact, the model mechanism itself is similar to Blanchard et al. (2016) in that both my model and the model in Blanchard et al. (2016) assume imperfect substitutability between different assets and constrained foreign investors.

[30] See Aoki et al. (2018), Akinci and Queralto (2019), and Bocola and Lorenzoni (2019)

with the capital market channel, forming a negative loop mechanism of the risk appetite shocks.

To add foreign currency debts to the model, I now assume that domestic banks can borrow abroad in the form of foreign currency debt. Let's denote local currency debt and foreign currency debt by d_t and d_t^* respectively. In addition, R_{t+1}^* denotes the borrowing rate on foreign currency debts. Then, the bank balance sheet is

$$Q_t k_t^d = N_t + d_t + \varepsilon_t d_t^* \tag{24}$$

For notational convenience, I define

$$D_t \equiv d_t + \varepsilon_t d_t^*$$
$$\widetilde{R}_{t+1}\left(\varepsilon_{t+1}\right) \equiv R_{t+1}\frac{d_t}{d_t + \varepsilon_t d_t^*} + \frac{\varepsilon_{t+1}}{\varepsilon_t} R_{t+1}^* \frac{\varepsilon_t d_t^*}{d_t + \varepsilon_t d_t^*}$$

Then, the net worth is

$$N_t = (\sigma + \xi)\left(z_t + Q_t\right) k_{t-1}^d - \sigma\left(\widetilde{R}_t\left(\varepsilon_t\right) D_{t-1} + \Theta\left(\varepsilon_{t-1} d_{t-1}^*, D_{t-1}\right)\right) \tag{25}$$

where $\Theta\left(\varepsilon_{t-1} d_{t-1}^*, D_{t-1}\right)$ is the management cost of foreign currency debts, which I will describe below.

See that $\widetilde{R}_t\left(\varepsilon_t\right)$ does increase in the exchange rate. That is, the debt burden after the realization of the exchange rate rises as the local currency depreciates. Then from (25), it is easy to see local currency depreciation (higher ε_t) dampens the net worth of the bank. The marginal impact of risk appetite shock on the capital price is

$$\frac{dQ_t}{d\nu_t} = \underbrace{\left(\frac{\left(p_t^k - \sigma R_{t+1}^* d_t^* \phi\right)}{\varXi_t\left(N_t, p_t^k \varepsilon_t\right)}\left(\frac{d\varepsilon_t}{d\nu_t}\right) + \frac{\varepsilon_t}{\varXi_t\left(N_t, p_t^k \varepsilon_t\right)}\left(\frac{dp_t^k}{d\nu_t}\right)\right)}_{\textit{First Foreign Demand Shock}} \cdot \underbrace{\left(1 - \frac{(\sigma + \xi)\, k_{t-1}^d \phi}{\varXi_t\left(N_t, p_t^k \varepsilon_t\right)}\right)^{-1}}_{\textit{Second Fire Sale}} < 0 \tag{26}$$

where $\varXi_t(\cdot) = \sqrt{(\varphi - 1)^2 + 4\varphi \frac{N_t \phi +}{K_{t-1}^{-1}}}$. If $p_t^k - (1 - \sigma) R_{t+1}^* d_t^* \phi < 0$, local currency depreciations dampen the net worth of domestic banks so as to expedite capital price fall.

Similarly, I can characterize the impacts of risk appetite shocks on the exchange rate in environments where domestic banks have net foreign currency debts. The equilibrium exchange rate is characterized as follows.

$$\varepsilon_t = \left(\frac{\varepsilon_t c_t^m + R_t^k k_{t-1}^f + R_t b_{t-1}^f - \varepsilon_t\left[p_t^k + p_t^b\right] - \varepsilon_t\left[d_t^*\left(Q_t\left(v_t\right), v_t\right) - R_t^* d_{t-1}^*\right]}{Y_t^*}\right)^{\frac{1}{\gamma}} \tag{27}$$

In equation (27), it is important to notice that the foreign currency borrowing d_t^* depends on Q_t. Intuitively, lower capital price induces deleveraging of the banks and accordingly less borrowing abroad. To see it more clearly, let's look at the optimal borrowing decision of domestic banks. Because of the leverage constraint, the only optimal decision of the domestic bank is to choose between domestic deposits and foreign currency debts. To characterize the foreign currency borrowing explicitly, I borrow an assumption from Aoki et al. (2018). Let's suppose domestic banks face the management cost of foreign currency borrowing.

$$\Theta\left(\varepsilon_t d_t^*, D_t\right) = \frac{\psi}{2} x_t^2 D_t \tag{28}$$

$\Theta(\cdot)$ is the management cost and x_t is the foreign currency debt ratio $\frac{\varepsilon_t d_t^*}{d_t + \varepsilon_t d_t^*}$. To make it more tractable, I assume the management cost will be paid next period; $\Theta\left(\varepsilon_t d_t^*, Q_t k_t^d\right)$ is paid in time t+1. Then the foreign currency borrowing will be

$$d_t^* = N_t\left(\phi - 1\right) \frac{\mathbb{E}_t\left[R_{t+1} - \frac{\varepsilon_{t+1}}{\varepsilon_t} R_{t+1}^*\right]}{\psi \varepsilon_t} \tag{29}$$

Therefore, the foreign currency borrowing increases in N_t. Intuitively, as the bank deleverages due to negative shocks to its own capitals, the bank does not need to borrow from either depositors or foreign investors, thereby reducing foreign currency borrowing; less foreign currency supplies to the foreign exchange market. Now we can derive the comparative statics $\frac{d\varepsilon_t}{d\nu_t}$.

$$\frac{d\varepsilon_t / d\nu_t}{\varepsilon_t} = \frac{Y_t^*\left[\eta_t^b\left(1 - \frac{dS_t^b/d\nu_t}{S_t^b}\right) + \eta_t^k + \frac{\varepsilon_{t-1}}{\varepsilon_t}\frac{dR_t^k}{d\nu_t} g_t^{Y^*} \eta_{t-1}^k\right] + \frac{dc_t^m}{d\nu_t} - \left(\frac{\partial d_t^*}{\partial Q_t}\frac{dQ_t}{d\nu_t}\right)}{Y_t^*\left(\gamma \varepsilon_t^{\gamma-1} + \eta_t^k + \eta_t^b\right) - c_t^m + \left(d_t^* - R_t^* d_{t-1}^*\right) - \varepsilon_t\left(\frac{\partial d_t^*}{\partial \nu_t}\right)} > 0 \tag{30}$$

Since $\frac{\partial d_t^*}{\partial Q_t} > 0$ and $\frac{dQ_t}{d\nu_t} < 0$, the falls in the capital price due to risk-off shocks amplify local currency depreciation.[31]

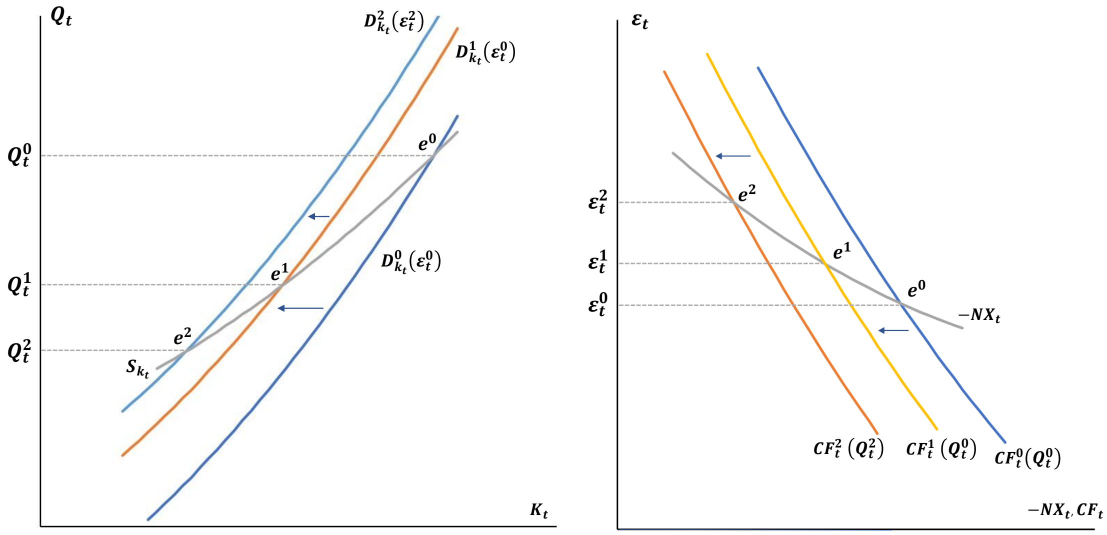
As a result, the falling capital price and rising exchange rate interact with each other, forming a negative loop mechanism, as illustrated in figure 5. To illustrate the mechanism in figure 5, let's again think of a risk-off scenario. The risk-off shock induces falls in the capital price and the local currency, higher exchange rates as we saw above. Now think of the equilibrium in the capital market and foreign exchange market separately. In the capital market, the risk-off shocks shift left the capital demand curve, given exchange rate ε_t^0. Similarly, the risk-off shock shift left the net capital inflow curve, given the capital price Q_t^0. Given the initial capital price and exchange rate alternatively in the capital and foreign exchange market, the "imaginary" equilibrium in the capital market and foreign exchange market move from e^0 to e^1. Then, the higher exchange rate obviously raises the real debt burden of the domestic bank, which reduces the net worth of the banks and in turn forces the banks to buy less capital, as it is in equation in (30). In the same way, the lower capital price expedites the deleveraging of the banks; banks are forced to take less deposits and borrow less in foreign currency debts, reducing the capital inflows. As a result, both the capital demand curve and the capital inflow curve shift left further, resulting in even lower capital price and higher exchange rate in equilibrium e^2 in figure 5.

I summarize this finding in proposition 3.

Proposition 3. *Suppose domestic banks have positive net foreign currency debts, that is* $d_t^* > 0$. *Then we have*

[31] The statement should be understood as effects other than through the capital price, the term $\left(\frac{dQ_t}{d\nu_t}\right) k_{t-1}^f$

Figure 5: Market Crashes from Risk-Off Shocks



1) Local currency depreciation (appreciation) lowers (raises) net worth of domestic banks. That is, $\frac{\partial N_t}{\partial \varepsilon_t} < 0$.

2) Impact on the capital price is amplified through the exchange rate and the impact on the exchange rate is amplified through the capital price. That is, given $p^k_t - (1-\sigma)\, R^*_{t+1} d^*_t L < 0$ *and holding other states,* $\mid \frac{dQ_t}{d\nu_t} \mid$ *increase in* $\frac{d\varepsilon_t}{d\nu_t}$*, and* $\frac{d\varepsilon_t}{d\nu_t}$ *increases in* $\mid \frac{\partial d^*_t}{\partial Q_t} \frac{dQ_t}{d\nu_t} \mid$

The statements in the proposition summarize the discussion above. An important note is that although the quantitative effects from the currency mismatch (in an EME whose liabilities are mostly foreign currency debts) may be larger, the capital price fall driven by foreign investors' disposal of the assets does a role in igniting the negative feedback loop. In other words, outflows in the LC portfolio investments work as a trigger of the negative feedback loop.

One discrepancy between the prediction from the model and my empirical results is that there is no statistically significant effect of sizable net foreign currency debts of nonfinancial corporate sectors in the empirical results, while the model predicts these debts should matter. While I cannot completely resolve the discrepancy, I suggest an extended model to explain the insignificance. The extended model borrows some insights from the literature of pricing in international trade. Many of the nonfinancial corporates in EMEs are exporters and the prices in the exporting goods are denominated in key currencies such US dollar, while many of their costs, like wages, are denominated in local currency. Then local currency depreciation boosts the profitability of exporters; costs are given, whereas the revenues from exports in local currency increase. If more foreign currency debts are positively associated with more benefits to exporters from local currency depreciation, higher net foreign currency debts of nonfinancial corporate sectors do not necessarily lead to higher fragility. I refer interested readers to the appendix.

3.2 Microlevel Evidence of the Capital Market Channel

The capital market channel is newly introduced in this paper although few preceding papers have a similar mechanism in their models. While there are plenty of evidence regarding the exchange rate channel using micro-level data[32], evidence of the new channel from micro-level data has not been reported, to the best of my knowledge. Thus, I provide evidence proving the existence of the capital market channel, using bank balance sheet data in Korea.

The model in this paper is a representative agent model and there is only one bank (or numerous identical banks) in the model. However, in reality, there are different banks with different exposures to the shocks to capital markets from global financial shocks. Abusing the implications from the model, the model predicts that, given impacts on the domestic capital markets, banks whose assets are more centered on risky financial securities and leverages are higher should be more impacted than others: for example, a risk-off shock will force almost all domestic banks to reduce their risky asset holdings, but the magnitude should be larger for banks with more risky assets and higher leverages.

To test the "hypothesis," I deploy the balance sheet data of Korean financial intermediaries. Similarly with many countries, certain "investment bank" type financial intermediaries in Korea have important roles in equity and bond markets, capital markets. I can access the data provided by the regulatory in Korea. The data of course includes basic information of each of the investment bank; e.g., total asset, net worth, and liabilities. Further, the data includes more detailed information on the composition of the asset and liabilities of the investment banks. The data shows how much foreign (mostly USD) currency debts or Korean won debts each investment bank has. More importantly, the data shows the composition of assets of each investment bank; the assets are classified as corporate bonds (in different categories), government bonds, equities, loans, cash or cash-like assets, tangible assets such as buildings, and so on.[33]

Deploying the available information and avoiding more complexity, first I estimate how the risk-on/off shock impact the price of different securities in Korea, which are held by investment banks. Then I compute the exposure of each investment bank to risk on/off shocks. After estimating the exposures, I finally how the asset growth of each investment bank is affected by the exposure and leverage of each investment bank. I relegate the detailed estimation procedure to the appendix and put the estimation equation below.

First I estimate the price elasticities of different securities with respect to unexpected changes in VIX.

$$ln\left(Q_{i,t}\right) = c_i + \delta_i \left[ln\left(\mathrm{VIX_t}\right) - \mathbb{E}_{t-1}\left[ln\left(\mathrm{VIX_t}\right)\right]\right] + \varepsilon_{i,t} \tag{31}$$

Then $\delta_i \left[ln\left(\mathrm{VIX_t}\right) - \mathbb{E}_{t-1}\left[ln\left(\mathrm{VIX_t}\right)\right]\right]$ gives me changes in the price if security i due to changes in VIX. Using it, I can estimate the gains or losses of capital of each investment bank from

[32] See Baskayaa et al. (2017) and Hardy (2018).

[33] It would be more ideal to have security level information; for example, equity or corporate bond of what firms held by each of the investment bank. Unfortunately, I do not have such detailed information and I am still seeking more detailed information at the time of this writing.

Table 3: Capital Market Channel Regressions

	(1)	(3)	(2)	(4)	(5)	(6)	(7)
$\Delta ln\left(A^R_{i,t-1}\right)$	-0.140†	-0.114†	-0.112†	-0.115	-0.110	-0.105	-0.104
	[0.089]	[0.074]	[0.075]	[0.078]	[0.778]	[0.074]	[0.074]
$\chi_{i,t}$	1.701**		1.417**	0.608	0.881	0.955	0.904
	[0.819]		[0.603]	[0.941]	[0.674]	[0.673]	[1.31]
$\frac{A^R_{i,t-1}}{N_{i,t-1}} \times \chi_{i,t}$		1.973**	1.928*	2.047**	2.205*	2.423*	2.515*
		[0.961]	[0.922]	[0.976]	[1.186]	[1.450]	[1.472]
$\frac{C_{i,t-1}}{A_{i,t-1}} \times \chi_{i,t}$				3.706	3.660	3.607	4.009
				[3.200]	[3.263]	[3.190]	[3.308]
$\frac{S_{i,t-1}}{A_{i,t-1}} \times \chi_{i,t}$					-2.519	-2.936	-2.949
					[4.720]	[4.885]	[4.890]
$size_{i,t-1} \times \chi_{i,t}$						-44.276	-59.178
						[63.946]	[66.958]
$\frac{A^R_{i,t-1}}{N_{i,t-1}}$		-0.041**	-0.041**	-0.041**	-0.037**	-0.032**	-0.032**
		[0.016]	[0.016]	[0.016]	[0.015]	[0.015]	[0.015]
$\frac{C_{i,t-1}}{A_{i,t-1}}$				-0.029	0.003	-0.023	-0.020
				[0.345]	[0.346]	[0.344]	[0.342]
$\frac{S_{i,t-1}}{A_{i,t-1}}$					-0.119†	-0.181**	-0.184**
					[0.074]	[0.081]	[0.083]
$size_{i,t-1}$						-1.812	-1.814
						[1.237]	[1.229]
$Bank\ Dummy \times \chi_{i,t}{}^{3)}$							2.693*
							1.504
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	No
Observation #	909	899	899	899	899	899	899
R-squared	0.093	0.123	0.124	0.124	0.128	0.133	0.133
# of banks	35	35	35	35	35	35	35

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) Sample periods 2005 Q1 ~ 2016 Q4 23 S: Total financial security holdings, N: Net worth, C: Cash or Cash alike assets, A: Total asset, and A^R: the total assets, excluding cashes and tangible assets. 3) Bank Dummy indicates that the interaction of the the gains/losses and dummy variable of investment banks owned by commerical banks.

risk-off/on shocks. I computed as follows.

$$\chi_{i,t} = \theta'_{i,t-1}\delta \cdot \left[ln\left(\mathrm{VIX_t}\right) - \mathbb{E}_{t-1}\left[ln\left(\mathrm{VIX_t}\right)\right]\right] \tag{32}$$

where δ is the vector of the price elasticities and $\theta_{i,t-1}$ is the vector of the different securities holdings (denominated by the total asset excluding cash alike assets and tangible assets, $A^R_{i,t}$ below) of the investment bank i.[34] Hence, $\chi_{i,t}$ measures capital gains or losses of the total asset of each bank due to risk-on/off shocks. Then the regression equation is formulated as below.

$$\Delta ln\left(A^R_{i,t}\right) = \alpha_i + \beta_0\chi_{i,t} + \beta_1\frac{A^R_{i,t-1}}{N_{i,t-1}}\chi_{i,t} + \Gamma'_0 z_{i,t-1}\chi_{i,t} + \Gamma'_1\lambda_{i,t-1} + \varepsilon_{i,t}$$

where $A^R_{i,t}$ is the total assets excluding cash or cash alike assets and tangible assets, $\frac{A^R_{i,t}}{N_{i,t-1}}$ is the

[34] The asset holings are the data at the end of last period.

risky assets to net worth ratio (hence the leverage ratio[35]) of the investment bank i, $z_{i,t-1}$ is the vector of other balance sheet conditions such as the ratio of risky assets to total assets, and $\lambda_{i,t-1}$ is the balance conditions including $\frac{A^R_{i,t}}{N_{i,t-1}}$ and $z_{i,t-1}$. The result is reported in table 3.

As expected, the coefficient β_1 of the interactive term between the "effective" leverage and the gains/losses due to VIX changes is positive and highly significant. I included another interaction term, capital gains or losses interacted with $z_{i,t-1}$—bank characteristics observable in the bank balance sheet data. These results are robust to the different controls.

The empirical analysis captures the propagation of global financial shocks in the capital market. Often, macro-financial literature is interested in credit market (loan market) as the credit market is often larger than the capital market even in countries where capital markets are well developed. Appendix E introduces another empirical analysis to see how the global financial shocks are propagated from the capital market to the credit market in Korea. A simple illustration of the analysis is that commercial banks in Korea often finance in wholesale funding markets where the investment banks provide short term funds[36] to the commercial banks. When the investment banks cut down their fund supplies in the market due to negative impacts on their net worth, the commercial banks have trouble financing from the wholesale funding market, and then subsequently reduce their credit supplies to the real sector.

4 Quantitative Exercise

In this section, I introduce a medium-scale new Keynesian model to conduct quantitative exercises. The purpose of introducing the DSGE model is to quantify the importance of the capital market channel. In other words, in a small open economy where much of external liabilities are equities or LC bonds, how much variation does global financial shock generate in the financial markets and the real sector in the economy?

For this purpose, I augment the standard new Keynesian small open economy model with the key features in the simple model; leverage constrained domestic banks and global investors who purchase capitals and LC bonds in the small open economy. Although the model is much more general and richer than the simple model in the last section, I abstract from several important features in reality, which are often important in the analysis of business cycles in EMEs. The model is still designed to study the transmission of global financial shocks to emerging markets, not to study business cycles in EMEs.

4.1 Environments

Most environments in the model are the same as the simple model, except for the nominal rigidity in goods price, more sophisticated bank leverage, and incomplete exchange rate pass-through in export price. For some of the specifications and notations, I follow the influential paper, Aoki et al. (2018).

[35]Actually, substantial part of the total asset is cash or cash alike assets such as deposits at commercial banks. However, the leverage ratio in the model is more like risky assets to net worth ratio. Hence, I use the financial securities to net worth ratio.

[36]It includes call loans, repo transactions, and most importantly short-term bank debentures.

Goods producers Following the standard in the literature, final goods are produced by the retailer under perfect competition, and each of the differentiated intermediate goods is produced by an exclusive producer under monopolistic competition. Same as the simple model, the producers use the Cobb-Douglas technology. The difference from the simple model is the producers use imported intermediated inputs. Hence, the production function is

$$y_{i,t} = A_t \left(\frac{k_{i,t-1}}{\alpha_k}\right)^{\alpha_k} \left(\frac{m_{i,t}}{\alpha_m}\right)^{\alpha,m} \left(\frac{l_{i,t}}{1-\alpha_k-\alpha_m}\right)^{1-\alpha_k-\alpha_m}$$

where α_k, α_m and $\alpha_k + \alpha_m \in (0,1)$. A_t is a TFP in this economy and follows a AR(1) stochastic process.

I introduce nominal rigidities following Calvo. In each period, a producer can adjust her price with a probability of $1-\kappa$. Accordingly, each producer chooses the reset price P_t^* to maximize expected discounted profits subject to the restriction on the adjustment frequency. The first order condition is given by

$$\mathbb{E}_t \left[\left\{\sum_{j=0}^{\infty} \kappa^j \Lambda_{t,t+j} \left(\frac{P_t^*}{P_{t+j}} - \frac{\eta}{\eta-1} mc_t\right) y_{i,t+j}\right\}\right] = 0$$

where $\Lambda_{t,t+j}$ is the stochastic discount factor of the representative households, and mc_t is the real marginal cost. I skip the steps to derive the equation as I followed the standard in the literature. The real marginal cost is a result of the cost minimization problem and is formulated as below

$$mc_t = \frac{1}{A_t} z_t^{\alpha_k} \varepsilon_t^{\alpha_m} w_t^{1-\alpha_k-\alpha_m}$$

From the law of large numbers, the aggregate price level is characterized as below.

$$P_t = \left[(1-\eta)\left(P_t^*\right)^{1-\eta} + \eta \left(P_{t-1}\right)^{1-\eta}\right]^{\frac{1}{1-\eta}} \tag{33}$$

Households The representative households are identical to the simple model in that they consume both domestic and imported consumption goods. But, in the medium-scale model, there is disutility of labor so that the labor supply is endogenous. Also, unlike the simple model, households cannot invest in government bonds directly. The investment has to be done through intermediations by domestic banks. The optimization problem of the representative households is

$$\max_{\left\{c_{t+j}^d, c_{t+j}^m\right\}_{j=0}^{\infty}} \mathbb{E}_t \left[\sum_{j=0}^{\infty} \beta^t U\left(C_{t+j}^d, C_{t+j}^m, L_t\right)\right]$$

$$\textit{subject to } \; c_t^d + \varepsilon_t c_t^m + D_t + \tau_t \leq w_t L_t + R_t D_{t-1} + \pi_t$$

Now the per-period utility function of the consumptions is given by

$$U\left(C_{t+j}^d, C_{t+j}^m\right) = ln\left(H\left(C_{t+j}^d, C_{t+j}^m\right)\right) - \frac{1}{1+\zeta} L_t^{1+\zeta}$$

where $H\left(C^d_{t+j}, C^m_{t+j}\right)$ is the CES composite.

$$H\left(C^d_t, C^m_t\right) = \left(\omega \left(C^d_t\right)^{\frac{\mu-1}{\mu}} + (1-\omega)\left(C^m_t\right)^{\frac{\mu-1}{\mu}}\right)^{\frac{\mu}{\mu-1}}$$

ω controls the share of imports in consumption while μ is the elasticity between domestic goods and imported goods.

Note that all the terms in the budget constraint are denominated in the price of domestic goods. For example, w_t and R_t are the real wages and real interest rates on the deposits respectively, in terms of domestic goods. In the same way, ε_t is the price of imported goods, but is not necessarily the same as the terms of trade as I deviate from the law of one price. Since the aggregate CPI index is not the same as the price of domestic goods because of the imported goods consumptions, ε_t is not the real exchange rate. However, the movement of ε_t is qualitatively the same as the real exchange rate as I fix the foreign price and even quantitatively similar with the true real exchange rate as long as the weight on the imported goods is relatively small.

The optimality conditions of the households are identical to the simple model, except for the new labor-leisure condition.

$$w_t \frac{\partial H_t}{\partial C^d_t} = L^\zeta_t$$

Capital producers Instead of the adjustment cost of the investment to capital ratio, I used the adjustment cost by which the investment cost varies with the investment growth. The objective of the capital producer is to choose

$$\max_{\{I_{t+j}\}} \mathbb{E}_t \left[\sum \Lambda_{t,t+j} \left(Q_{t+j} I_{t+j} - \left(1 + \varPhi\left(\frac{I_{t+j}}{I_{t+j-1}}\right)\right) I_{t+j}\right)\right]$$

with

$$\varPhi\left(\frac{I_t}{I_{t-1}}\right) = \frac{\varphi}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2$$

The optimality condition of the capital producer is as below.

$$Q_t = 1 + \varPhi\left(\frac{I_t}{I_{t-1}}\right) + \frac{I_t}{I_{t-1}} \varPhi'\left(\frac{I_t}{I_{t-1}}\right) - \mathbb{E}_t\left[\Lambda_{t,t+1}\left(\frac{I_{t+1}}{I_t}\right)^2 \varPhi'\left(\frac{I_{t+1}}{I_t}\right)\right] \tag{34}$$

Long-term bond To model the impacts of sell-off of global investors in bond markets in EMEs, I model the government bond as a perpetual bond.[37] I mostly follow the specification in Gertler and Karadi (2013). The perpetual bond pays one unit of domestic consumption goods every period. Denoting the real bonds price by q_t, the return to the bonds including the capital

[37] The perpetual bond here is like the inflation-adjusted bond, like TIPs in the US. I can model it as the nominal pertetual bond, but I find the volatility of the bond price in the model simulation is too high, comparing with the observed volatility in data. However, of course, whether bond strip is nominal or real does not meaningfully alter the quantitative results.

gains/losses is

$$R^b_{t+1} = \frac{1 + q_{t+1}}{q_t}$$

Therefore, the bond investment is risky as its return changes along with the bond price in the next period, q_{t+1}.

Domestic banks Domestic banks, which refer to financial intermediaries in different forms in reality, take deposits from households or borrow abroad, to invest in domestic capital and government bonds. What are different from the simple model are 1) domestic banks can invest in government bonds as well as the capitals, and 2) the leverage constraint as a function of the profitability in the futures, as in Gertler and Kiyotaki (2010) and Aoki et al. (2018).

Before illustrating the banks in the model, I note that I adopt the leverage constraint in Gertler and Kiyotaki (2010) because I want to show how the key insights survive and bring quantitative results in the environment that is widely used in the literature. It does not mean the approach in the paper is more precise than others. As long as banks in the model are leverage constrained, qualitative results should be the same, but different modeling gives a different quantitative result. Precise specifications of leverage constraints on financial intermediaries are beyond the scope of this paper, and how the impacts of risk-on/off shocks vary with different modeling of the leverage constraint is for future research.[38]

Similar with the banks in the simple model, the banks purchase capitals or government bonds and finance the investments through the deposits of the households, foreign borrowings, and their net worth. Therefore, the balance sheet of a typical bank is

$$Q_t k^d_t + q_t b^d_t = d_t + \varepsilon_t d^*_t + n_t \tag{35}$$

Accordingly, the evolution of the net worth of a bank is

$$n_t = (z_t + Q_t)\, k^d_{t-1} + R^b_t q_{t-1} b^d_{t-1} - R_t d_{t-1} - \varepsilon_t R^*_t d^*_{t-1} - \Theta\left(x^2_t, D_t\right) \tag{36}$$

where $\Theta\left(x^2_t, D_t\right) = \frac{\zeta_d}{2} x^2_t D_t$ and $x_t = \frac{\varepsilon_t d^*_t}{d_t + \varepsilon_t d^*_t}$, the foreign currency debt ratio to the total debts and thus $\Theta\left(x^2_t, D_t\right)$ is the management cost of the foreign currency debt.

