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Financial Development, Capital Flow, and Income Differences between Countries

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Abstract

This paper demonstrates with a simple two-country general equilibrium model that the difference in the levels of financial development between countries determines the direction of capital movement and that for some parameter values, if financial markets are integrated internationally, countries with a poorly developed financial sector are never industrialized, while if they had remained closed economies, they would have experienced steady endogenous growth. This result is consistent with a traditional but non-mainstream view of structuralists and gives a theoretical foundation for capital flow regulations which are often imposed by developing countries.

Keywords: Financial development; Capital flow; Income differences between countries; Credit market imperfections; Two-country model.
JEL Classification Numbers: F2 O43

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1 Introduction

Since the mid-1980s, financial globalization has been promoted by reducing capital controls in many economies including countries which had successfully industrialized such as Korea and Taiwan. As a result, capital flows between countries have grown since then. According to the standard neoclassical growth model, with international financial integration, capital flows from rich countries where capital is abundant to poor countries where capital is scarce, so that the marginal products of capital are equalized over the countries. If this claim is correct, financial integration is definitely helpful for development of poor countries. However, in reality, as pointed out by Lucas (1990), capital does not flow from rich to poor countries as much as the standard neoclassical growth model predicts. In many developing countries, capital flow is still controlled by the government. This regulation of capital flow is inconsistent with what the neoclassical growth theory tells us.

Meanwhile, since the 1950s, structuralists, such as Nurkse (1953) and Myrdal (1957), have had the view that if financial markets in poor countries (whose financial sectors are probably underdeveloped) are internationally integrated, lenders in the poor countries are given better opportunities to invest in rich countries and capital flies out of poor countries to rich countries.[1] Poor countries are squeezed and end up failing to take off. Regulation of capital flow is consistent with the structuralists' beliefs. However, few articles with some exceptions (for instance Matsuyama (2004, 2007)) make a formal formulation of the structuralist view.

With a simple general equilibrium model, this paper demonstrates that the difference in the levels of financial development determines the direction of capital movement, and that for some parameter values, if financial markets are integrated internationally, countries with a poorly developed financial sector are never industrialized, while if they had remained closed

[1]See also Matsuyama (2004) for this discussion.

economies, they would have experienced steady endogenous growth. This result is consistent with the structuralist view and gives a theoretical foundation for capital flow regulation imposed by developing countries.

We consider two countries which have the same technology, the same initial production resources, the same number of people, and the same preferences.[2] The only difference between the two countries is in their levels of financial development.

Within an economy, there are heterogeneous agents. The heterogeneity comes from the productivity in creating intermediate goods which are used as inputs for final production. Each agent has two saving methods: one is to deposit his initial endowments in a financial intermediary and the other is to start an investment project. Less capable agents prefer to deposit their endowments in the financial intermediary rather than to start an investment project. This is because their marginal product in producing capital goods is less than a market interest rate acquired when depositing in the financial intermediary. On the other hand, more capable agents prefer to create capital goods rather than to deposit their endowments in the financial intermediary, since their marginal product is greater than the interest rate.

As in the literature, the level of financial development is measured by the degree of credit market imperfections. While each agent can deposit his endowments in the financial intermediary as much as he wants, he can borrow only up to some proportion of his investments, i.e., each agent faces credit constraints. This proportion measures the degree of credit market imperfections and for it we use a parameter. If this parameter is close to zero, then there is no financial sector and no one can borrow nor deposit. If this parameter approaches one, then credit market imperfections are fully resolved and the market is close to a perfect one.

Now let us suppose that two countries (country 1 and country 2) are

[2]In section 5, we extend a static model to an overlapping generations model in which we relax the assumption of the same initial production resources.

financially integrated, implying that initial endowments freely move between the two economies. Consider a case in which country 1 has a perfect credit market, whereas country 2 faces credit market imperfections. In this case, the financial intermediary who collects initial endowments from savers both in countries 1 and 2 lends all the endowments to the most capable agents living in country 1. In this case, the financial intermediary can repay the savers with the highest interest rate. Almost all agents but the most capable in country 1 become savers.

Under these circumstances, in country 2 there is no creation of intermediate goods and then no industry can develop in that country. Agents in country 2 acquire the return from deposits, whereas they cannot obtain wages because there is no industry in that country. Meanwhile, the source of inequality between countries is wage incomes. In country 1, there is a final production sector and thus agents in country 1 obtain wage incomes, whereas agents in country 2 do not. In a static model, the negative effect of capital under-accumulation in country 2 on inequality between the two countries (which eventually has a negative effect on wage incomes in country 2) is only one shot, implying that inequality is not exacerbated as time goes by. In order to investigate an exacerbating effect of financial underdevelopment in country 2 on inequality, we extend the static model to an overlapping generations model in section 5.

There are a large number of empirical articles which deal with the relationship between financial globalization and economic growth.[3] Almost all report a mixed, obscure effect of financial integration on economic growth. In particular, Edwards (2001) concludes that financial openness has a positive effect on economic growth when a country has reached a certain degree of financial development. This mixed, obscure effect of financial integration on economic growth is consistent with our theoretical results, implying that

[3] Kose, et al. (2006) provide a fine survey of the literature.

depending upon the degree of financial development, some countries become winners and other countries become losers when economies are financially integrated.

While this paper is allocated to the theoretical literature on capital flight (see for instance Lucas (1990), Gertler and Rogoff (1990), Tornell and Velasco (1992), and Sakuragawa and Hamada (2001)), we focus more on income inequality between countries rather than on capital flight.[4] In this sense, this paper is closely related to Matsuyama (2004) and Kikuchi (2008). Matsuyama (2004) studies a small open economy with credit constraints, as well as a closed economy. He demonstrates that (i) if each country is a closed economy with the same parameter values, each one of them converges to the same steady state regardless of the initial capital endowments, and that (ii) if each country is a small open economy even with the same parameter values, a symmetry-breaking occurs due to international financial integration, i.e., depending upon initial capital endowments, countries are polarized with respect to their incomes. Kikuchi (2008) extends Matsuyama's model to a two country model and investigates both income inequality between countries and their endogenous business fluctuations. They both investigate how the slight difference in initial capital stock amplifies income inequality between countries assuming that the degrees of credit market imperfections are the same between countries. By contrast, our interest is in how the difference in financial development (i.e., the degree of credit market imperfections) affects income inequality between countries.

The current paper proceeds as follows. We begin with a static model in section 2. The static model simply demonstrates how the difference in financial development affects income inequality. In particular, we study a closed economy in section 3, and a two country model in section 4. In section 5, we extend the static two-country model to an overlapping generations model

[4] See also Alfaro, et al. (2007) for empirical investigation of capital flight from poor to rich countries.

in order to investigate the exacerbating effect of financial under-development on income inequality. Section 6 concludes with remarks on our results and on future research.

2 Model Setup

An economy consists of a continuum of agents, a financial intermediary, and a representative firm creating consumption goods. The economy continues two periods. The population of agents is assumed to be L.

