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essays in international economics

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Part I

Introduction

This dissertation contains three essays that model private entities' cross border activities in the presence of contractual imperfections, and apply techniques in applied macroeconomics to verify the theoretical results derived. The first essay sets up a decentralized international borrowing arrangement to study the channel through which the absence of formal enforcement on a debt contract between citizens can slacken private sector's credit constraint in the international asset market. The second empirical paper completes the first essay via investigating, in a sample consisting of 73 developing and emerging market countries over the period 2004-2009, whether weaker domestic debt enforcement is associated with a larger amount of external debts owed by private sectors to outside creditors. The last essay turns to the field of vertical intrafirm trade, where I build an incomplete contract framework to show that the number of foreign affiliates (extensive margin) accounts for a greater share of the changes in aggregate intrafirm trade than the variation in the average exports per affiliate (intensive margin). This prediction is estimated using a 2007 cross-industry dataset on the number of affiliates as well as their shipments to parent multinational companies headquartered in the United States.

In particular, the first essay studies the effects of private international debt on risk sharing and welfare, where individual residents are assumed to have access to both international and domestic asset markets. Like Jeske (2006), the assumption is that domestic

residents cannot commit to repay their debts across borders. Unlike the previous literature, the novel feature in this paper is the introduction of unenforceable debt contracts within borders. The pervasive risk of default creates heterogeneity in marginal rate of substitution (MRS hereafter) for countries that are, as a whole, participation constrained in the international asset market. This leads to harsher punishment for international debt defaulters and hence allows more international risk sharing than a complete market setup. The paper shows how this improvement depends upon the interaction between the endogenous borrowing constraints in either market. The second essay tests whether a country's strength of enforcing domestic debt contract can exert a negative influence on its private sector's ability to borrow in the international asset market. Quality internal institution raises post-default value on external debt, which in turn may cause foreign creditors to tighten credit constraint. This hypothesis is based on the notion that the positive effects of both international contract enforcement and the broad quality of institutions have been successfully distinguished and controlled for in the data. In a dataset consisting of 73 developing and emerging market countries, I find that private sectors in countries with more efficient domestic courts accumulate relatively less debt owed overseas. In the third essay, The firm-level approach to intra-industry trade reveals that the variation in the number of exporters or exported varieties (extensive margin) accounts for a greater share of the changes in aggregate trade than the variation in the average exports per firm-variety (intensive margin). Using Bureau of Economic Analysis' U.S. Multinational Company data of 2007, this paper shows vertical intrafirm trade follows a similar pattern. Like Antràs (2003), the share of intrafirm imports in total U.S. imports

is found to be higher, the higher the headquarters intensity of the exporting affiliates in foreign countries. This paper further demonstrates this increase in imports is mainly due to the establishment of a large number of foreign affiliates. In addition, lower trade barriers and a better investment environment in a country attract greater amounts of U.S. direct investment, and this attraction materializes mostly in terms of new affiliates than in terms of more sales per existing affiliate. The endogenous choice of optimal number of affiliates can be rationalized in a theoretical framework that combines three ingredients—Antràs' property-rights model, Melitz's heterogeneity view on productivity applied to affiliates, and a multiproduct setup. Therefore, the paper's key contribution lies in identifying the extensive margin of intrafirm trade—headquarters-intensive firms tend to integrate larger numbers of productive suppliers as affiliates, and will redraw their boundaries under trade liberalization.

Part II

Private Debt with Pervasive Risk of Default

1 Introduction

In the presence of limited commitments, regardless of complete asset markets, international loans are made available only to the extent their repayments can be enforced by the threat of imposing penalties to the debtor country, such as infinite reversion to autarky. This commitment problem creates limited risk sharing among countries, and the risk-sharing size is determined by the specification of outside options. Jeske (2006) argues that in economies where domestic debt contracts are enforceable but international contracts are not, a centralized setting where only a government borrows internationally and redistributes domestically may allow more capital flows and thus achieve a higher social welfare than a decentralized arrangement, where individuals have access to capital markets. This is because individuals can continue to insure consumption risk through domestic complete and frictionless asset markets even after defaulting on international debt and therefore their implied (endogenous) debt constraints are tighter. A central planner by construction does not have an alternative insurance option and its aggregate participation constraints are relatively loose.

This paper asks what if domestic debts are too unenforceable. Compared to international defaulters who are excluded from foreign markets but retaining access to domestic markets, domestic defaulters are penalized harsher by exclusion from all markets. This degree of creditor discrimination seems more realistic than the previous one where domestic creditors are fully protected. The lack of legal enforcement in domestic debts has opposite effects on a small open economy's welfare. On the one hand, it may hamper internal risk sharing (negative effect), but on the other hand, it intensifies punishment for external debt default and induces increments in infusion of overseas capital (positive effect). The logic behind the latter is that international defaulters' scheme of using the non-defaulted as intermediaries to reaccess external markets will be restricted in an imperfect domestic environment. The question then becomes which effect dominates. The positive effect overwhelms suggests that the object of welfare comparison is a private international debt setup with complete domestic markets. The reason is that agents on the edge of domestic default enjoy an increase in foreign capital inflow, while domestically unconstrained agents remain unaffected. When centralized borrowing is the benchmark for comparison, welfare effects can go either way. The paper demonstrates in a numerical example that centralization is superior only if the endowment structure is such that income fluctuation across countries is large relative to variation across agent types within a country. Hence, there exists a rationale for government in decentralized economies with extensive wealth disparity to sacrifice domestic debts enforcement for more international risk sharing.

The prevalence of default risk also causes a hierarchy of pricing rules. In closed

economy models, domestic interest rate is the lowest rate possible to ensure repayment.[1] In open economies with enforceable domestic debts, the international interest rate is determined by the lowest domestic interest rate in different countries around the world, and MRS within any country is equalized.[2] The feature in this model is a nested rate structure: domestic interest rate in a constrained country equals to the lowest rate among all residents, and international rate in turn equals to the minimum domestic rate. This wider gap between international and domestic financing costs raises the international borrowing quota and rewards domestically constrained agents with a higher utility level.

Of critical importance in this literature is what defaulters might be entitled. Several related works replace complete exclusion[3] with partial exclusion, under which defaulters retain some access to markets or have alternative ways to smooth consumption. This causes international risk sharing to diminish further in size, since life after a default is less painful than it would otherwise be. Partial exclusion arises if defaulters can reenter the international asset market indirectly through intermediaries as in Jeske (2001; 2006). Wright (2006) builds on Jeske's model and argues that international borrowing subsidies can also lead to constrained efficient allocations, instead of Jeske's radical way of centralization. A defaulter continuing to take advantage of international savings gives rise to partial exclusion as well. Bulow and Rogoff (1989) first use this idea and prove that borrowing cannot be supported in a small open economy that takes the international interest rate as given (partial equilibrium). Hellwig and Lorenzoni (2007) carry their work

[1] See, e.g., Alvarez and Jermann (2000; 2001); Azariadis and Lambertini (2002).
[2] See, e.g., Jeske (2006); Wright (2006).
[3] See, e.g., Kehoe and Levine (1993); Kocherlakota (1996); Alvarez and Jermann (2000); Kehoe and Perri (2002; 2004).

forward to a multi-country (general equilibrium) setup, where they show international risk sharing can exist with low interest rates. Then, Wright (2006) establishes some equivalence between the above two modeling methods on partial exclusion, if the extra dimension of heterogeneity among residents in Jeske's model is accommodated. Reduced penalty can be due to other internal opportunities. For instance, Kehoe and Perri (2002; 2004) study international risk sharing in a real business cycle model with productivity shock, where the autarky value depends upon the quantity of capital the country has accumulated up to default. Defaulters continue to produce and employ capital in autarky, but are not allowed to buy or sell capital and other financial assets. Broner and Ventura (2011) assume that countries cannot discriminate against foreign creditors. Thus, international risk sharing is obtained even in the absence of default penalty. Unlike this paper's model, where residents make default decisions (decentralized arrangement) and the government only decides whether or not to enforce domestic debt, the government in their setup makes default decisions on behalf of all residents (sovereign default) and chooses endogenously whether to enforce all debt contracts or none. Broner and Ventura (2011) show a decrease of trade barriers in goods market facilitates international trade and raises the cost of enforcement. As a result, government may favor enforcing none after globalization to prevent large amount of capital outflow at the cost of hampering domestic trade. Similar to their findings, the government in this study also chooses not to enforce in order to encourage international capital inflow at the expense of hindering domestic risk sharing.

The remainder of this paper is organized as follows. Section 2 presents the model

and derives equilibrium results. Section 3 compares the social welfare in a private international debt setup with that under a centralized arrangement. Section 4 introduces a simple example aimed at illustrating the essence of the problem. Section 5 concludes, followed by a technical Appendix A at the end of this dissertation.

2 The Model

The world economy consists of a finite number of countries denoted as $m \in \{1, 2, ..., M\}$. Each country is populated by a finite number of types, denoted by $n \in \{1, 2, ..., N\}$, with a continuum of residents in each type. Time t is infinite and discrete. Information is indexed by state $\theta_t \in \Theta$ and history $\theta^t \equiv \{\theta^0, \theta_1, ..., \theta_t\} \in \Theta^t$ with θ^0 given. Transition probability from history θ^t to the next period's state θ_{t+1} is known as $\pi\left(\theta_{t+1}|\theta^t\right)$. $\pi\left(\theta^t\right)$ is the unconditional probability of observing θ^t, and $\pi\left(\theta^r|\theta^t\right)$ is the probability of observing θ^r conditional on having been in θ^t. There is one non-storable goods denoted by $e_n^m\left(\theta^t\right)$, the endowment of type n in country m at θ^t, and by $c_n^m\left(\theta^t\right)$, the corresponding consumption. $M+1$ number of one-period maturity securities are traded in the economy—M domestic bonds for each country and one international bond. Let $b_n^m\left(\theta^t, \theta_{t+1}\right)$ and $f_n^m\left(\theta^t, \theta_{t+1}\right)$, respectively, be the amounts of domestic and international state-contingent bonds held by type n in country m, purchased at θ^t and for payment next period in state θ_{t+1}; $p^m\left(\theta^t, \theta_{t+1}\right)$ and $q\left(\theta^t, \theta_{t+1}\right)$ are their respective prices. Use $\beta \in (0, 1)$ as the discount factor and denote $U(\cdot)$ as the single-period utility function, which is strictly increasing, strictly concave, and twice continuously differentiable. A

representative resident of type n living in country m has preference,

$$\sum_{r=t}^{\infty} \beta^{r-t} \sum_{\theta^r|\theta^t} \pi\left(\theta^r|\theta^t\right) U\left(c_n^m\left(\theta^r\right)\right),$$

after θ^t with $t \in [0, \infty)$.

Risk of default is pervasive in a sense that debt contracts between any two parties are not enforced. Border is still important because default on domestic bond leads to a harsher punishment than the penalty for default on international bond. To be specific, domestic bond defaulters are denied access to both domestic and international asset markets forever, thereby receiving a utility level of **Resident's Autarky (RA)**,

$$A_n^m\left(\theta^r\right) \equiv \sum_{s=r}^{\infty} \beta^{s-r} \sum_{\theta^s|\theta^r} \pi\left(\theta^s|\theta^r\right) U\left(e_n^m\left(\theta^s\right)\right), \tag{RA}$$

given the domestic default happened at θ^r. In contrast, international bond defaulters prohibited from any future access to the international asset market can still trade bond overseas indirectly through borrowing from other non-defaulted residents in the domestic asset market. I will hereafter refer to this situation as **Resident's International Autarky (RIA)**, which offers the following post-default value given the international default occurred at θ^t.[4]

$$V_n^m\left(\theta^t, b_n^m\left(\theta^t\right)\right) \equiv \max_{\left\{c_n^m(\theta^r), b_n^m(\theta^r, \theta_{r+1})\right\}_{r\in[t,\infty)}} \sum_{r=t}^{\infty} \beta^{r-t} \sum_{\theta^r|\theta^t} \pi\left(\theta^r|\theta^t\right) U\left(c_n^m\left(\theta^r\right)\right), \tag{RIA}$$

[4]Since individual's influences are miniscule relative to the market, a single international bond defaulter does so by assuming that domestic bond prices stay unchanged after her default.

subject to the budget constraint,

$$e_n^m(\theta^r) + b_n^m(\theta^r) \geqslant c_n^m(\theta^r) + \sum_{\theta_{r+1}} p^m(\theta^r, \theta_{r+1})\, b_n^m(\theta^r, \theta_{r+1}), \tag{RIA-BC}$$

the participation constraint in the domestic asset market,

$$\sum_{s=r}^{\infty} \beta^{s-r} \sum_{\theta^s|\theta^r} \pi(\theta^s|\theta^r)\, U(c_n^m(\theta^s)) \geqslant A_n^m(\theta^r), \tag{RIA-PC}$$

and the no-Ponzi game condition,

$$b_n^m(\theta^r, \theta_{r+1}) \geqslant -\bar{B},$$

with $b_n^m\left(\theta^t\right)$ and $\{p^m(\theta^r, \theta_{r+1})\}_{r\in[t,\infty)}$ given, $\forall\theta^r$ with $r \in [t, \infty)$. $\bar{B} > 0$ is sufficiently large to ensure compactness of the budget set. Let $\left\{c_n^{m,D}(\theta^r)\right\}_{r\in[t,\infty)}$ be the optimal consumption path to the (RIA) problem with initial history θ^t and inherited obligations $b_n^m\left(\theta^t\right)$. First order condition with respect to $c_n^m(\theta^r)$ is

$$\lambda_n^m(\theta^r) = \beta^{r-t}\pi\left(\theta^r|\theta^t\right) U'\left(c_n^{m,D}(\theta^r)\right)\left[1 + \sum_{s=t}^{r}\sum_{\theta^r|\theta^s} \nu_n^m(\theta^s)\,\beta^{t-s}\frac{\pi(\theta^r|\theta^s)}{\pi\left(\theta^r|\theta^t\right)}\right], \tag{1}$$

where $\lambda_n^m(\theta^r)$ and $\nu_n^m(\theta^r)$ denote, respectively, the Lagrange multipliers on the budget constraint (RIA-BC) and the domestic participation constraint (RIA-PC) if θ^r occurs.

The outside options for both domestic and international bond defaulters have been defined at this point. Next, the **Resident's Problem (RP)** at period 0 is established

before any default.

$$\max_{\left\{c_n^m\left(\theta^t\right),b_n^m\left(\theta^t,\theta_{t+1}\right),f_n^m\left(\theta^t,\theta_{t+1}\right)\right\}_{t\in[0,\infty)}} \sum_{t=0}^{\infty}\beta^t\sum_{\theta^t}\pi\left(\theta^t\right)U\left(c_n^m\left(\theta^t\right)\right), \tag{RP}$$

subject to the budget constraint,

$$\begin{aligned} & e_n^m\left(\theta^t\right)+b_n^m\left(\theta^t\right)+f_n^m\left(\theta^t\right) && \text{(RP-BC)}\\ \geqslant\ & c_n^m\left(\theta^t\right)+\sum_{\theta_{t+1}}p^m\left(\theta^t,\theta_{t+1}\right)b_n^m\left(\theta^t,\theta_{t+1}\right)+\sum_{\theta_{t+1}}q\left(\theta^t,\theta_{t+1}\right)f_n^m\left(\theta^t,\theta_{t+1}\right), \end{aligned}$$

the participation constraint in the international asset market,

$$\sum_{r=t}^{\infty}\beta^{r-t}\sum_{\theta^r|\theta^t}\pi\left(\theta^r|\theta^t\right)U\left(c_n^m\left(\theta^r\right)\right)\geqslant V_n^m\left(\theta^t,b_n^m\left(\theta^t\right)\right), \tag{RP-IPC}$$

the participation constraint in the domestic asset market,

$$\sum_{r=t}^{\infty}\beta^{r-t}\sum_{\theta^r|\theta^t}\pi\left(\theta^r|\theta^t\right)U\left(c_n^m\left(\theta^r\right)\right)\geqslant A_n^m\left(\theta^t\right), \tag{RP-DPC}$$

and the no-Ponzi game conditions,

$$b_n^m\left(\theta^t,\theta_{t+1}\right)\geqslant-\bar{B},\ f_n^m\left(\theta^t,\theta_{t+1}\right)\geqslant-\bar{F},$$

with $b_n^m\left(\theta^0\right)$, $f_n^m\left(\theta^0\right)$, and $\left\{p^m\left(\theta^t,\theta_{t+1}\right),q\left(\theta^t,\theta_{t+1}\right)\right\}_{t\in[0,\infty)}$ given, $\forall\theta^t$ with $t\in[0,\infty)$.

First order conditions with respect to $c_n^m\left(\theta^t\right)$, $b_n^m\left(\theta^t,\theta_{t+1}\right)$, and $f_n^m\left(\theta^t,\theta_{t+1}\right)$ are:

$$\kappa_n^m\left(\theta^t\right)=\beta^t\pi\left(\theta^t\right)U'\left(c_n^m\left(\theta^t\right)\right)\left[1+\sum_{s=0}^{t}\sum_{\theta^t|\theta^s}\beta^{-s}\left[\mu_n^m\left(\theta^s\right)+\hat{\mu}_n^m\left(\theta^s\right)\right]\frac{\pi\left(\theta^t|\theta^s\right)}{\pi\left(\theta^t\right)}\right], \tag{2}$$

$$p^m\left(\theta^t,\theta_{t+1}\right)=\frac{\kappa_n^m\left(\theta^t,\theta_{t+1}\right)-\mu_n^m\left(\theta^t,\theta_{t+1}\right)\frac{dV_n^m\left(\left(\theta^t,\theta_{t+1}\right),b_n^m\left(\theta^t,\theta_{t+1}\right)\right)}{db_n^m\left(\theta^t,\theta_{t+1}\right)}}{\kappa_n^m\left(\theta^t\right)}, \tag{3}$$

$$q\left(\theta^t,\theta_{t+1}\right)=\frac{\kappa_n^m\left(\theta^t,\theta_{t+1}\right)}{\kappa_n^m\left(\theta^t\right)}, \tag{4}$$

where $\kappa_n^m\left(\theta^t\right)$, $\mu_n^m\left(\theta^t\right)$, and $\hat{\mu}_n^m\left(\theta^t\right)$ denote, respectively, the Lagrange multipliers on the budget constraint (RP-BC), the international participation constraint (RP-IPC), and the domestic participation constraint (RP-DPC) if θ^t occurs.

A default-free equilibrium of the economy (as defined below) can thus be constructed, given that sophisticated default prevention constraints are imposed on the level of atomistic agents.

Definition 1 *A **Trade Equilibrium** is an allocation*

$$\left\{c_n^m\left(\theta^t\right),b_n^m\left(\theta^t,\theta_{t+1}\right),f_n^m\left(\theta^t,\theta_{t+1}\right)\right\}_{t\in[0,\infty)}$$

and a price sequence $\left\{p^m\left(\theta^t,\theta_{t+1}\right),q\left(\theta^t,\theta_{t+1}\right)\right\}_{t\in[0,\infty)}$ *such that each type solves its (RP) given prices and initial bond holdings, while the resource feasibility,*

$$\sum_{m=1}^{M}\sum_{n=1}^{N}c_n^m\left(\theta^t\right)\leq\sum_{m=1}^{M}\sum_{n=1}^{N}e_n^m\left(\theta^t\right),$$

M domestic asset market clearing conditions,

$$\sum_{n=1}^{N} b_n^m\left(\theta^t, \theta_{t+1}\right) = 0, \ \forall m, \theta_{t+1},$$

and one international asset market clearing condition,

$$\sum_{m=1}^{M}\sum_{n=1}^{N} f_n^m\left(\theta^t, \theta_{t+1}\right) = 0, \ \forall \theta_{t+1},$$

are satisfied $\forall \theta^t$ *with* $t \in [0, \infty)$.

Turning to equilibrium characteristics, the analysis begins by focusing on agents with $\mu_n^m\left(\theta^t, \theta_{t+1}\right) > 0$, particularly, their consumption path and the externality of their borrowing decisions. A strictly positive multiplier μ implies the corresponding (RP-IPC) holds with equality, so that those private borrowers are *participation constrained* in the international asset market at $\left(\theta^t, \theta_{t+1}\right)$ and hence *borrowing constrained* at θ^t in obtaining international debt for payment next period in state θ_{t+1}.

Lemma 2 *At every future history that grows out of* $\left(\theta^t, \theta_{t+1}\right)$*, residents with* $\mu_n^m\left(\theta^t, \theta_{t+1}\right)$ *strictly greater than* 0 *consume the same amount after an international bond default as by staying undefaulted,*

$$c_n^{m,D}\left(\theta^r, \theta_{r+1}\right) = c_n^m\left(\theta^r, \theta_{r+1}\right), \ \forall r \in [t, \infty).$$

Proof. *According to the second part of Lemma 10 in Appendix A,* $\mu_n^m\left(\theta^t, \theta_{t+1}\right) > 0$ *implies that both* $\left\{c_n^{m,D}\left(\theta^r, \theta_{r+1}\right)\right\}_{r\in[t,\infty)}$ *and* $\left\{c_n^m\left(\theta^r, \theta_{r+1}\right)\right\}_{r\in[t,\infty)} \subseteq \left\{c_n^m\left(\theta^t\right)\right\}_{t\in[0,\infty)}$ *solve*

the strictly convex problem (RIA), thereby identical on and after $\left(\theta^t, \theta_{t+1}\right)$. ■

Lemma 3 *For all histories, either all types in a country are internationally participation constrained, i.e.,* $\mu_n^m(\theta^t, \theta_{t+1}) > 0$, $\forall n$, *or none.*

Proof. $\forall m, \left(\theta^t, \theta_{t+1}\right)$, *without loss of generality suppose* $\mu_1^m\left(\theta^t, \theta_{t+1}\right) > 0$ *and thus, using bond price formulas (A.2) and (A.3) from Appendix A,* $q\left(\theta^t, \theta_{t+1}\right) > p^m\left(\theta^t, \theta_{t+1}\right)$, *which the other way around implies* $\mu_n^m\left(\theta^t, \theta_{t+1}\right) > 0$, $\forall n$ *for this price inequality applies to every type in country* m. ■

In an internationally unconstrained country, all residents are unconstrained for domestic debt since the slackness of (RP-IPC) means (RP-DPC) is slack as well. Both shadow prices $\mu_n^m\left(\theta^t, \theta_{t+1}\right)$ and $\hat{\mu}_n^m\left(\theta^t, \theta_{t+1}\right)$ equal to 0. The MRS in this country is therefore equalized across different types, and the international bond price is determined by this MRS, which in turn equals to the country's domestic bond price to rule out arbitrage possibilities. Oppositely, when a country is as a whole participation constrained in the international asset market, the mutual MRS of its agents unconstrained for domestic debt is higher than a host of heterogeneous MRS's of those constrained within borders.

