International Equity and Debt Flows to Emerging Market Economies: Composition, Crises, and Controls*

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Abstract

We study how a country's composition of capital inflows is linked to the quality of its public institutions and what policies can be used to address an externality. In the model, poor institutional quality leads to an inefficiently low equity share and an inefficiently high volume of total inflows. Interestingly, a social planner would impose taxes on both debt and equity inflows. Our economic mechanism differs in important ways from an alternative narrative focusing on the collateral constraint.

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1 Introduction

Emerging market economies with a greater reliance on foreign debt to finance their investment typically fare worse during a crisis (Caballero and Krishnamurthy 2003, Tong and Wei 2010 and Forbes and Warnock 2012). Foreign borrowing by an emerging market economy may suffer from a negative externality, and some restriction (tax) on external borrowing may improve welfare (Bianchi 2011, Korinek 2018).[1] But foreign equity financing is qualitatively different from debt financing in terms of their risk-sharing property. In principle, if all foreign financing takes the form of foreign equity investment, the externality problems highlighted in the existing models could have disappeared. Of course, most countries in reality have a combination of foreign equity and debt financing. As far as we know, how an endogenously determined structure of capital inflows in turn affects the structure of optimal capital controls has not been discussed in the literature.

In this paper, we provide a set of empirical facts on the composition of capital inflows across countries, and a model of international financing for emerging market economies that consider simultaneously foreign equity and debt financing. We highlight the importance of a country's domestic institutional quality in shaping its external financing structure and financial instability. The optimal capital control policies in our model naturally need to reflect a country's institutional quality as well.[2] Our contribution is to provide a micro-foundation for countries' external capital structure based on the notion that equity financing faces a greater moral hazard risk than debt and

[1]The literature has highlighted two types of externalities in foreign debt financing that may justify capital controls (see Engel 2016, Rebucci and Ma 2020, Erten, Korinek, and Ocampo 2021). The first is a pecuniary externality due to price-dependent collateral constraints as in Jeanne and Korinek (2010), Bianchi (2011), Benigno, Chen, Otrok, Rebucci, and Young (2013), Jeanne and Korinek (2018), Bianchi and Mendoza (2018), Schmitt-Grohé and Uribe (2021). The second is an aggregate demand externality in the presence of sticky wages or prices and a fixed exchange rate regime (see Farhi and Werning 2014, 2016, Korinek and Simsek 2016, Schmitt-Grohé and Uribe 2016). While our baseline model is based on a pecuniary externality argument, our results generalize to the case of an aggregate demand externality (see Appendix C).

[2]Alfaro, Kalemli-Ozcan, and Volosovych (2008) show empirically that the domestic institutional quality could explain the "Lucas Paradox", i.e. seemingly too little capital flowing from rich to poor countries. Eichengreen and Rose (2014) report evidence that capital controls vary with country-level institutional development.

the institutional quality is a key determinant of the extent of the moral hazard problem. By introducing both institutional quality and equity financing, we generalize the work-horse international finance model for an emerging market economy as in Bianchi (2011) and Korinek (2018). Using our framework, we also revisit the issues of currency composition of debt (compared to Engel and Park 2022), foreign direct investment versus portfolio equity investment (compared to Goldstein and Razin 2006), and maturity structure of foreign debt.

Our model provides new insight into the design of capital controls. One result that may be counter-intuitive at first sight is that the optimal policy features positive taxes on both foreign equity and debt financing if the country's institutional quality is below some threshold. This is somewhat surprising because foreign equity financing has a desirable risk-sharing property—an economy financed entirely by equity investment can achieve the first best. However, the theoretical prediction is consistent with the data: many countries with restrictions on cross-border debt flows also have restrictions on equity flows. We will clarify the logic behind this seeming paradox. Specifically, when both equity and debt financing are present, just taxing foreign debt is insufficient as the externality in the economy affects both financing decisions.[3] Therefore, a social planner wants to tax both forms of capital flows ex-ante. However, the optimal tax rate on equity is lower than debt, mimicking a "pecking order" of capital control policy design proposed by the IMF staff (Ostry, Ghosh, Habermeier, Chamon, Qureshi, and Reinhardt 2010).

Our model makes cross-country predictions on the composition of external liabilities, financial stability, and the extent of capital controls, all of which are empirically validated. Specifically, the quality of domestic institutions is a key determinant of the share of foreign equity in its total external liabilities, which in turn affects the total volatility of capital flows. Countries with good institutional quality (e.g., typically developed countries) can issue more equity-like securities and

[3] Korinek (2018) analyzes foreign debt and equity flows one at a time. In comparison, both flows are jointly determined in our paper and the exact composition is a function of domestic institutions.

are therefore less likely to run into inefficient sudden stop episodes. As a result, they have less need to use capital controls to manage their capital flows. On the other hand, countries with weaker public institutions (i.e., typical developing countries) need to rely more heavily on debt instruments for financing and are more exposed to the risk of sudden stops. As a result, capital controls are more necessary for them.

If some external capital structure is riskier than others, why do so many countries live with unfavorable structures? One theory is that the quality of domestic institutions (e.g., control of corruption, or impartiality of the local courts) is not easy to change and is an important determinant of the external capital structure (see Wei 2000 and Wei and Zhou 2018). Because equity investment does not have a pre-specified fixed payoff, the payoff to equity investors is more dependent on legal and other institutions than debt contracts. In the language of Holmstrom (2015), debt is a lot less "information-intensive," and is much less demanding on the ability of international investors to collect, analyze, and understand the information about the nature and payoffs of underlying projects. When a country has inadequate legal protection of investor rights, foreign equity investors are more concerned than foreign debt investors. As a result, there will be relatively less demand for equity-like securities from that country. This intuition is reflected in a bin scatter plot in Figure 1, which shows a strongly positive relationship across countries between the quality of a country's public institutions and the share of equity in its total external liability during 1996-2015.[4] In a similar vein, Modigliani and Perotti (2000) show that, in countries with weak investor protection, corporate investment is more likely to be financed by bank loans than by the equity market.

As countries with poor domestic institutions are more likely to issue debt-like securities, they

[4]Our measure of institutional quality is from the World Bank's World Government Indicators database, which includes six measures such as "Control of Corruption", "Government Effectiveness", Political Stability and Absence of Violence/Terrorism", "Rule of Law", "Regulatory Quality" and "Voice and Accountability". We take a simple average of the six measures and use it to proxy expropriation risk for foreign investment in a country. A higher value of the institutional quality measure is a lower expropriation risk.

Figure 1 EQUITY SHARE AND INSTITUTIONAL QUALITY: BIN SCATTER PLOT

NOTE. This is a bin scatter plot of the average equity share (in % of total external liability) against the average institutional quality during 1996-2015 across countries. The slope of the fitted line is 7.78 (17.93) with a t-statistic of 3.75 (3.25) for emerging market economies (advanced economies). See Appendix A for data sources and variable construction, and Section 2 for additional regression results.

in turn are also more susceptible to sudden stop episodes. In other words, a country's vulnerability to *sudden stops* is *not* random, but related to its external capital structure and institutional quality.[5] Our theory suggests that a country's external capital structure would naturally vary by the stage of development as captured by the quality of public institutions. As a country becomes more developed with improving institutions, a greater share of its external liabilities would feature better risk sharing with international investors. Correspondingly, both financial instability and the optimal level of capital controls decline.

[5]Our theory also provides a partial explanation for a home bias in the equity market in emerging market economies (see Coeurdacier and Rey 2013 for a survey). As the poor institutional quality repels foreign investors from providing equity financing, the domestic agents have to hold more home equities in their portfolio than a full risk-sharing model

Comparing middle-income (developed) with poor (developing) countries, there are differences in both the quality of public institutions that limit expropriation risks and financial development that affects collateral constraints for borrowing in international debt markets. Our analysis suggests that, to understand cross-country differences in capital flows, differences in institutions are more important than financial development.

Existing literature interprets the parameter denoting the degree of collateral constraints as representing the level of financial development (see Mendoza, Quadrini, and Rios-Rull 2009 and Bianchi 2011). It is natural to ask whether cross-country variations in that parameter can generate the same predictions as our institutional quality story. The short answer is no. While a relaxed borrowing constraint can also result in fewer crises, the two are different in important ways. First, while an improvement in institutions leads to a higher share of equity financing in a country's external liabilities, a relaxation of collateral constraints leads to an opposite change (i.e., a lower equity share). Second, while a higher institutional quality reduces the required level of capital controls needed to remove economic inefficiency, a more relaxed collateral constraint might lead to the opposite result.[6] The two different predictions are both validated in the data and the model.

Our paper has important implications for the optimal design of capital controls policy. In general, optimal policies should depend on a country's institutional quality. A higher quality of domestic institutions leads to a safer external capital structure and therefore a higher level of financial stability. In this case, there is no need for restrictions on cross-border capital flows. On the other hand, a poor domestic institutional quality reduces the country's ability to issue equity-like securities and this leads to more financial vulnerability. In this scenario, capital control policies are needed to correct this inefficiency. These results suggest that if there is a way to improve a

without an expropriation risk would have predicted.

[6]Similarly, Bianchi (2011), in the simulation part of his model (Panel C of Figure 6), reports that the optimal average tax on capital flows would increase as the collateral constraint on borrowing relaxes.

country's domestic institutional quality, it is worth pursuing because it allows the country to fully utilize the benefits of financial globalization (see Kose, Prasad, Rogoff, and Wei 2010). If a country is unable to improve its institutional quality, capital controls can then be used to correct this inefficiency and externality. Yet, the need for capital controls declines as an economy matures in the form of improved institutions.[7]

We discuss a number of extensions in Section 5. In our baseline model, we only allow for the institutional quality to affect the combination of both external equity and debt. In general, our economic mechanism can apply to other types of financing choices. For example, institutional quality can affect the decision to obtain control rights for equity investment. In one extension, we consider the combination of foreign direct investment (with control rights) and (passive) equity investment jointly. Similarly, institutional quality can also affect the currency or maturity choice of external debt financing and we analyze them separately in two extensions.[8] The key insight from our baseline model applies. Given that financing choices with better risk-sharing properties typically suffer more from the moral hazard problem, a country's external capital structure, financial stability, and optimal policies will depend on its institutional quality.

We make several contributions to the literature. First, our paper adds new insight, including optimal policy packages, to the literature on a nation's foreign capital structure. Razin, Sadka, and Yuen (1998) study the share of FDI in a model with asymmetric information. Caballero and Krishnamurthy (2003) and Bolton and Huang (2018) analyze the local and foreign currency debt. Our paper's focus is on the role of domestic institutions in determining foreign equity and debt composition. In extensions, we show the same insight also helps to understand local vs. foreign

[7] Throughout the paper, we assume that a country's institutional quality is a deep parameter. The justification is that relative to policies on interest rates, tax rates, and capital controls, a country's institutional quality is a much slower-moving object and much harder to change. In future work, one may also consider the endogenous determination of institutional quality, for example, along the line of Jiao and Wei (2017).

[8] Similarly, Liu, Ma, and Shen (2021) allow both local currency and domestic currency debt in a sudden stop model and investigate the optimal capital controls.

currency debt. Most importantly, we study how an optimal policy package designed to correct externality needs to evolve with country institutions. An interesting insight is that, when the institutional quality is sufficiently imperfect, the optimal policy package entails restrictions on both foreign equity financing and foreign debt financing.

Second, this paper enhances our understanding of the design of capital controls. Relative to the existing literature that features only debt inflows (such as Bianchi 2011 and Jeanne and Korinek 2018), our framework features a menu of tools on foreign equity and debt financing.[9] The existing literature can thus be regarded as a special case of our theory. Note that debt-only financing can emerge endogenously in our model when the domestic institutional quality is below some threshold value. In general, however, both financing forms co-exist in equilibrium. Their relative importance affects the relative financial stability. An optimal policy package would feature separate taxes on foreign equity and debt financing.[10] As noted earlier, empirically, those countries with restrictions on foreign debt flows often also have controls on equity inflows in spite of the intrinsically better risk-sharing property of the latter. Our theory rationalizes this pattern.

Third, our paper enriches the literature on the role of institutional quality in finance. La Porta et al. (1997, 2000) have emphasized the importance of legal origin in corporate governance. In comparison, our focus is on a country's external capital composition. Alfaro, Kalemli-Ozcan, and Volosovych (2008) and Ju and Wei (2011) have studied the role of poor institutional quality in reducing the volume of capital inflows. In comparison, we use a micro-founded model to show that a given institutional problem affects foreign equity and debt financing differently. We also differ from them by deriving an optimal policy package that addresses an externality problem in a way that evolves with institutional quality. Additionally, we discuss the differences between

[9] Arce, Bengui, and Bianchi (2019) study the patterns of private debt flows and foreign exchange reserve accumulation in a model similar to Bianchi (2011).

[10] In a model that features only foreign debt financing, Bianchi (2011), Benigno et al. (2013), Jeanne and Korinek (2018), Bianchi and Mendoza (2018), and Ma (2020) have computed an optimal tax on foreign borrowing.

financial development and institutional quality in this context.

This paper is organized as follows: Section 2 presents three empirical patterns that motivate our research; Section 3 presents our benchmark model; Section 4 contrasts financial development with institutional improvement; Section 5 presents several extensions, and Section 6 concludes. Additional information is provided in online Appendices.

2 Some Data Patterns

In this section, we distill some data patterns on international capital flows that will motivate and guide our theory in the next section. We document three patterns in particular:

Fact 1. The share of foreign equity financing in total external liability tends to rise with the strength of a country's institutional quality.

Fact 2. Financial crises are more frequent in countries with a lower institutional quality.

Fact 3. Countries with a lower institutional quality tend to have more restrictions on both cross-border equity and debt flows.

To establish these facts, we combine data sets from several sources for 134 economies from 1996-2015: the External Wealth of Nations (EWN) data set from Lane and Milesi-Ferretti (2007), the Worldwide Governance Indicators (WGI) from the World Bank Institute, systemic crisis and banking crisis from the Global Crises database constructed by Carmen Reinhart, and capital controls from Fernández, Klein, Rebucci, Schindler, and Uribe (2016). The details on the country lists and the construction of the variables are given in Appendix A.

Our key variable of interest is a measure of a country's domestic institutional quality. Ideally, it should capture the quality of a country's governance that limits and constrains the risk of arbitrary expropriation for foreigners investing in the country. The World Bank's World Governance

Institute (WGI) provides six different measures related to a broad concept of "governance": control of corruption, government effectiveness, political stability and absence of violence/terrorism, rule of law, regulatory quality, and voice and accountability. We take a simple average of the six measures as our measure for institutional quality. Note that they each capture some dimension of the investment risk and are highly correlated with each other. [11]

In Table 1, we examine the relationship between the share of equity (the sum of inward foreign direct investment and inward portfolio equity investment) in a country's external liability and its institutional quality. As in Figure 1, countries with better institutions do exhibit a higher share of equity financing.[12] The relationship is positive, statistically significant, and economically strong. For ease of interpretation, we standardize all variables in the regression. Using the point estimate in column (1) as an illustration, an improvement in the institutional quality by one standard deviation is associated with a higher equity share by 6.4 percentage points or around 0.33 of one standard deviation of the equity share in the sample.[13] The coefficients on the control variables are also consistent with the existing literature (see Wei and Zhou 2018). This positive relationship continues to be true when we include measures for economic development (GDP per capita), measures for financial development (either IMF's financial development index or private credit as a share in GDP), and measures for economic openness (trade as a share in GDP). In fact, the coefficient on institutional quality becomes larger by 42 percent with those control variables included.

Why does the external capital structure (or the quantities of equity and debt external financing) vary with institutional quality? One potential reason is that a given change in institutional quality

[11]The World Bank's WGI dataset has a much broader coverage of countries than the index by La Porta et al. (1997) and is hence preferred for our purpose.

[12]We add an interaction term between our institutional quality measure and the measures for equity/debt holder protection constructed by La Porta et al. (1997) in Table C4. We find that the interaction terms are negative in most specifications although not statistically significant.

[13]The unconditional standard deviation for the equity share is 19.5% (see Table C1). An increase in the institutional quality by one standard deviation is associated with an increase in the equity share by $19.5\% * 0.33 = 6.4\%$.

Table 1 EXTERNAL CAPITAL STRUCTURE AND INSTITUTIONAL QUALITY

	Equity Share (% in total liability)			Equity Return		Bond Return	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Quality_{t-1}	0.33**	0.47***	0.46***	-0.40**	-0.47***	-0.15	-0.18
	(0.16)	(0.17)	(0.16)	(0.16)	(0.15)	(0.31)	(0.30)
$\text{Financial Development}_{t-1}$		-0.63***		-0.33***		-0.18	
		(0.16)		(0.12)		(0.15)	
$\text{Private Credit}_{t-1}$			-0.48***		-0.18***		-0.04
			(0.09)		(0.06)		(0.06)
$\text{Log GDP per capita}_{t-1}$		-0.53	-0.50	-0.54	-0.53	-0.77	-0.81
		(0.34)	(0.34)	(0.40)	(0.36)	(0.49)	(0.49)
Trade_{t-1}		0.07	0.08	0.14**	0.14**	0.17	0.17
		(0.11)	(0.11)	(0.06)	(0.06)	(0.14)	(0.14)
Country FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y
Number of Countries	134	134	134	67	67	63	63
Observations	2546	2546	2546	1273	1273	1165	1165
Adjusted R^2	0.400	0.432	0.453	0.471	0.471	0.104	0.103

NOTE. The dependent variable in columns (1)-(3) is equity share (portfolio equity and FDI) in total external liability. The dependent variable in columns (4) and (5) is the MSCI equity index return. The dependent variable in columns (6) and (7) is the bond return (EMBI bond index return for EMBI countries and MSCI bond index return for advanced economies). All independent variables are lagged by one year. We standardize all variables for ease of comparison. All standard errors are clustered by countries and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

has differential effects on the prices of equity and debt financing. To investigate this possibility, we use the equity return by country, constructed from the MSCI equity index (available for 67 countries) as a proxy for the external financing cost in equity, and the bond return for the same country, constructed from either the EMBI bond index for an emerging market economy or the MSCI bond index for an advanced economy, as a proxy for external financing cost in bonds. From Columns (4)-(7), we see that countries with better institutional quality exhibit a lower financing cost for both equity and bond financing, but the effect is stronger for equity financing. Such differential effect is both statistically and economically significant.

Holmstrom (2015) postulates that debt financing is less information-sensitive than equity. As a bond investor, one only needs to know whether the firm's EBITA is enough to cover the interest and principal payment of the bond, but not how much more nor the exact amount of EBITA. In comparison, one does need to know the exact amount of EBITA to work out the payoff to equity to equity investors. As a result, equity investors are more vulnerable than bond investors to cheating behavior by corporate management. Our empirical pattern is consistent with the interpretation that a given improvement in the business environment that restricts the scope of cheating is more useful to equity investors than to bond investors.