2.1 Individuals

Each agent is born with one unit of physical endowments (called "raw" capital) and one unit of labor endowments. In the first period, since raw capital cannot be consumed, each agent deposits it in a financial intermediary or invests in a project to create "sophisticated" capital goods. Henceforth, we call initial endowments "raw" capital, and we call "sophisticated" capital just capital. As we will assume, since sophisticated capital is country-specific, it is non-tradable. If an agent wants to borrow from the financial intermediary, then he can do so up to some proportion of his investments, i.e., the financial intermediary imposes credit constraints on agents. Credit constraints come from asymmetric information between agents and the financial intermediary.[5]

The final production takes one gestation period and thus each agent obtains the return from deposits and investments in the second period. Each agent earns a wage income in the second period by supplying his labor to a representative firm. In the second period, an agent consumes all of his income.

Given the prices $\{r, p, w\}$, an agent maximizes his consumption:

$$c = rb + p\hat{h} + w, \tag{1}$$

[5] We give a microfoundation for credit constraints in appendix.

subject to:

$$b + i \leq k \tag{2}$$

$$\hat{h} = \phi i \tag{3}$$

$$b \geq -\mu i \tag{4}$$

$$i \geq 0, \tag{5}$$

where r is the interest rate from the first period to the second period, p is the price of capital goods, and w is a wage. Eq.(2) is a budget constraint in the first period, where b is a deposit if positive and a debt if negative and i is investment. k is raw capital. Eq.(3) is a production function for capital goods and ϕ is the marginal product for it. Eq.(4) is a credit constraint. As mentioned, an agent borrows from the financial intermediary up to μ times his investment i. $\mu \in [0, 1)$ is the measure of financial development. If μ is close to zero, the financial sector is poorly developed, whereas if μ is close to one, the credit market becomes perfect. Eq.(5) is a non-negativity constraint for investment.

Now we introduce the heterogeneity of agents. Agents are heterogeneous in terms of their productivity in creating capital goods. An agent receives a shock for his productivity level ϕ from a time-invariant distribution $G(\phi)$ whose support is $[0, a]$, where $a > 0$.

Assumption 1

- $\int_0^a \phi dG(\phi) < \infty$.
- *$G(\phi)$ has a continuous density $g(\phi)$ on $[0, a]$.*

Each agent knows his productivity at his birth and thus he takes it into account when he solves his maximization problem. However, the productivity of each agent is private information, i.e., no one knows the productivity of other agents. Therefore, it is impossible that less capable agents ask more capable agents to produce capital goods with their own endowments. Even the financial intermediary does not know agents' productivity. Henceforth we use ϕ as an index of the heterogeneity of agents as well as a productivity parameter.

Under these circumstances, lemma 1 gives a solution to an agent's maximization problem.

Lemma 1
Let $\phi^* := \frac{r}{p}$. Then, the following hold.

- *If $\phi^* > \phi$, then $i(\phi) = 0$ and $b(\phi) = k$.*
- *If $\phi^* < \phi$, then $i(\phi) = \frac{k}{1-\mu}$ and $b(\phi) = -\frac{\mu k}{1-\mu}$.*

Proof: From Eqs.(1)-(5), the maximization problem reduces to:

$$\max_{-\mu i \leq b \leq k} (r - p\phi)b + p\phi k.$$

If $r > p\phi$, then it is optimal for the agent to choose $b = k$, and from Eq.(2) it follows that $i = 0$. Likewise, if $r < p\phi$, then the agent chooses $b = -\mu i$ and $i = \frac{k}{1-\mu}$. $\square$

2.2 Production

A representative firm creates consumption goods from capital goods and labor. The production function is given by:

$$Y = AH^{\alpha}L^{1-\alpha}\bar{h}^{1-\alpha}, \tag{6}$$

where H is aggregate capital goods, L is aggregate labor, and $\bar{h}$ is average capital goods per capita which have a positive external effect on the production. A is a productivity parameter and is constant.

The representative firm solves a profit maximization problem as follows:

$$\max_{H,L} \; AH^{\alpha}L^{1-\alpha}\bar{h}^{1-\alpha} - pH - wL.$$

From the first-order condition, we obtain:

$$p = A\alpha \tag{7}$$

$$w = A(1-\alpha)h, \tag{8}$$

where $h := \frac{H}{L}$. We note that p is constant and w is linear with respect to h. These are due to the externality of capital goods.

3 Closed Economy

3.1 Equilibrium

A competitive equilibrium is defined as follows.

Definition 1

A competitive equilibrium is expressed by prices $\{r, p, w\}$ and allocation $\{\{c(\phi)\}, \{b(\phi)\}, \{i(\phi)\}\}$ and $\{H, L\}$, so that (i) for each $\phi \in [0, a)$, given $\{r, p, w\}$, $\{c(\phi), b(\phi), i(\phi)\}$ solves the agent's maximization problem; (ii) given $\{p, w\}$, $\{H, L\}$ solves the representative firm's maximization problem; and (iii) all markets clear.

From a market-clearing condition for capital goods, Eq.(3), and lemma 1, we have:

$$\begin{aligned} H &= \int_0^a h(\phi) L dG(\phi) \\ &= \int_{\phi^*}^a \frac{\phi k}{1-\mu} L dG(\phi) \\ &= \frac{F(\phi^*)}{1-\mu} kL, \end{aligned} \tag{9}$$

where $F(\phi^*) := \int_{\phi^*}^{a} \phi dG(\phi)$. Therefore, we have $h = \frac{F(\phi^*)}{1-\mu}k$ in equilibrium and thus the production function becomes:

$$y = \frac{AF(\phi^*)}{1-\mu}k, \tag{10}$$

which seems a so-called Ak type production function. k in Eq.(10) is per capita raw capital in the economy. We can define the total factor productivity of this economy as $T := \frac{AF(\phi^*)}{1-\mu}$.

Prescott (1998) argues that we need a theory of total factor productivity (TFP) in order to explain income differences between countries. He demonstrates that differences in physical and intangible capital cannot account for the big income differences between countries. In Eq.(10), an effect of credit market imperfections shows up in the total factor productivity. In other words, the total factor productivity is determined endogenously by the degree of credit market imperfections.[6]

Financial development has a first-order positive effect on T because given A and ϕ^*, as μ approaches one, T becomes big. However, there must be a general equilibrium effect because μ affects ϕ^* as well. From a credit market clearing condition and lemma 1, we obtain:

$$\begin{aligned} & \int_0^{\phi^*} b(\phi)LdG(\phi) + \int_{\phi^*}^{a} b(\phi)LdG(\phi) = 0 \\ \iff \quad & kG(\phi^*) = \frac{\mu k}{1-\mu}(1 - G(\phi^*)) \\ \iff \quad & G(\phi^*) = \mu. \end{aligned} \tag{11}$$

It follows from Eq.(11) that ϕ^* is increasing with μ. By assumption 1, $G(.)$ is strictly increasing and thus ϕ^* is uniquely determined by μ. Then we have

[6]There are a few articles which derive the total factor productivity endogenously as in our model. Lagos (2006) shows that labor-market policies can lead to a low level of total factor productivity. Jeong and Townsend (2007) investigate the sources of total factor productivity, decomposing the TFP into several effects including a financial-deepening effect.