Proposition 4 *In the* ***Trade Equilibrium****,* $\forall n, m, \left(\theta^t, \theta_{t+1}\right)$, *the domestic bond price is the maximum MRS in country* m,

$$p^m\left(\theta^t, \theta_{t+1}\right) = \max_{n=1,2,\ldots,N}\left\{\beta\frac{U'\left(c_n^m\left(\theta^t, \theta_{t+1}\right)\right)}{U'\left(c_n^m\left(\theta^t\right)\right)}\pi\left(\theta_{t+1}|\theta^t\right)\right\};$$

and the international bond price is the maximum of all domestic bond prices,

$$q\left(\theta^t, \theta_{t+1}\right) = \max_{m=1,2,\ldots,M} \left\{p^m\left(\theta^t, \theta_{t+1}\right)\right\}.$$

Proof. *The first part is proved by seeking a contradiction. The result is obvious in participation unconstrained countries, so focus on a constrained country. It is given that the international participation constraint (RP-IPC) binds for all residents in a constrained country. As can be seen in (A.4), a constrained country's domestic bond price* $p^m\left(\theta^t, \theta_{t+1}\right)$ *is determined by the MRS of residents unconstrained for domestic debt. Suppose this price is not the maximum MRS. Given a higher MRS than* $p^m\left(\theta^t, \theta_{t+1}\right)$*, those domestically constrained residents with* $\nu_n^m\left(\theta^t, \theta_{t+1}\right) > 0$ *will start to lend at* $p^m\left(\theta^t, \theta_{t+1}\right)$*. Since the RHS of (RP-IPC) grows faster than its LHS when* $b_n^m\left(\theta^t, \theta_{t+1}\right)$ *increases,*

$$\left[1 + \nu_n^m\left(\theta^t, \theta_{t+1}\right)\right] U'\left(c_n^{m,D}\left(\theta^t, \theta_{t+1}\right)\right) > U'\left(c_n^m\left(\theta^t, \theta_{t+1}\right)\right),$$

the international participation constraint is violated and a default occurs; this contradicts our original hypothesis that (RP-IPC) is satisfied. Therefore it must not be true that $p^m\left(\theta^t, \theta_{t+1}\right)$ *is not the maximum. The second part can be readily read off from comparing Eqs. (A.1) and (A.3).* ■

The absence of legal enforcement on a debt between citizens lowers the continuation value of (RIA), thereby relaxing the international participation constraint (RP-IPC). The newly added domestic participation constraint (RP-DPC) is superfluous due to the crucial

ingredient of this paper—domestic default will never happen before an international default. Put it another way, as a result of $V_n^m\left(\theta^t, b_n^m\left(\theta^t\right)\right) \geqslant A_n^m\left(\theta^t\right), \forall \theta^t$, repayment on domestic debt is secured as long as the mechanism prevents attempted international default. International bond defaulters are confronted with more severe penalties, which allows larger international capital inflow than that a model with domestically complete asset markets would predict.

In general, (RP-IPC) makes the problem (RP) non-convex, but the sufficiency of the first-order-condition approach to characterize a global maximum can be justified using the same technique proposed by Jeske (2006). First, define an alternative maximization problem with the same objective function and a convex constraint set that is a superset of the non-convex constraint set in the original non-convex problem. In particular, (RP-IPC) is replaced by its necessary condition $F_n^m\left(\theta^t\right) \geqslant 0$ according to Lemma 10. Then, it can be shown a solution to the original problem is also affordable and individually rational in the alternative convex problem. It turns out that both problems have identical first order conditions together with transversality conditions; thus the same optimal solutions.

3 Welfare Analysis

Under the assumption of complete and perfect domestic asset markets, aggregate welfare in the setting of private international borrowing can be elevated by centralized borrowing (Jeske, 2006) or a less radical way of using a system of borrowing subsidies to mimic the constrained optimum under centralization (Wright, 2006). The intuition behind this

remedy is that the planner internalizes a negative externality—individual defaulter holding the belief that domestic bond price will stay unchanged after her default—and hence reduces post-default values. This paper argues that a central planner may sometimes do worse than the market equilibrium under the assumption of pervasive default risk. This is due to the fact that the planner can, by implicitly completing the markets domestically, provide a smoother identical consumption to all. As a result aggregate autarky values are higher than that under market equilibrium thus discouraging international debt flows. This negative impact dominates the positive impact of externality removal when the aggregated post-default value in market equilibrium is smaller than autarky utility in centralized borrowing. In a numerical example where endowment path is specified, this condition can be further materialized in terms of parameters on endowment distributions.

Suppose a small open economy is taken over by a benevolent planner. The planner trades international bonds and allocates consumption domestically, whereas residents have no access to any asset market. The default risk on domestic debt is eliminated, but the planner can still default on national debt overseas if autarky turns out better at some history. Assume the type-specific welfare weights are given by $\varphi_n \in \mathbb{R}_{++}\ \forall n$; the **Planner's Autarky (PA)** value is:

$$V^m\left(\theta^t\right) \equiv \max_{\left\{c_n^m(\theta^r)\right\}_{r\in[t,\infty)}} \sum_{n=1}^{N} \varphi_n \sum_{r=t}^{\infty} \beta^{r-t} \sum_{\theta^r|\theta^t} \pi\left(\theta^r|\theta^t\right) U\left(c_n^m\left(\theta^r\right)\right), \tag{PA}$$

subject to the resource constraint,

$$\sum_{n=1}^{N} e_n^m\left(\theta^r\right) \geqslant \sum_{n=1}^{N} c_n^m\left(\theta^r\right), \tag{PA-BC}$$

$\forall \theta^r$ with $r \in [t, \infty)$. Before a default, the **Planner's Problem (PP)** is:

$$\max_{\left\{c_n^m\left(\theta^t\right), f^m\left(\theta^t\right)\right\}_{t\in[0,\infty)}} \sum_{n=1}^{N} \varphi_n \sum_{t=0}^{\infty} \beta^t \sum_{\theta^t} \pi\left(\theta^t\right) U\left(c_n^m\left(\theta^t\right)\right), \tag{PP}$$

subject to the resource constraint,

$$\sum_{n=1}^{N} e_n^m\left(\theta^t\right) + f^m\left(\theta^t\right) \geqslant \sum_{n=1}^{N} c_n^m\left(\theta^t\right) + \sum_{\theta_{t+1}} q\left(\theta^t, \theta_{t+1}\right) f^m\left(\theta^t, \theta_{t+1}\right), \tag{PP-BC}$$

the planner's participation constraint in the international asset market,

$$\sum_{n=1}^{N} \varphi_n^m \sum_{r=t}^{\infty} \beta^{r-t} \sum_{\theta^r|\theta^t} \pi(\theta^r|\theta^t) U\left(c_n^m\left(\theta^r\right)\right) \geqslant V^m\left(\theta^t\right), \tag{PP-IPC}$$

and the no-Ponzi game condition,

$$f^m\left(\theta^t, \theta_{t+1}\right) \geqslant -\bar{F},$$

with $f^m\left(\theta^0\right)$ and $\left\{q\left(\theta^t, \theta_{t+1}\right)\right\}_{t\in[0,\infty)}$ given, $\forall \theta^t$ with $t \in [0, \infty)$. The following proposition formalizes the possibility that centralization being a welfare-inferior scenario.

Proposition 5 *Exogenously given* $\{\varphi_n\}_{n=1,2,...,N}$, *let*

$$\left\{c_n^m\left(\theta^t\right), b_n^m\left(\theta^t,\theta_{t+1}\right), f_n^m\left(\theta^t,\theta_{t+1}\right)\right\}_{t\in[0,\infty)}$$

solve (RP), and $\left\{c_n^{m,P}\left(\theta^t\right), f^m\left(\theta^t,\theta_{t+1}\right)\right\}_{t\in[0,\infty)}$ *solve (PP),*

$$\sum_{n=1}^{N}\varphi_n\sum_{t=0}^{\infty}\beta^t\sum_{\theta^t}\pi\left(\theta^r|\theta^t\right)U\left(c_n^m\left(\theta^t\right)\right) > \sum_{n=1}^{N}\varphi_n\sum_{t=0}^{\infty}\beta^t\sum_{\theta^t}\pi\left(\theta^t\right)U\left(c_n^{m,P}\left(\theta^t\right)\right),$$

if the endowment structure satisfies

$$\sum_{r=t}^{\infty}\beta^{r-t}\sum_{\theta^r|\theta^t}\pi\left(\theta^r|\theta^t\right)U\left(c_n^{m,P}\left(\theta^t\right)\right)\geqslant A_n^m\left(\theta^t\right),\ \forall n,\theta^t,$$

and there is a history $\left(\theta^t,\theta_{t+1}\right)$ *such that*

$$\sum_{n=1}^{N}\varphi_n V_n^m\left(\left(\theta^t,\theta_{t+1}\right),b_n^m\left(\theta^t,\theta_{t+1}\right)\right) < V^m\left(\theta^t,\theta_{t+1}\right).$$

Proof. *See Appendix A.* ■

4 Numerical Example

The outcomes are illustrated through an instance. Consider a simple economy where there are only two countries: 1 and 2. Each country is populated by a unit mass of residents with static preference $U(c)=\log(c)$ and discount factor $\beta\in(0,1)$. Residents born at $t=0$ live forever in a discrete time context. One sort of non-storable consumption goods

is traded every period according to risk sharing contracts signed before the realization of endowment structure. A country's beginning endowment could be high state $1+y$ or low state $1-y$, and is contrary to the other country. Given this initial value, aggregate endowment then alternates between high and low deterministically in either country. The sum of two countries' endowment is however always 2, since they are mirror images of one another by design. Residents are labeled as either type A, who face an idiosyncratic shock in high state $1+y+\varepsilon$ and a negative shock in low state $1-y-\varepsilon>0$, or type B, who receive the opposite treatment: $1+y-\varepsilon$ in high and $1-y+\varepsilon$ in low. It is assumed that $y, \varepsilon \in (0,1)$ and $y \geqslant \varepsilon$, capturing the notion that income fluctuation across countries is more volatile than variation within a country.[5] Type B's endowment path is relatively smoother than type A's in all cases.

Prior to period 0, the timeline of contracting is as follows. First, residents in the same country enter into a domestic risk-sharing contract. Second, a coin flip determines the type of half random residents in both countries. Then, domestic obligations will be fulfilled under the assumption of perfect enforcement within borders or exposed to default risk if there exists a pervasive problem of commitment. However, a domestic default means losing the opportunity of exchange across borders. Next, domestic citizens and foreigners agree on an international risk-sharing contract. After that, another independent coin flip determines countries' initial endowments. Eventually, agents decide whether to deviate from the international agreement depending upon post-default utilities.

Suppose Country 1 starts off with high state. The entire Country 1 is thereby partic-

[5] $y<\varepsilon$ makes the limited commitment problem on domestic debt irrelevant since domestic risk sharing will always be perfect irrespective of legal enforcement.

ipation constrained in the international asset market at even numbered periods. Table 1a summarizes the endowment structure at even numbered periods, while Table 1b includes all odd numbered periods. Let z denote the consumption deviation in general. The lifetime preference for residents in Country 1 is:

$$\sum_{t=0}^{\infty} \beta^t \log\left(1 + (-1)^t z\right) = \frac{\beta}{1-\beta} \log\left[(1+z) + \beta \log(1-z)\right].$$

Rescale it to obtain

$$u^1(z) = \log(1+z) + \beta \log(1-z),$$

and residents in Country 2 have

$$u^2(z) = \log(1-z) + \beta \log(1+z).$$

Note $u^m(z)$ represents ex-post utility in the sense that host country's initial endowment has been revealed. For the purpose of welfare comparison, the corresponding ex-ante utility is defined as

$$E[u(z)] = \frac{1}{2}u^1(z) + \frac{1}{2}u^2(z).$$

Since $E[u(z)]$ is strictly decreasing in z, smaller consumption deviation z signifies more international risk sharing and hence higher ex-ante welfare.

Table 1: Endowment Structure

Measure	Type n	Country m	
	a) Even numbered periods		
		$m=1$	$m=2$
$\frac{1}{2}$	$n=A$	$1+y+\varepsilon$	$1-y-\varepsilon$
$\frac{1}{2}$	$n=B$	$1+y-\varepsilon$	$1-y+\varepsilon$
$\frac{1}{2}(A+B)$		$1+y$	$1-y$
	b) Odd numbered periods		
		$m=1$	$m=2$
$\frac{1}{2}$	$n=A$	$1-y-\varepsilon$	$1+y+\varepsilon$
$\frac{1}{2}$	$n=B$	$1-y+\varepsilon$	$1+y-\varepsilon$
$\frac{1}{2}(A+B)$		$1-y$	$1+y$

4.1 Private Borrowing with Domestic Enforcement

Because debt between two domestic residents is perfectly enforced, different types in the same country consume an identical amount $c^m(t)$ each period.

$$\begin{aligned} c^1(2k) &= 1+x^J,\ c^1(2k+1)=1-x^J; \\ c^2(2k) &= 1-x^J,\ c^2(2k+1)=1+x^J, \end{aligned}$$

where $2k$ represents even numbered periods and $2k+1$ odd numbered periods with $k \in \mathbb{N}$, the set of non-negative integers. Discounted by Arrow-Debreu type of prices, the present value of all future payments from the participation constrained country to the unconstrained must equal to zero,

$$\frac{x^J - y + q\left(y - x^J\right)}{1-pq} = 0, \tag{5}$$

where q and p respectively denote the one-period domestic bond price in the country that is participation unconstrained and constrained in the international asset market next period.[6] In other words, q can be found for residents who consume $1+x^J$ at current period and $1-x^J$ at next period,

$$q \equiv \beta \frac{1+x^J}{1-x^J}. \tag{6}$$

Residents who consume $1-x^J$ at current period and $1+x^J$ at next period face domestic bond price,

$$p \equiv \beta \frac{1-x^J}{1+x^J}.$$

Thus, the international bond price $q(t) = q, \forall t$, and the domestic bond price $p^m(t)$ jumps between p and q over time.

$$\begin{aligned} p^1(t) &= \begin{cases} p \text{ at } t = 2k; \\ q \text{ at } t = 2k+1. \end{cases} \\ p^2(t) &= \begin{cases} q \text{ at } t = 2k; \\ p \text{ at } t = 2k+1. \end{cases} \end{aligned} \tag{7}$$

There are two solutions to Eq. (5). The first is autarky, or $x^J = y$, while the second requires $q = 1$, which further implies $x^J = \frac{1-\beta}{1+\beta}$ using Eq. (6). Let x^J be the benchmark level of consumption deviation. It can be reduced by two competing setups: centralization

[6] See the derivation in Appendix A.

in Section 4.2 and pervasive risk in Section 4.3. Section 4.4 discusses the ranking of these two improvements.

4.2 Centralized Borrowing

In a centralized economy, government prohibits private borrowing. Instead, it borrows in the international asset market on behalf of its residents and apportions total resources equally. One can aggregate each country into a representative agent with the following consumption pattern.

$$\begin{aligned} c^1(2k) &= 1 + x^c,\ c^1(2k+1) = 1 - x^c; \\ c^2(2k) &= 1 - x^c,\ c^2(2k+1) = 1 + x^c, \end{aligned}$$

where x^c is the smallest deviation satisfying Country 1's international participation constraint in an even numbered period.

$$x^c = \min_{z \geqslant 0} \{z : \log(1+z) + \beta \log(1-z) \geq \log(1+y) + \beta \log(1-y)\}.$$

To support *some* international risk sharing, the aggregate endowment y must satisfy two restrictions given an exogenous discount factor β. The first restriction is

$$-\frac{\log(1+y)}{\log(1-y)} > \beta, \tag{8}$$

otherwise consumption is fully smoothed, i.e., $x^c = 0$; and the second restriction is

$$y > \frac{1-\beta}{1+\beta}, \tag{9}$$

otherwise autarky is preferred, i.e., $x^c = y$. Once these two constraints are met, $x^c < \frac{1-\beta}{1+\beta}$ can be observed in Figure 1. Known $x^J = \frac{1-\beta}{1+\beta}$ or y, the arrangement of centralized borrowing is welfare superior than Jeske's decentralized setup.

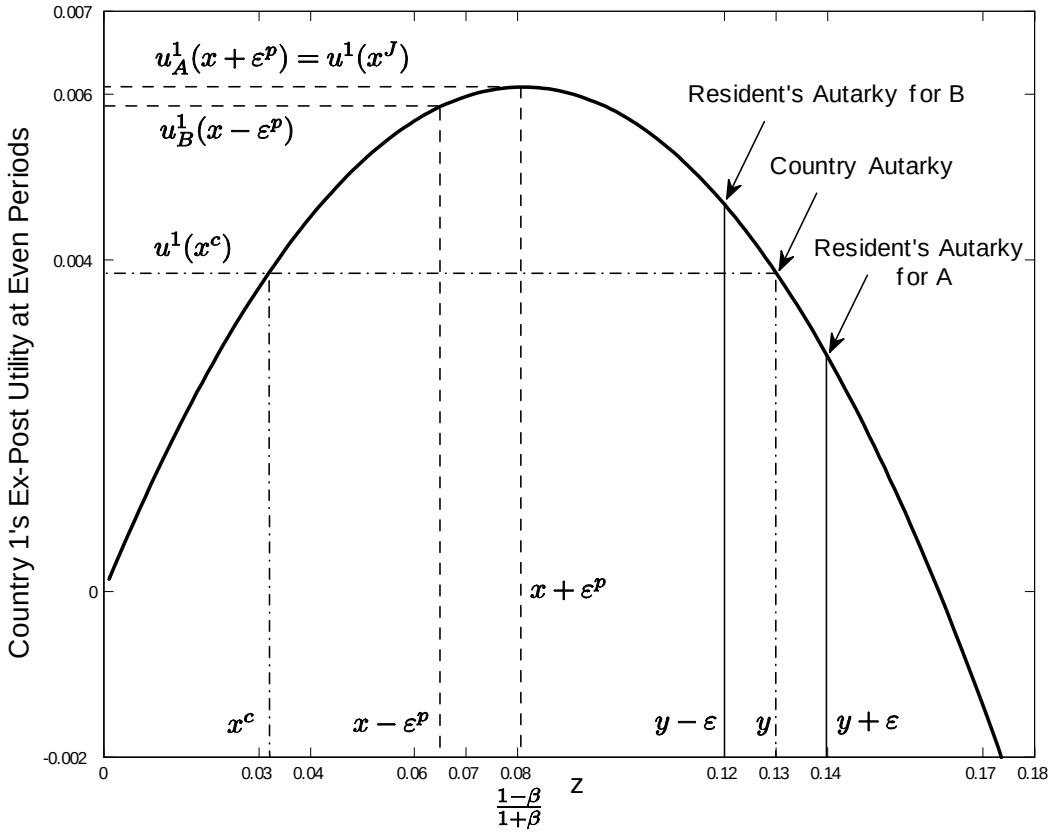
$$E\left[u\left(x^c\right)\right] > E\left[u\left(x^J\right)\right].$$

4.3 Private Borrowing under Pervasive Default Risk

When there exists no legal enforcement on domestic contract, the optimal consumption $c_n^m(t)$ varies between types in addition to across countries. By symmetry,

$$\begin{aligned}
c_A^1(2k) &= 1 + x + \varepsilon^p,\ c_A^1(2k+1) = 1 - x - \varepsilon^p; \\
c_B^1(2k) &= 1 + x - \varepsilon^p,\ c_B^1(2k+1) = 1 - x + \varepsilon^p; \\
c_A^2(2k) &= 1 - x - \varepsilon^p,\ c_A^2(2k+1) = 1 + x + \varepsilon^p; \\
c_B^2(2k) &= 1 - x + \varepsilon^p,\ c_B^2(2k+1) = 1 + x - \varepsilon^p,
\end{aligned}$$

Figure 1: Equilibrium Allocation and Ex-Post Utilities in The Numerical Example



Notes: This figure illustrates the optimal consumption deviations in Country 1 with high initial endowment at even periods. The curve is symmetric in shape around the maximum. A representative resident in Jeske's setup and a centralized arrangement achieves, respectively, the ex-post utility level of $u^1\left(x^J\right)$ and $u^1\left(x^c\right)$. In the setup of pervasive risk of default, type A's utility level is $u_A^1\left(x+\varepsilon^p\right)$, while type B's utility level is denoted as $u_B^1\left(x-\varepsilon^p\right)$. The values of parameters used in this figure are as follows. The aggregate component of income fluctuation is characterized by $y=0.13$. The idiosyncratic component of income fluctuation is characterized by $\varepsilon=0.01$. The discount factor $\beta=0.85$ satisfies both restrictions (8) and (9) given the value of y. Some international risk sharing can be supported.

where $\varepsilon \geqslant \varepsilon^p > 0$ indicates imperfect domestic risk sharing.[7] Type B is domestically borrowing constrained when its host country is as a whole internationally participation constrained, whereas in participation unconstrained country type A is domestically borrowing constrained. x and ε^p are jointly determined by the binding international participation constraints for both types,

$$\begin{cases} \frac{(x+\varepsilon^p)-y+q[y-(x+\varepsilon^p)]}{1-pq} = 0 \text{ for type A;} \\ \frac{(x-\varepsilon^p)-y+q[y-(x-\varepsilon^p)]}{1-pq} = 0 \text{ for type B,} \end{cases} \tag{10}$$

and they have to satisfy the domestic participation constraints for type B:

$$\begin{cases} \log(1+x-\varepsilon^p) + \beta \log(1-x+\varepsilon^p) \geq \log(1+y-\varepsilon) + \beta \log(1-y+\varepsilon); \\ \log(1-x+\varepsilon^p) + \beta \log(1+x-\varepsilon^p) \geq \log(1-y+\varepsilon) + \beta \log(1+y-\varepsilon). \end{cases}$$

The international bond price always equals to the highest MRS in the world,

$$q(t) = q \equiv \beta \frac{1+x+\varepsilon^p}{1-x-\varepsilon^p}, \tag{11}$$

and the domestic bond price in a next-period participation constrained country equates to the highest MRS within a country,

$$p \equiv \beta \frac{1-x+\varepsilon^p}{1+x-\varepsilon^p}.$$

[7] Jeske's setup is then a special case of pervasive risk of default when one sets $\varepsilon^p = 0$. To make the problem of limited commitment within a country interesting, assume ε^p to be strictly positive throughout this section.

