International Trade and Capital Movement under Financial Imperfection *

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Abstract

The paper examines the impacts of trade and capital movement between the North and the South under financial imperfection. We find that trade and capital movement are complements, rather than substitutes as in the case of perfect financial institution, in the sense that when capital is perfectly mobile, trade in goods will induce further capital movement and capital moves from the South to the North. We also find that an international difference in financial development induces reciprocal foreign direct investment.

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1 Introduction

Recent financial turmoil reminded us of the importance of the high-quality credit market on the economy. The subprime loan problem in the United States seriously hurt the financial systems in the United States and other countries in the world, which led to the global economic downturn as banks and other financial intermediaries became cautious and reluctant to lend money that is necessary for firms to smoothly operate. The financial crisis had spread very quickly and its impact was large worldwide because the financial market had been globalized in the last decades.

The purpose of this paper is to examine the impacts of trade in goods and international capital movement when the financial institution is not perfect. The impact of globalization of the financial market on the economy has been extensively analyzed.[1] However, the literature of international trade under financial imperfection is premature. Kletzer and Bardhan (1987), Beck (2002), Matsuyama (2005), Wynne (2005), Levchenko (2007), Ju and Wei (2008), and Antràs and Caballero (2009), for example, find that the cross-country differences in the quality of financial institutions significantly affect the structure of countries' comparative advantage and trade patterns. Chaney (2005), Manova (2008a), and Suwantaradon (2008) develop their models in which heterogeneous firms are faced with credit-constraints when they finance trade costs. Their models predict that more-productive and wealthier firms engage in export, while others sell their products only domestically.[2] Foellmi and

[1]Henry (2007), for example, finds evidence that financial globalization contributes to economic growth. Klein (2005) shows that countries with better (but not the best) institutions exhibit positive effects of capital account liberalization on economic growth. Kose, Prasad, Rogoff, and Wei (2006) argue that countries that meet threshold conditions (about institutional quality and trade openness, for example) are better able to reap the growth and stability benefits of financial globalization. Financial development itself depends on general institutional quality and political and economic environment. Chinn and Ito (2006) find evidence that capital account liberalization leads to equity market development only if a threshold level of legal development has been attained and that trade openness is a prerequisite for capital account liberalization. Rajan and Zingales (2003) and Do and Levchenko (2007) find that trade and international capital movement induce financial development. Indeed, the quality of financial institution has long been recognized to be critical to the economic prosperity. McKinnon (1973, 1993), for example, emphasizes that less-developed countries and countries in transition from socialism to democracy should develop reliable financial institution in order to achieve economic growth. He argues that countries should first improve their internal financial institutions before opening to trade in goods. Rajan and Zingales (1998) find evidence that financial development contributes positively to the economic growth. Kose, Prasad, Rogoff, and Wei (2006, 2009) provide excellent surveys of the studies on the economic impacts of financial globalization.

[2]Manova (2008b) and Chor and Manova (2009) find evidence that credit constraints are an important

Oechslin (2010) also theoretically investigate the effect of international trade on exogenously-heterogeneous firms within an industry and show that rich entrepreneurs win while poor ones lose from opening to trade. Despite that these studies in the field of international trade reveal many important features and mechanisms that appear under financial imperfection, we have yet to analyze many aspects of international trade and capital movement in the economy with imperfect financial institutions. Because financial imperfection is so pervasive, it is important to re-establish the trade literature under the assumption that the financial institution is not nearly perfect.

In this paper, we examine the impacts of trade and capital movement between the North and the South under financial imperfection. We are especially interested in economic interaction between trade in goods and international capital movement. More specifically, we examine how trade and capital movement affect the industry in individual countries with possibly different qualities of financial institutions. We also allow countries to differ from each other in their wealth distributions (which can be considered as capital endowments for now) in order to distinguish the effects caused by the difference in countries' financial development from those caused by a traditional difference in factor endowments.

The main result of the paper is that under financial imperfection, trade in goods and international capital movement are complements, rather than substitutes as in the case of perfect financial institution, in the sense that when capital is perfectly mobile, trade in goods will induce further capital movement and capital moves from the South to the North. Trade and capital movement are substitutes, according to the traditional international trade theory which assumes perfect financial institutions (Mundell 1957 and Krugman 1979). But we find that they are complements under financial imperfection. Together with the observation (which is theoretically confirmed in this paper) that capital account liberalization by both countries induces capital flight from the South if countries are different in the quality of financial institution (which is known as Lucas Paradox, Lucas 1990), trade liberalization amplifies the capital flight under financial imperfection according to our result. This result

determinant of international trade flows.

is important because it is suggestive to policy makers in the South who attempt to assess the economic impacts of liberalizing trade and capital account; they may naturally reconsider opening to trade and international capital movement if they know our result.