The evolution of the net worth with the exit of incumbent bankers and the entry of new bankers is[39]

$$N_t = (\sigma + \xi)\left((z_t + Q_t)\, k^d_{t-1} + R^b_t q_{t-1} b^d_{t-1}\right) - \sigma\left(R_t d_{t-1} + \varepsilon_t R^*_t d^*_{t-1} - \left(x^2_t, D_t\right)\right)$$

The key idea in Gertler and Kiyotaki (2010) is the continuation value should be larger than

[38] Another possible approach is Value at Risk (VaR) constraint on financial intermediaries, as I modeled global investors in this paper. Adrian and Shin (2013), Nuno and Thomas (2017), and Coimbra and Rey (2020) model the banks facing a form of VaR constraint. The approaches in the strand of the literature seem to closer to the risk management of financial intermediaries in reality, and it potentially gives a stronger result to me. However, I follow the approach in Gertler and Kiyotaki (2010) because the goal in this paper is not a precise identification of the leverage constraint.

[39] For the convenience, I include the bonds, $R^b_t q_{t-1} b^d_{t-1}$, in the start-up funds. We can think of the start-up funds as a fraction of the total financial assets held by domestic agents. Of course, exclusion of the bonds from the start-up fund does not meaningfully change any results in this paper.

the fraction of the total assets that the banks can divert. The continuation value is defined as the sum of present values of the future dividend as

$$V_t = \mathbb{E}_t \left[\sum_{j=1}^{\infty} \Lambda_{t,t+j} (1-\sigma) \sigma^{j-1} n_{t+j} \right]$$

The continuation value can be reformulated in a recursive form as

$$V_t = \mathbb{E}_t \left[\Lambda_{t,t+1} \left[(1-\sigma) n_{t+1} + \sigma V_{t+1} \right] \right] \tag{37}$$

The leverage constraint arises due to the following moral hazard problem. After raising funds, the banks can decide whether to operate honestly or divert assets for personal use. To divert means to secretly channel funds away from investment in order to consume personally. Specifically, the banker can divert θ fractions of the total capitals and $\triangle\theta$ of the government bond. Government bonds are harder to divert; government bonds are more transparent and have better legal protections. Reflecting those features, I let $\triangle \in (0,1)$.

Then, the bank's problem is reduced to comparing the continuation value, V_t, to the gains from diverting the funds. That means, if the continuation value is less than the gain from diverting funds, the banks cannot raise any outside financing. Therefore the following incentive constraint must be satisfied.

$$V_t \geq \theta Q_t k_t^d + \Delta \theta b_t^d \tag{38}$$

The optimization of the banks is to maximize (37) subject to (36) and (38). Since the solution of the maximization problem is well known, I introduce the solutions of the banks as follows.

$$\phi_t = \frac{E_t \Lambda_{t,t+1} \Omega_{t,t+1} R_{t+1}}{\theta - E_t \Lambda_{t,t+1} \Omega_{t,t+1} \left(R_{t+1}^k - R_{t+1} \right)} \tag{39}$$

$$E_t \Lambda_{t,t+1} \Omega_{t,t+1} \left(R_{t+1}^k - R_{t+1} \right) \Delta = E_t \Lambda_{t,t+1} \Omega_{t,t+1} \left(R_{t+1}^b - R_{t+1} \right) \tag{40}$$

where $\Omega_{t,t+1}$ reflects the shadow value of one unit of net worth to the bank in each state at time $t+1$. Hence, $\Lambda_{t,t+1}\Omega_{t,t+1}$ is the stochastic discount factor of the banks.

In the equilibrium, the marginal cost of the foreign currency debt, the expected interest rates on foreign currency debts in local currency and the adjustment cost, discounted by the stochastic discount factors of the banks, must be the same as the interest rates on the deposits. The optimization of the bank characterizes the foreign currency debt as follows.

$$d_t^* = D_t \frac{\mathbb{E}_t \left[\Lambda_{t,t+1} \Omega_{t,t+1} \left(R_{t+1} - \frac{\varepsilon_{t+1}}{\varepsilon_t} R_{t+1}^* (v_t) \right) \right]}{\psi \varepsilon_t} \tag{41}$$

$R_{t+1}^* (v_t)$ is the borrowing rate on the foreign currency debts of the domestic banks. Rather than modeling the determination of the interest rate R_{t+1}^*, I assume that the interest rate will react to the risk-appetite v_t. More specifically,

$$R_{t+1}^* (v_t) = 1 + r^* e^{\chi_d v_t}$$

where $r^* e^{\chi_d v_t}$ is the time-varying net interest rate and $\chi_d \in (0, \infty)$. v_t is the time-varying risk-appetite, same with the simple model. Thus, v_t follows an AR(1) process in the equation (12). We can think of the interest rate as EMBI spread in reality, which is strongly correlated with VIX index; higher VIX is correlated with higher EMBI spreads.

Again, I note that I abstract from the endogenous determination of the interest rate, but recent studies such as Morelli (2019) showed that the interest rates on foreign currency sovereign bonds of EMEs are heavily affected by the bond demands from global banks. Considering the influence of the risk-appetite of global investors on the borrowing rates of EMEs, such a reduced form approach is a way to include necessary ingredients without setting up another optimization problem.

Global investors Global investors purchase capitals and LC bonds in the small open economy, and their decisions are made by the equations.

$$p_t^k = Q_t k_t^f \varepsilon_t^{-1} = \frac{1}{\Gamma e^{v_t}} \left[\chi_k^0 + \chi_k^1 \mathbb{E}_t \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^k - R_{t+1}^m (v_t) \right] \right]$$

$$p_t^b = b_t^f \varepsilon_t^{-1} = \frac{1}{\Gamma e^{v_t}} \left[\chi_b^0 + \chi_{\mathrm{b}}^0 \mathbb{E}_t \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^b - R_{t+1}^m (v_t) \right] \right]$$

Now I lift the assumptions that χ_k^0 and χ_b^0 are zero. In addition, it is not necessary that $\frac{dR_t^{k^*}}{d\nu_t} > \frac{dR_{t+1}^m}{d\nu_t}$ as I estimate the medium-scale model. Similarly with $R_{t+1}^* (v_t)$, the return to the global portfolio reacts to the risk-on/off shocks.

$$R_{t+1}^m (v_t) = 1 + r^m e^{\chi_{,m} v_t}$$

We can think R^m as yields on the BAA grade corporate bonds in the US, and similarly with R^*, risk-off (on) shock raise (lower) the return to the global portfolio.

Government Government is just identical to the simple model. The budget constraint of the government is

$$G = \tau_t + q_t B_t - R_t^g q_{t-1} B_{t-1}$$

I abstract from the problem of the government and fiscal policy. The supply of government bond is fixed at $\overline{B}$. Hence $B_t = \overline{B}$.

Export In the simple model, I adopted the producer currency pricing (PCP) in export pricing for tractability. However, of course, it is counterfactual and the trade literature comes to a consensus that exporters can set a different price in the foreign markets (Local Currency Pricing, LCP) or the price of tradable goods are in general priced in key currencies like USD (Dominant Currency Pricing, DCP).[40] Since the risk-on (off) shocks in my model cause local currency appreciations (depreciations), it is important to model the export pricing in a realistic way to assess the quantitative impacts of the shocks on the small open economy.

[40] See Betts and Devereux (2000) for LCP and Gopinath and Stein (2020) for DCP.

For the purpose, I make an assumption of the export pricing, following Wang (2018). Denote the export price in the foreign market by p_t^{ex}. Then p_t^{ex} is

$$p_t^{ex} = \left(\varepsilon_t^{-1}\right)^{\lambda}\left(p_t^{ex^*}\right)^{1-\lambda}$$

where $\lambda \in (0,1)$. If $\lambda = 1$, the export pricing follows a perfect PCP. In contrast, if $\lambda = 0$, it indicates a perfect LCP or DCP. $p_t^{ex^*}$ is the exogenously given price of the exports; for example, the price of competitors in the foreign markets. Such a "reduced form" approach to the export pricing makes the model simple, but also allows tractability. The reality obviously lies in somewhere between LCP and PCP and accordingly I can set a reasonable parameter value for λ reflecting empirical evidence. Moreover, I can experiment on how the transmission of GFS varies along with different export pricing policies by setting different values of λ in the DSGE model.

The export is

$$EX_t = \left(p_t^{ex}\right)^{1-\gamma} Y_t^* \tag{42}$$

where $\gamma > 1$ and $Y_t^* = Y_t e^{T_t}$. T_t is a AR(1) stochastic process, which captures trade shocks, i.e., shocks to the demand for exporting goods from the small open economy.

Monetary authority The monetary authority conducts policy using a nominal interest rates rule. The nominal rate i responds to the deviation of inflation from target, π_t relative to $\overline{\pi}$, which is one in this model. In addition, I assume that the authority tends to avoid drastic changes in the nominal interest rate. As a result, the interest rate rule is characterized as

$$i_t = \bar{i} + (1-\rho_i)\,\omega_\pi\,(\pi_t - 1) + \rho_i\left(i_{t-1} - \bar{i}\right) + m_t \tag{43}$$

where $\rho_i \in (0,1)$ and $\omega_\pi > 1$, and m_t is the monetary policy shock in this model.

Resource constraint The output is divided between consumption, investment, government consumption, export and foreign currency debt management cost. The economy-wide resource constraint is thus given by

$$Y_t = C_t^d + \left[1 + \Phi\left(\frac{I_t}{I_{t-1}}\right)\right] I_t + G + EX_t + \Theta\left(x_t^2, D_t\right) \tag{44}$$

where $Y_t = \left(\int_0^1 y_{i,t}^{\frac{\eta-1}{\eta}}\,di\right)^{\frac{\eta}{\eta-1}}$.

The net output, GDP of this economy is the total output minus the imported intermediate inputs.

$$Y_t^{net} = Y_t - \varepsilon_t M_t \tag{45}$$

where $M_t = \left(\int_0^1 m_{i,t}^{\frac{\eta-1}{\eta}}\,di\right)^{\frac{\eta}{\eta-1}}$.

4.2 Calibration

I calibrate the model to the Korean economy because it is an ideal example in the context of the analysis in this paper, as most of the external liabilities in Korea are equities and LC bond portfolio investments. To capture the short-run dynamics, I set one period to a quarter in reality.

For most of the parameters in the model, I used standard values in the literature or values reported in well-known preceding studies. For some parameters regarding trade openness or output to capital ratio, I calibrate the parameters to match the observed ratios in Korea. The parameters I newly calibrated in this paper are the parameters about the global investors and global financial shocks, which are new components in this model.

Assigned parameters First, I explain the parameters I set externally. For those parameters, I mostly followed Akinci and Queralto (2019), Aoki et al. (2018), Gertler and Karadi (2013), and few others. I set the discount factor, β, to be 0.9925 so that the annual interest rate is 3%. This corresponds to the discount rate used in Akinci and Queralto (2019) for their emerging market bloc in their two country model. It also approximately matches the real interest rate in Korea before the global financial crisis in 2008. For the labor supply parameters, I set the Frisch elasticity to be 0.33 following Gali and Monacelli (2005); therefore the inverse of the Frisch elasticity, ζ is 3. The elasticity between the domestic goods and imported goods is 1.5 ($\mu = 2$), same as Akinci and Queralto (2019). This is in the range of standard values in the literature. I set the parameter of imported goods $1 - \omega$ to 0.225. This value corresponds to the foreign goods and service consumption to GDP ratio in Korea.[41]

On the production side, I calibrate the capital share and imported intermediate goods share to Korean economy. The calibrated values of the capital share α_K and imported goods share α_M are 0.25 and 0.225 respectively. The elasticity of demand from the aggregator, η, is 9 following Aoki et al. (2018). For the inverse elasticity of net investment to the capital price, capital depreciation rate, and Calvo parameter (probability of keeping the price constant), I followed the standard values in the parameters. I set the investment adjustment cost parameter to be 2.85, following Akinci and Queralto (2019). This value is in the range of conventional values in the literature.[42]

I set the elasticity of export demand, γ, to be 2.5 so that the elasticity is similar to the elasticity of domestic demands for imported consumption goods. An important parameter is the exchange rate pass-through, λ. I used the value reported in Gopinath and Burstein (2014). The exchange rate pass-through from local currency to USD is 0.2 Reflecting on the consensus that most of tradable goods are in fact denominated in USD, I set λ to be 0.2.

For the parameters of the domestic bank, I mostly follow Aoki et al. (2018) and Gertler and Karadi (2013). The bank survival rate σ and the fraction of the total financial assets to the new bankers ξ are set to 0.94 and 0.462 respectively, following Aoki et al. (2018). The proportion of

[41] The consumption of imported goods and services includes the expenditures made aborad by residents in Korea, such as traveling abroad or tuitions for students studying abroad.

[42] This is a little higher than the value in Gertler and Karadi (2013), 1.728. It is to capture more realistic volatilities of the capital price and investments so that the generated second moments are closer the volatilities of stock index and investment in Korea.

divertible capital to the total capital, θ_0 is set to 0.34. This value is close to Gertler and Karadi (2013).[43] With the parameter values, the spread between the return to the capital and deposit rates in deterministic steady state is very close to 0.02 annually. This is the target used in the calibration in Gertler and Kiyotaki (2010) and Gertler and Karadi (2013). In this paper, it is important to have realistic capital to GDP ratios in the model as the impact of risk-on/off shocks depends on the foreign investors' share in the capital market. The capital to GDP (annual GDP) ratio in the steady state is close to 2 and it is close to tangible assets to GDP ratio in Korea, after excluding residential real estates from the tangible assets. The parameter of the advantage of government bond in terms of leverage, Δ, is set to 0.5, following Gertler and Karadi (2013).

Besides the global financial shocks, there are three exogenous shocks in the model, TFP shock, export shock and monetary policy shock. For both TFP and export shock, I set the autocorrelation parameter to be 0.9, which lies in the range of the values used in the literature. I set the standard deviation of the TFP shock to be 0.004 and 0.01 for the export shock. These are smaller than the values used in the emerging market literature. There are two reasons I use relatively low values. First, the financial amplification mechanism in my model amplifies the impacts of TFP and export shocks and therefore feeding standard values into the model will make the model economy more volatile than the real economy in reality. More importantly, I calibrate the model to the Korean economy, which is stable compared to typical example countries in the emerging market literature, such as Mexico or Brazil. The standard deviation of the calibrated model economy is 0.015, which is a little higher than the true standard deviation of quarterly GDP in Korea, 0.012, in the sample period 2001-12. The standard deviation of monetary policy shock is 0.001 so that the unexpected changes in policy rate is 0.4% annualized rate. The monetary policy shock is serially uncorrelated as the shock will be persistent by the Taylor rule in equation (43)

I set the parameters in the Taylor rule, following Aoki et al. (2018). Regarding the government, I set government consumption to GDP and government debt to GDP ratio to be 0.2 and 0.45 respectively, same as Gertler and Karadi (2013). These ratios are also close to the observed ratios in Korea.[44]

I summarize the assigned parameters in table 8.

Estimated parameters I need to estimate the parameters of the global investors and the related global financial shock because these are novel components in the model in this paper. Recall the equity and local currency bond investment of the global investor and the determination of foreign currency debt.

$$p_t^k = Q_t k_t^f \varepsilon_t^{-1} = \frac{1}{\Gamma_k e^{v_t}} \left[\chi_k^0 + \chi_k^1 \mathbb{E}_t \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^k - R_{t+1}^m (v_t) \right] \right] \tag{46}$$

$$p_t^b = b_t^f \varepsilon_t^{-1} = \frac{1}{\Gamma_b e^{v_t}} \left[\chi_b^0 + \chi_b^1 \mathbb{E}_t \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^b - R_{t+1}^m (v_t) \right] \right] \tag{47}$$

[43] In Aoki et al., the proportion of divertable assets depends on the ratio of foreign currency debts to the total assets. However, I have no reasoning or empirical evidence to support it.

[44] The government debt to GDP ratios are higher than government debt to GDP ratios in Korea, but it is close once we inlude the monetary stabilization bonds issued by the central banks in Korea, Bank of Korea.

Table 4: Assigned Parameters

Parameter	Symbol	Value
Discount factor	β	0.925
Inverse Frisch elasticity of labor supply	ζ	3.000
Trade elasticity	μ	2.000
Share of imported goods	$1-\omega$	0.225
Capital share	α_K	0.250
Imported intermediate goods share	α_M	0.240
Elasticity of demand from the aggregator	η	9.000
Capital depreciation rate	δ	0.025
Inverse elasticity of net investment to the capital price	φ	1.728
Probability of keeping the price constant	κ	0.779
Government consumption to GDP ratio in steady state	$\frac{G}{Y_{net}}$	2.000
Government bond to GDP ratio in steady state	$\frac{qB}{Y_{net}}$	0.450
Inflation coefficient in the Taylor rule	ω_π	1.500
Persistence coefficient in the Taylor rule	ρ_i	0.800
Elasticity of export demand	γ	1.500
Exchange rate pass-through	λ	0.200
Fraction of capital that can be diverted	θ	0.340
Leverage advantage in seizure rate of government bond	$\triangle$	0.500
Transfer to the entering bankers	ξ	0.046
Survival rate of the bankers	σ	0.940
Management cost for foreign currency debt	ψ	0.111

$$d_t^* = D_t \frac{\mathbb{E}_t \left[\Lambda_{t,t+1}\Omega_{t,t+1}\left(R_{t+1} - \frac{\varepsilon_{t+1}}{\varepsilon_t} R_{t+1}^* (v_t)\right)\right]}{\psi\varepsilon_t} \tag{48}$$

where $R_{t+1}^m (v_t)$, $R_{t+1}^* (v_t)$ and v_t are as follows.

$$R_{t+1}^m (v_t) = 1 + r^m e^{\chi_{,m} v_t}$$

$$R_{t+1}^* (v_t) = 1 + r^* e^{\chi_* v_t}$$

$$v_t = \rho_v v_{t-1} + \nu_t$$

I let R^m and R^* be the 5 years BAA corporate bond yields in the US and JP Morgan Emerging Market Bond Index (EMBI Index). I estimate $\chi_{,m}$ and χ_d by regressing those interest rates on Cboe VIX index. I relegate details of the estimations to the appendix. The estimated values of χ_m and χ_* are 1.04 and 1.37 respectively.[45] I used the values in quarterly data and also considered the standard deviations of VIX and global financial shock process in my model, which I describe below.

[45] The regression might suffer from autocorrelation in R_t and v_t. I discuss this issue in a separate section in appendix, and show the results do not change much in another empirical identification, which is relatively free from the concern of autocorrelation.

Table 5: Estimated Parameters

Parameter	Symbol	Value	Target
Stickness of equtiy portfolio investment	$\frac{\chi_k^1}{\chi_k^0}$	4.645	g_{p_k}
Stickness of LC bond portfolio investment	$\frac{\chi_b^1}{\chi_b^0}$	9.363	g_{p_b}
Inverse of funds allocated to the capital market	Γ_k	0.053	$\frac{LCE}{Y_{net}}$
Inverse of funds allocated to the bond market	Γ_b	0.180	$\frac{LCB}{Y_{net}}$
Elasticity of global portfolio return to risk-on/off shock	χ_m	1.046	BAA
Elasticity of foreign borrowing rates to risk-on/off shock	χ_*	1.372	EMBI
Standard deviation of risk-on/off shock	σ_ν	0.090	σ_{p_k}
Autocorrelation of the risk-appetite	ρ_ν	0.850	ρ_{p_k}

I estimate the parameters in equation (46) and (47), using GMM. Notice that once I get the ratio of χ_j^0 to χ_j^1, I can easily compute Γ_j based on the observed equity liability to GDP and LC bond to GDP ratios. Target moment in the GMM estimation is the growth of the portfolio investments. I relegate the detail of the estimation to the appendix. Estimated $\frac{\chi_k^1}{\chi_k^0}$ and $\frac{\chi_b^1}{\chi_b^0}$ are 4.621 and 9.785. These values reflect that global investors do not strongly respond to the arbitrage opportunity. Then it is easy to compute Γ_k and Γ_b from the data. I set Γ_k and Γ_b to match the equity portfolio investment to GDP ratio (0.28, on average in 2012 - 18) and Korean won bond portfolio investment to GDP (0.08, on average in 2012 - 18).[46]

There is a handful number of papers, which estimate global financial shocks from different risk assets over the real world. The approach in those papers is beyond the scope of this paper. Instead, I calibrate related parameters in the simplest way. In the model simulations, global financial shocks matter through capital flows. Motivated by this, I set the standard deviation and autocorrelation to match the observed standard deviation and autocorrelation of the foreign equity portfolio investments in Korea. The observed standard deviation of the equity portfolio investment (in the US dollar) is 0.2 and the autocorrelation is 0.834. To capture the autocorrelation, I set ρ_v to bo 0.85. With Th value ρ_v= 0.85, the autocorrelation of simulated p_k is 0.84, which is close to the data. To have the standard deviation of 0.2, I need the standard deviation of ν_t at 0.104. However, this might yield a too high standard deviation since the observed equity portfolio investment includes changes in stock price, which is more volatile than the Tobin-Q in the model. Therefore, I take a litter lower value: I set the standard deviation of the risk-appetite shock to be 0.09.

There are four shocks in the model, global financial shock, TFP shock, export demand shock, and monetary policy shock. Except for monetary policy shock, the other three shocks are certainly correlated in reality. The correlations among the shocks are not crucial in my analysis, but I let the shocks are correlated, depending on the purpose of the model simulation. If the shocks are correlated, I set the correlation between global financial shock and export demand shock to be 0.6 and global financial shock and TFP shock to be 0.3.

[46]This includes local currency deposits and I counted as the deposits are mostly held by foreign investors in Korean won bond market. The reason I excluded it in the regressions is that in some countries like India, the deposits are much held by residents abroad, who are actually citizens of the emerging market country.

4.3 Results

4.3.1 Transmission of Global Financial Shocks in Korea

I simulated the model, using standard techniques.[47] First, I illustrate how much fluctuations in financial markets and the real economy can be generated by global financial shocks in the model economy calibrated to Korea, where most of the external liabilities are equities and Korean won denominated debts.

I opened the discussion in the paper with the comovements of stock indices and exchange rates with VIX. Furthermore, proposition 1 predicts a risk-off (on) shock causes a fall (rise) in stock price, rise (fall) in exchange rate, fall (rise) in investment, and rise (fall) in export. To see whether the model can generate such patterns in the simulated data, I simulate the model with four "uncorrelated" shocks. Figure 5 below confirms that the model can generate dynamics corresponding to the theoretical prediction.

As it is clear in the figure, a risk-off shock causes a fall in Tobin-Q and a rise in the real exchange rate (Korean won depreciation). Some discrepancies between the simulated path and the data are Tobin Q seems to be stable compared with the stock index in Korea. Surely, Tobin Q in this DSGE model cannot seriously replicate the volatility of the stock index in reality. The relative stability of simulated Tobin Q is also attributable to the features in the model in that the global risk-appetite process in the model probably misses sudden big falls in the risk-appetite in reality.[48]

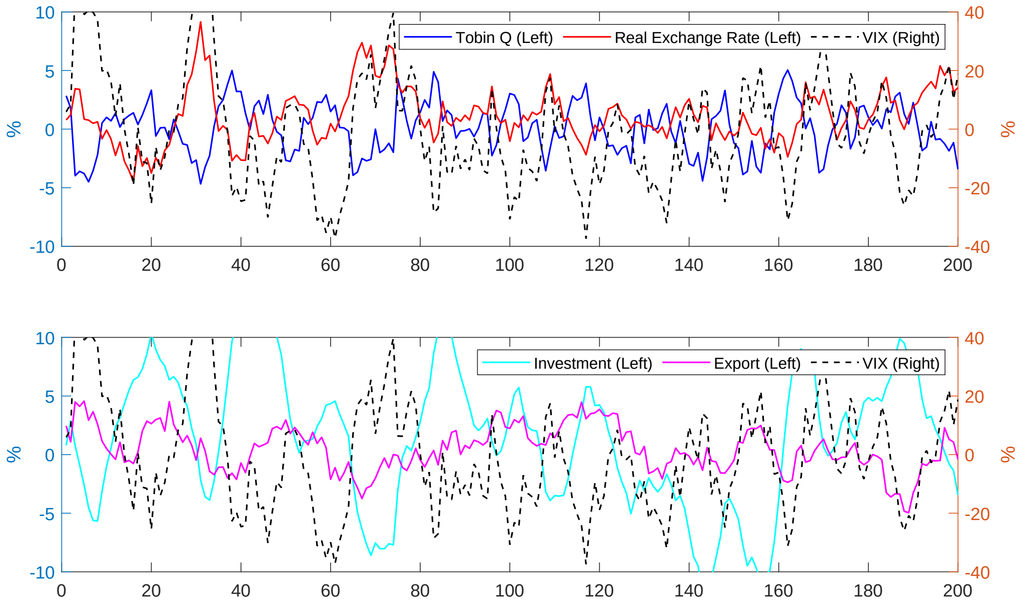
In terms of impacts on the real economy, it is observable in the figure that a risk-off shock causes a fall in investment and a rise in export. As it will be clear in the impulse response analysis, simulated VIX lags behind the simulated investment due to the features in adjustment cost. Export varies with VIX, but the exports do not react to global financial shock strongly as the exchange rate pass-through is low in the calibration (λ=0.2).

Next, I examine how the key macro variables react to a risk-off shock. I give a risk-off shock of one standard deviation to the model economy. In figure 7 below, I show the response of the key financial variables such as capital price, bond price and real exchange rate, and the key real variables such as consumption, investment, export and GDP. I also show responses of important endogenous variables, which are important to understand the mechanism. Those variables are capitals and bonds held by global investors and net worth and leverage of the domestic banks. To highlight the importance of the leverage constrained banks in the model, I also simulate another model in which there is no domestic financial friction, but otherwise is identical to the baseline model. In figure 7, the "baseline" indicates the results from the model with the leverage constrained domestic banks and the "frictionless" indicates the results from the model without

[47] I solved the model using dynare in third order approximation. I also used the pruning technique built in dynare. As discussed in Brunnermeier and Sannikov (2014), such pertubation techniques miss some of the non-linear dynamics in a model of financial amplification mechanism. However, I limit my attention to a normal business cycle, not a big crisis event. Use of the pruning technique can create some inaccuracy in the estimation, but it is unavoidable to prevent the spurious explosive path as discussed in Dou et al. (2017).

[48] Perhaps, it is ideal to include some jump process in the risk appetite. But, this is beyond the scope in this paper.

Figure 6: Simulated Capital Prices and Exchange Rates with VIX



banking sectors.

First, I describe the impulse response functions from the baseline model. The responses of the variables are all as expected. Tobin Q, capital price, falls by nearly 0.8%, and the bond price fall is slightly lower (0.5%). The capital outflows obviously depreciate the local currency and the depreciation rate is close to 0.6%. The impulse response of other variables illustrates the mechanism behind the falls in the capital and bond price. The risk-off shocks induce sell-off of the global investors in domestic financial markets, as shown in the impulse responses in the response functions of capital and bond held by global investors. The sell-off lowers the capital price, which in turn lowers the net worth of the domestic bank and raises the return to the capital investment; the gross return increases by 0.3%. The higher expected return raises the leverage, but it is not enough because of the leverage constraint rooted in the agency problem of the banker.[49] As a result, the demand from domestic banks cannot increase enough so that the capital and bond price fall significantly.

