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Abstract

How are the financial market and the product market interrelated? Product market selection affects the default rate and screening incentive of financial intermediaries. In contrast to previous studies, bad screening technology implies a low interest rate and a low default rate: i.e. intermediaries are successfully repaid more often when the country has a bad screening technology. When a country has an underdeveloped financial market, then the product market is also inefficient. This product market inefficiency means that the selection effect of the market is weak. In this case, many entrepreneurs successfully enter the market. Financially underdeveloped countries suffer from low productivity not only for inefficient screening technology but also for weak product market selection.

Many firms in financially developed countries tend to choose exports, merely because firms in such countries are more productive. Financially developed countries have a comparative advantage in a financially dependent sector.

JEL Classification Codes: E22; E44; F12; O11; O16; O31
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1 Introduction

The condition of the product market affects a project's profitability and severe competition increases the default rate. How are the financial market and the product market interrelated? Financial intermediaries decide on the severity at which they screen a borrower's ability.[1] Intermediaries lend money to entrepreneurs who need money to invent new products. When the product market is competitive, the borrower often cannot repay money; i.e., product market conditions determine the default rate. Many questions exist related to this market condition. How does financial development affect product market competition? Does weak competition in a developing country affect the screening decision of intermediaries?

When a country has bad screening technology, it has a low interest rate and a high entry rate, in contrast to the assumption taken by previous studies such as King and Levine (1993), Laeven et al. (2015), and Sunaga (2016). A country's bad screening technology weakens its product market selection. Weak selection produces a low default rate. Why is this result different from that of previous studies? Previous studies considered the case in which screening efforts directly affect the default rate; this study considers the case in which screening efforts indirectly affect the default rate by increasing the entrant's expected productivity. Good screening technology increases an entrepreneur's productivity, but this also means that the productivity of their rival is also increasing. In this sense, this result indicates a general equilibrium effect.

This result has two implications for economic development. First, an uncompetitive product market is a byproduct of a weak financial market. When a country has bad screening technology, not only this technology itself but also weak product market competition reduces entrants ' productivity. For example, India suffers from too many small enterprises (Nageswaran and Natarajan (2016)). This uncompetitive product market can result from an underdeveloped financial market. Second, the default risk is not a good indicator for inefficiency despite the common view. Financial underdevelopment weakens product market competition and facilitates product market entry.

Interactions between product market selection and financial markets also affect firms ' export decisions. Firms in financially developed countries are produc-

[1] In this paper, intermediaries screen an entrepreneur's ability before lending. This type of screening is called ex ante screening. See also Aghion and Howitt (2009), who classified the financial screening model into an ex ante or ex post screening model. In contrast to ex ante screening, ex post screening is done after lending and intends to prevent the borrower from engaging in opportunistic behavior.

tive because of efficient screening of financial markets and a competitive product market. Because firms in such countries are productive, they tend to export, and many exporters exist in financially developed countries.[2]

Somewhat unexpectedly, intermediaries ' screening decisions do not depend on product market conditions except for the funds required for lending. Product market competition only affects the interest rate, which is high when the product market is competitive because the default rate is high.

1.1 Literature

Intermediaries affect economic development by selecting able entrepreneurs. This economic development mechanism is explained by King and Levine (1993) and Laeven et al. (2015), and Sunaga (2016). However, these studies do not consider how product market competition affects financial markets. In their model, screening determines the default rate. It is natural to consider that the default rate is not only determined by financial market efficiency but also depends on the product market. In the previous studies mentioned, this channel is omitted. I use the Melitz (2003) type of heterogeneous firm model to construct a model with this property. The Melitz (2003) model has the following specification. Entrepreneurs pay fixed costs to invent a new product before productivity is revealed. Entrepreneurs must pay an additional fixed cost after productivity is revealed when they establish a firm to enter the product market. Otherwise, they do not enter the product market —there is product market selection. The default rate is not only determined by screening efficiency but also by the severity of the product market selection.

The heterogeneous firm model is used to analyze many problems: Helpman et al. (2004), Nocke and Yeaple (2007), and Nocke and Yeaple (2008) for analyzing FDI; Baldwin and Okubo (2006) for analyzing economic geography; Baldwin and Robert-Nicoud (2008) and Naito (2016) for analyzing economic growth ; and Egger and Kreickemeier (2009) and Helpman et al. (2010) for analyzing the relationship between trade liberalization and wage inequality.[3]

Many papers empirically examined the heterogeneous firm model. Roberts and Tybout (1997) showed that the fixed cost to engage in exports is substantial. This fixed cost has a significant role for the heterogeneous firm model because it

[2] Manova (2013) showed that the liquidity constraint of the exporter is important to explain the relationship between financial development and trade; however, this concept is out of the scope of this paper.

[3] See also Baldwin (2005) and Baldwin and Forslid (2010).

affects product market selection. Pavcnik (2002) showed that resources are reallocated from less to more productive producers after trade liberalization. Eaton et al. (2011) showed that productivity is positively correlated with a firm's export decision, which is consistent with the prediction of the heterogeneous firm model[4]

Previous studies have confirmed that product market selection changes the property of the model; for example, Chaney (2008) used the heterogeneous firm model to analyze the gravity equation and obtained results that differed from those of the Krugman model. The results of this paper also depend on the existence of additional fixed costs and the entry decision: product differentiability does not affect equilibrium screening efforts only if there is product market selection; trade costs affect interest rates only if there is product market selection; and high fixed costs decrease the productivity of entrants only if there is product market selection.

Many papers also examined the relationship between financial markets and product markets. Manova (2013) and Chaney (2016) analyzed how financial markets affect export decisions. If the financial institution in a country is functioning well, firms in a financially vulnerable sector in this country export more than firms in other countries. Benabou (1996), Benabou (2002), Buera and Shin (2013), Banerjee and Moll (2010) and Moll (2014) explained how the distribution of productivity is determined in a borrowing constrained economy.

1.2 Contents

Section 2 describes the basic structure of the model. Section 3 describes the properties of the model without product market selection. Although the case with product market selection is more realistic, it is useful to examine the case without product market selection: without analyzing this case, how product market selection affects the outcome is unknown. Section 4 analyzes the case with product market selection, and the determination of the screening effort and the interest rate is shown. Although the product market determines the default rate, the screening effort is not related to the condition of this market. As previously mentioned, bad screening technology means low interest rates. This effect exists only if countries trade goods internationally and are asymmetric. When countries do not trade goods, screening technology does not affect the default rate.

[4] See also Tybout (2003), Redding (2011) and Bernard et al. (2012).

2 Model

There are two countries and L_j units of homogeneous households in country $j \in \{1, 2\}$. Each household inelastically supplies one unit of labor and obtains wage income. According to Helpman and Krugman (1985), sector A is homogeneous goods sector: goods in this sector can be traded without trade costs and marginal productivity is one regardless of country. Sector M is a monopolistic competitive market, and a monopolistic competitive firm produces goods differentiated as variety v.

Households in country j maximize utility U_j:

$$\begin{aligned} \text{maximize} \quad & U_j = (1-\beta)\log Y_0 + \beta \log Y_{ij} \\ \text{subject to} \quad & \sum_{i=1,2} \int_{v \in \Omega_{ij}} p_j(v) y_j(v) = I_j \\ & \left(\int_{\Omega_j} y_j(v)^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}} = Y_j \end{aligned}$$

$p_{ij}(v)$ is the price of variety v goods produced by country i and that are sold to country j. $y_{ij}(v)$ is the quantity of goods produced by country i and sold to households in country j. Y_j is a sectoral aggregate of differentiated goods in country j consumed by households. ρ is the elasticity of substitution across differentiated goods. Ω_{ij} is the set of variety v goods produced by country i and sold to country j. I_j is the income of country j. From the first-order conditions, demand function of goods $y_{ij}(v)$ is obtained:

$$y_j(v) = \frac{p_j(v)^{-\rho}}{P_j^{1-\rho}} \beta I_j \tag{1}$$

$P_j(v) \equiv (\int_{\Omega_j} p_j(v)^{1-\rho})^{\frac{1}{1-\rho}}$ is the price index in country j. Additionally, goods in all sectors are assumed to be produced in all country. Wage rate in country j equals 1 when good A is taken as numeraire. In this case, I_j equals L_j.

2.1 Firm's production decision

Variety v produced in country i and sold to country j has the following production function:

$$y_{ij}(v) = \psi(v) l_{ij}(v)$$

$\psi(v)$ is labor productivity, and $l_{ij}(v)$ is labor input. Firms maximize the operating profit $\pi_{ij}(v)$ of market j:

$$\text{maximize} \quad \pi_{ij}(v) = p_{ij}(v)y_{ij}(v) - (1+\tau_{ij})l_{ij}(v) \tag{2}$$

$$\text{subject to} \quad y_{ij}(v) = \psi(v)l_{ij}(v) \tag{3}$$

$$y_{ij}(v) = \frac{p_{ij}(v)^{-\rho}}{P_{ij}^{1-\rho}}\beta L_j \tag{1}$$

τ_{ij} indicates iceberg trade costs. If firms sell goods to foreign markets, they must pay costs proportional to the value of the goods: $\tau_{ij} > 0$ if $i \neq j$ and $\tau_{ii} = 0$. From the first-order condition of this problem, I obtain an equilibrium markup:

$$p_{ij}(v) = \frac{\rho}{\rho - 1}\frac{1+\tau_{ij}}{\psi(v)}$$

Combining this equation with (3), I obtain the equilibrium operating profit:

$$\pi_{ij}(\psi(v)) = A_j(\frac{\psi(v)}{1+\tau_{ij}})^{\rho-1} \tag{4}$$

$A_j \equiv \frac{1}{\rho}(\frac{\rho}{\rho-1})^{1-\rho}\frac{L_j}{P_{ij}^{1-\rho}}$ is the demand for goods in country j. Equation (4) implies that operating profit elasticity to productivity is $\rho - 1$. Operating profit is more responsive to productivity when goods are more differentiated.