The pattern of domestic bond price $p^m(t)$ can be defined similarly as in Eq. (7). In contrast to the formal model, current period MRS's are not equalized within a country that is unconstrained next period for continuing participation in the international asset market. Specifically, Country 1's type A has a larger MRS than type B at even periods. The reason this occurs is consumption flips back and forth only every two periods. Solving Eq. (10) gives one unique solution, $q = 1$, which further implies $x + \varepsilon^p = \frac{1-\beta}{1+\beta}$ for type A using Eq. (11). Domestic borrowing imperfections lead to a consumption deviation $x - \varepsilon^p < \frac{1-\beta}{1+\beta}$ for type B. As a result, the pervasive risk of default improves the welfare level in Jeske's decentralized setup as well.

$$\frac{1}{2}E\left[u\left(x+\varepsilon^p\right)\right]+\frac{1}{2}E\left[u\left(x-\varepsilon^p\right)\right]>E\left[u\left(x^J\right)\right].$$

4.4 A Comparison of Welfare Improvement

Both centralized borrowing and pervasive risk of default can strictly increase welfare in Jeske's benchmark setup, the question then becomes which one provides a better improvement. The answer depends upon the distance between two endowment distribution parameters: cross-country aggregate deviation y and within-country cross-sectional shock ε. When y is relatively larger than ε, centralization results in a greater increment. On the other hand, if ε lies within a close neighborhood of y, pervasiveness does a better

job.[8]

$$\frac{1}{2}E\left[u\left(x+\varepsilon^{p}\right)\right]+\frac{1}{2}E\left[u\left(x-\varepsilon^{p}\right)\right]\begin{cases}\leqslant E\left[u\left(x^{c}\right)\right] & \text{if } y-\varepsilon\geqslant\psi;\\ >E\left[u\left(x^{c}\right)\right] & \text{if } y-\varepsilon<\psi,\end{cases}$$

where the cutoff $\psi<\frac{1-\beta}{1+\beta}$ is implicitly defined by

$$\frac{1}{2}E\left[u\left(\frac{1-\beta}{1+\beta}\right)\right]+\frac{1}{2}E\left[u\left(\psi\right)\right]=E\left[u\left(x^{c}\right)\right].$$

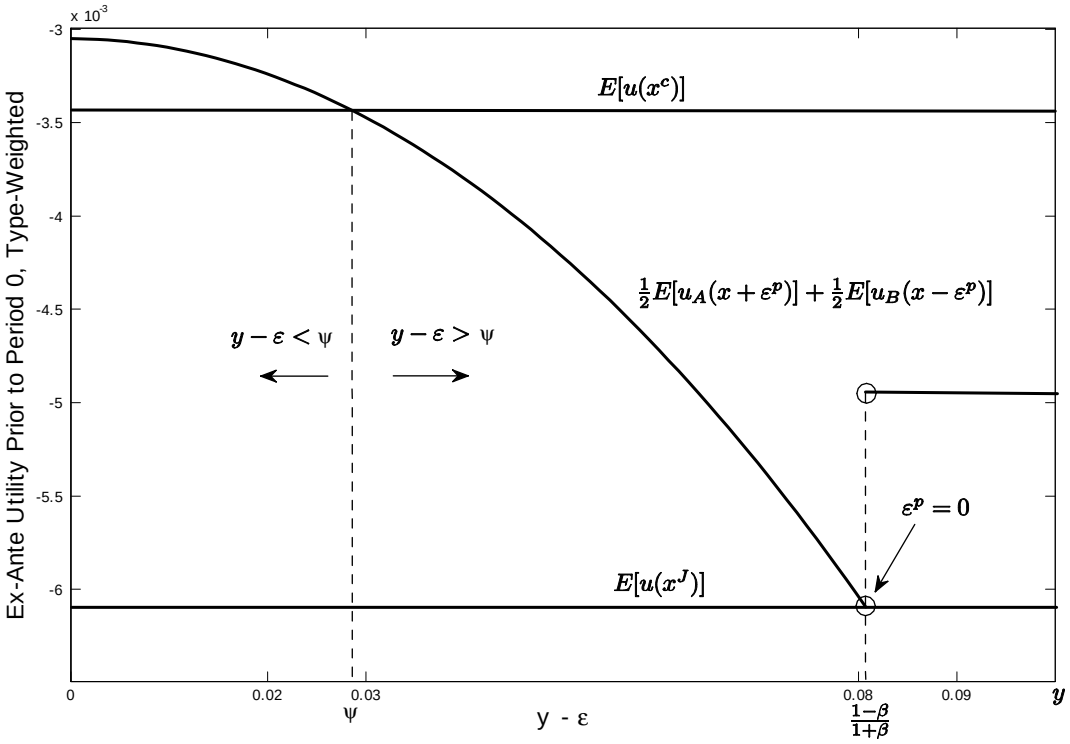
However, aggregate income fluctuation that is either highly volatile or fairly smooth will compromise the benefits of pervasive risk of default. At one extreme is relaxing restriction (8) and therefore a complete international risk sharing, which can never be an equilibrium outcome in a private debt environment, is attained by the centralized arrangement. At the other end would be relaxing restriction (9), where both centralized arrangement and Jeske's setup lead to autarky with perfect domestic risk sharing, $x^{c}=x^{J}=y$, whereas pervasive risk of default produces the worst-case scenario—resident level autarky, $x=y$ and $\varepsilon^{p}=\varepsilon$.

5 Conclusion

This paper builds upon Jeske's (2006) private international borrowing setup with heterogeneous agents and complete capital markets in a default-free equilibrium, except for relaxing his assumption of perfect enforcement on domestic debt. To handle this I assume, with an element of realism, that domestic bankruptcy debars agents from ac-

[8] See Figure 2.

Figure 2: Ex-Ante Utilities and Welfare Comparison in The Numerical Example



Notes: This figure compares at ex-ante the aggregate welfare levels for Jeske's setup, $E\left[u\left(x^J\right)\right]$, and a centralized arrangement, $E\left[u\left(x^c\right)\right]$, with the type-weighted welfare level under the assumption of pervasive risk of default, $\frac{1}{2}E\left[u\left(x+\varepsilon^p\right)\right]+\frac{1}{2}E\left[u\left(x+\varepsilon^p\right)\right]$. The values of parameters used in this figure are as follows. The aggregate component of income fluctuation $y = 0.10$ and hence $x^c = 0.06$. The idiosyncratic component of income fluctuation ε increases from 0 to y. The discount factor $\beta = 0.85$. The cutoff $\psi = 0.028$.

cessing international markets as well, but not vice versa. Two results are obtained from the pervasive absence of formal enforcement of debt contracts. First, when a country is constrained in obtaining international debt, the MRS of its agents unconstrained for domestic debt is higher than those constrained for debt—consistent with the standard result in the credit constraints literature—and therefore the option to default on foreign debt is less attractive than that an otherwise complete asset markets model would provide. It turns out that a country's domestic interest rate is determined by the reciprocal of the highest MRS within the country and the international interest rate equals to the lowest domestic interest rate to induce repayment. The second relates to centralized borrowing. Contrary to conventional wisdom, the private international debt framework can outperform a centralized arrangement in terms of social welfare under certain circumstances. The reason this could happen is because of the central planner's ability to provide higher aggregate autarky values that will potentially discourage international capital inflows.

Part III

Contracting Institutions, Outside Options, and Private Sector External Debt

6 Introduction

An emerging market's external liabilities have been shown to increase with the country's institutional quality, or particularly, the quality of contracting institutions aimed at enforcing a contract between host country's government or residents and foreign investors [Lane, 2004; and Martinez-Vazquez and Mina, 2006, in the context of private and public debt stocks in total; Alfaro, Kalemli-Ozcan, and Volosovych, 2008, in the context of private equity flows].[9] After controlling for contract enforcement involving foreigners, research employing firm-deal-level data finds that the strength of enabling contracts between citizens[10] appears to have a mixed impact on the size of private debt owed overseas. Esty's [2004] work shows that foreign banks provide a greater share of their total

[9] This research body measures legal enforcement using risk indexes from International Country Risk Guide, which focus on a country's institutional impact on foreign business.

[10] Strong internal contract enforcement results in the ease of obtaining private credit inside borders, which in turn can be reflected in a number of measurable indicators, e.g., powerful domestic creditor protection, sound mechanism of facilitating domestic loans, advanced domestic financial markets, and etc.

funds in countries with stronger creditor rights and less-developed financial systems. Bae and Goyal [2009] state that stronger legal rights of domestic creditors against defaulting debtors do not seem to matter for the size of foreign bank loans (the relationship is negative and statistically insignificant). I consider this ambiguous result to be a combination of two opposite effects. On the one hand, effective protection of domestic creditors signifies favorable institutional quality in general which facilitates international borrowing (the potential overlap between international and domestic contract enforcement), but on the other hand, it forces foreign lenders to tighten debt constraint because of the presence of alternative funding channels after an international default hence hinders international borrowing (a distinguishing feature of domestic contract enforcement). One might fear that the latter effect could also be due to substitution effect, i.e., private entities have less incentive to borrow internationally when local resources can easily satisfy their financial needs. I argue the role of substitution is small in developing countries, where domestic funding cannot dominate foreign loan in terms of cost and accessibility. Weak contracting and unimproved financial institutions in emerging markets substantially increase the cost of internal financing [Fabbri and Padula, 2004, in the context of allocation of credit to private household; Cole and Ariss, 2010, in the context of private bank lending; Martinez, 2010, in which lend spread rises in countries that most efforts are expended in financial development even if institution improves]. Moreover, private equity firms are willing to invest in countries where contract enforcement was weaker for a better rate of return [Taussig, 2011] or for diversification purpose [Bekaert and Urias, 1996].

In this paper, I test whether a country's strength of enforcing domestic debt contract

could exert a negative influence on its private sector's ability to borrow in the international asset market. This hypothesis is based on the notion that we have successfully distinguished and controlled for the positive effects of both international contract enforcement and the broad quality of institutions in the data. This causal relationship I propose is built on the theoretical model presented in Chapter 1. To see exactly how it works, consider the extreme case in which there is no enforcement on a private debt contract between two residents. Assume domestic residents have access to international asset market, and they are contemplating a default. Although the punishment was being prohibited from the international market forever, an atomistic defaulter believes she can still re-enter the market through borrowing from other non-defaulted residents as intermediaries. However, an inner-environment without contract enforcement will tie these potential defaulters' hands with very tight credit constraints after they return to the domestic asset market. Hence post-default utility is lower and default leads to a less attractive outside option than in an otherwise perfect domestic market. From this it follows that foreign lenders are able to raise the credit ceiling imposed on private debtors in the home country.

I only consider developing and emerging market countries. In doing this, the question that I am asking is, conditional on a country having relatively weaker institutions and its residents' credit constraint binding, how do differences in the contracting system without foreign party involvement affect the volume of international debt in private sectors. I differentiate between private (corporations and households) and public (government and monetary authorities) or publicly backed debt, since the theoretic story is

more reasonable for atomistic corporations. Many authors argue that debt instruments have intrinsic public characteristics, thereby the identity of the borrower reveals little information [Alfaro, Kalemli-Ozcan, and Volosovych, 2008, excluding debt from private capital flows; Lane, 2004, treating private debt as public debt]. In a robustness test using public debt instead of private debt as dependent variable, I show the identity does indeed make a difference. Word Bank's "external debt stocks, private nonguaranteed" serves as the variable to pick up the amount that private firms borrow overseas while government assume no responsibility for repayment. The amount that government borrows to re-lend domestically to private firms and assures repayment is absorbed by "external debt stocks, publicly guaranteed private". In this paper, I take the same approach as Lane and Milesi-Ferretti [2001a,b] by focusing on the fundamental, slow-moving, cross-country variations and, more importantly, working with stocks, rather than flows. Fundamental variations draw attention because institutional quality rarely changes overtime. Therefore, this analysis is based on cross-country regressions of time-series means from 2004-2008. The reasons of working with stocks are twofold. One, the design of credit constraint depends upon the level of stocks. Two, empirical studies of the determinants of external debt typically rely on cross-sectional data on liability stocks at the country level.

The conceptually challenging part in this empirical study is to disentangle contract enforcement against foreigners and citizens, as well as the dual implications by strong contract enforcement between citizens: quality internal legal system in a broad sense and convenient domestic fund raising. There is potentially much overlap between these three aspects. Acemoglu, Johnson, and Robinson [2001] suggest there is a "cluster of institu-

tions". Acemoglu and Johnson [2005] attempt to unbundle property rights, which provide protect against expropriation by the government, and contract enforcement, which executes private contracts. In contrast, this paper does not distinguish between the forms of institutions; instead it makes a distinction between legal entity's nationalities. For instance, a credible legal system implies strong enforcement on both international and domestic debt contracts; and the processes of enforcing international and domestic contract are very likely to share the same objective provisions. Nevertheless, there are also important differences. First of all, high judicial quality in broad terms does not guarantee full recovery of domestic loans even if the debtor is able to pay. Second, international and domestic debt enforcement may be uncorrelated due to subjective judgment and discrimination against creditors' nationality. Evidence reveals that there exists discrimination against either foreign or domestic creditors by legal authorities [Esty, 2004, in the context of private sectors in default situations; Erce and Díaz-Cassou, 2010, in the context of sovereign debt restructurings]. Also in international trade disputes, foreign creditors may receive unfair treatment [Finger, 1992; Rajan and Lee, 2007]. The question then becomes finding valid and distinct proxies for each set of institutions to identify their respective impacts. For contract enforcement directed at foreigners, I use the simple average of two risk indicators from International Country Risk Guide's (ICRG hereafter) IRIS-3 index: repudiation of contract and expropriation of private investment. Both indicators explicitly deal with claims made by foreign nationals. I validate the result by investment profile ratings from ICRG's political risk index, which measures viability of foreign contracts and the efficiency of collecting payoff from foreign investments. The

measures of the general judicial quality are taken from three different sources: the "legal enforcement of contracts" from Economic Freedom of the World (EFW hereafter); the "rule of law" from Worldwide Governance Indicators (WGI hereafter); and the "property rights" index from the Heritage Foundation (HF hereafter). Among them, EFW's component index is used as my primary measure since it evolved out of a case study where all parties are domestic entities and the dispute is over *commercial sales*. For the ease of domestic financing caused by strong domestic contract enforcement, the ideal proxy would measure the costs of enforcing private *loan* contracts in which both parties are ordinary domestic bodies. Three different measures originating from World Bank's Doing Business Project (WBDB hereafter) come close to such an ideal measure. The first and primary measure is the simple average of the "time" and logarithm of "cost" for creditors to recover their credit, and the second is the "recovery rate" recouped by creditors, both from WBDB's closing a business methodology. The third is the "strength of legal rights" index from WBDB's getting credit methodology. All three measures correspond to the costs of enforcing a straightforward contract in which all the parties are local entities or citizens; no foreign parties are involved. In an attempt to reduce potential endogeneity bias, I follow the strategy of multiple instrumental variables suggested by Acemoglu and Johnson [2005]. Domestic credit to private sector is the fourth proxy I employed to confirm the negative relationship between domestic financial development and international borrowing.

Consistent with the related literature, I find at a macro level that the key determinants of countries' external debt stocks (especially the amount owed by private sectors)

include quality of contracting institutions, size of economic activity, reliance on trades, the availability of natural resources and, to a lesser extent, educational attainment, and private sector performance. Unlike conventional studies, I break up contracting institutions into three kinds and devote extensive attention to the role of contract enforcement on facilitating domestic credit. Holding other institutional factors and a host of determinants constant, worse inner contracting institutions relax credit constraints and allow private sectors to accumulate more outer debts. This main result is confirmed by several robustness exercises, where I show robustness to changes in the sample, measures, the set of control variables, and estimation techniques.

The rest of the paper is organized as follows. Section 7 reports the estimating equation and presents the empirical strategy. Section 8 introduces data sources, explaining the selection and construction of measures for contracting institutions. Section 9 describes data, examines preliminary relationships, and reports the main results. Section 10 documents robustness tests and tackles the issue of endogeneity. Section 11 concludes, followed by Appendix B containing a list of countries in the sample.

7 Specification and Strategies

I test whether private debtors in a country, where internal credit is difficult to obtain due to poor efficiency of contract enforcement between citizens, are able to accumulate relatively more long-term external obligations that are not guaranteed for repayment by

a public entity. The following equation is estimated:

$$f_m = \alpha + \beta_1 IntlEnf_m + \beta_2 Q_m + \beta_3 DomEnf_m + \boldsymbol{X}\boldsymbol{\beta} + \varepsilon_m, \tag{12}$$

where f_m denotes the nonguaranteed external debt stocks owed by private sectors in country m to all creditors outside the country such as foreign commercial banks, other governments, international financial institutions; $IntlEnf_m$ is a proxy for the quality of legal enforcement on a debt contract between a domestic resident and a foreigner, whereas Q_m and $DomEnf_m$ measure, respectively, two contradictory effects of the enforcement intensity on a debt contract between two domestic residents in country m; Q_m stands for the broadly perceived judicial quality and $DomEnf_m$ stands for the ease of obtaining private credit inside boarders; $\boldsymbol{X}$ is a vector of alternative determinants of private debt recognized in the literature. Specifically, I include in $\boldsymbol{X}$ the size of the economy GDP (total gross domestic product); material reliance on the rest of the world $NetIM$ (net imports of goods and services); the relative importance of natural resources NR (net exports of agricultural raw materials, fuels, ores, and metals); human capital H (percentage of population over 25 that completed secondary schooling); and private sector wealth $Asset$ (gross external assets held by a country's residents against nonresidents). All level variables are in U.S. billions of dollars at current (i.e., 2011) prices. The *baseline sample*, for which all data on the above-mentioned variables are available, consists of 60-73 countries depending on the specification over the period 2004-2008. I test robustness in Section 5 for alternative sample sizes (a larger sample with more data

on measures of Q_m available and a smaller sample allowing only strictly positive f_m); different forms of dependent variable (private debt in per-capita form and public debt stocks); the introduction of additional determinant factors such as the degree of government control on capital flows CC (popular index of capital account openness), a dummy $OECD$ for member countries of the Organization for Economic Co-operation and Development (OECD hereafter), monetary policy and economic stability $Inflation$ (annual percentage change in the cost to the average consumer of acquiring a basket of goods and services), and domestic stock market development $MktCap$ (market capitalization of listed companies in U.S. billions of dollars at current prices); alternative measures for the quality of each contracting institutions; and panel-data estimating strategies (pooled OLS, fixed-effects, and random-effects model).

The estimation here is conceptually distinct from studies that show there is a positive relationship between various compositions of external liabilities in an emerging market and the quality of its institutions. This strand of research has shown that higher institutional quality tilt countries' liability structures toward longer maturity [Martinez-Vazquez and Mina, 2006], higher shares of equity [Lerner and Schoar, 2005; Faria and Mauro, 2009], wider spread [Bae and Goyal, 2009], as well as higher leverage and lower Weighted Average Cost of Capital [Arellano, Bai, and Zhang, 2007; Okere, Tamule, and Maloney, 2010]. Unlike them, in my estimating equation, the dependent variable only considers the level of debt stocks (total value of the debt at a point in time) owed by private (corporations or private households) nonguaranteed (repayment not secured by government) debtors in a developing country.

In equation (12), when a set of explanatory variables $\boldsymbol{X}$ has been controlled for, OLS regressions show the rest part of external debt stocks are explained by three sets of interactive institutions. Using valid proxies for each institution, the theory suggests we expect a negative coefficient β_3: corporations and households in countries with a worse post-default option borrow more outside the borders. If two countries have similar internal financing structure, but private sectors in the country that establishes quality legislative system and assures repatriation of foreign earnings borrows relatively more, then β_1 and β_2 will be positive. However, the empirical challenge that such an investigation has to overcome is endogeneity. Both omitted variable and simultaneity can cause the loop of causality between debt and institution variables.

Firstly, the model is specified as a cross-section: 2004-2008 averages of variables over times. Thereby I follow related literature [Lane and Milesi-Ferretti, 2001a,b; Klein and Olivei, 2008; Faria and Mauro, 2009; Martinez, 2010] in utilizing a "between" estimator from panel-data analysis. The problem with cross sectional data is that there may be determinants of external debt that are omitted from the estimation equation. One natural response is adopting fixed-effects model and time-varying measures of institutional quality to control for unobservable country heterogeneity using country effects, but this is problematic for the following reasons. (I) Yearly data on long-term external debt outstanding are intertwined given different inception and maturity dates;[11] (II) measures of institutional quality are not available over a long time period, e.g., WBDB data started

[11]Pooling data causes endogeneity once again due to autocorrelated errors. Although this might be corrected by specifying how errors are correlated e.g., an AR1 process, you add one more layer of possible modeling errors.

in 2004,[12] and they vary considerably across countries but rarely changing over time within countries;[13] (III) the panel approach, especially fixed-effects, only looks at within country effects hence digresses from the aim of this paper. Because of all these, I choose between-effects among other estimators, and carefully control for a host of alternative determinants suggested by previous literature. Nevertheless, I report the results of pooled OLS, fixed-effects, and random-effects in Section 5.

Second, OLS correlations do not account for reverse causality that may run from debt stocks to various aspects of institutions. That is, countries that borrow more have higher growth and hence better institutions. Although it has been shown that capital account liberalization, defined as easing restrictions on capital flows across a country's borders, can promote financial deepening [Klein and Olivei, 2008] and affect the development of institutional quality [Klein, 2005], and eventually result in greater economic growth. Less well studied is whether debt can also affect contract enforcement. One of the only sources of evidence on this comes from Ahlquist and Prakash [2009], where multinational corporations have incentives to influence contract enforcement costs in host countries, and equally, host governments are more likely to respond to multinationals' wishes when they are more dependent on foreign capital markets. The same logic also applies to foreign lenders. To isolate variation in all degrees of legal enforcement across country that are

[12] Moreover, countries may experience political and economic transitions over a longer time period (transitional countries like Czech Republic, Hungary, and etc. are included in the sample), resulting in jumps of institutional quality which have to be accounted for. But this feature is not relevant for my analysis.

[13] Even if there are changes at all, it is very likely to be gradual improving and path-dependent. E.g., Djankov, McLiesh, and Shleifer (2007) find that creditor rights are remarkably stable over time, contrary to the hypothesis that legal rules across the world are converging.

unaffected by private debt holdings, I instrument my measures of contract enforcement using a multiple instrumental variables strategy in a similar way as Acemoglu and Johnson [2005]. The instruments used include settlers' mortality [Acemoglu and Johnson, 2005; Ranjan and Lee, 2007; Faria and Mauro, 2009], population density in the 1500s [Acemoglu and Johnson, 2005], legal origin [Nunn, 2007; Amin and Ranjan, 2008], and ethnolinguistic fractionalization [Mauro, 1995; Faria and Mauro, 2009].

