On the Effects of the Development of International Financial Markets When the World Economy Is Stratified

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Abstract

This paper analyzes global and national growth under imperfect international financial markets, and evaluates the effects of financial market development using a simple endogenous growth model. The world economy is assumed to be stratified. The agents in developed countries in the face of financial market development may lose by the 'hollowing-out' effect caused by the capital outflows. On the other hand, for agents in developing countries, the development is beneficial, though it prevents them from catching up with agents in developed countries.

Keywords: Stratification; Hollowing-out; Catching up; Financial market development; Convergence

JEL Classification: D31, F43, O40, R11

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1 Introduction

This paper analyzes the growth of the stratified world economy under imperfect international financial markets, and evaluates the effects of financial market development.

Considering a number of empirical analyses about capital mobility, Obstfeld (1995) concludes: "As far as industrial countries are concerned, capital mobility appears substantial when judged by past experience ... Although the experience of the developing countries is diverse ... it is clear that much of the developing world still stands outside the nexus of industrial-country financial markets." (p.255). Actually, the number of financial transactions between developed and developing countries is much smaller than the number of transactions within the group of developed countries. The international allocation of credit does not seem to be sufficient to equalize capital stocks of countries.

Lucas (1990) presents possible reasons for capital immobility and suggests that it is difficult to fully explain this immobility using the simplest neoclassical growth model with different levels of human capital and related externalities. Political risk, underdeveloped financial technology, and controls on financial transactions by policy makers all seem to generate financial market imperfections.

In the first half of our paper, it is assumed that the international financial markets between developed and developing countries are incomplete. In addition, our analysis takes into account the fact that the world economy is stratified in the following sense. Countries are divided into two groups, developed countries and developing countries. Countries within the same group are close and those within the different groups are distant in both geographic and socioeconomic sense. The productivity of a country is assumed to be strongly affected by the capital abundance of her group.

In this stratified world economy, the interaction between the capital abundance and the productivity of countries generate dynamic patterns of global and national growth.[1] The first issue that we analyze in this paper relates to the determinants of the growth of the stratified world economy under international capital immobility.

However, capital immobility is diminishing year by year due to both tech-

[1]Stratification is also analyzed in Benabou (1996), which takes up the problem of school finance, and their model is closely related to ours.

nological progress in financial transaction and the deregulation of financial markets. The second issue that we analyze in this paper is the impact of this international financial market development on the stratified world economy. How does the development affect global and national growth rates? Is the development favorable for both the developed and the developing countries?

We should note here that national policies concerning international financial markets are somewhat paradoxical at first glance. Developed countries usually require developing countries to open their capital markets, although subsequent capital outflow of the developed countries sometimes leads to the "hollowing-out" of their home industries. On the other hand, developing countries usually control capital inflow despite all the benefits from this inflow, such as the expansion of production opportunities and positive externalities on the production technology of home industries. Do the developed and the developing countries want international financial markets to be more open or not?

Our model suggests an answer to the question. As for the agents in developed countries, the development of international financial markets affects their utilities through two channels. First, it enables them to invest their capital more efficiently. Second, it reduces the productivity of their home industries because we assume that there is positive externality of capital on the production of neighbor countries. We call the second effect as the 'hollowing-out' effect. When the hollowing-out effect dominates the former effect, the development of international financial markets reduces the utilities of the agents in developed countries. We show in this paper, however, that it is difficult for the policy makers of the developed countries to prevent the capital outflow.

On the other hand, the lifetime utilities of the infinitely-lived agents in developing countries are raised by the development of the international financial markets, while the development prevents them from catching up with the agents in developed countries in terms of their period consumption levels.

Boyd and Smith (1997) also analyze the effects of opening international financial markets under the presence of a costry state verification problem. We do not assume informational asymmetry, and show that the stratification of the world economy has interesting dynamic consequences. The welfare implications of the different types of financial market structures is also analyzed in Devereux and Saito (1997). They argue the effects of moving from incomplete to complete international financial markets by introducing state

contingent claims. In contrast to their analysis our model is deterministic.[2]

This paper proceeds as follows: Section 2 presents a basic model, which is analyzed under the assumption of incomplete financial markets. The case of complete markets is studied in section 3, and the result is then compared with that of section 2. Policy implications are shown in section 4, and Section 5 concludes.