2.2 Firms'entry decision

Firms in country i must invest F_i^d units of fixed beachhead costs to enter the domestic market and F_i^x units of fixed beachhead costs to enter the foreign market. These fixed costs have interpretations. According to Blanchard and Giavazzi (2003) one can interpret these fixed costs to enter the market as a proxy for market regulations. Alternatively, according to Lee and Mukoyama (2012) these costs can be viewed as the cost to build a plant. The net profits from entering each market can be written as follows:

$$\begin{aligned} \pi_i^d(\psi(v)) &= \max\{\pi_{ii}(\psi(v)) - F_i^d, 0\} \\ \pi_i^x(\psi(v)) &= \max\{\pi_{ij}(\psi(v)) - F_i^x, 0\} \quad i \neq j \end{aligned} \tag{5}$$

$i \in \{1,2\}$ is the home country of the firm producing variety v, and j is the firms'foreign country. Combining these equations with equation (4), entry cut-offs ψ_i^d and ψ_i^x are defined:

$$
\begin{aligned}
F_i^d &= \pi_d(\psi_i^d) = A_i(\psi_i^d)^{\rho-1} \\
F_i^x &= \pi_x(\psi_i^x) = A_j(\frac{\psi_i^x}{1+\tau_{ij}})^{\rho-1}
\end{aligned} \tag{6}
$$

As depicted in Figure 1, firms with productivity ψ enter the domestic market if and only if $\psi \geq \psi_i^d$, and firms enter the foreign market if and only if $\psi \geq \psi_i^x$. As depicted in Figure 2, a low A_i can be interpreted as strong market selection: if A_i is decreasing, less productive firms do not enter the market.

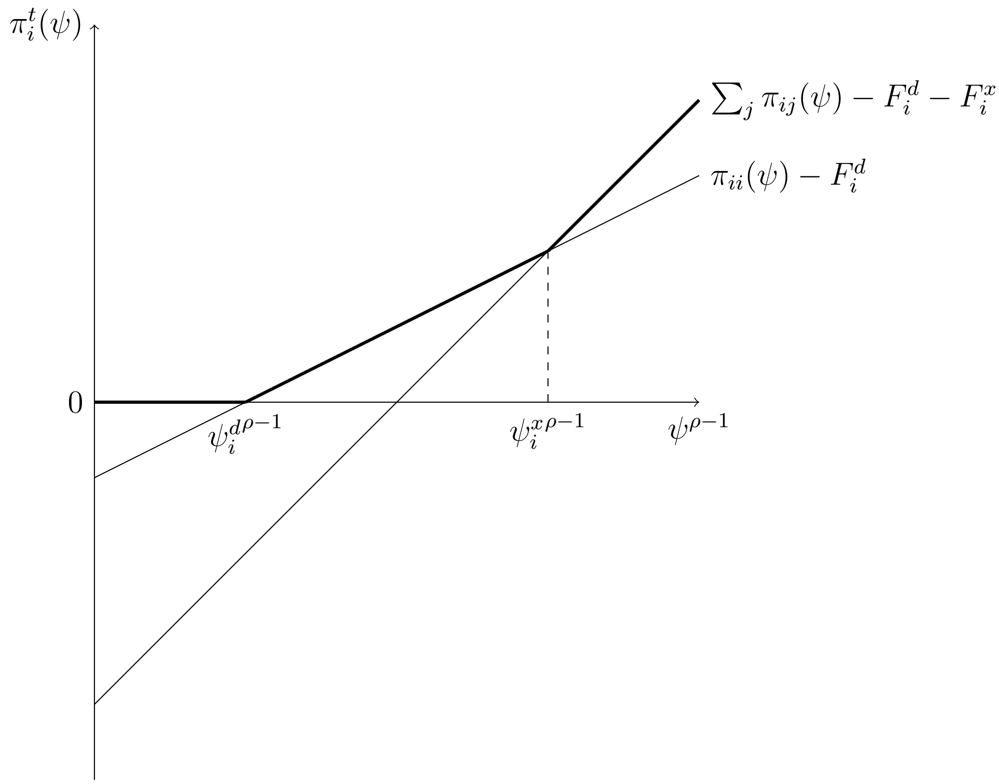

Figure 1: Productivity and entry decision.

The high demand factor A_j weakens market selection. Weak market selection reduces the productivity of entrants. As is shown in section 4, demand A_i is high if country i has bad technology.

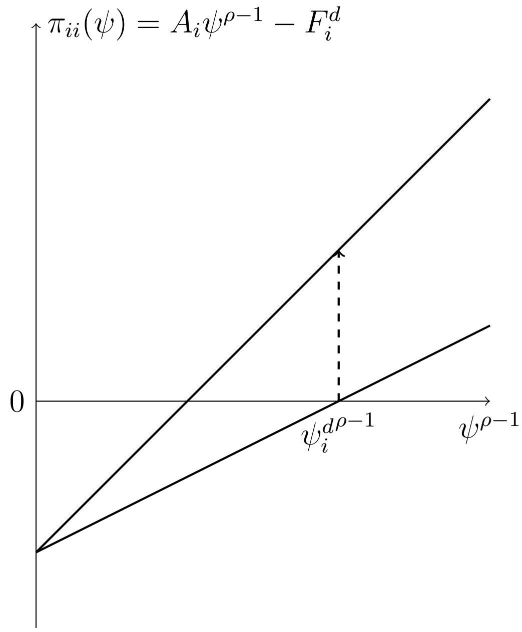

Figure 2: Demand of domestic market and productivity of entrants.

Firms'total net profit $\pi_i^t(\psi)$ can be written as follows:

$$\pi_i^t(\psi) \equiv \pi_i^d(\psi) + \pi_i^x(\psi) \tag{7}$$

If the total net profit is not positive, firms do not enter the product market.

2.3 Financial intermediaries

Entrepreneurs need to pay F_i^r units of money to produce a new variety. Similar to beachhead costs, this fixed cost has many interpretations: Lee and Mukoyama (2012) and Arkolakis et al. (2008) interpreted this fixed cost as R&D cost. To pay this cost, an entrepreneur must borrow from a financial intermediary. Although another interpretation is possible, this interpretation is followed for clarity.

The potential productivity of an entrepreneur in country i is follows a Pareto distribution:

$$G_i(\psi) = 1 - (\frac{\psi}{\psi_i^{min}})^{-k} \tag{8}$$

The slope parameter satisfies $k > (\rho - 1)$. After paying the screening cost $S \equiv \theta(\psi_i^f)^\gamma$, both the financial intermediary and the entrepreneur know whether or not the entrepreneur's productivity is higher than ψ_i^f; before screening, even if the entrepreneur does not know the productivity. Intuitively, the entrepreneur may know the properties of the goods she wants to produce but does not know their profitability. Previous studies made this assumption. In Laeven et al. (2015) and Sunaga (2016), the entrepreneur is heterogeneous only on the probability of success, in contrast to this study. Helpman et al. (2010) worked with screening technology similar to that of this study.

The intermediary and the entrepreneur randomly match each other. After matching, the intermediary decides on whether or not to screen the entrepreneur. If the intermediary decides not to screen the matched entrepreneur, the match is dissolved. If the intermediary decides to screen, it offers financial contract $\hat{R}(\psi)$ conditional on ψ before screening. The financial contract must satisfy the limited liability constraint. That is, the entrepreneur cannot pledge a repayment higher than the net profit: $\hat{R}(\psi) \leq \pi_i^t(\psi)$ for all ψ. Because the payoff from this contract is nonnegative, the entrepreneur always accepts any offer that satisfies limited liability. To maximize their profits, intermediaries offer the contract $\hat{R}(\psi) = \pi_i(\psi)$. After screening, they know whether or not the productivity of the entrepreneur is higher than ψ_i^f. The conditional distribution of productivity—productivity ψ is higher than ψ_i^f—is also distributed according to a Pareto distribution:[5]

$$G(\psi|\psi \geq \psi_i^f) = 1 - (\frac{\psi}{\psi_i^f})^{-k} \tag{9}$$

If the entrepreneur passes the screening test, the intermediary lends F_i^r units of money; otherwise, the match is dissolved. Otherwise, he lends money to the entrepreneur. After investing F_i^r units of money, the profitability of the invention is revealed.