Antràs and Caballero (2009) also theoretically examine the complementarity between international trade in goods and capital movement under financial imperfection. They show among others that trade in goods and capital movement are complements in the sense that trade in goods induces capital to flow into a financially-less-developed country (i.e., the South). We share the complementarity result with them. But there is an important difference: they predict that trade in goods induces capital to flow into the South while we predict the opposite direction of international capital flow. This difference is obviously important especially for policy makers in the South. The key to the complementarity in the framework of Antràs and Caballero (2009) is that trade induces the South to specialize in the financially-unconstrained industry so that labor employed disproportionately in that sector depresses (compared to the North) the wage rate in the South and raises the rental rate of capital that is mobile across countries. This traditional, general-equilibrium mechanism of specialization causes the complementarity between trade and capital *inflow* (to the South). Trade and capital *outflow* (from the South) are complements in our model, on the other hand, because trade benefits firms in the financially-dependent industry in the North and harms those in the South (the positive market expansion effect outweighs the negative competition enhancement effect for firms in the North but not for firms in the South) so that trade pushes up the interest rate (or rental rate) in the North but pushes down that in the South. That is, the key to our complementarity is the competition effect in the industry. Our competition effect is relevant and important especially for contemporary trade because the proportion of intra-industry trade to inter-industry trade is higher than ever before.[3] In addition, our analysis applies better to trade among developed countries and emerging-market economies since they tend to trade manufactures whose production operation depends heavily on external finance.

[3]Our result can be considered to be in contrast to Krugman's (1979) substitutability result, just as Antràs and Caballero's (2009) complementarity is in contrast to Mundell's (1957) substitutability result.

Our study here is also related to the one in the companion paper (Furusawa and Yanagawa 2012), which investigates the impacts of trade and capital-account liberalization on the productivity distribution of the industry that depends on external finance. The main purpose of the companion paper is to explore the relationship between the financial development and firm heterogeneity in their productivity (which is absent in this paper) and to show that trade and capital-account liberalization leads to the global convergence in the productivity distribution in. This paper, on the other hand, examines the substitutability between trade in goods and international capital movement, a traditional and fundamental question in international trade.

After setting out the model in the next section, we briefly examine trade equilibrium when financial institution is perfect, and confirm that trade and capital movement are (almost) perfect substitutes. Section 4, which is the main section of the paper, examines the economy with imperfect financial institutions. We first show that trade in goods alone will not affect the size of the industry in either country and that capital movement, on the other hand, makes a significant impact on the industry. Finally in this section, we show that under perfect capital mobility, trade induces capital movement from the South to the North, affecting the size of the industry in both countries; trade affects the size of the industry in either country only when it is accompanied by international capital movement.

Section 5 considers the possibility of foreign direct investment (FDI). We investigate FDI flows between two countries with different financial development, and find that reciprocal FDI may arise in such situations. On one hand, FDI from a (relatively) financially-developed country (the North) to a financially-less-developed country (the South) arises since firms in the North, which locally finance part of their FDI projects, attempt to exploit interest rate differential. On the other hand, there also exists FDI from the South to the North aiming to overcome financial constraints. Ju and Wei (2010) also establish a theoretical model that reveals a mechanism of two-way capital flow. In their model, financial capital flows from the financially-less-developed South to the North, while FDI from the North in which the expected return from the investment is low (due to the capital abundance) to the South.

Unlike their model, ours naturally spotlights overcoming financial constraints as the main motive for FDIs. Indeed, if both international portfolio investment and FDI are allowed in our model, both financial and FDI-oriented capital move from the South to the North, which is obviously different from their prediction. Southern firms' FDIs driven by the motive of overcoming financial constraints have not been stressed in the literature, but will become practically important as more and more southern firms become competitive in the world market.

2 Model

There are two countries, which we call North (N) and South (S). In country $k \in \{N, S\}$, there is a mass m_k of individuals; we normalize the population such that $m_N + m_S = 1$. Each individual owns one unit of labor and a wealth of ω that is distributed according to the cumulative distribution of F_k. The wealth distribution in North has first order stochastic dominance over that in South, i.e., $F_N(\omega) < F_S(\omega)$ for any ω, if the distributions are different between the countries at all. All individuals share the same utility function over the two goods, a differentiated good X and a numeraire good Y, which is characterized by

$$u = \log u_x + y,$$

where

$$u_x = \left[\int_{\Omega_k} x(i)^{\frac{\sigma-1}{\sigma}} di\right]^{\frac{\sigma}{\sigma-1}}; \ \sigma > 1, \tag{1}$$

denotes the subutility derived from the consumption of continuum varieties of good X, $\{x(i)\}_{i\in\Omega_k}$ (where Ω_k denotes the set of all varieties available in country k), and y denotes the consumption level of good Y. The numeraire good is competitively produced such that one unit of labor produces one unit of the good, so the wage rate equals one.

Each individual chooses a consumption profile of good X to maximize u_x subject to $\int_{\Omega_k} p(i)x(i)di \leq E$, where $p(i)$ and E denote the price for variety i and the total expenditure on all varieties of good X, respectively. It is immediate to obtain $x(i) = p(i)^{-\sigma}E/P_k^{1-\sigma}$, where $P_k \equiv \left[\int_{\Omega_k} p(i)^{1-\sigma} di\right]^{\frac{1}{1-\sigma}}$ denotes the price index of good X. We substitute this result

into (1) to obtain $u_x = E/P_k$, so that an individual's utility function can be written as $u = \log E - \log P_k + y$. Maximizing the utility with the constraint $E + y \leq I$, where I denote the individual's income (which is the sum of her labor income and the investment return from her wealth), we obtain $E = 1$. That is, each individual spends $E = 1$ on good X, so the country k's aggregate expenditure on good X is m_k.