$\phi^* = G^{-1}(\mu)$. By using this, Eq.(10) is rewritten as:

$$
\begin{aligned}
y &= \frac{AF(G^{-1}(\mu))}{1-\mu}k, \\
&= \frac{A\Psi(\mu)}{1-\mu}k, \qquad (12)
\end{aligned}
$$

where $\Psi(\mu) := F(G^{-1}(\mu))$.

Proposition 1
As a financial sector is developed very well, T goes up, i.e., $\frac{\partial T}{\partial \mu} > 0$.

Proof: Since $G(\phi^*) = \mu$, $G^{-1\prime}(\mu) = \frac{1}{g(\phi^*)}$ and $F(\phi^*) - \phi^*(1 - G(\phi^*)) > 0$, we have:

$$
\begin{aligned}
\frac{\partial T}{\partial \mu} &= \frac{\partial}{\partial \mu}\Big(\frac{A\Psi(\mu)}{1-\mu}\Big) \\
&= \frac{A(F'(G^{-1}(\mu))G^{-1\prime}(\mu)(1-\mu) + F(G^{-1}(\mu)))}{(1-\mu)^2} \\
&= \frac{A(-\phi^* g(\phi^*)(1/g(\phi^*))(1-\mu) + F(G^{-1}(\mu)))}{(1-\mu)^2} \\
&= \frac{A(F(\phi^*) - \phi^*(1 - G(\phi^*))}{(1-\mu)^2} > 0. \quad \square
\end{aligned}
$$

3.2 Income Differences between Closed Economies

In the previous subsection, we have found that financial development affects the total factor productivity in an economy. However, we did not make clear how much per capita income differences between closed economies arise depending upon the degree of credit market imperfections.

We suppose that there exist two countries with the same per capita endowments, the same technologies, the same distributions of heterogeneous agents, the same population size, and the same preferences. A difference between the two countries is only seen in the levels of financial development, i.e, μ. We consider an extreme case in which μ of the first country (country

1) is sufficiently close to one and μ of the second country (country 2) is zero. Henceforth, we put scripts on variables to discriminate between the countries like μ_j $(j = 1, 2)$.

Proposition 2

Let T_j and y_j be the total factor productivity and per capita income for country j, respectively. Suppose that μ_1 is sufficiently close to one and μ_2 is zero. Then the following hold:

- *$T_1 = Aa$ and $y_1 = Aak$,*
- *$T_2 = Am$ and $y_2 = Amk$*

where $m := F(0)$ is equal to the average productivity of agents.

Proof: For the first part, by de l'Hospital's rule, we have $\lim_{\mu_1 \uparrow 1} \frac{A\Psi(\mu_1)}{1-\mu_1} = \lim_{\mu_1 \uparrow 1}[A\phi_1^* g(\phi_1^*)(1/g(\phi_1^*))] = \lim_{\mu_1 \uparrow 1} AG^{-1}(\mu_1) = Aa$. For the second part, since $G^{-1}(0) = 0$, from Eq.(12) the total factor productivity and per capita income of country 2 are given by $T_2 = AF(0)$ and $y_2 = AF(0)k$, respectively. We note that $F(0)$ is equal to the average productivity of agents in country 2. □

From proposition 2, we obtain an income difference between the two closed economies such that $\frac{y_1}{y_2} = \frac{a}{m}$. We note that as the distance between the mean of agents' productivity and the productivity of most capable agents becomes big, the income difference becomes greater. Indeed, this closed economy model might explain income differences between countries to some extent; however, we are doubtful whether the model can explain the income differences we observe in the real world of more than fifty-fold.

Example 1. Let us suppose that $\phi \sim U(0, 1)$. In this case, $m = \frac{1}{2}$ and $a = 1$. Therefore, $\frac{y_1}{y_2} = 2$. If we assume a uniform distribution between zero and one, the income difference between the two countries with extreme cases of financial development is at most twice.

In order to explain more than fifty times income differences, we have to change some assumptions in this model. There are several ideas to alter the assumptions. One straightforward idea is to modify the assumption for the same endowments k or the common productivity factor A. However, our objective is to create income differences even though two countries have the same fundamentals other than credit market imperfections. Another idea is to alter the assumption of the same distributions for heterogeneous agents. If we assume that one country has a low mean and the other country has very big productivity of the most capable agents, we might be able to produce big income inequality. However, this must be related to human capital formation for each country. In some sense, this is also an issue of countries' fundamentals. Therefore, we put the issue aside in this paper.

In the following sections, we give an alternative possible explanation for big income differences with the same fundamentals other than credit market imperfections, extending our model to a two-country model.

4 Two Country Model

4.1 World Interest Rate

We consider again two countries (country 1 and country 2) with the same per capita endowments, the same technologies, the same distributions of heterogeneous agents, the same population size, and the same preferences. As in the previous section, the only difference between the two countries is in their levels of financial development. We assume that financial markets are perfectly integrated. For simplicity, we do not distinguish between domestic and international financial markets, and thus when an agent borrows from a financial intermediary he always faces the same credit constraints characterized by the country where he lives. Again, we denote parameters for financial development of the two countries by μ_1 and μ_2, respectively. Without loss of generality, as in the previous section, we assume that $\mu_1 > \mu_2$, i.e., a financial sector in country 1 is developed better than in country 2.

Let ϕ_j^* be a cut-off point for country j which divides agents into savers and investors *before* the financial markets are integrated. It follows from Eq.(11) that $\phi_1^* > \phi_2^*$ holds, implying that since country 1 has a better financial sector than country 2, financial resources (raw capital) in country 1 are more likely to go to more capable agents than in country 2, while the number of investors in country 1 is less than in country 2. Due to this, if each country is closed, the equilibrium interest rate in country 1 ($r_1 = \alpha A \phi_1^*$) is greater than that in country 2 ($r_2 = \alpha A \phi_2^*$). This is contrasting with the neo-classical growth models in which a country with capital scarcity exhibits a greater interest rate than a country with capital abundance. The usual neo-classical growth models do not take into consideration credit market imperfections.

In this two country model, we assume that raw capital moves freely between countries, and consumption goods produced by the representative firm are tradable, while sophisticated capital goods created by agents are not tradable, meaning that they are country-specific. Therefore, the credit market clearing condition and the equilibrium condition for the interest rate in the two country model are different from those in a closed economy model.

In the two country model, the credit market clearing condition is given by:

$$\int_0^a b_1(\phi) L dG(\phi) + \int_0^a b_2(\phi) L dG(\phi) = 0. \tag{13}$$

From lemma 1 and Eq.(13), we obtain:

$$\frac{-\mu_1 + G(\tilde{\phi}_1^*)}{1-\mu_1} + \frac{-\mu_2 + G(\tilde{\phi}_2^*)}{1-\mu_2} = 0, \tag{14}$$

where $\tilde{\phi}_j^*$ is the cut-off point of country j after the financial markets are integrated. Henceforth, tilde stands for variables after the financial markets are integrated.