The expected profit of the intermediary before screening Π_i^f can be written as follows:

$$\Pi_i^f(\psi_i^f) = (\mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^f] - F_i^r)\mathbf{Prob}(\psi \geq \psi_i^f) - S_i \tag{10}$$

$(\mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^f] - F_i^r)$ is the gross return from lending after knowing that the productivity is higher than ψ_i^f. $\mathbf{Prob}(\psi \geq \psi_i^f)$ is the probability that the entrepreneur is more productive than ψ_i^f.

[5]In general, the conditional probability of a Pareto distribution has the following property: $\mathbf{Prob}[\psi \geq b|\psi \geq a] = (\frac{b}{a})^{-k}$ for all $a \leq b$.

It is useful to consider the screening costs per lending contract $\tilde{S}_i$:

$$\begin{aligned}\tilde{S}_i &\equiv \frac{S}{\mathbf{Prob}(\psi \geq \psi_i^f)} \\ &= \theta_i(\psi_i^{min})^{-k}(\psi_i^f)^{\gamma+k}\end{aligned} \tag{11}$$

Using (11), (10) can be rewritten:

$$\Pi_i^f(\psi_i^f) = (\mathbf{E}[\pi_i^t(\psi) - F_i^r|\psi \geq \psi_i^f] - \tilde{S}_i)\mathbf{Prob}(\psi \geq \psi_i^f) \tag{12}$$

Intermediaries'profits Π_i are determined in equilibrium. If Π_i^f is positive, more contracts emerge and more entrepreneurs enter the market, which reduces the price index P_i, the profits of firms $\pi_i^t(\psi)$, and the profits of the intermediary Π_i^f. If Π_i^f is negative, the financial intermediary does not screen the entrepreneur and does not lent. It increases P_i, $\pi_i^t(\psi)$ and Π_i^f. Hence, Π_i^f must be zero in equilibrium:

$$\mathbf{E}[\pi_i^t(\psi) - F_i^r|\psi \geq \psi_i^f] - \tilde{S}_i = 0 \tag{13}$$

The first-order condition of intermediary $\frac{\partial \Pi_i^f}{\partial \psi_i^f}$ can be calculated as follows:

$$\begin{aligned}\frac{\partial \Pi_i^f}{\partial \psi_i^f} &= \{\mathbf{E}[\pi_i^t(\psi) - F_i^r|\psi \geq \psi_i^f] - \tilde{S}_i\}\frac{\partial}{\partial \psi_i^f}\mathbf{Prob}(\psi \geq \psi_i^f) \\ &\quad + \mathbf{Prob}(\psi \geq \psi_i)\frac{\partial}{\partial \psi_i^f}\{\mathbf{E}[\pi_i^t(\psi) - F_i^r|\psi \geq \psi_i^f] - \tilde{S}_i\} \\ &= 0\end{aligned}$$

Using the zero profit condition (13), this equation can be rewritten to a more convenient form:

$$\epsilon\mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^f] = (\gamma + k)\tilde{S}_i$$

$\epsilon \equiv \frac{\partial \log \mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^f]}{\partial \log \psi_i^f}$ is the repayment elasticity. Substituting this equation for the zero profit condition (13), the following equation is obtained:

$$(\frac{\gamma + k}{\epsilon} - 1)\tilde{S}_i = F_i^r \tag{14}$$

As is described in the following sections, ϵ changes according to whether or not product market selection exists—product market selection changes the decision of the intermediary.

The interest rate R_i is defined as the expected return from a successful entrepreneur:

$$R_i = \frac{\mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^d]}{F_i^r} \tag{15}$$

From this equation and the zero profit condition, the following equation is obtained:

$$R_i \mathbf{Prob}(\psi \geq \psi_i^d | \psi \geq \psi_i^f) = F_i^r + S_i$$

R_i is high when the intermediaries screen the entrepreneur more intensively or market selection is strong. $\mathbf{Prob}(\psi \geq \psi_i^d | \psi \geq \psi_i^f)$ indicates the entry rate. $1 - \mathbf{Prob}(\psi \geq \psi_i^d | \psi \geq \psi_i^f)$ can be viewed as the default rate.

3 Product Market without Selection

In this section, the case without product market selection is addressed: $F_i^d = F_i^x = 0$ and $\psi_i^f = \psi_i^d = \psi_i^x$. All firms enter the market. Hence, the expected total operating profit can be calculated using (4):

$$\mathbf{E}[\pi_i^f(\psi)|\psi \geq \psi_i^f] = \frac{k}{k-(\rho-1)} \sum_j \frac{A_j}{(1+\tau_{ij})^{\rho-1}} (\psi_i^f)^{\rho_s - 1} \tag{16}$$

This equation implies the elasticity of repayment ϵ is $\rho - 1$. The equilibrium screening efforts is obtained using (11) and (14):

$$\tilde{S}_i = \frac{1}{\frac{k+\gamma}{\rho-1} - 1} F_i^r \tag{17}$$

Proposition 1. *a) Product differentiation—high ρ—is positively correlated with screening efforts:*

$$\frac{\partial \psi_i}{\partial \rho} > 0 \qquad \frac{\partial S_i}{\partial \rho} > 0 \qquad \frac{\partial \tilde{S}_i}{\partial \rho} > 0$$

b) R&D cost is positively correlated with screening efforts:

$$\frac{\partial \psi_i}{\partial F_i^r} > 0 \qquad \frac{\partial S_i}{\partial F_i^r} > 0 \qquad \frac{\partial \tilde{S}_i}{\partial F_i^r} > 0$$

c) Screening inefficiency implies a less productive entrant and higher individual screening cost S_i. However, total screening cost per lending $\tilde{S}_i$ is not changed:

$$\frac{\partial \psi_i}{\partial \theta_i} < 0 \qquad \frac{\partial S_i}{\partial \theta_i} > 0 \qquad \frac{\partial \tilde{S}_i}{\partial \theta_i} = 0$$

d) Screening effort is not related to trade cost:

$$\frac{\partial \psi_i^f}{\partial \tau_{jk}} = \frac{\partial S_i}{\partial \tau_{ij}} = \frac{\partial \tilde{S}_i}{\partial \tau_{ij}} \qquad i, j, k \in \{1, 2\}$$

When the product market is highly differentiated, intermediaries screen more intensively because the expected profit is more sensitive to screening efforts in these sectors. Although this result is intuitive, it is not obtained if there is product market selection: see section 4. When R&D costs are high, intermediaries should lend more money. They screen the entrepreneur more intensively. Another interpretation of this result is the quality-quantity substitution—if the cost of producing one variety of goods is high, it is profitable to produce the variety with higher quality rather than producing greater variety. These relationships remain valid even with product market selection described in the following section. But ψ_i^f cannot be interpreted as the productivity of entrants in the case of the following section. When the screening technology is inefficient, the intermediary must pay a higher screening cost and endure a less efficient borrower. However, the total screening cost to produce one variety $\tilde{S}_i$ is not changed because it must adjust to satisfy the zero profit condition. Many variables are not related to screening efforts: the equilibrium screening efforts depends only on limited variables. This result remains valid even when considering product market selection, as described in the following section.

The interest rate (15) depends only on product differentiation from the zero profit condition (13) and equilibrium screening (17):

$$\begin{aligned} R_i &= 1 + \left(\frac{\tilde{S}_i}{F_i^r}\right) \\ &= 1 + \left(\frac{1}{\frac{k+\gamma}{\rho - 1} - 1}\right) \end{aligned} \tag{18}$$

Proposition 2. *a) The interest rate is positively correlated with product differentiation:*

$$\frac{\partial R_i}{\partial \rho} > 0$$

b) The interest rate is not relate to R&D costs, screening inefficiency, and trade costs:

$$\frac{\partial R_i}{\partial F_i^r} = \frac{\partial R_i}{\partial \theta_i} = \frac{\partial R_i}{\partial \tau_{ij}} = \frac{\partial R_i}{\partial \tau_{ji}} = 0 \qquad\qquad i \neq j$$

A highly differentiated market implies that the intermediary screens the entrepreneur more intensively. To compensate for this screening cost, additional money must be repaid, which increases the interest rate . Other variables do not affect the interest rate: for example, the interest rate of an efficient country is not different from that of an inefficient country. This insensitivity result does not hold when there is product market selection(see section 4).

The effect of financial development to welfare is derived. Demand A_i is used as a measure of welfare: A_i is positively correlated with the price index P_i and a low A_i indicates a high level of welfare. From (11), (17), and (13), I obtain the following equation:

$$\sum_j A_j \phi_{ij} (\psi_i^f)^{\rho-1} = \frac{1}{1 - \frac{\rho-1}{k+\gamma}} F_i^r$$

$\phi_{ij} \equiv (1 + \tau_{ij})^{1-\rho}$ indicates market openness: it is low when trade costs are high. This equation can be rewritten into a more convenient form using (11) and (17):

$$A_1 + \phi_{12} A_2 = \tilde{F}_1^r \qquad (19)$$

$$\phi_{21} A_1 + A_2 = \tilde{F}_2^r \qquad (20)$$

$\tilde{F}_i^r \equiv \{\frac{k+\gamma}{\rho-1} - 1\}^{\frac{\rho-1}{k+\gamma}-1} \theta_i^{\frac{\rho-1}{\gamma+k}} (\psi_i^{min})^{-\frac{k}{\gamma+k}(\rho-1)} (F_i^r)^{1-\frac{\rho-1}{\gamma+k}}$ means R&D inefficiency. $\tilde{F}_i^r$ is high if the screening technology is inefficient and R&D costs are high. These equations can be solved diagrammatically—see Figure 3 and 4.