The differentiated-good industry is characterized by the monopolistic competition with free entry and free exit. When a firm enters, however, it incurs an R&D (or setup) investment of g units of labor (or the numeraire good Y). Each entrepreneur needs to raise capital of g to finance this investment before the operation. Since there is a continuum of varieties, each firm naturally ignores the impact of its pricing on the price index, so that firms select prices that are $\sigma/(\sigma - 1)$ times their individual marginal costs of c. Let n_k denote the mass of firms in country k. Then, it is easy to see that the profits for firm i in country k equal

$$\pi_k = m_k/\sigma n_k. \tag{2}$$

Individuals in country k decide whether or not they become entrepreneurs who can borrow money at a gross interest rate of R_k to finance their investments if necessary. If she decides not to be an entrepreneur or if part of her wealth is left after the investment for her firm, she will lend out her (remaining) wealth.

The critical feature of the model is that entrepreneurs are faced with a financial constraint. We assume that entrepreneurs in country k can only pledge themselves to repay only a fraction $\theta_k \in (0, 1]$ of the profits that they will earn, and hence entrepreneur i in country k can borrow only up to the amount such that the repayment does not exceed $\theta_k \pi_k$. The fraction θ_k represents the quality of the financial institution of the country. (Matsuyama 2000, for example, adopts this formulation of financial imperfection.[4]) A financial institution is perfect if $\theta_k = 1$; any entrepreneur with any wealth level can finance the investment effectively without any constraint. A financial institution is imperfect if $\theta_k < 1$; individuals with small amounts of wealth may not be able to finance the investment in this case. We

[4]Matsuyama (2007) describes various economic implications of the credit market imperfection of this type.

assume, without loss of generality, that $\theta_N \geq \theta_S$.

We can list several reasons why θ (from which we drop the subscript k for the following general argument) can be smaller than one. A natural cause of financial imperfection is the imperfection of legal enforcement.[5] If the legal enforcement is perfect, as assumed in the traditional literature, a court can enforce a borrowing contract as long as the repayment under the contract does not exceed the profit from the project, which is denoted by π. Empirical evidences show, however, the enforcement power is not perfect (La Porta, et al., 1998). Thus, in reality, a court may be able to force a borrower to pay only up to a fraction of the profits, i.e., $\theta\pi$ where $\theta < 1$, even though the realized profit is π. Hence, unless the non-pecuniary penalty for the default is large enough, the borrower is likely to refuse to pay more than $\theta\pi$ even if the promised payment exceeds this amount. This behavior is called the "strategic default." A contract cannot be a perfect commitment device if the legal enforcement is imperfect; it is difficult for a lender to expect that a borrower will sincerely make the promised payment. Given that, lenders will not lend more than the amount such that the return from the lending equals $\theta\pi$. Another cause of financial imperfection is the agency problem of the lender-borrower relationship, which is explained briefly in a simple model in the Appendix.

In the economy that we consider, there are two types of the constraints that must be satisfied: the profitability constraint and the borrowing constraint. The profitability constraint

$$\text{(PC)} \quad \pi_k - R_k g \geq 0 \tag{3}$$

simply means that the net profits must be non-negative. The borrowing constraint, on the other hand, can be written as

$$\text{(BC)} \quad \theta_k \pi_k \geq R_k(g - \omega), \tag{4}$$

which mean that in country k, an entrepreneur with the wealth of ω can borrow money only up to the amount such that the repayment does not exceed the fraction θ_k of the profits. It is easy to see that the profitability constraint is tighter than the borrowing constraint if θ_k

[5]See for example Hart(1995).

is large, whereas the borrowing constraint is tighter if θ_k is small. The borrowing constraint tends to be tighter for entrepreneurs with a small amount of wealth.

We investigate the effects of trade and international capital movement under an imperfect financial institution on the economy and establish the main result that trade and international capital movements are complement and only if the financial institution is not perfect. To this end, we first analyze the case in which the financial institution is perfect.

We also emphasize here that the numeraire good is always tradable in all cases that we consider, so "opening to trade in goods" here means opening to trade in the differentiated good as well as the numeraire good. We need this assumption in order to meaningfully analyze the effect of capital movement. In this static model, the balance-of-payment consideration requires some goods be traded in order for capital to flow from one country to the other.

3 Equilibrium under a perfect financial institution

This section shows that if there is no financial constraint, trade in goods and international capital movement will be substitutes in a sense that is made clear shortly. The constraint that binds is the profitability constraint (3) because $\theta_k = 1$ for $k = N, S$.

Let us begin with deriving the autarkic equilibrium. The equilibrium is characterized by the capital market clearing condition and the profitability constraint.

Capital demands must be equal to capital supplies in each country k in autarky. That is, the total capital demands $n_k g$ must be equal to the total capital supplies $m_k \bar{\omega}_k$, where $\bar{\omega} \equiv \int_0^\infty \omega dF_k(\omega)$ denotes the average wealth of individuals in country k. It is immediate that the equilibrium mass of firms is given by

$$n_k = \frac{m_k \bar{\omega}_k}{g}. \tag{5}$$

We assume that $\bar{\omega}_k < g$ so that $n_k < m_k$.