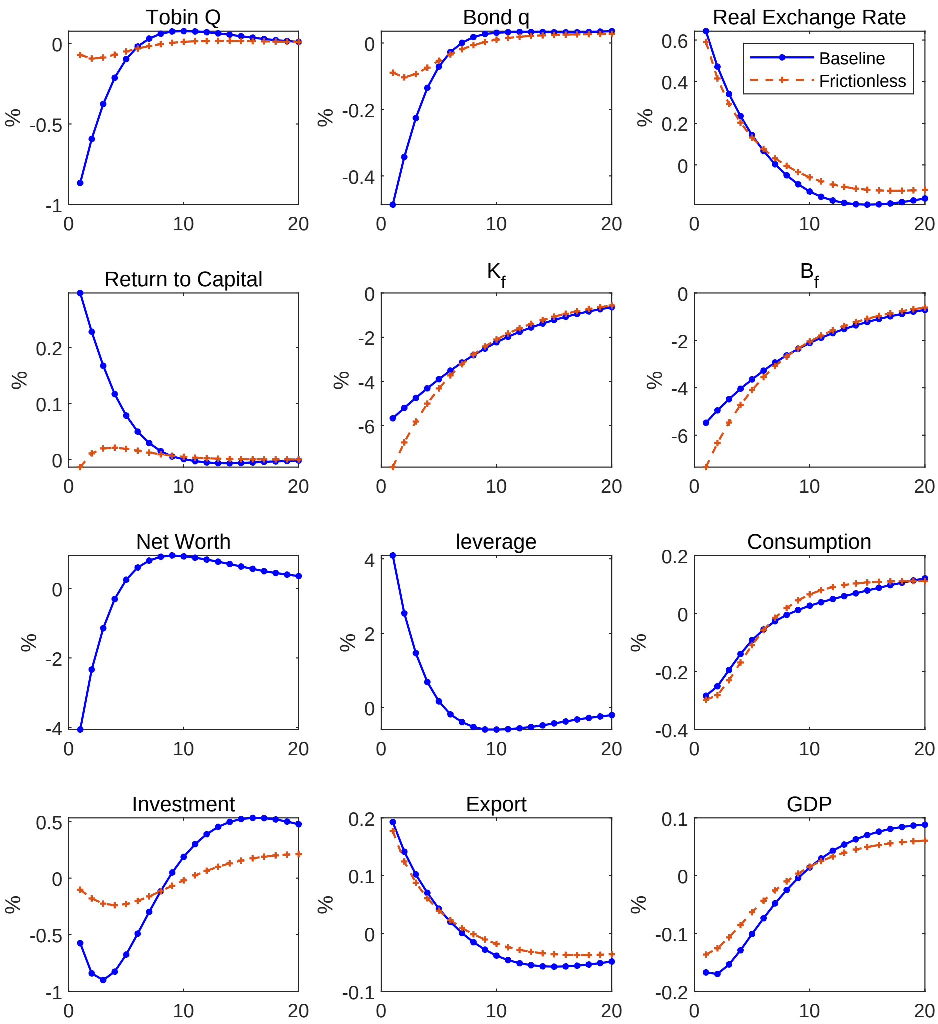
The fall in the capital price simultaneously happens with the fall in investment; investment falls by nearly 0.5%. Because of the technological features in the adjustment cost, the fall in the investment peaks one period after the shock.[50] Consumption falls, and it is mainly due to the falls in the consumption of imported goods. On the other hand, the local currency depreciation increases the exports despite the low exchange rate pass-through, and accordingly, the falls in GDP is relatively mild; it falls by 0.2%.

Comparison of the results from the baseline model to the frictionless model highlights the

[49]The rate of leverage increase is slightly lower than the rate of net worth decrease, as predicted in proposition 2.

[50]It is a typical observations in a DSGE model with "investment" adjustment cost. Once I replace the investment adjustment cost with the capital adjustment cost, the hump shape response disappears.

Figure 7: Impulse Response Functions



importance of leverage constraint on domestic banks. First, one can easily notice that the negative impacts on domestic financial markets, falls in the capital price and bond price, are much smaller than the baseline model. Accordingly, falls in investment are much smaller as well. This is because, in the frictionless environment, the expected returns to capital and government bond are dictated by the household Euler equations. That is, if capital price and bond price falls and thus the expected return to the investments rises, then it immediately results in more saving from households as they expect higher returns. Despite higher borrowing rates on the foreign currency debts, the households are incentivized to borrow more in foreign currency to invest in domestic assets as the local currency is expected to appreciate. As a result, increased investments by households significantly offset the decrease in investments by global investors, preventing large falls in the asset prices and the investment. In contrast, the impact on the FX market is almost the same in the two models, and similarly for export. Falls in consumption are slightly higher for the frictionless model since the households in the model are incentivized to save and invest more. As a result, GDP falls are slightly higher for the baseline model.

The purpose of the quantitative analysis is to evaluate the quantitative importance of the capital market channel. To quantify the importance in a different way, I compare the impulse response functions above to the other small open economy, in which everything is identical, but most of the external liabilities are foreign currency debts.[51] Suppose another economy where foreign currency debt to GDP ratio is 28% and equity liability to GDP, LC bond to GDP ratios are 5% each. Again two economies are almost identical, except for the composition of external liabilities. For notational convenience, we call the economy of equity and LC bond external liability "LC" economy and call the other economy "FC" economy. The different responses of the two different economies are introduced in figure 8.

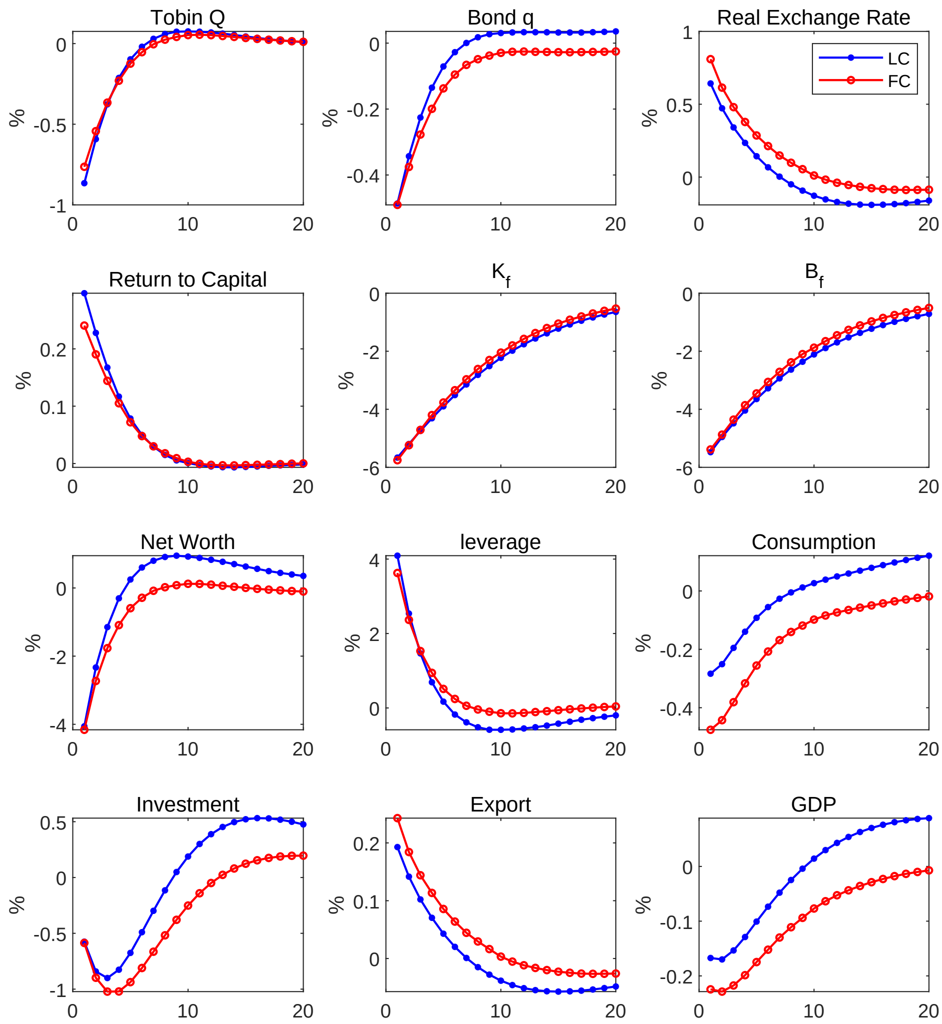
Surprisingly, it turns out that the two economies show quite similar responses to the one standard deviation risk-off shock. My model is designed to evaluate the impacts of different types of capital flows on the small open economy, and therefore I abstracted from several features in EMEs, by which can amplify potential risks from foreign currency debt, such as sovereign default risk or country level collateral risk, as Bianchi (2011). Despite the limit, figure 8 shows that a large sell-off of global investors in domestic financial market can generate sizable falls in small open economies. To understand the similarity, notice that the financial amplification mechanisms in the two different economies are similar. In both economies, the negative impacts of risk-off shock are amplified through the negative balance sheet effects; i.e., negative pecuniary externality on the net worth of domestic bank. In LC economy, the sell-off of global investors directly causes the capital price fall and of course, it reduces the net worth accordingly. In FC economy, the higher exchange rate caused by capital outflows raises the real debt burden and reduces the net worth. The lower net worth again put downward pressure on capital price. Regardless of whether the negative impacts are on the liability side or asset side, in both economies, financial market prices (capital price or exchange rate) hurt the net worth of the domestic banks.

Despite the similarity, one can notice that the falls in the real economy are larger in FC. There are two reasons why the fall is larger for FC economy. First, in FC economy the capital price and exchange rate both work in a way of reducing net worth, while in LC economy, only capital price falls lower the net worth. Hence, the drops in net worth are larger in FC economy, and so the falls in investments in FC economy. Second, falls in the prices of capital and bond held by foreign (global) investors create positive income effects for the residents in the LC economy. The lower asset prices hurt the balance sheets of domestic banks, but at the same time, the lower asset prices (in local currency) and the local currency depreciation "inflate away" the liabilities in the sense that values of the liabilities decline, when measuring the values in terms of export price or imported goods price.[52] This positive income effect upholds the aggregate consumption

[51] The size of foreign currency debts is affected by ϕ. Changing the parameter value makes it hard to compare the results from the two different model economies. To avoid confusion, I adjust the management cost. In the "FC debt dominated economy," I change the management cost to $\Theta\left(\varepsilon_t d_t^*, D_t\right) = \frac{\psi}{2}\left(x-c\right)_t^2 D_t$. I adjust c so that the marginal management costs in the two different economies are almost identical.

[52] More precisely, the values of the liabilities decline in terms of tradable goods. If all the tradable goods are denominated in US dollar, as it is in DCP hypothesis, local currency depreciation devalues the local currency-denominated assets in terms of tradable good. See Fanelli (2018) for a more sophisticated analysis.

Figure 8: Impulse Response Functions, LC vs. FC



during a recession caused by the risk-off shock.

4.3.2 Quantitative evaluation of the importance of the capital market channel

One of the important questions in the literature of Global Financial Cycle is "How important is the global financial cycle to peripheral economies, small open economy like Korea?" The answer to the question should vary country by country. Different countries have different features in their financial markets and the real economies, and thus the transmission and propagation mechanism in each of the economies should be different from others. Because of the difficulty, I limit my focus to the model economy calibrated to Korean economy and then evaluate the quantitative importance of GFS in financial and business cycles in Korea. I gave four different shocks to the model economy as I described in the calibration section. I set the four shocks to be all independent from each other for the accurate assessment. I simulated the model for 20,000

Table 6: Variance Decomposition

	Q_t	q_t	ε_t	R_t^k	R_t^b	C_t	I_t	Ex_t	Y_t^{net}
Global Financial Shock	**52.9**	**30.4**	**36.6**	**59.3**	**42.8**	**18.0**	**27.6**	**2.9**	**10.6**
Export Shock	1.0	2.4	30.8	1.2	1.6	4.6	1.0	94.6	9.2
TFP Shock	20.5	50.2	26.8	7.2	7.2	72.9	58.6	2.1	79.0
Monetary Policy Shock	25.6	16.9	5.9	33.3	48.4	5.5	12.8	0.5	1.2

periods and dropped the first 2,000 periods. The result of the variance decomposition is in table 6.

The first observation from the variance decomposition is risk-on/off shocks account for large parts of the fluctuations in financial markets in the model economy. The risk-on/off shock accounts for more than half of the variations in Tobin Q (52.9%) and the return to the capital (59.3%), and 36.6% of the real exchange rate variation. Similar to the capital price, the risk-appetite shocks explain 30.4% of bond price variations and 42.8% of the variations in return to the bond. Comparing to the financial variables, relatively small parts of the variations in real sector variables are attributable to the risk-on/off shocks. For the investment and the consumption (including both domestic goods and imported goods), 27.6%t and 18.0% are attributable to the risk-on/off shock respectively. For the export and GDP, only 2.9% of export variations and 10.6% of GDP variations are attributable to the risk-on/off shocks.

The variance decomposition analysis provides reasonable results, but we should not take each of the point estimate too seriously. The small open economy model is designed to study the impact of global risk-appetite shock on EMEs through different capital flows. I added some necessary features, which are potentially important for quantitative analysis, but the DSGE model is still short of accommodating all the important ingredients. Different parameter values about the global financial shocks and the global investors can substantially change the result of the variance decomposition analysis. Nevertheless, the result is comparable to the recent study of global financial shocks and the usual belief in financial market practitioners. Among the traders and commentators in Korean financial markets, a pervasive view is that a dominant factor in the market is the movements of global financial market, especially the markets in the US. More importantly, a recent paper, Acalin and Rebucci (2020) empirically analyzed the importance of global financial shock in explaining the stock market movements and business cycles in Korea. They showed that approximately 50% of stock market variations are attributable to global financial shocks (GFS) and 10% of GDP variations are attributable to the same GFS.[53] If their estimation is precise enough, then the calibrated model in this paper has generated realistic quantitative results.

Despite the results quantitatively similar to Acalin and Rebucci (2020), I interpret the variance decomposition results differently. In their paper, the authors stated that the importance of the global risk-appetite shocks in the business cycles in Korea is limited as only 10% of GDP

[53] I note that their approach is much different from this paper. Besides the different methodologies, they computed how much of the forecast errors can be attributable to each of different shocks. Hence, their results are not directly comparable to the variance decomposition.

forecast errors are attributable to the shocks. However, the low number for GDP is because the falls in investments are largely offset by the rises in net exports. The parts of the variations attributable to the risk-on/off shocks are much larger for investments and consumption. Considering consumption is the variable most relevant to welfare, taking GDP as a criterion for the impacts of the global financial shocks on the real economy results in an underestimation of the importance of the shocks. A heuristic way to mute the increase in export is to let the export shock be negatively correlated with the risk-appetite shock, as it should be in the real world. Once the correlation between the export shock and the risk-appetite shock is set to -0.6, 18.7% of GDP variations are attributable to the risk-appetite shocks.

5 Concluding Remarks

In this paper, I explored the channel through which global financial shocks—risk appetite shocks to global investors—are transmitted to small open economies, in particular EMEs. Motivated by the fact that nowadays, substantial parts of the external liabilities of many EMEs are actually local currency denominated portfolio investments, such as LC equities or LC bonds, I proposed the capital market channel. In an environment where domestic financial intermediaries are leverage constrained, shifts in demands for domestic financial assets from global investors can cause drastic changes in asset prices, which in turn affect domestic financial intermediaries through the changes in their net worth. Risk-off (on) shocks lower (raise) the asset prices: the lower (higher) the asset prices, the weaker (stronger) the intermediations of the domestic financial intermediaries. The impacts on the financial markets and financial intermediations propagate into the real economy, mainly through capital investments.

I also studied the conventional exchange rate channel. Here, I used a different approach wherein the local currency depreciation is sparked by capital outflows from the domestic bond market and the exchange rate channel interacts with the capital market channel, thereby producing more devastating effects of a risk-off shock. However, the traditional exchange rate channel seems to be weakened in the current states of EMEs. Financial intermediaries in EMEs have little exposure to changes in exchange rates as they are balanced between foreign currency debts and assets. Meanwhile, nonfinancial corporations have sizable net foreign currency debts in some EMEs, but they have foreign currency revenues from exports. A pervasive view of export pricing in the trade literature predicts the mark-up from exports to rise in domestic currency depreciation.

The theoretical findings in this paper are supported by evidence of different layers. The cross-country panel regressions indicate that financial variables in an EME, namely, stock indices and exchange rates, tend to be affected by the global financial shocks more when the EME received more equity and LC bond portfolio investments. Using the model calibrated to the Korean economy, quantitative studies have shown that global financial shocks are the dominant factor in the financial markets and also important for business cycles in Korea. Moreover, empirical analysis using bank balance sheet data in Korea evidenced the validity of the capital market channel in realistic environments.

To conclude, all theoretical and empirical findings in this paper reveal that to a substantial extent, the risk-appetite shocks to global investors are transmitted to EMEs via fickle portfolio capital flows to equity and local currency bond markets in EMEs. More broadly, EMEs have a lesser concern about foreign currency debts, the previous cause of crises, as their borrowing ability in equities and LC debts has improved. However, they simultaneously face a new risk from the new sources of external financing.

I abstracted from several important features, in reality, to focus on the key question. The external assets by residents in EMEs were not added to the model. The existence of foreign currency assets abroad held by residents in EMEs can insulate the residents from exchange rate fluctuations, but it can stabilize or destabilize the economy through different channels. An important factor missed in this study's analysis is the evolution of beliefs of both domestic and foreign investors in financial markets. Presumably, financial market booms (falls) caused by risk-on (off) shocks generate optimistic (pessimistic) beliefs among the domestic market participants. The interaction between changing beliefs and financial amplification mechanism will significantly amplify the quantitative impacts of the capital market channel. Meanwhile, another deep question related to this paper is "What is behind the original sin dissipation?" In this paper and the companion paper, I suggested related empirical regularities and theoretical explanations for the facts. However, that is far short of answering the deep question of the causes of the original sin dissipation.

I believe all the issues above give us hard, but interesting questions unanswered in this paper. I leave these issues to future research.

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A Data Appendix

A.1 Other Data

I denote sources of other data used in the cross-country panel regressions

- International Investment Position: Internatonal Monetary Fund
- Exchange Rates and Stock Indices: Bloomberg
- Other Controls
  - Trade Openness: World Bank
  - Financial Openness: Chinn and Ito website (http://web.pdx.edu/~ito/Chinn-Ito_website.htm)
  - Oil Price: IMF Commodity Data Portal Crude Oil Price Index
  - Commodity price: IMF Commodity Data Portal Non-Fuel Commodity Price Index
  - Short term interest rates: 3 Month Treasury Bill Rates from CEIC database (Brazil, Columbia, Czech Republic, Hungary, India, Mexico, Philippines, Russia, South Africa, and Thailand), 3 Month Interbank Interest Rates from CEID database (Indonesia, Peru, Poland, Romania, and Turkey), and 3 Month Interbank Interest Rates from IMF IFS (Argentina, Bulgaria and Chile)
  - Real Effective Exchange Rates: BIS Effective Exchange Rate Indices
  - Inflation: IMF IFS[54]
  - Indutrial Production: CEIC database
  - M2 Monetary Aggregate: CEIC database

B Portfolio of Global Investors

Global investors are the international financial intermediaries who purchase local currency denominated equities and bonds in the small open economy. Like other component in the model, I model the global investors in a simple way, but also aim at capturing key features in the reality. Since this paper studies impacts of risk appetite shock to global investors, the global investors in the model need to be risk-averse. While there are different ways, I model the global investors as international financial intermediaries under VaR constraint, following Miranda-Agrippino and Rey (2019).

Global investor in the model at time t has her own capital W_t^G and can raise outside financing in foreign currency in the form of one period debt to invest in different assets indexed by $j \in \{1, 2, ..., N\}$. Let $\mathbf{p}_t$ and $\mathbf{R}_{t+1}$ are the vectors of the global investor portfolio and the excess return of the risky assets over the safe asset respectively. The optimization problem of the global investor is formulated as follows.

$$\max_{\mathbf{x}_t} \mathbb{E}_t \left[\mathbf{p'}_t \Big(\mathbf{R}_{t+1} - \mathbf{1_N} \cdot \mathrm{R}^{\mathrm{f}}_{\mathrm{t+1}} \Big) \right] \quad \textit{subject to} \;\; \mathrm{VaR_t} \leq \mathrm{W}_t^G$$

[54] Monthly inflation in Argentina since 2015 is not available anywhere. Hence I extraploated using nominal and real effective exchage rates of BIS effective exchange rate indices.

where $\mathrm{VaR_t} = \alpha \left[\mathbb{V}ar\left[\mathbf{p}_t'\mathbf{R}_{t+1}\right]\right]^{\frac{1}{2}}$. The solution to the problem is

$$\mathbf{p}_t = \frac{\mathrm{W}_t^G}{\alpha\lambda_t}\left[\mathbb{V}ar\left(\mathbf{R}_{t+1}\right)\right]^{-1}\mathbb{E}_t\left(\mathbf{R}_{t+1} - \mathbf{1}_N \cdot \mathrm{R}^{\mathrm{f}}_{\mathrm{t+1}}\right) \tag{49}$$

where $\lambda_t = \left[\mathbb{E}_t\left(\mathbf{R}_{t+1} - \mathbf{1}_N \cdot \mathrm{R}^{\mathrm{f}}_{\mathrm{t+1}}\right)'\left[\mathbb{V}ar\left(\mathbf{R}_{t+1}\right)\right]^{-1}\mathbb{E}_t\left(\mathbf{R}_{t+1} - \mathbf{1}_N \cdot \mathrm{R}^{\mathrm{f}}_{\mathrm{t+1}}\right)\right]^{-1/2 55}$ and $\mathbb{V}ar\left(\mathbf{R}_{t+1}\right)$ denotes the variance.

Hence, the solution is identical to the optimal portfolio of a mean-variance investor. Also, notice that any shock to the capital of the global investor W_t^G or expected volatility of the world risky assets $\mathbb{V}ar\left(\mathbf{R}_{t+1}\right)$ leads to changes in the risky asset holdings of the global investor.

To study the optimal portfolio of the global investor more specifically, let's formulate the problem as a consideration of an investment in a "marginal" asset: the investor had already formed a market portfolio composed of N-1 different assets, hence all the available risky assets except for i. And further, the marginal asset i follows $R_t^i \backsim N\left(\overline{R_t}^i, \sigma_i^2 + \theta^i\sigma_{m-i}^2\right)$ and $Cov\left(R_t^i, R_t^{m-i}\right) = \theta^i\sigma_{m-i}^2$. Hence, θ^i is the "market beta" for asset i.

The share of asset i, denoted by x_t^i, is given by

$$x_t^i = \frac{\left(\overline{R}^i - R^f\right)/\left(R^{m-i} - R^f\right) - \theta^i}{\sigma_i^2/\sigma_{m-i}^2 + \left(\overline{R}^i - R^f\right)/\left(R^{m-i} - R^f\right) - \theta^i\left(\left(\overline{R}^i - R^f\right)/\left(R^{m-i} - R^f\right) + 1\right)} \tag{50}$$

It is easy to show that x_i decreases in θ^i if $p_i\overline{R}^i < \left(1 - p_i\right)R^{m-i}$.

We have two different assets in the model small open economy, the captial and the government bond. However, I assume that the share of the two assets in the total portfolio is small enough, so that I can take the result in equation (55) to both the capital and the bond.

Not let $\mathrm{W}_t^G = \mathrm{W}^G e^{-v_t}$. Hence, I interpret risk-on/off shocks as shocks to the capital of the global investors[56]. V_t corresponds to VIX and therefore it is a measure of the risk appetite of the investors. In addition, I assume that V_t follows a mean-reverting process similarly with VIX. Thus

$$v_t = \rho v_{t-1} + \nu_t \tag{51}$$

where $\nu_t \sim N\left(0, \sigma_\nu^2\right)$ and $\rho_v \in (0,1)$. Henceforth, I call $\nu_t > 0$ "risk-off" shock and $\nu_t < 0$ "risk-on" shock.

I need to simplify the specification in equation (55) to make it suitable for quantitative analysis. I can reasonably assume $\overline{R}^i \simeq R^{m-i}$, i.e., $\frac{\overline{R}^i - R^f}{R^{m-i} - R^f} \simeq 1$. Then taking a first-order approximation around $\overline{R}^i \simeq R^{m-i}$gives me the approximation of p_t^i, $\widetilde{p}_t^i$

$$\begin{aligned}
\widetilde{x}_t^i &= \frac{1}{\sigma_i^2/\sigma_{m-i}^2 + 1 - 2\theta^i} + \left(1 - \frac{1 - \theta^i}{\sigma_i^2/\sigma_{m-i}^2 + 1 - 2\theta^i}\right)\left(\frac{\overline{R}^i - R^{m-i}}{R^{m-i} - R^f}\right) \\
&\simeq \frac{1}{\sigma_i^2/\sigma_{m-i}^2 + 1 - 2\theta^i} + \frac{1}{s^{m-i}}\left(1 - \frac{1 - \theta^i}{\sigma_i^2/\sigma_{m-i}^2 + 1 - 2\theta^i}\right)\left(\overline{R}^i - R^{m-i}\right)
\end{aligned} \tag{52}$$

[55]Hence λ_t is the sharpe ratio.

[56]This interpretation is in line with Miranda-Agrippino and Rey (2019) and Bruno and Shin (2015a).

where s^{m-i} is a constant close to $R^{m-i} - R^f$. s^{m-i} denotes spread of the global portfolio over the return to the safe asset. This another approximation is to reduce the number of the parameters I need to estimate for the calibration.

To make it even more tractable, I assume that the parameters regarding the risk properties σ_i^2, σ_m^2 and θ^i are invariant in short run. We can think of investors who update their belief sporadically.[57] Then I finally get

$$\widetilde{x}_t^i \simeq \chi_0^i + \chi_1^i \left(\overline{R}^i - R^{m-i}\right) \tag{53}$$

Then, let's denote the money invested in the asset i by p_t^i. It is

$$p_t^i = \frac{\mathrm{W}^G}{\chi_0^i e^{v_t}} \left[1 + \frac{\chi_0^i}{\chi_0^i} \left(\overline{R}^i - R^{m-i}\right)\right]$$

Once I replace $\frac{\mathrm{W}^G}{\chi_0^i}$ with $\frac{1}{\Gamma^i}$ and fully express the terms, the demand from the global investors for the equity and government bonds in the small open economy are given by[58]

$$p_t^k = Q_t k_t^f \varepsilon_t^{-1} = \frac{1}{\Gamma^k e^{v_t}} \left[1 + \frac{\chi_0^k}{\chi_0^k} \mathbb{E}_t \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^k\right] - R_{t+1}^m (v_t)\right]$$

$$p_t^b = q_t b_t^f \varepsilon_t^{-1} = \frac{1}{\Gamma^b e^{v_t}} \left[1 + \frac{\chi_0^b}{\chi_0^b} \mathbb{E}_t \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^b\right] - R_{t+1}^m (v_t)\right]$$

C Pricing to Markets and Exchange Rate Channel

In this subsection, I introduce an extension of the simple model before I build a more general model to be used for quantitative exercises. The purpose of the extension is to illustrate how resilient nonfinancial corporates in EMEs can be to local currency depreciations so that the seemingly large amounts of net foreign currency debts of nonfinancial corporates do not show a significance in the cross-country regressions. For tractability and simplicity, in this subsection, I treat domestic banks as a conglomeration of financial and non-financial corporates. This is a way to illustrate desired mechanism, while keeping consistency in modeling techniques.

While maintaining simplicity even in the extended model, I give one change to the simple model. I adopt monopolistic competition to the model. Following the standard in the literature, final goods are produced from a variety of differentiated goods $y_{i,t}, i \in [0,1]$ under perfect competition according to CES technology as below.

$$Y_t = \left(\int_0^1 y_{i,t}^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$$

[57] I implicitly assume that the invetors update the belief of expected return more frequently. We can think the information to predict the expected return is mroe available or cheaper.

[58] The seminal paper Gabaix and Maggiori (2015), and following papers derive similar forms from agency frictions between global financial intermediaries and investors.

where $\eta > 1$. Each differentiated intermediate good is by the standard Cobb-Douglas technology.

$$y_{i,t} = A_t \left(k_{i,t}\right)^{\alpha} \left(l_{i,t}\right)^{1-\alpha}$$

where subcript i denotes inputs used by producer i.

Following the standard in the literature, I assume that the imtermediate goods producers are under monopolistic competition and thus face a downward sloping demand curve as follows.

$$y_{i,t} = \left(\frac{p_{i,t}}{P_t}\right)^{-\eta} Y_t$$

where $p_{i,t}$ is the nominal price of goods i and P_t is the aggregate price index as follows.

$$P_t = \left(\int_0^1 p_{i,t}^{1-\eta} di\right)^{\frac{1}{1-\eta}}$$

Notice I do not introduce nominal rigidity; in each period, the intermediate goods producers can set their prices optimally. The producers can separately set their prices in foreign markets, as argued in Local Currency Pricing (LCP) hypothesis.[59] However, while the producers can optimally change their prices in local markets, producers, who export to foreign markets, take foreign market prices as given. This is a way to keep the model simple, while capturing observed empirical features. As it is well known, exchange rate pass-through into export prices is usually low in reality.[60] Also, for many exporting goods, the exporting prices are determined under strategic considerations of the exporters, from which I abstract here or the prices are determined in large international markets, like some commodities in the reality.

Then the two different prices in domestic and foreign markets are determined as follows.

$$p_{i,t} = \frac{\eta}{\eta - 1} mc_t \quad \text{and} \quad p^*_{i,t} = p^*_t \left(\epsilon_t p^*_t > mc_t\right)$$

Please notice that the price in the foreign markets is assumed to be higher than the marginal costs, and therefore the local currency depreciation, higher exchange rates will gift higher mark-ups to the exporters if the marginal costs in local currency are fixed.