8 Data Sources

8.1 Dependent Variable and Control Variables

Data on the dependent variable—external debt stocks, private nonguaranteed (PNG) (DOD, current US$)—are taken from the World Bank's World Development Indicators (WBWDI hereafter) with a coverage of 127 countries. In the World Bank classification, external debt stocks comprise long-term (consisting of private nonguaranteed and public and publicly guaranteed by the identity of the borrower), short-term, and use of International Monetary Fund (IMF hereafter) credit. I use alternative data on private sector debt for seven additional countries including Croatia, Czech Republic, Hungary, Israel, Jordan, Poland, and Slovak Republic to complement World Bank's dataset. As a result, the *full sample* of debt data contains 134 countries. The Institute of International Finance (IIF hereafter) Economic Databases act as this complementary source, where external debts are divided according to the borrower's identity into private sector, public sector, and deposit money banks' debt. IIF does not further distinguish between

long-term and short-term under this classification, but I argue short-term debt accounts for a small proportion of total external debt stocks, the average share is around 14%. The debt data in the full sample are from 2004-2009 with no gap, but the beginning and ending year may vary across countries. The unit of debt data is billions of U.S. dollars at current prices. The sample mostly consists of developing and emerging market countries, though there are eight of them (Chile[14], Czech Republic, Hungary, Israel, Mexico, Poland, Slovak Republic, and Turkey) who hold the membership of OECD.[15]

Data on GDP, GDP per capita, trade volume, natural resources, equity market, and inflation are all from WBWDI. For some countries GDP and trade data are missing for the year of 2009, I use estimates from the IMF's World Economic Outlook and Central Intelligence Agency's World Factbook to fill in the blanks. Data on external assets of domestic private sectors, referring to claims and transactions between a country's residents and nonresidents, were assembled by Lane and Milesi-Ferretti [2001a,b and 2006] in their 2009 version of External Wealth of Nations Mark II dataset. The human capital variable is measured as the percentage of total population over 25 that have completed secondary schooling in the year of 2000,[16] as reported by Barro and Lee [2001]. The index measuring a country's degree of capital control is drawn from two places both updated to 2008: the Chinn-Ito index of capital account openness assembled by Chinn

[14]Chile being the only OECD member which is also a member in the organization of developing countries, the Group of 77.

[15]Countries that join the OECD improve their credibility as their economic policy is restricted and monitored by other member states. Most of them are high-income economies with a high Human Development Index (HDI) and are regarded as developed countries.

[16]Human capital only have information available for, at best, several discontinuous years (1990, 1995, and 2000). I use the data for the most recent available year to proxy for my targeted time period 2004-2009.

and Ito [2008], and Fraser Institute's "international capital market controls" component index published in 2010 EFW Annual Report.

8.2 Measures of Institutional Quality

For each set of contracting institutions, I rely on one primary measure that most closely fit the description of a specific institution, and validate the result with several alternative measures.

International Contract Enforcement

The measure of international contract enforcement $IntlEnf$ is taken from two files: the academic version of ICRG known as IRIS-3 and ICRG's political risk index. The first one is my primary indicator, and I take advantage of the second one in the robustness regression. IRIS-3 contains annual values for six indicators of the quality of governance over the period 1982-1997, constructed by Stephen Knack and the IRIS Center at the University of Maryland, based on monthly ICRG data provided by the Political Risk Services group. The six indicators are corruption in government, rule of law (law and order tradition), bureaucratic quality, ethnic tensions, repudiation of contracts by government, risk of expropriation. I am only interested in the last two indicators because they closely relate to foreign participation by definition. Risk of repudiation "addresses the possibility that foreign businesses, contractors and consultants face the risk of a modification in a contract taking the form of repudiation, postponement, or scaling down, due to an income drop, budget cutbacks, and indigenization priorities." Lower scores signify "a greater likelihood that a country will modify or repudiate a contract with a

foreign business." Similarly, risk of expropriation of private investment evaluates the risk "outright confiscation and forced nationalization" of property. Lower ratings "are given to countries where expropriation of private foreign investment is a likely event." Both indicators are scales ranging from zero to 10, with higher values indicating better ratings, i.e., less risk. $IntlEnf\_R\&E$ takes the value of the simple average of these two variables. Since this is a relatively "old" dataset, I focus on a country's average level during the years 1984-1997 rather than the measured level in 1997, the last year of coverage, in order to minimize random variations and account for history dependence. In my full sample of 134 countries, ICRG's IRIS-3 has data for 84 of them. ICRG's political risk index is based on poll of experts' opinions and ratings of 12 political risk indicators available during the time span of 1984-2007. The indicators are government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability, and bureaucracy quality. This paper focuses on investment profile ($IntlEnf\_IP$) since this indicator represents the risk of foreign investment. The risk rating of investment profile assigned equals to the sum of three subcomponents: contract viability, profits repatriation, and payment delays, each with a maximum score of four points and a minimum score of zero point. Higher score equates lower risk. The coverage of investment profile data coincides with only part of the time period I study. Whenever investment profile appears in a robustness check regression, all other variables are limited to the time span of 2004-2007.

General Judicial Quality

As my main measure of average judicial quality Q, I use the component index "legal enforcement of contracts" (Q_ENF) from Fraser Institute's EFW dataset complied by Gwartney, Hall, and Lawson [2010], which in turn is based on estimates from WBDB's enforcing contracts methodology for the time and money required to resolve a commercial sale dispute, first introduced by Djankov, La Porta, López-de-Silanes, and Shleifer [2003]. The time and money measurements are built by following the step-by-step evolution of a dispute case study, where raw data are collected through the codes of civil procedure and other court regulations as well as surveys completed by local litigation lawyers and by judges. The value of the claim is assumed to equal 200% of the economy's per-capita income where the plaintiff has complied with the contract and judicial judgment is rendered in his favor. Zero-to-10 ratings were constructed for (I) the time cost (measured in number of calendar days required from the moment the lawsuit is filed until payment) and (II) the monetary cost of the case (measured as a percentage of the claim). These two ratings were then averaged to arrive at the final rating for the "legal enforcement of contracts". The formula used to calculate the zero-to-10 ratings was: $\frac{V_{\max}-V_i}{V_{\max}-V_{\min}}$ multiplied by 10. V_i represents the time or money cost value. The values for $V_{\max}$ and $V_{\min}$ were set at 725 days and 82.3% (1.5 standard deviations above average) and 62 days (1.5 standard deviations below average) and 0%, respectively. Countries with values outside of the $V_{\max}$ and $V_{\min}$ range received ratings of either zero or 10 accordingly. Gwartney et al.'s dataset is in every five years from 1970 and becomes annual after 2000 with most recent update in 2008. And 101 countries in the full sample have this data. In the section of robustness test, values for some of the missing countries and the year 2009

are constructed in the same way as described above, based on recently released time and money cost data from WBDB's enforcing contracts methodology. I have chosen Gwatney et al.'s variables as my baseline measure because the dispute concerns a lawful transaction between a seller and a buyer, which is most likely to reflect the general judicial quality but least likely to affect the ease of obtaining a domestic loan. There is one extra cost measure from WBDB's enforcing contracts methodology—the number of procedures (Q_PROC).[17] Similar results are obtained by using Q_PROC as the proxy of general judicial system. I also test the sensitivity of my results to the use of alternative measures from Kaufmann, Kraay, and Mastruzzi [2010] and the HF. Kaufman et al. provide indexes for six dimensions of governance starting from 1996 to 2009: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. The six governance indicators are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes. I rely on the "rule of law" (Q_ROL) in their WGI dataset. This component captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The HF makes an index of property rights (Q_HF) available, and I utilize this index for the year of 2011 to take the place of 2004-2009 values. The property rights index is an assessment of the ability of individuals to accumulate private

[17] The number of procedures traces the chronology of a commercial dispute before the relevant court. A procedure is defined as any interaction, required by law or commonly used in practice, between the parties or between them and the judge or court officer. This includes steps to file and serve the case, steps for trial and judgment and steps necessary to enforce the judgment.

property, secured by clear laws that are fully enforced by the state. It measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. This index runs from zero to 100. The more certain the legal protection of property, the higher a country's score; similarly, the greater the chances of government expropriation of property, the lower a country's score.

Domestic Contract Enforcement

The data to proxy for domestic credit facility $DomEnf$ is constructed from several measures capturing different aspects of domestic debt contract enforcement, most of which are likely to be highly correlated with the easiness of obtaining private credit domestically. There are four measures from three different sources under the World Bank Group: WBDB's closing a business, WBDB's getting credit, and WBWDI's domestic credit to private sector.

The data on closing a business methodology are derived from survey responses by local insolvency practitioners and verified through a study of laws and regulations as well as public information on bankruptcy systems. This study contains three subcomponents of insolvency proceedings involving domestic entities: time for creditors to recover their credit in calendar years, the cost of the proceedings as a percentage of the value of the debtor's estate, and the recovery rate as cents on the dollar recouped by creditors through reorganization, liquidation, or debt enforcement (foreclosure) proceedings. My

first measure of domestic contract enforcement is derived from a simple average between time and logarithm of cost ($DomEnf\_T\&C$), in a way that higher value implies easier credit (11 years minus actual years passed and 6 minus logarithm of cost spent). Recover rate ($DomEnf\_REC$) serves as the *second* measure. Its calculation takes into account not only time and cost but also the debt seniority and outcome of bankruptcy: whether the business emerges from the proceedings as a going concern or the assets are sold piecemeal. In specific,

$$DomEnf\_REC \equiv \frac{100 \times GC + 70 \times (1 - GC) - 12 \times (P - 1) - 100 \times c}{(1 + r)^{\tau}},$$

where dummy variable GC equals to 1 if the firm continues operating as a going concern, and to 0 if it is liquidated; integer P is the payment priority with 1 representing the first lien claim, 2 second lien and so on; c is the costs of bankruptcy proceedings; τ is the processing time it takes to get paid; and r is the prevailing discount rate. Higher ex-post recovery rate represents easier private credit ex ante. Measures taken from closing a business methodology satisfy almost all criteria of becoming an ideal proxy for the ease of getting a domestic loan due to contracting institutions. This qualification is revealed by several assumptions about the business, the case, and the parties.

"**Assumption about the business**

The business: Is a limited liability company. Operates in the economy's largest business city. Is 100% domestically owned, with the founder, who is also the chairman of the supervisory board, owning 51% (no other shareholder

holds more than 5% of shares). Has downtown real estate, where it runs a hotel, as its major asset. The hotel is valued at 100 times income per capita or $200,000, whichever is larger. Has a professional general manager. Has 201 employees and 50 suppliers, each of which is owed money for the last delivery. Has a 10-year loan agreement with a domestic bank secured by a universal business charge (e.g., a floating charge) in economies where such collateral is recognized or by the hotel property. If the laws of the economy do not specifically provide for a universal business charge but contracts commonly use some other provision to that effect, this provision is specified in the loan agreement. Has observed the payment schedule and all other conditions of the loan up to now. Has a mortgage, with the value of the mortgage principal being exactly equal to the market value of the hotel.

Assumption about the case

The business is experiencing liquidity problems. The company's loss in 2009 reduced its net worth to a negative figure. It is January 1, 2010. There is no cash to pay the bank interest or principal in full, due the next day, January 2. The business will therefore default on its loan. Management believes that losses will be incurred in 2010 and 2011 as well. The amount outstanding under the loan agreement is exactly equal to the market value of the hotel business and represents 74% of the company's total debt. The other 26% of its debt is held by unsecured creditors (suppliers, employees, tax authorities). The company has too many creditors to negotiate an informal out-of-court

workout. The following options are available: a judicial procedure aimed at the rehabilitation or reorganization of the company to permit its continued operation; a judicial procedure aimed at the liquidation or winding-up of the company; or a debt enforcement or foreclosure procedure against the company, enforced either in court (or through another government authority) or out of court (e.g., by appointing a receiver).

Assumption about the parties

The bank wants to recover as much as possible of its loan, as quickly and cheaply as possible. The unsecured creditors will do everything permitted under the applicable laws to avoid a piecemeal sale of the assets. The majority shareholder wants to keep the company operating and under its control. Management wants to keep the company operating and preserve their jobs. All the parties are local entities or citizens; no foreign parties are involved."

If an economy has had fewer than five cases a year over the past five years involving a judicial reorganization, judicial liquidation, or foreclosure, the economy receives a "no practice" ranking. This means that creditors are unlikely to recover their money through a formal legal process (in or out of court). The recovery rate for "no practice" economies is zero. After dropping data entries labeled as "no practice", closing-a-business measures are available for 94 countries in the full sample.

To validate the main result, I also use a *third* measure—"strength of legal rights index" ($DomEnf\_LR$)—from getting credit methodology to evaluate the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and

thus facilitate lending. The last and *fourth* measure, domestic credit to private sector ($DomEnf\_CREDIT$), gauges the degree of sophistication and development in financial intermediation, therefore a higher value is symptomatic of better financial services hence more accessible private credit within a country's borders.

Table 2 presents the summary statistics of variables used in the baseline model. Among all potential explanatory variables, these substitutable measures of contracting institutions are correlated with each other both within (italic numbers in Table 3) and across (bold numbers in Table 3) my classification of three aspects of contract enforcement. Considering the univariate correlations between the amount of external debt and alternative proxies from each category of institutions, a number of significant correlations emerge (first column of Table 3) ranging from a low of -0.23 to a high of 0.42.

8.3 Instrumental Variables

The instruments I work with include: logarithm of settler mortality, logarithm of population density in the 1500s, ethnolinguistic fractionalization, and legal origin (consisting of British, French, Socialist, German, and Scandinavia). Settlers' mortality and population density in the 1500s are for former colonies. In a famous paper, Acemoglu, Johnson, and Robinson [2001], while trying to explain the impact of institutions on per-capita income, use the settlers' mortality rate as an instrument to control for the endogeneity of institutions. Data on population density in the 1500s come from Acemoglu and Johnson [2005], where they advise the usage of settlers' mortality and population density as instruments for property rights institution. The next instrument, ethnolinguistic fractionalization, is

Table 2: Summary Statistics: averages 2004-2008 baseline sample

Variable	Obs.	Min	Max	Mean	Median	Stdev	Coef. of Variance
f	73	0.00	148.99	13.48	0.71	27.75	2.06
$IntlEnf\_R\&E$	73	3.52	9.43	6.27	6.21	1.17	0.19
Q_ENF	73	0.00	7.53	3.87	3.93	1.53	0.40
$DomEnf\_T\&C$	73	2.40	7.00	5.35	5.45	0.87	0.16
$DomEnf\_REC$	73	2.00	64.18	24.84	22.68	14.53	0.59
$DomEnf\_LR$	73	1	10	4.85	4	2.25	0.46
$DomEnf\_CREDIT$	73	0.08	3264.20	96.96	9.39	389.30	4.01
GDP	73	0.99	2983.48	167.45	30.93	412.18	2.46
$NetIM$	73	-207.87	36.12	-4.83	0.59	29.34	-6.07
NR	68	-179.48	208.10	2.51	-0.35	37.17	14.80
H	65	0.70	25.20	9.10	8.30	6.51	0.72
$Asset$	73	0.36	1520.09	71.03	9.22	196.85	2.77

Table 3: Pairwise Correlations between Debt and Different Institutional Qualities: averages 2004-2008

	f	$IntlEnf\_$		$Q\_$				$DomEnf\_$		
		$R\&E$	IP	ENF	$PROC$	ROL	HF	$T\&C$	REC	LR
$IntlEnf\_R\&E^{\dagger}$	0.42***									
$IntlEnf\_IP$	0.24**	*0.50****								
$Q\_ENF^{\dagger}$	0.38***	**0.32*****	**0.04**							
Q_PROC	0.03	**0.32*****	**0.26****	*0.23**						
Q_ROL	0.24**	**0.61*****	**0.70*****	*0.25***	*0.26***					
Q_HF	0.21*	**0.61*****	**0.60*****	*0.11*	*0.19*	*0.82****				
$DomEnf\_T\&C^{\dagger}$	-0.23**	**-0.03**	**0.01**	**0.18**	**0.05**	**0.05**	**0.02**			
$DomEnf\_REC$	0.01	**0.34*****	**0.39*****	**0.22***	**0.17**	**0.38*****	**0.36*****	*0.67****		
$DomEnf\_LR$	0.04	**0.38*****	**0.37*****	**0.20***	**0.29****	**0.40*****	**0.33*****	*0.09*	*0.32****	
$DomEnf\_CREDIT$	0.42***	**0.22***	**0.01**	**0.28****	**0.07**	**0.08**	**-0.02**	*-0.01*	*0.07*	*0.01*

Notes: Inter-institution correlation in bold. Intra-institution correlation in italics. *** significant at 1%, ** significant at 5%; * significant at 10%.

† denotes the primary measure for each kind of institutions.

defined as the probability that two randomly selected persons from a given country will not belong to the same ethnolinguistic group. Classification of ethnolinguistic groups and according probability data are draw from Roeder's [2001] ELF indexes computed for the year of 1985. Mauro [1995] and Faria and Mauro [2009] use this variable as instrument for institutional qualities. Data on legal origin are taken from La Porta, López-de-Silanes, Shleifer, and Vishny [1999], and justified as proper instrument for contract enforcement by Amin and Ranjan [2008]. When I restrict countires to have available data on other three instruments, the baseline sample shrinks to 54 countries (further to 42 if a full set of control variables is requred) and contains no country that inherits German and Scandinavian legal origins; hence this legal origin instrument degenerates to two binary indicators (British and French) after the intercept term (Socialist) is included in the first stage regression.

9 Empirical Results

In my complete debt sample consisting of 134 countries, total external debt stocks in 2008 consist of on average 81% long term (17% of which flows to private sectors as nonguaranteed debt and 83% to public and publicly guaranteed destinations), 15% short term, and 2% use of IMF credit. The share of private nonguaranteed debt as total debt is growing steadily since 2004, reaches a peak at 2008, and falls in 2009 likely due to the aftermath of U.S. subprime mortgage crisis. As the share of long term debt stays roughly stable, the remaining component of public and publicly guaranteed debt is decreasing over

the same period. However, the cross-sectional correlation between private and public debt is still high at around 0.83.

Before turning to estimates of equation (12), I check whether single contracting institution by itself is an important determinant of external debt stocks. I do this by conducting "univariate" regressions with each kind of institutions. Notice that the size of economy GDP or the level of economic development $GDPCap$ (log GDP per capita in thousands of U.S. dollars at current prices) is included depending upon specifications. The results of this procedure are summarized in Table 4. Columns (1)-(3) report the estimated relationship between the total level of debt and respective measures for international contract enforcement, general judicial quality, and domestic contract enforcement. Columns (4)-(6) report the same regressions using per-capita debt as dependent variables. The conclusion is that if we consider a single aspect of institutions at a time then one observes that only counties with strong protection on foreign investment accumulate larger stocks of private external debt. However, general judicial quality or domestic contract enforcement (which is my primary concern) alone has limited explanatory power, highlighting the necessity of including all three institutional factors.

Turning to my baseline estimating equation with multivariate measures of institutional quality, results are presented in Table 5 with international contract enforcement proxied by the average ICRG's IRIS-3 measure of repudiation and expropriation risk, $IntlEnf\_R\&E$, and general judicial quality proxied by the EFW measure of legal enforcement on contracts, Q_ENF. Columns (1)-(3) present results using the average closing-a-business measure of domestic credit accessibility due to enforcement on a con-

Table 4: External Private Debt and Single Set of Contracting Institutions

	Debt Stocks Regressions			Per-Capita Debt Regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
$IntlEnf\_R\&E$	4.66***			0.14**		
	(1.73)			(0.07)		
Q_ENF		2.05*			0.04	
		(1.06)			(0.04)	
$DomEnf\_T\&C$			**-3.26**			**-0.09**
			(2.18)			**(0.08)**
GDP	0.04***	0.05***	0.05***			
	(0.01)	(0.01)	(0.01)			
$GDPCap$				0.31***	0.42***	0.45***
				(0.07)	(0.06)	(0.06)
$Cons.$	-22.52**	-2.96	22.85**	-2.80***	-2.84***	-2.51***
	(10.64)	(4.49)	(12.03)	(0.43)	(0.45)	(0.06)
$Obs.$	84	101	110	84	101	110
R^2	0.49	0.48	0.44	0.36	0.32	0.28

Notes: The dependent variables are the private nonguaranteed external debt in the form of debt stocks (1)-(3) and per-capita level (4)-(6). Standard errors are in parentheses. Ordinary squares regressions on time serial (2004-2008 or -2009 depending upon specifications) averages within countries. *** significant at 1%, ** significant at 5%; * significant at 10%.

tract between citizens, $DomEnf\_T\&C$, columns (4)-(6) using the closing-a-business recovery rate, $DomEnf\_REC$, columns (7)-(8) using the getting-credit legal rights index, $DomEnf\_LR$, and columns (9)-(10) using the domestic credit to private sector measure, $DomEnf\_CREDIT$. I begin by focusing on the interactions between three sets of contracting institutions without other potential determinants. The results are reported in columns (1), (4), (7), and (9). The coefficient of domestic contract enforcement is large, negative, and statistically significant at 1% for my primary measure. The result is confirmed by other alternative measures of domestic contract enforcement being negative and, at least minimally, significant at 10%.[18] This is consistent with the discussion following the theoretical model that easier internal credit is expected to tighten external credit constraint. Not surprisingly, the coefficients of other two sets of contracting institutions involving with foreign claims and general legal quality are positive and significant. It is meaningful to directly compare the magnitude of three institutional measures in column (1), since all of them are defined roughly in the same range of $[0, 10]$. The magnitude of the negative effect is economically significant and comparable to those positive effects. This observation is reasonable robust to changes in the set of controls as in columns (2) and (3).

Next, I control for the size of the economy, GDP, and the severity of punishment via trade sanction, $NetIM$, as determinants of private debt stocks. These two variables seem to play a considerable role with statistically and economically significant impact in all

[18]The parameter associated with $DomEnf\_CREDIT$ is positive in specification (10) since domestic credit is highly positively correlated with GDP, which is in turn in a positive relationship with debt level. One will see the parameter becomes negative after GDP is controlled for.

specifications. Total external debt owed by private sectors is positively correlated with economic size perhaps because economic outputs provides collateral to foreign creditors, and imports because borrowers cannot afford a default in anticipation of foreign creditors' ability to cease exports against defaulting parties (but when domestic credit is used as a regressor, the correlation with imports turns to negative due to the potential interaction between domestic credit and net imports). I also control for other determinants of debt stocks that, if omitted, may bias the estimated importance of contract enforcement. In specific, I include natural resource abundance, NR, indicators of educational attainment, H, and residents' holding of external assets, $Asset$. All these variables can be considered as some kind of repayment assurance. Accordingly, they are positively associated with the debt level. However, only the coefficient of NR is significant and robust across different specifications. The overall ability of these independent variables to fit the cross-sectional variation in the total external debt is considerable with R^2 ranging from 0.77 to 0.81 in all full-loaded specifications.

10 Robustness Analysis

In this section, I outline several potential concerns regarding my main estimates, seek evidence to alleviate hesitations, and report the related findings, as follows. Note that in all robust regression, I report only the results with $DomEnf\_T\&C$ as the measure of domestic contract enforcement. The usage of alternative measures for domestic contract enforcement leads to similar results.