We examine the relationship between financial instability and institutional quality in Table 2. Given the previous fact and a large existing literature that has documented a tight connection between a country's external capital structure and financial stability, one should not be surprised to find that institutional quality affects financial stability. We use two indicators of financial crises in a country-year sample constructed by Carmen Reinhart in the Global Crises database: one for systemic crises and the other for banking crises. Those variables are constructed to capture financial distress either in the whole economic system or the banking system.

We use a panel logit model, and control for economic development, private credit as a share of GDP, trade, and time-fixed effects. We also allow for country fixed effects in columns (3), (4), (7), and (8). Our results suggest that countries with higher institutional quality experienced a lower probability of crises and the effects are statistically significant. Using Column (2) as an example, a one-standard-deviation increase in institutional quality is associated with a reduction in the incidence of systemic crises by 9.3 percentage points. The negative association between the two holds for a variety of model specifications. This result is also consistent with the literature that emphasizes higher leverage as a predictor of future crises (see Frankel and Rose 1996, Tong

Table 2 FINANCIAL CRISES AND INSTITUTIONAL QUALITY

	Systemic Crises				Banking Crises			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quality$_{t-1}$	-1.00***	-1.05***	-2.69***	-2.93***	-0.98***	-1.06***	-3.20***	-2.96***
	(0.21)	(0.21)	(0.84)	(0.91)	(0.19)	(0.19)	(0.82)	(0.87)
Financial Development$_{t-1}$	0.49***		-0.11		0.99***		2.50***	
	(0.19)		(0.61)		(0.17)		(0.58)	
Private Credit$_{t-1}$		0.40***		1.85***		0.74***		3.14***
		(0.12)		(0.38)		(0.11)		(0.43)
Log GDP per capita$_{t-1}$	0.69***	0.94***	-4.53**	-6.56***	0.39	0.87***	-7.50***	-7.77***
	(0.26)	(0.25)	(2.09)	(2.29)	(0.24)	(0.23)	(1.90)	(2.04)
Trade$_{t-1}$	0.22***	0.23***	1.71***	1.55**	-0.00	-0.00	0.64	0.49
	(0.08)	(0.08)	(0.58)	(0.63)	(0.09)	(0.09)	(0.52)	(0.59)
Country FE	N	N	Y	Y	N	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Number of Countries	64	64	64	64	62	62	62	62
Observations	1126	1126	576	576	1111	1111	788	788
Pseudo R^2	0.096	0.102	0.237	0.299	0.150	0.166	0.256	0.372

NOTE. All columns are based on the panel Logit model. The dependent variable is the dummy for crises from the Global Crises database constructed by Carmen Reinhart. All independent variables are lagged by one year and are standardized. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

and Wei 2010, Adrian and Shin 2014, for example), considering our first stylized fact in Table 1 suggests that institutional quality predicts the external capital structure.

We study the relationship between capital controls and institutional quality across countries in Table 3. Of special interest to us are the restrictions imposed by country authorities on foreign purchases of domestic debt and equities, respectively (see Fernández et al. 2016). We group the restrictions on equity (EQ), collective investment securities (CI), derivatives (DE), and direct investment (DI) as a composite measure of the controls on equity financing, and group the restrictions on bonds with an original maturity of more than one year (BO), money market instruments (MM), commercial credits (CC) and financial credits (FC) as a composite measure of the controls on debt financing. To ensure robustness, we construct two types of capital control measures: a

Table 3 Capital Controls and Institutional Quality

	Panel A: Presence of Capital Controls (Extensive Measure)								Panel B: Number of Asset Categories with Capital Controls (Intensive Measure)							
	Equity				Debt				Equity				Debt			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Quality_{t-1}	-1.15***	-0.97***	-2.02**	-2.13**	-1.52***	-1.39***	-2.72***	-2.82***	-0.20***	-0.17***	-0.15**	-0.16**	-0.17***	-0.15***	-0.18*	-0.18*
	(0.12)	(0.12)	(0.90)	(0.89)	(0.14)	(0.13)	(0.80)	(0.82)	(0.02)	(0.02)	(0.06)	(0.07)	(0.02)	(0.01)	(0.10)	(0.09)
$\text{Financial Development}_{t-1}$	0.56***		-1.09		0.63***		-0.06		0.08***		-0.07*		0.09***		-0.05	
	(0.11)		(0.73)		(0.12)		(0.59)		(0.02)		(0.04)		(0.01)		(0.05)	
$\text{Private Credit}_{t-1}$		0.20***		-0.22		0.30***		0.15		0.01		-0.03		0.04***		-0.03
		(0.07)		(0.35)		(0.08)		(0.36)		(0.01)		(0.02)		(0.01)		(0.02)
$\text{Log GDP per capita}_{t-1}$	-0.12	0.10	-7.81***	-8.27***	-0.68***	-0.44***	-5.29**	-5.39**	0.00	0.04**	-0.15	-0.15	-0.10***	-0.07***	-0.05	-0.05
	(0.12)	(0.11)	(2.41)	(2.39)	(0.13)	(0.12)	(2.30)	(2.25)	(0.02)	(0.02)	(0.11)	(0.11)	(0.02)	(0.02)	(0.13)	(0.13)
Trade_{t-1}	-0.13**	-0.15***	0.17	0.19	0.05	0.03	0.43	0.39	-0.02**	-0.02**	-0.00	-0.00	0.00	-0.00	0.02	0.02
	(0.06)	(0.06)	(0.34)	(0.34)	(0.06)	(0.07)	(0.49)	(0.50)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)	(0.03)	(0.03)
Country FE	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of Countries	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89
Observations	1560	1560	599	599	1631	1631	591	591	1560	1560	1560	1560	1631	1631	1631	1631
Pseudo/Adjusted R^2	0.117	0.107	0.148	0.145	0.279	0.273	0.097	0.098	0.172	0.158	0.049	0.045	0.275	0.265	0.030	0.031

NOTE. The dependent variable in panel A is a dummy for the presence of restrictions on equity inflows, taking the value of one if a restriction is placed on any of the following: "shares or other securities of a participating nature", "collective investment securities", "derivatives and other instruments" or "direct investment", or debt inflows, taking the value of one if a restriction is placed on any of the following: "bonds or other debt securities", "money market instruments", "commercial credits", or "financial credits", based on on the information in Fernández et al. (2016). The dependent variable in panel B is a count of the number of relevant asset categories that face restrictions, normalized by the total number of relevant asset categories. We standardize all the independent variables for ease of comparison. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

dummy indicator for the presence of restrictions (or an extensive measure); and the fraction of the number of asset categories with restrictions (which takes a value between 0 and 1).[14]

With a logit model, we analyze the extensive margin of the capital control. We have country-level controls and time-fixed effects in Panel A, including country-fixed effects in columns (3)-(4) and (7)-(8). We do a similar analysis with an intensive margin of the capital controls in Panel B. Across all specifications, we see a clear negative relationship between a country's quality of institutions and capital controls. That is, a country is more likely to impose capital account restrictions when it has a poorer institutional quality. This continues to be true after we control economic development, financial development, and economic openness.

It is noteworthy that in countries with low-quality institutions, capital account restrictions tend to be placed on both equity and debt flows. As we will note later, this might appear surprising at first look given the better risk-sharing property of equity flows. We will provide a way to understand this data pattern in our model.

In sum, a country's institutional quality appears to be a robust predictor of its external capital structure, financial stability, and capital control policy. These data patterns suggest that good institutional quality (associated with lower external equity financing costs) may enable a country to obtain more equity-like financing which reduces the probability of crises. With more risk sharing and more financial stability, there is less need for the country to impose capital controls.

[14] We also construct a de facto measure for capital controls, i.e. total equity (debt) assets and liabilities normalized by GDP. A larger number of the de facto measure thus implies a lower level of capital controls. The results are consistent with Table 3 and presented in Table C5 .

3 Benchmark Model

We now develop a model that is motivated by the salient empirical patterns documented in the previous section. The model builds on the notion that equity financing is more vulnerable to moral hazard in the capital-recipient country than debt financing, and institutional quality counteracts the moral hazard incentives. This provides a micro-foundation for the relationship between equity share in external liability and institutional quality. Institutional quality can be represented by a parameter in a three-period model that generalizes Bianchi (2011) and Korinek (2018). We then characterize the optimal capital controls in such an economy.

3.1 The Model

The economy has three time periods, $t = 1, 2$, and 3. There are three types of agents, domestic households, domestic CEOs, and international investors. The CEOs make financial decisions on behalf of the households and return profits to the households. We focus on cross-border financial transactions between domestic CEOs and international investors, and abstract from investments by domestic households. There are two types of goods, tradable and non-tradable. The tradable good is used as a numeraire with its price normalized to 1. To simplify the analysis, the non-tradable consumption only appears in period 2, whose price is denoted by p.[15]

Preferences The utility function of the representative household is given by

$$\omega_T \log C_{T1} + \beta E_1 \left[\omega_T \log C_{T2} + \omega_N \log C_{N2} + \beta \omega_T \log C_{T3}\right] \tag{1}$$

[15]The role of the non-tradable good is to provide a relative price between the two goods, which enters into the collateral borrowing constraint. As will be shown, the collateral borrowing constraint only matters for period 2. It is therefore innocuous for the non-tradable good consumption to occur only in period 2.

where β is the discount factor, $\omega_T(\omega_N = 1 - \omega_T)$ equals the share of tradable (non-tradable) consumption in the total spending on consumption, and $C_{Tt}(C_{N2})$ is tradable (non-tradable) consumption at time $t = 1,2,3$ (time 2).[16]

Income Stream We assume that both tradable and non-tradable incomes are generated by some investment projects managed by domestic CEOs. The tradable income stream is given by $\{0, y_2, y_3\}$ while the non-tradable income stream is given by y_{N2}.[17] The only risk in this economy is from the second-period tradable income, $y_2 \in (0, \bar{y}]$.

Information Structure Domestic agents and international investors have different abilities in observing the tradable income $\{y_2, y_3\}$. Both domestic households and CEOs can observe the true income while international investors cannot. In such an environment, a representative domestic CEO has the incentive to misreport the true income in order to underpay the international investors and keep the stolen payoffs to himself.

Debt and Equity Contracts We consider two types of financial contracts.[18] The first one is a one-period debt denominated in the tradable income and traded at a price p_d in period 1. This corresponds to a dollar debt in the existing literature (Bianchi 2011 for example). It can be rolled over at price $p_{d'}$ in period 2. The second one is an equity claim to future tradable income $\{y_2, y_3\}$ at periods 2 and 3. The domestic CEO decides how many shares $s \in [0,1]$ to sell in period 1 at

[16] We only need curvature in the utility function at period 2 as only that period features risk.

[17] By construction, the first-period consumption has to be financed externally by either selling an equity claim on the tradable goods, selling a bond, or a combination of the two. Note that the domestic agent could buy a foreign bond but sell a domestic equity claim simultaneously.

[18] This will be relaxed later. Note that our model features one representative agent who issues both equity and debt contracts. In reality, however, international equity is issued by companies while international debt can be issued by both companies and the government (and perhaps to some degree even by households). Relaxing our representative agent model assumption is interesting but out of the scope of this paper.

a unit price p_e.[19] All financial decisions are made by the domestic CEOs on behalf of domestic households. At the end of each period, the CEOs return all the income from financial transactions and investment projects to the households.

Financial Frictions and Collateral Constraints Following Bianchi (2011) and Korinek (2018), we assume that the representative domestic firm takes out a one-period loan with collateral from international investors. If its CEO walks away from his obligation on the debt, the investors can seize the collateral and sell it in the domestic market. The level of domestic financial development determines that only a fraction, $\phi \in (0,1)$, of the total output can be used as collateral. Therefore, international investors never lend to domestic firms for more than the maximum recoverable value of the collateral given by[20]

$$p_{d'}d' \leq \phi[p_2 y_{N2} + (1-s)y_2] \tag{2}$$

where d' is the debt issued in period 2, s is the share sold in period 1, and $p_{d'}$ is the price of debt. Given the constraint, the CEO never finds it optimal to run away from the debt obligation since the collateral is worth more than the debt.

The existence of a collateral borrowing constraint has both positive and normative implications. Mendoza (2010) and Bianchi (2011) argue that it is a good way to capture financial crises.[21] In the model, a binding collateral constraint in period 2 represents an occurrence of a financial crisis. It also provides a rationale for policy intervention as the model embeds a pecuniary externality, to be

[19] We do not differentiate between portfolio equity investment and FDI here and do not allow the agents to issue equity in period 2. These assumptions will be relaxed in Section 5 and Online Appendix D, respectively.

[20] The domestic firm can only pledge $py_{N2} + (1-s)y_2$ period-2 income stream after selling s share of the tradable income. We obtain qualitatively similar results if we let the firm pledge all period-2 income $py_{N2} + y_2$.

[21] Ottonello, Perez, and Varraso (2022) point out that how the collateral constraint is specified matters for policy analysis. In particular, no policy intervention is needed when the collateral constraint depends on future prices. However, in our view, for countries with a non-trivial expropriation risk (i.e., most developing countries), it is unlikely for lenders to accept future income as collateral. As a result, precisely for these countries, it is reasonable to assume that the collateral is defined over current income only.

explained later (see Korinek 2018 and Dávila and Korinek 2018). We could introduce a collateral constraint in period 1 by allowing a tradable and non-tradable income stream at period 1. However, as such an addition does not make a difference for our analysis, we choose not to do so, which is consistent with the previous literature (see Jeanne and Korinek 2010).

Institutional Quality and Payoff Manipulation As the CEO has an informational advantage over international investors about the true Period-2 income, he has the incentive to misreport the security payoffs, a Tirole-style moral hazard problem. The misreporting depends on both the nature of securities and the quality of institutions. For example, holding institutional quality constant, it is easier to manipulate equity payoffs than debt payoffs. On the other hand, a better institution can reduce the manipulation incentive by punishing mischief more heavily.

To formulate this argument, we assume that a domestic CEO can pretend his firm's income is only $\{(1-\kappa)y_2, (1-\kappa)y_3\}$ with $\kappa \in [0,1]$ when the true income stream is $\{y_2, y_3\}$. Such misreporting reduces the payoff to equity investors but is potentially costly to the CEO because there is a chance that the international investors may discover the true payoff and convince the local court to punish the CEO. In this case, the CEO has to pay a fine of $\{\chi y_2, \chi y_3\}$ to the investor with $\chi \in (\kappa, 1]$. If the CEO manages to escape detection or punishment, we assume he keeps the stolen income without passing it on to domestic households. If he fails, he has to pay the fine by himself using his own endowment w, which is assumed to be exogenous and outside the model. Therefore, from the household's perspective, the CEO's stealing behavior is a pure dead-weight loss. While the domestic household cannot change directly the CEO's incentive to steal, the institutional quality can make a difference. Denote the probability that the international investors fail to recoup what they are due by $q \in [0,1]$. A higher value of q means a lower probability for international investors to discover the misdeed of the CEO and a lower probability for international investors to find an impartial local court to win the case. A higher value of q can also mean poorer corporate accounting standards or more corruptible local judges.

The domestic CEO can also manipulate the payoff to international debt holders by falsely declaring bankruptcy. We denote the bankruptcy cost by B for each unit of debt contracts. In bankruptcy, the CEO can reduce each unit of the debt contract's payment from 1 to $1-\kappa'$ with $\kappa' \in [0,1]$. Without loss of generality, we assume that the probability for the international debt holders to suffer a loss in the event of (a fake) bankruptcy is also given by q. Once they win in the court, the penalty on the domestic CEO is given by χ' with $\chi' \in (\kappa', 1]$.

The Incentive to Manipulate The timing for the domestic CEO is as follows. In period 1, he decides the equity share s and the dollar debt d. In period 2, after observing the true income, he decides whether to manipulate the equity and/or debt payoffs. If he manipulates and succeeds, he keeps the stolen payoff as his private benefit. If he fails, he pays a penalty using his own endowment. In either case, this will not affect the payment delivered to domestic households. In period 2, he can also roll over debt d' and then decide whether to steal. In period 3, the CEO collects the project income and delivers it to the domestic households after fulfilling all financial obligations. Due to the collateral constraint, the CEO never finds it optimal to run away from his debt obligation in period 2.

The CEO's incentive to manipulate the payouts to international investors depends on the expected payoffs from doing so. Intuitively, the net benefit from manipulating equity payoff is the expected fraction of the present value of the promised cash flow, $q\kappa-(1-q)\chi$. As long as the net benefit is non-negative, the CEO finds it worthwhile to manipulate the equity payoff. In comparison, the net benefit from manipulating debt payoff, $q\kappa'-(1-q)\chi'$ has to be higher than a bankruptcy cost B. Otherwise, it is not worth manipulating the debt payoff. These decisions are summarized by Proposition 1.

Proposition 1. The incentive for domestic agents to manipulate payoffs depends on parameter values. Specifically,

- CEO's expected payoff from cheating equity investors is given by $[q\kappa-(1-q)\chi]\left[y_2+\frac{y_3}{1+r}\right]$. He does not manipulate equity payoffs when $q<\frac{\chi}{\kappa+\chi}$ but does so when $q\geq\frac{\chi}{\kappa+\chi}$.

- CEO's expected payoff from cheating debt investors is given by $q\kappa'-(1-q)\chi'-B$. He does not manipulate debt payoffs when $q<\frac{\chi'+B}{\chi'+\kappa'}$ but does so when $q\geq\frac{\chi'+B}{\chi'+\kappa'}$.

The institutional quality matters crucially for the manipulation incentive. When the domestic institutional quality is high, the probability for investors to lose (unfairly) in a local court will be low, i.e. q is likely to be low. When q is sufficiently low such as below a threshold $\frac{\chi}{\kappa+\chi}$, domestic agents never manipulate equity payoff in equilibrium. The equity is thus priced at its actuarially fair price. However, when the institutional quality is sufficiently bad, i.e. q is above the threshold, domestic agents will always manipulate the equity payoff. As a sufficient statistic, we introduce a parameter $\theta\equiv\max\{0,q\kappa-(1-q)\chi\}$ as expected payoff from equity manipulation.

The difference in the incentives to manipulate equity and debt payoffs lies in the bankruptcy cost B. For the domestic agents to manipulate debt payoffs, the probability q has to be above a higher threshold than that for equity, i.e. $q\geq\frac{\chi'+B}{\chi'+\kappa'}$. Therefore, the debt price also reflects the degree of domestic institutional quality. Because the cost of bankruptcy is very high (which has been empirically estimated to be about 45% of the firm value), we assume $B>\kappa'$.[22] In this case, domestic agents would not find it optimal to manipulate debt payoffs.

[22] Using the data for defaulted firms, Davydenko, Strebulaev, and Zhao (2012) estimate an average default cost of 21.7% of the market value of assets. This may be an underestimate since there is sample selection inherent in observed defaults. Guided by a dynamic model in Glover (2016), the average default cost is estimated to be 45% of the firm value. It is therefore very costly to declare bankruptcy when there is none.