Since the price is higher than the marginal costs, the monopolistic producer can have some profits as follows.

$$\pi_{i,t} = \underbrace{\frac{1}{\eta} Y^d_t}_{Dometic\ Profit} + \underbrace{Y^*_t \left(p^*_t\right)^{-\eta^*} \left(e_t - mc_t\right)}_{Export\ Profit}$$

where $Y^d_t = c^d_t + I_t + G$ and e_t is the real exchange rate. $mc_t = \frac{1}{A_t} \left(\alpha z_t\right)^{\alpha} \left(\left(1-\alpha\right) w_t\right)^{1-\alpha}$ and z_t and w_t are the real rental cost of capital and the real wage in terms of "domestic price of the final goods." In other words, the marginal cost of the producers is denominated in local currency.

Now I show the "economic" profits of the corporates whose revenues are partially denominated in foreign currency move opposite to risk-appetite of the global investors. That is, risk-off (on)

[59] For the different pricing in different markets of exporters, see the seminal paper Betts and Devereux (2000)

[60] See the excellent survey Burstein and Gopinath (2014)

shocks increase (decrease) the profits of the corporates. I highlight this in the following lemma.

Lemma 1. *Risk-off (on) shocks increase (decrease) the corporate profits* π_t . *That is,* $\frac{d\pi_t}{d\nu_t} > 0$

Therefore, the profits of corporates increase when risk-appetite of global investors unexpectedly falls, despite the negative impacts on the capital market. This is a particular case because I abstract from some features in the reality, like nominal rigidity, which generates aggregate demand externality. The implication from the lemma should be understood as such that profits of the exporting corporates are impacted less than others or the profits are relatively stable from the risk-appetite shocks. Of course, in reality, profits of export oriented firms in EMEs can even increase although the economy falls into a recession.

How are the corporates in the model benefiting from the risk-off shocks? Recall the costs of the corporates are denominated in local currency in the sense that real wages and rental costs are measured by marginal products in domestic markets. On the contrary, parts of the revenues are denominated in foreign currency. Therefore, local currency depreciations raise markups for the corporates.

While local currency depreciation benefits the corporates on the profit side, the depreciation should raise the real debt burden of foreign currency debts if the corporates have foreign currency debts. Thus, the positive effects and negative effects offset each other, and which effect is dominating depends on amounts of the foreign currency debts and the magnitude of the positive impacts on the profit, which again depend on different conditions such as share of exports in the outputs of the corporates, i.e., trade openness of the economy for the country representative firm.

To see it more clearly, let's look at the impacts of local currency depreciation on the net worth.[61] Recall that the exchange rate channel works throuhg the impact of the exchange rate on the net worth of the domestic banks, which include the nonfinancial corporates here.

$$\frac{\partial N_t}{\partial \varepsilon_t}\frac{d\varepsilon_t}{d\nu_t} = \left(1 - \frac{\partial Q_t}{\partial N_t} k^d_{t-1}\right)^{-1} \left[\frac{\partial \pi_t}{\partial \varepsilon_t} + \frac{\partial Q_t}{\partial \left(p^k_t \varepsilon_t\right)} \frac{\partial \left(p^k_t \varepsilon_t\right)}{\partial \varepsilon_t} - R^*_t d^*_{t-1}\right] \tag{54}$$

In equation (54), the conventional balance sheet effects are captured by $R^*_t d^*_{t-1}$; negative effects of local currency depreciation and the impacts on the profits are captured by $\frac{\partial \pi_t}{\partial \varepsilon_t}$; positive effects of the depreciation. Because of the different effects offseting each other, the sign of $\frac{\partial N_t}{\partial \varepsilon_t}\frac{d\varepsilon_t}{d\nu_t}$ is inconclusive.

In my regression, I have no proper measure of the impacts of exchange rate movements on the corporate profits, $\frac{\partial \pi_t}{\partial \varepsilon_t}$. If $\frac{\partial \pi_t}{\partial \varepsilon_t}$ is positively correlated with the foreign currency debt d^*_{t-1} as it is likely in reality, then consistently with the empirical results, more net foreign currency debts in nonfinancial corporate sectors do not necessarily mean higher fragility to local currency depreciations.

To give it another way, let's imagine that one looks at different EMEs with different levels of foreign currency debts in non-financial corporate sectors, and estimates correlations between

[61] $\frac{\partial N_t}{\partial \varepsilon_t}\frac{\partial \pi_t}{\partial \varepsilon_t} = \frac{Y^*_t \left(p^*_t\right)^{1-\eta^*}}{P_t}$ and $\frac{\partial Q_t}{\partial N_t} = \frac{\varphi \phi_t}{\sqrt{\left(\varphi K_{t-1} - 1\right)^2 + 4\varphi\left(N_t \phi_t + p^k_t \varepsilon_t\right)}}$

the foreign currency debts and fragility measures such as changes in stock indices. If $\frac{\partial \pi_t}{\partial \varepsilon_t}$ is not properly controlled due to some unobservable features like different pricing in exports, then the correlation $corr\left(\frac{\partial N_t}{\partial \varepsilon_t}\frac{d\varepsilon_t}{d\nu_t}, d^*_{t-1}\right)$ is hard to be meaningfully high.

Then the following question is whether the positive impacts on the profits are positively correlated with the foreign currency debts. Theoretically, one can build a model where desires to stabilize cash flows lead corporates to borrow more in foreign currency when they export more or leverage constraint from tail risk, like Vale at Risk constraint, incentivizes exporting firms to issue more foreign currency debts since exporting firms have less risk from foreign currency debts as their profits increase in local currency depreciation. Empirically, finding relevant evidence is challenging and it is beyond the scope of this paper. Recently, Dalgic (2020) documents that in Turkey foreign currency debts are centered on large exporters.

The central message in this paper is the decline of the risk from foreign currency debts in EMS, but the rise of the new risk from equity and local currency portfolio investment capital flows. To focus on the new channel uncovered in this paper, I do not pioneer more about the assessment of foreign currency debt risks of nonfinancial corporates in EMEs. Instead, I highlight the findings in the following remark.

Remark. In different types of models where profits of exporters increase in local currency depreciation, the exporters whose profits increase more in local currency depreciation will borrow more in foreign currency. Then more foreign currency debts do not necessarily lead to higher fragility: during a risk-off event, the positive effects on the profits largely offset the negative impacts on the foreign currency debts.

C.1 Discussion of the implication

Broadly speaking, the implication here is profits of the exporters are likely to increase in local currency depreciations. To the best of my knowledge, such effects have not been extensively studied. However, all the underlying assumptions are in line with recent progress in the international macroeconomics literature. As revealed in influential papers of Dominant Currency Pricing (DCP), for example, Gopinath and Stein (2020) and Gopinath et al. (2019), most tradable goods are denominated in dominant currency, in fact USD. On the contrary, the "domestic" costs of corporates in EMEs are local currency denominated and rigid in short run. The obvious example is the wages in EMEs and wage rigidity in EMEs has been discussed in many papers such as Schmitt-Grohe and Uribe (2016). Then, it is clear that local currency depreciation itself boosts the profitability of exporters in EMEs as their revenues are denominated in foreign currency like USD, whereas much of their costs are denominated in local currency.

One assumption that can alter the conclusion above is positive covariance between the risk appetite shocks and foreign demands for exports from EMEs. In other words, if the trade shocks substantially move together with the risk appetite shocks, then exporters will be hit harder. Certainly, the two different shocks are positively correlated with each other to some extent, but many specific cases of risk-off shocks hardly accompany trade shocks. For instance, risk-off shocks driven by US Fed monetary policy normalization do not necessarily cause negative trade shocks as Fed would roll back the expansionary monetary policy, conditioning on Fed judges US economy is resilient enough. However, a global crisis like 2008 Global Financial Crisis or recent COVID-19 Crisis accompanies both large trade shocks and risk appetite shocks.[62] To accommodate such tail risks, I need more informative data and need to conduct a more sophisticated theoretical analysis. These are beyond the scope of this paper.

One straightforward prediction from the model is a positive correlation between trade openness and net foreign currency debts of nonfinancial corporate sectors. In my 20 sample EMEs, the observed correlation is 0.31. In reality where pricing in exports and price elasticities of exporting goods are different among EMEs, sensitivities of corporate profits to exchange rates depend on many factors other than trade openness. Identification of the factors is also beyond the scope of this paper.

Last, I emphasize that the conclusion here does not imply net foreign currency debts of nonfinancial corporates in EMEs are efficient from the viewpoint of financial stability. Rather, the statement should be understood as positive correlations between countercyclical components in nonfinancial corporates profits and foreign currency debts in the sectors: thus, more foreign currency debts do not necessarily lead to higher fragility in the data. The foreign currency debts in reality may be determined by the risk-hedging desires of the corporates, but the foreign currency debts in the first-best equilibrium should be determined taking account of pecuniary externalities and aggregate demand externalities.[63] Since the focus in this paper is on the channels through which risk appetite shocks are transmitted, I do not further analyze the efficiency of foreign currency debts.[64]

D Who Can Borrow More in Equity and LC Bond?

An important question related to the research agenda in this paper is "Which EMEs can borrow more in equities and LC debts?" In other words, "How can we explain different structures of external liabilities of EMS, which were reported in section 2 in this paper?" Answer to these questions is also important for the validity of the cross-country regression in section 2, which motivated our model; explaining different amounts of equity external liabilities and LC debts can help me with dealing with the concern about the endogeneity.

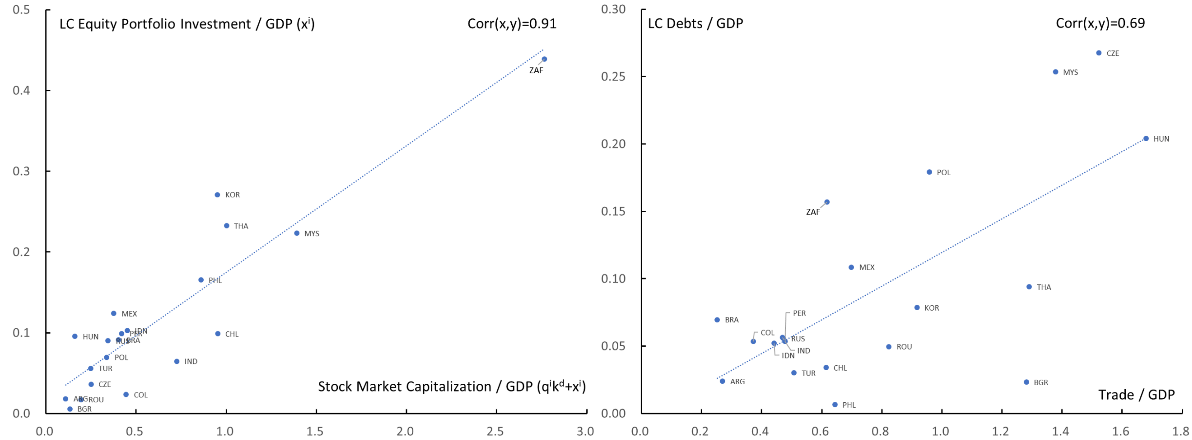
I examined a few economic fundamentals that are possibly correlated with the amounts of external equity liabilities and LC debts. While most of the fundamentals such as economic growth rate, inflation or government debt to ratio do not show significantly high correlations, two

[62]The exterem crises must dampen the profitability of the exporters in EMEs, but the role of exchange rates in this context is unclear. Besides the negative demand shocks, the higher exchagne rates still help the exporters with lessening the negative impacts.

[63]For a more serious analysis, I need more detailed information about different features of expoerts in the EMEs, such as different pricing or price elasticities of the exports.

[64]My presumption is the net foreign currency debt levels observed in the data are still higher than the first-best equilibrium levels. This is because the risk-on/off shocks impact EMEs not only throug foreign currency debts, but also through the capital market channel, which I uncover and highlight in this paper. To stabilize the economy from the global financial cycles, the net worth of the corporates need to be procyclical to exchange rates; higher exchagne rates (local currency depreciations) increase the cash flows of the corporates, as higher (lower) exchage rates follow risk-off (on) shocks. To explain more, the net worth of the corporates are stabilized from exchange rates with some foreign currency debts, but without the foreign currency debts the local currency depreciations can strengthen the net worth so as to cover the negative impacts of risk-off shocks through the capital price.

Figure 9: Stock Marekt Capitalization, Trade Openness, and LC external liabilities



Note: all measures are the average of yearly data from 2012 to 2017

fundamentals turn out to be particularly relevant. First, amounts of both equity and LC debt are highly correlated with domestic capital markets: that is, EMEs with larger stock markets tend to receive more equity portfolio investments from abroad and similarly, EMEs with larger bond markets tend to receive more (LC denominated) bond portfolio investments. For the LC debts, trade openness also significantly matter. The correlation between equity external liabilities[65] to GDP ratio and stock market capitalization to GDP ratio is 0.91. For LC debts, the correlation between domestic bond market outstanding to GDP ratio and LC debts to GDP ratio is 0.61, and the correlation between trade openness and LC debts to GDP ratio is even higher; the correlation is 0.69.

To explain the correlation, I consider an optimal portfolio construction of global investors. In the appendix, I analyzed how global investors under VaR constraints build her portfolio. Imagine a global investor who has a portfolio composed of $m-1$ number of assets. For the global investor who is seeking an investment opportunity in equity market in coutny i, the amount of the investments is determined by

$$p_i\left(\theta^i, :\right) = \frac{\frac{\overline{R}^i - R^f}{R^{m-i} - R^f} - \theta^i\left(\widehat{\theta^i}\left(p_i, Q_i k_i^d\right)\right)}{\sigma_i^2/\sigma_{m-i}^2 + \frac{\overline{R}^i - R^f}{R^{m-i} - R^f} - \theta^i\left(\widehat{\theta^i}\left(p_i, Q_i k_i^d\right)\right)\left(\frac{\overline{R}^i - R^f}{R^{m-i} - R^f} + 1\right)} \tag{55}$$

where $\overline{R}^i$ is the expected return to the equity in country i, σ_i^2 and σ_{m-i}^2 are the standard deviations of asset i and the pre-determined portfolio. θ^i is the covariance of the equity return and the return to the pre-determined portfolio. From the findings in section 2 and 3, I know that the covariance between equity market return in country i and the risk appetite shock to global investors $\left(\theta^i\right)$ depends on the share of the investors in the equity market in country i, $\widehat{\theta^i} = \frac{p_i}{p_i + Q_t k_i^d}$.[66] The size of the capital market can be proxied by $Q_i k_i^d$. Then it is obvious larger $Q_i k_i^d$ must be associated with higher p_i: holding the investment by global investors p_i fixed, larger $Q_i k_i^d$ leads to a lower share of global investor $\widehat{\theta^i}$ so as to lower the covariance with global

[65] As data permits, I only included local currency denominated equities, which are issued in each of the EMEs.
[66] Here I am abstracting from currency and also ignoring the possible comovements from the trade channel.

risky asset prices θ^i, and then more global investors are attracted to the market because of the low exposure to the global systemic risk.

More formally, equation (55) forms a fixed problem in which global investors' share in the equity market in country i is determined in equilibrium. Global (foreign) investors make a decision based on the exposure to their own risk and the exposure is determined by the decision of the investors. Therefore the following proposition follows.

Proposition 4. *In the optimal portfolio decision in (55),*

1) Given $\overline{R}^i$ and σ_i^2, p_i increases in $Q_i k_i^d$.

2) Moreover, for different country i and j, if $\sigma_i^2 = \sigma_j^2$ and $\overline{R}^i = \overline{R}^j$, then in equilibrium $\widehat{\theta}^i = \widehat{\theta}^j$

The first statement summarizes the discussion above. To see what the second statement means, imagine there are two different EMEs and the average return R^i and idiosyncratic volatility σ_2^i are the same in the two EMEs.[67] If the share of global investors is higher in one country, then the equities in the country are more sensitive to the risk appetite shocks to the global investors so that the equities are less attractive to the global investors since the returns are more correlated with the investors' own risk profile. Then the global investors move capitals to the other country and therefore the global investor shares in the two EMEs are must be the same in equilibrium.

A similar story can be applied to the relationship between trade openness and LC bond portfolio investment. Higher trade openness, given LC portfolio bond investment, make the currency less correlated to the investors' own risk profile, and thereby attracting more global investors into the LC bond markets in the country.

E Omitted Algebras and Proofs

Proof of Proposition 1 To prove the statements in the proposition, I find it useful to found the lemma below.

Lemma. *The equilibrium of the small open economy is represented by the equations below, which shows the capital market clearing condition, the foreign exchange market clearing condition, and the law of motion for the risk appetite of global investors respectively.*

$$Q_t = f_1(\varepsilon_t, v_t)$$
$$0 = f_2(Q_t, \varepsilon_t, v_t)$$

Proof) First, remember that I assume $\chi_i^1 = 0$ so that the capital inflows from global investors, p_t^k and p_t^b, are determined regardless of the expectation. The resource constraint of this economy is as follows.

[67]Precisely, this is slightly misleading since the foreign investor participation would alter the average return and idiocyncratic volatility. Howeve, these two factors should be less sensitive to foreign investors' share in the market than the covariance. Hence, the main insights would not be changed.

$$AK_{t-1}^{\alpha}L^{1-\alpha} = c_t^d + I_t + \frac{\varphi}{2}\left(\frac{I_t}{K_{t-1}}\right)^2 K_{t-1} + G + Ex_t$$

The optimality condition of the capital producer, $1 + \varphi I_t = Q_t$, pins down the investment given the capital price, Q_t. From the equation (19), we know Q_t is a function of the states, v_t and ε_t. Real exchange rate ε_t determines the exports, Ex_t. Since the output in this economy is determined from the previoud period, K_{t-1}, capital price Q_t and real exchange rate ε_t determine the domestic goods consumption c_t^d.

The real exchagne rate ε_t is determined by the foreign exchange market clearing condition (21). Note that the imported goods consumption is determined given domestic goods consumption and the real exchange rate by the equation below.

$$c_t^m \varepsilon_t = c_t^d \left(\frac{\omega}{1-\omega}\right) \tag{56}$$

Thus, c_t^m is a function of Q_t, ε_t and v_t. In equation (21), ε_t is determined by c_t^m, and the investments by global investors, p_t^k and p_t^b, which are solely determined by v_t. This tells me that Q_t and v_t uniquely determine ε_t. This completes the proof.

Now we prove the proposition. Plugging in $N_t = \sigma\left(\left(z_t + Q_t\right)k_{t-1}^d - R_t d_{t-1}\right) + \xi\left(z_t + Q_t\right)k_{t-1}^d$ into equation (19) yields

$$Q_t = \frac{\varphi\left(\varphi^{-1} + \phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{K_{t-1}} - 1\right) + \sqrt{\varphi^2\left(\varphi^{-1} + \phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{K_{t-1}} - 1\right)^2 + 4\varphi\frac{p_t^k\varepsilon_t + \phi\left(\left(\sigma+\xi\right)z_t k_{t-1}^d - \sigma R_t d_{t-1}\right)}{K_{t-1}}}}{2} \tag{57}$$

$$\frac{dQ_t}{d\nu_t} = \frac{\varepsilon_t\left(-1 + \frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}\right)}{\sqrt{\left(\phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{p_t^k\varepsilon_t} + \varphi^{-1}\frac{K_{t-1}}{p_t^k\varepsilon_t} - \frac{K_{t-1}}{p_t^k\varepsilon_t}\right)^2 + 4\varphi^{-1}\frac{K_{t-1}}{p_t^k\varepsilon_t}\left(1 + \phi\left(\frac{(\sigma+\xi)z_t k_{t-1}^d - \sigma R_t d_{t-1}}{p_t^k\varepsilon_t}\right)\right)}} \tag{58}$$

To prove $\frac{dQ_t}{d\nu_t} > 0$, I need to show $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} < 1$.

Plugging into the equation (56) to the foreign exchange market clearing condition yields

$$\frac{1}{1-\omega}Y_t^*\varepsilon_t^{\gamma} - \frac{\omega}{1-\omega}\left(Y_t - I_t - \frac{\varphi}{2}\left(\frac{I_t}{K_{t-1}}\right)^2 K_{t-1} - G\right) = R_{t-1}^k k_{t-1}^f + R_{t-1}^b b_{t-1}^f - \varepsilon_t\left(p_t^k + p_t^b\right)$$

By the implicit function theorem, I have

$$\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} = \frac{p_t^k\left(1 + \frac{dQ_t}{d\left(p_t^k\varepsilon_t\right)}\left(\frac{\omega}{1-\omega}\left(\varphi^{-1} + I_t\right) - k_{t-1}^f\right)\right) + p_t^b}{\frac{Y_t^*}{1-\omega}\gamma\varepsilon_t^{\gamma-1} + p_t^k\left(1 + \frac{dQ_t}{d\left(p_t^k\varepsilon_t\right)}\left(\frac{\omega}{1-\omega}\left(\varphi^{-1} + I_t\right) - k_{t-1}^f\right)\right) + p_t^b} \tag{59}$$

It is obvious that $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} < 1$. It proves the first statement in the proposition.

Next I show $\frac{\partial^2 Q_t}{\partial\nu_t\partial\widehat{\theta}_t}\mid_{\varepsilon_t} < 0$. To derive the desired result, I need to show $\frac{\partial Q_t}{\partial\nu_t}\mid_{\varepsilon_t}$ decreases in $p_t^k\varepsilon_t$. For the purpose, I find it is convenient to denote $\frac{K_{t-1}}{p_t^k\varepsilon_t}$ by x_t. Then the term in the denominator turns out to be a following quadratic equation.

$$H(x_t)=\left(\left(\phi\left(\sigma+\xi\right)\frac{k^d_{t-1}}{K_{t-1}}+\left(\varphi^{-1}+1\right)\right)^2+4\varphi^{-1}\phi\left(\frac{\left(\sigma+\xi\right)z_tk^d_{t-1}-\sigma R_td_{t-1}}{K_{t-1}}\right)\right)^2x_t^2+4\varphi^{-1}x_t$$

Since x_t is inverseIy related with $p^k_t\varepsilon_t$, I want to show $H^{'}>0$ for $x_t>0$. It is equivalent to

$$x_t>\frac{-4\varphi^{-1}}{2\left(\left(\phi\left(\sigma+\xi\right)\frac{k^d_{t-1}}{K_{t-1}}+\left(\varphi^{-1}+1\right)\right)^2+4\varphi^{-1}\phi\left(\frac{(\sigma+\xi)z_tk^d_{t-1}-\sigma R_td_{t-1}}{K_{t-1}}\right)\right)}$$

Since $x_t>0$,the sufficient condition for the inequality is

$$\left(\phi\left(\sigma+\xi\right)\frac{k^d_{t-1}}{K_{t-1}}+\left(\varphi^{-1}+1\right)\right)^2>-4\varphi^{-1}\phi\left(\frac{\left(\sigma+\xi\right)z_tk^d_{t-1}-\sigma R_td_{t-1}}{K_{t-1}}\right)$$

As I assumed in the proposition.

Lastly, I prove the third statement. It is trivial. Notice $k^d_t=\frac{N_t}{Q_t}\phi$ and furthermore

$$\frac{N_t}{Q_t}=\left(\sigma+\xi\right)k^d_{t-1}+\frac{\left(\sigma+\xi\right)z_tk^d_{t-1}-\sigma R_td_{t-1}}{Q_t}$$

It is straightforward that $\frac{N_t}{Q_t}$ increases in Q_t if $\left(\sigma+\xi\right)z_tk^d_{t-1}-\sigma R_td_{t-1}<0$. This completes the proof.

Corollary 2. *if $K_{t-1}\approx K_t$, $k^d_{t-1}\approx k^d_t$,and $Q_t\approx 1$, then I can approximate $\frac{\partial Q_t}{\partial\nu_t}\mid_{\varepsilon_t}$ as follows.*

$$\frac{\partial Q_t}{\partial\nu_t}\mid_{\varepsilon_t}\approx\frac{\varepsilon_t\left(-1+\frac{dS^k_t/d\nu_t}{S^k_t}\right)}{\sqrt{\left(\phi\left(\sigma+\xi\right)\left(\frac{1-\theta_t}{\theta_t}\right)+\frac{\varphi^{-1}}{\theta_t}-\frac{1}{\theta_t}\right)^2+4\frac{\varphi^{-1}}{\theta_t}\left(1+\phi\left(\frac{1-\theta_t}{\theta_t}\right)\left(\left(\sigma+\xi\right)z_t-\sigma R_t\left(\frac{\phi-1}{\phi}\right)\right)\right)}}$$

It is easy to see that, given the value of $\frac{dS^k_t/d\nu_t}{S^k_t}$, approximated $\frac{\partial Q_t}{\partial\nu_t}\mid_{\varepsilon_t}$ does increase in θ_t if $\left(\phi\left(\sigma+\xi\right)\left(\frac{1-\theta_t}{\theta_t}\right)+\left(\varphi^{-1}+1\right)\right)^2>-4\varphi^{-1}\phi\left(\frac{1-\theta_t}{\theta_t}\right)\left(\left(\sigma+\xi\right)z_t-\sigma R_t\left(\frac{\phi-1}{\phi}\right)\right)$. Corollary 2 provides a comparative statics matching the empirical results from the cross-country panel regressions.

Proof of Proposition 2 See if $\chi^0_k=\chi^0_b=0$, then

$$\frac{dQ_t}{d\nu_t}=\frac{\varepsilon_t\left(-1+\frac{dS^k_t/d\nu_t}{S^k_t}+\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}\right)}{\sqrt{\left(\phi\left(\sigma+\xi\right)\frac{k^d_{t-1}}{p^k_t\varepsilon_t}+\varphi^{-1}\frac{K_{t-1}}{p^k_t\varepsilon_t}-\frac{K_{t-1}}{p^k_t\varepsilon_t}\right)^2+4\varphi^{-1}\frac{K_{t-1}}{p^k_t\varepsilon_t}\left(1+\phi\left(\frac{(\sigma+\xi)z_tk^d_{t-1}-\sigma R_td_{t-1}}{p^k_t\varepsilon_t}\right)\right)}}\tag{60}$$

$$\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} = \frac{p_t^k\left(1+\frac{dQ_t}{d\left(p_t^k\varepsilon_t\right)}\left(\frac{\omega}{1-\omega}\left(\varphi^{-1}+I_t\right)-k_{t-1}^f\right)\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right)+p_t^b\left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right)}{\frac{Y_t^*}{1-\omega}\gamma\varepsilon_t^{\gamma-1}+\left(p_t^k+p_t^b\right)+p_t^k\frac{dQ_t}{d\left(p_t^k\varepsilon_t\right)}\left(\frac{\omega}{1-\omega}\left(\varphi^{-1}+I_t\right)-k_{t-1}^f\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right)} \tag{61}$$

It is easy to see that under the assumptions in the proposition, $0<\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}<1$.

Then by the assumption, $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}>0$ and moreover, by the assumption that $\frac{\gamma\varepsilon_t^{\gamma-1}}{1-\omega}>-\frac{dS_t^b/d\nu_t}{S_t^b}\eta_t^b$, $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}<1$.

Backing to $\frac{dQ_t}{d\nu_t}$, see

$$\frac{dQ_t}{d\nu_t} = \frac{\varepsilon_t\left(-1+\frac{dS_t^k/d\nu_t}{S_t^k}+\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}\right)}{\sqrt{\left(\phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{p_t^k\varepsilon_t}+\varphi^{-1}\frac{K_{t-1}}{p_t^k\varepsilon_t}-\frac{K_{t-1}}{p_t^k\varepsilon_t}\right)^2+4\varphi^{-1}\frac{K_{t-1}}{p_t^k\varepsilon_t}\left(1+\phi\left(\frac{(\sigma+\xi)z_tk_{t-1}^d-\sigma R_td_{t-1}}{p_t^k\varepsilon_t}\right)\right)}}$$

As $\frac{dS_t^k/d\nu_t}{S_t^k}\to 0$, $-1+\frac{dS_t^k/d\nu_t}{S_t^k}\to -1$, but $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}$ is strictly smaller than 1. It proves that $\frac{dQ_t}{d\nu_t}<0$ for $\frac{dS_t^k/d\nu_t}{S_t^k}$ small enough.

Next I show $\frac{\partial^2 Q_t}{\partial\nu_t\partial\widehat{\theta}_t}\mid_{\varepsilon_t}<0$. Recall

$$\frac{\partial Q_t}{\partial\nu_t}\mid_{\varepsilon_t} = \frac{\varepsilon_t\left(-1+\frac{dS_t^k/d\nu_t}{S_t^k}\right)}{\sqrt{\left(\phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{p_t^k\varepsilon_t}+\varphi^{-1}\frac{K_{t-1}}{p_t^k\varepsilon_t}-\frac{K_{t-1}}{p_t^k\varepsilon_t}\right)^2+4\varphi^{-1}\frac{K_{t-1}}{p_t^k\varepsilon_t}\left(1+\phi\left(\frac{(\sigma+\xi)z_tk_{t-1}^d-\sigma R_td_{t-1}}{p_t^k\varepsilon_t}\right)\right)}}$$

To derive the desired result, I need to show $\frac{\partial Q_t}{\partial\nu_t}\mid_{\varepsilon_t}$ decreases in $p_t^k\varepsilon_t$.