2 Stratification and Incomplete Financial Markets

2.1 The Model

This section studies economic growth under incomplete international financial markets. Its actual formulation builds on Tamura (1991), which shows that an endogenous growth model can produce income convergence.

Consider an economy consisting of two groups of countries, developed and developing. "Developed" countries are type r countries and "developing" countries are of type p. The important assumption in this section is that financial markets between the two groups of countries are nonexistent. On the other hand, financial markets within each group of countries are complete.[3]

There is a continuum of agents with unit mass within each group of countries. Each agent has some initial capital distribution which can be used for consumption of either real goods or leisure, and for investment in either human or physical capital. The agents have common preferences, but differ in terms of their initial capital endowment and their production technology. The only source of heterogeneity of agents is that the agents in developed countries have larger initial capital endowments than do agents in developing countries. This capital distribution determines the production technology that each agent can exclusively employ. Agents are assumed to be immobile across borders.

[2]Allen and Gale (1995) also analyze incomplete financial markets and the effects of completion. Bernanke and Gertler (1989) analyze business fluctuations of a country under imperfect financial markets.

[3]Actually, in our model, there are no financial transactions within each group due to the homogeneity of agents within a group of countries.

Each of the agents in type i $(= r, p)$ countries faces the following problem:

$$\max_{\{C_{ti}, H_{t+1i}\}_{t=0}^{\infty}} \left\{ \sum_{t=0}^{\infty} \beta^t \ln C_{ti} \right\},$$

subject to

$$H_{t+1i} = A\widehat{H}_{ti}^{\delta}(\tau_{ti} H_{ti})^{1-\delta}, \tag{1}$$

$$(0 < \delta < 1)$$

$$C_{ti} = (1 - \tau_{ti}) H_{ti}, \tag{2}$$

given

$$\{H_{0r}, H_{0p}\},$$

$$(H_{0r} > H_{0p}), \tag{3}$$

where C_{ti}, H_{ti}, and τ_{ti} are the consumption, capital, and savings rate, respectively, of every agent in type i country in the t-th year, and $\widehat{H}_{ti}$ is the spillover effect of capital on the production of an agent in type i countries in the t-th year. The solution to this problem is:

$$\tau_{ti} = \tau = \beta(1 - \delta), \quad \text{for all } (t, i). \tag{4}$$

(4) shows that the savings rate, τ_{ti}, does not depend on time, country type, or the specification of $\widehat{H}_{ti}$. This result, which is needed to elucidate the role of international financial markets, depends on the assumption of a logarithmic utility function. Under the savings behavior of (4), global and national savings rates are also constant. Therefore, the growth rate of each country is determined only by the production efficiency in the country, and the global growth rate is determined by worldwide production efficiency.

Next we specify the capital spillover effect, $\widehat{H}_{ti}$. We introduce the insight of Lucas (1990) regarding the assumption of the spillover effect. As he put it, "Ordinary experience suggests that while some of the external benefits of increases in individual knowledge are local, ... others are worldwide in scope." (p.94). In addition, our model takes geographic and socioeconomic conditions into account. The world economy is stratified, in that most of the rich countries are located in the North, and the poor countries in the South. Two countries in the same region are closer than those in different regions. Then the capital spillover effect is formulated as follows.

$$\widehat{H}_{tr} = H_{tr}^{\gamma} H_{tp}^{1-\gamma}, \; \widehat{H}_{tp} = H_{tp}^{\gamma} H_{tr}^{1-\gamma}, \tag{5}$$

where γ denotes the degree of stratification. We assume $.5 \leqslant \gamma < 1$. (5) implies that an agent's production is positively affected by another agents' capital holdings according to their distance from the agent. Agents in developed countries benefit greatly from the externality derived from the large amount of capital around them. The externality benefit is weak for agents in developing countries, because human capital is scarce around them. When γ is close to 1, the world is severely stratified, that is, countries of the same type are very close, and the two groups of countries are very distant, in both a geographic and a socioeconomic sense. When γ is close to .5, the world is not stratified at all. (5) also implies that H_{tr} and H_{tp} are complementary in determining $\widehat{H}_{ti}$.