International Investors There is a continuum of risk-neutral international investors who have access to a storage technology with a return $r > 0$. They price the equity contract and debt contract by taking into account the possibility of payoff manipulation in the capital-recipient country. Denote the actuarially fair prices for debt and equity by $\frac{1}{R} \equiv \frac{1}{1+r}$ and $y_1 = E\left[\frac{y_2+\frac{y_3}{1+r}}{1+r}\right]$ respectively. The expected reductions in the fraction of equity and debt payoffs after possible manipulation by the CEO are given, respectively, by $[q\kappa - (1-q)\chi]$ and $[q\kappa' - (1-q)\chi']$. According to the previous discussion, the CEO always manipulates equity payoffs but not debt payoffs.[23] Therefore, the equity price can be written as

$$p_e = (1-\theta)y_1$$

while the debt price is given by

$$p_d = p_{d'} = \frac{1}{1+r}$$

.

Interpretation of Institutional Quality In our model, θ captures the expected loss for international equity investors. As they are risk-neutral, the return on equity investment is still equal to the risk-free rate. Nevertheless, there exists a deadweight loss on equity issuance from the households' perspective, captured by θ. Such a loss is generated by the misconduct or moral hazard of domestic agents including CEOs (who steal) and corruptible judges (who let the CEOs get away with stolen wealth). The distortion captured by θ can be thought of as an "iceberg cost" in equity issuance for domestic households, and an expropriation risk for international equity investors.

If we think broadly, θ as an expropriation risk can also result from actions by government officials. Good institutions can be thought of as strong restraints on expropriation (the risk of having

[23] This is consistent with Table 1 where equity return is more sensitive to institutional quality than bond return.

private property taken by the government or a well-connected private party without compensation or a just clause). In either case, the level of expropriation risk matters for the willingness of foreign investors to provide equity financing.

In the subsequent analysis, we use θ to denote institutional quality and push the manipulation of the security payoff into the background. This expropriation risk will be reflected in the households' budget constraints as well. In each period, the CEO makes the financing decision and then delivers the monetary receipts to domestic households. But if a CEO decides to cheat on foreign investors, he would keep the stolen payoff to himself.[24] In such a setting, there is a deadweight loss from the CEO's cheating behavior, captured by θy_1 per unit of equity issuance.

Budget Constraints In period 1, domestic CEOs collect income from tradable and non-tradable projects and deliver receipts to domestic households. Domestic households make decisions on consumption plans. Without loss of generality, we combine both financial decisions and consumption decisions together and write the following budget constraints given by

$$C_{T1} = sy_1(1-\theta) + \frac{d}{1+r}, \tag{3}$$

$$pC_{N2} + C_{T2} = py_{N2} + (1-s)y_2 - d + \frac{d'}{1+r}, \tag{4}$$

$$C_{T3} + d' = (1-s)y_3. \tag{5}$$

3.2 Competitive Equilibrium

The competitive equilibrium is defined as an allocation $\{s, d, d', C_{T1}, C_{T2}, C_{T3}, C_{N2}\}$, the price of non-tradable p and the prices of equity and debt $\left\{p_e = (1-\theta)y_1, p_d = \frac{1}{1+r}\right\}$ that maximize the

[24] We make this assumption for simplicity. Alternatively, we can let the stolen payoff be distributed to the household in a lump-sum fashion, which will produce qualitatively similar results.

utility function (1) subject to the budget constraints, financial constraint (2) and a market clearing condition for non-tradable good, i.e. $C_{N2} = y_{N2}$.

Period-2 Equilibrium

Define a liquid net worth at the beginning of period 2 as $m = (1-s)y_2 - d$. The competitive equilibrium can be solved using backward induction. The maximization problem can be written as

$$
\begin{aligned}
V(m,s,y_2) = \quad & \max_{C_{N2},C_{T2},C_{T3},d'} \omega_T \log C_{T2} + \omega_N \log C_{N2} + \beta\omega_T \log C_{T3}, \\
& \text{s.t. } (2),(4),(5).
\end{aligned}
$$

At the beginning of period 2, two states are possible, depending on the state variables $\{m,s,y_2\}$. In the good state, the financial constraint is slack and the economy can borrow to smooth consumption between periods 2 and 3. In the bad state, the financial constraint binds and the economy cannot borrow enough to smooth consumption. The realization of a bad state depends on the external financing decision in period 1.

Proposition 2. The financial constraint binds if and only if the debt-to-income ratio $\frac{d}{1-s}$ exceeds some threshold, i.e.

$$
\frac{d}{1-s} > \frac{y_2\left(\frac{\beta}{1+\beta} + \frac{\phi/\omega_T}{1-\phi\frac{\omega_N}{\omega_T}}\right) - \frac{y_3}{(1+\beta)(1+r)}}{\frac{\beta}{1+\beta} + \frac{\phi\frac{\omega_N}{\omega_T}}{1-\phi\frac{\omega_N}{\omega_T}}}
$$

Proof. The proof is given in Appendix E.1 □

The intuition for Proposition 2 is consistent with the literature. When the country issues too much debt d relative to its income stream share $1-s$, it has a lower net worth at the beginning of the period. Compared to the previous literature, issuing too much equity s can also lead to a lower net worth m. Yet, as will be shown later, equity issuance provides better risk-sharing opportunities.

Period-1 Equilibrium: the Capital Structure

In Period 1, the representative private agent chooses the capital structure $\{s,d\}$ of its external financing to solve the following problem.

$$W_1 = \max_{s\in[0,1],d} \omega_T \log C_{T1} + \beta E_1[V(m,s,y_2)],$$
$$\text{s.t. } C_{T1} = sy_1(1-\theta) + \frac{d}{1+r},\ m = (1-s)y_2 - d.$$

The first-order conditions for debt and equity, respectively, are

$$\frac{\omega_T}{C_{T1}} = \beta(1+r)E_1\left[V_m\right]$$
$$\frac{\omega_T}{C_{T1}} y_1(1-\theta) = \beta E_1\left[y_2 V_m - V_s\right]$$

where $V_m = \frac{\partial V(m,s,y_2)}{\partial m}$ and $V_s = \frac{\partial V(m,s,y_2)}{\partial s}$.[25]

The economic interpretation is straightforward. Private agents equate the marginal benefit of debt (equity) with its marginal cost. To better understand the tradeoff, we start from an extreme case where there is no expropriation risk, i.e. $\theta = 0$. As we show below, the country will choose to sell all of its future tradable income since equity allows full risk-sharing between the country and international investors. International investors are indifferent since they are risk-neutral. The

[25] The optimality condition for equity is for the interior solution. For the corner solutions, we have

$$\frac{\omega_T}{C_{T1}} y_1(1-\theta) - \beta E_1\left[y_2 V_m - V_s\right] > 0,\ \text{if } s = 1.$$
$$\frac{\omega_T}{C_{T1}} y_1(1-\theta) - \beta E_1\left[y_2 V_m - V_s\right] < 0,\ \text{if } s = 0.$$

following proposition summarizes the intuition.

Proposition 3. When there is no expropriation risk, i.e. $\theta = 0$, the agent chooses (and obtains) $s = 1$ in order to achieve full insurance, i.e. the first best allocation.

Proof. The proof is given in Appendix E.2. □

Proposition 3 suggests that the capital recipient country prefers equity financing over debt financing when there is no additional cost for equity issuance. However, in general, a positive expropriation risk $\theta > 0$ raises the equity issuance cost. This presents a trade-off between equity and debt financing. On the one hand, equity financing provides better risk-sharing; On the other hand, the expropriation risk reduces the present value of future income stream, causing investors to apply a discount to the equity price. The equilibrium structure of capital financing reflects a balance between these two forces. The following proposition establishes an equilibrium capital structure in this economy.

Proposition 4. The equilibrium capital structure reflects the degree of expropriation risk θ.

1. When the quality is sufficiently good, i.e. $\theta < \underline{\theta}$, there will be only equity financing.[26]

2. When the quality is sufficiently poor, i.e. $\theta > \bar{\theta}$, there will be only debt financing.

3. When $\theta \in (\underline{\theta}, \bar{\theta})$, there will be a combination of equity and debt. As the cost of issuing equity θ increases, the country chooses a higher level of debt d, a lower share of equity s, and a higher leverage, $\frac{d/(1+r)}{s(1-\theta)y_1+d/(1+r)}$. This will result in a more binding collateral constraint in the second period, i.e. a higher probability of crises.[27]

Proof. The proof is given in Appendix E.3. □

[26] In this situation, private agents sell all shares of equity ($s = 1$) and save in bonds (negative debt financing).

[27] When institutional quality worsens (a higher θ), debt (d) financing increases and equity financing (s) decreases. However, leverage ($\frac{d}{1-s}$) increases, which implies that d has to rise at a faster rate than $1 - s$ when institutional quality deteriorates. Intuitively, agents issue d units of debt or sell s units of equity to smooth consumption between periods

3.3 Optimal Capital Controls

In general, an economy with incomplete markets and pecuniary externalities may have sub-optimal allocations (see Geanakoplos and Polemarchakis 1986 and Greenwald and Stiglitz 1986). This opens up a role for policy intervention. The existence of pecuniary externality in our context is due to the collateral borrowing constraint, resulting in a vicious cycle of "*lower price – more binding constraint – asset sale – lower price*". Intuitively, when the collateral constraint binds, the private agent cuts spending. With a decline in aggregate spending, the price of non-tradable goods falls, which leads to even lower income of other agents, precipitating further deleveraging in the economy. In deciding how much financing in period 1 to obtain from international investors, private agents do not take into account the effect of their actions on other agents' income and on this vicious cycle. In this sense, they borrow too much (relative to a socially efficient level).

What would a social planner do to correct this externality if she cannot remove collateral constraints directly? She can internalize the general equilibrium effect through the price of non-tradable goods in the aggregate borrowing constraint. Below, we compare the allocation chosen by the social planner with the one that arises from competitive equilibrium.

The social planner solves the following maximization problem.

$$\begin{aligned} W_1^{SP} = \max_{d,s\in[0,1]} \quad & \omega_T \log C_{T1} + \beta E_1 \left[V^{SP}(m,s,y_2) \right] \\ \text{s.t.} \quad & C_{T1} = s(1-\theta)y_1 + \frac{d}{1+r}, \\ & m = (1-s)y_2 - d. \end{aligned}$$

1 and 2 and across different states at period 2. As the equity contract has a better risk-sharing property than the debt contract, a one-unit decrease in equity contract caused by a poor institutional quality has to be replaced by a more than one-unit increase in debt contract to meet the original level of cross-state risk-sharing demand in period 2.

where $V^{SP}(m,s,y_2)$ is given by

$$
\begin{aligned}
V^{SP}(m,s,y_2) \quad = \quad & \max_{C_{T2},C_{T3},d'} \omega_T \log C_{T2} + \omega_N \log y_{N2} + \beta\omega_T \log C_{T3}, \\
& \text{s.t. } C_{T2} = m + \frac{d'}{1+r}, \\
& \frac{d'}{1+r} \leq \phi\left(\frac{\omega_N}{\omega_T} C_{T2} + (1-s)y_2\right), \\
& C_{T3} + d' = (1-s)y_3.
\end{aligned}
$$

The key difference from the competitive equilibrium is that the planner internalizes the general equilibrium effect of the non-tradable good price p on the allocation. The competitive equilibrium displays constrained inefficiency.

Proposition 5. The social planner values the net worth $m = (1-s)y_2 - d$ more than private agents, i.e. $\frac{\partial V^{SP}(m,s,y_2)}{\partial m} > \frac{\partial V(m,s,y_2)}{\partial m}$.

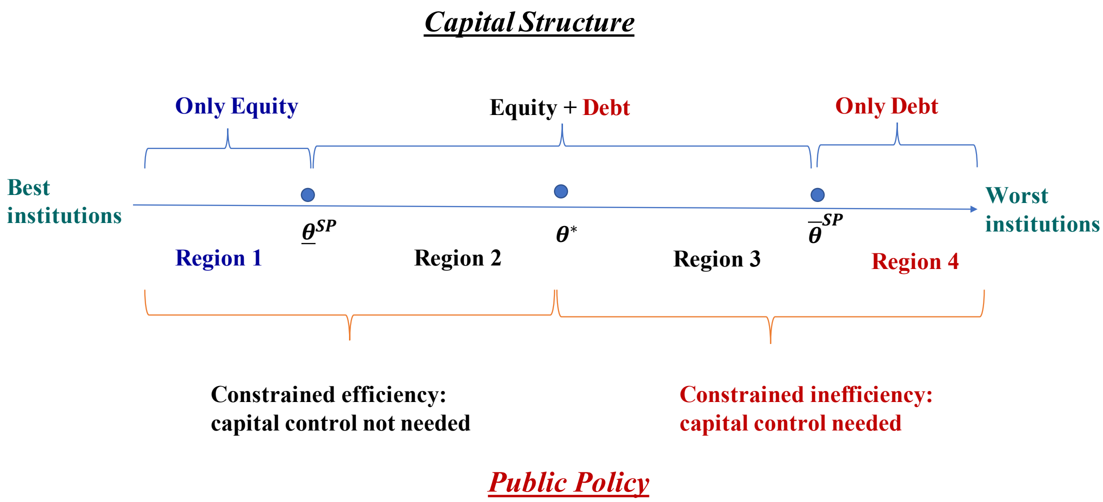
Proof. The proof is given in Appendix E.4. □

While the social planner cannot change the allocation in period 2, she values the net worth at the end of the first period more than the private agents, and would therefore choose a lower level of external financing in period 1. She would discourage the private agents from issuing too much debt or equity since both create a pecuniary externality.

Proposition 6. There exist three thresholds for institutional quality, $\underline{\theta}^{SP} < \theta^* < \bar{\theta}^{SP}$, as shown in Figure 2,

- When the institutional quality is sufficiently good, i.e. $\theta < \underline{\theta}^{SP}$, there will be only equity issuance and the economy is constrained efficient.

Figure 2 Capital Structure and Efficiency: An Illustrative Graph



- With $\theta \in (\underline{\theta}^{SP}, \bar{\theta}^{SP})$, a mixture of equity and debt occurs. As θ increases, the country chooses a higher level of debt d, a lower share of equity s, and a higher leverage, $\frac{d/(1+r)}{s(1-\theta)y_1+d/(1+r)}$, and experiences a greater likelihood of a binding constraint in the second period.

- When the quality is sufficiently poor, i.e. $\theta > \bar{\theta}^{SP}$, there will be only debt financing.

- The competitive equilibrium is constrained efficient if and only if $\theta < \theta^*$. Otherwise, compared to the competitive equilibrium, the social planner chooses both a lower level of total external financing and a lower level of leverage $\frac{d}{1-s}$.

Proof. The proof is given in Appendix E.5. □

The optimal capital structure chosen by the social planner strikes a balance between debt and equity financing. To internalize the externality, the social planner does two things. First, she chooses less external financing, resulting in a higher level of net worth in the second period. Second, she chooses a less risky capital structure featuring a lower debt-to-equity ratio.

Proposition 6 points to the institutional quality as a key determinant of the optimal capital structure. If the social planner were able to reduce θ to be below θ^*, the economy would converge to a constrained efficient world. Even if the first-best allocation cannot be achieved due to the distortions in equity issuance cost, the economy is free of financial crises. On the other hand, if institutional reforms cannot be obtained in the short run, optimal capital controls have to be deployed to reduce financial vulnerability.

To achieve the optimal allocation, the social planner can use a Pigovian approach, i.e., a vector of capital control taxes $\{\tau^s, \tau^d\}$ on equity and debt, together with a lump-sum transfer T. The budget constraint of private agents changes into

$$C_{T1} = (1-\tau^s)\,s(1-\theta)y_1 + \left(1-\tau^d\right)\frac{d}{1+r} + T$$

where $T = \tau^s s(1-\theta)y_1 + \tau^d \frac{d}{1+r}$.

Proposition 7. The social planner would use the following pair of capital control taxes $\{\tau^s, \tau^d\}$ on external equity and debt:

$$\tau^d = \frac{\beta(1+r)E\left[\phi\mu\frac{\omega_N}{\omega_T}\right]}{\frac{\omega_T}{C_{T1}}} > 0$$

$$\tau^s = \frac{\beta E\left[\phi\mu\frac{\omega_N}{\omega_T}y_1\right]}{\frac{\omega_T}{C_{T1}}(1-\theta)y_1} > 0$$

Furthermore, $\tau^d > \tau^s$.

Proof. The proof is given in Appendix E.5. □

It may appear surprising that the optimal tax on equity is positive when institutional quality is low even though equity financing provides better risk-sharing than debt. To see the intuition, note that selling equity shares in period 1 also lowers the net worth in period 2 (as $m = (1 - s)y_2 - d$). If there had been a tax on debt but none on equity financing, the agents would have issued more equity than desired by the social planner. In other words, when the institutional quality is low, the externality in the debt market financing "spills over" to equity financing. As the social planner values the end-of-period-1 net worth more than the private agents, she corrects this spillover problem by imposing positive taxes on both equity and debt.

Because debt embeds more externality than equity financing, the optimal policy features a higher tax rate on debt than on equity financing, consistent with Korinek (2018). This theoretical prediction is consistent with the practice of capital controls by the Brazilian government during 2008-2013 when a higher tax on external debt relative to that on equity was imposed. It is also consistent with the "pecking order" theory of capital controls proposed by Ostry et al. (2010), where controls are first imposed on foreign debt and then on portfolio equity (see Forbes et al. 2016 and Chamon and Garcia 2016).

The capital control decision made by a bureaucrat can in principle differ from a social planner's choice, but would still be related. In the theory of tariff determination by Grossman and Helpman (1994), the politician is assumed to maximize a convex combination of social welfare and private benefits. In a celebrated empirical estimation of such a model, Goldberg and Maggi (1999) find that the empirical weight on the social welfare is in excess of 90 percent. Similar results are found for other countries as well. If one were to write down a political economy model on capital control taxes, the comparative statics with respect to institutional quality are likely to be similar to the social planner's choice, even though the levels of the taxes could be different.