Previous studies, including Venables (1987), Melitz and Ottaviano (2008), and Demidova (2008), obtained similar results. Even if financial market screening exists, these results remain valid. If one country becomes more efficient, the welfare of the other country is decreasing. This result is reminiscent of the home market effect: aggregate demand externality deprives a less efficient market of firms. If one country becomes more efficient, the welfare of this country is increasing as is expected.

The more liberalized country endures lower welfare. Firms in a country with a low trade barrier are at a disadvantage: they need to pay higher trade costs than firms in a country with a high trade barrier. Fewer firms enter the market in a

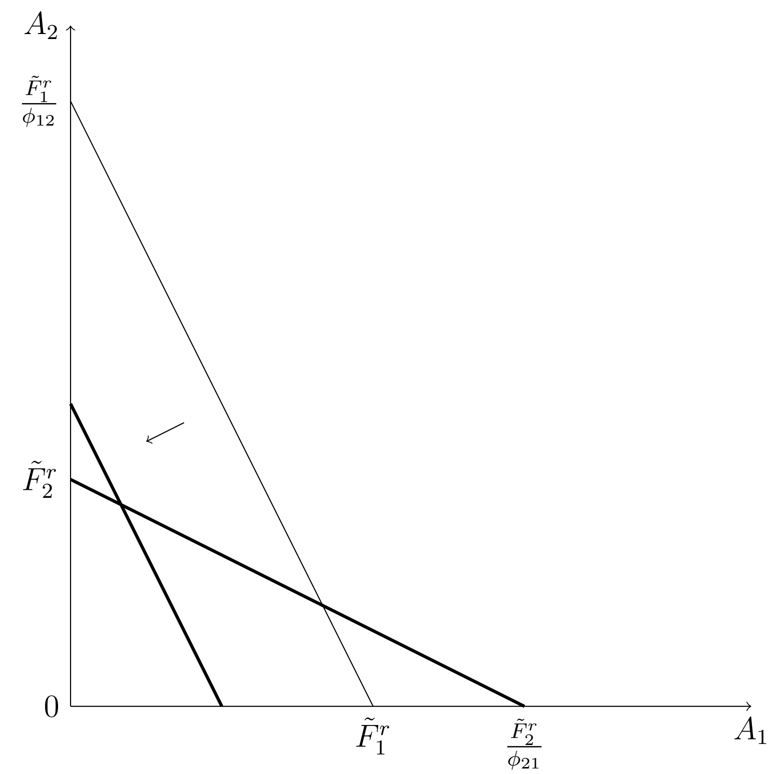

Figure 3: Technological improvement in the home country increases welfare in the home country, and decreases welfare in the foreign country.

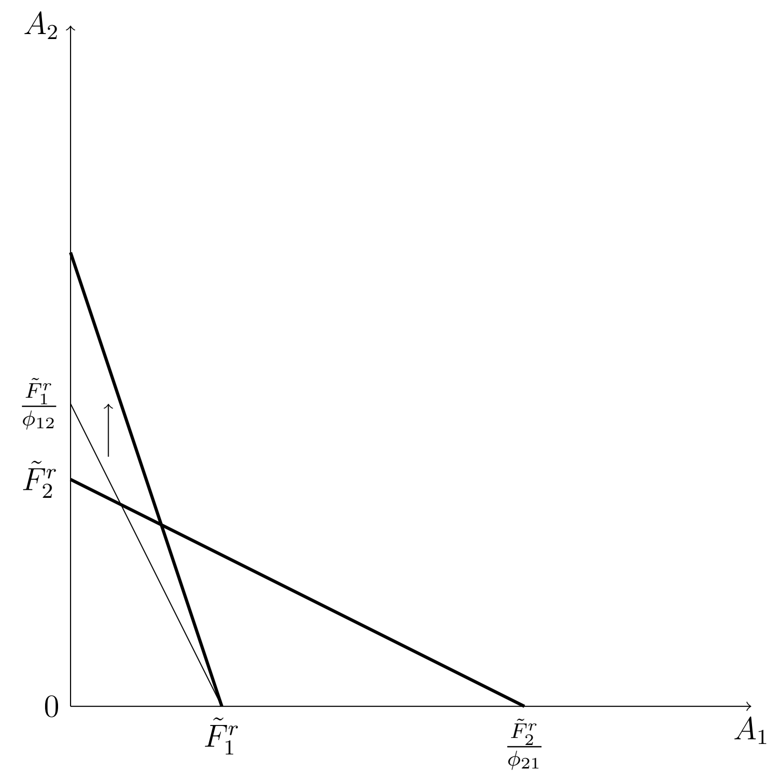

Figure 4: Unilateral trade liberalization of the home country decreases the welfare of the home country, and increases the welfare of the foreign country.

country with a low trade barrier, leading to a high price index of a country with a low trade barrier.

Equations (19) and (20) can also be solved using algebra:

$$A_i = \frac{\tilde{F}_i^r - \phi_{ij}\tilde{F}_j^r}{1 - \phi_{ij}\phi_{ji}} \qquad\qquad i \neq j \tag{21}$$

Openness is assumed to be sufficiently low to ensure a positive price index: i.e. $\tilde{F}_i^r - \phi_{ij}\tilde{F}_j^r > 0$. Using (21), the following result is obtained:

Proposition 3. *a) If inefficiency in country 1 is increasing, demand A_1 of this country is increasing; however, that of the other country A_2 is decreasing.*

$$\frac{\partial A_1}{\partial \tilde{F}_1^r} > 0 > \frac{\partial A_1}{\partial \tilde{F}_2^r}$$

b) Unilateral trade liberalization of a country hurts this country, and benefits the foreign country:

$$\frac{\partial A_1}{\partial \phi_{21}} > 0 > \frac{\partial A_1}{\partial \phi_{12}}$$

c) Suppose that $\phi = \phi_{12} = \phi_{21}$. Bilateral trade liberalization increases the welfare of both countries.

$$\frac{\partial A_1}{\partial \phi} < 0$$

Proof. It is straightforward to show $\frac{\partial A_1}{\tilde{F}_1^r} > 0 > \frac{\partial A_2}{\partial \tilde{F}_2^r}$ and $\frac{\partial A_1}{\partial \phi_{21}} > 0$ from (21). The differentiation of A_1 with respect to ϕ_{12} can be described as follows:

$$\frac{\partial A_1}{\partial \phi_{12}} = \frac{\phi_{21}\tilde{F}_1^r - \tilde{F}_2^r}{(1 - \phi_{12}\phi_{21})^2} < 0$$

Inequality is derived from $\tilde{F}_2^r - \phi_{21}\tilde{F}_1^r > 0$.

The effect of bilateral liberalization can be obtained as follows:

$$\frac{\partial A_1}{\partial \phi} = \frac{2\phi\tilde{F}_1^r - (1 + \phi^2)\tilde{F}_2^r}{(1 - \phi^2)^2}$$

$\frac{\partial A_1}{\partial \phi}$ is positive if and only if $\frac{\tilde{F}_1^r}{\tilde{F}_2^r} < \frac{\phi + \phi^{-1}}{2}$. However, this inequality is incompatible with $\tilde{F}_i^r - \phi_{ij}\tilde{F}_j^r > 0$. $\square$

4 Product Market with Selection

In this section, the following assumption is taken as in the standard heterogeneous firm model:

Assumption 1. *a) Some potential firms do not enter the market and some domestic firms do not export:*

$$\psi_i^f < \psi_j^d < \psi_k^x \qquad\qquad i,j,k \in \{1,2\}$$

The expected repayment can be written as a function of the entry rate $\mathbf{Prob}(\psi \geq \psi^d | \psi \geq \psi^f)$ because $\pi^d(\psi)$ is zero if ψ is lower than ψ_i^d:

$$\mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^f] = \mathbf{E}[(\pi_i^d(\psi) + \pi_i^x(\psi) - F^r)|\psi \geq \psi_i^d]\mathbf{Prob}(\psi \geq \psi^d|\psi \geq \psi^f)$$

Repayment elasticity ϵ is k in this case. (14) and $\epsilon = k$ imply the following equation:

$$\tilde{S}_i = \frac{k}{\gamma} F_i^r \tag{22}$$

This equation is similar to but slightly different from (17): this equation does not include ρ—screening efforts do not depend on product differentiation. Using this equation, the following results were obtained:

Proposition 4. *a) Product differentiation is not related to screening efforts:*

$$\frac{\partial \psi_i^f}{\partial \rho} = \frac{\partial S_i}{\partial \rho} = \frac{\partial \tilde{S}_i}{\partial \rho} = 0 \tag{23}$$

b) R&D cost is positively correlated with screening efforts:

$$\frac{\partial \psi_i^f}{\partial F_i^r} > 0 \qquad \frac{\partial S_i}{\partial F_i^r} > 0 \qquad \frac{\partial \tilde{S}_i}{\partial F_i^r} > 0$$

c) Screening inefficiency implies a lower screening threshold and a higher individual screening cost S_i. However, screening cost per lending $\tilde{S}_i$ is not changed:

$$\frac{\partial \psi_i^f}{\partial \theta_i} < 0 \qquad \frac{\partial S_i}{\partial \theta_i} > 0 \qquad \frac{\partial \tilde{S}_i}{\partial \theta_i} = 0$$

d) Screening effort is not relate to physical capital cost and trade cost:

$$\frac{\partial \psi_i^f}{\partial F_j^d} = \frac{\partial \psi_i^f}{\partial F_j^x} = \frac{\partial \psi_i^f}{\partial \tau_{jk}} = 0 \qquad\qquad i,j,k \in \{1,2\}$$

Product differentiation does not affect screening efforts, in contrast to the previous section. Screening efforts do not change the total net profit π^t but only change the probability of entry. This produces an insensitivity to the elasticity of substitution. Except for ρ, the implication of this proposition is same as the previous section: only the amount of money that the intermediary must lend F_i^r affects screening efforts. It is unexpected that the product market condition does not affect the screening decision. Product market regulation, as represented by a high F_i^d, does not affect the screening decision even if it affects entry severity. Additionally, other variables representing the product market condition do not affect screening.[6]

The interest rate and the entry rate are analyzed. The interest rate is intimately related to the entry rate. The following equation can be obtained from (13), (15), and (22):

$$R_i\mathbf{Prob}(\psi \geq \psi_i^d|\psi \geq \psi_i^f) = (1 + \frac{k}{\gamma}) \tag{24}$$

This equation implies that the interest rate and the entry rate move in opposite directions. If the entry rate is low, intermediaries offer a high interest rate. Before analyzing interest rate, the expected operating profit is calculated using (6):

$$\begin{aligned}
\mathbf{E}[\pi_i^d(\psi)|\psi \geq \psi_i^d] &= \frac{k}{k-(\rho-1)}A_i(\psi_i^d)^{-k} - F^d \\
&= \frac{F_i^d}{\dfrac{k}{\rho-1} - 1} \\
\mathbf{E}[\pi_i^x(\psi)|\psi \geq \psi_i^d] &= \mathbf{E}[\pi^x(\psi)|\psi \geq \psi^x]\mathbf{Prob}(\psi \geq \psi_i^x|\psi \geq \psi_i^d) \\
&= \frac{F_i^x}{\dfrac{k}{\rho-1} - 1}(\frac{\psi_i^x}{\psi_i^d})^{-k}
\end{aligned}$$

[6] This result does not depend on the special functional form in this paper. For instance, consider the following non constant elasticity case: $\epsilon(\psi_i^f) \equiv \frac{\partial \log S}{\partial \log \psi_i^f}$ and $\epsilon_p(\psi_i^f) \equiv \frac{\partial \log \mathbf{Prob}(\psi \geq \psi_i^d|\psi \geq \psi_i^f)}{\partial \log \psi_i^f}$. From the zero profit condition and first-order condition, the following is obtained: $\tilde{S}\frac{\epsilon_p(\psi_i^f)}{\epsilon_s(\psi_i^f)}F$. When this equation has a unique solution, equilibrium screening does not depend on the product market condition.

Substituting these equations for (15), I obtain the interest rate:

$$\begin{aligned} R_i &= \frac{\mathbf{E}[\pi_i^t(\psi)|\psi \geq \psi_i^d]}{F_i^r} \\ &= \frac{1}{\dfrac{k}{\rho-1}-1}\frac{1}{F_i^r}\{F_i^d + F_i^x(\frac{\psi_i^x}{\psi_i^d})^{-k}\} \quad i \neq j \end{aligned} \tag{25}$$

This equation is slightly cumbersome. I analyze the symmetric country case before analyzing the general asymmetric case.

4.1 Symmetric country

When two countries is symmetric, the export entry rate $\mathbf{Prob}(\psi \geq \psi^x|\psi \geq \psi^d)$ takes the following simple form from (6):

$$\mathbf{Prob}(\psi \geq \psi_i^x|\psi \geq \psi_i^d) = (\frac{\psi^x}{\psi^d})^{-k} = (1+\tau)^{-k}(\frac{F^x}{F^d})^{-\frac{k}{\rho-1}}$$

Substituting this equation for (25), I can rewrite the equilibrium interest rate:

$$R = \frac{1}{\dfrac{k}{\rho-1}-1}\frac{1}{F^r}\{F^d + F^x(1+\tau)^{-k}(\frac{F^x}{F^d})^{-\frac{k}{\rho-1}}\}$$

Combining this equation with (24), I obtain the following proposition:

Proposition 5. *a) The interest rate is negatively correlated to trade costs τ and F^x:*

$$\begin{aligned} \frac{\partial R}{\partial \tau} < 0 < \frac{\partial}{\partial \tau}\mathbf{Prob}(\psi \geq \psi^d|\psi \geq \psi^f) \\ \frac{\partial R}{\partial F^x} < 0 < \frac{\partial}{\partial F^x}\mathbf{Prob}(\psi \geq \psi^d|\psi \geq \psi^f) \end{aligned}$$

b) The interest rate is negatively correlated to the R&D cost:

$$\frac{\partial R}{\partial F^r} < 0 < \frac{\partial}{\partial F^r}\mathbf{Prob}(\psi \geq \psi^d|\psi \geq \psi^f)$$

c) The interest rate is positively correlated to the domestic entry cost:

$$\frac{\partial R}{\partial F^d} > 0 > \frac{\partial}{\partial F^d}\mathbf{Prob}(\psi \geq \psi^d | \psi \geq \psi^f)$$

d) The interest rate is not related to screening inefficiency:

$$\frac{\partial R}{\partial \theta} = \frac{\partial}{\partial \theta}\mathbf{Prob}(\psi \geq \psi^d | \psi \geq \psi^f) = 0$$

The entry rate's movement is similar to standard Melitz model. High trade costs and high R&D costs lead product market less competitive. A less competitive market implies a high entry rate. If the domestic entry cost is increasing, entry becomes difficult.

Screening inefficiency does not affect the interest rate. Although inefficient screening technology reduces the entry rate by reducing the entrepreneur's productivity, it also increases the entry rate by weakening product market competition. In the symmetric country case, these two forces cancel out each other. As is subsequently shown, screening technology affects product market selection when countries are asymmetric.

I analyze the productivity of entrant ψ^d:

Proposition 6. *a) For $x = F^d, F^x, \tau$, the productivity of the entrant is increasing if and only if the entry rate is decreasing:*

$$\frac{\partial \psi^d}{\partial x} > 0 \iff \frac{\partial \mathbf{Prob}(\psi \geq \psi^d | \psi \geq \psi^f)}{\partial x} < 0 \tag{26}$$

b) The productivity of the entrant is decreasing if R&D cost is increasing:

$$\frac{\partial \psi^d}{\partial F^r} < 0 \tag{27}$$

Proof. Part a is evident from $\frac{\partial \psi^f}{\partial x} = 0$. From (11), (22), (25) and (24), I obtain these equations:

$$(k_s + \gamma)\frac{\partial \log \psi^f}{\partial \log F^r} = 1$$

$$-1 = \frac{\partial \log R}{\partial \log F^r} = k_s\left(\frac{\partial \log \psi^d}{\partial \log F^r} - \frac{\partial \log \psi^f}{\partial \log F^r}\right)$$

From these equations, I obtain $\frac{\partial \log \psi^d}{\partial \log F^r} = \frac{1}{\gamma + k} - \frac{1}{k} < 0$ □

Although the intermediary screens more severely when R&D costs are high, the productivity of the entrant is decreasing. The screening effect is weaker than the product market selection.

4.2 Asymmetric Country

Using the entry cutoff (6), the export cutoff can be written as a function of the domestic cutoff:

$$\frac{\psi_i^x}{\psi_j^d} = (1+\tau_{ij})(\frac{F_i^x}{F_j^d})^{\frac{1}{\rho-1}} \tag{28}$$

I eliminate the export cutoff from (25) using this equation:

$$R_i = \frac{1}{\dfrac{k}{\rho_s - 1} - 1}\frac{1}{F_i^r}\{F_i^d + \hat{\phi}_{ij}(F_j^d)^{\frac{k}{\rho-1}}(\frac{\psi_j^d}{\psi_i^d})^{-k}\} \quad i \neq j \tag{29}$$

$\hat{\phi}_{ij} \equiv (1+\tau_{ij})^{-k}(F_i^x)^{1-\frac{k}{\rho-1}}$ indicates the openness of country j as in section 3. Combining this equation with (24), I obtain the following equation:

$$F_1^d(\psi_1^d)^{-k} + \hat{\phi}_{12}(F_2^d)^{\frac{k}{\rho-1}}(\psi_2^d)^{-k} = \hat{F}_1^r \tag{30}$$

$$\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(\psi_1^d)^{-k} + F_2^d(\psi_2^d)^{-k} = \hat{F}_2^r \tag{31}$$

$\hat{F}_i^r \equiv \theta_i^{\frac{k}{\gamma+k}}(\frac{k}{\rho-1}-1)(\frac{k}{\gamma})^{-\frac{k}{\gamma+k}}(F_i^r)^{1-\frac{k}{\rho-1}}$ indicates R&D inefficiency: $\hat{F}_i^r$ is high if R&D cost is high and screening inefficiency is high. When openness is assumed to be sufficiently low, the slope of equation (30) is steeper than that of equation (31). This restriction ensures a diagrammatic analysis. The technological improvement of the home country—i.e. $\hat{F}_1^r$ is decreasing—decreases the productivity of domestic entrants ψ_1^d and increases the productivity of foreign entrants ψ_2^d as depicted in Figure 5. The unilateral trade liberalization of the home country increases the productivity of domestic entrants ψ_1^d and decreases productivity of foreign entrants ψ_1 as depicted in Figure 6.