Having derived the equilibrium mass of firms, we can now derive the equilibrium gross interest rate. It follows from (2) and (5) that the profits are $\pi_k = g/\sigma\bar{\omega}_k$. Then, we have

from (PC), expressed in (3), that

$$R_k = \frac{1}{\sigma \bar{\omega}_k}. \tag{6}$$

As expected, the gross interest rate is smaller in the capital-abundant country N if $F_N < F_S$ (so that $\bar{\omega}_N > \bar{\omega}_S$). The capital-abundant country will have a greater mass of firms per capita, which makes their profits smaller. The gross interest rate is also smaller than the capital-scarce country because capital demands are relatively weak as a result.

Note that the decision as to whether or not an individual becomes an entrepreneur does not depend on her wealth. This means that despite that the number of entrepreneurs is unambiguously determined, who become entrepreneurs is indeterminate. But if we suppose that only the wealthiest individuals become entrepreneurs, the wealth level of the poorest entrepreneur ω_k^* must satisfy $n_k = m_k[1 - F_k(\omega_k^*)]$, which we rewrite as

$$\bar{\omega}_k = g[1 - F_k(\omega_k^*)], \tag{7}$$

using the relationship given in (5).

Now, we turn to the examination of free trade, still assuming that there is no international capital movement. We will show that the gross interest rates are the same between the two countries, so free trade will eliminate the incentive for capital to move internationally.

In free trade, all firms compete in a level field regardless of their nationality, so each firm's profits become $\pi_w = 1/\sigma(n_N + n_S)$, where we have used $m_N + m_S = 1$. Individual country's capital market clearing condition still determines the mass of firms in each country as in (5). Consequently, we can write the profits as

$$\pi_w = \frac{g}{\sigma(m_N \bar{\omega}_N + m_S \bar{\omega}_S)}. \tag{8}$$

Then, it follows from (3) that

$$R_N = R_S = \frac{1}{\sigma(m_N \bar{\omega}_N + m_S \bar{\omega}_S)}. \tag{9}$$

As (9) indicates, trade and capital movement are substitute in the sense that free trade eliminates the interest rate differential between the countries.

If capital is mobile between the two countries while goods are not, on the other hand, the interest rates are equalized (i.e., $R_N = R_S \equiv R_w$). Then, it follows from (3) that $\pi_N = \pi_S$ and hence $m_N/n_N = m_S/n_S$; the profits are equalized between the countries as capital movement will equate the mass of firms per capita.

Capital moves from the capital-abundant country to the capital-scarce country as the traditional trade theory predicts. Let K denote the amount of capital that flows from North to South. (It takes a negative value if capital moves from South to North.) Then, we can write the capital market clearing condition in each country as $n_N g = m_N \bar{\omega}_N - K$ and $n_S g = m_S \bar{\omega}_S + K$. We solve these equations for n_N and n_S, respectively, to obtain

$$n_N = (m_N \bar{\omega}_N - K)/g, \tag{10}$$

$$n_S = (m_S \bar{\omega}_S + K)/g, \tag{11}$$

and substitute them to $\pi_N = \pi_S$ with the use of (2) to get the equilibrium capital flow from North:

$$K = m_N m_S (\bar{\omega}_N - \bar{\omega}_S). \tag{12}$$

Capital moves out of North to South if and only if $\bar{\omega}_N > \bar{\omega}_S$.

The profits and the gross interest rate are also the same in equilibrium as those in the free trade equilibrium without capital mobility. Substituting the equilibrium capital flow given in (12) to the expressions in (10) and (11), we obtain

$$n_N = m_N[m_N \bar{\omega}_N + m_S \bar{\omega}_S]/g,$$

$$n_S = m_S[m_N \bar{\omega}_N + m_S \bar{\omega}_S]/g.$$

Then, we find from (2) that the profits for any firm in any country are the same as those in free trade, given by (8), and so is the equilibrium interest rate, given by (9).

It is interesting that the equilibrium profits under capital movement are the same as those under free trade in goods. Trade in goods effectively expands the market for firms in North and shrinks the market for firms in South, which increases the profits for the firms in North and decreases those in South. Capital movement (without trade), on the other hand,

decreases the mass of firms in North while increases the mass of firms in South, and thereby changes their profits accordingly. Trade induces a net flow of the good from North to South, while capital movement induces a flow of firms themselves from North to South. The profits for the firms in North increase while those in South decrease as a result in both cases.

Proposition 1 *Under a perfect financial institution, trade in goods and international capital movement are perfect substitutes in the sense that (i) trade will equalize the two countries' interest rates, eliminating an incentive for capital to move internationally, (ii) capital movement will also equalize the interest rate at the same level as the equilibrium interest rate in free trade, and (iii) the profits are equalized between the two countries at a common level in either of the two regimes.*

Although some important economic variables, such as the profits and interest rates, are the same between the two regimes, consumers can enjoy more varieties in the case of free trade in goods than in the case of free capital mobility, as trade allows consumers in either country to consume varieties produced in the foreign country as well as those produced domestically. Trade in goods and capital movement are perfect substitutes from the perspective of the production side of the economy. But trade in goods is a better alternative than capital movement when the consumption side is taken into account.

4 Equilibrium under an imperfect financial institution

We have shown that under a perfect financial institution, an individual's wealth is irrelevant in her decision as to whether or not she becomes an entrepreneur. As expected, individual's wealth will be an important factor under financial imperfection. Due to a financial constraint, only wealthy individuals can borrow enough money to finance a project. We show in this section that trade and capital movement are complement unlike in the case of a perfect financial institution where they are substitutes.