For the purpose, I find it is convenient to denote $\frac{K_{t-1}}{p_t^k\varepsilon_t}$ by x_t. Then the term in the denominator turns out to be a following quadratic equation.

$$H(x_t) = \left(\left(\phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{K_{t-1}}+\left(\varphi^{-1}+1\right)\right)^2+4\varphi^{-1}\phi\left(\frac{\left(\sigma+\xi\right)z_tk_{t-1}^d-\sigma R_td_{t-1}}{K_{t-1}}\right)\right)^2 x_t^2+4\varphi^{-1}x_t$$

Since x_t is inverseIy related with $p_t^k\varepsilon_t$, I want to show $H^{'}>0$ for $x_t>0$. It is equivalent to

$$x_t > \frac{-4\varphi^{-1}}{2\left(\left(\phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{K_{t-1}}+\left(\varphi^{-1}+1\right)\right)^2+4\varphi^{-1}\phi\left(\frac{(\sigma+\xi)z_tk_{t-1}^d-\sigma R_td_{t-1}}{K_{t-1}}\right)\right)}$$

Since $x_t>0$,the sufficient condition for the inequality is

$$\left(\phi\left(\sigma+\xi\right)\frac{k_{t-1}^d}{K_{t-1}}+\left(\varphi^{-1}+1\right)\right)^2 > -4\varphi^{-1}\phi\left(\frac{\left(\sigma+\xi\right)z_tk_{t-1}^d-\sigma R_td_{t-1}}{K_{t-1}}\right)$$

As I assumed in the proposition.

Lastly, I show

$$\frac{\partial h_t}{\partial \eta_t^b} > 0 > \frac{\partial h_t}{\partial \eta_t^k} \quad or \quad \frac{\partial h_t}{\partial \eta_t^b} > \frac{\partial h_t}{\partial \eta_t^k} > 0$$

where $h\left(\eta_t^b, \eta_t^k\right) = \frac{d\varepsilon_t/d\nu_t}{\varepsilon_t}$, and $\eta_t^b = \frac{p_t^b}{Y_t^*}$ and $\eta_t^k = \frac{p_t^k}{Y_t^*}$. I transform equation (58) to

$$\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} = \frac{\eta_t^k\left(1+\frac{dQ_t}{d(p_t^k\varepsilon_t)}\left(\frac{\omega}{1-\omega}\varphi^{-1}-k_{t-1}^f\right)\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right)+\eta_t^b\left(1-\frac{dS_t^b/d\nu_t}{S_t^b}\right)}{\frac{\gamma\varepsilon_t^{\gamma-1}}{1-\omega}+\eta_t^b+\eta_t^k\left(1+\frac{dQ_t}{d(p_t^k\varepsilon_t)}\left(\frac{\omega}{1-\omega}\varphi^{-1}-k_{t-1}^f\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right)\right)} \tag{62}$$

Since $1-\frac{dS_t^b/d\nu_t}{S_t^b} > 1$ and $0 < 1-\frac{dS_t^b/d\nu_t}{S_t^b} < 1$, but $0 < \frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} < 1$, it is straightforward that $\frac{\partial h_t}{\partial \eta_t^b} > 0$, and $\frac{\partial h_t}{\partial \eta_t^b} > \frac{\partial h_t}{\partial \eta_t^k}$.

Furthermore, since $\frac{d\varepsilon_t/d\nu_t}{\varepsilon_t} < 1$ and the "coefficient" of η_t^k in the numerator is smaller than the denominator. That is,

$$\left(1+\frac{dQ_t}{d\left(p_t^k\varepsilon_t\right)}\left(\frac{\omega}{1-\omega}\varphi^{-1}-k_{t-1}^f\right)\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right) < 1+\frac{dQ_t}{d\left(p_t^k\varepsilon_t\right)}\left(\frac{\omega}{1-\omega}\varphi^{-1}-k_{t-1}^f\right)\left(1-\frac{dS_t^k/d\nu_t}{S_t^k}\right)$$

Therefore, it can be either of $\frac{\partial h_t}{\partial \eta_t^k} > 0$ or $\frac{\partial h_t}{\partial \eta_t^k} < 0$.

Proof of Corollary 1 $\frac{dI_t}{d\nu_t} < 0$ is trivial. To show $\frac{d(NX_t)}{d\nu_t} > 0$, let's recall the net export is $\varepsilon_t^{\gamma-1}Y_t^* - c_t^m$. The exports obviously increase in ν_t as I showed $\frac{d\varepsilon_t}{d\nu_t} > 0$ under the conditions. Then I only need to show $\frac{dc_t^m}{d\nu_t} < 0$. See $(1-\omega)\, c_t^m\varepsilon_t = \omega c_t^d$. From the resource constraint,

$$c_t^m\varepsilon_t = \left(\frac{\omega}{1-\omega}\right)(Y_t - I_t - G - EX_t)$$

By the assumption $\frac{dI_t}{d\nu_t} + \frac{\partial EX_t}{\partial\varepsilon_t}\frac{d\varepsilon_t}{d\nu_t} > 0$, $c_t^m\varepsilon_t$ decreases in ν_t. Since $\frac{d\varepsilon_t}{d\nu_t} > 0$ by the proposition 1, $\frac{dc_t^m}{d\nu_t} < 0$.

Proof of Proposition 2 It is trivial and see the discussion in the text.

Discussion of Claim 1

TBW

Proof of Lemma 1 The result comes from the allocation of the output. Notice

$$Y_t = C_t + I_t + G + EX_t$$

I factorize the aggregate ouput into domestic demands and foreign demands. That is,

$$Y_t^d = C_t + I_t + G = \left(\int_0^1 \left(y_{i,t}^d\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$$

$$EX_t = \left(\int_0^1 \left(y_{i,t}^*\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$$

$y_{i,t}^d$ and $y_{i,t}^*$ are the intermediate inputs for domestic demands and foreign demands (exports) respectively.

By the assumption, the price of export goods in the foreign market is fixed. Then, the demand from the foreign market EX_t is invariant to the risk-on/off shock ν_t. Then, accordingly, the domestic demand is invariant as well. The value of the total output in terms of the domestic price is

$$\left(\int_0^1 \left(y_{i,t}^d\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}} + \frac{p_t^* \varepsilon_t}{p_t}\left(\int_0^1 \left(y_{i,t}^*\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}} = w_t L + z_t K_{t-1} + \pi_t \tag{63}$$

See $\left(\int_0^1 \left(y_{i,t}^d\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$ and $\left(\int_0^1 \left(y_{i,t}^*\right)^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}}$ are invariant to the risk-on/off shocks. Furthermore, p_t^* and p_t are invariant as well because

$$p_t = \frac{\eta}{\eta-1} mc_t$$

Notice the marginal cost mc_t is invariant as well because there is no technological shock.

In the same way, w_t and z_t are invariant as well. In equation (63), the LHS increases in ν_t since risk-off (on) shock raises (lowers) ε_t. To hold the equality between the LHS and the RHS in the equation (63), the profit π_t has to change accordingly. This gives me the desired result.

To see it another way, the real profit measured by the domestic price is

$$\pi_t = \underbrace{\frac{1}{\eta} Y_t^d}_{Dometic\ Profit} + \underbrace{Y_t^* \left(p_t^*\right)^{-\eta^*}\left(\frac{p_t^* \varepsilon_t}{p_t} - \frac{1-\eta}{\eta}\right)}_{Export\ Profit}$$

Since Y_t^d is given, it is easy to see π_t increases in ν_t.

Proof of Proposition 4 Notice equation (55) defines a fixed problem. First, I show there exists a unique solution. It is trivial. RHS decreases in p_i as I assume θ^i increases in p_i, given $Q_i k_i^d$. Since the RHS is positive for $p_i = 0$, there exists a unique value of p_i that solves the equation (55).

Then it is easy to show the first statement in the proposition. Larger $Q_i k_i^d$. leads to a lower $\widehat{\theta^i}$ and thus a lower θ^i. To restore equality, p_i has to increase.

The second statement is also easy to show. Suppose Not. That is, $\widehat{\theta^i} \neq \widehat{\theta^j}$, but $R^i = R^j$ and $\sigma^i = \sigma^j$. Here let's say $\widehat{\theta^i} > \widehat{\theta^j}$. Then the global investor will move capitals to j country until $\theta^i = \theta^j$ and equivalently $\widehat{\theta^i} = \widehat{\theta^j}$.

F Estimation of the Parameters

First, I describe how I estimated the parameters $\frac{\chi_k^0}{\chi_k^1}$ and $\frac{\chi_b^0}{\chi_b^1}$. Transform equation (46) and (47) as below

$$p_t^k = Q_t k_t^f \varepsilon_t^{-1} = \frac{1}{\widetilde{\Gamma}_k e^{v_t}} \left[1 + \frac{\chi_k^1}{\chi_k^0} \mathbb{E}_{\mathrm{t}} \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^k - R_{t+1}^m (v_t) \right] \right]$$

$$p_t^b = b_t^f \varepsilon_t^{-1} = \frac{1}{\widetilde{\Gamma}_b e^{v_t}} \left[1 + \frac{\chi_{\mathrm{b}}^1}{\chi_{\mathrm{b}}^0} \mathbb{E}_{\mathrm{t}} \left[\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^b - R_{t+1}^m (v_t) \right] \right]$$

Serious estimation of $\frac{\chi_k^1}{\chi_k^0}$ and $\frac{\chi_b^1}{\chi_b^0}$ poses a challenge. As I emphasized, these parameters matter only to the extent that it matters for capital flows. Thus, I estimate the parameters from the capital flows data in Korea. The statistics portal of the financial supervisory service (FSS) provides monthly data of foreign investors' holding of public equities and bonds issued in domestic financial markets in Korea. The data of the equity holdings and the bond holdings begin from January 2005 and January 2006 respectively. However, it is observed in the data of the bond that the foreign investors' holding of the bonds in the Korean markets have been on a "stable trend" since 2010; before 2010, the foreign holdings had kept rising except for global financial crisis[68]. Therefore, for the bond, I only use the data after 2009.

First, I take the log of the data of the public equity and bond holdings by foreign investors, and then remove the linear trend. Let's denote the detrended portfolio investment by the $\widetilde{p}_t^j$, and let the growth of $\widetilde{p}_t^j$ be $g_{\widetilde{p}_t^j}$

Define the growth of the portfolio investment $g_{p_t^j} \equiv p_t^j / p_{t-1}^j$. Then I have

$$ln\left(g_{p_t^j}\right) = -\left(v_t - v_{t-1}\right) + ln\left(1 + \frac{\chi_j^1}{\chi_j^0}\mathbb{E}_{\mathrm{t}}\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^k - R_{t+1}^m(v_t)\right]\right) - ln\left(1 + \frac{\chi_j^1}{\chi_j^0}\mathbb{E}_{\mathrm{t}}\left[\frac{\varepsilon_t}{\varepsilon_{t+1}}R_{t+1}^k - R_{t+1}^m(v_t)\right]\right) \tag{64}$$

where $\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^k$ and $\frac{\varepsilon_t}{\varepsilon_{t+1}} R_{t+1}^b$ are the returns to the Korean stock market Index (KOSPI Index) and 3 year maturity goverment bond in the USD, and the return to the alternative investment, $R_{t+1}^m(v_t)$, is the quarterly yields on the BAA grade corporate bond in the US. Now I have two moment conditions to estimate the $\frac{\chi_j^1}{\chi_j^0}$

$$\mathbb{E}_{t-1}\left[g_{p_t^j} - g_{\widetilde{p}_t^j}\right] = 0 \tag{65}$$

$$\mathbb{E}_{t-1}\left[\left(v_t - v_{t-1}\right)\left(g_{p_t^j} - g_{\widetilde{p}_t^j}\right)\right] = 0 \tag{66}$$

The intuition of using the difference in VIX is that the difference between the theoretical moment and empirical moment should be uncorrelated with the growth of VIX once the model is correctly specified under the parameter values close to the true value.

One difficulty in this GMM estimation is the limited number of the observation. To circumvent the problem, I compute the changes in the portfolio investment from a quarter ago in every month, and accordingly the returns. That is, for every month, I compute the changes in the portfolio investments and VIX in "three months", and spreads in the USD between the portfolio investments in Korean markets and the alternative asset, also in three months. Then I estimate the parameters from the "quarterly" changes every month. In such a way, I can increase the

[68] One way to understand the period is to think the time as a transitional period like a transitional path from one steady state to another steady state.

Table 7: GMM estimation results

	χ_k^1/χ_k^0	χ_b^1/χ_b^0
Estimated Values	3.645***	9.363***
	(0.124)	(0.015)
Observations	174	112
P-value of J-test	0.411	0.932

Table 8: Sensitivity of the Interest Rates to VIX

	(1)	(2)	(3)	(4)
VIX_t	0.506***		0.643***	
	(0.132)		(0.090)	
ν_t		0.203***		0.475***
		(0.060)		(0.045)
$ln(r_{t-1}^j)$		0.934***		0.859***
		(0.037)		(0.034)
Observations	83	83	83	82
R-square	0.154	0.892	0.388	0.903

number of the sample to 174 and 112 for the equity and bond respectively. The results of the estimation are reported in table 11 above.

The estimation should be understood as a way to calibrate the model to the Korean economy in the context of this paper, not a very robust and precise estimation.

Next, I illustrate the estimation of χ_m and χ_*. I can simply estimate the parameters by running the OLS regressions.

$$ln(r_t^j) = \alpha_j + \widehat{\beta}_j VIX_t + e_t^j \tag{67}$$

r^m and r^* are the BAA corporate bond yields in the US and the JP Morgan Emerging Market Bond Index[69]. Notice that the purpose of the regression is to estimate the realized sensitivity of the yields on the risky bonds to the risk appetite, measured by VIX. One of the issues in the regression above is the autocorrelation in the error terms, which are possibly correlated with VIX. The regressions must be plagued by the autocorrelations. To see how much it matters, I run another regression below.

$$ln(r_t^j) = \alpha_j + \rho_j ln(r_{t-1}^j) + \widehat{\widehat{\beta}}_j \nu_t + e_t^j \tag{68}$$

where $\nu_t = ln\left(\mathrm{VIX_t}\right) - \mathbb{E}_{t-1}\left[ln\left(\mathrm{VIX_t}\right)\right]$.[70] The estimation results are introduced below.

Notice that the results of (67) and (68) are similar to each other once we consider estimated autocorrelation coefficients ρ_j. A tricky part is that in the calibration, I implicitly assumed

[69] I used the spread on BAA corporate bonds and similarly do not convert the EMBI index to the yields on the sovereign bonds of EMEs. In fact, in the sample period, the real return to US government bonds is close to zero.

[70] Same as the bank level regression, ν_t is estimated from AR (1) model. Extensio of the AR (1) model to ARMA (1) does not significantly change the results.

that the global risk-appetite process is a part of VIX; in other words, VIX includes the risk appetite and some noises. That means if I directly use the parameter value, I will underestimate the impact of risk-appetite shocks on the interest rates. Thus, I adjust the coefficient values so that one standard deviation of risk-on/off shocks in the model changes the interest rates by the magnitudes same with the regression results. The standard deviation of v_t in the calibrated model is 0.171, while the standard deviation of VIX in the sample period is 0.353. The converted parameter values for the BAA corporate bond and EMBI index are 1.046 and 1.372 respectively.

G Contagion to Credit Market

As I stated, I abstract from rich features in financial markets in reality to focus on the key insight and make the analysis more tractable. As the channel in the model works through capital market, I assumed that all firms issue equity type securities, which are purchased by the representative domestic banks and global investors. However, firms in reality finance through different instruments and the most common instrument is bank loan. Furthermore, there are different types of financial intermediaries. In almost all countries, there are some commercial banks, which take deposits and supply credits to nonfinancial corporates in the form of bank loan, and on the other hand, some market-oriented financial intermediaries, like investment banks in the US or insurance companies, finance different ways and invest in different financial securities such as equities and bonds.

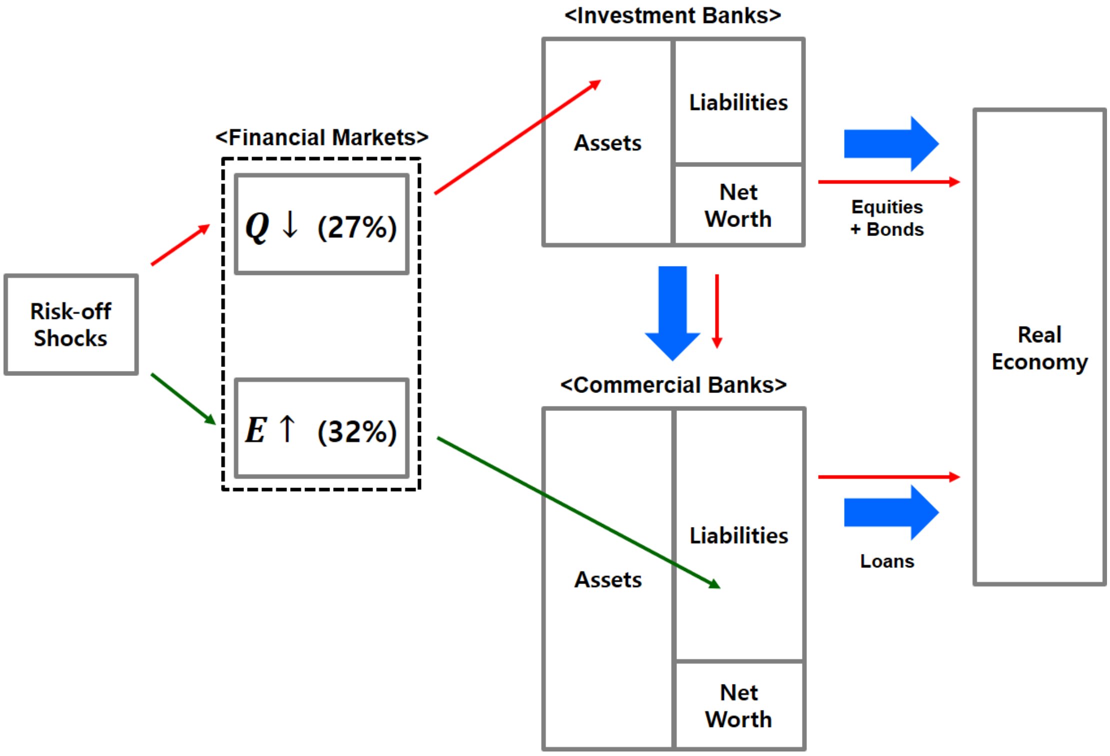
In this section, I introduce another empirical exercise in which I test the capital market channel in realistic environments. In the regressions of investment-type financial intermediaries in Korea, I tested how the impacts of global financial shocks on the capital markets affect financial intermediations of the financial intermediaries. Here, I test how the impacts on the capital markets are propagated into credit markets. Like many other countries, commercial banks in Korea mainly finance through deposits, but they also rely on market funding. The commercial banks issue short-term bank debentures and sell certificate of deposits (CDs) and the financing of these forms account for 13.4% of the total liability of the banks in my sample period. Much of the bank debentures and CDs are purchased by the "investment bank" type financial intermediaries. According to the unofficial statistics, approximately 60-70% of the securities are purchased by the investment banks. Henceforth, let's call the liabilities of bank debentures and CDs "noncore" liabilities.[71]

Then a natural prediction is global financial shocks are propagated into commercial banks, credit markets, through the noncore liability. To be more specific, a risk-off shock results in falls in asset prices in the capital market in Korea, which induce the investment banks to deleverage. The contraction of the investment banks decreases the investment banks' demands for bank debentures and CDs issued by commercial banks. The commercial banks will have trouble funding via bank debentures and CDs and as a result, the banks will be forced to reduce their credit supplies to nonfinancial corporates and households.[72] To make it short, the impacts on the

[71] The noncore liability of commercial banks in Korea and related fragilities of the banks during the global financial crisis are well documented and discussed in Shin and Shin (2011).

[72] The flow of funds described here is quite different from the US and perhaps other emerging and advanced

Figure 10: Contagion to Credit Market



capital market are contagious to the credit market through the noncore liabilities of commercial banks.

On the other hand, the commercial banks have some mild exposures to Korean won depreciations. Net foreign currency debts of the banks are, on average, 1% of the total assets in the sample period. Therefore, I can test how the two different channels, the capital market channel and the exchange rate channel, work in financial intermediations of commercial banks in Korea. Figure 11 below the two transmission channels in the regressions, which I introduce below.

The regression equation is as below.

$$\Delta ln\left(A_{i,t}\right)=\alpha_i+\alpha_t+\beta_0\theta_{i,t-1}\nu_t+\beta_1 fc_{i,t-1}\nu_t+\Gamma' X_{i,t-1}+\varepsilon_{i,t} \tag{69}$$

$\theta_{i,t-1}$ is the ratio of the noncore liabilities to the total liabilities and $fc_{i,t-1}$ is the ratio of net foreign currency debt to total liability ratio. ν_t is unexpected changes in VIX, $ln\left(\mathrm{VIX_t}\right)-\mathbb{E}_{t-1}\left[ln\left(\mathrm{VIX_t}\right)\right]$, which is the same as the capital market channel regressions.

If commercial banks with higher reliance on the noncore liability will be affected by the risk-on/off shocks more than others, β_0 will be significantly negative. Similarly, β_1 will be significantly negative if risk-on/off shocks affect the asset growth of the commercial banks through net foreign currency debts. While I control different characteristics of the commercial banks, it is crucial to control the group heterogeneity of the banks. As usual in many countries, the number of commercial banks in Korea is limited: there are 16 banks, including some foreign-owned banks

economies. Hence, I do not claim the propagation channel and mechanism here are general. It is Korea-specific rather general. The goal of the empirical study is to test the capital market channel mechanism in realistic environments although it is a little Korea-specific.

and the banks specialized in certain provinces. Among the two special groups, the group of foreign-owned banks might move in a different way than other banks. Hence, I control the group by putting the interaction term between the foreign group and the unexpected changes in VIX. There is also a special bank, Industrial Bank of Korea (IBK), which heavily relies on the special bank debenture issuance. The problem is IBK is in part owned by government bank, and therefore their operations are heavily affected by government policy, although the behavior of IBK is similar to other commercial banks in many aspects. Considering the unique feature of IBK, I control the bank in a similar way to the foreign-owned bank group.

In addition, I control financial derivative holdings and sizes of the banks as the two variables turn out to be significant. In particular, controlling the derivative holdings is important since the banks hedge risks related to market fluctuations driven by global financial shocks; most importantly, exchange rate risks.

The results in table 13 are mostly as predicted. The coefficient of the interaction term between the noncore liability and the risk-on/off shock is negative and significant in all different specifications. In contrast, all the interaction terms of net foreign currency debt are insignificant. That probably reflects that the net foreign currency debts are very small parts of the total assets and thus the balance sheet effects cannot be sizable enough. As the net foreign currency debts of the banks are relatively small, the banks might easily hedge their risks in derivative markets.

Table 13: Contagion to Credit Market

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta ln\left(A^R_{i,t-1}\right)$	0.06	0.01	0.01	0.02	0.02	0.03	0.03
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
$\theta_{i,t-1} \times \nu_t$	-0.04*	-0.25***	-0.17**	-0.16**	-0.15**	-0.15**	-0.13†
	(0.02)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
$FC_{i,t-1} \times \nu_t$				0.16	0.13	0.13	0.15
				(0.19)	(0.21)	(0.21)	(0.20)
$\frac{D_{i,t-1}}{A_{i,t-1}} \times \nu_t$			1.19***	1.19***	1.12***	1.17***	1.15
			(0.17)	(0.16)	(0.18)	(0.17)	(0.18)
$Foreign\ owned \times \nu_t$		-0.05***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
$Local \times \nu_t$					-0.01	-0.01	-0.01
					(0.01)	(0.01)	(0.01)
$IBK \times \nu_t$		0.08***	0.05***	0.04*	0.03†	0.03	0.03
		(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
$\theta_{i,t-1}$	-0.00	0.06	0.07*	0.07*	0.07*	0.07*	0.08*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
$FC_{i,t-1}$				-0.05	-0.04	-0.01	-0.01
				(0.06)	(0.06)	(0.06)	(0.06)
$\frac{D_{i,t-1}}{A_{i,t-1}}$		-0.09	-0.09	-0.08	-0.08	-0.09	-0.08
		(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
$Size_{i,t-1}$		-0.64***	-0.79***	-0.81***	-0.81***	-0.76***	-0.77***
		(0.15)	(0.15)	(0.15)	(0.15)	(0.16)	(0.16)
$\frac{A^R_{i,t-1}}{N_{i,t-1}} \times \chi_{i,t}$						-0.01	-0.01
						(0.09)	(0.09)
$\frac{C_{i,t-1}}{A_{i,t-1}} \times \nu_t$							1.41
							(2.01)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
Observation #	727	727	727	727	727	727	727
R-squared	0.33	0.39	0.44	0.44	0.44	0.45	0.45
# of banks	16	16	16	16	16	16	16

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) The dependent variable is the growth of asset, except for cashes and tangible assets. 3) $\frac{D_{i,t-1}}{A_{i,t-1}}$ is derivate assets to total asset ratio. $\frac{C_{i,t-1}}{A_{i,t-1}}$ is the cash holding to total asset ratio. $\chi_{i,t}$ is the estimate of changes in values of financial securities held by the banks, due to unexpected changes in VIX. $\frac{A^R_{i,t-1}}{N_{i,t-1}}$ is the leverage ratio, the effective asset to net worth ratio, where the effective asset is the all the assets excluding cashes and tangible assets.

Table 9: Exchange Rate Regressions_Sector level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta ln\,(VIX)_t$	0.040**	0.043***	0.044***	0.044***	0.046***	0.056**	0.046**
	[0.016]	[0.013]	[0.013]	[0.013]	[0.013]	[0.022]	[0.020]
$\left(\frac{LCB}{GDP}\right)_t^j \times$ "	0.189**	0.215***		0.123*	0.152*	0.182**	0.193**
	[0.076]	[0.086]		[0.070]	[0.083]	[0.093]	[0.088]
$\left(\frac{LCE}{GDP}\right)_t^j \times$ "	-0.005	-0.028		-0.015	-0.026	-0.003	-0.053
	[0.036]	[0.034]		[0.032]	[0.073]	[0.063]	[0.053]
$\left(\frac{HH\_NF}{GDP}\right)_t^j \times$ "			-0.242*	-0.190	-0.196	-0.201	-0.100
			[0.137]	[0.144]	[0.146]	[0.140]	[0.132]
$\left(\frac{FC\_NF}{GDP}\right)_t^j \times$ "	-0.046	-0.054	-0.027	-0.060	-0.048	-0.038	-0.082
	[0.045]	[0.047]	[0.041]	[0.049]	[0.060]	[0.053]	[0.074]
$\left(\frac{NFC\_NF}{GDP}\right)_t^j \times$ "	-0.028	-0.024	-0.094†	-0.081	-0.094	-0.063	-0.039
	[0.027]	[0.025]	[0.063]	[0.060]	[0.066]	[0.051]	[0.054]
$\left(\frac{G\_NF}{GDP}\right)_t^j \times$ "		0.079		0.061	0.081	0.038	0.092
		[0.088]		[0.080]	[0.088]	[0.076]	[0.069]
$\left(\frac{Reserve}{GDP}\right)_{t-1}^j \times$ "	-0.064**	-0.068***	-0.011	-0.028	-0.029	-0.026	-0.029
	[0.028]	[0.027]	[0.036]	[0.038]	[0.049]	[0.043]	[0.028]
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	No	No	No	No	No	Yes
# of Obs.	1577	1577	1577	1577	1577	1577	1577
R-squared	0.052	0.046	0.027	0.022	0.033	0.090	0.232

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of government sector. 3) Driscoll-Kraay standard errors. 4) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 5) Time fixed effects are not two-way fixed effects, but time dummies (random effects), because one of the key explanatory variables, the VIX log difference is the time series variable.

H Regressions with Sector Level Currency Mismatches

Same as the regressions without aggregate level currency mismatches, I first introduce the results of the exchange rate regressions. Again, for brevity, I introduce only the estimated coefficients of the key variables. The results for the other control variables are relegated to the appendix. I denote net foreign currency assets (foreign currency assets of debt instruments minus foreign currency debts) by NFC, and denote households, financial corporate sector, nonfinancial corporate sector, and government by HH, FC, NFC and G respectively. Hence, HH_NFC indicates net foreign currency assets of households in the form of debt instrument[73].