The solution to equations (30) and (31) has the following form:

$$(\psi_1^d)^{-k} = \frac{\hat{F}_1^r - \hat{\phi}_{12}(F_2^d)^{\frac{k}{\rho-1}-1}\hat{F}_2^r}{F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1}} \tag{32}$$

Openness is assumed to be sufficiently low:[7]

[7] This assumption is slightly different from the assumption used for Figure 5 and 6. This paper primarily works with algebraic solutions. The diagrams are used only for pedagogical purposes.

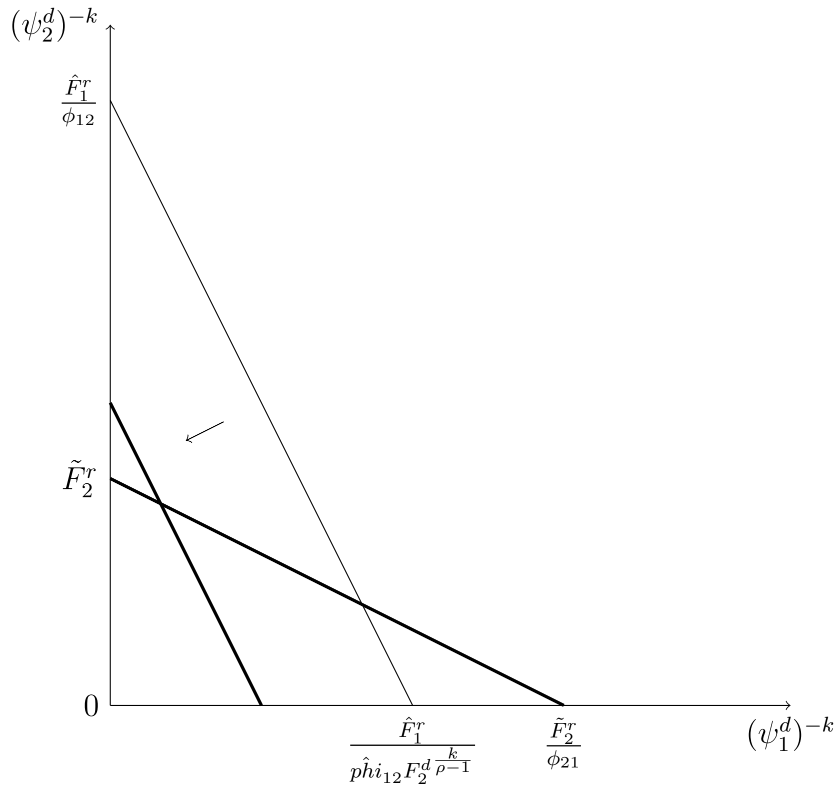

Figure 5: Technological improvement and cutoff

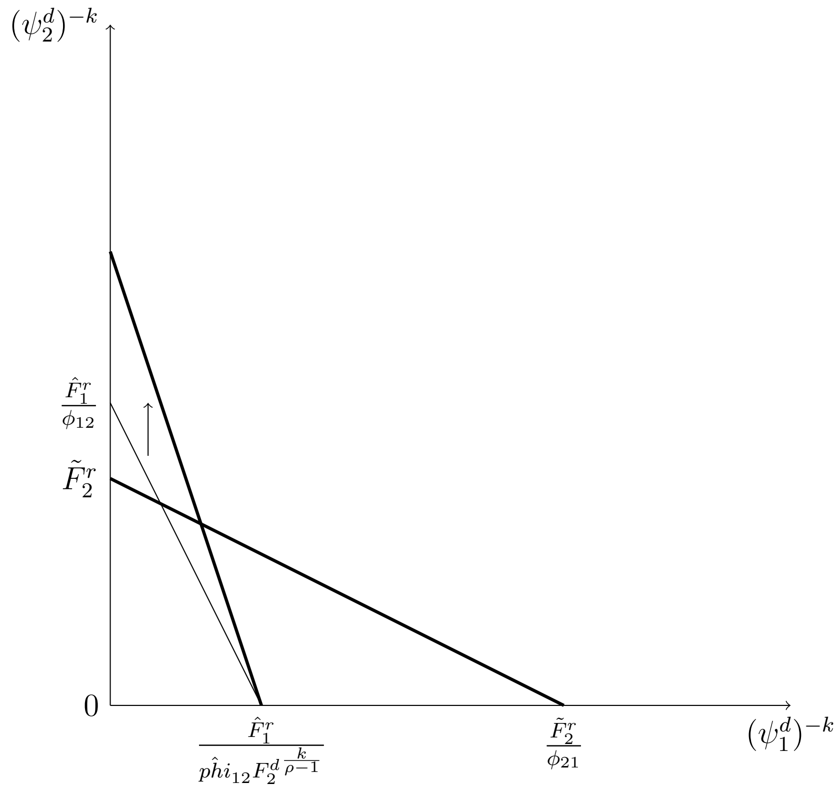

Figure 6: Unilateral trade liberalization and cutoff.

Assumption 2.

$$1 > \frac{k}{\rho - 1}\hat{\phi}_{ij}(F_j^d)^{\frac{k}{\rho-1}-1}$$
$$\hat{F}_i^r > \phi_{ij}(F_j^d)^{\frac{k}{\rho-1}-1}\hat{F}_j^r \quad i \neq j$$

Using (32), the following proposition is obtained:

Proposition 7. *a) R&D inefficiency in the home country is negatively correlated with domestic cutoff and is positively correlated with export cutoff. R&D inefficiency in the foreign country has the opposite effect from that of the domestic and the export cutoffs:*

$$\frac{\partial \psi_1^d}{\partial \hat{F}_1^r} < 0 < \frac{\partial \psi_1^d}{\partial \hat{F}_2^r}$$
$$\frac{\partial \psi_1^x}{\partial \hat{F}_1^r} > 0 > \frac{\partial \psi_1^x}{\partial \hat{F}_2^r}$$

b) The domestic entry cost of each country is positively correlated with the domestic cutoff of each country. The domestic entry cost of the home country is positively correlated with the export cutoff of the home country; the domestic entry cost of the foreign country is negatively correlated with the export cutoff of the home country:

$$\frac{\partial \psi_1^d}{\partial F_1^d} > 0$$
$$\frac{\partial \psi_1^d}{\partial F_2^d} > 0$$
$$\frac{\partial \psi_1^x}{\partial F_1^d} < 0$$
$$\frac{\partial \psi_1^x}{\partial F_2^d} < 0$$

c) The openness of the home country is negatively correlated with the domestic cutoff. The openness of the foreign country has an opposite effect from that of domestic cutoff:

$$\frac{\partial \psi_1^d}{\partial \hat{\phi}_{21}} < 0 < \frac{\partial \psi_1^d}{\partial \hat{\phi}_{12}}$$

Proof. See appendix. □

The welfare implication of technical change and trade liberalization is similar to that of the previous section:

Corollary 1. *a) R&D inefficiency and high domestic entry cost decrease the welfare of this country and increase the welfare of the foreign country:*

$$\frac{\partial A_1}{\partial \hat{F}_1^r} > 0 > \frac{\partial A_1}{\partial \hat{F}_2^r}$$
$$\frac{\partial A_1}{\partial F_1^d} > 0 > \frac{\partial A_1}{\partial F_2^d}$$

b) A country's unilateral trade liberalization decreases the welfare of this country and increases the welfare of the foreign country:

$$\frac{\partial A_1}{\partial \hat{\phi}_{21}} > 0 > \frac{\partial A_1}{\partial \hat{\phi}_{12}}$$

Proof. For $x = \hat{F}_j^r, \hat{\phi}_{jk}$, the log differentiation of $F_i^d = A_i(\psi_i^d)^{\rho-1}$ implies that A_i and ψ_i^d move in the opposite direction:

$$\frac{\partial \log A_i}{\partial x} = (1-\rho)\frac{\partial \log \psi_i^d}{\partial x}$$

For F_j^d, the log differentiation of $F_i^x = A_j(\frac{\psi_i^x}{1+\tau_{ij}})^{\rho-1}$ implies that A_i and ψ_j^x move in the opposite direction:

$$\frac{\partial \log A_i}{\partial F_j^d} = (1-\rho_s)\frac{\partial \log \psi_i^x}{\partial F_j^d}$$

Combining these two equations with proposition 7 shows that the above proposition is correct. □

Inefficient technology in the home country implies low welfare in this country. Inefficient technology in the foreign country implies high welfare in the home country: inefficient technology in the foreign country allows the home country to specialize in differentiated sectors. Firms in a country with high openness must pay high trade costs. In this country, fewer firms enter the market.