Next, we focus on the growth rates and the convergence of countries. From (1), (4), and (5),

$$H_{t+1i} = A\tau^{1-\delta} H_{ti}^{1-\delta(1-\gamma)} H_{tj}^{\delta(1-\gamma)} = A\tau^{1-\delta} \left(\frac{H_{tj}}{H_{ti}}\right)^{\delta(1-\gamma)} H_{ti}. \tag{6}$$

Therefore, the growth rate of a type i country is given by

$$g_{ti}^{I} = \frac{H_{t+1i}}{H_{ti}} - 1 = A\tau^{1-\delta} \left(\frac{H_{tj}}{H_{ti}}\right)^{\delta(1-\gamma)} - 1, \tag{7}$$

where the superscript I denotes that international financial markets are incomplete.

The initial difference in capital endowments reduces over time, due to growth rate differences. The rate of convergence is obtained from (4) and (6).

$$\frac{H_{t+1r}}{H_{t+1p}} = \left(\frac{H_{tr}}{H_{tp}}\right)^{1-2\delta(1-\gamma)}. \tag{8}$$

The rate of convergence depends on the degree of stratification, γ. When the world is highly stratified (that is, γ is large), then the difference in the marginal product of capital is small and convergence is slow. If $\gamma = 1$ (the world is perfectly stratified), then there is no convergence. Note that the convergence rate is equal to that of consumption, because aggregate consumption in each country is proportional to the amount of capital in that country as is shown in (4). In the long run, once convergence is complete, all agents and countries become homogeneous.

(3) and (8) implies $H_{tr} > H_{tp}$ for all t. From this and (7),

$$g^I_{tr} < g^I_{tp} \quad \text{for all } t. \tag{9}$$

(7) also implies that the difference between g^I_{tr} and g^I_{tp} is decreasing in γ and increasing in (H_{tr}/H_{tp}).

What can we say about the global growth rate? From (6),

$$\widetilde{H}_{t+1} = A\tau^{1-\delta}\widetilde{H}_t, \tag{10}$$

where $\widetilde{H}_t$ denotes the geometric mean of capital ($\widetilde{H}_t \equiv H^{.5}_{tr}H^{.5}_{tp}$). The global growth rate of the geometric mean of capital is constant over time. The degree of stratification or capital distribution is irrelevant.

However, a more appropriate measure to capture the growth rate of an economy is *the arithmetic* mean rather than the geometric mean. Benabou (1996) pointed out that discriminating between these means is important.[4] The arithmetic mean of two numbers is greater than or equal to their geometric mean, and the ratio of the arithmetic mean to the geometric mean decreases as the two numbers converge. Therefore,

$$\overline{H}_{t+1} < A\tau^{1-\delta}\overline{H}_t \quad \text{for all } t, \tag{11}$$

where $\overline{H}_t$ is the arithmetic mean of capital ($\overline{H}_t \equiv (H_{tr} + H_{tp})/2$). In the long run, once the convergence process is complete, the difference between the left hand and the right hand side of (11) disappears. Therefore, g_L, the long run global growth rate measured in $\overline{H}_t$, coincides with that measured in $\widetilde{H}_t$.

$$g_L = A\tau^{1-\delta} - 1. \tag{12}$$

On the other hand, from (11) and (12), the short run global growth rate measured in $\overline{H}_t$ is

$$g^I_{tW} = \frac{\overline{H}_{t+1}}{\overline{H}_t} - 1 < g_L \quad \text{for all } t. \tag{13}$$

We can show that g^I_{tW} is increasing in γ and decreasing in (H_{tr}/H_{tp})using (8) and (10). The economic implications of this result will be discussed in the next subsection, focusing on the production inefficiency that is caused by incomplete financial markets.

[4]Tamura (1989) leaves this problem untouched.