For the rest of the analysis, we focus on the case in which θ_k is small such that the borrowing constraint, given in (4), holds with equality, while profitability constraints, given

in (3), holds with strict inequality. If θ_k is small enough that the borrowing constraint is binding, wealthiest individuals become entrepreneurs and the poorer individuals lend out their wealth. We define a critical level of wealth, ω_k, such that all individuals with $\omega \geq \omega_k$ become entrepreneurs.

At the critical value of θ_k as to which constraint is the one that binds in equilibrium, both (3) and (4) hold with equality at the threshold value $\omega_k = \omega_k^*$, so we obtain the critical value $\hat{\theta} = 1 - (\omega_k^*/g)$. In this section, we focus on the case in which $\theta_k < \hat{\theta}$ for $k = N, S$, so that the relevant constraint is the binding (BC), which we write here as

$$R_k = \frac{\theta_k \pi_k}{g - \omega_k}. \tag{13}$$

After we derive the autarkic equilibrium in the first subsection, we will turn to the analysis of free trade without international capital mobility and that of the case of perfect international capital mobility in the absence of trade in the subsequent sections. We will show that trade and international capital movement are complement in the sense that under perfect capital mobility trade will induce further capital movement from South to North.

4.1 Autarkic Equilibrium

Since the profits for the firms are determined by the mass of firms, which is in turn determined by the capital market clearing condition, the profits for the firms in this case are the same as those under perfect financial institution. The mass of firms is given by (5) and the threshold wealth for being an entrepreneur is characterized by (7). Then, it follows from (2) that the profits are $\pi_k = g/\sigma\bar{\omega}_k$, which is the same as in autarky.

The equilibrium gross interest rate, however, is different from that under perfect financial institution, since (BC), rather than (PC), determines the rate here. It is easy to see from (13) that the autarkic equilibrium interest rate is

$$R_k = \frac{\theta_k g}{\sigma\bar{\omega}_k(g - \omega_k^*)}. \tag{14}$$

As (14) indicates, any change in θ_k will induce offsetting change in R_k. In partial equilibrium analyses, financial development generally induces firms to enter the market because it

becomes easier for entrepreneurs to finance the investment costs. But this seemingly obvious causality breaks down in this general equilibrium model. The size of the industry hinges critically on the total credit supply that is fixed in the autarkic economy. That is why financial development would increase the interest rate to offset enhanced demands in the credit market.

Lemma 1 *Under financial imperfection (such that both borrowing constraint (4) is binding), financial development would only raise the interest rate, leaving the size of the industry unchanged.*

Which of R_N and R_S is greater than the other is important because it will determine the direction of capital movement when capital is internationally mobile. We examine this issue in two cases. The first case is that $\theta_N = \theta_S$ but $F_N < F_S$. This case can be considered as the traditional case because the countries are different in their factor endowments. The second case is that $\theta_N > \theta_S$ while $F_N = F_S$. In this case, countries are different in their qualities of financial institution.

If $\theta_N = \theta_S$ but $F_N < F_S$, the question is reduced to the relative size of $\bar{\omega}_k(g-\omega_k^*)$ between the two countries. If F_k is a uniform distribution on $[0, \omega_k^m]$ such that $\omega_N^m > \omega_S^m$, for example, we have $\bar{\omega}_N(g-\omega_N^*) > \bar{\omega}_S(g-\omega_S^*)$. Then, it follows that $R_N < R_S$. But in general, whether R_N is smaller than R_S depends on the specific shape of the distribution function of ω.

If $\theta_N > \theta_S$ and $F_N = F_S$, then $\bar{\omega}_N(g-\omega_N^*) = \bar{\omega}_S(g-\omega_S^*)$ and hence $R_N > R_S$. Under imperfect financial institution, some (potential) entrepreneurs would not be able to borrow money merely because of the borrowing constraints; the poorer the financial institution, the lower the effective capital demands. Consequently, the gross interest rate is smaller in financially less-developed South.

4.2 Equilibrium with Free Trade in Goods

In this subsection, we show that opening to trade induces intra-industry trade so that consumers enjoy an increase in variety of the good, but it does not affect the size of the industry

in either country. Trade in goods, however, will lead to an increase in the interest rate in North and a decrease in that in South if the two countries differ in their capital endowments.

As in autarky, the capital market clearing condition gives us $\omega_k = \omega_k^*$ and $n_k = m_k\bar{\omega}_k/g$. That is, opening to trade will not affect the size of the industry in either country. But the profits will change in general as expected. The effect of opening to trade is the same as in the case of perfect financial institution, so the equilibrium profits are given by (8) for every firm in either country. Then, the gross interest rate is determined by (BC), which is given in (13):

$$R_k = \frac{\theta_k g}{\sigma(m_N\bar{\omega}_N + m_S\bar{\omega}_S)(g - \omega_k^*)}.$$

If $\theta_N = \theta_S$ but $F_N < F_S$, then $\bar{\omega}_S < \bar{\omega}_N$ so that $\bar{\omega}_S < m_N\bar{\omega}_N + m_S\bar{\omega}_S < \bar{\omega}_N$. Therefore, the profits for the firms in North increase while those for the firms in South decrease as a result of trade liberalization. Then, it follows from (13) that trade liberalization leads to a rise in R_N and a fall in R_S.