Table 5: The Determinants of External Private Debt Stocks: Averages 2004-2008

	DomEnf_T&C			*DomEnf_REC*			*DomEnf_LR*		*DomEnf_CREDIT*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
IntlEnf_R&E	7.14***	4.11**	3.31*	9.21***	5.39**	4.57**	9.74***	4.00*	6.29**	2.30
	(2.49)	(1.97)	(1.78)	(2.69)	(2.09)	(1.74)	(2.89)	(2.14)	(2.36)	(1.42)
Q_ENF	6.16***	3.21**	1.30	5.50***	2.96*	1.18	5.87***	0.79	3.64**	0.44
	(1.93)	(1.56)	(1.25)	(1.97)	(1.55)	(1.22)	(2.14)	(1.47)	(1.91)	(0.99)
DomEnf	**-9.05*****	**-5.10***	**-4.11****	**-0.36***	**-0.28***	**-0.27****	**-2.57***	**-0.02**	**0.02*****	**-0.16*****
	(3.20)	**(2.56)**	**(1.94)**	**(0.21)**	**(0.16)**	**(0.12)**	**(1.48)**	**(0.97)**	**(0.01)**	**(0.03)**
GDP		0.05***	0.07***		0.06***	0.07***		0.07***		0.09***
		(0.01)	(0.02)		(0.01)	(0.02)		(0.02)		(0.01)
NetIM		0.24**	0.47**		0.29**	0.48**		0.58***		-0.03
		(0.12)	(0.21)		(0.11)	(0.21)		(0.21)		(0.19)
NR			0.41***			0.41***		0.42***		-0.25**
			(0.06)			(0.06)		(0.06)		(0.12)
H			0.22			0.29		0.18		0.35
			(0.30)			(0.30)		(0.36)		(0.24)
Asset			0.02			0.01		0.04		0.17***
			(0.05)			(0.05)		(0.05)		(0.05)
Cons.	-6.73	-4.82	-3.44	-56.57***	-32.69***	-26.99**	-57.01***	-28.50**	-42.35***	-17.88**
	(22.92)	(17.86)	(16.08)	(15.70)	(12.23)	(10.73)	(16.30)	(12.44)	(14.46)	(8.79)
Obs.	73	73	60	73	73	60	76	59	76	60
R^2	0.27	0.59	0.78	0.23	0.59	0.77	0.24	0.79	0.31	0.81

Notes: The dependent variable is external debt stocks, private nonguaranteed. Coefficients of various measures for the ease of obtaining private credit inside borders in bold. Standard errors in parentheses. Ordinary squares regressions on averages 2004-2008 (2004-2007 whenever *Asset* is included as a regressor) within countries. *** significant at 1%, ** significant at 5%; * significant at 10%.

10.1 Changes in the Sample

The results are robust to two alternative samples as shown in Table 6. One is an enlarged sample augmented by debt data on additional countries and the year of 2009, which are made available by a wider coverage of self-constructed Q_ENF measure. The other is a narrower sample that restricts countries to those with strictly positive amount of private debt for at least one year within the baseline sample period of 2004-2008.

10.2 Expanding the List of Explanatory Variables

The main result holds when I introduce a number of additional determinants as regressors. I compare two competing measures of capital controls, and choose EFW's index for the rest of the specifications for the reason of data availability. The coefficient on $DomEnf\_T\&C$ is essentially unchanged and remains significant until the size of domestic stock market is added, whereas new regressors are never statistically significant except for the binary indicator of OECD membership. The signs of coefficients for these new regressors are as expected. Fewer restrictions on capital flows are always positively associated with private debt owed across borders. OECD membership significantly increases borrowing. Higher inflation signals failed monetary policy, economic mismanagement and instability thus raises the probability of defaults. Domestic stock market development may help attract not only foreign equity and direct investment, but also portfolio debt and loan. Table 7 reports the findings.

Table 6: Robustness Regression: Enlarging and Narrowing Sample Size

	Enlarged Sample			Narrower Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
$IntlEnf\_R\&E$	6.76***	4.15**	3.31*	7.91**	4.75	2.46
	(2.48)	(2.02)	(1.78)	(3.68)	(2.96)	(2.18)
Q_ENF	6.33***	3.61**	1.30	8.13***	4.74**	2.59*
	(2.04)	(1.67)	(1.25)	(2.46)	(2.06)	(1.46)
$DomEnf\_T\&C$	**-9.84*** **	**-5.54*** *	**-4.11*** **	**-10.01*** **	**-5.79*** *	**-4.98*** **
	(3.49)	**(2.84)**	**(1.94)**	**(3.95)**	**(3.25)**	**(2.08)**
GDP		0.05***	0.07***		0.05***	0.07***
		(0.01)	(0.02)		(0.01)	(0.02)
$NetIM$		0.26*	0.47**		0.24*	0.44*
		(0.13)	(0.21)		(0.13)	(0.22)
NR			0.41***			0.42***
			(0.06)			(0.06)
H			0.22			0.30
			(0.30)			(0.33)
$Asset$			0.02			0.01
			(0.05)			(0.05)
$Cons.$	-0.66	-3.75	-3.44	-13.57	-10.47	1.64
	(23.52)	(18.90)	(16.08)	(35.32)	(28.54)	(19.31)
$Obs.$	78	77	60	55	55	49
R^2	0.24	0.55	0.78	0.30	0.58	0.78

Notes: The dependent variable is external debt stocks, private nonguaranteed. The enlarged sample includes additional countries and year 2009 made available by self-constructed Q_ENF measure. The narrower sample excludes those countries with external private debt equating to zeros. Standard errors in parentheses. Ordinary squares regressions on time-serial averages (2004-2009 in the enlarged sample, 2004-2008 in the narrower sample, and 2004-2007 whenever $Asset$ is included as a regressor). *** significant at 1%, ** significant at 5%; * significant at 10%.

Table 7: Robustness Regression: Expanding the List of Explanatory Variables

	Benchmark	Additional Regressors Added			
		CC	*OECD*	*Inflation*	*MktCap*
IntlEnf_R&E	3.31*	3.25*	1.25	1.15	1.48
	(1.78)	(1.79)	(1.85)	(1.89)	(2.67)
Q_ENF	1.30	1.19	0.54	0.60***	0.78
	(1.25)	(1.28)	(1.23)	(1.30)	(1.70)
DomEnf_T&C	**-4.11****	**-4.09****	**-3.66***	**-3.88****	**-3.50**
	(1.94)	**(1.96)**	**(1.85)**	**(1.91)**	**(2.35)**
GDP	0.07***	0.07***	0.07***	0.07***	0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
NetIM	0.47**	0.47**	0.29	0.26	0.16
	(0.21)	(0.21)	(0.21)	(0.22)	(0.30)
NR	0.41***	0.41***	0.40***	0.40***	0.40***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
H	0.22	0.18	0.12	0.11	0.18
	(0.30)	(0.31)	(0.29)	(0.30)	(0.38)
Asset	0.02	0.02	-0.01	-0.01	-0.04
	(0.05)	(0.05)	(0.05)	(0.05)	(0.08)
CC		0.43	0.22	0.27	0.06
		(0.78)	(0.74)	(0.77)	(1.11)
OECD			15.93**	17.48***	18.32*
			(5.95)	(6.46)	(10.43)
Inflation				-0.64	-0.52
				(4.23)	(5.35)
MktCap					0.01
					(0.03)
Cons.	-3.44	-4.61	8.43	10.01	5.96
	(16.08)	(16.33)	(16.16)	(16.56)	(24.61)
Obs.	60	60	60	59	46
R^2	0.78	0.78	0.81	0.81	0.81

Notes: The dependent variable is external debt stocks, private nonguaranteed. Standard errors in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%.

10.3 Changes in Dependent Variable

Instead of using the nominal level of debt as dependent variable, I check the per-capita level in column (1)-(3) of Table 8. All nominal explanatory variables are also transformed to per-capita level in thousands of U.S. dollars at current prices, by dividing population data from the same sources. One still observes a negative and statistically significant relationship between the size of foreign debt and the accessibility of domestic debt. However, this relationship no longer exists when I check the power of the same explanatory variables in explaining foreign debt stocks owed by public sectors. Public and publicly guaranteed debt seems to be positively associated with $DomEnf\_T\&C$, which is reasonable since the story of atomic defaulters re-accessing market via the non-defaulted does not equally apply to governmental debt. Although domestic financial development may hinder private corporations from borrowing abroad, it indicates government's capabilities and economic growth potential hence increasing the amount of public debt. The different results confirm my assertion in the introduction part that the identity of external debt borrower could make a difference.

10.4 Alternative Measures for Institutional Quality

I run regressions with alternative measures on my other two sets of contracting institutions. When international contract enforcement is proxied by investment profile ratings from the ICRG's political risk index, the main result holds and investment profile is significant as well. As for alternatives on general judicial quality, the results are only robust to changes in specification (4), (7), and (9), which include only three sets of institu-

Table 8: Robustness Regression: Alternative Dependent Variables

	Per-Capita Private Debt			Public Debt Stocks		
	(1)	(2)	(3)	(4)	(5)	(6)
$IntlEnf\_R\&E$	0.38***	0.20**	0.10	5.29**	1.53	0.75
	(0.07)	(0.08)	(0.06)	(2.53)	(1.70)	(1.97)
Q_ENF	0.07	0.02	0.05	4.54**	1.39	0.12
	(0.06)	(0.05)	(0.04)	(1.96)	(1.34)	(1.38)
$DomEnf\_T\&C$	**-0.16***	**-0.20****	**-0.16****	**-4.46**	**0.56**	**1.64**
	(0.09)	**(0.08)**	**(0.06)**	**(3.25)**	**(2.21)**	**(2.16)**
$GDP(Cap)$		0.33***	0.02		0.07***	0.10***
		(0.08)	(0.08)		(0.01)	(0.02)
$NetIM(Cap)$		0.34**	0.50***		0.39***	0.38
		(0.14)	(0.15)		(0.10)	(0.24)
$NR(Cap)$			0.50***			0.32***
			(0.15)			(0.07)
H			0.01			0.41
			(0.01)			(0.33)
$Asset(Cap)$			0.17***			-0.05
			(0.02)			(0.06)
$Cons.$	-1.42**	-2.36***	-0.16	-8.41	-8.50	-10.09
	(0.66)	(0.63)	(0.57)	(23.26)	(15.40)	(17.86)
$Obs.$	73	73	64	73	73	60
R^2	0.32	0.47	0.75	0.19	0.60	0.71

Notes: The dependent variable in specification (1)-(3) is external debt per capita, private nonguaranteed. The dependent variable in (4)-(6) is external debt stocks, public and publicly guaranteed. Standard errors in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%.

tional measures and suppress the set of control variables. Nevertheless, those alternative proxies for general judicial quality are never significant, indicating their limited ability to separate different aspects of institutions comparing to Q_ENF. Table 9 reports the result of variations.

10.5 Panel Data Methods

Besides the between-effects method, there are three ways to estimate a panel dataset: pooled OLS, within-effects a.k.a fixed-effects, and random-effects strategy. I have explained why the between-effects estimator is chosen over other estimators in detail. But it is still worthwhile to run regressions using other panel data techniques for a visualized comparison. The empirical results are shown in Table 10. Note an array of year dummies are added to account for the time fixed effects. The main result is confirmed by pooled OLS. Fixed-effects model generates inconsistent result probably because it eliminates the between-country and focuses on within-country variations. Since private debt is growing and all countries work on improving domestic institutional system overtime, it is possible that one observes a positive relationship between them within a country in column (4). Random-effects estimator in columns (7)-(9) is a weighted average of between-effects and fixed-effects estimators; moreover, it is consistent and efficient under the condition that country-specific effect is uncorrelated with the regressors. However, this condition is rejected by Hausman test in our case.

Table 9: Robustness Regression: Alternative Measures of International Contract Enforcement and General Judicial Quality

	Benchmark		*IntlEnf_IP*		*Q_PROC*		*Q_ROL*		*Q_HF*	
	(1)	(2)	(3)	(4)	(4)	(6)	(7)	(8)	(9)	(10)
IntlEnf_R&E	7.15***	4.11**			10.17***	5.49**	8.80***	4.36*	9.02***	4.16
	(2.49)	(1.97)			(2.62)	(2.16)	(3.06)	(2.54)	(3.05)	(2.69)
IntlEnf_IP			2.63**	2.17**						
			(1.18)	(0.93)						
Q_ENF	6.15***	3.21**	5.65***	3.05**						
	(1.93)	(1.56)	(1.44)	(1.17)						
Q_PROC					-0.58	-0.14				
					(0.62)	(0.49)				
Q_ROL							0.89	1.35		
							(2.86)	(2.31)		
Q_HF									0.04	0.17
									(0.24)	(0.19)
DomEnf_T&C	**-9.04*****	**-5.10***	**-9.74*****	**-5.40****	**-7.43****	**-4.31**	**-7.64****	**-4.49**	**-7.63****	**-4.59**
	(3.21)	**(2.56)**	**(2.70)**	**(2.19)**	**(3.61)**	**(2.87)**	**(3.63)**	**(2.88)**	**(3.63)**	**(2.89)**
GDP		0.05***		0.05***		0.05***		0.05***		0.05***
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)
NetIM		0.24**		0.15		0.22		0.22		0.20
		(0.12)		(0.12)		(0.14)		(0.14)		(0.14)
Cons.	-6.73	-4.82	20.41	5.13	2.54	-2.19	-4.12	-2.73	-3.58	-1.90
	(22.92)	(17.86)	(17.07)	(13.39)	(25.89)	(20.43)	(24.95)	(19.56)	(25.23)	(20.74)
Obs.	73	73	81	80	78	77	78	77	78	76
R^2	0.27	0.59	0.23	0.57	0.18	0.53	0.17	0.53	0.17	0.53

Notes: The dependent variable is external debt stocks, private nonguaranteed. Standard errors in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%.

Table 10: Robustness Regression: Panel-Data Estimation Techniques

	Pooled OLS			Fixed Effects			Random Effects		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$IntlEnf\_IP^{\dagger}$	2.42***	1.96***	1.60***	0.10	0.43	0.26	0.77	0.70	0.93
	(0.60)	(0.49)	(0.51)	(0.75)	(0.56)	(0.79)	(0.66)	(0.50)	(0.62)
Q_ENF	5.54***	2.91***	1.57**	-2.64	-1.74	-1.69	3.47**	1.11	0.31
	(0.77)	(0.63)	(0.68)	(3.50)	(2.66)	(3.90)	(1.38)	(1.07)	(1.15)
$DomEnf\_T\&C$	-9.16***	-4.95***	-4.66***	11.25***	-3.23	-1.44	-0.58	-1.34	-2.99**
	(1.43)	(1.15)	(1.04)	(3.22)	(2.59)	(2.59)	(2.16)	(1.64)	(1.50)
GDP		0.05***	0.07***		0.10***	0.05***		0.08***	0.05***
		(0.004)	(0.01)		(0.01)	(0.02)		(0.004)	(0.01)
$NetIM$		0.18***	0.34***		0.41***	0.44***		0.31***	0.39***
		(0.05)	(0.09)		(0.05)	(0.07)		(0.04)	(0.06)
NR			0.40***			0.25***			0.32***
			(0.03)			(0.05)			(0.04)
H			0.31**			omitted			0.34
			(0.15)						(0.27)
$Asset$			0.01			0.08***			0.07***
			(0.02)			(0.02)			(0.02)
Country specific effect	n.a.	n.a.	n.a.	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy 2004-07	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	81	80	64	81	80	64	81	80	64
$Obs.$	318	308	237	318	308	237	318	308	237
R^2	0.24	0.57	0.77	0.09	0.49	0.62	0.14	0.53	0.72

Notes: The dependent variable is external debt stocks, private nonguaranteed. Standard errors in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%. n.a. stands for not available.

† the primary measure of international contract enforcement is changed to $IntlEnf\_IP$ because $IntlEnf\_R\&E$ is constant over time hence will be eliminated in the fixed-effects model.

10.6 Endogeneity

The results of instrumental variable regressions using former colonial variables, ethnolinguistic fractionalization, and legal origin as instruments are reported in Table 11 (second stage result) and Table 12 (first stage regression). The full sample contains country from all five legal origins. But in the sample where data on other instrumental variables are available, there are no German or Scandinavian legal origin countries. Consequently, only British and French legal origin appear as an instrument in the specifications of Table 12. The omitted legal origin category is Socialist.

The identifying assumption is that these instruments Z affect institutional quality, i.e., $cov\left(Z, IntlEnf\right) \neq 0$, $cov\left(Z, Q\right) \neq 0$, as well as $cov\left(Z, DomEnf\right) \neq 0$, and institutional quality in turn affects the external debt stocks, with no other links between debt and these instruments, i.e., $cov\left(Z, \varepsilon\right) = 0$. In column (2) of Table 11, all three sets of contracting institution are instrumented, but the corresponding first stage results, as presented in columns (1)-(3) of Table 12, show that (I) only settlers' mortality is a valid instrument for international contract enforcement; (II) only estimates on legal origins are significant when general judicial quality is the dependent variable; and (III) domestic contract enforcement seems to be not correlated with all my instruments. In the literature, there exists no evidence that external debt can directly affect the part of domestic financial development contributed by institutional attributes. The channel is indirect: external debt affects general legal quality, and then the positive effect is passed onto domestic contract enforcement, at last materialized in the ease of obtaining domestic credit. Therefore in column (3) of Table 11, I treat domestic contract enforcement as exogenous,

and instrument for international contract enforcement and general judicial quality. In both scenarios, columns (2) and (3) of Table 11, the IV coefficient on $DomEnf\_T\&C$ rises in absolute value compared with the corresponding OLS estimation. This result is consistent with previous literature using similar instruments to exclude reverse impact on institutional qualities. A common explanation is that these instruments may affect debt outcomes through channels other than contracting institutions [see, e.g., La Porta et al. 1998; Mahoney 2001; Glaeser and Shleifer 2002; Acemoglu and Johnson, 2005; Ranjan and Lee, 2007; Faria and Mauro, 2009]. In terms of my framework, this would amount to $cov\,(Z, \varepsilon) \neq 0$, violating the exclusion restriction.

11 Conclusions

This study has shown that the ease of obtaining domestic private credit, which might be a direct result of enhancing domestic contract enforcement, could potentially decrease the amount that private sectors are able to borrow overseas. I emphasize on the identity of the borrower (corporations and households versus governmental entities) in external debt, which may eventually lead to contradictory result using the same set of explanatory factors. Like previous works, external debt stocks are significantly associated with indicators of international contract enforcement and general courts' quality, as well as costs of future exclusion from international capital markets (measured by net imports of goods and services) and natural resources abundance (measured by net exports of agricultural raw materials, fuels, ores, and metals). Educational attainment as a proxy of human

Table 11: Robustness Regression: Two Stage Least Squares Regressions Second Stage Results

	OLS	IV	IV	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)
OLS and second stage IV estimates						
$IntlEnf\_R\&E$	8.73***	7.38	7.44	1.41	3.96	4.86
	(2.28)	(5.73)	(5.64)	(1.55)	(6.65)	(5.64)
Q_ENF	2.53	5.81	5.58	0.50	-2.19	-2.14
	(1.75)	(4.19)	(4.04)	(0.94)	(2.64)	(2.62)
$DomEnf\_T\&C$	-10.65***	-14.02	-11.33***	-4.86***	-6.29	-4.02**
	(2.65)	(11.04)	(2.82)	(1.49)	(9.00)	(2.00)
Cons.	4.61	18.92	4.83	15.27	18.39	1.27
	(18.55)	(63.59)	(29.99)	(12.78)	(75.10)	(35.25)
Full set of control variables	No	No	No	Yes	Yes	Yes
Variables instrumented:						
$IntlEnf\_R\&E$	n.a.	Yes	Yes	n.a.	Yes	Yes
Q_ENF	n.a.	Yes	Yes	n.a.	Yes	Yes
$DomEnf\_T\&C$	n.a.	Yes	No	n.a.	Yes	No
Obs.	54	54	54	42	42	42
R^2 in second stage	0.34	0.31	0.31	0.86	0.84	0.85

Notes: The dependent variable is external debt stocks, private nonguaranteed. Standard errors in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%. n.a. stands for not available.

Table 12: Robustness Regression: Two Stage Least Squares Regressions First Stage Results

Dependent Variables:	$IntlEnf\_R\&E$	Q_ENF	$DomEnf\_T\&C$	$IntlEnf\_R\&E$	Q_ENF
	(1)	(2)	(3)	(5)	(6)
First stage IV estimates					
Settlers' mortality	-0.52***	-0.21	0.01	-0.52***	-0.21
	(0.15)	(0.19)	(0.14)	(0.15)	(0.19)
Population density in 1500s	-0.04	-0.22	0.01	-0.05	-0.22
	(0.11)	(0.14)	(0.10)	(0.11)	(0.14)
Ethnolinquistic fractionalization	0.59	-1.14	-0.81	0.66	-0.97
	(0.60)	(0.76)	(0.56)	(0.62)	(0.78)
British legal origin	-0.87	-2.40**	0.76	-0.94	-2.57**
	(0.79)	(1.01)	(0.73)	(0.80)	(1.02)
French legal origin	-1.12	-3.03***	0.42	-1.16	-3.12***
	(0.74)	(0.95)	(0.69)	(0.74)	(0.95)
$DomEnf\_T\&C$				0.10	0.22
				(0.16)	(0.20)
Cons.	9.27***	8.26***	5.32***	8.75***	7.12***
	(0.96)	(1.23)	(0.89)	(1.28)	(1.62)
R^2 in first stage	0.27	0.29	0.06	0.28	0.31
F-statistics (Prob > F)	3.30 (0.01)	4.07 (0.00)	n.s.	2.78 (0.02)	3.60 (0.01)

Notes: The dependent variables are various contracting institutions. Specification (1)-(3) characterize the first stage results when all three institutions are defined as endogenous variables, specification (4)-(6) when domestic contract enforcement is considered exogenous. The results of first stage regression with a full set of control variables are not shown to conserve space, but the result is similar to those reported. Standard errors in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%. n.s. stands for not significant.

capital accumulation and external asset stocks as a proxy of loan collateral are occasionally significant in my regressions. My interpretation of the novel result is that improving institutions alone may fail to attain the economic goal of promoting private borrowing abroad. This policy should be combined with eliminating discrimination against foreign creditors, otherwise, institutional quality may cause foreign creditors to tighten credit constraint and hence reduce the amount lent to domestic private sectors. In conclusion, foreign lenders tend to invest more in private sectors whose host countries have weaker domestic contract enforcement or other unobserved characteristics that will harm private sector's backup plan after an international default.