Next, I introduce the results of stock indices regressions.

Same as the exchange rate regressions with sector level net foreign currency assets, the overall results are much similar with the results of aggregate level currency mismatch: the foreign investor share is still negative with little more significance, and net foreign currency assets

[73]Unlike the regressions of the aggregate level currency mismatches, I use net positions rather than putting foreign currency assets and liabilities separately. The net foreign currency assets allow me for more straightforward interpretations, as I focus on foreign currency asset and debt valuation effects due to exchange rate changes. However, the results introduced below are highly consistent although I put foreign currency assets and debts separately. The results are omitted due to limited space.

Table 10: Stock Indices Regressions_Sector level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta ln\,(VIX)_t$	-0.078***	-0.078***	-0.085***	-0.077***	-0.077***	-0.057***	-0.031
	[0.016]	[0.016]	[0.015]	[0.017]	[0.018]	[0.018]	[0.027]
$\left(\frac{LCB}{GDP}\right)_t^j \times$ "	0.104	0.103		0.200*	0.209**	0.243**	0.248**
	[0.119]	[0.120]		[0.105]	[0.103]	[0.104]	[0.116]
$\left(\frac{LCE}{Mkt.\ Cap.}\right)_t^j \times$ "	-0.091***	-0.089**		-0.115***	-0.117***	-0.113***	-0.126**
	[0.043]	[0.038]		[0.039]	[0.038]	[0.037]	[0.063]
$\left(\frac{HH\_NF}{GDP}\right)_t^j \times$ "			0.065	0.138	0.136	0.094	0.090
			[0.125]	[0.120]	[0.121]	[0.124]	[0.091]
$\left(\frac{FC\_NF}{GDP}\right)_t^j \times$ "		-0.011	0.100	-0.031	-0.024	0.004	0.049
		[0.095]	[0.080]	[0.086]	[0.086]	[0.074]	[0.164]
$\left(\frac{NFC\_NF}{GDP}\right)_t^j \times$ "		-0.044	-0.026	-0.002	-0.006	-0.003	-0.004
		[0.031]	[0.061]	[0.058]	[0.062]	[0.063]	[0.053]
$\left(\frac{G\_NF}{GDP}\right)_t^j \times$ "				-0.001	-0.006	-0.042	-0.056
				[0.074]	[0.063]	[0.079]	[0.089]
$\left(\frac{Reserve}{GDP}\right)_{t-1}^j \times$ "	0.051†	0.051	0.018	0.029	0.026	0.029	-0.023
	[0.035]	[0.036]	[0.019]	[0.041]	[0.044]	[0.042]	[0.066]
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effect	No	No	No	No	No	No	Yes
# of Obs.	1577	1577	1577	1577	1577	1577	1577
R-squared	0.055	0.059	0.067	0.058	0.053	0.064	0.208

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, $\dagger$ p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of government sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), because one of the key explanatory variables, the VIX log difference is the time series variable.

in different sectors are all insignificant. The interpretation of the insignificance of the sector-level currency mismatches is that foreign currency debts of each of the sectors in the EMEs are matched with foreign currency assets or foreign currency denominated revenues, and then accordingly local currency depreciations do not seriously impact balance sheets of the different sectors in the EMEs.

To explain a little more, let's think of the financial corporate sectors that borrow abroad in foreign currency and supply the foreign currency to domestic foreign exchange markets. A risk-off shock can cause local currency depreciations so as to dampen the balance sheets of the financial corporates, which in turn results in less foreign currency supplies due to the deleveraging of the financial intermediaries. However, such a scenario can be realized only when the financial corporate sectors have large enough net foreign currency debts and we saw in many EMEs that the financial corporate sectors are squared-off in foreign currency. Similarly, unexpected local currency depreciations probably increase real debt burdens of nonfinancial corporates in EMEs since the corporates have sizable net foreign currency debts as we confirmed in the data in the last subsection. However, currency depreciations can boost the profitability of some of the non-financial corporates who export to foreign markets as their revenues from the exports are foreign currency denominated while much of their costs like wages are local currency denominated. If the net foreign currency debts of the nonfinancial corporates are correlated with more foreign currency revenues, then foreign currency depreciations do not necessarily lead to deleveraging of the nonfinancial corporates.

Besides the main result, a noteworthy difference from the regressions of aggregate currency mismatch data is that in stock indices regressions (4) - (7), the coefficients of local currency bond portfolio investments become positively significant; higher local currency bond portfolio to GDP ratios are associated with more resilient stocks markets to global financial shocks.

To interpret the results, recall the results in the exchange rate regressions: currencies in EMEs having more local currency debts in the form of bond portfolio investment tend to be more sensitive to risk-on/off shocks. That is, a risk-off shock depreciates currencies of EMEs and the depreciations are larger for an EME if the EME was receiving more local currency bond portfolio investments. There are two mechanisms by which the currency depreciation caused by LC bond portfolio investment outflows help the stock markets with becoming resilient from risk-on/off shocks.

First, the depreciations discount the stock prices in foreign currency so as to attract more investors. Second, as I already discussed the results of the exchange rate regressions, the depreciations might cause positive effects on the profitability of exporters in the EME, given other impacts through foreign currency debts, because the revenues from exports are fixed in the foreign currency (hence higher in the local currency), but much of the costs, for example wages, are fixed in local currency.

As one can easily see, the second reasoning also explains why I do not have significant results for net foreign currency assets of nonfinancial corporate sectors. If the positively significant coefficient captures the positive effects of local currency depreciations on the profits of the nonfinancial corporates, then it suggests that increases in the profits following local currency depreciations can offset the negative valuation effects of foreign currency debts.

I Additional Figures and Tables

I.1 Figures of External Liabiliteis and Foreign Currency Exposures

Figure 11: External Liabilities of EMEs

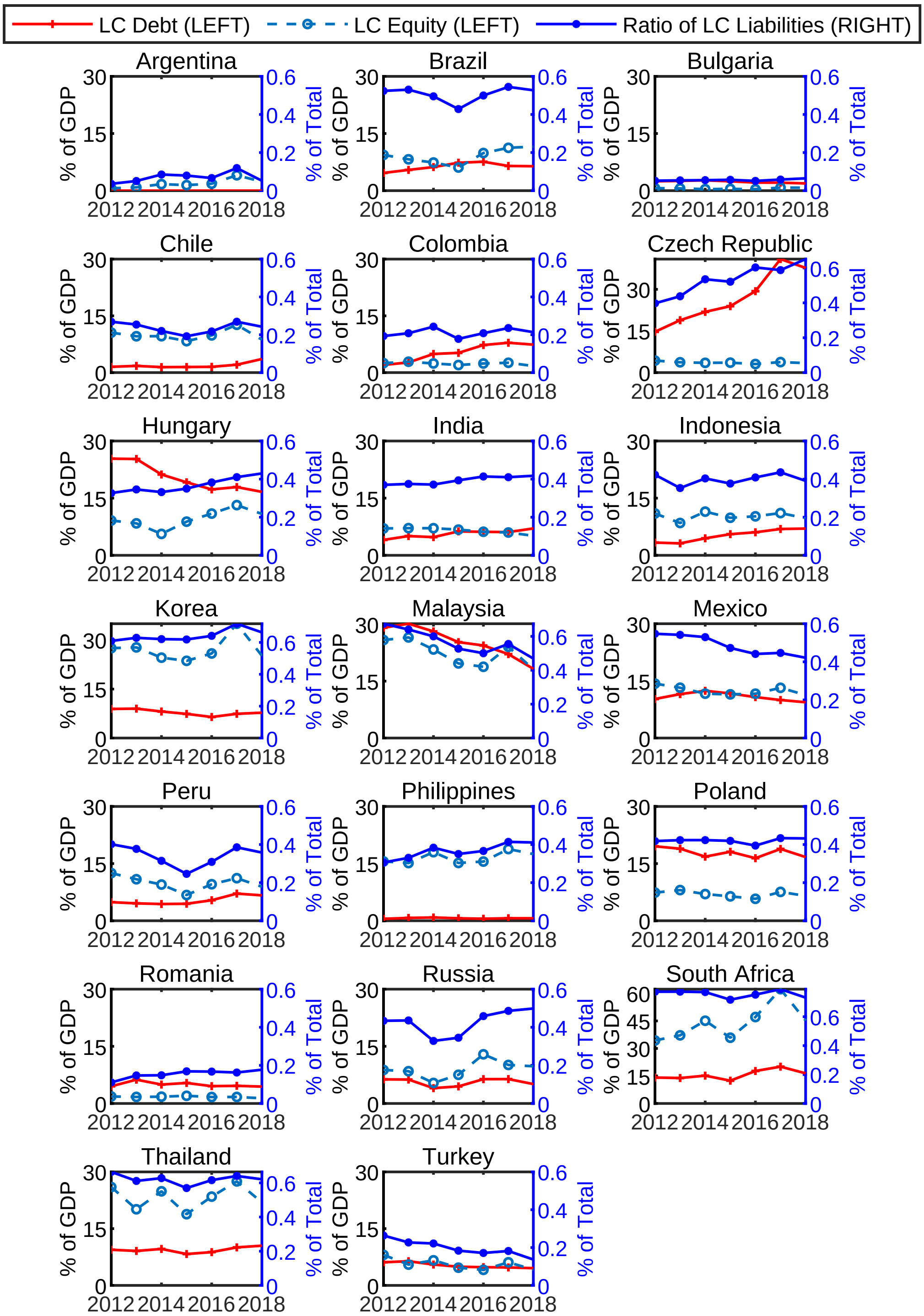
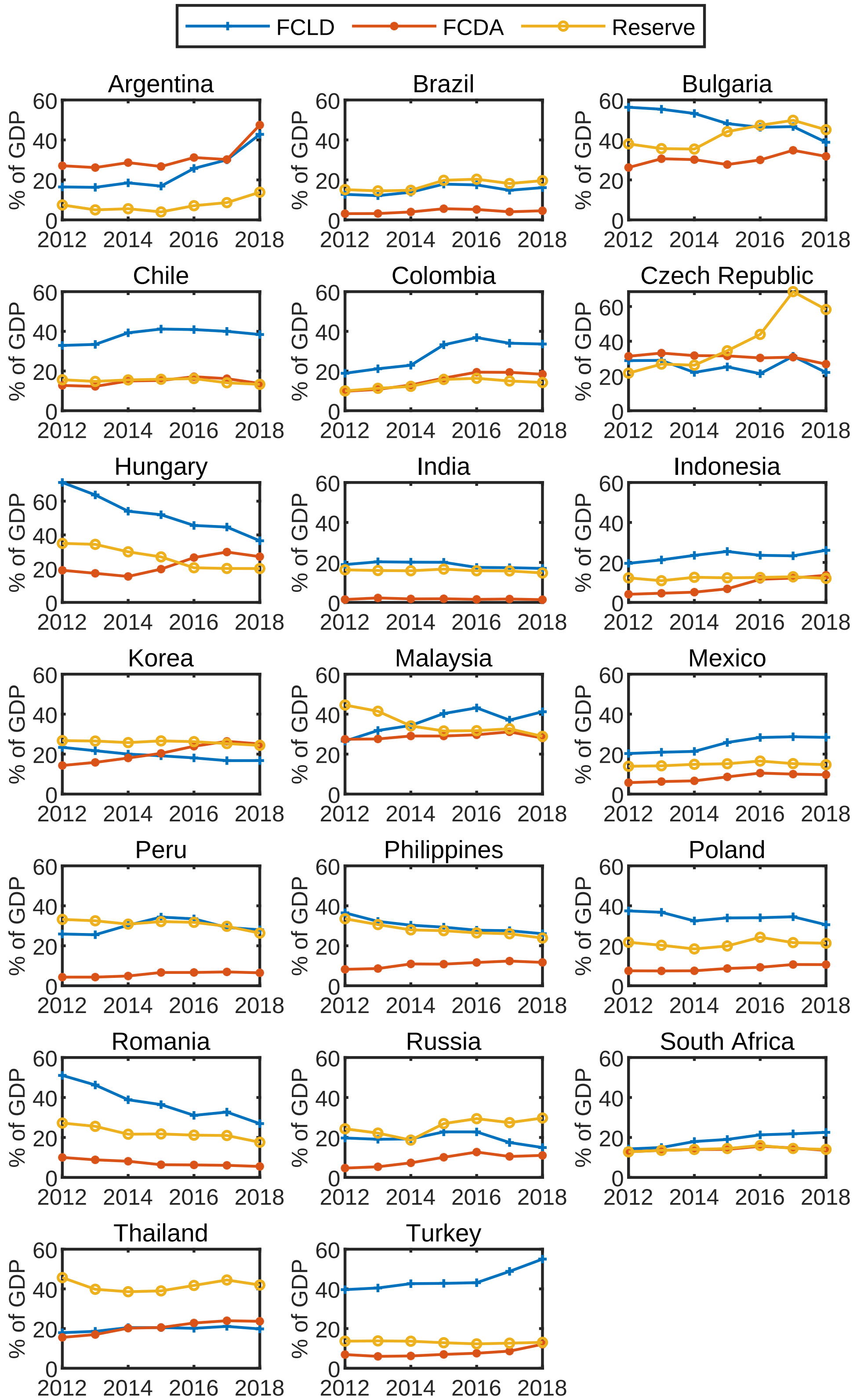


Figure 12: Foreign Currency Exposures



I.2 Notations in the tables

Before introducing the results, I list the notations used in the tables

- $\Delta\varepsilon_{t-1}$: lag of percentage changes in exchange rates
- Δq_{t-1}: lag of percentage changes in stock indices
- $(Fin.\ openness)^j$: Sample averages of financial openness index by Chin and Ito for each of the EMEs.
- $(Trade.\ openness)^j$: Sample averages of trade openness for each of the EMEs.
- $Oil\_G(x)$: Interaction terms between monthly percentage changes in oil price and group dummies. Group 1 is the oil expoerters: Brazil, Colombia, Mexico, and Russia. Group 2 is the group of the countries whose oil exports and imports are balanced. Group 3 is the oil importers (rest of the countries).
- $Com\_G(x)$: Interaction terms between monthlypercentage changes in the commodity price index and group dummies. Group 1 is the commodity exporters: Argentina, Brazil, Bulgaria, Chile, Colombia, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Russia, South Africa, and Thailand. Goup 2 is the commodity importers (manufacturers): Czech Republic, Hungary, Korea, Poland
- $i_t^j - i_t^{us}$: Short-term interest rates [74] differentials between country j and the US.
- i_t^j: Short-term interest rates in country j.
- IP_t^j : Industrial production index percentage changes from the same month in a previous year (year to year).
- $M2_t^j$: M2 monetary aggregate percentage changes from the same month in a previous year (year to year).
- $Inflation_t^j$: CPI percentage changes from a previous month (month to month)
- $ln\,(REER)_{t-1}^j$: Lag of log real effective exchagne rates
- $\left(\frac{CA}{GDP}\right)_t^j$: Current account balance to GDP ratios

[74] To avoid posible endogeneities, I used short-term interest rates. Ideally, I can use three month treasury bill rates for each of the countries. However, not all the EMEs in the sample have a 3-month treasury bill rates and accordingly I opt to use proxies to the bill rates. See the data appendix A.

I.2.1 Full Tables in Section 2

Table 3: Exchange Rate_Aggregate FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\varepsilon^{j}_{t-1}$	0.034	0.034	0.026	0.033	0.031	0.023	-0.064	0.015
	(0.047)	(0.046)	(0.047)	(0.046)	(0.048)	(0.047)	(0.050)	(0.052)
$\Delta ln\left(VIX\right)_t$	0.044***	0.043***	0.040***	0.039***	0.041***	0.042***	0.059***	0.076*
	(0.012)	(0.012)	(0.014)	(0.013)	(0.012)	(0.012)	(0.022)	(0.044)
$ln\left(VIX\right)_{t-1}$	0.010	0.008	0.005	0.009	0.012	0.009	0.003	
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	
$\left(\frac{LCD}{GDP}\right)^j_t \times \Delta ln\left(VIX\right)_t$		0.105**						
		(0.043)						
$\left(\frac{LCB}{GDP}\right)^j_t \times$ "				0.176***	0.178***	0.189**	0.254**	0.184**
				(0.066)	(0.059)	(0.073)	(0.112)	(0.080)
$\left(\frac{LCE}{GDP}\right)^j_t \times$ "			0.034			-0.025	-0.013	-0.056
			(0.033)			(0.072)	(0.068)	(0.052)
$\left(\frac{FCD}{GDP}\right)^j_t \times$ "	0.008				0.013	0.004	-0.012	-0.028
	(0.043)				(0.040)	(0.046)	(0.047)	(0.052)
$\left(\frac{FCA\_D}{GDP}\right)^j_t \times$ "					-0.097†	-0.101	-0.074†	-0.088
					(0.067)	(0.070)	(0.048)	(0.084)
$\left(\frac{FCA\_E}{GDP}\right)^j_t \times$ "					0.011	0.021	0.006	0.026
					(0.019)	(0.039)	(0.031)	(0.028)
$\left(\frac{Reserve}{GDP}\right)^j_t \times$ "	-0.039	-0.072***	-0.041	-0.058**	-0.022	-0.014	-0.038	-0.053
	(0.029)	(0.024)	(0.029)	(0.026)	(0.046)	(0.060)	(0.044)	(0.035)
$\left(\frac{LCD}{GDP}\right)^j_t$		-0.196***						
		(0.043)						
$\left(\frac{LCB}{GDP}\right)^j_t$				-0.185***	-0.197***	-0.074	-0.106**	-0.101***
				(0.056)	(0.053)	(0.052)	(0.042)	(0.035)
$\left(\frac{LCE}{GDP}\right)^j_t$			-0.140***			-0.163***	-0.131***	-0.090***
			(0.042)			(0.040)	(0.032)	(0.032)
$\left(\frac{FCL\_D}{GDP}\right)^j_t$	0.032				0.036	0.019	-0.001	0.014
	(0.032)				(0.030)	(0.032)	(0.028)	(0.027)
$\left(\frac{FCA\_D}{GDP}\right)^j_t$					0.095†	0.113*	0.096**	0.066*
					(0.065)	(0.061)	(0.038)	(0.034)
$\left(\frac{FCA\_E}{GDP}\right)^j_t$					0.005	0.075*	0.057*	0.033
					(0.031)	(0.043)	(0.030)	(0.025)
$\left(\frac{Reserve}{GDP}\right)^j_t$	0.001	0.089***	0.006	0.033*	0.036*	0.020	0.025	0.012
	(0.013)	(0.024)	(0.016)	(0.018)	(0.021)	(0.022)	(0.020)	(0.019)

Table 3: Exchange Rate_Aggregate FC_Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(Fin.\ open.)^{j} \times$ "								-0.001
								(0.004)
$(Tade\ open.)^{j} \times$ "								0.022
								(0.027)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j \times$ "							-0.057*	-0.046
							(0.032)	(0.042)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j$							0.001***	0.001***
							(0.000)	(0.000)
Oil_G1_t							-0.042	0.000
							(0.030)	(0.000)
Oil_G2_t							0.021	0.055
							(0.049)	(0.037)
Oil_G3_t							-0.010	0.032*
							(0.035)	(0.018)
Com_G1_t							-0.375***	
							(0.085)	
Com_G2_t							-0.416***	
							(0.112)	
$i_t^j - i_t^{us}$	0.001**	0.002***	0.002***	0.002***	0.001**	0.002**	0.001**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP_t^j	-0.006	-0.007	-0.005	-0.006	-0.006	-0.004	0.000	0.002
	(0.012)	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)	(0.014)	(0.012)
$M2_t^j$	0.049	0.033	0.046	0.031	0.043	0.054	0.063	0.055
	(0.049)	(0.041)	(0.042)	(0.041)	(0.049)	(0.048)	(0.045)	(0.041)
$Inflation_t^j$	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln\,(REER)_{t-1}^{j}$	0.064**	0.067***	0.056**	0.065***	0.084***	0.084***	0.075***	0.081***
	(0.025)	(0.024)	(0.024)	(0.024)	(0.022)	(0.021)	(0.018)	(0.020)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	YES
R-squared	0.088	0.037	0.053	0.055	0.040	0.052	0.122	0.297
Observations	1,660	1,660	1,660	1,660	1,660	1,660	1,660	1,660
Number of groups	20	20	20	20	20	20	20	20

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 4: Stock Indices_Aggregate FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δq^{j}_{t-1}	0.030	0.030	0.030	0.032	0.032	0.031	-0.011	0.010
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.035)	(0.034)
$\Delta ln\left(VIX\right)_{t}$	-0.093***	-0.089***	-0.088***	-0.076***	-0.076***	-0.082***	-0.059***	-0.059**
	(0.016)	(0.014)	(0.015)	(0.014)	(0.014)	(0.015)	(0.016)	(0.024)
$ln\left(VIX\right)_{t-1}$	-0.028***	-0.028***	-0.025**	-0.027**	-0.027**	-0.028**	-0.023**	
	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)	
$\left(\frac{LCB}{GDP}\right)^{j}_{t} \times \Delta ln\left(VIX\right)_{t}$		-0.003			0.091	0.084	0.172*	0.183**
		(0.092)			(0.096)	(0.100)	(0.096)	(0.089)
$\left(\frac{LCE}{GDP}\right)^{j}_{t} \times$ "			0.010					
			(0.037)					
$\left(\frac{LCE}{Mkt\ Cap}\right)^{j}_{t} \times$ "				-0.072*	-0.092**	-0.093**	-0.104**	-0.105**
				(0.037)	(0.038)	(0.039)	(0.043)	(0.051)
$\left(\frac{FCA\_D}{GDP}\right)^{j}_{t} \times$ "						-0.015	-0.011	-0.013
						(0.082)	(0.085)	(0.094)
$\left(\frac{FCL}{GDP}\right)^{j}_{t} \times$ "	0.016					0.027	0.028	0.020
	(0.041)					(0.042)	(0.040)	(0.050)
$\left(\frac{FCA\_E}{GDP}\right)^{j}_{t} \times$ "						0.003	-0.007	-0.012
						(0.016)	(0.015)	(0.018)
$\left(\frac{Reserve}{GDP}\right)^{j}_{t-1} \times$ "	0.070**	0.073**	0.071**	0.081***	0.074**	0.076*	0.056	0.027
	(0.030)	(0.029)	(0.030)	(0.030)	(0.030)	(0.043)	(0.044)	(0.047)
$\left(\frac{LCB}{GDP}\right)^{j}_{t}$		0.003			0.009	0.002	-0.036	-0.034
		(0.042)			(0.041)	(0.041)	(0.051)	(0.056)
$\left(\frac{LCE}{GDP}\right)^{j}_{t}$			0.084**					
			(0.038)					
$\left(\frac{LCE}{Mkt\ Cap}\right)^{j}_{t}$				0.064	0.064	0.065	0.063	0.057
				(0.071)	(0.071)	(0.068)	(0.070)	(0.065)
$\left(\frac{FCA\_D}{GDP}\right)^{j}_{t}$						-0.004	-0.047	-0.008
						(0.075)	(0.073)	(0.066)
$\left(\frac{FCL}{GDP}\right)^{j}_{t}$	0.025					0.026	0.021	0.010
	(0.029)					(0.029)	(0.037)	(0.038)
$\left(\frac{FCA\_E}{GDP}\right)^{j}_{t}$						-0.028	-0.038	-0.026
						(0.029)	(0.028)	(0.027)
$\left(\frac{Reserve}{GDP}\right)^{j}_{t-1}$	-0.003	0.000	0.001	-0.001	-0.002	-0.004	-0.001	0.010
	(0.014)	(0.019)	(0.015)	(0.015)	(0.019)	(0.019)	(0.019)	(0.018)

Table 4: Stock Indices_Aggregate FC_Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(Fin.\ open.)^j \times$ "								-0.000
								(0.005)
$(Tade\ open.)^j \times$ "								0.006
								(0.019)
$(\frac{Govt\ Debts}{GDP})^j_t \times$ "							-0.038*	-0.046
							(0.020)	(0.032)
$(\frac{Govt\ Debts}{GDP})^j_t$							0.000	0.000
							(0.000)	(0.000)
Oil_G1_t							0.077*	0.000
							(0.040)	(0.000)
Oil_G2_t							-0.004	-0.084**
							(0.049)	(0.033)
Oil_G3_t							-0.009	-0.089***
							(0.041)	(0.022)
Com_G1_t							0.394***	
							(0.131)	
Com_G2_t							0.307**	
							(0.131)	
i^j_t	-0.001	-0.001	-0.001	-0.001*	-0.001*	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP^j_t	-0.000	0.000	-0.000	0.001	-0.000	-0.001	-0.008	-0.013
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.017)	(0.019)	(0.018)
$M2^j_t$	-0.001	-0.007	-0.010	-0.011	-0.011	-0.006	-0.009	0.004
	(0.015)	(0.018)	(0.018)	(0.017)	(0.017)	(0.014)	(0.016)	(0.015)
$Inflation^j_t$	-0.000†	-0.000†	-0.000†	-0.000†	-0.000†	-0.000*	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	YES
R-squared	0.070	0.077	0.048	0.060	0.059	0.049	0.083	0.244
Observations	1,660	1,660	1,660	1,660	1,660	1,660	1,660	1,660
Number of groups	20	20	20	20	20	20	20	20

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 5: Exchange Rates_Sector FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta\varepsilon^{j}_{t-1}$	0.012	0.012	0.012	0.004	0.003	-0.085	0.004
	(0.049)	(0.049)	(0.045)	(0.048)	(0.047)	(0.051)	(0.051)
$\Delta ln\,(VIX)_t$	0.034**	0.043***	0.044***	0.044***	0.046***	0.056**	0.046**
	(0.016)	(0.013)	(0.013)	(0.013)	(0.013)	(0.022)	(0.020)
$ln\,(VIX)_{t-1}$	0.004	0.004	0.012	0.008	0.008	0.003	
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	
$\left(\frac{LCB}{GDP}\right)^j_t \times \Delta ln\,(VIX)_t$	0.188**	0.215**		0.123*	0.152*	0.182*	0.193**
	(0.076)	(0.086)		(0.070)	(0.083)	(0.093)	(0.088)
$\left(\frac{LCE}{GDP}\right)^j_t \times$ "	0.005	-0.023		-0.015	-0.026	-0.003	-0.053
	(0.036)	(0.034)		(0.030)	(0.073)	(0.064)	(0.053)
$\left(\frac{FC\_NF}{GDP}\right)^j_t \times$ "	-0.046	-0.054	-0.027	-0.060	-0.048	-0.038	-0.082
	(0.045)	(0.047)	(0.041)	(0.049)	(0.060)	(0.053)	(0.074)
$\left(\frac{NFC\_NF}{GDP}\right)^j_t \times$ "	-0.027	-0.024	-0.094†	-0.081	-0.094	-0.063	-0.039
	(0.027)	(0.025)	(0.063)	(0.060)	(0.066)	(0.051)	(0.054)
$\left(\frac{HH\_NF}{GDP}\right)^j_t \times$ "			-0.242*	-0.190	-0.196	-0.201	-0.100
			(0.143)	(0.144)	(0.146)	(0.141)	(0.132)
$\left(\frac{G\_NF}{GDP}\right)^j_t \times$ "		0.079		0.061	0.081	0.038	0.092
		(0.088)		(0.080)	(0.088)	(0.076)	(0.069)
$\left(\frac{NFC\_FCAE}{GDP}\right)^j_t \times$ "					0.154	0.109	0.121
					(0.172)	(0.144)	(0.149)
$\left(\frac{FC\_FCAE}{GDP}\right)^j_t \times$ "					-0.126	-0.105	-0.067
					(0.110)	(0.099)	(0.097)
$\left(\frac{Reserve}{GDP}\right)^j_{t-1} \times$ "	-0.064**	-0.068**	-0.011	-0.028	-0.029	-0.026	-0.029
	(0.028)	(0.027)	(0.036)	(0.038)	(0.049)	(0.042)	(0.028)
$\left(\frac{LCB}{GDP}\right)^j_t$	-0.086*	-0.114***		-0.060†	-0.049	-0.063	-0.034
	(0.050)	(0.043)		(0.040)	(0.053)	(0.044)	(0.039)
$\left(\frac{LCE}{GDP}\right)^j_t$	-0.125***	-0.118***		-0.112***	-0.153***	-0.126***	-0.111***
	(0.043)	(0.039)		(0.037)	(0.034)	(0.034)	(0.036)
$\left(\frac{FC\_NF}{GDP}\right)^j_t$	0.025	0.024	-0.011	0.016	0.021	0.009	-0.006
	(0.035)	(0.035)	(0.034)	(0.037)	(0.038)	(0.031)	(0.029)
$\left(\frac{NFC\_NF}{GDP}\right)^j_t$	-0.007	-0.013	-0.027	-0.025	-0.018	-0.030	-0.035
	(0.028)	(0.026)	(0.027)	(0.024)	(0.022)	(0.022)	(0.021)
$\left(\frac{HH\_NF}{GDP}\right)^j_t$			0.246***	0.267***	0.269***	0.195***	0.196***
			(0.064)	(0.076)	(0.077)	(0.056)	(0.065)
$\left(\frac{G\_NF}{GDP}\right)^j_t$		-0.065		-0.131*	-0.125†	0.065	0.048
		(0.064)		(0.074)	(0.076)	(0.090)	(0.093)
$\left(\frac{NFC\_FCAE}{GDP}\right)^j_t$					0.001	0.001	0.000
					(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)^j_t$					0.000	0.001	0.001
					(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)^j_{t-1}$	0.019	0.016	0.020	0.019	0.014	0.036*	0.023
	(0.018)	(0.018)	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)
$(Fin.\ open.)^j \times$ "							0.002
							(0.004)
$(Tade\ open.)^j \times$ "							0.003
							(0.015)