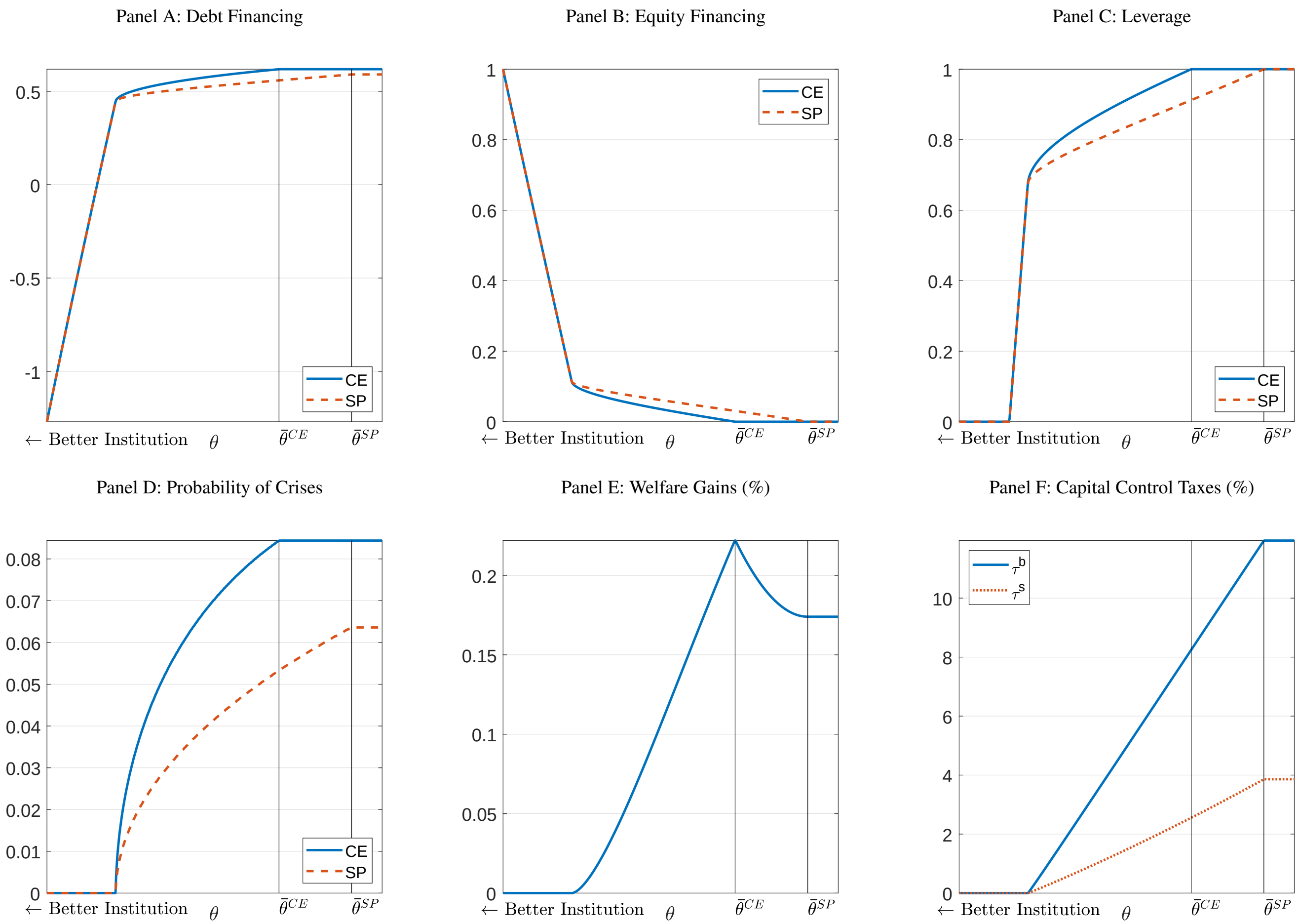
4 Institutional Quality θ versus Financial Development ϕ

While the institutional quality parameter, θ, plays a crucial role in our theory, it is natural to wonder whether variations in another parameter, the degree of collateral constraint, ϕ, can generate the same predictions. For example, improvement in either parameter could result in a lower probability of a financial crisis. Indeed, from the existing literature on sudden stops of international capital flows, one is tempted to think that the main difference between developing and developed countries is in the level of financial development (as represented by the degree of collateral constraint). This section compares the two.

Through a series of simulations, we will show two key differences. First, while an improvement in institutions leads to a higher share of equity financing in a country's external liabilities, an opposite pattern is associated with a more relaxed collateral constraint. Second, while countries with better institutions need less capital control, countries with a more relaxed collateral constraint might need more capital control. Bianchi (2011) also reports that the optimal tax on capital flows becomes higher, in his simulation (Panel C of Figure 6 in his paper), when a country's collateral constraint is relaxed. It is worth noting that both predictions from the model are consistent with our empirical facts in Tables 1 and 3 where institutional quality and financial development enter the regressions separately.

We conduct our simulations in two steps. First, we hold the degree of collateral constraint ϕ constant (at the same benchmark value as in Bianchi 2011) and vary the values of θ. This is equivalent to numerically simulating the theoretical predictions from the previous section, with the aim of providing further intuition. Second, we re-do the exercise by varying the values of ϕ. This can be understood as a numerical comparative statistics exercise over changes in the degree of collateral constraint.

Figure 3 COMPARATIVE STATISTICS ABOUT θ



NOTE. This figure shows the comparative statistics by varying institutional quality parameter θ, while keeping the values of all other parameters the same as in Table C3. For a given value of θ, we solve the model both in competitive equilibrium and with the social planner. We plot debt (d), equity (s), leverage $\left(\max\left\{\frac{\frac{d}{1+r}}{C_{T1}}, 0\right\}\right)$, probability of crises (defined as the frequency of binding constraint states in period 2), welfare gains (%, defined as $100\left(e^{W^{SP}-W^{CE}}-1\right)$, where W^{SP} and W^{CE} are the welfare functions under the social planner and competitive equilibrium allocations) and capital control taxes (defined in Proposition 7) in Panels A-F, respectively, as a function of θ.

4.1 Variations in Institutional Quality θ

The parameter values chosen for the simulation exercises are reported in Table C3. For the share of tradable expenditure in total consumption spending, we choose 30% following Bianchi (2011). The risk-free interest rate is set at 5%, a common value used in the literature. We assume that the discount rate, β, is the inverse of $1+r$. The collateral constraint value ϕ is chosen to be 0.3 in the baseline case, meaning that the country can only pledge 30% of its current income to international investors (see Ma 2020). For period-2 income y_2, we use a uniform distribution in $U[\bar{y}_2-\varepsilon, \bar{y}_2+\varepsilon]$, with a mean of $\bar{y}_2$ and ε governing its income risk. We vary θ to see how institutional quality affects the composition of capital flows and the gap in the allocations between the competitive equilibrium and the social planner's choice.

In Figure 3, consistent with our theoretical prediction, when expropriation risk θ increases, debt d increases while equity share s decreases. When θ rises, up to $\bar{\theta}^{CE}$ in the competitive equilibrium (or $\bar{\theta}^{SP}$ in the social planner's allocation), equity issuance becomes increasingly costly such that the equity share shrinks to zero. In sum, as the expropriation risk rises, the economy takes on more leverage and exhibits a higher probability of crises.

Relative to the free market equilibrium, the social planner prefers a safer capital structure, with a (weakly) lower level of debt and a higher level of equity at any given level of θ (as shown in Panels A, B, and C). For example, when the expropriation risk exceeds some threshold i.e. $\theta \in [\bar{\theta}^{CE}, \bar{\theta}^{SP}]$, the private agents would find it too costly to issue any equity in the competitive equilibrium. On the other hand, the social planner would continue to issue equity. In other words, the threshold value of θ for the equity issuance to converge to zero is higher for the social planner than for the free market equilibrium (in Panel B or C), i.e. $\bar{\theta}^{SP} > \bar{\theta}^{CE}$. The equity/debt choice by the social planner leads to a lower probability of crises (Panel D).

A policy intervention that guides the economy away from the free market equilibrium towards the social planner's choice can raise welfare (Panel E). Moreover, the greater the expropriation risk, θ, up to a threshold, the greater the welfare gains from the intervention. This is because the over-leveraging problem becomes more severe when the expropriation risk rises.

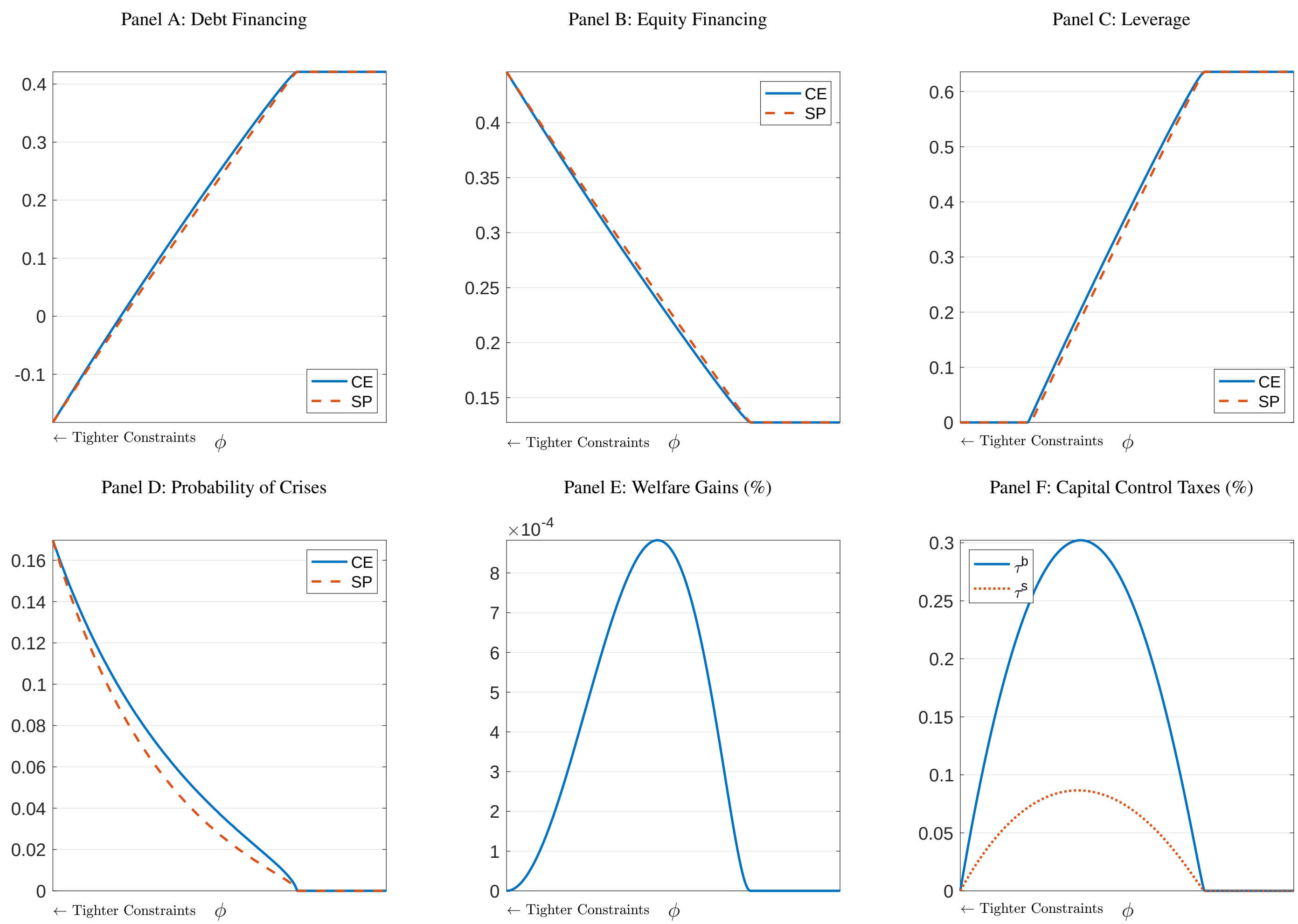
The optimal policy intervention entails two separate taxes on debt and equity issuance, which rise with the expropriation risk (Panel F in Figure 3). This is consistent with the theoretical prediction. Furthermore, the optimal capital control tax on debt is larger in magnitude than that on equity. Interestingly, the optimal tax on external debt in our model ranges from 0 to 12%, which are comparable to the numbers in Bianchi (2011). The optimal tax on external equity is between 0 to 4%. While this tax has not been computed in the existing literature, the numbers here are comparable to the empirically estimated tax rates on portfolio equity inflows (see Forbes et al. 2016 and Chamon and Garcia 2016).

4.2 Variations in Financial Development ϕ

We now simulate comparative statics with respect to ϕ while fixing institutional quality θ at 3%. In Figure 4, with a higher level of financial development, ϕ, the free market equilibrium features more debt and less equity in the external liability (Panels A and B), which leads to higher leverage (Panel C). These comparative statistics are the exact opposite of those associated with an improvement in institutional quality. In comparison, with more financial development, the economy exhibits a lower probability of crises (Panel D), which is similar to an improvement in institutional quality.

The social planner's choices are depicted by a red dotted line. By choosing a lower leverage (i.e., a lower level of debt and a higher level of equity in Panels A, B, and C), the planner achieves a lower probability of crises (Panel D). An optimal set of taxes on external debt and equity can guide the economy away from the free market equilibrium to the social planner's choices. The exact welfare gains from the optimal taxes exhibit a non-linear relationship with respect to financial

Figure 4 Comparative Statistics about ϕ



Note. This figure shows the comparative statistics from varying financial development parameters ϕ, while keeping the values of all other parameters the same as in Table C3. For a given value of ϕ, we solve the model both in competitive equilibrium and with the social planner. We plot debt (d), equity (s), leverage $\left(\max\left\{\frac{\frac{d}{1+r}}{C_{T1}}, 0\right\}\right)$, probability of crises (defined as the frequency of binding constraint states in period 2), welfare gains (%, defined as $100\left(e^{W^{SP}-W^{CE}}-1\right)$, where W^{SP} and W^{CE} are the welfare functions under the social planner and competitive equilibrium allocations) and capital control taxes (defined in Proposition 7) in Panels A-F, respectively, as a function of θ.

development (Panel E). From a very low level of financial development to some threshold level, the externality problem becomes more severe. As a result, the gains from an intervention rise. On the other hand, when financial development is sufficiently high, the externality problem becomes less severe, and the gain from an intervention also becomes smaller.

The optimal taxes on external debt and equity as a function of financial development mirror the discussion above: they rise initially and then decline (Panel F). Intuitively, the wedge between the social and private values of the end-of-period-one wealth is related to the expected social cost of a financial crisis, which can be decomposed into the probability of a crisis and the severity of a crisis. While a relaxation of the collateral constraint (a higher ϕ) lowers the probability of a crisis, it raises the leverage ex-ante and the severity of a crisis. The net effect depends on the relative strength of the two forces. In Bianchi (2011)'s simulation reported in Panel C of his Figure 6, the optimal tax on debt needs to go up when the collateral constraint is relaxed (a lower ϕ parameter in Figure 4). (His model does not have equity financing and therefore no tax on equity investment.)

To summarize, financial development (ϕ) and institutional improvement (θ) are not equivalent in terms of their effects on either the composition of capital flows or the optimal capital control taxes. For most developing countries (whose financial development is below the threshold in Panel F), while an improvement in financial development calls for an increase in capital control taxes, an improvement in institutional quality justifies a reduction in these taxes.

Economic development may be associated with both improving institutional quality and a more relaxed collateral constraint. Since more developed countries tend to have both a higher equity share in their external liabilities and fewer capital controls, such patterns can be easily reconciled in our model with better institutional quality, but not with more financial development. In other words, to understand cross-country differences in capital flow composition and patterns of capital controls, institutional quality appears more important than financial development.

5 Model Extensions

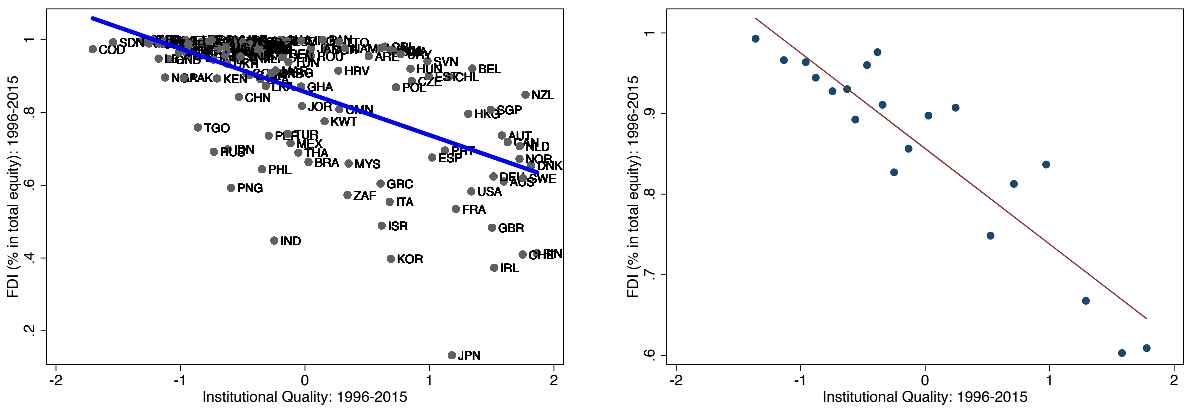
We discuss three extensions to the baseline model. In the first one, we allow for both passive equity and FDI. In the second one, we introduce long-term debt. In the third one, we introduce local currency debt. Both long-term debt and local-currency debt carry more risk-sharing than short-term foreign-currency debt and therefore share some similarities with equity financing. But each is also different from equity financing in some ways.

5.1 Passive Equity Versus FDI

In our baseline model, we do not differentiate between passive equity and foreign direct investment. The key difference between them lies in the control right. Presumably, if foreign investors possess control rights, it would reduce informational asymmetry between the foreign investors and the domestic CEO and consequently make it more difficult for the domestic CEO to cheat foreign investors. However, foreign investors would need to set aside additional resources in order to conduct FDI, and not all investors wish to do that. For example, it may be expensive for an international hedge fund or mutual fund to hire competent managers to be stationed in the host country. This might create a trade-off for FDI investment versus passive equity investment as in Goldstein and Razin (2006). In this section, we aim to incorporate such a tradeoff into our model.

To guide our model development, we look at the relationship between FDI investment and institutional quality in the data. Figure 5 reports the average relationship during 1996-2015. Clearly, one can see that FDI shares in total equity liability falls with institutional quality. This can be interpreted as evidence that asymmetric information and moral hazard by domestic agents are relieved by improvement in institutional quality. Therefore, the benefit of obtaining a control right through FDI becomes relatively less important.

Figure 5 FDI SHARE (IN EQUITY) AND INSTITUTIONAL QUALITY:
RAW AND BIN SCATTER PLOTS



NOTE. This first figure shows the relationship between FDI share (% in total equity liability) and domestic institutional quality during 1996-2015. Each dot represents a country's average FDI share and average quality measure during this period. The second figure is a bin scatter plot version of the first figure. The slope of the fitted line is -0.12 with t-statistics of -8.68 in both figures.