Finally, we show some results regarding the growth rate of each country. From (6),

$$g^I_{tp} > g_L \quad \text{for all } t. \tag{14}$$

Summing up (13) and (14),

$$g^I_{tp} > g_L > g^I_{tW} > g^I_{tr} \quad \text{for all } t. \tag{15}$$

As time goes by, g^I_{tp}, g^I_{tW}, and g^I_{tr} converge to their long run value g_L by capital convergence.

2.2 Sources of Production Inefficiency

We note that g^I_{tW} is affected by two types of production inefficiency. The first type of inefficiency arises from the absence of international financial markets, which makes it impossible to allocate capital input efficiently. Let us assume $\gamma = .5$ by way of illustration. This implies that there is no stratification, and all agents employ the same production technology. The capital input of an agent is, however, proportional to his own capital, as we have seen in (4), and this investment behavior generates the first type of inefficiency. Unequal capital distribution between countries intensifies this inefficiency and lowers g^I_{tW}. When $.5 < \gamma < 1$, the developed countries are more productive than the developing countries. This justifies a portion of the larger investment of the developed countries, but inefficient capital input still remains.

However, even without the first type of inefficiency, i.e., even if investment behavior were efficient, g^I_{tW} changes as time passes. This is because we have assumed in (5) that H_{tr} and H_{tp} are complementary in determining the spillover effect of capital that affects aggregate global productivity. The global production function, when capital is invested efficiently, is calculated from (1) as follows:

$$H_{t+1} = A(\widehat{H}_{tr} + \widehat{H}_{tp})^{\delta} S_t^{1-\delta}, \tag{16}$$

where H_t is the amount of world capital in the t-th year ($H_t \equiv H_{tr} + H_{tp}$), and S_t is aggregate global capital input. There is no first type of inefficiency in (16) and aggregate productivity changes as $(\widehat{H}_{tr} + \widehat{H}_{tp})$. The second type of inefficiency comes about as unequal capital distribution decreases $(\widehat{H}_{tr} + \widehat{H}_{tp})$. Discriminating between these two types of inefficiencies is important in the evaluation of the effect of financial market development in the next section.

If $\gamma = 1$, the capital input of each agent under nonexistent international financial markets coincides with that under complete markets, and there is no inefficiency of the first type. In addition, H_{tr} and H_{tp} are perfect substitutes in determining aggregate productivity, and there is no inefficiency of the second type. In this case, $g^I_{tW} = g_L$ for all t.

The sum of the two types of inefficiency is decreasing in γ and increasing in (H_{tr}/H_{tp}) because it changes in the opposite direction to g^I_{tW}. In the next subsection, we apply this result and analyze the effect of γ on the time series, g^I_{tW}.

2.3 Stratification and Global Growth Patterns under Incomplete Financial Markets

We can make some predictions about how global stratification affects the pattern of the time series, g^I_{tW}, by applying the results in the previous subsection. If the world is highly stratified (γ is large), g^I_{tW} is relatively high at the outset, because the inefficiency in production is low. The growth rate, however, does not readily go up as time passes, because the inefficiency lingers due to slow convergence. On the other hand, if the global economy faces low stratification (γ is small), g^I_{tW} is low at the outset, however the inefficiency disappears quickly due to convergence and the growth rate rises sharply.

In short, if the world is stratified, g^I_{tW} is relatively high at the outset, but rises slowly. If the world is not stratified, g^I_{tW} is relatively low at the outset, but rises sharply. Numerical examples of this result are shown in figure 1. We set $\{A, \beta, \delta, H_{0r}, H_{0p}\} = \{1.305531, .9, .1, 100, 20\}$, $\gamma = .5, .7$, and $.9$.[5] These parameter values are used throughout this paper. In the long run, when capital convergence is complete, g^I_{tW} converges to g_L. The convergence, however, takes several decades, and g^I_{tW} at the outset is lower than in the long run. We can see that the generated time series, g^I_{tW}, is affected by the degree of stratification in the same manner as we predicted above.

[5] The value of A is adjusted so that g_L becomes .08.

3 The Creation of International Financial Markets

3.1 The Economy

We have assumed so far that there are no international financial markets between the two groups of countries. These markets are, however, developing year by year due to developments in financial technology and by deregulation in developing countries. To consider the effects of this development, we assume in this section that international financial markets are complete. Thus there are no obstacles to financial transactions. Comparison of the results with those of the previous sections clarifies the effect of this development on global and national growth rates, on the utilities of agents, and on the international payments of countries.