Table 5: Exchange Rates_Sector_Coutinued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\left(\frac{Govt\_Debts}{GDP}\right)_t^j \times$ "						-0.057*	-0.020
						(0.033)	(0.029)
$\left(\frac{Govt\_Debts}{GDP}\right)_t^j$						0.001***	0.001**
						(0.001)	(0.000)
Oil_G1_t						-0.037	0.000
						(0.034)	(0.000)
Oil_G2_t						0.019	0.047
						(0.047)	(0.043)
Oil_G3_t						-0.016	0.022*
						(0.035)	(0.012)
Com_G1_t						-0.329***	
						(0.089)	
Com_G2_t						-0.410***	
						(0.108)	
$i_t^j - i_t^{us}$	0.002***	0.002**	0.002***	0.002**	0.002**	0.002**	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP_t^j	-0.006	-0.007	0.003	0.001	0.002	0.005	0.006
	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)
$M2_t^j$	0.040	0.045	0.030	0.043	0.045	0.056	0.048
	(0.042)	(0.047)	(0.039)	(0.048)	(0.048)	(0.044)	(0.038)
$Inflation_t^j$	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000†	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln\,(REER)_{t-1}^j$	0.061**	0.063**	0.097***	0.100***	0.106***	0.094***	0.093***
	(0.025)	(0.025)	(0.019)	(0.021)	(0.020)	(0.019)	(0.021)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.052	0.046	0.027	0.022	0.033	0.090	0.232
Observations	1,577	1,577	1,577	1,577	1,577	1,577	1,577
Number of groups	19	19	19	19	19	19	19

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 6: Stock Indices_Sector FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δq^{j}_{t-1}	0.026	0.026	0.025	0.026	0.023	-0.015	0.005
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)
$\Delta ln\left(VIX\right)_t$	-0.078***	-0.078***	-0.085***	-0.077***	-0.077***	-0.057***	-0.031
	(0.016)	(0.016)	(0.015)	(0.017)	(0.017)	(0.018)	(0.027)
$ln\left(VIX\right)_{t-1}$	-0.026**	-0.027**	-0.027**	-0.026**	-0.029**	-0.024**	
	(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.010)	
$\left(\frac{LCB}{GDP}\right)^j_t \times \Delta ln\left(VIX\right)_t$	0.105	0.104		0.200*	0.209**	0.243**	0.248**
	(0.119)	(0.120)		(0.105)	(0.103)	(0.104)	(0.116)
$\left(\frac{LCE}{Mkt.\ Cap.}\right)^j_t \times$ "	-0.091**	-0.089**		-0.115***	-0.117***	-0.113***	-0.126**
	(0.035)	(0.038)		(0.039)	(0.038)	(0.037)	(0.063)
$\left(\frac{FC\_NF}{GDP}\right)^j_t \times$ "	-0.012	-0.011	0.100	-0.031	-0.024	0.004	-0.049
	(0.094)	(0.095)	(0.083)	(0.086)	(0.086)	(0.074)	(0.164)
$\left(\frac{NFC\_NF}{GDP}\right)^j_t \times$ "	-0.043	-0.044	-0.026	-0.002	-0.007	-0.003	0.004
	(0.031)	(0.031)	(0.061)	(0.058)	(0.062)	(0.063)	(0.053)
$\left(\frac{HH\_NF}{GDP}\right)^j_t \times$ "			0.065	0.138	0.136	0.094	0.090
			(0.125)	(0.120)	(0.122)	(0.124)	(0.091)
$\left(\frac{G\_NF}{GDP}\right)^j_t \times$ "		0.001		-0.001	0.006	-0.042	-0.056
		(0.074)		(0.074)	(0.071)	(0.079)	(0.089)
$\left(\frac{NFC\_FCAE}{GDP}\right)^j_t \times$ "					0.038	0.036	0.031
					(0.086)	(0.085)	(0.083)
$\left(\frac{FC\_FCAE}{GDP}\right)^j_t \times$ "					-0.041	-0.041	-0.044
					(0.071)	(0.072)	(0.065)
$\left(\frac{Reserve}{GDP}\right)^j_t \times$ "	0.051	0.051	0.018	0.029	0.026	0.029	-0.023
	(0.035)	(0.036)	(0.044)	(0.041)	(0.043)	(0.042)	(0.066)
$\left(\frac{LCB}{GDP}\right)^j_t$	0.010	-0.011		-0.007	-0.045	-0.065	-0.019
	(0.043)	(0.048)		(0.047)	(0.057)	(0.056)	(0.053)
$\left(\frac{LCE}{Mkt.\ Cap.}\right)^j_t$	0.046	0.035		0.032	0.031	0.051	0.035
	(0.066)	(0.066)		(0.065)	(0.066)	(0.070)	(0.067)
$\left(\frac{FC\_NF}{GDP}\right)^j_t$	0.015	0.017	0.018	0.017	0.017	-0.001	0.009
	(0.041)	(0.041)	(0.038)	(0.042)	(0.043)	(0.044)	(0.040)
$\left(\frac{NFC\_NF}{GDP}\right)^j_t$	-0.018	-0.021	-0.016	-0.021	-0.020	-0.033	-0.026
	(0.030)	(0.030)	(0.031)	(0.030)	(0.029)	(0.034)	(0.035)
$\left(\frac{HH\_NF}{GDP}\right)^j_t$			-0.003	0.010	0.016	0.015	0.095
			(0.091)	(0.105)	(0.103)	(0.083)	(0.078)
$\left(\frac{G\_NF}{GDP}\right)^j_t$		-0.056		-0.059	-0.065	-0.079	-0.021
		(0.049)		(0.063)	(0.063)	(0.079)	(0.085)
$\left(\frac{NFC\_FCAE}{GDP}\right)_t$					0.001	0.002†	0.000
					(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)^j_t$					-0.002	-0.002*	-0.001
					(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)^j_{t-1}$	-0.002	-0.004	0.000	-0.004	-0.001	-0.003	0.014
	(0.018)	(0.018)	(0.019)	(0.018)	(0.017)	(0.019)	(0.020)
$\left(\frac{Govt\ Debts}{GDP}\right)^j_t \times$ "						-0.045†	-0.075**
						(0.028)	(0.028)

Table 6: Stock Indices_Sector_Coutinued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\left(\frac{Govt\ Debts}{GDP}\right)^j_t$						-0.000	0.000
						(0.000)	(0.001)
$(Fin.\ open.)^j \times$ "							-0.003
							(0.005)
$(Trade\ open.)^j \times$ "							0.025
							(0.027)
Oil_G1_t						0.046	0.047
						(0.041)	(0.039)
Oil_G2_t						-0.001	0.000
						(0.048)	(0.000)
Oil_G3_t						-0.005	-0.005
						(0.040)	(0.037)
Com_G1_t						0.351***	
						(0.127)	
Com_G2_t						0.304**	
						(0.125)	
i^j_t	-0.001†	-0.001†	-0.001†	-0.001	-0.001*	-0.001†	-0.001†
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP^j_t	0.003	0.002	0.003	0.002	0.003	-0.001	-0.005
	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)	(0.018)	(0.019)
$M2^j_t$	-0.005	0.000	-0.002	0.001	-0.005	-0.010	0.001
	(0.017)	(0.017)	(0.018)	(0.018)	(0.019)	(0.019)	(0.018)
$Inflation^j_t$	-0.000†	-0.000*	-0.000	-0.000*	-0.000*	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.055	0.059	0.067	0.058	0.053	0.064	0.208
Observations	1,577	1,577	1,577	1,577	1,577	1,577	1,577
Number of groups	19	19	19	19	19	19	19

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

J Robustness Check

J.1 Additional Controls

Table 14: Exchagne Rates_Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\varepsilon_{t-1}^{j}$	-0.064	-0.063	-0.063	0.015	-0.033	-0.082	-0.085	0.006
	(0.050)	(0.050)	(0.049)	(0.052)	(0.044)	(0.049)	(0.051)	(0.053)
$\Delta ln\,(VIX)_t$	0.062***	0.109**	0.110**	0.087*	0.075***	0.065***	0.076***	0.070**
	(0.023)	(0.042)	(0.043)	(0.048)	(0.024)	(0.022)	(0.023)	(0.032)
$ln\,(VIX)_{t-1}$	0.003	0.003	0.004		0.000	0.003	0.003	
	(0.007)	(0.007)	(0.007)		(0.009)	(0.007)	(0.007)	
$\left(\frac{LCB}{GDP}\right)_t^j \times \Delta ln\,(VIX)_t$	0.249**	0.162**	0.170*	0.225**	0.184**	0.122†	0.176*	0.206**
	(0.115)	(0.077)	(0.087)	(0.091)	(0.090)	(0.082)	(0.093)	(0.091)
$\left(\frac{LCE}{GDP}\right)_t^j \times$ "	-0.024	-0.068	-0.068	-0.131**	-0.098	-0.068	-0.107	-0.163**
	(0.079)	(0.069)	(0.069)	(0.060)	(0.076)	(0.066)	(0.075)	(0.081)
$\left(\frac{FCA\_D}{GDP}\right)_t^j \times$ "	-0.081*	-0.135†	-0.128*	-0.069				
	(0.047)	(0.081)	(0.076)	(0.098)				
$\left(\frac{FCD}{GDP}\right)_t^j \times$ "	-0.009	-0.020	-0.021	-0.016				
	(0.041)	(0.051)	(0.051)	(0.050)				
$\left(\frac{FCA\_E}{GDP}\right)_t^j \times$ "	0.011	0.016	0.013	0.035				
	(0.036)	(0.032)	(0.034)	(0.030)				
$\left(\frac{Reserve}{GDP}\right)_{t-1}^j \times$ "	-0.042	-0.118***	-0.116***	-0.062*	-0.058	-0.079***	-0.057†	-0.063†
	(0.043)	(0.032)	(0.026)	(0.032)	(0.038)	(0.025)	(0.037)	(0.040)
$\left(\frac{LCB}{GDP}\right)_t^j$	-0.105**	-0.109***	-0.108**	-0.103***	-0.064	-0.059	-0.061	-0.030
	(0.044)	(0.041)	(0.043)	(0.037)	(0.053)	(0.042)	(0.045)	(0.040)
$\left(\frac{LCE}{GDP}\right)_t^j$	-0.131***	-0.129***	-0.130***	-0.090***	-0.160***	-0.118***	-0.124***	-0.107***
	(0.032)	(0.032)	(0.032)	(0.031)	(0.036)	(0.031)	(0.035)	(0.037)
$\left(\frac{FCA\_D}{GDP}\right)_t^j$	0.097**	0.097**	0.098**	0.064*				
	(0.038)	(0.037)	(0.038)	(0.035)				
$\left(\frac{FCL}{GDP}\right)_t^j$	-0.004	-0.001	-0.004	0.018				
	(0.026)	(0.028)	(0.027)	(0.026)				
$\left(\frac{FCA\_E}{GDP}\right)_t^j$	0.056*	0.054*	0.054*	0.032				
	(0.030)	(0.030)	(0.030)	(0.025)				
$\left(\frac{FC\_NF}{GDP}\right)_t^j \times$ "					0.036	-0.026	0.020	-0.038
					(0.064)	(0.062)	(0.059)	(0.080)
$\left(\frac{NFC\_NF}{GDP}\right)_t^j \times$ "					-0.155**	-0.093	-0.144**	-0.099
					(0.073)	(0.061)	(0.062)	(0.096)
$\left(\frac{HH\_NF}{GDP}\right)_t^j \times$ "					-0.343*	-0.199	-0.314**	-0.182
					(0.176)	(0.140)	(0.152)	(0.181)
$\left(\frac{G\_NF}{GDP}\right)_t^j \times$ "					-0.049	0.051	-0.025	0.018
					(0.086)	(0.085)	(0.077)	(0.054)
$\left(\frac{NFC\_FCAE}{GDP}\right)_t^j \times$ "					0.418*	0.215	0.402**	0.330
					(0.220)	(0.166)	(0.201)	(0.285)
$\left(\frac{NFC\_FCAE}{GDP}\right)_t^j \times$ "					-0.318**	-0.167	-0.297**	-0.199
					(0.141)	(0.115)	(0.122)	(0.198)
$\left(\frac{FC\_NF}{GDP}\right)_t^j$					-0.003	0.042	0.016	0.003
					(0.035)	(0.030)	(0.029)	(0.027)
$\left(\frac{NFC\_NF}{GDP}\right)_t^j$					-0.025	-0.004	-0.010	-0.016
					(0.023)	(0.020)	(0.019)	(0.021)
$\left(\frac{G\_NF}{GDP}\right)_t^j$					0.111	-0.141*	0.070	0.048
					(0.093)	(0.075)	(0.089)	(0.094)
$\left(\frac{HH\_NF}{GDP}\right)_t^j$					0.216***	0.261***	0.227***	0.237***
					(0.080)	(0.068)	(0.072)	(0.089)

Table 14: Exchagne Rates_Additional Controls_Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\left(\frac{NFC\_FCAE}{GDP}\right)_t^j$					0.001	0.001	0.001	0.000
					(0.001)	(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)_t^j$					-0.000	0.001	0.000	0.001
					(0.001)	(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^j$	0.027	0.026	0.028	0.010	0.050**	0.017	0.046**	0.033†
	(0.020)	(0.020)	(0.020)	(0.020)	(0.023)	(0.017)	(0.021)	(0.022)
$(Fin.\ open.)^j \times$ "		-0.000	-0.000	0.003		0.006		0.002
		(0.003)	(0.003)	(0.005)		(0.005)		(0.004)
$(Tade\ open.)^j \times$ "		0.047†	0.048†	0.024		0.017		0.017
		(0.029)	(0.031)	(0.036)		(0.014)		(0.023)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j \times$ "	-0.056*	-0.061*	-0.062*	-0.040	-0.074*		-0.063*	-0.035
	(0.032)	(0.031)	(0.032)	(0.042)	(0.040)		(0.034)	(0.036)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j$	0.001***	0.001***	0.001***	0.001***	0.002***		0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)		(0.000)	(0.000)
$\left(\frac{CA}{GDP}\right)_t^j \times$ "	0.057		-0.063	-0.109	0.402*		0.400*	0.164
	(0.185)		(0.221)	(0.217)	(0.227)		(0.234)	(0.298)
$\left(\frac{CA}{GDP}\right)_t^j$	-0.000		-0.000	0.000	-0.001		-0.001	-0.001
	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)
$\mathbf{I}_{G1} \times$ "		-0.006	-0.008	-0.019†	-0.003	-0.009	-0.002	-0.011
		(0.009)	(0.010)	(0.013)	(0.009)	(0.008)	(0.009)	(0.011)
$\mathbf{I}_{G2} \times$ "		-0.019*	-0.022	-0.031*	-0.015	-0.031**	-0.014	-0.030†
		(0.009)	(0.016)	(0.018)	(0.012)	(0.014)	(0.011)	(0.020)
Oil_G1_t	-0.042	-0.044†	-0.044†	0.000	-0.094***	-0.039	-0.035	
	(0.029)	(0.029)	(0.028)	(0.000)	(0.022)	(0.034)	(0.033)	
Oil_G2_t	0.022	0.022	0.022	0.056	-0.045	0.016	0.018	
	(0.049)	(0.049)	(0.050)	(0.037)	(0.041)	(0.049)	(0.046)	
Oil_G3_t	-0.010	-0.009	-0.009	0.032*	-0.078***	-0.012	-0.016	
	(0.035)	(0.035)	(0.034)	(0.017)	(0.019)	(0.035)	(0.034)	
Com_G1_t	-0.375***	-0.375***	-0.375***			-0.344***	-0.329***	
	(0.085)	(0.084)	(0.084)			(0.092)	(0.089)	
Com_G2_t	-0.416***	-0.415***	-0.414***			-0.417***	-0.410***	
	(0.110)	(0.110)	(0.108)			(0.107)	(0.106)	
$i_t^j - i_t^{us}$	0.001**	0.001**	0.001**	0.001**	0.002**	0.002**	0.001**	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP_t^j	0.001	0.000	0.000	0.001	0.004	0.006	0.006	0.008
	(0.014)	(0.014)	(0.014)	(0.012)	(0.016)	(0.016)	(0.016)	(0.015)
$M2_t^j$	0.064	0.062	0.062	0.054	0.061	0.050	0.059	0.051
	(0.046)	(0.045)	(0.046)	(0.041)	(0.049)	(0.047)	(0.047)	(0.041)
$Inflation_t^j$	-0.000*	-0.000*	-0.000*	-0.000†	-0.000*	-0.000*	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln\,(REER)_{t-1}^j$	0.075***	0.075***	0.075***	0.080***	0.108***	0.090***	0.098***	0.096***
	(0.018)	(0.018)	(0.018)	(0.020)	(0.021)	(0.019)	(0.021)	(0.022)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	YES	NO	NO	NO	YES
R-squared	0.122	0.123	0.123	0.300	0056	0.077	0.091	0.229
Observations	1,660	1,660	1,660	1,660	1,577	1,577	1,577	1,577
Number of groups	20	20	20	20	19	19	19	19

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable. 7) Group 1 is the Latin America countries. Group 2 is Europeanc countries, and Russia, South Africa and Turkey, which might be more similar with European countries than Latin America countries or Asian countries.

Table 15: Stock Indices_Additional Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δq^{j}_{t-1}	-0.011	-0.012	-0.011	0.009	-0.014	-0.015	-0.014	0.005
	(0.035)	(0.035)	(0.036)	(0.034)	(0.036)	(0.036)	(0.036)	(0.037)
$\Delta ln\left(VIX\right)_t$	-0.057***	-0.064**	-0.060***	-0.052*	-0.049**	-0.038*	-0.046**	-0.005
	(0.017)	(0.029)	(0.018)	(0.029)	(0.020)	(0.021)	(0.021)	(0.027)
$ln\left(VIX\right)_{t-1}$	-0.023**	-0.023**	-0.023**		-0.024**	-0.024**	-0.024**	
	(0.011)	(0.011)	(0.011)		(0.010)	(0.010)	(0.010)	
$\left(\frac{LCB}{GDP}\right)^j_t \times \Delta ln\left(VIX\right)_t$	0.163*	0.163*	0.184*	0.178*	0.216**	0.230**	0.227**	0.238*
	(0.096)	(0.095)	(0.098)	(0.099)	(0.107)	(0.111)	(0.107)	(0.124)
$\left(\frac{LCE}{Mkt\ Cap}\right)^j_t \times$ "	-0.109**	-0.128**	-0.106**	-0.122*	-0.118***	-0.178**	-0.098***	-0.158**
	(0.046)	(0.052)	(0.046)	(0.061)	(0.039)	(0.071)	(0.036)	(0.076)
$\left(\frac{FCA\_D}{GDP}\right)^j_t \times$ "	-0.022	-0.005	-0.007	-0.019				
	(0.085)	(0.126)	(0.097)	(0.114)				
$\left(\frac{FCL}{GDP}\right)^j_t \times$ "	0.039	0.055	0.055	0.045				
	(0.044)	(0.052)	(0.050)	(0.055)				
$\left(\frac{FCA\_E}{GDP}\right)^j_t \times$ "	-0.005	-0.011	-0.013	-0.018				
	(0.015)	(0.017)	(0.022)	(0.020)				
$\left(\frac{Reserve}{GDP}\right)^j_{t-1} \times$ "	0.046	0.040	0.051	-0.003	0.004	-0.050	0.016	-0.094
	(0.048)	(0.044)	(0.051)	(0.055)	(0.046)	(0.061)	(0.045)	(0.078)
$\left(\frac{LCB}{GDP}\right)^j_t \times$ "	-0.034	-0.027	-0.034	-0.030	-0.065	-0.070	-0.064	-0.010
	(0.051)	(0.046)	(0.051)	(0.058)	(0.056)	(0.057)	(0.056)	(0.053)
$\left(\frac{LCE}{Mkt\ Cap}\right)^j_t \times$ "	0.059	0.078	0.060	0.046	0.046	0.051	0.046	0.015
	(0.073)	(0.074)	(0.073)	(0.068)	(0.072)	(0.071)	(0.072)	(0.067)
$\left(\frac{FCA\_D}{GDP}\right)^j_t \times$ "	-0.045	-0.037	-0.045	0.001				
	(0.071)	(0.071)	(0.071)	(0.064)				
$\left(\frac{FCL}{GDP}\right)^j_t \times$ "	0.012	0.026	0.012	-0.011				
	(0.047)	(0.032)	(0.047)	(0.049)				
$\left(\frac{FCA\_E}{GDP}\right)^j_t \times$ "	-0.040	-0.036	-0.039	-0.028				
	(0.029)	(0.027)	(0.028)	(0.026)				
$\left(\frac{FC\_NF}{GDP}\right)^j_t \times$ "					0.021	-0.067	0.084	-0.041
					(0.077)	(0.183)	(0.105)	(0.171)
$\left(\frac{NFC\_NF}{GDP}\right)^j_t \times$ "					-0.037	-0.040	-0.028	-0.044
					(0.087)	(0.071)	(0.087)	(0.071)
$\left(\frac{HH\_NF}{GDP}\right)^j_t \times$ "					0.042	0.107	0.051	0.037
					(0.157)	(0.119)	(0.154)	(0.107)
$\left(\frac{G\_NF}{GDP}\right)^j_t \times$ "					-0.078	-0.079	-0.146	-0.176
					(0.092)	(0.104)	(0.125)	(0.118)
$\left(\frac{NFC\_FCAE}{GDP}\right)^j_t \times$ "					0.131	0.133	0.061	0.149
					(0.156)	(0.145)	(0.167)	(0.168)
$\left(\frac{FC\_FCAE}{GDP}\right)^j_t \times$ "					-0.116	-0.140	-0.076	-0.165
					(0.130)	(0.118)	(0.133)	(0.138)
$\left(\frac{FC\_NF}{GDP}\right)^j_t$					0.003	-0.005	0.003	0.026
					(0.048)	(0.045)	(0.048)	(0.042)
$\left(\frac{NFC\_NF}{GDP}\right)^j_t$					-0.025	-0.037	-0.026	0.003
					(0.036)	(0.034)	(0.036)	(0.038)
$\left(\frac{G\_NF}{GDP}\right)^j_t$					-0.077	-0.044	-0.076	-0.014
					(0.079)	(0.058)	(0.079)	(0.084)
$\left(\frac{HH\_NF}{GDP}\right)^j_t$					0.025	0.004	0.026	0.153*
					(0.087)	(0.090)	(0.087)	(0.087)
$\left(\frac{NFC\_FCAE}{GDP}\right)^j_t$					0.002	0.002	$0.002^{\dagger}$	0.000
					(0.001)	(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)^j_t$					-0.002*	-0.002*	-0.002*	$-0.001^{\dagger}$
					(0.001)	(0.001)	(0.001)	(0.001)

Table 15: Stock Indices_Additional Controls_Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\left(\frac{Reserve}{GDP}\right)^j_{t-1}$	0.004	-0.001	0.004	0.022	0.002	0.003	0.002	0.030
	(0.020)	(0.018)	(0.020)	(0.018)	(0.022)	(0.017)	(0.022)	(0.022)
$(Fin.\ open.)^j \times$ "		0.006		0.003†		0.005		-0.000
		(0.004)		(0.005)		(0.005)		(0.005)
$(Tade\ open.)^j \times$ "		-0.003		0.011		0.033		0.054
		(0.033)		(0.029)		(0.038)		(0.036)
$\left(\frac{Govt\ Debts}{GDP}\right)^j_t \times$ "	-0.035*		-0.039*	-0.034	-0.049*		-0.067*	-0.090***
	(0.019)		(0.021)	(0.031)	(0.029)		(0.034)	(0.028)
$\left(\frac{Govt\ Debts}{GDP}\right)^j_t$	0.000		0.000	0.000	-0.000		-0.000	0.000
	(0.000)		(0.000)	(0.000)	(0.000)		(0.000)	(0.001)
$\left(\frac{CA}{GDP}\right)^j_t \times$ "	0.084		-0.016	0.026	0.199		0.031	0.045
	(0.106)		(0.146)	(0.132)	(0.208)		(0.222)	(0.207)
$\left(\frac{CA}{GDP}\right)^j_t$	-0.000		-0.000	-0.001	-0.000		-0.000	-0.001
	(0.001)		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)
$\mathbf{I}_{G1} \times$ "		-0.010	-0.005	-0.007		-0.007	-0.013	-0.010
		(0.014)	(0.013)	(0.016)		(0.013)	(0.014)	(0.016)
$\mathbf{I}_{G2} \times$ "		-0.021	-0.013	-0.017		-0.033	-0.022	-0.038
		(0.013)	(0.016)	(0.018)		(0.022)	(0.018)	(0.024)
Oil_G1_t	0.078*	0.080**	0.077*	0.000	0.047†	0.050	0.047	0.000
	(0.040)	(0.039)	(0.040)	(0.000)	(0.041)	(0.041)	(0.041)	(0.000)
Oil_G2_t	-0.004	-0.003	-0.003	-0.082**	-0.001	-0.000	0.001	-0.047
	(0.049)	(0.050)	(0.050)	(0.035)	(0.049)	(0.049)	(0.049)	(0.039)
Oil_G3_t	-0.010	-0.010	-0.010	-0.091***	-0.006	-0.005	-0.006	-0.055*
	(0.042)	(0.041)	(0.042)	(0.023)	(0.041)	(0.041)	(0.041)	(0.029)
Com_G1_t	0.394***	0.393***	0.395***		0.350***	0.353***	0.351***	
	(0.130)	(0.130)	(0.130)		(0.127)	(0.127)	(0.127)	
Com_G2_t	0.307**	0.304**	0.307**		0.304**	0.304**	0.305**	
	(0.132)	(0.130)	(0.132)		(0.125)	(0.126)	(0.126)	
i^j_t	-0.001	-0.001	-0.001	-0.001	-0.001†	-0.001†	-0.001†	-0.001†
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP^j_t	-0.008	-0.007	-0.008	-0.012	-0.001	-0.001	-0.001	-0.003
	(0.019)	(0.019)	(0.019)	(0.019)	(0.018)	(0.018)	(0.018)	(0.019)
$M2^j_t$	-0.008	-0.012	-0.008	0.007	-0.008	-0.011	-0.008	0.006
	(0.015)	(0.015)	(0.015)	(0.015)	(0.018)	(0.019)	(0.018)	(0.017)
$Inflation^j_t$	-0.000*	-0.000*	-0.000*	-0.000	-0.000*	-0.000*	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	YES	NO	NO	NO	YES
R-squared	0.085	0.078	0.085	0.251	0.063	0.067	0.064	0.210
Observations	1,660	1,660	1,660	1,660	1,577	1,577	1,577	1,577
Number of groups	20	20	20	20	19	19	19	19

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable. 7) Group 1 is the Latin America countries. Group 2 is Europeanc countries, and Russia, South Africa and Turkey, which might be more similar with European countries than Latin America countries or Asian countries.