To capture this idea, we assume that foreign direct investment by investor i requires a fixed cost $c_i y_1$ with $c_i \in [0,1]$. Depending on the cost parameter c_i, the investors decide on either passive equity investment or FDI so as to maximize the expected payoff. Denote the total units of equity (passive equity and FDI) as $s \in [0,1]$, of which the share of passive equity is denoted as $\pi \in [0,1]$. The domestic household decides to sell passive equity at price p_e and FDI at price p_f. The bond can be sold at price p_d as before. In this environment, the period-1 budget constraint is given by

$$C_{T1} = p_d d + s[p_e \pi + p_f (1-\pi)] \tag{6}$$

We need to work out $\{p_d, p_e, p_f\}$ in equilibrium. Similar to our benchmark model, we will assume that the bankruptcy cost is high enough such that the domestic CEO never cheats on debt investors, which implies $p_d = \frac{1}{1+r}$. For the prices of FDI and passive equity, we will impose equilibrium conditions. Define the marginal international investor with $\bar{c}$ as the one who is indifferent between FDI and passive equity investment. By definition,

$$(1-\theta)y_1 - p_e = y_1 - (p_f + \bar{c}y_1)$$

Therefore,

$$\bar{c} = \theta + \frac{p_e - p_f}{y_1} \tag{7}$$

From this condition, one can see that investors with $c_i > \bar{c}$ choose passive equity over FDI while the rest choose FDI over equity. Therefore, the share of FDI investors is given by $\bar{c}$. In equilibrium, $\pi = 1 - \bar{c}$. Moreover, the prices of FDI and equity should make investors earn zero profit ex-ante. That is

$$0 = \int_{\bar{c}}^{1} [(1-\theta)y_1 - p_e] dc_i + \int_{0}^{\bar{c}} (y_1 - c_i y_1 - p_f) dc_i \tag{8}$$

Given this equilibrium condition, one can show that $p_e = p_f$. We can prove this by contradiction. If $p_e > p_f$, the domestic agents will prefer passive equity (see equation (6)), i.e. $\pi = 1$ and $\bar{c} = 0$. However, when $p_e > p_f$ and $\bar{c} > \theta \geq 0$. By the same argument, one can show that $p_e < p_f$ cannot hold in equilibrium. With the zero-profit condition, one can solve the price of equity given by $p_e = p_f = \frac{1+(1-\theta)^2}{2} y_1$.

With this simple modification, this new model preserves the key insight from the baseline model while matching data patterns on the FDI share in total equity liability. To see this, the share of FDI in total equity financing is given by $\bar{c} = \theta$. Therefore, the FDI share in total equity falls with a lower value of θ, i.e. a better institutional quality. Moreover, there is a linear transformation between this new model and our baseline model. One can redefine $\theta' \equiv \frac{\theta(2-\theta)}{2}$ and then $p_e = (1-\theta')y_1$. In such a scenario, all the analysis in the baseline model carries over to the new framework.

5.2 Long-term Debt

Long-term debt could also provide better risk-sharing than short-term debt. For example, one can introduce a long-term debt D with a promised return $(1+r)^2$ at period 3 in addition to the short-term debt d at period 1. If there were no additional costs associated with long-term debt, the economy would strictly prefer long-term debt to short-term debt because long-term debt avoids the binding constraint in the second period. To be more realistic, we assume that institutional quality also affects the issuance of long-term debt as in Wei and Zhou (2018). Specifically, long-term debt investors face a "dilution risk" in countries with a weak institutional environment—the CEO in the capital recipient country may issue additional short-term debt in period 2 before the long-term debt matures in period 3. As the additional short-term debt dilutes the expected payoff to long-term debt, the long-term debt investors may ask the firm not to issue additional short-term debt or make the long-term debt senior to any new short-term debt. However, the ability to enforce such a covenant depends on the capital recipient country's institutional quality.

The budget constraints in an economy with long-term debt can be written as

$$\begin{aligned}
&C_{T1} = \frac{d}{1+r} + (1-\theta)\frac{D}{(1+r)^2} \\
&pC_{N2} + C_{T2} = y_2 - d + py_{N2} + \frac{d'}{1+r} \\
&C_{T3} = y_3 - d' - D
\end{aligned}$$

The long-term bond provides better risk-sharing than the short-term bond since it avoids the costly binding financial constraint in the second period. However, the long-term bondholder is vulnerable to an expropriation (dilution) risk. The equilibrium strikes a balance between these two. Due to the same pecuniary externality as in the baseline model, the economy displays an over-borrowing problem that applies only to the short-term bond. The social planner uses capital controls to correct the problem. The following proposition summarizes the key results.

Proposition 8. When the economy can issue both long-term and short-term debt, the competitive equilibrium features a combination of both whose ratio depends on the institutional quality θ. Specifically, there exist two thresholds $\{\underline{\theta}, \bar{\theta}\}$ such that a combination of short-term and long-term debt exists when $\theta \in (\underline{\theta}, \bar{\theta})$. When the institutional quality is high enough, i.e. $\theta < \underline{\theta}$, the economy uses only long-term debt. On the other extreme, when the institutional quality is sufficiently low, i.e. $\theta > \bar{\theta}$, there is only short-term debt in equilibrium. In this economy, pecuniary externality only affects the short-term debt. The social planner would impose a tax on short-term borrowing to correct the overborrowing problem.

Proof. The proof is given in Appendix E.6. □

As in our benchmark model with equity and short-term debt, the combination of long-term and short-term debt depends ultimately on the degree of institutional quality. In fact, in our setup, long-term debt is better than equity since its issuance is not affected by the pecuniary externality associated with short-term debt. However, this is due to the assumption that the collateral constraint only shows up in the second period and the long-term debt matures in the last period.

In general, long-term debt can also be affected by a pecuniary externality if a collateral constraint exists in the period when the long-term debt matures. In that case, equity financing likely still dominates the long-term debt other things equal since it provides more risk-sharing. In other words, in a model with long-term debt, short-term debt, and equity, the equilibrium proportions of the three securities depend on how institutional quality affects their respective prices.

5.3 Local-Currency Debt

We assume that the economy can issue both dollar-denominated debt d and local-currency debt l in period 1.[28] As in the benchmark economy, the dollar-denominated debt has a promised return of world interest rate r and is thus priced at $\frac{1}{1+r}$. The return on local-currency debt is expressed in terms of units of tradable goods and denoted by ρ. Since international investors are risk-neutral, a no-arbitrage condition requires the following

$$E[\rho] = 1 + r$$

Since return ρ depends on the realized real exchange rate p in period 2, it implies that

$$\rho = \frac{p}{E[p]}(1+r)$$

If the local-currency debt l could be issued without additional cost, the country would prefer this due to its better risk-sharing property. It has been observed that developing countries are usually not able to issue local-currency debt to international investors—a phenomenon labeled as the "original sin" by Eichengreen and Hausmann (1999). A possible explanation is an inability of these countries to credibly commit not to use inflation to expropriate the holders of local-currency debt in economic downturns (see a formulation of the idea by Engel and Park 2022). It is reasonable to assume that those countries with poorer institutional quality are less able to commit to price stability in their monetary policy. A hallmark of poor public institutions is excessive discretionary power by government officials and relatively few constraints on their power. These same features are also likely to prevent their central banks from making credible commitments in the conduct of

[28] While we could introduce local-currency debt in period 2, it would add no new insight. Without uncertainty in period 3, the local-currency debt and dollar-denominated debt would have been perfect substitutes (see Korinek 2009).

monetary policy. As a consequence, their local-currency debt will be discounted more by international investors. With a slight abuse of notations, we capture the extent of the discount by θ. Given this structure, the budget constraints in periods 1 and 2 become

$$C_{T1} = \frac{d}{1+r} + l(1-\theta),$$
$$pC_{N2} + C_{T2} = y_2 + py_{N2} - d - \rho l + \frac{d'}{1+r}$$

The equilibrium configuration of debt can be summarized by the following proposition.

Proposition 9. When the economy can issue both dollar-denominated and local-currency debt, their equilibrium combination depends on the value of institutional quality θ relative to two threshold levels, $\{\underline{\theta}, \bar{\theta}\}$. When the institutional quality is good enough, i.e. $\theta < \underline{\theta}$, there is only local-currency debt. When the institutional quality is poor enough, i.e. $\theta > \bar{\theta}$, there is only dollar debt. When $\theta \in (\underline{\theta}, \bar{\theta})$, there is a mixture of both types of debt.

Proof. The proof is given in Appendix E.7. □

Social Planner with Commitment

A pecuniary externality in this economy calls for policy intervention. In particular, the social planner internalizes the general equilibrium effect through the real exchange rate p. Note that the policy intervention itself also faces a commitment issue. Since the payoff for the local-currency debt ρ is given by $\frac{p}{E[p]}(1+r)$, if the planner could commit in Period-1 to a consumption profile C_{T2}, it can change the payoff structure across states in period 2, which ultimately affects period-1 consumption. However, in period 2, the planner has an incentive to deviate from her original plan when a particular state is actually materialized. We assume that the social planner can commit.

Her problem is given below.

$$
\begin{aligned}
V^C(\theta) = \quad \max_{d,l,C_{T1},C_{T2},d',C_{T3}} \quad & \omega_T \log C_{T1} + \beta E[\omega_T \log C_{T2} + \omega_N \log y_{N2} + \beta \omega_T \log C_{T3}] \\
\text{s.t.} \quad & C_{T1} = \frac{d}{1+r} + (1-\theta)l \\
& C_{T2} = y_2 - d + \frac{d'}{1+r} - \rho(C_{T2}, E[C_{T2}])l \\
& \frac{d'}{1+r} \leq \phi\left(y_2 + \frac{\omega_N}{\omega_T} C_{T2}\right) \\
& C_{T3} = y_3 - d'
\end{aligned}
$$

Proposition 10. A social planner with commitment chooses a different allocation from the private agents. To correct the inefficiency, three capital control taxes are needed on period-1 dollar debt and local-currency debt $\{\tau_d, \tau_l\}$ and on period-2 dollar debt $\tau_{d'}$.

$$
\begin{aligned}
\tau_d &= \beta(1+r)E_1\left[\frac{\phi\mu^C \frac{\omega_N}{\omega_T} - \frac{\omega_T}{C_{T2}} l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}{1 + l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}\right] / \left(\frac{\omega_T}{C_{T1}}\right) \\
\tau_l &= \beta E_1\left[\frac{\phi\mu^C \frac{\omega_N}{\omega_T} - \frac{\omega_T}{C_{T2}} l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}{1 + l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}\rho\right] / \left(\frac{\omega_T}{C_{T1}}\right) / (1-\theta) \\
\tau_{d'} &= \frac{l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}{1 + l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}
\end{aligned}
$$

Proof. The proof is given in Appendix E.7 □

Since there are two types of inefficiencies in the competitive equilibrium, it can produce either over-borrowing or under-borrowing relative to the social planner's solution. The exact parameter values matter. Nevertheless, capital controls can be put in place to implement the optimal allocation under commitment.

A Government's Solution

A government that sees the market failure in the decentralized equilibrium may wish to intervene. However, a government's ability to commit and hence its ability to replicate the social planner's solution cannot be taken for granted. We consider the case of a government whose ability to commit depends on institutional quality. Poorer institutional quality is assumed to imply a weaker commitment ability. To capture such a distortion, we introduce a welfare loss related to θ, $\Psi(\theta)$, and define a government's problem as follows.

$$V^B(\theta) = V^C(\theta) - \Psi(\theta)$$

The desirability of the capital controls can be ascertained by comparing the welfare from the bureaucratic solution $V^B(\theta)$ with the welfare in the competitive equilibrium. Only when the former is larger than the latter it would be desirable to impose capital controls. Otherwise, the welfare loss from weak commitment $\Psi(\theta)$ could overwhelm the gains from capital controls. In short, the institutional quality matters for the type of capital controls — not only through its impact on the price of local-currency debt (as in our benchmark economy) but also through its impact on the commitment ability of the government.

To summarize, local-currency debt provides better risk-sharing than dollar debt. Similar to equity issuance, its cost depends on the quality of institutions. Therefore, the equilibrium composition of the securities depends on the effect of institutional quality on their costs. A difference between local-currency debt and equity is that the former involves a commitment problem, which depends on the institutional quality. In general, local-currency debt does not dominate equity financing since correcting the inefficiency in local-currency debt requires the government to have a strong commitment power.

6 Conclusion

This paper provides a tractable framework to study the role of institutional quality in determining both a country's external capital structure and its optimal capital controls. We articulate two forms of asymmetries between equity and debt and between international investors and emerging market economies. The first asymmetry is that, from the viewpoint of a capital-recipient country, equity financing provides more sharing of the real-side risks than debt financing. This means that the capital recipient country prefers equity financing to debt financing, other things equal. The second asymmetry is that, from the viewpoint of international investors, equity financing is more vulnerable to expropriation risks in a capital-recipient country than debt financing. This means that international investors are more willing to offer debt financing than equity financing to a country with a high level of expropriation risk. The equilibrium composition of capital inflows and the equilibrium likelihood of an economic crisis are both determined by the capital recipient country's institutional quality (among other factors). As a consequence, a country's need to impose capital controls to correct the inefficiency depends on the quality of its institutions.

Our story can be compared with an alternative narrative that focuses on cross-country differences in financial development. While both financial development and institutional improvement can reduce the probability of a crisis, there are important differences. First, while a relaxation of the borrowing constraint reduces the ratio of equity to debt financing, institutional improvement produces an opposite change. Second, while a more relaxed borrowing constraint leads to a higher capital control tax, better institutions reduce capital controls.

Our paper has implications for corrective measures. The best action to correct pecuniary externality is reforms that raise institutional quality. Better quality increases both financial stability and economic efficiency simultaneously. The optimal capital controls are the second-best policy to be used when institutional reform is not attainable. The case for capital controls weakens endogenously with an improvement in the quality of institutions.

To the best of our knowledge, this is the first paper to analyze optimal capital controls in a framework with an endogenous structure of foreign capital inflows. Besides adding equity financing to standard models of externality in international borrowing, we have considered several extensions by allowing for other securities that also have (partial) risk-sharing properties, such as local-currency debt and long-maturity debt. There are a number of directions to further extend our work. For example, it would be interesting to embed our setup in a DSGE framework as in Bianchi (2011) and Jeanne and Korinek (2018). In addition, our formulation may be used to study pro-cyclical leverage ratios and the corresponding optimal policies.

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Internet Appendix

‘International Equity and Debt Flows to Emerging Market Economies: Composition, Crises, and Controls’

(Intended for online publication only)

by C. Ma, and S. Wei

October 2023

A Data Source

Our sample consists of 134 economies during 1996-2015, including Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bangladesh, Belarus, Belgium, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo, Costa Rica, Cote d'Ivoire, Croatia, Czech Republic, Democratic Republic of Congo, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Ethiopia, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Hong Kong, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Republic, Laos, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Macedonia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Venezuela, Vietnam and Zambia. The summary statistics are in Appendix Table C1. The variable construction is given below:

Equity (% of total liabilities) is constructed as the ratio of the sum of portfolio equity liabilities and FDI liabilities over total liabilities, based on Lane and Milesi-Ferretti (2007).

Institutional Quality is the average of the six Worldwide Governance Indicators from the World Bank Institute. The WGI database provides six measures of government institutional quality for most World Bank member countries from 1996–2017.[A1] They are Control of Corruption (CC), Government Effectiveness (GE), Political Stability, and Absence of Violence/Terrorism (PS), Rule of Law (PL), Regulatory Quality (RQ), and Voice and Accountability (VA). Each index is constructed in units of standard normal distribution, i.e. ranging from -2.5 to 2.5, where a higher value means a higher quality institution. All six measures are highly correlated with each other as shown in Table C2. Furthermore, the cross-country ranking is stable over time. Following Wei and Zhou (2018), we use the simple average of the six measures as our proxy for institutional quality.

Systemic Crises and Banking Crises Indicator is from the Global Crises database constructed by Carmen Reinhart in `https://www.hbs.edu/behavioral-finance-and-financial-stability/data/Pages/global.aspx`.

GDP per capita (constant 2010 US$), **Domestic Private Credit (in % of GDP)**, and **Trade/GDP** are from the World Development Indicators (WDI).

Capital Control measures are from Fernández et al. (2016) which is based on the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER). The AREAER contains descriptions and summaries of de jure restrictions in each of the IMF member countries.[A2] Fernández et al. (2016) translate the narrative in the AREAER database into a 0/1 qualitative indicator denoting the absence (0) or presence (1) of controls. To proxy for restrictions on foreign purchases by non-residents, we use the measure for "purchase locally by non-residents."

[A1] For three years with missing data, i.e. 1997, 1999, and 2001, we linearly interpolate the missing data.

[A2] There are 10 asset categories in the data set, including equity (EQ), bonds with an original maturity of more than one year (BO), money market instruments (MM), collective investment securities such as mutual funds and investment trusts (CI), derivatives (DE), commercial credits (CC), financial credits (FC), guarantees, sureties and financial back-up facilities (GS), direct investment (DI), and real estate transactions (RE).

B Appendix Tables

Table C1 SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
Equity (% of total liability)	2680	38.82	19.53	0.04	91.89
Institutional Quality	2680	-0.05	0.90	-2.10	1.97
Financial Development Index	2680	0.31	0.24	0.00	1.00
Log GDP per capita	2665	8.32	1.59	4.81	11.43
Private Credit (% of GDP)	2579	46.74	44.41	0.19	233.39
Trade (% of GDP)	2610	82.92	51.25	15.64	455.28
Equity Return	1340	0.02	0.09	-0.46	0.40
Bond Return	1224	0.01	0.04	-0.33	0.29
Systemic Crisis Indicator	1254	0.11	0.31	0.00	1.00
Banking Crisis Indicator	1173	0.17	0.37	0.00	1.00
Capital Controls on Equity (Intensive Measure)	1637	0.31	0.35	0.00	1.00
Capital Controls on Debt (Intensive Measure)	1631	0.28	0.35	0.00	1.00
Capital Controls on Equity (Extensive Measure)	1637	0.55	0.50	0.00	1.00
Capital Controls on Debt (Intensive Measure)	1631	0.47	0.50	0.00	1.00

Table C2 PAIRWISE CORRELATION FOR INSTITUTIONAL QUALITY

	CC	GE	PS	RL	RQ	VA
Control of Corruption (CC)	1.00					
Government Effectiveness (GE)	0.94*	1.00				
Political Stability and Absence of Violence/Terrorism (PS)	0.75*	0.74*	1.00			
Rule of Law (PL)	0.90*	0.94*	0.74*	1.00		
Regulatory Quality (RQ)	0.96*	0.96*	0.78*	0.93*	1.00	
Voice and Accountability (VA)	0.79*	0.81*	0.68*	0.84*	0.84*	1.00

NOTE. The * shows significance at the 0.01 level.