If $\theta_N > \theta_S$ and $F_N = F_S$, trade liberalization does not change the profits for the firms nor the gross interest rate in either country. If $F_N = F_S$, then $\bar{\omega}_N = \bar{\omega}_S = m_N\bar{\omega}_N + m_S\bar{\omega}_S$. An increase in market competitiveness completely offsets the positive effect of market expansion. Trade liberalization will not change the profits, so that the interest rates stay the same as neither profits nor the threshold wealth level change as a result of trade (see (13)).

4.3 Equilibrium with International Capital Movement

Since the interest rates are different in general between the two countries, capital moves internationally if it is sufficiently mobile. In this section, we consider the case in which capital is perfectly mobile between the countries and show that in equilibrium, the profits are smaller for the firms in North than those in South. This difference in equilibrium profits is the key to the complementarity between trade in goods and capital movement.

Interest rate differential between the countries in autarky induces international capital movement, which changes the size of the industry in each country and hence the profits for the firms through the changes in the market competitiveness. We use $n_k = m_k[1 - F_k(\omega_k)]$

to write the profits as

$$\pi_N = \frac{1}{\sigma[1 - F_N(\omega_N)]}, \tag{15}$$

$$\pi_S = \frac{1}{\sigma[1 - F_S(\omega_S)]}. \tag{16}$$

Perfect capital mobility will equate the interest rates between the countries, so we have from (13) that

$$\frac{\theta_N}{\sigma[1 - F_N(\omega_N)](g - \omega_N)} = R_w = \frac{\theta_S}{\sigma[1 - F_S(\omega_S)](g - \omega_S)}. \tag{17}$$

If $\theta_N = \theta_S$ and $F_N < F_S$, it follows from (17) that

$$[1 - F_N(\omega_N)](g - \omega_N) = [1 - F_S(\omega_S)](g - \omega_S). \tag{18}$$

Suppose temporarily that $\omega_N = \omega_S$. Then, our assumption of stochastic dominance implies that $F_N(\omega_N) < F_S(\omega_S)$ and hence the left-hand side of (18) is greater than the right-hand side. To restore the equality, therefore, it must be the case that $\omega_N > \omega_S$ and hence $1 - F_N(\omega_N) > 1 - F_S(\omega_S)$. This result immediately implies from (15) and (16) that $\pi_N < \pi_S$. Because the proportion of rich individuals is greater in North than in South, the threshold wealth for being an entrepreneur is greater in North. Then the profits in North must be smaller than those in South in equilibrium with a common interest rate, for the threshold entrepreneurs in North who have the higher wealth than those in South to find the borrowing constraint to be biding.

If $\theta_N > \theta_S$ and $F_N = F_S$, on the other hand, $R_N > R_S$ in autarky so that capital flows out of South. Thus, in equilibrium, $\omega_N < \omega_S$ since they were the same in autarky. This also implies $1 - F_N(\omega_N) > 1 - F_S(\omega_S)$ (note that $F_N = F_S$), and hence $\pi_N < \pi_S$. North attract capital because of the interest rate differential caused by the difference in the quality of financial institution. Consequently, the market in North becomes more competitive than that in South.

Proposition 2 *International capital movement will equate the interest rates between the two countries, but leave the profits differential between the firms in North and those in South such that the profits are smaller in North than in South.*

4.4 Equilibrium with Trade in Goods and Capital Movement

We have seen that the profits for the firms in North are smaller than those in South in the equilibrium with international capital movement. Thus, if trade is allowed (in addition to capital movement) so that all firms compete in a level field, the profits rise in North and drop in South, which will induce further capital movement and capital moves from South to North.

To see this more formally, we first note that the profits for any firm are the same as in the case of free trade with no capital movement since the total mass of firms in the world would not be affected by capital movement; the profits are given in (8). Then, it follows from (BC) and equality of the interest rates between the countries that

$$\frac{\theta_N g}{\sigma(m_N\bar{\omega}_N + m_S\bar{\omega}_S)(g-\omega_N)} = R_w = \frac{\theta_S g}{\sigma(m_N\bar{\omega}_N + m_S\bar{\omega}_S)(g-\omega_S)},$$

and hence

$$\frac{\theta_N}{g-\omega_N} = \frac{\theta_S}{g-\omega_S}. \tag{19}$$

If $\theta_N = \theta_S$ and $F_N < F_S$, it immediately follows from (19) that $\omega_N = \omega_S$. But there are more firms in North than in South because $1 - F_N(\omega_N) > 1 - F_S(\omega_S)$ when $\omega_N = \omega_S$. Recall that in this case, $\omega_N > \omega_S$ in the equilibrium under perfect capital mobility without international trade in goods. Thus, we find that capital moves out of South to North when trade in goods is allowed in addition to capital movement. Figure 1 shows threshold wealth levels in the two countries in every case that we have examined (the figure depicts the case in which the ranking of the thresholds accords with the case of the uniform distribution of wealth); Superscripts A, T, K, and KT are used to indicate the corresponding cases of autarky, trade equilibrium, equilibrium with capital movement, and equilibrium with capital movement and trade in goods, respectively. Figure 1 shows that trade in goods affects the threshold wealth only when it is accompanied by international capital movement.