J.2 Lagged External Liabilities

Table 16: Exchange Rate_Lagged External Liabilities_Aggregate FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta\varepsilon_{t-1}^{j}$	0.029	0.032	0.032	0.041	0.039	-0.030	0.024
	(0.045)	(0.045)	(0.045)	(0.046)	(0.047)	(0.045)	(0.054)
$\Delta ln\,(VIX)_t$	0.046***	0.043***	0.039***	0.042***	0.044***	0.070*	0.060†
	(0.014)	(0.013)	(0.014)	(0.015)	(0.016)	(0.039)	(0.040)
$ln\,(VIX)_{t-1}$	0.018**	0.018**	0.017**	0.017**	0.017**	0.009	
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	
$\left(\frac{LCD}{GDP}\right)_{t-12}^{j} \times \Delta ln\,(VIX)_t$		0.081**					
		(0.038)					
$\left(\frac{LCB}{GDP}\right)_{t-12}^{j} \times$ "			0.131**	0.125***	0.133***	0.179*	0.184**
			(0.058)	(0.047)	(0.048)	(0.095)	(0.092)
$\left(\frac{LCE}{GDP}\right)_{t-12}^{j} \times$ "					-0.021	0.009	-0.011
					(0.050)	(0.035)	(0.036)
$\left(\frac{FCD}{GDP}\right)_{t-12}^{j} \times$ "				-0.038	-0.041	-0.037	-0.018
				(0.040)	(0.040)	(0.062)	(0.068)
$\left(\frac{FCA\_D}{GDP}\right)_{t}^{j} \times$ "	-0.005			-0.005	-0.011	-0.024	-0.022
	(0.028)			(0.029)	(0.026)	(0.038)	(0.039)
$\left(\frac{FCA\_E}{GDP}\right)_{t-12}^{j} \times$ "				0.013	0.019	0.001	0.013†
				(0.023)	(0.032)	(0.023)	(0.029)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^{j} \times$ "	-0.041†	-0.067**	-0.056*	-0.040	-0.033	-0.079**	-0.045
	(0.027)	(0.027)	(0.028)	(0.037)	(0.041)	(0.035)	(0.038)
$\left(\frac{LCD}{GDP}\right)_{t-12}^{j}$		-0.055					
		(0.062)					
$\left(\frac{LCB}{GDP}\right)_{t-12}^{j}$			-0.043	-0.046	-0.104**	-0.073†	-0.058
			(0.064)	(0.043)	(0.052)	(0.048)	(0.061)
$\left(\frac{LCE}{GDP}\right)_{t-12}^{j}$					0.066	-0.042	-0.027
					(0.065)	(0.047)	(0.040)
$\left(\frac{FCL\_D}{GDP}\right)_{t-12}^{j} \times$ "	0.009			0.051	0.057	-0.013	0.007
	(0.034)			(0.037)	(0.041)	(0.025)	(0.027)
$\left(\frac{FCA\_D}{GDP}\right)_{t-12}^{j} \times$ "				-0.016	-0.030	0.030	-0.042
				(0.062)	(0.055)	(0.047)	(0.037)
$\left(\frac{FCA\_E}{GDP}\right)_{t-12}^{j} \times$ "				-0.064*	-0.098**	-0.022	-0.069
				(0.032)	(0.043)	(0.034)	(0.043)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^{j}$	0.001	0.023	0.010	0.012	0.022	0.017	-0.009
	(0.017)	(0.030)	(0.020)	(0.022)	(0.026)	(0.023)	(0.024)

Table 16: Exchange Rate_Lagged External Liabilities_Aggregate FC_Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$(Fin.\ open.)^j \times$ "						-0.001	-0.001
						(0.003)	(0.003)
$(Tade\ open.)^j \times$ "						0.013	0.004
						(0.025)	(0.026)
$\left(\frac{Govt\ Debts}{GDP}\right)^j_t \times$ "						-0.063†	-0.051
						(0.039)	(0.047)
$\left(\frac{Govt\ Debts}{GDP}\right)^j_t$						0.001***	0.001***
						(0.000)	(0.000)
Oil_G1_t						-0.052*	0.000
						(0.026)	(0.000)
Oil_G2_t						0.008	0.053
						(0.047)	(0.037)
Oil_G3_t						-0.020	0.031†
						(0.033)	(0.020)
Com_G1_t						-0.340***	-0.003
						(0.083)	(0.057)
Com_G2_t						-0.340***	0.000
						(0.100)	(0.000)
$i^j_t - i^{us}_t$	0.002***	0.002***	0.002***			0.001**	0.002**
	(0.001)	(0.001)	(0.001)			(0.001)	(0.001)
IP^j_t	-0.012	-0.012	-0.012	-0.024	-0.025	-0.002	0.001
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.020)	(0.018)
$M2^j_t$	0.055	0.049	0.050	0.068	0.064	0.061	0.055
	(0.056)	(0.052)	(0.052)	(0.063)	(0.060)	(0.052)	(0.045)
$Inflation^j_t$	-0.000*	-0.000*	-0.000*	-0.000†	-0.000†	-0.000*	-0.000†
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln\,(REER)^j_{t-1}$	0.091***	0.093***	0.092***	0.063***	0.060**	0.086***	0.098***
	(0.025)	(0.026)	(0.025)	(0.023)	(0.024)	(0.021)	(0.025)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.087	0.070	0.079	0.014	0.009	0.086	0.174
Observations	1,660	1,660	1,660	1,660	1,660	1,660	1,660
Number of groups	20	20	20	20	20	20	20

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 17: Stock Indices_Lagged External Liabilities_Aggregate FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δq_{t-1}^{j}	0.006	0.006	0.001	0.007	0.006	0.005	-0.019	-0.001
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)	(0.035)
$\Delta ln\,(VIX)_t$	-0.093***	-0.087***	-0.088***	-0.081***	-0.080***	-0.084***	-0.049*	-0.061**
	(0.016)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)	(0.029)	(0.027)
$ln\,(VIX)_{t-1}$	-0.033***	-0.033***	-0.033***	-0.033***	-0.033***	-0.033***	-0.026**	
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	
$\left(\frac{LCB}{GDP}\right)_{t-12}^{j} \times \Delta ln\,(VIX)_t$		0.011			0.063	0.065	0.129*	0.158**
		(0.088)			(0.092)	(0.098)	(0.075)	(0.078)
$\left(\frac{LCE}{GDP}\right)_{t-12}^{j} \times$ "			0.015					
			(0.037)					
$\left(\frac{LCE}{Mkt\ Cap}\right)_{t-12}^{j} \times$ "				-0.038	-0.054*	-0.063†	-0.080*	-0.075†
				(0.034)	(0.032)	(0.038)	(0.047)	(0.046)
$\left(\frac{FCA\_D}{GDP}\right)_{t-12}^{j} \times$ "						-0.044	-0.059	-0.024
						(0.076)	(0.116)	(0.107)
$\left(\frac{FCL}{GDP}\right)_{t-12}^{j} \times$ "	0.026					0.036	0.025	0.030
	(0.040)					(0.044)	(0.051)	(0.048)
$\left(\frac{FCA\_E}{GDP}\right)_{t-12}^{j} \times$ "						0.006	-0.004	-0.007
						(0.016)	(0.017)	(0.019)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^{j} \times$ "	0.061*	0.067**	0.067**	0.073**	0.067**	0.074†	0.048	0.029
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.048)	(0.042)	(0.046)
$\left(\frac{LCB}{GDP}\right)_{t-12}^{j}$		-0.103			-0.104	-0.130†	-0.124†	-0.129
		(0.075)			(0.075)	(0.080)	(0.082)	(0.095)
$\left(\frac{LCE}{GDP}\right)_{t-12}^{j}$			-0.128***					
			(0.040)					
$\left(\frac{LCE}{Mkt\ Cap}\right)_{t-12}^{j}$				0.007	0.009	0.017	0.002	-0.006
				(0.094)	(0.094)	(0.092)	(0.090)	(0.090)
$\left(\frac{FCA\_D}{GDP}\right)_{t-12}^{j}$						-0.009	-0.058	-0.045
						(0.057)	(0.053)	(0.054)
$\left(\frac{FCL}{GDP}\right)_{t-12}^{j}$	0.039†					0.051*	0.028	0.035
	(0.026)					(0.026)	(0.028)	(0.030)
$\left(\frac{FCA\_E}{GDP}\right)_{t-12}^{j}$						-0.030	-0.055*	-0.063*
						(0.031)	(0.028)	(0.034)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^{j}$	0.009	0.029	0.007	0.012	0.028	0.028	0.026	0.035
	(0.019)	(0.026)	(0.018)	(0.019)	(0.026)	(0.028)	(0.026)	(0.026)

Table 17: Stock Indices_Lagged External Liabilities_Aggregate FC_Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(Tade\ open.)^j \times$ "							0.007	0.002
							(0.027)	(0.024)
$(\frac{Govt\ Debts}{GDP})^j_t \times$ "							-0.038*	-0.043**
							(0.022)	(0.021)
$(\frac{Govt\ Debts}{GDP})^j_t$							0.000	0.000
							(0.000)	(0.000)
Oil_G1							0.074*	0.000
							(0.039)	(0.000)
Oil_G2							0.005	-0.068*
							(0.053)	(0.039)
Oil_G3							0.001	-0.074***
							(0.039)	(0.020)
Com_G1							0.344**	0.139**
							(0.130)	(0.069)
Com_G2							0.205*	0.000
							(0.121)	(0.000)
i^j_t	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**	-0.002**	-0.002**	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP^j_t	-0.013	-0.009	-0.006	-0.009	-0.009	-0.011	-0.021	-0.035
	(0.027)	(0.028)	(0.028)	(0.027)	(0.028)	(0.029)	(0.030)	(0.031)
$M2^j_t$	-0.012	-0.027	-0.020	-0.022	-0.027	-0.017	-0.020	-0.009
	(0.017)	(0.019)	(0.019)	(0.019)	(0.019)	(0.017)	(0.018)	(0.018)
$Inflation^j_t$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	NO	YES
R-squared	0.036	0.044	0.049	0.044	0.044	0.031	0.051	0.158
Observations	1,660	1,660	1,660	1,660	1,660	1,660	1,660	1,660
Number of groups	20	20	20	20	20	20	20	20

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 18: Exchange Rates_Lagged External Liabilities_Sector FC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta\varepsilon^{j}_{t-1}$	0.014	0.013	0.013	0.014	0.013	-0.052	0.011
	(0.046)	(0.046)	(0.046)	(0.045)	(0.047)	(0.048)	(0.054)
$\Delta ln\,(VIX)_t$	0.037**	0.048***	0.043***	0.048***	0.048***	0.054*	0.045*
	(0.016)	(0.016)	(0.013)	(0.015)	(0.016)	(0.028)	(0.025)
$ln\,(VIX)_{t-1}$	0.016*	0.017**	0.017**	0.018**	0.016**	0.005	
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	
$\left(\frac{LCB}{GDP}\right)_n \times \Delta ln\,(VIX)_t$	0.134**	0.169**		0.128†	0.148*	0.170*	0.181**
	(0.059)	(0.071)		(0.079)	(0.082)	(0.093)	(0.088)
$\left(\frac{LCE}{GDP}\right)_n \times$ "	0.011	-0.021		-0.016	-0.039	0.018	-0.012
	(0.034)	(0.031)		(0.033)	(0.063)	(0.053)	(0.048)
$\left(\frac{FC\_NF}{GDP}\right)_n \times$ "	-0.040	-0.048	-0.013	-0.047	-0.056	-0.024	-0.036
	(0.041)	(0.043)	(0.035)	(0.042)	(0.050)	(0.059)	(0.060)
$\left(\frac{NFC\_NF}{GDP}\right)_n \times$ "	-0.011	-0.011	-0.048	-0.038	-0.040	-0.009	0.002
	(0.028)	(0.028)	(0.054)	(0.056)	(0.058)	(0.046)	(0.052)
$\left(\frac{HH\_NF}{GDP}\right)_n \times$ "			-0.141	-0.088	-0.086	-0.089	-0.041
			(0.116)	(0.128)	(0.127)	(0.123)	(0.135)
$\left(\frac{G\_NF}{GDP}\right)_n \times$ "		0.094†		0.094†	0.110†	0.031	0.055
		(0.063)		(0.062)	(0.072)	(0.043)	(0.048)
$\left(\frac{NFC\_FCAE}{GDP}\right)_n \times$ "					0.001†	0.000	0.000
					(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)_n \times$ "					-0.000	-0.000	0.000
					(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)_n \times$ "	-0.056**	-0.062**	-0.025	-0.046	-0.040	-0.044*	-0.021
	(0.027)	(0.028)	(0.035)	(0.040)	(0.045)	(0.025)	(0.033)
$\left(\frac{LCB}{GDP}\right)_n$	-0.010	-0.024		-0.000	0.035	0.052	0.028
	(0.049)	(0.046)		(0.039)	(0.057)	(0.051)	(0.059)
$\left(\frac{LCE}{GDP}\right)_n$	-0.022	-0.019		-0.028	0.009	-0.039	-0.033
	(0.054)	(0.055)		(0.046)	(0.052)	(0.047)	(0.035)
$\left(\frac{FC\_NF}{GDP}\right)_n$	0.011	0.014	0.005	0.015	0.006	-0.038	-0.037
	(0.026)	(0.027)	(0.030)	(0.027)	(0.029)	(0.035)	(0.038)
$\left(\frac{NFC\_NF}{GDP}\right)_n$	-0.010	-0.011	-0.013	-0.011	-0.020	-0.030	-0.027
	(0.023)	(0.025)	(0.021)	(0.025)	(0.027)	(0.030)	(0.034)
$\left(\frac{HH\_NF}{GDP}\right)_n$			0.047	0.066	0.064	0.080	0.018
			(0.091)	(0.100)	(0.097)	(0.068)	(0.079)
$\left(\frac{G\_NF}{GDP}\right)_n$		-0.035		-0.046	-0.046	0.155**	0.102*
		(0.061)		(0.069)	(0.067)	(0.068)	(0.059)
$\left(\frac{NFC\_FCAE}{GDP}\right)_n$					-0.003***	-0.003***	-0.002***
					(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)_n$					0.001	0.002*	0.001
					(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)_n$	0.001	0.001	0.002	-0.001	-0.002	0.013	-0.006
	(0.022)	(0.022)	(0.020)	(0.019)	(0.020)	(0.022)	(0.023)
$(Fin.\ open.)^j \times$ "						-0.000	0.001
						(0.004)	(0.004)
$(Tade\ open.)^j \times$ "						0.001	-0.005
						(0.014)	(0.014)

Table 18: Exchange Rates_Lagged External Liabilities_Sector FC_Coutinued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j \times$ "						-0.062†	-0.038
						(0.039)	(0.047)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j$						0.002***	0.001***
						(0.000)	(0.000)
Oil_G1_t						-0.051*	0.000
						(0.029)	(0.000)
Oil_G2_t						0.004	0.046
						(0.047)	(0.046)
Oil_G3_t						-0.026	0.023*
						(0.033)	(0.013)
Com_G1_t						-0.303***	0.000
						(0.087)	(0.000)
Com_G2_t						-0.358***	-0.041
						(0.102)	(0.057)
$i_t^j - i_t^{us}$	0.002***	0.002***	0.002***	0.002***	0.002***	0.001*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP_t^j	-0.012	-0.011	-0.008	-0.008	-0.009	-0.001	-0.002
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)
$M2_t^j$	0.054	0.054	0.051	0.053	0.050	0.061	0.057
	(0.052)	(0.054)	(0.049)	(0.053)	(0.052)	(0.050)	(0.045)
$Inflation_t^j$	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln\,(REER)_{t-1}^j$	0.098***	0.097***	0.103***	0.106***	0.106***	0.103***	0.104***
	(0.027)	(0.027)	(0.021)	(0.021)	(0.021)	(0.020)	(0.026)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.086	0.084	0.080	0.073	0.033	0.036	0.143
Observations	1,577	1,577	1,577	1,577	1,577	1,577	1,577
Number of groups	19	19	19	19	19	19	19

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 19: Stock Indices_Lagged External Liabilities_Sector

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δq_{t-1}^{j}	-0.004	-0.004	-0.004	-0.004	-0.005	-0.025	-0.008
	(0.037)	(0.036)	(0.037)	(0.036)	(0.036)	(0.037)	(0.038)
$\Delta ln\,(VIX)_t$	-0.081***	-0.080***	-0.087***	-0.080***	-0.078***	-0.022	-0.024
	(0.017)	(0.018)	(0.016)	(0.018)	(0.019)	(0.029)	(0.030)
$ln\,(VIX)_{t-1}$	-0.033***	-0.033***	-0.033***	-0.032***	-0.032***	-0.027***	
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)	
$\left(\frac{LCB}{GDP}\right)_{t-12}^{j} \times \Delta ln\,(VIX)_t$	0.125	0.125		0.174*	0.177*	0.204**	0.258**
	(0.115)	(0.116)		(0.100)	(0.094)	(0.099)	(0.111)
$\left(\frac{LCE}{Mkt.\ Cap.}\right)_{t-12}^{j} \times$ "	-0.083*	-0.081*		-0.096**	-0.095**	-0.140**	-0.160**
	(0.042)	(0.045)		(0.043)	(0.042)	(0.065)	(0.075)
$\left(\frac{FC\_NF}{GDP}\right)_{t-12}^{j} \times$ "	-0.087	-0.087	0.012	-0.104*	-0.097†	-0.196	-0.212
	(0.063)	(0.063)	(0.037)	(0.059)	(0.061)	(0.143)	(0.158)
$\left(\frac{NFC\_NF}{GDP}\right)_{t-12}^{j} \times$ "	-0.052	-0.052	-0.047	-0.032	-0.035	-0.039	-0.010
	(0.036)	(0.036)	(0.059)	(0.056)	(0.059)	(0.058)	(0.057)
$\left(\frac{HH\_NF}{GDP}\right)_{t-12}^{j} \times$ "			0.002	0.072	0.070	0.049	0.118
			(0.106)	(0.099)	(0.100)	(0.089)	(0.106)
$\left(\frac{G\_NF}{GDP}\right)_{t-12}^{j} \times$ "		0.006		0.001	0.007	-0.006	-0.023
		(0.068)		(0.068)	(0.068)	(0.091)	(0.093)
$\left(\frac{NFC\_FCAE}{GDP}\right)_{t-12}^{j} \times$ "					0.000	0.001	0.001
					(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)_{t-12}^{j} \times$ "					-0.000	-0.001	-0.001
					(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^{j} \times$ "	0.054†	0.053†	0.040	0.044	0.041	-0.038	-0.067
	(0.035)	(0.035)	(0.041)	(0.038)	(0.040)	(0.063)	(0.069)
$\left(\frac{LCB}{GDP}\right)_{t-12}^{j}$	-0.105	-0.116		-0.097	-0.127	-0.133	-0.161†
	(0.079)	(0.088)		(0.083)	(0.102)	(0.096)	(0.111)
$\left(\frac{LCE}{Mkt.\ Cap.}\right)_{t-12}^{j} \times$ "	-0.003	-0.007		-0.019	-0.020	0.000	-0.005
	(0.096)	(0.098)		(0.094)	(0.095)	(0.091)	(0.088)
$\left(\frac{FC\_NF}{GDP}\right)_{t-12}^{j} \times$ "	0.004	0.008	-0.003	0.007	0.005	0.011	0.020
	(0.042)	(0.042)	(0.041)	(0.042)	(0.040)	(0.041)	(0.046)
$\left(\frac{NFC\_NF}{GDP}\right)_{t-12}^{j} \times$ "	-0.089**	-0.090**	-0.092**	-0.090**	-0.092**	-0.087**	-0.085*
	(0.040)	(0.040)	(0.038)	(0.039)	(0.042)	(0.041)	(0.047)
$\left(\frac{HH\_NF}{GDP}\right)_{t-12}^{j} \times$ "			0.061	0.058	0.075	-0.020	-0.034
			(0.073)	(0.076)	(0.074)	(0.059)	(0.075)
$\left(\frac{G\_NF}{GDP}\right)_{t-12}^{j} \times$ "		-0.030		-0.045	-0.056	0.025	0.013
		(0.065)		(0.070)	(0.067)	(0.080)	(0.101)
$\left(\frac{NFC\_FCAE}{GDP}\right)_{t-12}^{j}$					0.001	0.001	0.001
					(0.001)	(0.001)	(0.001)
$\left(\frac{FC\_FCAE}{GDP}\right)_{t-12}^{j}$					-0.002*	-0.002**	-0.002*
					(0.001)	(0.001)	(0.001)
$\left(\frac{Reserve}{GDP}\right)_{t-1}^{j}$	0.033	0.033	0.020	0.032	0.035	0.041	0.053*
	(0.025)	(0.025)	(0.020)	(0.023)	(0.024)	(0.026)	(0.029)
$\left(\frac{Govt\ Debts}{GDP}\right)_{t}^{j} \times$ "						-0.058	-0.060**
						(0.037)	(0.030)

Table 19: Stock Indices_Lagged External Liabilities_Sector_Coutinued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\left(\frac{Govt\ Debts}{GDP}\right)_t^j$						0.000	0.000
						(0.001)	(0.001)
$(Fin.\ open.)^j \times$ "						-0.003	-0.002
						(0.005)	(0.005)
$(Trade\ open.)^j \times$ "						0.040	0.044†
						(0.030)	(0.029)
Oil_G1_t						0.041	0.000
						(0.041)	(0.000)
Oil_G2_t						0.010	-0.031
						(0.052)	(0.045)
Oil_G3_t						0.005	-0.038
						(0.039)	(0.027)
Com_G1_t						0.299**	0.000
						(0.130)	(0.000)
Com_G2_t						0.198*	-0.101
						(0.118)	(0.077)
i_t^j	-0.001**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP_t^j	-0.006	-0.007	-0.005	-0.005	-0.003	-0.016	-0.031
	(0.027)	(0.027)	(0.027)	(0.028)	(0.028)	(0.029)	(0.031)
$M2_t^j$	-0.011	-0.010	-0.008	-0.010	-0.010	-0.011	-0.005
	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)	(0.019)	(0.018)
$Inflation_t^j$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.011	0.012	0.007	0.009	0.010	0.023	0.108
Observations	1,368	1,368	1,368	1,368	1,368	1,368	1,368
Number of groups	19	19	19	19	19	19	19

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, HH_NFC: net foreign currency assets of household sector , FC_NFC: net foreign currency assets of financial corporate sector, NFC_NFC: net foreign currency assets of non-financial corporate sector and G_NFC: net foreign currency assets of goverment sector. 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

J.3 Average External Liabilities

Table 20: Exchange Rate_Average External Liabilities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta\varepsilon_{t-1}^{j}$	0.032	0.033	0.033	0.039	0.039	-0.053	0.026
	(0.047)	(0.047)	(0.047)	(0.048)	(0.049)	(0.049)	(0.051)
$\Delta ln\,(VIX)_t$	0.049***	0.053***	0.052***	0.053***	0.053***	0.043***	0.044***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.010)
$ln\,(VIX)_{t-1}$	0.012	0.012	0.012	0.014*	0.014*	0.004	
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)	
$(\frac{LCD}{GDP})^j \times \Delta ln\,(VIX)_t$		0.099**					
		(0.044)					
$(\frac{LCB}{GDP})^j \times$ "			0.166***	0.159***	0.160***	0.144**	0.144**
			(0.062)	(0.056)	(0.057)	(0.055)	(0.061)
$(\frac{LCE}{GDP})^j \times$ "					-0.001	0.001	0.013
					(0.039)	(0.038)	(0.045)
$(\frac{FCA}{GDP})^j \times$ "				0.004	0.004	0.005	0.004
				(0.014)	(0.019)	(0.018)	(0.018)
$(\frac{FCL}{GDP})^j \times$ "	0.028			0.014	0.014	0.006	-0.011
	(0.031)			(0.029)	(0.028)	(0.027)	(0.024)
$(\frac{Reserve}{GDP})_{t-1}^j \times$ "	-0.042	-0.059**	-0.051*	-0.055**	-0.055**	-0.055**	-0.058
	(0.027)	(0.025)	(0.028)	(0.025)	(0.025)	(0.025)	(0.043)
$(\frac{Reserve}{GDP})_{t-1}^j$	0.007	0.007	0.007	0.013	0.013	0.006	-0.007
	(0.014)	(0.014)	(0.014)	(0.016)	(0.016)	(0.014)	(0.013)
$(Fin.\ open.)^j \times$ "							0.004
							(0.005)
$(Tade\ open.)^j \times$ "							0.000
							(0.014)
Oil_G1_t						-0.039	0.000
						(0.030)	(0.000)
Oil_G2_t						0.024	0.055
						(0.052)	(0.039)
Oil_G3_t						-0.010	0.028
						(0.035)	(0.018)
Com_G1_t						-0.384***	
						(0.089)	
Com_G2_t						-0.409***	
						(0.112)	
$i_t^j - i_t^{us}$	0.002***	0.002***	0.002***			0.002***	0.002***
	(0.001)	(0.001)	(0.001)			(0.001)	(0.001)
IP_t^j	-0.011	-0.011	-0.011	-0.015	″-0.015	-0.004	-0.002
	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)	(0.013)	(0.012)
$M2_t^j$	0.041	0.041	0.041	0.052	0.052	0.046	0.043
	(0.041)	(0.041)	(0.041)	(0.046)	(0.046)	(0.039)	(0.034)
$Inflation_t^j$	-0.000*	-0.000*	-0.000*	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln\,(REER)_{t-1}^j$	0.059**	0.059**	0.059**	0.031	0.031	0.045**	0.075***
	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)	(0.019)	(0.018)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.100	0.102	0.103	0.073	0.073	0.200	0.376
Observations	1,640	1,640	1,640	1,640	1,640	1,640	1,640
Number of groups	20	20	20	20	20	20	20

Note: 1) *** $p<0.01$, ** $p<0.05$, * $p<0.1$, * $p<0.1$, † $p<0.15$. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, FCA: Foreign Currency Asset, and FCL : Foreign Currency Liability 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.

Table 21: Stock Indices_Average External Liabilities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δq^j_{t-1}	0.032	0.031	0.032	0.032	0.033	-0.008	0.012
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)	(0.034)	(0.034)
$\Delta ln\,(VIX)_t$	-0.090***	-0.092***	-0.093***	-0.094***	-0.091***	-0.082***	-0.090***
	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.017)	(0.012)
$ln\,(VIX)_{t-1}$	-0.028***	-0.028***	-0.028***	-0.028***	-0.028***	-0.021**	0.003*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.002)
$\left(\frac{LCE}{GDP}\right)^j \times \Delta ln\,(VIX)_t$			-0.004				
			(0.031)				
$\left(\frac{LCD}{GDP}\right)^j \times$ ”			-0.023		0.004		
			(0.066)		(0.066)		
$\left(\frac{LCB}{GDP}\right)^j \times$ ”		-0.013				0.080	0.117
		(0.085)				(0.091)	(0.119)
$\left(\frac{LCE}{Mkt.\ Cap.}\right)^j \times$ ”				-0.069*	-0.082**	-0.104**	-0.112**
				(0.042)	(0.040)	(0.047)	(0.048)
$\left(\frac{FCA}{GDP}\right)^j \times$ ”					-0.003	-0.011	-0.010
					(0.023)	(0.021)	(0.022)
$\left(\frac{FCL}{GDP}\right)^j \times$ ”	0.046				0.062	0.063	0.056
	(0.035)				(0.039)	(0.039)	(0.044)
$\left(\frac{Reserve}{GDP}\right)^j_{t-1} \times$ ”	0.072**	0.082***	0.087***	0.090***	0.079**	0.075***	0.062
	(0.030)	(0.029)	(0.030)	(0.030)	(0.030)	(0.028)	(0.046)
$\left(\frac{Reserve}{GDP}\right)^j_{t-1}$	0.005	0.005	0.005	0.005	0.005	0.006	0.012
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)
$(Fin.\ open.)^j \times$ ”							0.003
							(0.004)
$(Tade\ open.)^j \times$ ”							-0.006
							(0.014)
Oil_G1_t						0.074*	0.000
						(0.040)	(0.000)
Oil_G2_t						-0.003	-0.080**
						(0.048)	(0.030)
Oil_G3_t						-0.008	-0.085***
						(0.041)	(0.021)
Com_G1_t						0.386***	
						(0.131)	
Com_G2_t						0.303**	
						(0.126)	
i^j_t	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IP^j_t	-0.011	-0.011	-0.011	-0.011	-0.011	-0.018	-0.024
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.019)	(0.020)
$M2^j_t$	-"0.003	-0.004	-0.004	-0.003	-0.003	-0.005	0.006
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
$Inflation^j_t$	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country FE	YES	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO	YES
R-squared	0.072	0.077	0.077	0.078	0.079	0.124	0.287
Observations	1,640	1,640	1,640	1,640	1,640	1,640	1,640
Number of groups	20	20	20	20	20	20	20

Note: 1) *** p<0.01, ** p<0.05, * p<0.1, * p<0.1, † p<0.15. 2) LCD: Local Currency Debt, LCB: Local Currency Bond Portfolio, LCE: Local Currency Equity, FCA: Foreign Currency Asset, and FCL : Foreign Currency Liability 3) Exclude Brazil as there is no available data of foreign currency deposit in Brazil. 4) Driscoll-Kraay standard errors. 5) Regression (7) adds more controls (commodity price index and related groups) to regression (5). 6) Time fixed effects are not two-way fixed effects, but time dummies (random effects), becasue one of the key explanatory variables, the VIX log difference is the time series variable.