Table C3 PARAMETER VALUES FOR NUMERICAL EXAMPLE

ω_T	$\omega_N = 1 - \omega_T$	r	$\beta = (1+r)^{-1}$	ε	ϕ	y_{N2}	$\bar{y}_2$	y_3
0.3	0.7	5%	0.95	0.05	0.3	1	1	1

Table C4 External Capital Structure and Institutional Quality: Robustness

	Equity Share (% in total liability)					
	(1)	(2)	(3)	(4)	(5)	(6)
Quality_{t-1}	0.33**	0.47***	0.46***	0.33**	0.48***	0.47***
	(0.16)	(0.17)	(0.16)	(0.16)	(0.17)	(0.16)
Quality_{t-1}*Equity Protection_i	-0.01	0.06	-0.22			
	(0.41)	(0.43)	(0.35)			
Quality_{t-1}*Credit Protection_i				-0.34	-0.46	-0.29
				(0.29)	(0.30)	(0.24)
Financial Development_{t-1}		-0.63***			-0.64***	
		(0.16)			(0.16)	
Private Credit_{t-1}			-0.49***			-0.48***
			(0.09)			(0.09)
Log GDP per capita_{t-1}		-0.53	-0.50		-0.55	-0.51
		(0.34)	(0.34)		(0.34)	(0.34)
Trade_{t-1}		0.07	0.09		0.08	0.09
		(0.11)	(0.11)		(0.11)	(0.11)
Country FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Number of Countries	134	134	134	134	134	134
Observations	2546	2546	2546	2546	2546	2546
Adjusted R^2	0.400	0.431	0.453	0.401	0.434	0.454

NOTE. The dependent variable is equity share (portfolio equity and FDI) in total external liability. Both $Equity\ Protection_i$ and $Credit\ Protection_i$ are indices in 44 economies from La Porta et al. (1997) that measure the degree of protection for equity holders and creditors respectively. All independent variables are lagged by one year. We standardize all variables for ease of comparison. All standard errors are clustered by countries and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table C5 CAPITAL CONTROLS AND INSTITUTIONAL QUALITY: ROBUSTNESS

	De facto Capital Controls Measures			
	Equity		Debt	
	(1)	(2)	(3)	(4)
Quality_{t-1}	0.09***	0.17***	0.06*	0.12***
	(0.03)	(0.03)	(0.03)	(0.03)
$\text{Financial Development}_{t-1}$	0.38***		0.42***	
	(0.03)		(0.03)	
$\text{Private Credit}_{t-1}$		0.20***		0.24***
		(0.02)		(0.02)
$\text{Log GDP per capita}_{t-1}$	-0.12***	0.00	-0.11***	0.01
	(0.03)	(0.03)	(0.03)	(0.03)
Trade_{t-1}	0.50***	0.48***	0.46***	0.44***
	(0.02)	(0.02)	(0.02)	(0.02)
Country FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Number of Countries	134	134	134	134
Observations	2546	2546	2546	2546
Adjusted R^2	0.448	0.429	0.394	0.375

NOTE. The dependent variable is a de facto measure of capital controls. For equity (debt), it is the sum of total external equity (debt) assets and liabilities normalized by GDP. We standardize all the independent variables for ease of comparison. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Aggregate Demand Externality

This appendix uses a three-period model to discuss how the insight on an endogenous composition of capital flows affects the aggregate demand externality emphasized by Schmitt-Grohé and Uribe (2016). The aggregate demand externality emerges from a combination of a fixed exchange rate regime and a downward rigidity with nominal wage.

The economy features two types of goods, tradable and non-tradable. For simplicity, non-tradable consumption appears only in the first two periods. The preference of a representative agent is given by

$$E\left[\log C_1 + \beta \log C_2 + \beta^2 \omega_T \log C_{T3}\right], \text{ with } C_t = C_{Tt}^{\omega_T} C_{Nt}^{\omega_N}, \text{ for } t = 1,2$$

where β is the discount rate, $\omega_T \, (\omega_N = 1 - \omega_T)$ equals to the share of tradable (non-tradable) consumption in the total spending, and $C_{Tt} \, (C_{Nt})$ is the tradable consumption.

Income Stream As in the benchmark model, the tradable income stream is assumed to be exogenous and given by $\{y_{T1} = 0, y_{T2}, y_{T3}\}$. The only source of risk is from y_{T2} which is uniformly distributed from $U[\underline{y}, \bar{y}]$.

Non-tradable sector The non-tradable income is endogenous, given by $y_{Nt} = z_t h_t^{\alpha}$, where z_t is the level of TFP in the non-tradable sector, h_t is the labor demand and $\alpha \in (0,1)$ is a parameter in the production. A non-tradable sector firm chooses labor h_t for a given (nominal) wage W_t and (nominal) non-tradable price P_{Nt} to maximize its profit.

Following Schmitt-Grohé and Uribe (2016), we assume that $W_t \geq \gamma W_{t-1}$, with $\gamma \geq 0$ denoting the degree of nominal rigidity. As the past wage puts a floor on feasible wage adjustment, a representative firm's optimization problem in periods 1 and 2 is given by

$$\Pi_t = \max_{h_t} P_{Nt} y_{Nt} - W_t h_t, \text{ s.t. } W_t \geq \gamma W_{t-1}$$

The optimality condition implies that

$$\alpha P_{Nt} z_t h_t^{\alpha-1} = W_t$$

The representative household is assumed to supply labor inelastically. The total labor supply is bounded by the labor endowment $\bar{h}$, i.e. $h_t \leq \bar{h}$. As long as $W_t \geq \gamma W_{t-1}$ does not bind, the economy features full employment in the non-tradable sector and $h_t = \bar{h}$. Otherwise, there is involuntary unemployment. This implies

$$h_t^* = \min\left\{\bar{h}, \left(\frac{\alpha P_{Nt} z_t}{\gamma W_{t-1}}\right)^{\frac{1}{1-\alpha}}\right\}$$

and

$$(W_t - \gamma W_{t-1})(h_t^* - \bar{h}) = 0$$

The representative domestic agent can issue one-period debt d with a promised return of $1+r$, or sell s shares of equity claim on tradable income at price p_e at period 1, with $p_e = (1-\theta)y_1$ and $y_1 \equiv \frac{\frac{y+\bar{y}}{2} + \frac{y_{T3}}{1+r}}{1+r}$. In period 2, he can issue debt d' to smooth consumption.

The budget constraints for the domestic agent in the three periods are given by

$$P_{N1}C_{N1}+P_{T1}C_{T1}=W_1h_1+\Pi_1+\left[sp_e+\frac{d}{1+r}\right]\mathcal{E}_1,$$
$$P_{N2}C_{N2}+P_{T2}C_{T2}=W_2h_2+\Pi_2+P_{T2}(1-s)y_{T2}-\mathcal{E}_2d+\mathcal{E}_2\frac{d'}{1+r},$$
$$P_{T3}C_{T3}=P_{T3}(1-s)y_{T3}-\mathcal{E}_3d'$$

where $\mathcal{E}_t$ denotes the nominal exchange rate and P_{Tt} is the nominal price of tradable good. For tradable goods, we assume that the law of one price holds:

$$P_{Tt}=\mathcal{E}_tP^*_{Tt}$$

Normalizing $P^*_{Tt}=1$, we obtain the following

$$P_{Tt}=\mathcal{E}_t$$

Assume that W_0 is low enough such that the wage constraint does not bind in period 1. The constraint may bind in period 2 if there is an unfavorable realization of the tradable income in that period. We focus on the case of a fixed exchange rate as in Schmitt-Grohé and Uribe (2016), i.e. $\mathcal{E}_1=\mathcal{E}_2=\mathcal{E}_3$. The problem can be rewritten as

$$\begin{aligned} W &= \max_{C_{T1},C_{N1},s,d} \omega_T\log C_{T1}+\omega_N\log C_{N1}+\beta E_1[V(w_1,s,d)],\\ \text{s.t.} &\quad p_{N1}C_{N1}+C_{T1}=w_1\bar{h}+\pi_1+\left[sp_e+\frac{d}{1+r}\right]\end{aligned}$$

where the lower case variable x_t such as p_{Nt}, w_t, π_t is defined as $x_t = \frac{X_t}{P_{Tt}}$ and $V(w_1, s, d)$ is given by

$$
\begin{aligned}
& V(w_1, s, d) = \max_{C_{N2}, C_{T2}, C_{T3}, d'} \omega_T \log C_{T2} + \omega_N \log C_{N2} + \beta \omega_T \log C_{T3}, \\
& \text{s.t. } p_{N2} C_{N2} + C_{T2} = w_2 h_2 + \pi_2 + (1-s) y_{T2} - d + \frac{d'}{1+r}, \\
& h_2 = \min\left\{ \bar{h}, \left(\frac{\alpha p_{N2} z_2}{\gamma w_1} \right)^{\frac{1}{1-\alpha}} \right\} \\
& C_{T3} = (1-s) y_{T3} - d'.
\end{aligned}
$$

This setup generates an aggregate demand externality when the nominal wage constraint binds in period 2. To see this, note that $\frac{\partial V}{\partial w_1} < 0$ when $h_2 = \left(\frac{\alpha p_{N2} z_2}{\gamma w_1} \right)^{\frac{1}{1-\alpha}}$. Private agents do not take into account the general equilibrium effect through w_1 whereas the social planner does. In that case, the allocations under a competitive equilibrium differ from those chosen by a social planner.

Competitive Equilibrium

We solve for the competitive equilibrium backward from period 2. There are two states of the world in period 2, one with a binding wage constraint and the other with a slack wage constraint. As there is no friction in the debt market in period 2, optimal consumption smoothing requires that $C_{T2} = \frac{(1-s)\left(y_{T2} + \frac{y_{T3}}{1+r}\right) - d}{1+\beta}$. The amount of tradable consumption (aggregate demand) also implies that the maximum labor demand given the binding wage constraint is $\hat{h}_2 = \frac{\alpha \omega_N}{\gamma w_1 \omega_T} C_{T2}$. Clearly, when $\hat{h}_2 > \bar{h}$, the higher aggregate demand needs more labor that exceeds the maximum amount of labor in the economy. In equilibrium, the nominal wage will be higher than the lower bound γw_1 and there is full employment. When $\hat{h}_2 < \bar{h}$, the aggregate demand in the economy is insufficient to absorb full employment and there will be involuntary unemployed labor. The key friction is the wage constraint that prevents a fall in nominal wage to stimulate aggregate demand.

Period-1 Equilibrium In period 1, the agent chooses s and d to smooth tradable consumption C_{T1}. The optimal conditions are given by

$$\frac{\omega_T}{C_{T1}} p_e = \beta E\left[\frac{\omega_T}{C_{T2}} y_{T2} + \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]$$
$$\frac{\omega_T}{C_{T1}} = \beta(1+r)E\left[\frac{\omega_T}{C_{T2}}\right]$$

The first condition is consistent with an interior solution with $s \in (0,1)$. Otherwise, $s=1$ when $\frac{\omega_T}{C_{T1}} p_e > \beta E\left[\frac{\omega_T}{C_{T2}} y_{T2} + \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]$ and $s=0$ when $\frac{\omega_T}{C_{T1}} p_e < \beta E\left[\frac{\omega_T}{C_{T2}} y_{T2} + \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]$.

When $\theta = 0$ and $p_e = y_1$, the equilibrium features equity flow only, i.e. $s=1$. To see this, we note the following:

$$\begin{aligned}
&\frac{\omega_T}{C_{T1}} y_1 - \beta E\left[\frac{\omega_T}{C_{T2}} y_{T2} + \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]\\
&= \beta(1+r)E\left[\frac{\omega_T}{C_{T2}}\right] y_1 - \beta E\left[\frac{\omega_T}{C_{T2}} y_{T2} + \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]\\
&= \beta E\left[\frac{\omega_T}{C_{T2}}\left(\frac{\underline{y}+\bar{y}}{2} + \frac{y_{T3}}{1+r} - y_{T2}\right) - \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]\\
&= \beta E\left[\frac{\omega_T}{C_{T2}}\left(\frac{\underline{y}+\bar{y}}{2} - y_{T2}\right)\right] = -\beta cov\left(\frac{\omega_T}{C_{T2}}, y_{T2}\right) > 0
\end{aligned}$$

Therefore, the domestic agents issue only equity when $\theta = 0$. By doing so, the risk in the tradable sector has been shifted completely to the (risk-neutral) international investors. There is only one state of the world in period 2. Under a mild condition such that $\beta(1+r) > \gamma$, the period-2 equilibrium features full employment regards of the value of the tradable income. This means no aggregate demand externality in the economy. In general, however, when θ is within the region of $[0,1]$, the economy features both equity and debt issuance. By the same argument as in Section

E.3, both the capital structure in the economy and the severity of externality depend on θ.

The Social Planner's Problem

The social planner internalizes the aggregate demand externality and chooses the allocation differently. Her problem can be written as follows.

$$\begin{aligned} W^{SP} &= \max_{C_{T1},s,d} \omega_T \log C_{T1} + \omega_N \log z_1 \bar{h}^{\alpha} + \beta E_1 \left[V^{SP}(C_{T1},s,d) \right], \\ \text{s.t.} \quad & C_{T1} = s p_e + \frac{d}{1+r} \end{aligned}$$

where $V^{SP}(C_{T1},s,d)$ is defined as

$$\begin{aligned} & V^{SP}(C_{T1},s,d) = \max_{C_{T2},C_{T3},d'} \omega_T \log C_{T2} + \omega_N \log z_2 h_2^{\alpha} + \beta \omega_T \log C_{T3}, \\ & \text{s.t. } C_{T2} = (1-s) y_{T2} - d + \frac{d'}{1+r}, \\ & h_2 = \bar{h} \min \left\{ 1, \frac{C_{T2}}{\gamma C_{T1}} \right\} \\ & C_{T3} = (1-s) y_{T3} - d'. \end{aligned}$$

Period-2 Equilibrium Similar to the competitive equilibrium, there are two states of the world. The first is with full employment, i.e. $C_{T2} > \gamma C_{T1}$. The allocation of the social planner coincides with the competitive equilibrium. However, in the second state of the world when there is involuntary unemployment, i.e. $C_{T2} < \gamma C_{T1}$, the social planner's optimality condition implies that

$$C_{T2} = \frac{1}{1+\beta/(1+\alpha\omega_N/\omega_T)}\left[(1-s)\left(y_{T2}+\frac{y_{T3}}{1+r}\right)-d\right] > \frac{1}{1+\beta}\left[(1-s)\left(y_{T2}+\frac{y_{T3}}{1+r}\right)-d\right]$$

In other words, the social planner chooses a higher level of consumption so as to stimulate the aggregate demand during the involuntary unemployment state.

Period-1 Equilibrium The optimal conditions imply that

$$\lambda^{SP} = \frac{\omega_T}{C_{T1}} + \beta E\left[\frac{\partial V^{SP}}{\partial C_{T1}}\right]$$
$$\lambda^{SP} p_e = \beta E\left[\lambda_2^{SP} y_{T2} + \beta\frac{\omega_T}{C_{T3}} y_{T3}\right]$$
$$\lambda^{SP} = \beta(1+r)E[\lambda_2^{SP}]$$

where λ^{SP} and λ_2^{SP} are the Lagrangian multipliers associated with the budget constraints in periods 1 and 2, respectively.

To understand the source of inefficiency, we assume that the social planner's allocation can be implemented by a capital control tax with a lump sum transfer. The budget constraints for private agents are then changed into

$$p_{N1}C_{N1} + C_{T1} = w_1\bar{h} + \pi_1 + \left[sp_e(1-\tau_e) + \frac{d}{1+r}(1-\tau_d) + T\right]$$
$$p_{N2}C_{N2} + C_{T2} = w_2 h_2 + \pi_2 + (1-s)y_{T2} - d + \frac{d'}{1+r}(1-\tau_{d'}) + T'$$

with $T = \tau_e s p_e + \frac{d}{1+r}\tau_d$ and $T' = \frac{d'}{1+r}\tau_{d'}$.

To implement the social planner's allocation, the taxes are given by

$$
\begin{aligned}
\tau_e &= \frac{\beta E\left[\alpha \frac{\omega_N}{C_{T2}} y_{T2}\mu - p_e \frac{\partial V^{SP}}{\partial C_{T1}}\right]}{p_e \frac{\omega_T}{C_{T1}}} > 0 \\
\tau_d &= \frac{\beta E\left[(1+r)\alpha \frac{\omega_N}{C_{T2}}\mu - \frac{\partial V^{SP}}{\partial C_{T1}}\right]}{\frac{\omega_T}{C_{T1}}} > 0 \\
\tau_{d'} &= -\alpha \frac{\omega_N}{\omega_T}\mu < 0
\end{aligned}
$$

where $\mu = 1$ in the involuntary unemployment state and $\mu = 0$ in the full employment state. Moreover, $\tau_d > \tau_e$. Therefore, the optimal policy includes a macroprudential capital tax on both debt and equity in period 1 and a negative capital control tax on debt in the involuntary unemployment state in period 2.

D Equity Issuance During Crises

In this extension, we allow for equity issuance in the intermediate period. A key insight is a possible role for ex-post intervention because pecuniary externality affects two decision margins in the second period.

Suppose that in the second period, the economy can issue an additional share of equity $s' \in [0, 1-s]$ to foreign investors. Since the equity issuance is subject to expropriation risk θ, the share of equity is priced at $(1-\theta)\frac{y_3}{1+r}$. The budget constraints in periods 2 and 3 become

$$
\begin{aligned}
&pC_{N2} + C_{T2} = \underbrace{(1-s)y_2 - d}_{m} + py_{N2} + \frac{d'}{1+r} + s'(1-\theta)\frac{y_3}{1+r} \qquad (9)\\
&C_{T3} = y_3 - d' - (s+s')y_3
\end{aligned}
$$

The financial constraint in period 2 is unchanged, i.e.

$$
\frac{d'}{1+r} \leq \phi((1-s)y_2 + py_{N2}) \qquad (10)
$$

The economy can choose equity and debt financing to smooth consumption in the second period. However, the use of equity financing depends on the quality of domestic institutions. Consider the case where $\theta = 0$, i.e. very good domestic institution. In the second period, the economy always uses equity financing as opposed to debt financing since equity financing does not lead to a binding financial constraint. Therefore, there will be no case for debt financing, the same insight as in the benchmark model. However, equity financing is never used in equilibrium when the institution quality is poor (for example, $\theta = 1$). By continuity, there will be an optimal capital structure in the second period depending on θ.

Proposition 11. When the economy is allowed to issue equity in the second period, it chooses to do so when the constraint binds in the second period. However, the economy chooses too little equity financing due to the pecuniary externality, which justifies an ex-post intervention. There will still be an over-borrowing in the first period as in the benchmark economy. To correct the externality, the social planner needs to use both ex-ante and ex-post interventions.

Proof. The proof is given in Appendix E.8. □

The possibility of equity issuance in the second period allows a role for ex-post intervention since the pecuniary externality affects two decision margins in the second period when the constraint binds. Unlike the previous literature which allows for only debt financing (Bianchi 2011 and Jeanne and Korinek 2018), introducing equity financing allows the social planner to use ex-post intervention to change the composition of external financing when the constraint binds. In particular, the social planner favors equity financing as it provides better risk-sharing and suffers less pecuniary externality than debt financing. Nevertheless, the use of ex-post intervention cannot completely eliminate the pecuniary externality, which calls for the use of ex-ante policy intervention in equilibrium.

It is also worth pointing out that the feature of an ex-post intervention is different from the existing form of ex-post intervention in the literature such as Benigno et al. (2013), Ma (2020), and Jeanne and Korinek (2020). Our ex-post intervention is used to change the composition of external financing in order to reduce the cost of a binding constraint, while it is used in Benigno et al. (2016) to change the composition of labor supplies between the tradable and non-tradable sectors or in Ma (2020) the composition of consumption versus investment. The ex-post intervention takes the form of a fiscal transfer in Jeanne and Korinek (2020) but a tax on capital flows in our case.