Each agent in countries of type i faces the following problem under complete international financial markets:

$$\max_{\{C_{ti},H_{t+1i}\}_{t=0}^{\infty}} \left\{ \sum_{t=0}^{\infty} \beta^t \ln C_{ti} \right\},$$

subject to

$$\sum_{t=0}^{\infty} \left(\prod_{q=0}^{t} R_{q-1} \right) \times \{H_{ti} - S_{ti} - C_{ti}\} = 0, \tag{17}$$

$$H_{t+1i} = A\widehat{H}_{ti}^{\delta} S_{ti}^{1-\delta}, \tag{18}$$

given

$$\{H_{0r}, H_{0p}\}.$$

where S_{ti} is the amount of capital input in the t-th year of each agent in a type i country, and R_t is the market discount factor from year t to $t+1$. R_{-1} is defined to be 1. Note that each agent thinks that his or her decision has no effect on any of the economy averages or on any other agents' decision-making.

We assume that agents share common perfect-foresight expectation of countries' future capital stocks. Therefore, the expected capital spillover effect coincides with the investment behavior of agents. Thus

$$\widehat{H}_{tr} = H_{tr}^{\gamma} H_{tp}^{1-\gamma}, \quad \widehat{H}_{tp} = H_{tp}^{\gamma} H_{tr}^{1-\gamma}. \tag{19}$$

In equilibrium, the following market clearing condition holds.

$$C_{tr} + C_{tp} = H_{tr} + H_{tp} - S_{tr} - S_{tp}, \quad \text{for all } t. \tag{20}$$

The first order conditions are

$$C_{t+1r} = \frac{\beta}{R_t} C_{tr}, \quad C_{t+1p} = \frac{\beta}{R_t} C_{tp}, \tag{21}$$

$$H_{t+1r} = \left\{(1-\delta)\, R_t\right\}^{\frac{1-\delta}{\delta}} A^{\frac{1}{\delta}} \widehat{H}_{tr}, \quad H_{t+1p} = \left\{(1-\delta)\, R_t\right\}^{\frac{1-\delta}{\delta}} A^{\frac{1}{\delta}} \widehat{H}_{tp}. \tag{22}$$

The conditions that $\{R_t, C_{tr}, C_{tp}, H_{t+1r}, H_{t+1p}\}_0^\infty$ satisfy in equilibrium are (17)$\sim$(22). The convergence rate of human capital is obtained by manipulating (22).

$$\left(\frac{H_{t+1r}}{H_{t+1p}}\right) = \left(\frac{H_{tr}}{H_{tp}}\right)^{2\gamma-1}. \tag{23}$$

Comparing (8) and (23), we can see that the creation of international financial markets advances capital convergence. This is because under complete financial markets, convergence is caused not only by the differences in marginal productivity between countries, but also by capital flows from developed to developing countries. On the other hand, (21) implies that there is *no* convergence in consumption, in contrast to the consumption convergence under incomplete financial markets. This means that the creation of international capital markets does not allow agents in developing countries to catch up with agents in developed countries in terms of annual consumption. The result is straightforward from the assumptions of perfect financial markets and common utility functions, however, it should be noted that consumption convergence depends on imperfect financial markets.

In the following three subsections, we analyze the effect of financial market creation, focusing more precisely on global and national growth rates, the welfare of agents, and the international payments of countries.