Meanwhile, both countries face the same interest rate. By definition of $\tilde{\phi}_j^*$, $\tilde{r} := \tilde{\phi}_j^* \alpha A$ holds. Since this holds for $j = 1, 2$, we have $\tilde{\phi}_1^* = \tilde{\phi}_2^*$. This means that if the financial markets are integrated internationally, then both countries have the same cut-off point regardless of the levels of their financial development. This is due to the homogeneity of the two countries except for the levels of financial development. From Eq.(14) we have:

$$G(\tilde{\phi}^*) = \frac{\frac{\mu_1}{1-\mu_1} + \frac{\mu_2}{1-\mu_2}}{\frac{1}{1-\mu_1} + \frac{1}{1-\mu_2}} := \tilde{\mu}, \tag{15}$$

where we note that $\tilde{\phi}^*$ is independent of j. It follows from Eqs.(11) and (15) that $\phi_2^* < \tilde{\phi}^* < \phi_1^*$ if $\mu_2 \neq 0$, which implies $r_2 < \tilde{r} = \tilde{\phi}^* \alpha A < r_1$. The new world interest rate is determined between the old interest rates of the two countries.

4.2 Inequality between Two Integrated Economies

In this subsection, we investigate output and income inequalities between the two countries.

Proposition 3
Let $\tilde{T}_j$ and $\tilde{y}_j$ be the total factor productivity and per capita output for country j. Then the following hold:

- $\tilde{T}_1 = \frac{A\Psi(\tilde{\mu})}{1-\mu_1}$ *and* $\tilde{y}_1 = \frac{A\Psi(\tilde{\mu})}{1-\mu_1} k$
- $\tilde{T}_2 = \frac{A\Psi(\tilde{\mu})}{1-\mu_2}$ *and* $\tilde{y}_2 = \frac{A\Psi(\tilde{\mu})}{1-\mu_2} k.$

Proof: The claim follows from Eqs.(10) and (15). □

From proposition 3, inequality in per capita output between the two countries is given by $\frac{\tilde{y}_1}{\tilde{y}_2} = \frac{1-\mu_2}{1-\mu_1}$. We note that given $\mu_2 \in [0, 1)$, if μ_1 approaches one, the inequality goes to infinity. Contrasting with the case of closed economies, output inequality is affected not by the distributions of heterogeneous agents but by the levels of financial development.

Proposition 4

Output inequality between the two countries is magnified by financial integration, i.e., $\frac{\tilde{y}_1}{\tilde{y}_2} > \frac{y_1}{y_2}$*, as is wage inequality, i.e.,* $\frac{\tilde{w}_1}{\tilde{w}_2} > \frac{w_1}{w_2}$*.*

Proof: From Eq.(12), $\frac{y_1}{y_2} = \frac{\Psi(\mu_1)(1-\mu_2)}{\Psi(\mu_2)(1-\mu_1)}$. The claim follows from the fact that $\frac{\Psi(\mu_1)}{\Psi(\mu_2)} < 1$. $\frac{\tilde{w}_1}{\tilde{w}_2} > \frac{w_1}{w_2}$ is obvious from Eq.(8). □

Proposition 4 provides a testable implication. That is to say, when financial markets are integrated, inequality in wages expands more than when financial markets are not open. Intuitively, this is because workers in a country with high financial development benefit from capital deepening, whereas workers in a country with low financial development do not. In this sense, countries with low levels of financial development are squeezed by countries with high levels. This situation is consistent with the view of structuralists.

By comparing a two country model with a closed economy one, we find that in the former, if the levels of financial development are extremely different, industry in a country with a poorly developed financial sector does not develop at all, whereas it does in a closed economy model.

Proposition 5

Suppose that μ_1 *is sufficiently close to one. Then, we have:*

- $\lim_{\mu_1 \uparrow 1} \tilde{y}_2 = 0$
- $\lim_{\mu_1 \uparrow 1} \tilde{y}_1 = 2aAk$.

Proof: Since $\tilde{\mu} = \frac{\mu_1(1-\mu_2)+\mu_2(1-\mu_1)}{2-\mu_1-\mu_2}$ and then $\lim_{\mu_1 \uparrow 1} \Psi(\tilde{\mu}) = 0$, it follows that $\lim_{\mu_1 \uparrow 1} \tilde{y}_2 = 0$. Since $\lim_{\mu_1 \uparrow 1} \frac{\Psi(\tilde{\mu})}{1-\mu_1} = 2a$ by de l'Hospital's rule, it follows that $\lim_{\mu_1 \uparrow 1} \tilde{y}_1 = 2aAk$. □

We note from proposition 5 that all production for consumption goods is executed in country 1 by squeezing all raw capital from country 2. If a country opens its financial market to the world market when its domestic financial sector has not yet been developed very well, industry in the country might not develop. This claim has an important policy implication for development and international economics.

Although we have discovered inequality in per capita output, this is not appropriate for the measure of income inequality between countries. Since we consider a two country model, per capita output in a country is not equal to per capita income, i.e., the GDP is not equal to the GNP. Then, we investigate an income difference between the two countries.

Proposition 6

Per capita income (or equivalently per capita consumption) in country j is given by:

$$\tilde{c}_j := \frac{\tilde{\phi}^* \alpha(\tilde{\mu} - \mu_j) + F(\tilde{\phi}^*)}{1 - \mu_j} Ak. \tag{16}$$

Proof: From lemma 1, Eq.(7), and Eq.(8), consumption of agents with $\phi < \phi^*$ is given by $c(\phi) = \phi^* \alpha Ak + \frac{F(\phi^*)(1-\alpha)}{1-\mu_j} Ak$. Likewise, consumption of agents with $\phi > \phi^*$ is $c(\phi) = \phi^* \alpha A(-\frac{\mu_j k}{1-\mu_j}) + \alpha A \frac{\phi k}{1-\mu_j} + \frac{F(\phi^*)(1-\alpha)}{1-\mu_j} Ak$. Then, per capita consumption becomes:

$$\int_0^{\tilde{\phi}^*} c(\phi) dG(\phi) + \int_{\tilde{\phi}^*}^{a} c(\phi) dG(\phi) = \frac{\tilde{\phi}^* \alpha(\tilde{\mu} - \mu_j) + F(\tilde{\phi}^*)}{1 - \mu_j} Ak. \quad \square$$

Remark 1

$\tilde{c}_1$ is greater than $\tilde{c}_2$, i.e., $\tilde{c}_1 > \tilde{c}_2$.

Proof: The claim follows from the fact that $\tilde{c}_1 - \tilde{c}_2 = \frac{(\mu_1 - \mu_2)[F(\tilde{\phi}^*) - \alpha \tilde{\phi}^*(1 - G(\tilde{\phi}^*))]}{(1-\mu_1)(1-\mu_2)} \times Ak > 0$. $\square$

Let us consider the case in which the financial sector in country 1 is fully developed, i.e., μ_1 is sufficiently close to one.