Using corollary 1, the results of proposition 7 can be interpreted as follows. The productivity of entrant ψ_1^d is low if openness $\hat{\phi}_{21}$ is high: selection is weak in a highly open market. The R&D inefficiency of the home country increases its demand. The home country's high demand reduces the productivity of the entrants as depicted in Figure 2. The R&D inefficiency of the foreign country has the opposite effect and domestic entry cost has a more nuanced effect. If the domestic entry cost of the home country increases, it indirectly weakens the selection since it increases the demand of the home country but it directly strengthens the selection because entry is more costly. Moreover, direct effect dominates in this model.

From proposition 7 and equation (24), the following proposition is obtained:

Proposition 8. *a) R&D inefficiency in the home country decreases the interest rate and increases the entry rate of the home country; R&D inefficiency in the home country increases the interest rate and decreases the entry rate of the foreign country:*

$$\frac{\partial R_1}{\partial \hat{F}_1^r} < 0 < \frac{\partial}{\partial \hat{F}_1^r}\mathbf{Prob}[\psi \geq \psi_1^d | \psi \geq \psi_1^f]$$
$$\frac{\partial R_1}{\partial \hat{F}_2^r} > 0 > \frac{\partial}{\partial \hat{F}_2^r}\mathbf{Prob}[\psi \geq \psi_1^d | \psi \geq \psi_1^f]$$

b) Unilateral trade liberalization decreases the interest rate and increases the entry rate of this country, and increases the interest rate and decreases the entry rate of the foreign country:

$$\frac{\partial R_1}{\partial \hat{\phi}_{21}} < 0 < \frac{\partial}{\partial \hat{\phi}_{21}}\mathbf{Prob}[\psi \geq \psi_1^d | \psi \geq \psi_1^f]$$
$$\frac{\partial R_1}{\partial \hat{\phi}_{12}} > 0 > \frac{\partial}{\partial \hat{\phi}_{12}}\mathbf{Prob}[\psi \geq \psi_1^d | \psi \geq \psi_1^f]$$

c) The home country's high domestic entry cost increases the interest rate and decreases the entry rate of this country, and decreases the interest rate and increases the entry rate of the foreign country.

$$\frac{\partial R_1}{\partial F_1^d} > 0 > \frac{\partial}{\partial F_1^d}\mathbf{Prob}[\psi \geq \psi_1^d | \psi \geq \psi_1^f]$$
$$\frac{\partial R_1}{\partial F_1^d} < 0 < \frac{\partial}{\partial F_2^d}\mathbf{Prob}[\psi \geq \psi_1^d | \psi \geq \psi_1^f]$$

Proof. For $x = \hat{\phi}_{jk}, F_j^d, \hat{F}_2^r$, it is straightforward to show the sign of $\frac{\partial}{\partial x}\mathbf{Prob}(\psi \geq \psi_i^d | \psi \geq \psi_i^f)$ because the screening threshold does not depend on x:

$$\frac{\partial}{\partial x}\mathbf{Prob}(\psi \geq \psi_i^d | \psi \geq \psi_i^f) > 0 \iff \frac{\partial \psi_i^d}{\partial x} < 0$$

From (24), the sign of $\frac{\partial R_1}{\partial x}$ is also obtained. For $\hat{F}_1^r$, R_1 is a decreasing function:

$$\begin{aligned}\frac{\partial R_1}{\partial \hat{F}_1^r} &= -\frac{1}{\dfrac{k}{\rho - 1} - 1}\frac{1}{(F_1^r)^2}\{F_1^d + \hat{\phi}_{12}(F_2^d)^{\frac{k}{\rho-1}}(\frac{\psi_2^d}{\psi_1^d})^{-k}\} \\ &+ \frac{1}{\dfrac{k}{\rho - 1} - 1}\frac{1}{(F_1^r)}\{\hat{\phi}_{12}(F_2^d)^{\frac{k}{\rho-1}}\frac{\partial}{\partial \hat{F}_1^r}(\frac{\psi_2^d}{\psi_1^d})^{-k}\} \\ &< 0\end{aligned}$$

From proposition 7 the second term is negative. $0 < \frac{\partial}{\partial \hat{F}_1^r}\mathbf{Prob}(\psi \geq \psi_i^d | \psi \geq \psi_i^f)$ is satisfied from (24). □

In contrast to the symmetric country case, inefficient screening technology has a positive effect on the entry rate. A country's inefficient screening technology makes this country less competitive than the foreign country. This effect works only through international trade: when countries do not trade, the interest rate $R_i = \dfrac{1}{\frac{k}{\rho-1} - 1}\frac{F_i^d}{F_i^r}$ does not depend on θ_i. These observations imply that this effect is driven by international trade.

When F_i^d and F_i^x are interpreted as a proxy for product market regulation, product market regulation affects the default rate. Domestic market regulations increase the default rate; foreign market regulation decreases default rate which does not depend on regulations for domestic firms or exporters.

The export entry rate $\mathbf{Prob}(\psi \geq \psi_i^x | \psi \geq \psi_i^d)$ can also be calculable from proposition 7:

Proposition 9. *R&D inefficiency of the home country is negatively correlated with its export entry rate of home country; R&D inefficiency of foreign country is positively correlated to export entry rate of the home country:*

$$\frac{\partial}{\partial \hat{F}_1^r}\mathbf{Prob}[\psi \geq \psi_1^x | \psi \geq \psi_1^d] < 0 < \frac{\partial}{\partial \hat{F}_2^r}\mathbf{Prob}[\psi \geq \psi_1^x | \psi \geq \psi_1^d]$$

This proposition shows that many firms in the financially developed country engage in export activities. This finding reflects the concept that financially developed countries have a comparative advantage for differentiated sector. This is roughly consistent with Beck (2002) and Beck (2003).[8] Firms in financially developed countries tend to export more than firms in financially underdeveloped countries because firms in developed countries are more productive. Screening increases firms productivity and the competitive product market selects productive firms. These two sources of productivity gain enables firms to export.

5 Conclusion

Combining the heterogeneous firm model with the financial screening model indicates how product markets and financial markets are interrelated. The financial market has a one-sided influence on the product market. When there is product market selection, product market conditions do not affect the decisions of financial intermediaries: i.e. even if the selection is severe, intermediaries do not change their screening intensity. However, screening efficiency affects product market conditions.

In contrast to previous studies, an inefficient financial market decreases the default rate, which equals a high entry rate. A high entry rate reduces entrant productivity. Hence, a country with an inefficient financial market suffers from low productivity not only through inefficient screening but also through weak selection. This effect exists only if countries trade. More concretely, this effect can be viewed as a byproduct of international specialization. Countries with an inefficient financial market have a comparative disadvantage for differentiated goods. Hence, only a limited number of entrepreneurs produce a new product in this country, which weakens competition. Weak competition leads entrants to repay. Paradoxically, an inefficient financial market produces a low default rate. Default risk is not a good indicator of financial market efficiency. A financially underdeveloped country has an unproductive product market not only as a result of inefficient screening but also because of weak competition. This result is somewhat

[8]The caveats exist that are related to Manova (2013), who uses establishment size to control for selection effect. In contrast to her study, the price index is an appropriate measure of selection for the results of this paper. From cutoff condition, each cutoff is determined by the price index. Second, although Manova (2013) uses the price index for her analysis, the price index used in the empirical studies is not compatible with the index used in this paper. Since wage is used as numeraire in this paper, a relevant measure is the price index divided by factor prices.

paradoxical initially, but is a natural mechanism when appropriately interpreted.

References

Aghion, Philippe and Peter W Howitt, *The economics of growth*, MIT press, 2009.

Arkolakis, Costas, Svetlana Demidova, Peter J Klenow, and Andres Rodriguez-Clare, "Endogenous variety and the gains from trade," *NBER Working Paper*, 2008.

Baldwin, Richard, "Heterogeneous firms and trade: testable and untestable properties of the Melitz model," *NBER Working Paper*, 2005.

Baldwin, Richard E and Frédéric Robert-Nicoud, "Trade and growth with heterogeneous firms," *Journal of International Economics*, 2008, *74* (1), 21–34.

_ **and Rikard Forslid**, "Trade liberalization with heterogeneous firms," *Review of Development Economics*, 2010, *14* (2), 161–176.

_ **and Toshihiro Okubo**, "Heterogeneous firms, agglomeration and economic geography: spatial selection and sorting," *Journal of Economic Geography*, 2006, *6* (3), 323–346.

Banerjee, Abhijit V and Benjamin Moll, "Why does misallocation persist?," *American Economic Journal: Macroeconomics*, 2010, pp. 189–206.