Part IV

The Extensive Margin of Intrafirm Trade

12 Introduction

Recent firm-level approach reveals that fluctuations in intra-industry trade are dominated by extensive margin. To be specific, the variations in the number of exporters and the scope of exported varieties (extensive margin) account for a greater share of the changes in aggregate trade than the variation in the average exports per firm-variety (intensive

margin).[19] Does intrafirm trade follow a similar pattern? This paper defines intrafirm trade as domestic headquarters' (henceforth HQ) imports of manufactured parts from foreign upstream affiliates within a firm's boundaries. Like previous literature,[20] the share of intrafirm imports as total U.S. imports is found to be higher, the higher the HQ-services-input intensity of the industry of foreign affiliates in a cross-industry dataset. The novel finding is that this increase in intrafirm imports is mainly due to the acquisition of a large number of *productive* foreign affiliates. In a cross-country dataset, on the one hand, lower export costs attracts more manufactured-parts-input suppliers to enter the export marketplace, and on the other hand, lower wage and better contract enforcement attract greater amounts of U.S. direct investment in a country. The paper demonstrates these attractions materialize mostly in terms of larger numbers of export affiliates than in terms of more cross-border sales per affiliate.

Firm's endogenous choice of affiliate number can be rationalized in a theoretical framework that combines three ingredients—Antràs' property-rights model of vertically fragmented production, Melitz's view of productivity heterogeneity applied to exporting affiliates, and a multiproduct setup widely used in the industrial organization literature. Deviated from the seminal work of Antràs (2003), where a single-product firm decides whether to integrate its sole supplier as affiliate or outsource from it as an outsider, this paper studies the organizational choice of a single-brand multiproduct firm consisting of one HQ and a spectrum of suppliers. Each product is distinct, thus requires two specially designed intermediate inputs—manufactured parts made by a supplier and paired HQ

[19] See, e.g., Bernard, Jensen, Redding, and Schott (2009).
[20] See, e.g., Antràs (2003); Nunn and Trefler (2008).

services provided by the HQ. Contract incompleteness leads to ex-ante underinvestment in both intermediate inputs. Ex post, all suppliers under the same brand name unite to bargain with the HQ over allocation of sales revenue. There is a trade-off in integrating many suppliers as affiliates: it strengthens HQ's bargaining power but discouraging investment in manufactured parts. Benefits outweigh costs when HQ services are more important in all product lines. Different suppliers bring different productivity draws into their respective final-good productions. In the presence of fixed integration costs, only suppliers with high productivity levels will be integrated. The optimal bargaining result can thus be attained by internalizing the fewest number of suppliers. In an open economy, manufactured parts are traded across borders, but final varieties are nontradable. The coexistence of beachhead costs and productivity heterogeneity implies endogenous selection of exporters in the foreign country. Exporting suppliers not only have higher productivity than local suppliers on average but also result in the invention of new varieties. With access to exporters, domestic HQ redraws firm boundary—a fraction of *domestic* affiliates with relatively lower productivity ranks are rearranged as stand-alone outsiders to make some spaces for competent newcomers from the foreign country.

RELATED LITERATURE.—This paper is related to several branches of literature. First and foremost, the paper builds upon nascent works that consider firm boundary as a mechanism to reduce bargaining inefficiency in an incomplete contract environment. This growing body of literature stems from Antràs (2003), where a supplier providing labor intensive inputs is internalized by the HQ if final-variety production involves more capital-intensive inputs. Trade happens because countries differ in factor endowment. In a more

recent paper, Antràs (2005) applies this idea to study product's life cycle in a North-South trade model, in which the South endures incomplete contracts whereas the North is endowed with well-established contracting institutions. Antràs and Helpman (2004) develop a property-rights theory of transnational firm that allows for intra-industry heterogeneity in HQ's productivity as in Melitz (2003) combined with the organizational structure as in Antràs (2003). Their main result is that high productivity parent firm in HQ-intensive sectors are more likely to choose integration strategies, while in component-intensive sectors outsourcing is pervasive. Antràs and Helpman (2008) then generalize this framework. In addition to assuming different contractibility across countries, they accommodate varying degrees of contractual frictions across intermediate input investments. HQ and its suppliers undertake a continuum of relation-specific investments, with only a fraction of these investments contractible as in Acemoglu, Antràs, and Helpman (2007), to produce one intermediate input used in the production of final variety. They find that better contracting in South cause an increase in the prevalence of foreign direct investment (FDI hereafter) and related-party trade if the institutional improvement affects disproportionately the contractibility of inputs provided by suppliers rather than the HQ. Empirical evidence for the main predictions in Antràs (2003) and Antràs and Helpman (2004; 2008) is provided by Nunn and Trefler (2008). Secondly, this paper applies the firm-level heterogeneity of Melitz (2003) to affiliate level. Manufacturing plants are the exporters in this model, and HQ can still differ in overall productivity derived from a combination of all its affiliates' productivities. Thirdly, the multiproduct setup allows this paper to introduce multiple affiliates within a firm or brand and, more im-

portantly, to generate the rationalization of affiliate scope after trade opening, which is similar to the variety scope adjustments under trade shocks in Ma (2008). Finally, multiple affiliates can be modeled through alternative ways. Schwarz (2009) studies single product requiring multiple inputs besides HQ services, with each input supplied by an individual plant either as an affiliate or outsider. His formulation leads to the prediction that plants producing complex inputs that are proximate to the final-good are more likely to be integrated. Since plants are exogenously different by the definition of production function, there is no dynamics of sorting into different organizational forms, which in turn is of critical importance to generate the extensive margin of intrafirm trade.

The rest of the paper is organized as follows. The paper begins with analysis of a closed economy in section 13. Section 14 studies a two-country open economy and discusses the impact of trade liberalization on structural reorganization. The paper then investigates the main predictions using data on U.S. multinational companies in section 15. Section 16 concludes, followed by a technical Appendix C including all derivations.

13 Closed Economy Equilibrium

Consider the home country in autarky.

DEMAND.—A representative consumer has CES preference over a continuum of different brands, $i \in [0, 1]$,

$$Q = \left(\int_{i=0}^{1} q(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}, \ \theta > 1.$$

The brand output $q(i)$ represents the aggregated quantity of a basket of final varieties, $j \in \Omega$,[21]

$$q(i) = \left(\int_{j \in \Omega} q_j(i)^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}}, \ \sigma > 1, \tag{13}$$

where $q_j(i)$ is the variety output for j under brand i. One can think of this commodity hierarchy as capturing an industry (e.g., portable consumer electronics in the U.S.) consisting of many brands (e.g., Microsoft, Apple, Google, Sony, Amazon), under which the HQ of each brand supplies a line of varieties (e.g., laptop, smart phone, MP3 player, eBook reader, tablet) to local customers.

The price index for consumption composite Q is denoted as

$$P = \left(\int_{i=0}^{1} p(i)^{1-\theta} di \right)^{\frac{1}{1-\theta}},$$

where $p(i)$ is the price index for $q(i)$,

$$p(i) = \left(\int_{j \in \Omega} p_j(i)^{1-\sigma} dj \right)^{\frac{1}{1-\sigma}},$$

and $p_j(i)$ is the unit price of $q_j(i)$. Take the consumption composite and two tiers of price indices as given, the demand functions for brand output and variety output are, respectively,

$$q(i) = QP^{\theta} p(i)^{-\theta}, \ \forall i,$$

[21] Ω is the set of goods available to consumers in the home country. Though fixed in a closed economy, its size will be endogenously determined after opening to trade of intermediate inputs.

and

$$q_j(i) = QP^{\theta}p(i)^{\sigma-\theta}p_j(i)^{-\sigma},\ \forall i, j.$$

The total revenue generated by sales of brand output is

$$\begin{aligned} R(i) &= p(i)q(i) \\ &= Q^{\frac{1}{\theta}}Pq(i)^{\frac{\theta-1}{\theta}}. \end{aligned} \tag{14}$$

Alternatively, this revenue can be viewed as the summation of all variety revenues under the same brand,

$$R(i) = \int_{j\in\Omega} R_j(i)dj,$$

where variety revenue is defined as below,

$$\begin{aligned} R_j(i) &= p_j(i)q_j(i) \\ &= Q^{\frac{1}{\sigma}}P^{\frac{\theta}{\sigma}}p(i)^{\frac{\sigma-\theta}{\sigma}}q_j(i)^{\frac{\sigma-1}{\sigma}}. \end{aligned} \tag{15}$$

Moreover, the fraction of brand revenue that is contributed by sales of variety j is proportional to variety output as a fraction of brand output,

$$\frac{R_j(i)}{R(i)} = \left[\frac{q_j(i)}{q(i)}\right]^{\frac{\sigma-1}{\sigma}}. \tag{16}$$

PRODUCTION.—The production of any variety j involves two parties—one HQ de-

noted by H, who owns the brand, and one manufacturing plant denoted as M_j.[22] The technology is a Cobb-Douglas assembly of two variety-specific intermediate inputs: HQ services, h_j, and manufactured parts, m_j.

$$q_j = z_j \left(\frac{h_j}{\eta_h}\right)^{\eta_h} \left(\frac{m_j}{\eta_m}\right)^{\eta_m}, \ \eta_h \in [0,1], \ \eta_m = 1 - \eta_h, \tag{17}$$

where z_j is the productivity parameter, whereas η_h and η_m are, respectively, the intensity parameters for h_j and m_j. Intensity parameters are the characteristics associated with the brand, hence, the same across different varieties managed by that brand. HQ services can be produced only by H with a variable cost c_h per unit of h_j, and manufactured parts can be produced only by M_j with a variable cost c_m per unit of m_j.[23] By definition, H must hire a M_j in order to produce variety j at some productivity level z_j, which is drawn by M_j from a known distribution $G(z)$ with support $[z_{\min}, z_{\max}]$. Productivity parameters are asymmetric across varieties within one brand. Each M_j realizes its own productivity upon the establishment of cooperation agreements with the HQ.

It is assumed that both intermediate inputs for one variety are specially designed for its use, therefore worthless for other varieties. As a result, there exists two-way hold-up problem given contracts are incomplete.[24] After investments in inputs have been made, H and a coalition of all manufacturing plants, denoted as M, play a generalized Nash

[22] Since brands are symmetric, the paper will focus on one brand from now on, and drop i in the brackets to avoid clutter.

[23] In an open economy, this assumption prohibits HQ from building manufactured plants in a foreign country from scratch (the so-called Greenfield). Therefore, the only way to set up a foreign affiliate is by acquiring existing exporters.

[24] Incomplete contract in this paper means that the share of brand revenue apportioned to the HQ is the only item can be contracted upon.

bargaining game to determine the allocation of brand revenue R. H gains $\beta_h \in [0,1]$ fraction, and M gains $\beta_m = 1-\beta_h$ fraction. Since β_h will depend solely upon bargaining powers ex post, ex-ante investments are inefficient. To provide investment incentives, H builds up the optimal balance of bargaining powers between itself and M.

The hiring relationship between H and a single M_j can either take the form of vertical integration or outsourcing. With vertical integration, H pays a fixed fee to acquire M_j as one of its subsidiaries; hence, obtain the right to seize a fraction of M_j's output when bargaining breaks down. Anticipating this loss of ex-post bargaining power and a corresponding decrease in revenue share, M_j will further decrease investment. With outsourcing, H buys manufactured parts from an outsider M_j and thus exposes to the threat of cutting off supply. A raise in M_j's ex-post bargaining power increases β_m but encouraging investment.

An organizational form, denoted by $\gamma \in \Gamma$, is defined as a spectrum of binary hiring choices for all plants M_j, $j \in \Omega$. There is a one-to-one mapping between the set of organizational forms, Γ, and the share of brand revenue flows to the HQ, β_h. In other words, choosing Γ is equivalent to choosing its corresponding β_h. For example, consider two elements in a set of organizational forms: $\gamma_k,\ \gamma_l \in \Gamma$. Without loss of generality, suppose γ_k represents integrating M_j's with $j \leq k$, while γ_l represents integrating M_j's with $j \geq l$. Although they have different integration strategies, both lead to the same pattern of brand revenue allocation.

To sum up, the HQ faces the trade-off that an integration oriented Γ reduces R but increases β_h, while an outsourcing oriented Γ sacrifices β_h to improve R. The optimal

set Γ relies on the intensity of HQ services, η_h. The final choice of element γ relies on the distribution of productivity draws, z_j, over all varieties under the brand of H.

TIMING.—The timing of events is as follows.

1. $\forall j$, H enters into a cooperation agreement with any one plant among a large number of *identical* candidates, and refers to the selected as M_j.

2. A Ω set of M_j's find out their productivity draws separately, and found M to fight for a more favorable bargaining result.

3. H chooses Γ to set up according bargaining powers.

4. H chooses γ from Γ to minimize the integration costs.

5. H and M simultaneously choose their optimal investments in intermediate inputs $\{h_j\}_{j\in\Omega}$ and $\{m_j\}_{j\in\Omega}$, respectively.

6. Bargain over the incoming R begins, H proposes a revenue dividing scheme which keeps β_h fraction to itself, and offers the rest to M.

7. If M rejects, M gets nothing while H seizes a fraction of q_j from each integrated M_j defined in γ.

8. If M accepts the offer, then M transports $\{m_j\}_{j\in\Omega}$ to H, where q_j amount of variety j is assembled, $\forall j$.

9. Revenue R is collected, then divided in proportions specified in the offer.

10. M distributes its share of profit, $\beta_m R$, to all M_j's in a pro rata share of their contributions—$\beta_m R_j$ to plant M_j, $\forall j$.

PROFIT MAXIMIZATION.—The profit maximization problem is solved using backward induction.

At step 5, the optimal Γ, or equivalently, β_h is known. Given $\{m_j\}_{j\in\Omega}$, H maximizes its share of profit by choosing investments in various HQ services.

$$\max_{\{h_j\}_{j\in\Omega}} \beta_h R - c_h \int_{j\in\Omega} h_j dj,$$

subject to brand output (13), the definition of brand revenue (14), and variety production functions (17). Similarly, M maximizes its profit given $\{h_j\}_{j\in\Omega}$.

$$\max_{\{m_j\}_{j\in\Omega}} \beta_m R - c_m \int_{j\in\Omega} m_j dj,$$

subject to Eqs. (13), (14) and (17). Combine the first order conditions with Eq. (16), this noncooperative game yields:

$$\begin{cases} h_j = \left(\frac{\beta_h \eta_h}{c_h}\right)^{\frac{\theta-1}{\theta}} R_j; \\ m_j = \left(\frac{\beta_m \eta_m}{c_m}\right)^{\frac{\theta-1}{\theta}} R_j, \end{cases} \tag{18}$$

for all $j \in \Omega$.

At step 3, H observes all the productivity draws in its manufacturing facilities, and

chooses β_h to maximize ex-ante total profit.

$$\pi \equiv \max_{\beta_h} \int_{j\in\Omega} R_j dj - c_h \int_{j\in\Omega} h_j dj - c_m \int_{j\in\Omega} m_j dj, \tag{19}$$

subject to Eqs. (15) and (17), as well as incentive compatibility constraints (18) from step 5. Substitute all the constraints into the objective function to obtain an alternative maximization problem,[25]

$$\pi = \max_{\beta_h} Z \times A,$$

where Z is some measure of overall brand productivity,

$$Z \equiv \left(\int_{j\in\Omega} z_j^{\sigma-1} dj \right)^{\frac{1-\theta}{1-\sigma}},$$

the constant component in A reflects the impacts from consumer demands and variable costs of input investment on profit, and the variant component in A represents the trade-off between revenue pie and HQ's slice,

$$\begin{aligned} A \equiv & \underbrace{QP^{\theta} \left(\frac{\theta-1}{\theta} \right)^{\theta-1} c_h^{-\eta_h(\theta-1)} c_m^{-\eta_m(\theta-1)}}_{\text{Constant Component}} \\ & \times \underbrace{\left[1 - \left(\frac{\theta-1}{\theta} \right) (\eta_h \beta_h + \eta_m \beta_m) \right] \beta_h^{\eta_h(\theta-1)} \beta_m^{\eta_m(\theta-1)}}_{\text{Variant Component}}. \end{aligned}$$

To find the optimum, it is sufficient to maximize the variant component in A subject to

[25] See the derivation in Appendix C.

$\beta_m = 1 - \beta_h$ and $\eta_m = 1 - \eta_h$. If H can choose β_h freely from the $[0,1]$ interval, then there is an unique analytical expression for the optimal share of revenue,

$$\beta_h^*(\eta_h) = \frac{\eta_h\left[1+(\theta-1)\eta_h\right] - \sqrt{\eta_h(1-\eta_h)\left[\theta-(\theta-1)\eta_h\right]\left[1+(\theta-1)\eta_h\right]}}{\theta(2\eta_h-1)},\ \eta_h \neq \frac{1}{2},$$

with $\beta_h^*\left(\frac{1}{2}\right) = \frac{1}{2}$.[26] Note $\beta_h^*(0) = 0$, $\beta_h^*(1) = 1$, $\beta_h^{*\prime}(\eta_h) > 0$, $\beta_h^{*\prime\prime}(\eta_h) > 0$ when $\eta_h > \frac{1}{2}$ and $\beta_h^{*\prime\prime}(\eta_h) < 0$ when $\eta_h < \frac{1}{2}$.

Proposition 6 *Brands with high intensity in HQ services tend to acquire strong bargaining power against a group of collusive upstream plants.*

CHOICES OF ORGANIZATIONAL FORM.—More notations are needed to discuss the optimal organizational form γ. Consider a generalized Nash bargaining game, where two players bargain over a certain amount. Assume the results under equivalent bargaining powers are always the same such that β fraction is distributed to one party (without loss of generality, say, the HQ) and the rest to another party (the suppliers' union). Let δ be the fraction of q_j that can still be produced when bargain fails and, consequently, H seizes some manufactured parts from M_j if M_j is an integrated affiliate.

What H chooses in the original problem (19) is the set of organizational forms, Γ, which is lower bounded by a singleton, Γ_O, where H outsources from all M_j, and upper bounded by another singleton, Γ_I, where all plants are integrated by H. These boundaries restrict H to choose β_h from a subset of $[0,1]$, namely, $\left[\beta, \beta + (1-\beta)\delta^{\frac{\theta-1}{\theta}}\right]$. If H chooses Γ_O, then bargain breakdown leaves 0 residual to both H and M. Since the amount to

[26] See the derivation in Appendix C.

bargain over is the brand revenue R, H gains βR, while M gains $(1-\beta)R$. If H chooses Γ_I, then the outside option for M is again 0 when M rejects the offer, but H will be able to produce δ fraction of q_j for all variety $j \in \Omega$. According to Eq. (13), δq quantities of brand output are sold, and further translated into a sales revenue of $\delta^{\frac{\theta-1}{\theta}}R$. The amount that is subject to bargaining becomes $\left(1-\delta^{\frac{\theta-1}{\theta}}\right)R$. Therefore, H gains

$$\left[\beta+(1-\beta)\delta^{\frac{\theta-1}{\theta}}\right]R = \underbrace{\delta^{\frac{\theta-1}{\theta}}R}_{\text{Outside Option}} + \underbrace{\beta\left(1-\delta^{\frac{\theta-1}{\theta}}\right)R}_{\text{Bargain Share}},$$

and leaves the rest, $(1-\beta)\left(1-\delta^{\frac{\theta-1}{\theta}}\right)R$, to M. If H chooses an off-boundary set, denoted by Γ_{Mix}, then some plants in M are integrated affiliates while others are outsiders. However, it is still unclear which plants to integrate, since Γ_{Mix} is no longer a singleton. To find out the answer, an additional problem has to be solved.

At step 4, taking Γ_{Mix} as given, H picks out the element that minimizes the total costs incurred in integration.

$$\min_{\gamma\in\Gamma_{Mix}} f_I \times \text{number of integrated plants in } \gamma,$$

where f_I denotes the fixed fee to integrate any one manufacturing plant. There is however no such costs for outsourcing, $f_O = 0$. Rank all plants under the same brand from high to low according to their productivity draws, i.e., $z_j \geq z_k$, $\forall j < k$ and $j, k \in \Omega$. To attain the desired revenue share with the smallest number of affiliates, H starts integration from M_0, who possesses the highest productivity technology, and continues to do so towards

the other end. Suppose H arrives at β_h^* after acquiring M_k with a cutoff productivity, z_k. Put it another way, all M_j's with $z_j \geq z_k$ are integrated facilities, and the rest with $z_j < z_k$ are outsiders. When two parties fail to reach an agreement, M gains nothing as usual, while H now produce ε_k fraction of q. Define $\varepsilon_k \in [0, \delta]$ as

$$\varepsilon_k \equiv \frac{\left(\int_{j\leq k} \delta q_j^{\frac{\sigma-1}{\sigma}} dj\right)^{\frac{\sigma}{\sigma-1}}}{q}.$$

Using Eqs. (13), (17), (18), and (C.1)[27], this fraction degenerates to

$$\begin{aligned}
\varepsilon_k &= \delta \left(\frac{\int_{j\leq k} z_j^{\frac{(\sigma-1)^2+(\sigma-1)}{\sigma}} dj}{\int_{j\in\Omega} z_j^{\frac{(\sigma-1)^2+(\sigma-1)}{\sigma}} dj} \right)^{\frac{\sigma}{\sigma-1}} \\
&= \delta \left(\frac{\int_{j\leq k} z_j^{\sigma-1} dj}{\int_{j\in\Omega} z_j^{\sigma-1} dj} \right)^{\frac{\sigma}{\sigma-1}} \\
&= \delta Z^{\frac{\sigma}{1-\theta}} \left(\int_{j\leq k} z_j^{\sigma-1} dj \right)^{\frac{\sigma}{\sigma-1}}. \qquad (20)
\end{aligned}$$

Therefore, H gains $\left[\beta + (1-\beta)\varepsilon_k^{\frac{\theta-1}{\theta}}\right] R$, and leaves the rest, $(1-\beta)\left(1-\varepsilon_k^{\frac{\theta-1}{\theta}}\right) R$, to M.[28][29]

Let η_h^L and η_h^H denote, respectively, the HQ services intensities lead to lower and

[27] Essentially as for the integration over j is concerned, one can treat R_j as $K \times z_j^{\sigma-1}$, and K can be taken outside the integration.

[28] Notice $\varepsilon_k = 0$ implies that Γ_{Mix} shrinks to Γ_O, and $\varepsilon_k = \delta$ takes one back to Γ_I.