Lemma 2

Suppose that μ_1 is sufficiently close to one. Then it follows that:

- $\lim_{\mu_1 \uparrow 1} \tilde{c}_1 = (2 - \alpha) Aak$

- $\lim_{\mu_1 \uparrow 1} \tilde{c}_2 = \alpha A a k$.

Proof: The proof takes three steps. *Step 1.* From Eq.(15), $\lim_{\mu_1 \uparrow 1} G(\tilde{\phi}^*) = 1$. By continuity, $\lim_{\mu_1 \uparrow 1} \tilde{\phi}^* = a$. *Step 2.* From Eq.(15), we obtain $g(\tilde{\phi}^*)\frac{\partial \tilde{\phi}^*}{\partial \mu_1} = \frac{2(\mu_2 - 1)^2}{(2-\mu_1-\mu_2)^2}$. *Step 3.* From de l'Hospital's rule, *Step 1*, and *Step 2*, we have:

$$\begin{aligned}
\lim_{\mu_1 \uparrow 1} \tilde{c}_1 &= \lim_{\mu_1 \uparrow 1} \frac{F(\tilde{\phi}^*) - \alpha\tilde{\phi}^*(\mu_1 - G(\tilde{\phi}^*))}{1-\mu_1} Ak \\
&= \lim_{\mu_1 \uparrow 1} \left[[(1-\alpha)\tilde{\phi}^* g(\tilde{\phi}^*) + \alpha(\mu_1 - G(\tilde{\phi}^*))] \frac{\partial \tilde{\phi}^*}{\partial \mu_1} + \alpha \tilde{\phi}^* \right] Ak \\
&= \left[(a - \alpha a) \frac{2(1-\mu_2)^2}{(1-\mu_2)^2} + \alpha a \right] Ak \\
&= (2-\alpha) A a k,
\end{aligned}$$

and

$$\begin{aligned}
\lim_{\mu_1 \uparrow 1} \tilde{c}_2 &= \lim_{\mu_1 \uparrow 1} \frac{F(\tilde{\phi}^*) - \alpha\tilde{\phi}^*(\mu_2 - G(\tilde{\phi}^*))}{1-\mu_2} Ak \\
&= \alpha A a k. \quad \square
\end{aligned}$$

We note from lemma 2 that per capita income in country 2 is independent of μ_2 when μ_1 is sufficiently close to one. This is because, as made clear in proposition 5, all production for consumption goods is executed in country 1. Accordingly, in country 2 there is no labor income, whereas agents in country 2 can obtain the returns from deposits in the financial intermediary, which is equal to a half of the capital share of output. Country 2 cannot benefit from the capital deepening effect.

Proposition 7
Let us measure the social welfare of each country by per capita income (or equivalently per capita consumption). Suppose that μ_1 is sufficiently close to one and that $a\alpha < m$. If financial markets of the two countries are integrated, then the following hold:

- *Country 1 is better off, i.e., it holds that* $\lim_{\mu_1 \uparrow 1} \tilde{c}_1 > \lim_{\mu_1 \uparrow 1} c_1$.

- *Country 2 is worse off, no matter what the level of financial development in country 2, i.e., it holds that* $\lim_{\mu_1 \uparrow 1} \tilde{c}_2 < \lim_{\mu \uparrow 1} c_2$ *for any* $\mu_2 \in [0, 1)$.

Proof: From proposition 2, $\lim_{\mu_1 \uparrow 1} \tilde{c}_1 = (2 - \alpha)Aak > Aak = \lim_{\mu_1 \uparrow 1} c_1$ because $0 < \alpha < 1$. From proposition 1, $Amk = \lim_{\mu_2 \downarrow 0} c_2 \leq c_2$ for any $\mu_2 \in [0, 1)$; however, $\alpha Aak < Amk$. □

Remark 2

$$\lim_{\mu_1 \uparrow 1} \frac{\tilde{c}_1}{\tilde{c}_2} = \frac{2}{\alpha} - 1.$$

Contrasting with the case of closed economies, when the financial sector in country 1 is developed very well, income inequality in a two country model is independent of agents' productivity (see proposition 2). In particular, if $\alpha = \frac{1}{3}$ (which is often used for capital share), then $\lim_{\mu_1 \uparrow 1} \frac{\tilde{c}_1}{\tilde{c}_2} = 5$.

Income inequality is independent of the level of financial development in country 2 as well. With no matter what value μ_2, the income inequality is $\frac{2}{\alpha} - 1$. This result has an implication for the relationship between financial development and financial openness. Chinn and Ito (2006) provide empirical evidence that financial openness promotes the development of a financial sector in a country. However, our result says that if the financial sector in a country is fully developed, financial development in other countries caused by financial openness might not be able to lead to increases in per capita incomes in those countries, although of course, there are caveats in our result because it is based on an extreme case in which μ_1 is sufficiently close to one.

5 Extension to an OLG Model

We have investigated a simple two period model. Income inequality in the two country case originates in wage inequality because capital income is the same between the two countries. In this section, we extend the model to an overlapping generations model. The motivation for extending the static model to a dynamic general equilibrium model is that in a two period model, income inequality between countries is not so large relative to a real episode. This is because income inequality is not magnified by the prolonged periods. However, if the economy has an infinite horizon, inequality must be magnified.

5.1 Dynamical System

The maximization problem for a representative firm is exactly the same as in section 2. However, the maximization problem for individuals are changed. As in the previous section, each agent lives for two periods in youth and old age. He is born with one unit of labor endowments and with no physical endowments. In the first period of his lifetime, he supplies labor inelastically to the representative firm and earns a wage income. He consumes only in the second period. The earned wage income is invested in a project or deposited in a financial intermediary.

If an agent invests in a project, he creates capital goods used for the final production. In particular, if an agent invests one unit of consumption goods in a project at time t, then he acquires a claim to $p^j_{t+1}\phi$ units of consumption goods at time $t+1$, where p^j_{t+1} is the price of capital goods at time $t+1$ in country j. This is the same assumption as in the previous section. For the other saving method, each agent can deposit his wage income in the financial intermediary, which is the same assumption as in the previous section as well. If an agent deposits one unit of consumption goods in the financial intermediary at time t, then he obtains a claim to r_{t+1} units of consumption goods at time $t+1$, where r_{t+1} is the (real) interest rate.

Under the above assumptions, an agent in country $j \in \{1,2\}$ maximizes his consumption:

$$c^j_{t+1} = p^j_{t+1}\hat{h}^j_{t+1} + r_{t+1}b^j_t,$$

subject to:

$$\begin{aligned} i^j_t + b^j_t &\leq w^j_t \\ \hat{h}^j_{t+1} &= \phi i^j_t \\ b^j_t \geq -\mu_j i^j_t,&\quad 0 \leq \mu_j < 1 \\ i^j_t &\geq 0 \end{aligned}.$$

From the maximization problem, we obtain lemma 3 which is similar to lemma 1.