3.2 Growth Rates

In this subsection we analyze global and national growth rates. From (18) and (22),

$$R_t = \{A(1-\delta)\}^{-1} (\widehat{H}_{tr} + \widehat{H}_{tp})^{-\delta} S_t^{\delta}. \tag{24}$$

In addition (21) is merged into

$$C_{t+1} = \frac{\beta}{R_t} C_t, \tag{25}$$

where C_t is aggregate global consumption ($C_t \equiv C_{tr} + C_{tp}$). From (16), (24), and (25),

$$s_{t+1} = 1 + \beta(1-\delta) - \frac{\beta(1-\delta)}{s_t}, \tag{26}$$

where s_t denotes the global savings rate, so $S_t = s_t H_t$,$C_t = (1-s_t)H_t$. If $s_t < \beta(1-\delta)$, (26) implies that capital runs out after some periods and that first order conditions are violated. If $s_t > \beta(1-\delta)$, the transversality condition is not satisfied. Thus, we have the following constant global savings rate under complete financial markets:

$$s_t = s = \beta(1-\delta). \tag{27}$$

(4) and (27) show that the global savings rate is not affected by the creation of international financial markets. Thus we are able to focus on the effect of financial market creation on the supply side, that is, the productivity change.

Under complete markets, the first type of inefficiency disappears due to international capital flows. The second type of inefficiency, which is caused by capital complementarity, decreases quickly because the amount of capital in each country is quickly equalized due to international capital flows, as we have seen in (23). Therefore, the global growth rate under complete international financial markets, g_{tW}^C, is always higher than g_{tW}^I, and lower than g_L, due to the second type of inefficiency, under a given initial capital distribution:

$$g_L > g_{tW}^C > g_{tW}^I \quad \text{for all } t. \tag{28}$$

Numerical examples of the relation between g_{tW}^C and g_{tW}^I are shown in figures 2 and 3. The parameters are set at the same values as before.

Now we discuss national growth rates. Note that under complete international financial markets, a country's capital growth rate differs from its

consumption growth rate. From (21), the consumption growth rates of developed and developing countries under complete financial markets, g^C_{tr} and g^C_{tp}, are the same, and they are also equal to g^C_{tW}.

$$g^C_{tr} = g^C_{tp} = g^C_{tW} \quad \text{for all } t. \tag{29}$$

From (15), (28), and (29),

$$g^C_{tr} > g^I_{tr}, \tag{30}$$

$$g^C_{tp} < g^I_{tp}, \tag{31}$$

for all t under a given initial capital distribution.

The above result does not apply if growth rates under complete markets are measured in capital. The capital growth rate of developing countries is higher under complete financial markets than under incomplete markets, due to capital inflows from developed countries, and the capital of developed countries may even decrease at the outset of market completion due to capital outflows.

In this section, we analyzed the effects of the creation of international financial markets on global and national growth rates. However, a higher growth rate does not necessarily lead to the higher utility of agents. We focus on the utilities of agents in each country in the next subsection.

3.3 Utility: hollowing-out effect

Due to the creation of international financial markets, capital input becomes more efficient through borrowing and lending, and this improves agents' welfare. On the other hand, the spillover effect of capital on the production of an agent may be increased or decreased by the capital flow. As for the Agents in developed countries, they benefit from expanded investment opportunities, and at the same time, they face lower capital spillover effects, due to capital outflows following the creation of international financial markets. This second effect is the so-called 'hollowing-out' effect; developed countries are damaged by the re-location of home industries to other countries. The utilities of the agents in developed countries are affected by those two effects, and parameter values determine the magnitude of them.

For example, if $\gamma = .5$, capital location has no impact on the capital spillover effect. On the other hand, if $\gamma = 1$, capital does not move, even

under complete international financial markets. In both cases the creation of international financial markets does not bring about the hollowing-out effect. Therefore, it is in the intermediate case that agents in developed countries face a loss in utility due to the creation of international capital markets.

On the other hand, agents in developing countries benefit from fully exploiting their production opportunities as a result of the capital inflows from developed countries induced by the creation of international financial markets. Moreover, they enjoy increased productivity as a result of this introduced capital. We can prove that the lifetime utility of agents in the developing countries is higher under complete financial markets than under incomplete markets.

$$U_p^C > U_p^I, \tag{32}$$

where U_i^C and U_i^I are the maximized lifetime utility of the representative agent in type i country under complete and incomplete financial markets. See the appendix for the proof.