[29] If all plants are ranked from low to high instead, then H stops the process of integration at M_l. The fraction ε_k will be defined as,

$$\varepsilon_k \equiv \delta \left(\frac{\int_{j\leqslant l} z_j^{\sigma-1} dj}{\int_{j\in\Omega} z_j^{\sigma-1} dj} \right)^{\frac{\sigma}{\sigma-1}}.$$

To attain the same value of ε_k, a larger number of affiliates ($l > k$) is required in this alternative ranking method, which is less preferred.

upper boundaries. They are implicitly defined by

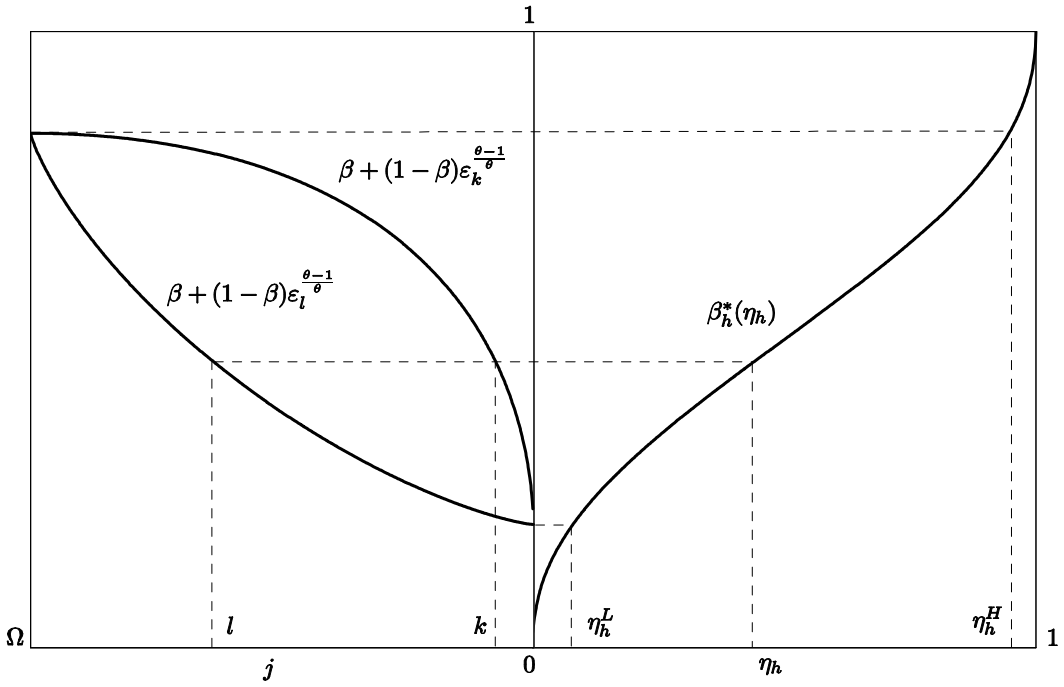
$$\begin{cases} \beta_h^*\left(\eta_h^L\right) = \beta; \\ \beta_h^*\left(\eta_h^H\right) = \left[\beta + (1-\beta)\delta^{\frac{\theta-1}{\theta}}\right]. \end{cases}$$

Proposition 7 *In a closed economy, if all manufacturing plants under brand i, $M_j(i)$, are ranked by their productivity draws z_j in a descending order, then the HQ of this brand, $H(i)$, will adopt the organizational form depending upon its intensity parameter of HQ services. Specifically, $H(i)$ adopts*

1. Γ_O *if* $\eta_h(i) \in \left[0, \eta_h^L(i)\right]$;
2. Γ_I *if* $\eta_h(i) \in \left[\eta_h^H(i), 1\right]$;
3. $\gamma_{k(i)} \in \Gamma_{Mix}$ *if* $\eta_h(i) \in \left(\eta_h^L(i), \eta_h^H(i)\right)$, *where* $\gamma_{k(i)}$ *represents integrating* $M_j(i)$ *with* $j \leq k(i)$ *and outsources from* $M_j(i)$ *with* $j > k(i)$, $\forall j \in \Omega$.

In conclusion, the optimal set of organizational forms Γ is mapped one-to-one to $\beta_h^*(\eta_h)$. Hence, Γ depends solely upon the intensity parameter of the HQ services, η_h. The optimal element, $\gamma \in \Gamma$, is mapped one-to-one to k after all plants are ranked. Figure 3 gives an illustration. Brands differ in organizational forms: greater HQ services intensity, $\eta_h(i)$, results in an integration oriented strategy—a larger $k(i)$ number of affiliates.

Figure 3: Choices of Organizational Form



Notes: The curve in the right panel is the function of optimal revenue allocation to the HQ given the intensity parameter. The concave function in the left panel represents revenue shares generated through ordering suppliers on the $[0, \Omega]$ interval from high to low by their productivities, whereas the convex function below represents a low to high ranking.

14 Open Economy and The Impact of Trade Liberalization

The world consists of two countries: home and foreign. Assume only manufactured parts are traded across borders, whereas varieties are nontradable. To be consistent with the previous example of portable electronics industry, one can think of the following stylized fact—most parts of iPod shuffle are made in factories outside the U.S., however, the primary target of sales is the U.S. market.

Using an apostrophe, the foreign brand that corresponds to home brand i is denoted by i'. Foreign plants under brand i' can only serve the corresponding home brand i. A new *domestic* variety under brand i with its manufactured parts supplied by a foreign plant is denoted as $j' \in \Omega'$. The manufactured parts for variety j' are produced by a foreign plant, $M_{j'}$, with a variable cost $c'_m < c_m$ per unit of $m_{j'}$. For simplicity, the fixed fee of acquiring a foreign plant is the same as integrating a domestic plant. It is also assumed that the domestic HQ can only collaborate with exporting foreign manufacturing plants. Foreign plants face two types of costs when ship their manufactured parts to the home country—a fixed cost to start exporting, f, and a unit export cost, τ. It is only after the realization of productivity draws that foreign manufacturers decide whether to export based on the below free entry condition:

$$\beta_m R_{j'} - (\tau + c'_m) m_{j'} \geq f, \tag{21}$$

where foreign plant j''s export revenue $R_{j'}$ and cross-border sales $m_{j'}$ are defined similarly as in Eq. (15) and (18), respectively. The export profit in the left hand side is strictly increasing in $z_{j'}$.[30] This condition implies that only foreign plants with productivity level, $z_{j'} \geqslant \bar{z}$, will export and make positive profit out of intrafirm trade. Assume $\max\{z_{j'} : z_{j'} \geqslant \bar{z}\} > z_k$ to capture the idea that foreign entrance indeed affects the organizational choice of domestic HQ.[31] Home and foreign are identical except for labor (variable) cost and the distribution of affiliate productivity levels. Note that, although all foreign plants draw productivity from the same distribution $G(\cdot)$ as their domestic counterparties, actual exporting foreign plants form a different conditional distribution.

In an open economy, the revenue share apportioned to H stays unchanged.

$$\beta_h^* = \left[\beta + (1-\beta)\varepsilon_k^{\frac{\theta-1}{\theta}}\right] = \left[\beta + (1-\beta)\varepsilon_{k'}^{\frac{\theta-1}{\theta}}\right] \Rightarrow \varepsilon_k = \varepsilon_{k'}.$$

With foreign subsidiaries involved, the fraction of brand output that can be captured by the HQ, $\varepsilon_{k'}$, is now defined as

$$\varepsilon_{k'} = \delta Z'^{\frac{\sigma}{1-\theta}} \left[\left(\int_{j\leq k'} z_j^{\sigma-1} dj\right)^{\frac{\sigma}{\sigma-1}} + \left(\int_{z_{j'}>\bar{z}}^{z_{j'}} z_{j'}^{\sigma-1} dj'\right)^{\frac{\sigma}{\sigma-1}}\right],$$

where Z' is the new measure of overall brand productivity with foreign participation.

[30] See the derivation in Appendix C.

[31] Conversely, $\max\{z_{j'} : z_{j'} \geqslant \bar{z}\} \leqslant z_k$ suggests that all exporting foreign plants will become outside suppliers. For boundary solutions, we no longer need this assumption. Instead let $z_k = z_{\max}$ when Γ_O is the right organizational form, and $z_k = z_{\min}$ when Γ_I is chosen.

Recall the definition of ε_k in Eq. (20),

$$\delta Z^{\frac{\sigma}{1-\theta}} \left(\int_{j \leq k} z_j^{\sigma-1} dj \right)^{\frac{\sigma}{\sigma-1}} = \delta Z'^{\frac{\sigma}{1-\theta}} \left[\left(\int_{j \leq k'} z_j^{\sigma-1} dj \right)^{\frac{\sigma}{\sigma-1}} + \left(\int_{z_{j'} > \overline{z}} z_{j'}^{\sigma-1} dj' \right)^{\frac{\sigma}{\sigma-1}} \right].$$

As there are more plants/productivity draws under the same brand, the new overall productivity measure $Z' > Z$. Therefore, we must have $k' < k$ in order to make the above equation satisfied.

International trade is beneficial since, on the one hand, domestic consumers have access to new varieties invented with foreign suppliers' participation (the basket of domestic consumption becomes $\Omega \cup \Omega'$), and on the other hand, domestic HQ improves profitability by operating at a high aggregate productivity Z' and low investment costs c'_m.[32]

Proposition 8 *When the market of intermediate inputs in the home country is open to imports of foreign manufactured parts, brand manager in the home country tends to*

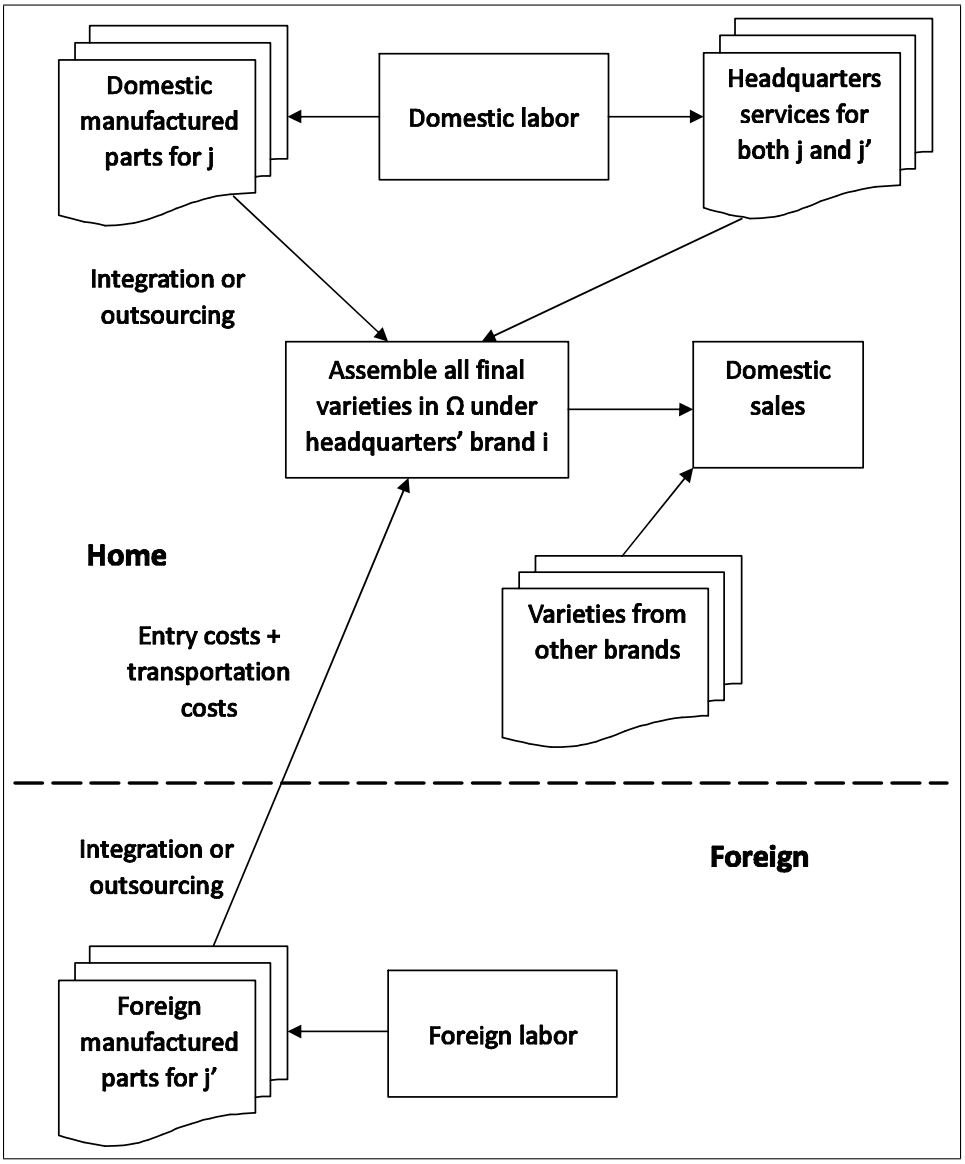
1. *expand the range of varieties with new varieties invented by the participation of foreign manufactured parts;*

2. *rationalize on its organizational form, through substituting a number of domestic affiliates with fewer foreign affiliates;*

3. *integrate a larger scope of foreign affiliates when the brand's HQ services intensity*

[32] Figure 4 lays out the vertical structure in an open economy. This paper ignores the "market-seeking" purpose of setting up foreign subsidiaries, which is more common in horizontal FDI than vertical FDI. Instead the paper focuses on the "factor-seeking" purpose. For example, in the portable electronics industry, standardized parts are offshored to cheaper and more efficient factories in a foreign country. In addition, the manufactured parts in electronics devices have high value to weight. This saves transportation costs and thus makes vertical FDI more attractive.

Figure 4: Trade in Manufactured Parts



is higher.

Since the total number of integrated plants is shrinking through substituting one high productive foreign affiliate for several relatively low productive domestic affiliates, the HQ lowers expenditures on merger and acquisition, but at the same time maintains its desired bargaining power.

Proposition 9 *When there is trade liberalization in an open economy, specifically, a decrease in exporting costs τ and/or entry fee f raises the total amount of intrafirm imports through increasing the number of foreign affiliates.*

The interpretation is that when τ and/or f reduce(s) more foreign plants are qualified to export according to Eq. (21), as a result, the domestic HQ has access to a larger pool of potential Merger and Acquisition targets and integrate more of them. One can expect to observe an increasing volume of manufactured parts transported across borders.

15 Empirical Analysis

The empirical part investigates, separately, the impact of industry characteristics and trade barriers on the number of foreign affiliates as well as their shipments to parent firms, in a cross-sectional dataset of the year 2007 for multinational companies headquartered in the United States.

Hypothesis 1 ***"The extensive margin"*** *of FDI and intrafirm trade*

Parent companies in a high HQ-intensity industry (or brand as in this paper) tend to integrate a large number of foreign affiliates with high productivity draws. This increase in extensive margin contributes to the large volume of intrafirm imports, even though high η_h *can exert a negative impact on imports per affiliate via lowering intensive margin.*[33]

At the NAICS 4-digit classification by industry of affiliate, Hypothesis 1 is tested in Eq. (22) with 114 observations on the number of majority-owned nonbank foreign affiliates and their financial and operating data in an industry, using Bureau of Economic Analysis (BEA) dataset on U.S. multinational companies' direct investment abroad. Eq. (23) considers the overall impacts of extensive and intensive margin on intrafirm imports. In particular, the paper considers the cross-industry regressions with:[34]

$$\ln(\text{No. of Affiliates}_i) = \alpha_0 + \alpha_1 \ln\left(\frac{K_i}{L_i}\right) + \alpha_2 \ln\left(\frac{M_i}{L_i}\right) + \alpha_3 \ln\left(\frac{RD_i}{L_i}\right) + \alpha_4 \ln\left(\frac{Q_i}{L_i}\right) + \epsilon_i, \tag{22}$$

and

$$\ln(\text{Intrafirm Imports}_i) = \rho_0 + \rho_1 \ln\left(\frac{K_i}{L_i}\right) + \rho_2 \ln\left(\frac{M_i}{L_i}\right) + \rho_3 \ln\left(\frac{RD_i}{L_i}\right) + \rho_4 \ln\left(\frac{Q_i}{L_i}\right) + u_i, \tag{23}$$

where $\ln(\text{No. of Affiliates}_i)$ is log of the number of foreign affiliates owned by U.S. HQ in industry i, and $\ln(\text{Intrafirm Imports}_i)$ is log of the intrafirm U.S. imports shipped by foreign affiliates to their U.S. parent firms as a share of total U.S. imports in industry i;

[33] *According to Eq. (18), the output of manufactured parts per affiliate,* m_j*, is decreasing in HQ-intensity,* $\eta_h = 1 - \eta_m$.

[34] Log transformation is used since there is evidence that data are skewed to the right.

$\ln\left(\frac{K_i}{L_i}\right)$ is log of capital expenditures divided by compensation of employees, and $\ln\left(\frac{RD_i}{L_i}\right)$ is log of the research and development expenditures divided by wages;[35] $\ln\left(\frac{M_i}{L_i}\right)$ is the log of expenses on materials such as property, plant, and equipment divided by wages; the log of affiliate sales divided by wages $\ln\left(\frac{Q_i}{L_i}\right)$ measures the average affiliate's productivity in industry i; ϵ_i and u_i are unobserved industry-specific errors. Capital intensity $\ln\left(\frac{K_i}{L_i}\right)$ and R&D intensity $\ln\left(\frac{RD_i}{L_i}\right)$ capture the HQ services intensity. On the contrary, material intensity $\ln\left(\frac{M_i}{L_i}\right)$ is created to measure the input that is *not* likely provided by the HQ.

The results are shown in Table 13. In all specifications for Eq. (22), the coefficients for HQ services intensity are positive and significant, whereas the estimated coefficient for manufactured parts intensity is negative and significant. Higher average affiliate productivity is associated with larger scope of integration. Since standardized coefficients are reported, one can easily assess and compare their magnitudes. Take column [22-III] for example. Controlling for all other explanatory variables, an increase of 1 standard percentage of capital intensity and material intensity results in, respectively, a 0.676 deviation increase and a 0.839 deviation decrease in the percentage of affiliate numbers. The estimated coefficient for R&D intensity is however much smaller at 0.262. In all specifications for Eq. (23), this paper concludes that no statistically significant relationship exists in coefficients for capital and material intensity, probably due to the small

[35] Since R&D expenditures in Eq. (22) include several zeros, the paper adapts log transformation by adding a constant 0.5 to each data value.

sample size. The second part of Hypothesis 1 is verified indirectly. In industry i, define

$$\text{Average Imports per Affiliate}_i = \frac{\text{Intrafirm Imports}_i}{\text{No. of Affiliates}_i}.$$

Compare column [22-III] and [23-III], an increase of 1 standard unit of capital intensity causes the overall intrafirm trade to increase by $\rho_1 \times$ Intrafirm Imports$_i$, which is smaller than the increase in aggregate intrafirm trade contributed by the newly established affiliates alone, $\alpha_1 \times$ No. of Affiliates$_i \times$ Average Imports per Affiliate$_i$. This difference must come from the negative impacts from a decrease in the sales per affiliate.

Hypothesis 2 ***"The effects of trade liberalization"***

A reduction in either the exporting costs τ or the entry fee f leads to an expansion in the range of exporting foreign affiliates and a resulting increase in total intrafirm trade.

This prediction is estimated by the following regressions that look across 109 countries:

$$\ln(\text{No. of Affiliates}_c) = \alpha_0' + \alpha_1' \ln(\tau_c) + \alpha_2' \ln(f_c) + \alpha_3' \ln(Enf_c) + \alpha_4' \ln\left(\frac{L_c}{K_c}\right) + \epsilon_c', \quad (24)$$

and

$$\ln(\text{Related Party Imports}_c) = \rho_0' + \rho_1' \ln(\tau_c) + \rho_2' \ln(f_c) + \rho_3' \ln(Enf_c) + \rho_4' \ln\left(\frac{L_c}{K_c}\right) + u_c', \quad (25)$$

where ln(No. of Affiliates$_c$) is log of the overall number of foreign affiliates operating in country c owned by U.S. HQ, and ln(Related Party Imports$_c$) is log of the related party

Table 13: Number of Affiliates and Intrafirm Trade: Looking Across Industries

Independent Variables	Dependent Variables: ln(No. of Affiliates$_i$)			ln(Intrafirm Imports$_i$)		
	[22-I]	[22-II]	[22-III]	[23-I]	[23-II]	[23-III]
Capital Intensity: $\ln\left(\frac{K_i}{L_i}\right)$	0.755***	0.750***	0.676***	0.931	0.375	0.102
	(0.27)	(0.26)	(0.25)	(0.62)	(0.66)	(0.68)
Material Intensity: $\ln\left(\frac{M_i}{L_i}\right)$	−0.817***	−0.787***	−0.839***	−1.000	−0.263	−0.286
	(0.25)	(0.24)	(0.23)	(0.60)	(0.69)	(0.68)
R&D Intensity: $\ln\left(\frac{RD_i}{L_i}\right)$		0.260***	0.262***		0.425*	0.342
		(0.63)	(0.60)		(0.12)	(0.12)
Affiliate Productivity: $\ln\left(\frac{Q_i}{L_i}\right)$			0.317***			0.372
			(0.13)			(0.38)
Constant	5.894***	7.025***	5.916***	4.041***	3.579***	1.86
	(0.49)	(0.61)	(0.66)	(1.11)	(1.09)	(1.60)
Number of Observations	114	114	114	30	30	30
Adjusted R-Squared	0.08	0.14	0.22	0.03	0.11	0.15

Notes: Standardized coefficients are reported. Standard errors are shown in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%.

imports as percentage shares of total imports from all foreign affiliates in country c to their parent firms in the U.S.;[36] $\ln(\tau_c)$ is log of exporting costs per standard container shipped out of country c (Doing Business Data: Trading Across Borders); $\ln(f_c)$ is the log of expenses to start a business in country c (Doing Business Data: Starting a Business), used to proxy the fixed fee of entering into exporting marketplace; $\ln(Enf_c)$ is log of contract enforcement costs in country c (Doing Business Data: Enforcing Contracts); $\ln\left(\frac{L_c}{K_c}\right)$ is log of foreign affiliate's compensation on employees divided by capital expenditures; ϵ_i' and u_i' are unobserved errors for country-specific characteristics. This paper utilizes the last two independent variables to control for the differences in contract incompleteness and labor costs across countries. Cheaper enforcement or lower wage indicates a favorable FDI environment. Estimates of Eqs. (24) and (25) are summarized in Table 14. All varieties of costs have negative impacts on the multinational activities. Statistically significant coefficients are found for entry fee f in specifications of both equations. However, the estimated coefficients for exporting costs τ have *no* statistically important impacts on intrafirm trade in all specifications of Eq. (25). For trade policy makers, this implies that a reduction in entry fee may be more efficient than a reduction in unit exporting costs.

[36] Related party imports are defined as trade with an entity located outside the U.S. in which the importer holds at least a 6% equity interest in the exporter. Using Intrafirm Imports$_c$ as independent variable creates problems since definitions and government policies on fully-owned affiliates differ across countries.