Lemma 3

Let $\phi^j_t := \frac{r_{t+1}}{p^j_{t+1}}$. Then, the following hold.

- *If $\phi^j_t > \phi$, then $i^j_t(\phi) = 0$ and $b^j_t(\phi) = w^j_t$.*
- *If $\phi^j_t < \phi$, then $i^j_t(\phi) = \frac{w^j_t}{1-\mu_j}$ and $b^j_t(\phi) = -\frac{\mu_j w^j_t}{1-\mu_j}$.*

Proof: The proof is the same as in lemma 1. □

In equilibrium, as in section 2, $p^1_{t+1} = p^2_{t+1} = A\alpha$ for all $t \geq 0$ and $w^j_t = A(1-\alpha)h^j_t$ where $h^j_t = \frac{H^j_t}{L^j_t}$. Since the two countries face the same world interest rate, it follows that $\phi^1_t A\alpha = \phi^2_t A\alpha \iff \phi^1_t = \phi^2_t$ for all $t \geq 0$.

From lemma 3, the international financial market clearing condition is given by:

$$\begin{aligned} &\int_0^a b^1_t(\phi) L dG(\phi) + \int_0^a b^2_t(\phi) L dG(\phi) = 0. \\ \iff\quad & \frac{(-\mu_1 + G(\phi^1_t))A(1-\alpha)h^1_t}{1-\mu_1} + \frac{(-\mu_2 + G(\phi^2_t))A(1-\alpha)h^2_t}{1-\mu_2} = 0 \\ \iff\quad & \frac{(-\mu_1 + G(\phi^1_t))h^1_t}{1-\mu_1} + \frac{(-\mu_2 + G(\phi^2_t))h^2_t}{1-\mu_2} = 0. \qquad (17) \end{aligned}$$

From Eq.(17) and $\phi_t^1 = \phi_t^2 := \phi_t$, we obtain:

$$G(\phi_t) = \frac{(1-\mu_2)\mu_1 h_t^1 + (1-\mu_1)\mu_2 h_t^2}{(1-\mu_2)h_t^1 + (1-\mu_1)h_t^2}$$
$$\iff \quad \phi_t = G^{-1}\left[\frac{(1-\mu_2)\mu_1 h_t^1 + (1-\mu_1)\mu_2 h_t^2}{(1-\mu_2)h_t^1 + (1-\mu_1)h_t^2}\right] := H(h_t^1, h_t^2). \quad (18)$$

From lemma 3 and the capital good market clearing condition, we have:

$$\frac{H_{t+1}^j}{L} = \int_{\phi_t}^{a} i_t^j(\phi)\phi dG(\phi)$$
$$\iff \quad h_{t+1}^j = \int_{\phi_t}^{a} \frac{w_t^j}{1-\mu_j}\phi dG(\phi)$$
$$\iff \quad h_{t+1}^j = \frac{A(1-\alpha)F(\phi_t)}{1-\mu_j} h_t^j. \quad (19)$$

We impose an assumption on parameters.

Assumption 2

$$A(1-\alpha)F(0) > 1.$$

Under assumption 2, a closed economy even with $\mu_j = 0$ can experience steady endogenous growth. Both of the financially integrated economies with $\mu_1 = \mu_2 = 0$ can experience steady endogenous growth as well (of course, in this case each economy is equivalent to a closed one).

From Eq.(18) and Eq.(19), we obtain a dynamical system for (h_t^1, h_t^2) as follows:

$$\begin{cases} h_{t+1}^1 = \frac{(1-\alpha)A}{1-\mu_1} F[H(h_t^1, h_t^2)] h_t^1 \\ h_{t+1}^2 = \frac{(1-\alpha)A}{1-\mu_2} F[H(h_t^1, h_t^2)] h_t^2. \end{cases} \quad (20)$$

5.2 Dynamic Behavior

From Eq.(20), we note that $\frac{h_t^1}{h_t^2} = [\frac{1-\mu_2}{1-\mu_1}]^t \frac{h_0^1}{h_0^2}$. As long as $\mu_1 > \mu_2$, $\lim_{t\to\infty} \frac{h_t^1}{h_t^2} = \infty$, implying that as long as the levels of financial development are slightly different, inequality of capital accumulation and thus income inequality between the two countries expand. However, country 2 might experience steady endogenous growth, even though income inequality is enlarged. We examine this in what follows.

Lemma 4

- $h_{t+1}^1 - h_t^1 > 0 \Longleftrightarrow (1-\mu_1)(\mu_2 - M_1)h_t^2 < (1-\mu_2)(M_1 - \mu_1)h_t^1,\ h_t^1 > 0$
- $h_{t+1}^2 - h_t^2 > 0 \Longleftrightarrow (1-\mu_1)(\mu_2 - M_2)h_t^2 < (1-\mu_2)(M_2 - \mu_1)h_t^1,\ h_t^2 > 0$

where $M_j := G\Big(F^{-1}\Big(\frac{1-\mu_j}{(1-\alpha)A}\Big)\Big)$.

Proof: From Eq.(20), it follows that

$$\begin{aligned} & h_{t+1}^j - h_t^j > 0 \\ \Longleftrightarrow \quad & h_t^j > 0 \ and \ F[H(h_t^1, h_t^2)] > \frac{1-\mu_j}{(1-\alpha)A}. \end{aligned}$$

$F[H(h_t^1, h_t^2)] > \frac{1-\mu_j}{(1-\alpha)A}$ can be rewritten as:

$$\begin{aligned} & H(h_t^1, h_t^2) < F^{-1}\Big(\frac{1-\mu_j}{(1-\alpha)A}\Big) \\ \Longleftrightarrow \quad & \frac{(1-\mu_l)\mu_j h_t^j + (1-\mu_j)\mu_l h_t^l}{(1-\mu_l)h_t^j + (1-\mu_j)h_t^l} < M_j \\ \Longleftrightarrow \quad & (1-\mu_j)(\mu_l - M_j)h_t^l < (1-\mu_l)(M_j - \mu_j)h_t^j. \ \square \end{aligned}$$

Assumption 3

$$M_j > \mu_j \quad for \ j = 1, 2.$$

Assumption 3 holds if A is very large. In particular, if $\phi \sim U(0,1)$ and if assumption 2 holds, then assumption 3 holds. This claim can be verified as follows. Since $\phi \sim U(0,1)$, we have $F(0) = \frac{1}{2}$. Therefore, assumption 2 with $\phi \sim U(0,1)$ becomes $1 < \frac{(1-\alpha)A}{2}$, which implies $\frac{1}{1+\mu_j} < \frac{(1-\alpha)A}{2}$. Since $F(\mu) = \frac{1-\mu^2}{2}$, this is rewritten as $\frac{1-\mu_j}{(1-\alpha)A} < F(\mu_j)$. From the last, we obtain $G(F^{-1}(\frac{1-\mu_j}{(1-\alpha)A})) > \mu_j$, since $G(\mu) = \mu$.