E Proofs

E.1 Proof of Proposition 2

Proof. When the constraint is slack, the following condition holds.

$$d' = \frac{(1-s)y_3 - \beta(1+r)m}{1+\beta}$$

The constraint is slack iff

$$\frac{d'}{1+r} \leq \phi\left(\frac{\omega_N}{\omega_T}C_{T2} + (1-s)y_2\right) = \phi\left(\frac{\omega_N}{\omega_T}\left(m + \frac{d'}{1+r}\right) + (1-s)y_2\right) \leq \frac{\phi\frac{\omega_N}{\omega_T}m + \phi(1-s)y_2}{1-\phi\frac{\omega_N}{\omega_T}}$$

Equivalently, the constraints bind if

$$\frac{d}{1-s} > \frac{y_2\left(\frac{\beta}{1+\beta} + \frac{\phi/\omega_T}{1-\phi\frac{\omega_N}{\omega_T}}\right) - \frac{y_3}{(1+\beta)(1+r)}}{\frac{\beta}{1+\beta} + \frac{\phi\frac{\omega_N}{\omega_T}}{1-\phi\frac{\omega_N}{\omega_T}}} \tag{11}$$

□

E.2 Proof of Proposition 3

Proof. When $\theta = 0$, the optimality conditions for d, s and d' are given by

$$\frac{\omega_T}{C_{T1}} = \beta(1+r)E_1\left[\frac{\omega_T}{C_{T2}}\right] \tag{12}$$

$$-\frac{\omega_T}{C_{T1}}y_1 + \beta E_1\left[\frac{\omega_T}{C_{T2}}y_2 + \mu\phi y_2 + \beta\frac{\omega_T}{C_{T3}}y_3\right] \leq 0 \tag{13}$$

$$\frac{\omega_T}{C_{T2}} = \beta(1+r)\frac{\omega_T}{C_{T3}} + \mu \tag{14}$$

where equation (13) holds with inequality when $s = 1$.

By plugging the optimality conditions (12) and (14) into (13), the LHS of equation (13) becomes

$$\beta E_1 \left[\frac{\omega_T}{C_{T2}} \left(y_2 - \frac{\underline{y} + \bar{y}}{2} \right) + \mu \left(\phi y_2 - \frac{y_3}{1+r} \right) \right] \tag{15}$$

which is negative because

$$E_1 \left[\frac{\omega_T}{C_{T2}} \left(y_2 - \frac{\underline{y} + \bar{y}}{2} \right) \right] = \text{cov} \left(\frac{\omega_T}{C_{T2}}, y_2 \right) < 0,$$
$$E_1 \left[\mu \left(\phi y_2 - \frac{y_3}{1+r} \right) \right] = E_1 \left[\frac{\mu}{1-s} \left(-\frac{C_{T3}}{1+r} - \phi \frac{\omega_N}{\omega_T} C_{T2} \right) \right] \leq 0$$

where μ is the Lagrangian multiplier associated with the financial constraint (2). $\text{cov} \left(\frac{\omega_T}{C_{T2}}, y_2 \right) < 0$ simply because

$$C_{T2} = \frac{(1-s)y_2 - d + (1-s)\frac{y_3}{1+r}}{1+\beta}, \text{ if the constraint is slack;}$$
$$C_{T2} = \frac{(1+\phi)(1-s)y_2 - d}{1 - \phi \frac{\omega_N}{\omega_T}}, \text{ if the constraint binds.}$$

Therefore, the optimal equity share s is 1. □

E.3 Proof of Proposition 4

Proof. The optimality conditions for d and s are given by

$$\frac{\omega_T}{C_{T1}} = \beta(1+r)E \left[\frac{\omega_T}{C_{T2}} \right] \tag{16}$$
$$\frac{\omega_T}{C_{T1}} y_1(1-\theta) - \beta E_1 \left[\frac{\omega_T}{C_{T2}} y_2 + \mu \phi y_2 + \beta \frac{\omega_T}{C_{T3}} y_3 \right] = 0 \tag{17}$$

From condition (16), one can define $d^* = D(s,\theta)$. By the implicit function theorem,

$$\frac{\partial d^*}{\partial s} = -\frac{-\frac{\omega_T}{C_{T1}^2}(1-\theta)y_1 - \beta(1+r)E\left[-\frac{\omega_T}{C_{T2}^2}\frac{\partial C_{T2}}{\partial s}\right]}{-\frac{\omega_T}{C_{T1}^2}\frac{1}{1+r} - \beta(1+r)E\left[-\frac{\omega_T}{C_{T2}^2}\frac{\partial C_{T2}}{\partial d}\right]} < 0$$

$$\frac{\partial d^*}{\partial \theta} = -\frac{-\frac{\omega_T}{C_{T1}^2}(-sy_1)}{-\frac{\omega_T}{C_{T1}^2}\frac{1}{1+r} - \beta(1+r)E\left[-\frac{\omega_T}{C_{T2}^2}\frac{\partial C_{T2}}{\partial d}\right]} > 0$$

where it follows that $\frac{\partial C_{T2}}{\partial s} < 0$ and $\frac{\partial C_{T2}}{\partial d} < 0$.

We define the following function to capture the optimality condition for equity issuance

$$F(s,d^*,\theta) = -\frac{\omega_T}{C_{T1}}y_1(1-\theta) + \beta E_1\left[\frac{\omega_T}{C_{T2}}y_2 + \mu\phi y_2 + \beta\frac{\omega_T}{C_{T3}}y_3\right]$$

Realize that $\frac{\partial F(s,d^*,\theta)}{\partial s} > 0$, $\frac{\partial F(s,d^*,\theta)}{\partial d^*} > 0$ and $\frac{\partial F(s,d^*,\theta)}{\partial \theta} > 0$, where the first two relationships are implied by the concavity of the problem. Therefore, we have $\frac{\partial s}{\partial d^*} = -\frac{\frac{\partial F(s,d^*,\theta)}{\partial d^*}}{\frac{\partial F(s,d^*,\theta)}{\partial s}} < 0$ and $\frac{\partial s}{\partial \theta} = -\frac{\frac{\partial F(s,d^*,\theta)}{\partial \theta}}{\frac{\partial F(s,d^*,\theta)}{\partial s}} < 0$.

The optimality condition for equity issuance implies that

$$s^* = 1,\ \textit{if}\ F(s,d^*,\theta) < 0\ \textit{for all}\ s \in [0,1]$$

$$s^* = 0,\ \textit{if}\ F(s,d^*,\theta) > 0\ \textit{for all}\ s \in [0,1]$$

$$s^* \in (0,1),\ \textit{if there exist}\ s \in [0,1]\ \textit{such that}\ F(s,d^*,\theta) = 0$$

Since $F(s,d^*,0) < 0$ as shown in E.2 and $F(s,d^*,1) > 0$ for $\forall s \in [0,1]$, by continuity, there exists a $\bar{\theta}$ such that $F(s,d^*,\bar{\theta}) = 0$ for $s = 0$. When $\theta > \bar{\theta}$, $F(s,d^*,\theta) > F(0,d^*,\theta) > F(0,d^*,\bar{\theta}) = 0$ for all $s \in [0,1]$. In this case, the optimal level of s is 0. The equilibrium features only debt and no equity issuance.

Similarly, since there exists a $\underline{\theta}$ such that $F(s,d^*,\underline{\theta}) = 0$ for $s = 1$. When $\theta < \underline{\theta}$, $F(s,d^*,\theta) < F(1,d^*,\theta) < F(1,d^*,\underline{\theta}) = 0$ for all $s \in [0,1]$. In this case, the optimal level of s is 1. The equilibrium features only equity and no debt.

When $\theta \in (\underline{\theta},\bar{\theta})$, there is an interior solution for equity issuance s. As θ decreases, the optimal level of equity share s increases and debt d decreases as implied by $\frac{\partial s}{\partial \theta} < 0$ and $\frac{\partial d^*}{\partial \theta} > 0$. In equilibrium, it is consistent with $\frac{\partial s}{\partial d^*} < 0$ and $\frac{\partial d^*}{\partial s} < 0$.

One can show that a higher θ leads to a higher $\frac{d}{1-s}$. To see this, one recognizes that equation (16) can be written as a function of s and $\frac{d}{1-s}$.

$$\frac{\omega_T}{(1-\theta)y_1 - (1-s)\left((1-\theta)y_1 - \frac{d/(1-s)}{1+r}\right)} = \beta(1+r)E\left[\frac{\omega_T}{C_{T2}}\right] \tag{18}$$

C_{T2} is a decreasing function of $d/(1-s)$ and an increasing function of $1-s$ since $C_{T2} = \frac{(1-s)\left(\frac{y_3}{1+r}+y_2-d/(1-s)\right)}{1+\beta}$ if unconstrained and $C_{T2} = \frac{(1-s)((1+\phi)y_2-d/(1-s))}{1-\phi\frac{\omega_N}{\omega_T}}$ if constrained. Therefore, following a higher value of θ, a higher $1-s$ raises the value of the LHS while reducing that of the RHS of equation (18), leading to a higher $d/(1-s)$.

Therefore, in equilibrium a higher θ leads to a lower s, a higher d and $d/(1-s)$, which implies a higher leverage ratio $\frac{d/(1+r)}{s(1-\theta)y_1+d/(1+r)}$. Notice that the probability of binding constraints depends on the level of $d/(1-s)$. A higher level of $d/(1-s)$ implies a higher probability of binding constraints due to equation (11). $\square$

E.4 Proof of Proposition 5

Proof. Given the definition of $V^{SP}(m,s,y_2)$, we have the following

$$
\begin{aligned}
V^{SP}(m,s,y_2) \quad &= \quad \max_{C_{T2},d',C_{T3}} \omega_N \log y_{N2} + \omega_T \log C_{T2} + \beta\omega_T \log C_{T3} \\
\text{s.t.} \quad & \quad C_{T2} = m + \frac{d'}{1+r}, \qquad (19) \\
& \quad C_{T3} + d' = (1-s)y_3, \\
& \quad \frac{d'}{1+r} \leq \phi\left(\frac{\omega_N}{\omega_T}C_{T2} + (1-s)y_2\right). \qquad (20)
\end{aligned}
$$

The optimality conditions are given by

$$
\begin{aligned}
\lambda &= \frac{\omega_T}{C_{T2}} + \phi\mu\frac{\omega_N}{\omega_T} \\
\lambda &= \mu + \beta(1+r)\frac{\omega_T}{C_{T3}}
\end{aligned}
$$

where λ and μ are the Lagrangian multipliers for the budget constraint (19) and collateral constraint (20).

When the constraint is slack, the following condition holds.

$$
d' = \frac{(1-s)y_3 - \beta(1+r)m}{1+\beta}
$$

The constraint is slack iff

$$
\frac{d'}{1+r} \leq \phi\left(\frac{\omega_N}{\omega_T}C_{T2} + (1-s)y_2\right) = \phi\left(\frac{\omega_N}{\omega_T}\left(m + \frac{d'}{1+r}\right) + (1-s)y_2\right) \leq \frac{\phi\frac{\omega_N}{\omega_T}m + \phi(1-s)y_2}{1-\phi\frac{\omega_N}{\omega_T}}
$$

Equivalently, the constraints bind if

$$\frac{d}{1-s} > \frac{y_2\left(\frac{\beta}{1+\beta}+\frac{\phi/\omega_T}{1-\phi\frac{\omega_N}{\omega_T}}\right)-\frac{y_3}{(1+\beta)(1+r)}}{\frac{\beta}{1+\beta}+\frac{\phi\frac{\omega_N}{\omega_T}}{1-\phi\frac{\omega_N}{\omega_T}}} \tag{21}$$

Since expressions (11) and (21) are identical, there is no difference between the private agents and the social planner in the condition for the constraints to be binding. The allocation is given by

$$C_{T2} = \frac{m+(1-s)\frac{y_3}{1+r}}{1+\beta}, \text{ if slack}$$
$$C_{T2} = \frac{m+\phi(1-s)y_2}{1-\phi\frac{\omega_N}{\omega_T}}, \text{ if constrained}$$

This is the same as that in the competitive equilibrium, which is characterized in $V(m,s,y_1)$.

By the envelope theorem, we have

$$\frac{\partial V^{SP}(m,s,y_2)}{\partial m} = \frac{\omega_T}{C_{T2}} + \phi\mu\frac{\omega_N}{\omega_T},$$
$$\frac{\partial V^{SP}(m,s,y_2)}{\partial s} = -\phi y_2\mu - \beta\frac{\omega_T}{C_{T3}}y_3,$$

As $\mu > 0$, we see that $\frac{\partial V^{SP}(m,s,y_2)}{\partial m} > \frac{\partial V(m,s,y_2)}{\partial m}$. □

E.5 Proof of Proposition 6 and 7

Proof. The optimality conditions for d and s are given, respectively, by

$$\frac{\omega_T}{C_{T1}} = \beta(1+r)E\left[\frac{\omega_T}{C_{T2}} + \phi\mu\frac{\omega_N}{\omega_T}\right] \tag{22}$$

$$\frac{\omega_T}{C_{T1}}y_1(1-\theta) = \beta E_1\left[\left(\frac{\omega_T}{C_{T2}} + \phi\mu\frac{\omega_N}{\omega_T}\right)y_2 + \mu\phi y_2 + \beta\frac{\omega_T}{C_{T3}}y_3\right] \tag{23}$$

Using the same proof as in Appendix E.3, one can show the following: (1) There exists a $\bar{\theta}^{SP}$ such that there will be only debt issuance when $\theta > \bar{\theta}^{SP}$; (2) There exists a $\underline{\theta}^{SP}$ such that there will be only equity issuance when $\theta < \underline{\theta}^{SP}$; (3) When $\theta \in (\underline{\theta}^{SP}, \bar{\theta}^{SP})$, there will be a mixture of equity and debt. Furthermore, a higher θ leads to a lower s, a higher d and $d/(1-s)$, which implies a higher leverage ratio $\frac{d/(1+r)}{s(1-\theta)y_1+d/(1+r)}$. Notice that the probability of the constraints becoming binding depends on the level of $d/(1-s)$: The higher the value of $d/(1-s)$, the greater the probability of binding constraints due to equation (21).

Suppose we impose capital control taxes on debt and equity, τ^d and τ^s, respectively, the first-period budget constraint becomes

$$C_{T1} = (1-\tau^s)s(1-\theta)y_1 + (1-\tau^d)\frac{d}{1+r} + T$$

where $T = \tau^s s(1-\theta)y_1 + \tau^d\frac{d}{1+r}$.

To close the gap between the social planner's allocation and that of the private agents, we have to have

$$\tau^d = \frac{\beta(1+r)E\left[\phi\mu\frac{\omega_N}{\omega_T}\right]}{\frac{\omega_T}{C_{T1}}} > 0$$

$$\tau^s = \frac{\beta E\left[\phi\mu\frac{\omega_N}{\omega_T}y_2\right]}{\frac{\omega_T}{C_{T1}}(1-\theta)y_1} > 0$$

It can be shown that $\tau^d > \tau^s$ since

$$\tau^d - \tau^s = \frac{\beta(1+r)\phi\frac{\omega_N}{\omega_T}E\left[\mu\left((1-\theta)y_1 - \frac{y_2}{1+r}\right)\right]}{\frac{\omega_T}{C_{T1}}(1-\theta)y_1}$$

and

$$\begin{aligned} & E\left[\mu\left((1-\theta)y_1 - \frac{y_2}{1+r}\right)\right] \\ = \quad & E[\mu]E\left[\left((1-\theta)y_1 - \frac{y_2}{1+r}\right)\right] + cov\left(\mu, \left((1-\theta)y_1 - \frac{y_2}{1+r}\right)\right) > 0. \end{aligned}$$

$E[\left((1-\theta)y_1 - \frac{y_2}{1+r}\right)]$ has to be positive for an positive amount of equity to be issued in equilibrium. $cov(\mu, \left((1-\theta)y_1 - \frac{y_2}{1+r}\right)) > 0$ since a lower level of y_2 is associated with a tighter borrowing constraint, i.e. a higher value of μ.

Given that $\tau^d > \tau^s$, the wedge in the debt financing is higher than that in the equity financing. As a result, the social planner chooses a lower overall level of external financing C_{T1}, and a smaller component of debt than equity financing. Therefore, the debt to income ratio of $d/(1-s)$ should be lower in the social planner's allocation, resulting in a lower probability of crises.

For $\theta < \underline{\theta}^{SP}$, the decentralized equilibrium features only equity financing. In this case, there is no difference between the social planner's choice and the decentralized equilibrium, and the collateral constraint does not bind. In comparison, for $\theta \geq \bar{\theta}^{SP}$, the decentralized equilibrium features only debt financing. There is a wedge between the private agents' and the social planner's allocations. By continuity, there exists a θ^* such that the allocation under the competitive equilibrium is constrained efficient when $\theta < \theta^*$, and constrained inefficient when $\theta > \theta^*$. Moreover, one can see that $\theta^* > \underline{\theta}^{SP}$. Notice that only when $\theta > \underline{\theta}^{SP}$, there will be debt issuance. The inefficiency arises only when $d/(1-s)$ is high enough. Consider θ is only marginally higher than $\underline{\theta}^{SP}$ such that the equilibrium d is lower enough. In that case, there is no binding constraint in the economy and also inefficiency. Therefore, one get $\theta^* > \underline{\theta}^{SP}$ and $\theta^* < \bar{\theta}^{SP}$. $\square$

E.6 Proof of Proposition 8

The problem can be written as

$$\max_{d,D} \omega_T \log C_{T1} + \beta E_1[V(d,D,y_2)],$$
$$\text{s.t. } C_{T1} = \frac{d}{1+r} + \frac{D}{(1+r)^2}(1-\theta)$$

where $V(d,D,y_2)$ is given by

$$\begin{aligned}
V(d,D,y_2) = \quad & \max_{C_{N2},C_{T2},C_{T3},d'} \omega_T \log C_{T2} + \omega_N \log C_{N2} + \beta\omega_T \log C_{T3}, \\
\text{s.t.} \quad & pC_{N2} + C_{T2} = y_2 - d + py_{N2} + \frac{d'}{1+r} && (24) \\
& \frac{d'}{1+r} \leq \phi(y_2 + py_{N2}) && (25) \\
& C_{T3} = y_3 - d' - D && (26)
\end{aligned}$$

The optimality conditions are given by

$$\begin{aligned}\text{FOC}(C_{T2}) &: \lambda = \frac{\omega_T}{C_{T2}} \\ \text{FOC}(d') &: \lambda = \mu + \beta(1+r)\frac{\omega_T}{C_{T3}}\end{aligned} \tag{27}$$

where λ and μ are the Lagrangian multipliers associated with equations (24) and (25), respectively.

In the first period, the optimality conditions for d and D are given by

$$\begin{aligned}\frac{\omega_T}{C_{T1}} &= \beta(1+r)E_1\left[\frac{\omega_T}{C_{T2}}\right] \\ \frac{\omega_T}{C_{T1}}(1-\theta) &= \beta^2(1+r)^2E_1\left[\frac{\omega_T}{C_{T3}}\right]\end{aligned}$$

Similar to the benchmark economy, there will be an equilibrium capital structure in which the ratio of d and D depends on θ. Define the marginal benefit function of long-term debt as follows

$$\begin{aligned}MB(d,D,\theta) &\equiv \frac{\omega_T}{C_{T1}}(1-\theta) - \beta^2(1+r)^2E_1\left[\frac{\omega_T}{C_{T3}}\right] \\ &= -\theta\frac{\omega_T}{C_{T1}} + \beta(1+r)E_1[\mu]\end{aligned}$$

where the last relationship combines two optimality conditions.