Next, we consider the case in which $\theta_N > \theta_S$ and $F_N = F_S$. Recall that in the case of perfect capital mobility without trade in goods, (17) holds with $\omega_N < \omega_S$, which implies $1 - F_N(\omega_N) > 1 - F_S(\omega_S)$. This means that compared with the threshold values in the case

of perfect capital mobility without trade, ω_N must be smaller and ω_S must be greater for (19) to be satisfied. That is, trade induce further capital outflow from South to North. All the thresholds in the case that $\theta_N > \theta_S$ and $F_N = F_S$ are shown in Figure 2; trade in goods affect the threshold wealth only when it is accompanied by international capital movement also in this case.

Proposition 3 *Trade in goods and capital movement are complement such that trade in goods induces further capital movement when capital has been mobile internationally. Trade induces capital flight from South, expanding Northern industry and shrinking Southern.*

International capital movement alone is not sufficient to equalize firms' profits between North and South; the market in the capital-abundant or financially-developed North is more competitive than the one in South. Opening to trade allows the firms in North to penetrate the less-competitive market in South and induces the firms in South to penetrate the more-competitive market in North, raising the profits for the firms in North while lowering those in South. That is why opening to trade when capital has been internationally mobile induces additional capital movement and capital moves from South to North. Proposition 3, which expresses this complementarity of trade and capital movement, is the core result of the paper.

5 Foreign Direct Investment under Financial Imperfection

We have shown how financial imperfection affects international capital movement and the resulting adjustment of the industry. The type of capital movement that we have considered is portfolio investment such that capital moves to the country in which borrowers utilize the capital to establish their firms. In this section, we consider foreign direct investment (FDI) such that it is entrepreneurs that move from one country to the other where they borrow money and invest to produce the good. We assume that goods are freely traded in this section, so whether entrepreneurs themselves move from the FDI source country to the host country or only their operations are relocated is not an issue.

FDI naturally arises if trade is prohibited. In such cases, entrepreneurs in the country with a more-competitive market have an incentive to locate their firms in the foreign country with a less-competitive market. Here, we consider a situation in which such incentives do not exist. We consider a free-trade situation in which profits are the same for all firms regardless of their locations. To derive a sharp result, we also assume that $F_N = F_S$. We show that even in such situations, some firms engage in FDI. Indeed, we find that two types of FDI co-exist in equilibrium: one that firms engage in FDI to exploit interest rate differential between the two countries, and the other that firms invest in the foreign country to overcome their borrowing constraints. Under financial imperfection, reciprocal FDI arises: firms in North invest in South to exploit interest rate differential whereas firms in South invest in North to overcome borrowing constraints.

Recall that in free trade, the interest rate is higher in North than in South, i.e., $R_N > R_S$, reflecting the difference in financial development between the two countries, i.e., $\theta_N > \theta_S$. If FDI is allowed, therefore, some firms in North invest in South, financing the investment at smaller costs. Consequently, the interest rate tends to decrease in North and rise in South, such that they become equal at the world interest rate, R_w in equilibrium with trade and FDI. Faced with the same interest rate, some individuals in South are credit-constrained in the South, but not in North, since the borrowing constraint is tighter in South; we have $\omega_N < \omega_S$ and hence all individuals with $\omega \in [\omega_N, \omega_S)$ in South will invest in North to overcome their borrowing constraint for becoming entrepreneurs.

In the equilibrium with free trade and FDI, both the profits for the firms and the gross interest rates must be the same between the two countries just as in the case of free trade and perfect capital mobility. That is, we have the same relationship as shown in (19). Then, it follows from $\theta_N > \theta_S$ that $\omega_N < \omega_S$, again just as in the case of free trade and perfect capital mobility.

But an important difference is that in this case, the potential entrepreneurs in South, whose wealth is less than ω_S but is greater than or equal to ω_N, have an incentive to move to North to establish their firms. Indeed, as indicated in Figure 3, all entrepreneurs in South

with $\omega \in [\omega_N, \omega_S)$ move to North, since they can only run a business in North. At the same time, some (and not necessarily all) entrepreneurs in North with $\omega \in [\omega_S, g)$ move to South, contributing to the interest rate parity between the two countries.

We record these findings as the final proposition.

Proposition 4 *Reciprocal FDI will arise even when the countries engage in free trade. Firms in North engage in FDI to exploit interest rate differential, while firms in South engage in FDI to overcome financial constraint.*

If international portfolio investment is allowed in addition to trade and FDI, capital may move from South to North in the form of portfolio investment, replacing the FDI from North to South. Just as northern firms' FDI, financial capital movement from South to North achieves the interest rate parity. In this case, capital moves out of South in the forms of both portfolio investment and FDI.

6 Concluding Remarks

We have examined the impact of international trade in goods and capital movement between two countries. We have found that (i) trade in goods alone will not affect the size of the industry in either country, (ii) capital tends to move from a country with a poorer financial institution to the other, shrinking the industry in the source country and expanding the industry in the host country, (iii) trade in goods affects the size of the industry in each country only when it is accompanied by capital movement, (iv) when capital is also allowed to move, trade in goods itself induces capital movement from South to North, and (v) reciprocal FDI arises even in free trade.

These findings regarding the impacts of financial imperfection on the differentiated-good sector that depends on external finance (which can be thought of as a manufacture industry) are in general quite different from the conventional wisdom in international trade theory without any consideration of financial imperfection. Since no country has a perfect financial institution in practice, it is important to know how the traditional theories should be modified when we incorporate financial imperfection into the models.