Lemma 5

$$M_1 > M_2.$$

Proof: The claim follows from the fact that $\mu_1 > \mu_2$ and $\frac{\partial M_j}{\partial \mu_j} > 0$. □

From assumption 3 and lemma 5, we have two cases. Case 1 is the case in which $M_1 > M_2 > \mu_1 > \mu_2$ and case 2 is the case in which $M_1 > \mu_1 > M_2 > \mu_2$. Case 1 holds if μ_1 and μ_2 are very close. Meanwhile, case 2 holds if the distance between the two is very large. In particular, if $\phi \sim U(0,1)$ and if $\frac{(1-\alpha)A}{2} < \frac{1-\mu_2}{1-(\mu_1)^2}$, then case 2 holds.

In both cases, it follows from lemma 4 that:

$$h_{t+1}^1 - h_t^1 > 0 \iff h_t^2 > \frac{(1-\mu_2)(M_1-\mu_1)}{(1-\mu_1)(\mu_2-M_1)} h_t^1, \ h_t^1 > 0 \tag{21}$$

and

$$h_{t+1}^2 - h_t^2 > 0 \iff h_t^2 > \frac{(1-\mu_2)(M_2-\mu_1)}{(1-\mu_1)(\mu_2-M_2)} h_t^1, \ h_t^2 > 0. \tag{22}$$

In case 1, the coefficients of h_t^1 both in Eq.(21) and Eq.(22) are negative. Therefore, the phase diagram is given by figure 1. As seen in figure 1, although inequality between the two countries expands as time goes by, both countries experience steady endogenous growth. However, since $\frac{(1-\mu_2)\mu^1 h_t^1 + (1-\mu_1)\mu_2 h_t^2}{(1-\mu_2)h_t^1 + (1-\mu_1)h_t^2} > \mu_2$, we note from Eq.(20) that the growth rate in country 2 is less than when the economy is closed. By contrast, since $\frac{(1-\mu_2)\mu^1 h_t^1 + (1-\mu_1)\mu_2 h_t^2}{(1-\mu_2)h_t^1 + (1-\mu_1)h_t^2} < \mu_1$, the growth rate in country 1 is greater than when the economy is closed.

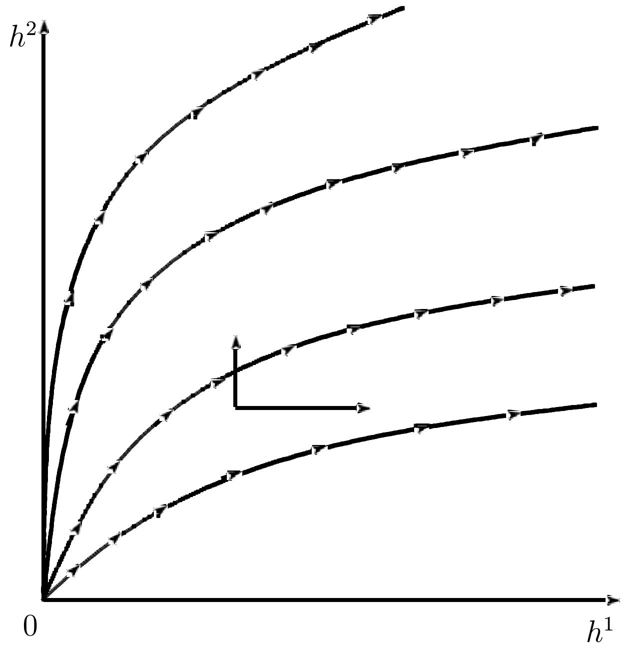

Figure 1: Case 1

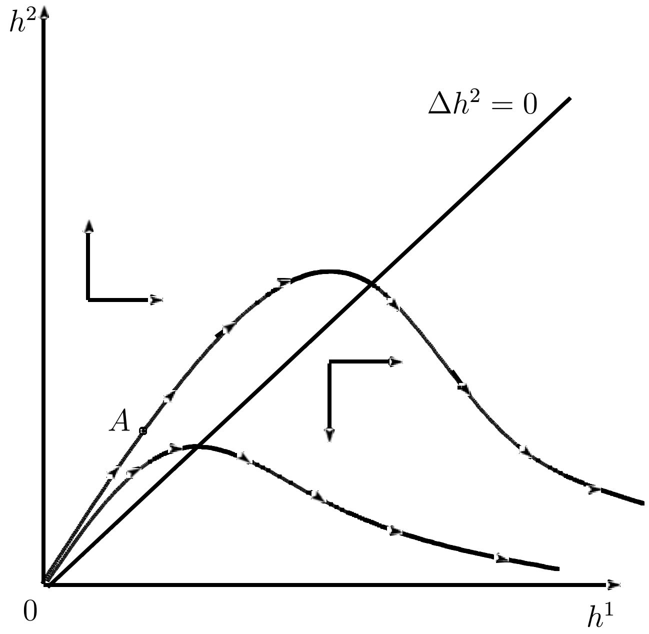

Figure 2: Case 2

In case 2, the coefficient of h_t^1 in Eq.(22) is positive., whereas the coefficient of h_t^1 in Eq.(21) is negative. Hence, the phase diagram of this case is given in figure 2. As time goes by, while country 1 experiences steady growth, the industry in country 2 turns down and the country falls in a poverty trap. It is certain that this catastrophic result for country 2 is due to financial integration, because if the economy is closed, steady endogenous growth is fulfilled in country 2 even with a low level of financial development. Proposition 8 summarizes the results we have obtained.

Proposition 8

Suppose that country 1 and country 2 are financially integrated and suppose that $\mu_1 > \mu_2$.

- *If the levels of financial development of the two countries are so close that $M_1 > M_2 > \mu_1 > \mu_2$ holds (case 1), then both countries experience steady endogenous growth. However, the growth rate of country 2 is less than when each economy is closed, whereas the growth rate of country 1 is greater.*

- *If the difference in the levels of financial development of the two countries is so large that $M_1 > \mu_1 > M_2 > \mu_2$ holds (case 2), then country 2 falls in a no-growth trap, whereas country 1 experiences steady endogenous growth.*

In each case, we observe overtaking. For example, let us suppose that the two countries start at point A in figure 2. At point A, the initial capital in country 1 is less than in country 2. However, after some periods, the capital accumulation in country 1 overtakes that in country 2 and the income inequality is reversed.

6 Concluding Remarks

We have investigated the relationship between financial development and economic growth with financial globalization. The effect of financial globalization on economic growth is one of puzzles in international economics. A large number of empirical studies provide ambiguous evidence for this relationship (See Kose, et al. (2006)). Some authors find mixed effects of financial globalization on economic growth, meaning that financial openness positively affects economic growth on the condition that a certain degree of financial sector development is achieved within a country (see for instance Edwards (2001)).