We present numerical examples, which show the effects of the opening of international financial markets on agents' lifetime utilities. Table 1 shows the agents' utilities under complete and nonexistent international financial markets. We tried two cases: $\gamma = .7$ and $\gamma = .9$. When $\gamma = .9$, the creation of international financial markets reduces the utilities of the agents in developed countries, since the hollowing-out effect dominates the gains from efficient investment. On the contrary when $\gamma = .7$, $U_r^C > U_r^I$. As for developing countries, the utilities of the agents are higher under complete international financial markets as shown in (32).

3.4 International Payments

Under the nonexistence of international financial markets, current accounts, financial accounts, trade balances, and income balances are all zero. After the markets have been opened, capital flows from developed to developing countries, because the developed countries have excess capital compared to the developing countries. This excess exists even if we take into account the higher productivity of developed countries. Thus, the developed countries arrive at current account surpluses and financial account deficits, and developing countries accrue current account deficits and financial account surpluses.

As time passes, productivity differences between countries decrease. This

induces new capital flows, and the above deficits and surpluses persist. In the long run, there is a complete convergence in capital and productivity, and current and financial accounts of all countries converge to zero.

We next focus on the composition of the current account to assess long run effects. Even after all countries attain capital convergence, some of the capital in the developing countries is owned by agents in developed countries. The interest payment to the agents in developed countries from this capital enables them to consume more than they produce at home. On the other hand, agents in developing countries consume less than they produce at home. This produces trade deficits and income surpluses for developed countries, and trade surpluses and income deficits for developing countries. These imbalances persist even in the long run.

Tables 2 and 3 show the results of numerical examples of international payments of countries. The tables correspond to the cases where $\gamma = .7$ and $\gamma = .9$ respectively. When $\gamma = .7$, the current account surplus (financial account deficit) of a developed country is 24.85% of its H_t immediately after the creation of international financial markets. The current account moves into a deficit position in 4 years. The country's long run trade deficit (income surplus) is 6.58% of its H_t. When $\gamma = .9$, the current account surplus (financial account deficit) of a developed country is 7.22% of its H_t at the outset. The current account moves into a deficit position in 7 years. The country's long run trade deficit (income surplus) is 7.97% of its H_t.

4 Policy Implications

In this section we endogenize the creation of international financial markets by placing this decision into policy makers' hands. The policy maker of each country decides whether to open international financial markets in their country.

Before analyzing the model, we note here that the actual policy making of countries regarding international financial markets seems somewhat paradoxical at first glance. It is common that a developed country's policy maker require a developing country to open her capital market, but the policy makers of the developing country deny the requirement. On the other hand, it is often pointed out that developed countries in the face of developing international financial markets suffer from the "hollowing-out" of manufacturing industries, while developing countries enjoy expanded production opportuni-

ties, and benefit from externalities generated by the imported capital. Our model can explain these seemingly inconsistent phenomena.

The utilities of agents in developed countries may increase or decrease by the creation of international financial markets. Even if their utilities decrease, that is, the hollowing-out effect dominates, closing the market is difficult for the reasons presented below.

For an agent in the developed countries, it is always beneficial to violate international capital transaction controls, because a small agent's behavior does not impact on the capital spillover effect. Similarly, the policy makers of a small developed country, who also cannot affect the economy average, can benefit agents in their country by allowing them to invest in developing countries.

Contrary to this, the policy maker of a sufficiently large developed country may be able to benefit agents in his country by prohibiting capital outflows to developing countries because this policy prevents the abatement of the capital spillover effect. In practice, however, the policy maker's capital controls are difficult to implement when there exist another sufficiently small developed country with which the agents in the policy maker's country can make financial transactions. Even if the policy maker prohibited capital outflows to developing countries, the capital of the large country still flows into developing countries via the small developed country, because the policy makers of small developed countries have no incentive to control capital outflows, as argued above.

On the other hand, (32) shows that for developing countries, the creation of international financial markets is favorable, although in reality the policy makers of developing countries often control capital inflows. To resolve this contraediction, it is helpful to take into account the effect of the creation on consumption convergence. Under the nonexistence of international financial markets, the consumption of all countries converges in the long run, contrary to the non-convergence under complete financial markets. In other words, developing countries cannot catch up with developed countries in yearly consumption under complete international financial markets. This suggests why policy makers of developing countries do not open their capital markets.