This paper is one of the first attempts to investigate interactions between financial development and international trade. We have shown that trade in goods and international capital movement are complements under financial imperfection such that trade induces capital flight from the South. There remain many important results in the trade literature yet to be challenged in the environment of imperfect financial institutions.

Appendix

A A Cause of Financial Imperfection

Here, we present a simple model to justify an imperfect financial institution. This model setting is a simplified version of Tirole's (2006).

Let us consider the situation in which an agent tries to borrow g from a lender to finance a profitable project. This project potentially generates profits of $\pi(> Rg)$ where R is the exogenous (gross) interest rate. In order to complete the project successfully with a high probability, however, the agent must exert effort, which is unobservable to the lender. If the agent exerts effort, the project generates π with the probability 1. If the agent shirks, one the other hand, the project generates π with the probability $p^L(< 1)$ and 0 with the probability $1-p^L$. By shirking, however, the agent can get non-pecuniary benefits $b\pi$, where $0 < b < 1$.

The agent unambiguously shirks if the entire π goes to the lender. In order to induce the agent to exert effort, therefore, the lender must abandon some of π, giving a contingent reward w to the agent; the reward is given to the agent if and only if the project has successfully generated π. The reward w should satisfy the incentive condition, $w \geq p^L w + b\pi$, where the left-hand side is the agent's payoff when she exerts effort, while the right-hand side is her expected payoff when she shirks. We assume that negative rewards (i.e., penalties) are not allowed perhaps because the asset held by the agent is limited. This incentive condition can be written as

$$w \geq \frac{b}{1-p^L}\pi.$$

The lender expects to obtain at most $[1-(b/(1-p^L))]\pi$ if he induces the agent to exert effort. Alternatively, he may set $w = 0$ so that he obtains the expected payoff of $p^L\pi$. Consequently, the lender obtains the returns at most $\theta\pi$, where

$$\theta \equiv \max\left\{1-\frac{b}{1-p^L},\ p^L\right\}.$$

Obviously, the lender will not lend g if Rg exceeds $\theta\pi$. Note that if p^L is small enough, θ is

equal to $1 - (b/(1 - p^L))$. Under a developed financial institution with a solid legal system, non-pecuniary benefits tend to be small. The parameter θ can be considered to represent the quality of a financial institution because θ increases as b diminishes.

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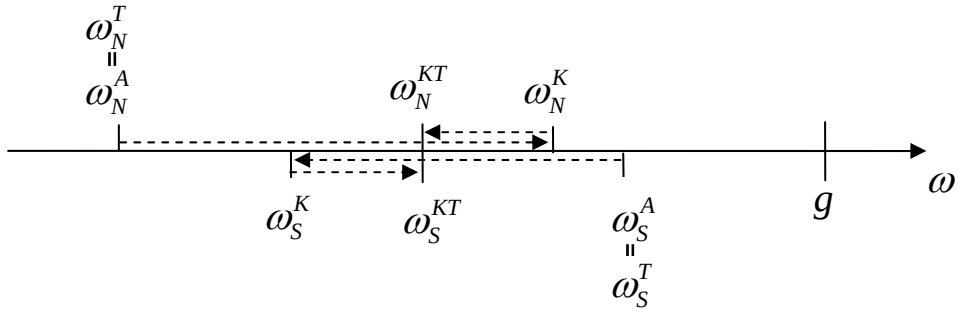

Figure 1: Threshold wealth levels: Case where $\theta_N = \theta_S$, $F_N < F_S$

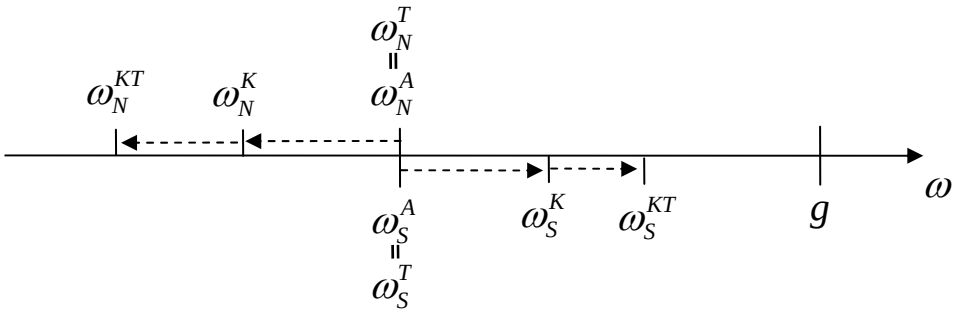

Figure 2: Threshold wealth levels: Case where $\theta_N > \theta_S$, $F_N = F_S$

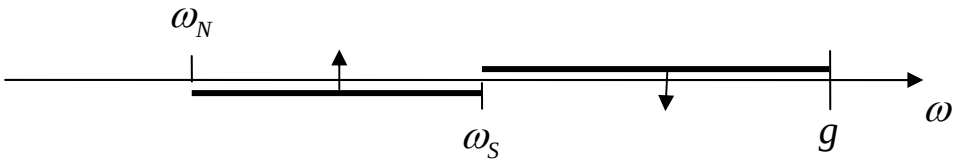

Figure 3. Reciprocal FDI Flows