Judging from these empirical studies, it seems that there are winners and losers with financial globalization. This paper provides an explanation of this consequence. That is to say, countries with fully developed financial sectors become winners with financial globalization, whereas countries with poorly developed financial sectors become losers. Indeed, as pointed out by Chinn and Ito (2006), financial openness probably promotes the development of a financial sector in a country. However, our model gives an important insight on the relationship between financial development and economic growth with financial globalization. Even if financial development is promoted by openness, this might have no positive effect on economic growth unless the financial development in a country overtakes that in another country. Due to the assumptions imposed in our model, this result might be extreme; however, we should note from this result that there is a negative effect of financial globalization on economic growth in countries financially underdeveloped.

These discussions have an important policy implication. Our result gives a theoretical foundation on the capital flow regulations imposed by developing countries, which is supported by a traditional but non-mainstream structuralist view.

We conclude this paper with some remarks on future research. In our model, an Ak type production function is used. While this simplifies our analysis without distorting any implication we would like to make, we come up with a question about what would happen to the two country OLG model if we use the usual neo-classical production function especially regarding dynamic properties. Kikuchi (2008) examines business cycles with a two country OLG model which is an extension of Matsuyama's (2004) model. However, he only examines the effect of a difference in population sizes between the two countries on business fluctuations. By contrast, we can study with our model the effect of a difference in the levels of financial development on business fluctuations. This investigation is left for future research.

Appendix

Microfoundation for Credit Constraints

Following the idea of Aghion, et al. (1999), we provide a microfoundation for credit constraints. The microfoundation is derived from the optimal monitoring behaivior of the financial intermediary.

Suppose that each agent is endowed with k units of raw capital at his birth. If he borrows $-b > 0$, his total investment resources become $i := k - b$. Let the return on one unit of investments be R. The financial intermediary monitors borrowers only when they default. When the financial intermediary monitors a borrower, it incurs costs $-rbC(p)$ to collect $-prb$, where r is a market interest rate and $p \in (0, 1)$ is the probability with which the financial intermediary can collect the repayment. We impose some assumptions on the function $C : [0, 1) \to \Re_+$. It is assumed that $C(.)$ is twice continuously differentiable, $\frac{\partial C(.)}{\partial p} > 0$, $\frac{\partial^2 C(.)}{\partial p^2} > 0$, $C(0) = 0$, $\lim_{p \to 1} C(p) = \infty$, and $C'(0) < 1$. As the financial intermediary takes on more costs, the probability to succeed in monitoring goes up.

When borrowers default, they have to pay default costs θri. We assume that $0 < \theta < 1 - C'^{-1}(1) < 1$ and due to this assumption, every borrower faces credit constraints that are severer than the natural debt limit. The closer is θ to $1 - C'^{-1}(1)$, the more nearly the credit market approaches a perfect one. The default costs are considered as fines or social sanctions.

The incentive compatibility constraint so as for a borrower not to default is given by:

$$Ri + rb \geq (R - \theta r)i + prb, \tag{23}$$

which is rewritten as:

$$b \geq -\frac{\theta}{1-p} i. \tag{24}$$

The left-hand side of Eq.(23) is the gain when the borrower starts a project and repays the financial intermediary, whereas the right-hand side is the gain when the borrower defaults. Eq.(24) is independent of the return on one unit of investments R.

In order to choose an optimal probability, the financial intermediary solves its maximization problem such that:

$$\max_p \; - prb + rbC(p),$$

which is rewritten as:

$$\max_p \; p - C(p).$$

From the first-order condition, we have:

$$p = C'^{-1}(1). \tag{25}$$

Substituting Eq.(25) into Eq.(24) gives:

$$b \geq -\frac{\theta}{1 - C'^{-1}(1)} i. \tag{26}$$

Letting $\mu := \frac{\theta}{1-C'^{-1}(1)} \in (0,1)$, we have:

$$b \geq -\mu i, \tag{27}$$

which is the credit constraint, Eq.(4). μ is the measure of financial development. We can say that a financial sector is fully developed in an economy if the monitoring costs are low, i.e., if the function $C(p)$ shifts down and $C'^{-1}(1)$ increases. In addition, financial development must be related to the social sanctions when an agent defaults. That is to say, a financial sector in an economy is fully developed if θ is large.

References

[1] Aghion, P., A. Banerjee, and T. Piketty (1999), Dualism and Macroeconomic Volatility, Quarterly Journal of Economics 114, 1359-1397.

[2] Alfaro L., S. Kalemli-Ozcan, and V. Volosovych, (2008), Why Doesn't Capital Flow from Rich to Poor Countries? An Empirical Investigation, Review of Economics and Statistics 90, 347-368.

[3] Chinn M.D. and H. Ito, (2006), What Matters for Financial Development? Capital Controls, Institutions, and Interactions, Journal of Development Economics 81, 163-192.

[4] Edwards S. (2001). Capital Mobility and Economic Performance: Are Emerging Economies Different?, NBER Working Paper No.8076.

[5] Galor O. and J. Zeira (1993). Income Distribution and Macroeconomics, Review of Economic Studies 60, 30-52.

[6] Gertler M. and K. Rogoff (1990). North-South Lending and Endogenous Domestic Capital Market Inefficiencies, Journal of Monetary Economics 26, 245-266.

[7] Jeong H. and R.M. Townsent (2007). Sources of TFP Growth: Occupational Choice and Financial Deepening, Economic Theory 32, 179-221.

[8] Kikuchi T. (2008). Inequality of Nations and Endogenous Fluctuations, Bielefeld University, Discussion Paper 554.

[9] Kose M.A., E. Prasad, K. Rogoff, and S. Wei (2006). Financial Globalization: A Reappraisal, NBER Working Paper No.12484.

[10] Lagos R. (2006). A Model of TFP, Review of Economic Studies 73, 983-1007.

[11] Matsuyama K. (2007). Aggregate Implications of Credit Market Imperfections, forthcoming in D. Acemoglu, K. Rogoff, and M. Woodford, eds, NBER Macroeconomics Annual 2007, Vol.22, MIT Press, Cambridge, MA, USA, 2007.

[12] Matsuyama K. (2004). Financial Market Globalization, Symmetry-Breaking and Endogenous Inequality of Nations, Econometrica 72, 853-884.

[13] Myrdal K., (1957). Economic Theory and Underdeveloped Regions, Duckworth: London.

[14] Nurkse, R. (1953). Problems of Capital Formation in Underdeveloped Countries, Blackwell: New York, NY, USA.

[15] Prescott E.C. (1998) Needed: A Theory of Total Factor Productivity, International Economic Review 39, 525-551.

[16] Reinhart C.M. and K.S. Rogoff (2004) Serial Default and the "Paradox" of Rich-to-Poor Capital Flows, The American Economic Review 94, 53-58.

[17] Sakuragawa M. and K. Hamada (2001) Capital Flight, North-South Lending, and Stages of Economic Development, International Economic Review 42, 1-24.

[18] Tornell A. and A. Velasco (1992). The Tragedy of the Commons and Economic Growth: Why Does Capital Flow from Poor to Rich Countries, The Journal of Political Economy 100, 1208-1231.