Beck, Thorsten, "Financial development and international trade: Is there a link?," *Journal of international Economics*, 2002, *57* (1), 107–131.

_ , "Financial dependence and international trade," *Review of International Economics*, 2003, *11* (2), 296–316.

Benabou, Roland, "Inequality and growth," *NBER macroeconomics annual*, 1996, *11*, 11–74.

_ , "Tax and Education Policy in a Heterogeneous-Agent Economy: What Levels of Redistribution Maximize Growth and Efficiency?," *Econometrica*, 2002, *70* (2), 481–517.

Bernard, Andrew B, J Bradford Jensen, Stephen J Redding, and Peter K Schott, "The empirics of firm heterogeneity and international trade," *Annual Review of Economics*, 2012, *4* (1), 283–313.

Blanchard, Olivier and Francesco Giavazzi, "Macroeconomic effects of regulation and deregulation in goods and labor markets," *Quarterly Journal of Economics*, 2003, *118* (3), 879–907.

Buera, Francisco J and Yongseok Shin, "Financial frictions and the persistence of history: A quantitative exploration," *Journal of Political Economy*, 2013, *121* (2), 221–272.

Chaney, Thomas, "Distorted gravity: the intensive and extensive margins of international trade," *American Economic Review*, 2008, *98* (4), 1707–1721.

_ , "Liquidity constrained exporters," *Journal of Economic Dynamics and Control*, 2016, *72*, 141–154.

Demidova, Svetlana, "Productivity improvements and falling trade costs: boon or bane?," *International Economic Review*, 2008, *49* (4), 1437–1462.

Eaton, Jonathan, Samuel Kortum, and Francis Kramarz, "An anatomy of international trade: Evidence from French firms," *Econometrica*, 2011, *79* (5), 1453–1498.

Egger, Hartmut and Udo Kreickemeier, "Firm heterogeneity and the labor market effects of trade liberalization," *International Economic Review*, 2009, *50* (1), 187–216.

Helpman, Elhanan and Paul Krugman, *Market structure and foreign trade: Increasing returns, imperfect competition, and the international economy*, MIT press, 1985.

_ , Marc J Melitz, and Stephen R Yeaple, "Export versus FDI with Heterogeneous Firms," *American Economic Review*, 2004, *94* (1), 300–316.

_ , Oleg Itskhoki, and Stephen Redding, "Inequality and unemployment in a global economy," *Econometrica*, 2010, *78* (4), 1239–1283.

King, Robert G and Ross Levine, "Finance, entrepreneurship and growth," *Journal of Monetary economics*, 1993, *32* (3), 513–542.

Laeven, Luc, Ross Levine, and Stelios Michalopoulos, "Financial innovation and endogenous growth," *Journal of Financial Intermediation*, 2015, *24* (1), 1–24.

Lee, Yoonsoo and Toshihiko Mukoyama, "Entry, Exit, and Plant-level Dynamics over the Business Cycle," 2012. Mimeo.

Manova, Kalina, "Credit constraints, heterogeneous firms, and international trade," *Review of Economic Studies*, 2013, *80* (2), 711–744.

Melitz, Marc J, "The impact of trade on intra-industry reallocations and aggregate industry productivity," *Econometrica*, 2003, *71* (6), 1695–1725.

_ **and Gianmarco IP Ottaviano**, "Market size, trade, and productivity," *Review of economic studies*, 2008, *75* (1), 295–316.

Moll, Benjamin, "Productivity losses from financial frictions: can self-financing undo capital misallocation?," *American Economic Review*, 2014, *104* (10), 3186–3221.

Nageswaran, V Anantha and Gulzar Natarajan, "Can India Grow? Challenges, Opportunities and the Way Forward," 2016.

Naito, Takumi, "An Asymmetric Melitz Model of Trade and Growth," *RIETI Discussion Paper*, 2016.

Nocke, Volker and Stephen Yeaple, "Cross-border mergers and acquisitions vs. greenfield foreign direct investment: The role of firm heterogeneity," *Journal of International Economics*, 2007, *72* (2), 336–365.

_ **and** _ , "An assignment theory of foreign direct investment," *Review of Economic Studies*, 2008, *75* (2), 529–557.

Pavcnik, Nina, "Trade liberalization, exit, and productivity improvements: Evidence from Chilean plants," *Review of Economic Studies*, 2002, *69* (1), 245–276.

Redding, Stephen J, "Theories of heterogeneous firms and trade," *Annual Review of Economics*, 2011, *3* (1), 77–105.

Roberts, Mark J and James R Tybout, "The decision to export in Colombia: an empirical model of entry with sunk costs," *American Economic Review*, 1997, pp. 545–564.

Sunaga, Miho, "Endogenous Growth Cycles with Financial Intermediaries and Entrepreneurial Innovation," 2016. mimeo.

Tybout, James R, "Plant-and firm-level evidence on " new " trade theories," *Handbook of international trade*, 2003, pp. 388–415.

Venables, Anthony J, "Trade and trade policy with differentiated products: A Chamberlinian-Ricardian model," *Economic Journal*, 1987, pp. 700–717.

A Proof of Proposition 7

I show the results of domestic cutoff before the results of the export cutoff.

$\frac{\partial \psi_1^d}{\partial \hat{F}_1^r} < 0$:

$$\frac{\partial \psi_1^{d^{-k}}}{\partial \hat{F}_1^r} = \frac{1}{(F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1}} > 0$$

$\frac{\partial \psi_1^d}{\partial \hat{F}_2^r} > 0$:

$$\frac{\partial \psi_1^{d^{-k}}}{\partial \hat{F}_2^r} = -\frac{\hat{\phi}_{12}(F_2^d)^{\frac{k}{\rho-1}-1}}{(F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1}} < 0$$

$\frac{\partial \psi_1^d}{\partial F_1^d} > 0$:

$$\frac{\partial (\psi_1^d)^{-k}}{\partial F_1^d} = -\frac{1 - \frac{k}{\rho-1}F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}-1}(F_2^d)^{\frac{k}{\rho-1}-1}}{(F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1})^2} < 0$$

Inequality is derived from assumption $1 > \frac{k}{\rho-1}\hat{\phi}_{ij}(F_j^d)^{\frac{k}{\rho-1}-1}$.

$\frac{\partial \psi_1^d}{\partial F_2^d} > 0$:

$$\frac{\partial (\psi_1^d)^{-k}}{\partial (F_2^d)^{\frac{k}{\rho-1}-1}} = \frac{\hat{\phi}_{12}(\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}\hat{F}_1^r - F_1^d\hat{F}_2^r)}{(F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1})^2} < 0$$

Last inequality is derived from $\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(\psi_1^d)^{-k} + F_2^d(\psi_2^d)^{-k} = \hat{F}_2^r$.

$\frac{\partial \psi_1^d}{\partial \hat{\phi}_{12}} > 0$:

$$\frac{\partial (\psi_1^d)^{-k}}{\partial \hat{\phi}_{12}} = \frac{(F_2^d)^{\frac{k}{\rho-1}-1}\hat{F}_2^r F_1^d + \hat{\phi}_{21}\hat{F}_1^r (F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1}}{(F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1})^2} < 0$$

$\frac{\partial \psi_1^d}{\partial \hat{\phi}_{21}} < 0$:

$$\begin{aligned}\frac{\partial (\psi_1^d)^{-k}}{\partial \hat{\phi}_{21}} = & \frac{\hat{F}_1^r - \hat{\phi}_{12}(F_2^d)^{\frac{k}{\rho-1}-1}\hat{F}_2^r}{(F_1^d - \hat{\phi}_{12}\hat{\phi}_{21}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1})^2} \\ & * (\hat{\phi}_{12}(F_1^d)^{\frac{k}{\rho-1}}(F_2^d)^{\frac{k}{\rho-1}-1}) > 0\end{aligned}$$

From equation (6), the following relationship is satisfied:

$$\begin{aligned}\frac{\partial \log A_2}{\partial x} &= (1-\rho)\frac{\partial \log \psi_2^d}{\partial x} && x = \hat{F}_i^r, F_1^d, \\ &= (1-\rho)\frac{\partial \log \psi_2^d}{\partial F_2^d} + 1 > 0 && x = F_2^d \\ \frac{\partial \log A_2}{\partial \hat{x}} &= (1-\rho)\frac{\partial \psi_1^x}{\partial \hat{x}} && \hat{x} = \hat{F}_i^r, F_i^d,\end{aligned}$$

Combining these two equations with $\frac{\partial \psi_2^d}{\partial \hat{F}_2^r} < 0 < \frac{\partial \psi_2^d}{\partial \hat{F}_1^r}$, and $\frac{\partial \psi_2^d}{\partial \hat{\phi}_{12}} < 0 < \frac{\partial \psi_2^d}{\partial \hat{\phi}_{21}}$ provide the following results:

$$\begin{aligned}\frac{\partial \psi_1^x}{\partial \hat{F}_1^r} > 0 > \frac{\partial \psi_1^x}{\partial \hat{F}_2^r} \\ \frac{\partial \psi_1^x}{\partial \hat{F}_1^d} > 0 > \frac{\partial \psi_1^x}{\partial \hat{F}_2^d}\end{aligned}$$