Table 14: Number of Affiliates and Intrafirm Trade: Look Across Countries

Independent Variables	Dependent Variables: ln(No. of Affiliates$_c$)			ln(Related Party Imports$_c$)		
	[24-I]	[24-II]	[24-III]	[25-I]	[25-II]	[25-III]
Variable Exporting Costs: $\ln(\tau_c)$	-0.212^{**}	-0.205^{**}	-0.208^{**}	-0.137	-0.123	-0.126
	(0.41)	(0.41)	(0.41)	(0.28)	(0.28)	(0.28)
Fixed Entry Fee: $\ln(f_c)$	-0.430^{***}	-0.377^{***}	-0.388^{***}	-0.381^{***}	-0.269^{**}	-0.281^{**}
	(0.12)	(0.13)	(0.13)	(0.08)	(0.09)	(0.09)
Enfocement Costs: $\ln(Enf_c)$		-0.101	-0.113		-0.214^{**}	-0.228^{**}
		(0.37)	(0.37)		(0.25)	(0.25)
Labor Costs: $\ln\left(\frac{L_c}{K_c}\right)$			-0.170			-0.094
			(0.16)			(0.11)
Constant	11.689^{***}	12.514^{***}	12.932^{***}	6.64^{***}	7.772^{***}	8.061^{***}
	(2.71)	(2.82)	(2.85)	(1.86)	(1.91)	(1.93)
Number of Observations	109	109	109	109	109	109
Adjusted R-Squared	0.29	0.29	0.29	0.19	0.21	0.22

Notes: Standardized coefficients are reported. Standard errors are shown in parentheses. *** significant at 1%, ** significant at 5%; * significant at 10%.

16 Concluding Remarks

The distinction between extensive and intensive margins of international trade identified in recent theoretical research also plays an important role in multinational activities, which are considered as complements to trade. For the U.S., 32% of imports in 2007 were intrafirm shipments to multinational parents from their majority-owned affiliates as a result of FDI, let alone the shares of arm's-length trade between multinationals and unaffiliated suppliers from all over the world. The establishment of a new affiliate can contribute up to 2% of intrafirm trade on average. This paper addresses the questions of how many input suppliers should be selected as affiliates within the boundaries of a transnational firm, and how the optimal number of affiliates vary across firms and countries, and in response to movements of trade barriers. Additional empirical examination of firms' characteristics and their investment environment that shape the respective contributions of the extensive and intensive margins would be helpful, e.g., investigating a more disaggregated (6-digit NAICS) and detailed (with FDI origins and destinations) firm-level panel.

Part V

Appendix

A Derivations and Proofs for Part II

Necessary Condition for (RP-IPC)

Think of an Arrow-Debreu setup, where domestic bonds that mature at any future period are traded at period 0. Denote $P^m\left(\theta^t\right) = \prod_{r=0}^{t} p^m\left(\theta^r, \theta_{r+1}\right)$ the forward price at period 0 for a t-period matured history-contingent bond in country m. The benefits of having access to international asset market from θ^t on, evaluated at period 0 using domestic interest rate as discount factor, can thus be summarized in $F_n^m\left(\theta^t\right) \in \mathbb{R}$ with $f_n^m\left(\theta^t\right)$ given.

$$F_n^m\left(\theta^t\right) \equiv \sum_{r=t}^{\infty} \sum_{\theta^r|\theta^t} P^m\left(\theta^r\right) \left[f_n^m\left(\theta^r\right) - \sum_{\theta_{r+1}} q\left(\theta^r, \theta_{r+1}\right) f_n^m\left(\theta^r, \theta_{r+1}\right) \right],$$

where $\left\{f_n^m\left(\theta^r, \theta_{r+1}\right)\right\}_{r\in[t,\infty)}$ are the optimal holdings of international bond to (RP). Define another resident's maximization problem in the Arrow-Debreu setup, the solution of which will overlap with the optimal consumption path to (RP) from θ^t on,

$$W_n^m\left(\theta^t, b_n^m\left(\theta^t\right), F_n^m\left(\theta^t\right)\right) \equiv \max_{\left\{c_n^m(\theta^r)\right\}_{r\in[t,\infty)}} \sum_{r=t}^{\infty} \beta^{r-t} \sum_{\theta^r|\theta^t} \pi\left(\theta^r|\theta^t\right) U\left(c_n^m\left(\theta^r\right)\right),$$

subject to a single budget constraint of Arrow-Debreu type,

$$\sum_{r=t}^{\infty}\sum_{\theta^r|\theta^t} P^m\left(\theta^r\right)e_n^m\left(\theta^r\right)+P^m\left(\theta^t\right)b_n^m\left(\theta^t\right)+F_n^m\left(\theta^t\right)\geqslant\sum_{r=t}^{\infty}\sum_{\theta^r|\theta^t} P^m\left(\theta^r\right)c_n^m\left(\theta^r\right),$$

and the participation constraints in the domestic asset market,

$$\sum_{s=r}^{\infty}\beta^{s-r}\sum_{\theta^s|\theta^r}\pi\left(\theta^s|\theta^r\right)U\left(c_n^m\left(\theta^s\right)\right)\geqslant A_n^m\left(\theta^r\right),\ \forall\theta^r\geqslant\theta^t,$$

with $b_n^m\left(\theta^t\right)$, $F_n^m\left(\theta^t\right)$, and $\{P^m\left(\theta^r\right)\}_{r\in[t,\infty)}$ given.

Lemma 10 *The international participation constraint (RP-IPC) implies* $F_n^m\left(\theta^t\right)\geqslant 0$, $\forall\theta^t$ *with* $t\in[0,\infty)$. *If (RP-IPC) holds with equality, then* $F_n^m\left(\theta^t\right)=0$, *which in turn implies that (RP) shares identical optimal consumption path with the (RIA) problem.*

Proof. *Note (RP)'s optimal consumption path* $\{c_n^m\left(\theta^r\right)\}_{r\in[t,\infty)}$ *satisfies*

$$\sum_{r=t}^{\infty}\beta^{r-t}\sum_{\theta^r|\theta^t}\pi\left(\theta^r|\theta^t\right)U\left(c_n^m\left(\theta^r\right)\right)=W_n^m\left(\theta^t,b_n^m\left(\theta^t\right),F_n^m\left(\theta^t\right)\right),\ \forall\theta^t,$$

and by definition of (RIA),

$$V_n^m\left(\theta^t,b_n^m\left(\theta^t\right)\right)=W_n^m\left(\theta^t,b_n^m\left(\theta^t\right),0\right),\ \forall\theta^t.$$

Since $U(\cdot)$ *is strictly increasing,* W_n^m *is strictly increasing in* $F_n^m\left(\theta^t\right)$. *If (RP-IPC) is*

satisfied at θ^t*, then*

$$W_n^m\left(\theta^t, b_n^m\left(\theta^t\right), F_n^m\left(\theta^t\right)\right) \geqslant W_n^m\left(\theta^t, b_n^m\left(\theta^t\right), 0\right),$$

and from this it follows $F_n^m\left(\theta^t\right) \geqslant 0$*. Moreover, if (RP-IPC) holds with equality, then* $F_n^m\left(\theta^t\right) = 0$*.* ■

Equilibrium Bond Prices

In solving (RIA), Envelope Theorem yields the impact of changes in the inherited domestic bond holdings on the post-default value.

$$\frac{dV_n^m\left(\theta^t, b_n^m\left(\theta^t\right)\right)}{db_n^m\left(\theta^t\right)} = \lambda_n^m\left(\theta^t\right) = \left[1 + \nu_n^m\left(\theta^t\right)\right] U'\left(c_n^{m,D}\left(\theta^t\right)\right). \qquad \text{(RIA-ET)}$$

Denote the conventional marginal rate of substitution by

$$MRS_n^m \equiv \beta \frac{U'\left(c_n^m\left(\theta^t, \theta_{t+1}\right)\right)}{U'\left(c_n^m\left(\theta^t\right)\right)} \pi\left(\theta_{t+1}|\theta^t\right).$$

Combine Eqs. (2), (3), (4), and (RIA-ET) to derive for the domestic and international bond prices,

$$\begin{cases} p^m\left(\theta^t, \theta_{t+1}\right) = MRS_n^m \frac{1+A_{n,2}^m - \left[1+\nu_n^m\left(\theta^t, \theta_{t+1}\right)\right] A_{n,1}^m}{1+A_{n,3}^m}; \\ q\left(\theta^t, \theta_{t+1}\right) = MRS_n^m \frac{1+A_{n,2}^m}{1+A_{n,3}^m}, \end{cases}$$

where $\nu_n^m\left(\theta^t, \theta_{t+1}\right)$ is the multiplier of domestic market participation constraint in the

$V_n^m\left(\left(\theta^t,\theta_{t+1}\right),b_n^m\left(\theta^t,\theta_{t+1}\right)\right)$ problem; and

$$\begin{aligned}
A_{n,1}^m &= \mu_n^m\left(\theta^t,\theta_{t+1}\right)\beta^{-t-1}\frac{U'\left(c_n^{m,D}\left(\theta^t,\theta_{t+1}\right)\right)}{U'\left(c_n^m\left(\theta^t,\theta_{t+1}\right)\right)}\frac{1}{\pi\left(\theta^t,\theta_{t+1}\right)};\\
A_{n,2}^m &= \sum_{s=0}^{t+1}\sum_{\left(\theta^t,\theta_{t+1}\right)|\theta^s}\left[\mu_n^m\left(\theta^s\right)+\hat{\mu}_n^m\left(\theta^s\right)\right]\beta^{-s}\frac{\pi\left(\left(\theta^t,\theta_{t+1}\right)|\theta^s\right)}{\pi\left(\theta^t,\theta_{t+1}\right)};\\
A_{n,3}^m &= \sum_{s=0}^{t}\sum_{\theta^t|\theta^s}\left[\mu_n^m\left(\theta^s\right)+\hat{\mu}_n^m\left(\theta^s\right)\right]\beta^{-s}\frac{\pi\left(\theta^t|\theta^s\right)}{\pi\left(\theta^t\right)}.
\end{aligned}$$

When (RP-IPC) is slack at $\left(\theta^t,\theta_{t+1}\right)$ and hence $\mu_n^m\left(\theta^t,\theta_{t+1}\right)=\hat{\mu}_n^m\left(\theta^t,\theta_{t+1}\right)=0$, two prices equal to each other,

$$p^m\left(\theta^t,\theta_{t+1}\right)=q\left(\theta^t,\theta_{t+1}\right)=MRS_n^m,\ \forall n. \tag{A.1}$$

In countries with $\mu_n^m\left(\theta^t,\theta_{t+1}\right)>0$, according to Lemma 2, the formula for domestic bond price collapses to

$$p^m\left(\theta^t,\theta_{t+1}\right)=MRS_n^m\left[1+\frac{\hat{\mu}_n^m\left(\theta^t,\theta_{t+1}\right)-\nu_n^m\left(\theta^t,\theta_{t+1}\right)\mu_n^m\left(\theta^t,\theta_{t+1}\right)}{\beta^{t+1}\pi\left(\theta^t,\theta_{t+1}\right)\left(1+A_{n,3}^m\right)}\right], \tag{A.2}$$

and its value is lower than the prevailing international bond price,

$$q\left(\theta^t,\theta_{t+1}\right)=MRS_n^m\left[1+\frac{\mu_n^m\left(\theta^t,\theta_{t+1}\right)+\hat{\mu}_n^m\left(\theta^t,\theta_{t+1}\right)}{\beta^{t+1}\pi\left(\theta^t,\theta_{t+1}\right)\left(1+A_{n,3}^m\right)}\right]. \tag{A.3}$$

If (RP-DPC) is slack besides $\mu_n^m\left(\theta^t,\theta_{t+1}\right)>0$, then $\hat{\mu}_n^m\left(\theta^t,\theta_{t+1}\right)=\nu_n^m\left(\theta^t,\theta_{t+1}\right)=0$

further simplifies bond pricing rules to

$$\begin{cases} p^m\left(\theta^t,\theta_{t+1}\right)=MRS_n^m; \\ q\left(\theta^t,\theta_{t+1}\right)=MRS_n^m\left[1+\frac{\mu_n^m\left(\theta^t,\theta_{t+1}\right)}{\beta^{t+1}\pi\left(\theta^t,\theta_{t+1}\right)\left(1+A_{n,3}^m\right)}\right]. \end{cases} \tag{A.4}$$

Proof of Proposition 5

Construct an alternative planner's problem (PP$^{\text{a}}$) by adding domestic participation constraints (RP-DPC) for all types to the (PP) problem, and using the following international participation constraint instead of (PP-IPC):

$$\sum_{n=1}^{N}\varphi_n\sum_{r=t}^{\infty}\beta^{r-t}\sum_{\theta^r|\theta^t}\pi\left(\theta^r|\theta^t\right)U\left(c_n^m\left(\theta^r\right)\right)\geqslant\sum_{n=1}^{N}\varphi_n V_n^m\left(\theta^t,b_n^m\left(\theta^t\right)\right),\ \forall\theta^t, \tag{PP$^{\text{a}}$-IPC}$$

where $\left\{b_n^m\left(\theta^t\right)\right\}_{t\in[0,\infty)}$ are the optimal holdings of domestic bond to (RP). With $U(\cdot)$ displaying a constant elasticity of intertemporal substitution and an appropriate set of transfers of initial bond holdings, it can be guaranteed that the optimal consumption stream described in Definition 1 indeed solves problem (PP$^{\text{a}}$). Since the optimal allocations in (PP) are both affordable and individual rational in (PP$^{\text{a}}$), the alternative planner can do strictly better by relaxing next period's international participation constraint (PP-IPC) and hence borrowing more at present history θ^t until (PP$^{\text{a}}$-IPC) at $\left(\theta^t,\theta_{t+1}\right)$ binds.

Derivation of (5)

Without loss of generality, consider Country 1 at $t=0$. Denote by $P(t)=\prod_{r=0}^{t}p(r)$ the price of Arrow-Debreu securities. Use the one-period domestic bond price (7) to

obtain

$$P(t) = \begin{cases} p(pq)^{\frac{t}{2}} & \text{at } t = 2k; \\ (pq)^{\frac{t+1}{2}} & \text{at } t = 2k+1. \end{cases}$$

The capital flow $N(t)$ from Country 1 to 2 flips back and forth,

$$N(t) = \begin{cases} x^J - y \text{ at } t = 2k; \\ y - x^J \text{ at } t = 2k+1. \end{cases}$$

According to Lemma 10, when discounting all future payments to period 0 using corresponding Arrow-Debreu prices, the summation of all present values should equal zero since Country 1 is internationally participation constrained at period 0.

$$\begin{aligned} \sum_{t=0}^{\infty} P(t) N(t) &= \left(\sum_{k=0}^{\infty} p^{k+1} q^k\right)\left(x^J - y\right) + \left(\sum_{k=0}^{\infty} p^{k+1} q^{k+1}\right)\left(y - x^J\right) \\ &= \frac{p\left[\left(x^J - y\right) + q\left(y - x^J\right)\right]}{1 - pq} = 0. \end{aligned}$$

The same method applies to the derivation of (10) in Section 4.3. Notice the international capital outflow at even periods becomes $(x \pm \varepsilon^p) - y$ and the domestic exchange is ε.

B Sample Description for Part III

I list below the 73 emerging and developing countries in my baseline sample, for which key explanatory variables on institutional quality are available at least for 3 years of the years between 2004 and 2008 for each country.

Algeria, Angola^{0}, Argentina, Bangladesh^{0}, Bolivia, Botswana^{0}, Brazil, Bulgaria^{T}, Burkina Faso^{0}, Cameroon, Chile*, China, Colombia, Democratic Republic of Congo^{0}, Republic of Congo^{0}, Costa Rica, Côte d'Ivoire, Czech Republic^{*AT}, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia^{0}, Gabon^{0}, Ghana^{0}, Guatemala, Guyana, Haiti^{0}, Honduras, Hungary^{*AT}, India, Indonesia, Iran^{0}, Israel^{*A}, Jamaica, Jordan, Kenya, Malawi^{0}, Malaysia, Mali^{0}, Mexico*, Mongolia, Morocco, Mozambique, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland^{*A}, Romania, Russian, Senegal, Sierra Leone^{0}, Slovak Republic^{*AT}, South Africa, Sri Lanka, Syrian Arab Republic^{0}, Tanzania, Thailand, Togo^{0}, Tunisia, Turkey*, Uganda^{0}, Uruguay, Venezuela, Vietnam^{0}, Zambia, Zimbabwe.

Countries marked with superscript * are OECD member countries; with ^{T} transition economies; with ^{A} additional countries made available by IIF; and with ^{0} countries having zero private sector debt stocks for all available years.

C Derivations for Part IV

Derivation of Alternative Objective Function

Use Eqs. (17) and (18) to expand the variety revenue.

$$\begin{aligned} R_j &= Q^{\frac{1}{\sigma}} P^{\frac{\theta}{\sigma}} p^{\frac{\sigma-\theta}{\sigma}} q_j^{\frac{\sigma-1}{\sigma}} \\ &= Q^{\frac{1}{\sigma}} P^{\frac{\theta}{\sigma}} p^{\frac{\sigma-\theta}{\sigma}} \left[z_j \left(\frac{\beta_h}{c_h} \right)^{\eta_h} \left(\frac{\beta_m}{c_m} \right)^{\eta_m} \frac{\theta-1}{\theta} R_j \right]^{\frac{\sigma-1}{\sigma}} \\ &= \underbrace{QP^{\theta} p^{\sigma-\theta} \left(\frac{\theta-1}{\theta} \right)^{\sigma-1} c_h^{-\eta_h(\sigma-1)} c_m^{-\eta_m(\sigma-1)} \beta_h^{\eta_h(\sigma-1)} \beta_m^{\eta_m(\sigma-1)}}_{K\text{: Factor constant for integration over } j} \times z_j^{\sigma-1}. \end{aligned} \quad \text{(C.1)}$$

The total brand revenue has two equivalent definitions.

$$R = \begin{cases} pq; \\ \int_{j\in\Omega} R_j dj. \end{cases}$$

This equivalence generates an expression for the price index of brand output.

$$\begin{aligned} QP^{\theta} p^{1-\theta} &= QP^{\theta} p^{\sigma-\theta} \left(\frac{\theta-1}{\theta} \right)^{\sigma-1} c_h^{-\eta_h(\sigma-1)} c_m^{-\eta_m(\sigma-1)} \beta_h^{\eta_h(\sigma-1)} \beta_m^{\eta_m(\sigma-1)} \int_{j\in\Omega} z_j^{\sigma-1} dj. \\ \Rightarrow \quad p &= \left(\frac{\theta-1}{\theta} \right)^{-1} c_h^{\eta_h} c_m^{\eta_m} \beta_h^{-\eta_h} \beta_m^{-\eta_m} \left(\int_{j\in\Omega} z_j^{\sigma-1} dj \right)^{\frac{1}{(1-\sigma)}}. \end{aligned}$$

Substitute this expression into the final profit function (19).

$$\begin{aligned}
& \int_{j\in\Omega} R_j dj - c_h \int_{j\in\Omega} h_j dj - c_m \int_{j\in\Omega} m_j dj \\
= & \int_{j\in\Omega} R_j \left(1 - \eta_h\beta_h \frac{\theta-1}{\theta} - \eta_m\beta_m \frac{\theta-1}{\theta}\right) dj \\
= & \int_{j\in\Omega} z_j^{\sigma-1} dj \times QP^{\theta} p^{\sigma-\theta} \left(\frac{\theta-1}{\theta}\right)^{\sigma-1} c_h^{-\eta_h(\sigma-1)} c_m^{-\eta_m(\sigma-1)} \\
& \times \left[1 - \left(\frac{\theta-1}{\theta}\right)(\eta_h\beta_h + \eta_m\beta_m)\right] \beta_h^{\eta_h(\sigma-1)} \beta_m^{\eta_m(\sigma-1)} \\
= & \left(\int_{j\in\Omega} z_j^{\sigma-1} dj\right)^{\frac{1-\theta}{1-\sigma}} \times QP^{\theta} \left(\frac{\theta-1}{\theta}\right)^{\theta-1} c_h^{-\eta_h(\theta-1)} c_m^{-\eta_m(\theta-1)} \\
& \times \left[1 - \left(\frac{\theta-1}{\theta}\right)(\eta_h\beta_h + \eta_m\beta_m)\right] \beta_h^{\eta_h(\theta-1)} \beta_m^{\eta_m(\theta-1)} \\
= & Z \times A.
\end{aligned}$$

Derivation of Optimal Bargaining Share $\beta_h^*(\eta_h)$

Given the consumption composite Q and its corresponding price index P, one can maximize the following function to find the optimum,

$$\max_{\beta_h} \left[1 - \left(\frac{\theta-1}{\theta}\right)(\eta_h\beta_h + (1-\eta_h)(1-\beta_h))\right] \beta_h^{\eta_h(\theta-1)} (1-\beta_h)^{(1-\eta_h)(\theta-1)},$$

with β_h, $\eta_h \in [0,1]$.

First order condition is:

$$\theta(2\eta_h - 1)\beta_h^2 - 2\eta_h[1 + \eta_h(\theta-1)]\beta_h + \eta_h[1 + \eta_h(\theta-1)] = 0.$$

If $\eta_h = \frac{1}{2}$, then it degenerates to a linear equation and $\beta_h^* = \frac{1}{2}$. Otherwise, there are two

possible solutions to this quadratic function,

$$\beta_h^{\pm}(\eta_h) = \frac{\eta_h\left[1+(\theta-1)\,\eta_h\right] \pm \sqrt{\eta_h\left[1+(\theta-1)\,\eta_h\right](1-\eta_h)\left[\theta-(\theta-1)\,\eta_h\right]}}{\theta\,(2\eta_h-1)}.$$

It is required that $\beta_h^*(\eta_h)$ must lie within the $[0,1]$ interval, since it is the fraction of profit distributed to the HQ. $\beta_h^+(\eta_h)$ is ruled out because it becomes negative if the HQ services intensity, η_h, is strictly smaller than $\frac{1}{2}$. Thus, there is one unique and continuous solution,

$$\beta_h^*(\eta_h) = \begin{cases} \frac{1}{2}, \text{ if } \eta_h = \frac{1}{2}; \\ \beta_h^-(\eta_h), \text{ otherwise.} \end{cases}$$

Increasing in Productivity

The left hand side of free entry condition (21) can be written as

$$\beta_m R_{j'}(i) - (\tau + c'_m) m_{j'} = \beta_m R_{j'}(i)\left[1 - \frac{(\tau + c'_m)\,\eta_m}{c'_m}\frac{\theta-1}{\theta}\right].$$

For the open economy problem to be interesting, assume positive profit from exports before the entry fee is paid.

$$1 - \frac{(\tau + c'_m)\,\eta_m}{c'_m}\frac{\theta-1}{\theta} > 0 \Rightarrow c'_m > \frac{\tau}{\left[\frac{\theta}{(\theta-1)\eta_m} - 1\right]}.$$

Given that variable costs in a foreign country is greater than the above threshold, foreign plant j''s export profit increases in its productivity draw, $z_{j'}(i)$.

Part VI

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