From the marginal benefit function, it is easy to see that $MB(d,D,0) > 0 > MB(d,D,1)$ for any $d,D \geq 0$. Furthermore, we have $MB_d > 0$, $MB_D > 0$ and $MB_\theta < 0$. Using these relationships, we find that the optimal level of short-term debt d is 0 when $\theta = 0$ while the long-term debt D is 0 when $\theta = 1$. By continuity, there will exists a $\underline{\theta}$ such that $MB(0,D,\underline{\theta}) = 0$. In this case, for any $\theta < \underline{\theta}$, $MB(d,D,\theta) > MB(d,D,\underline{\theta}) > MB(0,D,\underline{\theta}) = 0$, which implies that $d^* = 0$. In this region, only long-term debt will be issued. Similarly, one can define $\bar{\theta}$ such that $MB(d,D,\bar{\theta}) = 0$. In this case, for any $\theta > \bar{\theta}$, $D^* = 0$ as $MB(d,D,\theta) < 0$. Therefore, an interior solution exists in the region of $(\underline{\theta},\bar{\theta})$. Using the same logic in Appendix E.3, one can show that a higher θ in this region leads to a higher d and a lower D.

The case for policy intervention is similar to the benchmark economy since the pecuniary externality only applies to the short term debt. Specifically, the social planner values d differently from private agents. By the same logic as in Appendix E.5, there is overborrowing in the decentralized economy and the social planner uses capital controls to correct the inefficiency. To see this, define a social planner as follows.

$$
\begin{aligned}
V^{SP}(d,D,y_2) = \quad & \max_{C_{T2},C_{T3},d',} \omega_T \log C_{T2} + \omega_N \log y_{N2} + \beta\omega_T \log C_{T3}, \\
\text{s.t.} \quad & C_{T2} = y_2 - d + \frac{d'}{1+r} && (28) \\
& \frac{d'}{1+r} \leq \phi \left(y_2 + \frac{\omega_N}{\omega_T} C_{T2} \right) && (29) \\
& C_{T3} = y_3 - d' - D && (30)
\end{aligned}
$$

The optimality conditions of d and D for the social planner are given by

$$
\begin{aligned}
& \frac{\omega_T}{C_{T1}} = \beta(1+r)E_1[\lambda^{SP}] = \beta(1+r)E_1\left[\frac{\omega_T}{C_{T2}} + \phi\frac{\omega_N}{\omega_T}\mu^{SP}\right] \\
& \frac{\omega_T}{C_{T1}}(1-\theta) = \beta^2(1+r)^2E_1\left[\frac{\omega_T}{C_{T3}}\right]
\end{aligned}
$$

Because the pecuniary externality only affects the decision margin for short-term debt d, one only need one capital controls to correct the inefficiency. Specifically, we introduce a tax τ_d on short term debt and a lump-sum transfer T as follows.

$$C_{T1} = (1-\tau^d)\frac{d}{1+r} + (1-\theta)\frac{D}{(1+r)^2} + T \tag{31}$$

where $T = \tau^d \frac{d}{1+r}$.

We need to choose $\tau_d = \frac{\beta(1+r)E_1\left[\phi\frac{\omega_N}{\omega_T}\mu^{SP}\right]}{\frac{\omega_T}{C_{T1}}} > 0$ to close the gap between the social planner and private agents.

E.7 Proof of Proposition 9

The problem can be written as

$$\max_{d,l} \omega_T \log C_{T1} + \beta E_1[V(d,l,y_2)],$$
$$\text{s.t. } C_{T1} = \frac{d}{1+r} + l(1-\theta)$$

where $V(d,l,y_2)$ is given by

$$V(d,l,y_2) = \max_{C_{N2},C_{T2},C_{T3},d'} \omega_T \log C_{T2} + \omega_N \log C_{N2} + \beta\omega_T \log C_{T3},$$

$$\text{s.t.} \quad pC_{N2} + C_{T2} = y_2 - d + py_{N2} + \frac{d'}{1+r} - \rho l \tag{32}$$

$$\frac{d'}{1+r} \leq \phi(y_2 + py_{N2}) \tag{33}$$

$$C_{T3} = y_3 - d' \tag{34}$$

The optimality conditions are given by

$$\begin{aligned}
&\text{FOC}(C_{T2}) : \lambda = \frac{\omega_T}{C_{T2}} \\
&\text{FOC}(d') : \lambda = \mu + \beta(1+r)\frac{\omega_T}{C_{T3}}
\end{aligned} \tag{35}$$

where λ and μ are the Lagrangian multipliers associated with equations (32) and (33).

In the first period, the optimality conditions for d and l are given by

$$\begin{aligned}
\frac{\omega_T}{C_{T1}} &= \beta(1+r)E_1\left[\frac{\omega_T}{C_{T2}}\right] \\
\frac{\omega_T}{C_{T1}}(1-\theta) &= \beta E_1\left[\frac{\omega_T}{C_{T2}}\rho\right]
\end{aligned}$$

Simplifying the last optimality condition, the following relationship holds.

$$\begin{aligned}
\frac{\omega_T}{C_{T1}}(1-\theta) &= \beta E_1\left[\frac{\omega_T}{C_{T2}}\rho\right] = \beta(1+r)E_1\left[\frac{\omega_T}{C_{T2}}\frac{p}{E[p]}\right] \\
&= \beta(1+r)\frac{E_1\left[\frac{\omega_T}{C_{T2}}\right]E_1[p] + \text{cov}\left(\frac{\omega_T}{C_{T2}}, p\right)}{E[p]} \\
&< \beta(1+r)E_1\left[\frac{\omega_T}{C_{T2}}\right]
\end{aligned}$$

We can also define the marginal benefit function for issuing local-currency debt as follows

$$MB(d^*, l, \theta) \equiv \frac{\omega_T}{C_{T1}}(1-\theta) - \beta E_1\left[\frac{\omega_T}{C_{T2}}\rho\right]$$

We can see that $MB(d^*, l, 0) > 0$ and $MB(d^*, l, 1) < 0$. Furthermore, $MB_{d^*} < 0$, $MB_l < 0$ and $MB_\theta < 0$. Therefore, there exists $\underline{\theta}$ such that $MB(d^*, l, \underline{\theta}) = 0$. For $\theta < \underline{\theta}$, $MB(d^*, l, \theta) >$

$MB(d^*, l, \underline{\theta}) = 0$. The equilibrium condition features a corner solution with only local currency issuance. Similarly, define $\bar{\theta}$ satisfying $MB(d^*, 0, \bar{\theta}) = 0$. In this case, for $\theta > \bar{\theta}$, $MB(d^*, l, \theta) < MB(d^*, 0, \bar{\theta}) = 0$ and the equilibrium features zero local-currency debt. In the case of $\theta \in (\underline{\theta}, \bar{\theta})$, there is a combination of local-currency and dollar debt. Furthermore, one can also show that as θ increases l decreases. Similarly, one can show that an increase in θ increases d.

The problem of the social planner is given as follows.

$$
\begin{aligned}
\max_{d, l, C_{T1}, C_{T2}, d', C_{T3}} \quad & \omega_T \log C_{T1} + \beta E[\omega_T \log C_{T2} + \omega_N \log y_{N2} + \beta \omega_T \log C_{T3}] \\
\text{s.t.} \quad & C_{T1} = \frac{d}{1+r} + (1-\theta) l \\
& C_{T2} = y_2 - d + \frac{d'}{1+r} - \rho(C_{T2}, E[C_{T2}]) l \\
& \frac{d'}{1+r} \leq \phi \left(y_2 + \frac{\omega_N}{\omega_T} C_{T2} \right) \\
& C_{T3} = y_3 - d'
\end{aligned}
$$

The optimality conditions are given by

$$
\begin{aligned}
&\text{FOC}(d): \frac{\omega_T}{C_{T1}} = \beta(1+r) E[\lambda^C] \\
&\text{FOC}(l): \frac{\omega_T}{C_{T1}}(1-\theta) = \beta E[\lambda^C \rho] \\
&\text{FOC}(C_{T2}): \lambda^C = \frac{\frac{\omega_T}{C_{T2}} + \phi \mu^C \frac{\omega_N}{\omega_T}}{1 + l \left(\frac{\partial \rho}{\partial C_{T2}} + f(y_2) \frac{\partial \rho}{\partial E[C_{T2}]} \right)} \\
&\text{FOC}(d'): \lambda^C = \mu^C + \beta(1+r) \frac{\omega_T}{C_{T3}}
\end{aligned}
$$

where λ^C, μ^C are the Lagrangian multipliers for the period-2 budget constraint and collateral constraint respectively and $f(y_2)$ is the density function of state y_2 at time 2.

To implement the social planner's allocation, one needs three sets of capital controls $\{\tau_d, \tau_l, \tau d'\}$

together with lump-sum transfers $\{T, T'\}$. With those capital control policies, the budget constraints for the social planner change into

$$
\begin{aligned}
C_{T1} &= \frac{d}{1+r}(1-\tau_d) + l(1-\theta)(1-\tau_l) + T \\
pC_{N2} + C_{T2} &= py_{N2} + y_2 - d - \rho l + \frac{d'}{1+r}(1-\tau_{d'}) + T'
\end{aligned}
$$

with $T = \tau_d \frac{d}{1+r} + l(1-\theta)\tau_l$ and $T' = \frac{d'}{1+r}\tau_{d'}$.

By comparing the first-order conditions, one need

$$
\begin{aligned}
\tau_d &= \beta(1+r)E_1\left[\frac{\phi\mu^C\frac{\omega_N}{\omega_T} - \frac{\omega_T}{C_{T2}}l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}{1 + l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}\right] \Big/ \left(\frac{\omega_T}{C_{T1}}\right) \\
\tau_l &= \beta E_1\left[\frac{\phi\mu^C\frac{\omega_N}{\omega_T} - \frac{\omega_T}{C_{T2}}l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}{1 + l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}\rho\right] \Big/ \left(\frac{\omega_T}{C_{T1}}\right) \Big/ (1-\theta) \\
\tau_{d'} &= \frac{l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}{1 + l\left(\frac{\partial\rho}{\partial C_{T2}} + f(y_2)\frac{\partial\rho}{\partial E[C_{T2}]}\right)}
\end{aligned}
$$

E.8 Proof of Proposition 11

Proof. Define the net worth at the beginning of period 2 by $m = (1-s)y_2 - d$. The state variables in period 2 include $\{m, s, y_2\}$. The original problem can be written as

$$
\begin{aligned}
&\max_{s,d} \omega_T \log C_{T1} + \beta E_1[V(m, s, y_2)], \\
&\text{s.t. } C_{T1} = s(1-\theta)y_1 + \frac{d}{1+r},\ m = (1-s)y_2 - d.
\end{aligned}
$$

where $V(m,s,y_2)$ is given by

$$V(m,s,y_2) = \max_{C_{N2},C_{T2},C_{T3},d',s'\in[0,1-s]} \omega_T \log C_{T2} + \omega_N \log C_{N2} + \beta\omega_T \log C_{T3},$$

$$\text{s.t.} \quad pC_{N2} + C_{T2} = m + py_{N2} + \frac{d'}{1+r} + s'(1-\theta)\frac{y_3}{1+r} \tag{36}$$

$$\frac{d'}{1+r} \leq \phi((1-s)y_2 + py_{N2}) \tag{37}$$

$$C_{T3} = y_3 - d' - (s+s')y_3 \tag{38}$$

Period 2's problem The optimality conditions in period 2 are given by

$$\text{FOC}(C_{T2}) : \lambda = \frac{\omega_T}{C_{T2}}$$

$$\text{FOC}(d') : \lambda = \mu + \beta(1+r)\frac{\omega_T}{C_{T3}}$$

$$\text{FOC}(s') : \lambda = \theta\lambda + \beta(1+r)\frac{\omega_T}{C_{T3}}$$

where λ and μ are the Lagrangian multipliers associated with equations (36) and (37), respectively.

Depending on the state variables $\{m,s,y_2\}$, the financial constraint might be either slack or binding. When the constraint is slack, i.e. $\mu = 0$, we have $s' = 0$ since the bond financing is cheaper than the equity financing. In this case, the desired level of bond financing is given by

$$d' = \frac{(1-s)y_3 - \beta(1+r)m}{1+\beta}$$

The constraint is slack iff

$$\frac{d'}{1+r} \leq \phi\left(\frac{\omega_N}{\omega_T}C_{T2} + (1-s)y_2\right) = \phi\left(\frac{\omega_N}{\omega_T}\left(m + \frac{d'}{1+r}\right) + (1-s)y_2\right) \leq \frac{\phi\frac{\omega_N}{\omega_T}m + \phi(1-s)y_2}{1-\phi\frac{\omega_N}{\omega_T}}$$

When this condition is violated, $\mu > 0$, the interior solution of $\{C_{T2}, C_{T3}, s'\}$ is given by

$$
\begin{aligned}
C_{T2} &= m + s'(1-\theta)\frac{y_3}{1+r} + \phi\left((1-s)y_2 + \frac{\omega_N}{\omega_T}C_{T2}\right) \\
C_{T3} &= (1-s-s')y_3 - (1+r)\phi\left((1-s)y_2 + \frac{\omega_N}{\omega_T}C_{T2}\right), \\
(1-\theta)\frac{\omega_T}{C_{T2}} &= \beta(1+r)\frac{\omega_T}{C_{T3}}
\end{aligned}
$$

The solution s' is given by

$$
s' = s'(y_2, y_3, s, d) \equiv \frac{(1-s)[y_3 - \phi(1+r)y_2] - \frac{(1+r)(\beta/(1-\theta)+\phi\omega_N/\omega_T)}{1-\phi\omega_N/\omega_T}[(1-\phi)(1-s)y_2 - d]}{y_3 + \frac{(\beta/(1-\theta)\phi\omega_N/\omega_T)(1-\theta)y_3}{1-\phi\omega_N/\omega_T}}
$$

When $s'(y_2, y_3, s, d) > 1-s$, the allocation is given by the following conditions

$$
\begin{aligned}
C_{T2} &= m + s'(1-\theta)\frac{y_3}{1+r} + \phi\left((1-s)y_2 + \frac{\omega_N}{\omega_T}C_{T2}\right) \\
C_{T3} &= y_3(1-s-s')y_3 - (1+r)\phi\left((1-s)y_2 + \frac{\omega_N}{\omega_T}C_{T2}\right), \\
s' &= 1-s
\end{aligned}
$$

Period 1's problem The allocation in the first period is given by the following optimality conditions

$$
\begin{aligned}
\text{FOC}(d) &: \frac{\omega_T}{C_{T1}} = \beta(1+r)\beta E_1\left[\frac{\partial V}{\partial m}\right] \\
\text{FOC}(s) &: \frac{\omega_T}{C_{T1}}(1-\theta)y_1 = \beta(1+r)\beta E_1\left[\frac{\partial V}{\partial m}y_2 - \frac{\partial V}{\partial s}\right]
\end{aligned}
$$

Social planner's problem The social planner internalizes the general equilibrium effect through the real exchange rate. Her problem is given by

$$\max_{s,d} \omega_T \log C_{T1} + \beta E_1 \left[V^{SP}(m,s,y_2) \right],$$
$$\text{s.t. } C_{T1} = s(1-\theta)y_1 + \frac{d}{1+r},\ m = (1-s)y_2 - d.$$

where $V^{SP}(m,s,y_2)$ is given by

$$V^{SP}(m,s,y_2) = \max_{C_{T2},C_{T3},d',s'\in[0,1-s]} \omega_T \log C_{T2} + \omega_N \log y_{N2} + \beta\omega_T \log C_{T3},$$

$$\text{s.t.} \quad C_{T2} = m + \frac{d'}{1+r} + s'(1-\theta)\frac{y_3}{1+r} \tag{39}$$

$$\frac{d'}{1+r} \leq \phi\left((1-s)y_2 + \frac{\omega_N}{\omega_T}C_{T2}\right) \tag{40}$$

$$C_{T3} = y_3 - d' - (s+s')y_3 \tag{41}$$

The optimality conditions in the second period are given by

$$\text{FOC}(C_{T2}) : \lambda^{SP} = \frac{\omega_T}{C_{T2}} + \phi\frac{\omega_N}{\omega_T}\mu^{SP}$$
$$\text{FOC}(d') : \lambda^{SP} = \mu^{SP} + \beta(1+r)\frac{\omega_T}{C_{T3}}$$
$$\text{FOC}(s') : \lambda^{SP} = \theta\lambda^{SP} + \beta(1+r)\frac{\omega_T}{C_{T3}}$$

where λ^{SP} and μ^{SP} are the Lagrangian multipliers associated with equations (39) and (40), respectively. The allocation when the constraint is slack is the same as in the competitive equilibrium.

However, the allocation when the constraint binds is different and given by

$$C_{T2} = m + s'(1-\theta)\frac{y_3}{1+r} + \phi\left((1-s)y_2 + \frac{\omega_N}{\omega_T}C_{T2}\right)$$
$$C_{T3} = y_3(1-s-s')y_3 - d',$$
$$\left(1-\theta\frac{1-\phi\omega_N/\omega_T}{1-\theta\phi\omega_N/\omega_T}\right)\frac{\omega_T}{C_{T2}} = \beta(1+r)\frac{\omega_T}{C_{T3}}$$

Therefore, one needs to put an ex-post tax on equity issuance. Suppose we introduce a tax τ_s' on equity issuance and a lump-sum transfer as follows.

$$pC_{N2} + C_{T2} = m + py_{N2} + \frac{d'}{1+r} + (1-\tau_s')s'(1-\theta)\frac{y_3}{1+r} + T \tag{42}$$

where $T = \tau_s' s'(1-\theta)\frac{y_3}{1+r}$.

In this case, the optimality condition for s' becomes

$$(1-\theta)(1-\tau_s')\frac{\omega_T}{C_{T2}} = \beta(1+r)\frac{\omega_T}{C_{T3}}$$

We need $\tau_s' = -\frac{\theta\phi\omega_N/\omega_T}{1-\theta\phi\omega_N/\omega_T} < 0$ to close the gap between the social planners and the private agents' allocations. Given that the wedge is negative, the private agents' choice features too little equity financing relative to relative to that of the social planner.

The inefficiency also shows up in the different valuations of wealth λ^{SP} and λ. For the social planner, the envelope theorem implies that

$$\frac{\partial V^{SP}}{\partial m} = \lambda^{SP} = \frac{\omega_T}{C_{T2}} + \phi\frac{\omega_N}{\omega_T}\mu^{SP} \geq \frac{\omega_T}{C_{T2}} = \frac{\partial V}{\partial m}$$

Therefore, capital controls in the first period are needed to correct this inefficiency. Furthermore, there will be overborrowing due to the positive wedge above. The proof is similar to that in Appendix E.5. To fully correct the externality, the social planner has to use both an ex-ante tax on capital flows in the first period and an ex-post policy intervention τ_s'. $\square$