In summary, a large developed country may suffer from hollowing-out under open international financial markets. However, even when the policy maker of the country tries to control capital outflows, there is likely to be a loophole in the regulation. On the other hand, the policy maker of a developing country may prohibit capital introduction in order to catch up with

developed countries in yearly consumption, although this policy decreases the lifetime utility of agents in the developing country.

5 Conclusion

We considered a macroeconomic implication of international financial market development using a very simple endogenous growth model. Global and national growth are affected by the degree of stratification and by capital distribution. We explained the intertemporal and inter-country variability of growth rates by the efficiency in capital use.

Next, we analyzed the effect of opening international financial markets between developed and developing countries. The impact on global and national growth and the international payments of countries are discussed.

The lifetime utilities of the agents in developed countries may be decreased by the creation of international financial markets, for they are adversely affected by the hollowing-out of home industries. Prevention of the capital outflow is difficult, however, because investing capital in developing countries is beneficial for each agent in developed countries and for the policy makers of small developed countries.

While the lifetime utilities of agents in developing countries are increased by the creation of international financial markets, it also means that the developing countries are unable to catch up with developed countries in yearly consumption, contrary to the convergence that occurs under the nonexistence of these markets. Catching up matters, especially for the global economy, because there is no worldwide legal institution that rules conflicts between countries, and economic power is sometimes important for diplomatic negotiations.

Needless to say, the model used here is very simple and in some respects does not conform to reality. It should be noted that we assumed the sudden creation of international financial markets. The actual change would be more moderate than we calculated, but the qualitative results can be applied to understand actual financial market development.

Appendix

This appendix proves (32). We compare the case of complete and nonexistent international financial markets, with other conditions being equal. Let us denote the value under complete international financial markets by superscript C, and the value under no international financial markets by superscript I.

At the outset ($t = 0$), under a given initial capital distribution $\{H_{0r}, H_{0p}\}$ ($H_{0r} > H_{0p}$), the amount of capital invested in production in both cases are $\beta(1-\delta)H_0$ because the global savings rate is always $\beta(1-\delta)$ as can be seen in (4) and (27). Then $H_1^C > H_1^I$, because the production technology in each case is the same and production becomes more efficient through borrowing and lending under complete markets.

Next we analyze production in the u-th year under the assumption $H_u^C > H_u^I$, starting from the same initial capital distribution. The aggregate global production technology in the u-th year is determined by $\widehat{H}_{ur} + \widehat{H}_{up}$ as we have seen in (16), where $\widehat{H}_{ur} + \widehat{H}_{up}$ is increasing in H_u and decreasing in (H_{ur}/H_{up}). Since

$$(H_{tr}/H_{tp})^C < (H_{tr}/H_{tp})^I \quad \text{for all } t, \tag{A1}$$

by the difference in convergence rates, we have

$$\left(\widehat{H}_{ur} + \widehat{H}_{up}\right)^C > \left(\widehat{H}_{ur} + \widehat{H}_{up}\right)^I. \tag{A2}$$

In addition, the amount of capital input is larger under complete markets than under the nonexistence of financial markets, because $\beta(1-\delta)H_u^C > \beta(1-\delta)H_u^I$. In sum, the agents under complete markets invest large amounts of capital, allocating it efficiently by borrowing and lending, and employing superior technology. Therefore, $H_{u+1}^C > H_{u+1}^I$.

Thus,

$$H_t^C > H_t^I \quad \text{for all } t. \tag{A3}$$

by induction.

From (A1) and (A3), $\widehat{H}_{tp}^C > \widehat{H}_{tp}^I$ for all t, i.e., the production technology employed in developing countries in each period under complete international financial markets is always superior to the production technology employed under the nonexistence of financial markets.

Therefore, an agent faced with $\left\{\widehat{H}_{tp}^C\right\}_{t=0}^{\infty}$ can realize higher utility than another agent faced with $\left\{\widehat{H}_{tp}^I\right\}_{t=0}^{\infty}$, under no financial transactions and the

same initial capital endowment. The utility of the former agent can be raised even more by borrowing from developed countries. Thus $U_p^C > U_p^I$. Q.E.D.

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