Distribution Costs, International Trade and Industrial Location

Kikuchi, Toru

Kobe University

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Toru Kikuchi*

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Abstract

The purpose of this study is to illustrate, with a simple two-country, two-good, two-factor model, how a technological/regulational improvement in one country's distribution sector can affect firms' location decisions and the nature of the trading equilibrium. It is shown that, through improvements in distribution sector, one country might divert high-tech industries to another country. This effect reduces the incentive to improve distribution sector lower.

*Graduate School of Economics, Kobe University, Japan, e-mail: kikuchi@econ.kobe-u.ac.jp

1 Introduction

In the last decade the role of distribution sector in the global economy such as wholesale and retailing networks and storage has been widely discussed.[1] It is increasingly recognized that trade and transport services *within* the borders of trading countries impose international trade barriers.[2] According to this point, Rousslang and To (1993) point out that costs of domestic wholesaling and retailing services can act as natural trade barriers in the same manner as international transportation costs and estimate the barriers that such costs impose against U. S. imports.

Related to this, several studies emphasize the role of distribution costs as a determinant of trade patterns. Based on Ricardian trade setting, Bandyopadhay (1998) analyzes the effect of the distribution sector's technological progress on trade patterns. Also, based on Ricardian framework, Yano and Dei (2003) focus on the vertical production chain in which tradable middle products produced upstream and transformed into nontradable final consumption goods downstream: they show how the suppression of competition in one country's downstream sector affect trade patterns. Furthermore, based on "new economic geography" trade model, Martin and Rogers (1995) study the impact of improvement of the quality of local infrastructure. However, previous studies do note distinguish between "distribution costs for imported products" and "distribution costs for domestically produced products": an improvement in distribution's sector implies a *symmetric* reduction in transaction costs for both imports and domestically produced products. This assumption is justified for simplification. However, distribution sector's improvement often cause *asymmetric* reductions in transaction costs. These cases imply that imports require more domestic distribution services than locally produced products.[3] In other worlds, domestic distribution sector play a much greater role in insulating domestic producers from import competition than was previously recognized. This seems to suggest that the focus on an improvement in the quality of distribution sector should be accompanied by a focus on its "international trade barrier" nature.

[1] See, for example, Limao and Venables (2001) and World Bank (2004).

[2] See, for example, Wakasugi (2002).

[3] For example, since it take time to transport products from one country to another, wholesalers and retailers may have to maintain high inventory levels to ensure uninterrupted supply in the domestic market. Bandyopadhyay (1998) notes these possibilities.

To take this into consideration, in this study, we focus on the effect of an improvement in the distribution sector which is in favor of importing activities. The purpose of this study is to illustrate, with a simple two-country, two-good (homogeneous good/differentiated high-tech products), two-factor (labor/capital) model, how a technological/regulational improvement in one country's distribution sector can affect firms' location decisions and the nature of the trading equilibrium.

Section 2 presents the model. Section 3 analyzes the impact of an improvement in the quality of distribution sector on industrial location.

2 The Model

Suppose that there are two country (Country 1 and Country 2), each with two factors (capital, K and labor, L) and two types of goods (a homogeneous good and a large variety of differentiated high-tech products).[4] Assume that the countries are identical in regard to tastes, size, and technology, but differ with respect distribution costs on differentiated high-tech products, to which we assume those costs as directly related to the quality of their distribution sectors.

Consumers have Cobb-Douglas preferences over both categories and spend fraction μ of their income on high-tech products. Country i's price index for high-tech products is represented by the Dixit-Stiglitz form:

$$P_i = \left[n_i (p_i)^{1-\sigma} + n_j (t_I t_i p_j)^{1-\sigma} \right]^{1/(1-\sigma)}, \quad \sigma > 1 \tag{1}$$

where σ is the degree of substitution among all products, p_i is the producer prices of high-tech products produced in Country i, and n_i is the number of varieties produced in Country i, respectively. Trade costs consists of two parts: t_I ($t_I > 1$) represents the 'iceberg' international trade costs, which is common for two countries. Domestic distribution costs t_i ($t_i > 1$) for the *imported* high-tech products are also in the form of 'iceberg costs' and country-specific. Note that, for simplicity, we assume that the distribution costs for domestically produced products are zero. This assumption intends to capture the situation that more of distribution services are needed when

[4]The model is a variant of Kikuchi (2005).

the producer and consumer are not in the same country.[5] We assume these domestic distribution costs t_i as directly related to the quality of Country i's distribution sector: changes in these costs represent changes in its quality. Importing one unit of high-tech product variety for Country 1, $t_I t_1$ units of products must be shipped from Country 2. Thus, the demands of consumers in Country i for a Country i (i.e., local) variety and a Country j (i.e., imported) variety are

$$c_{ii} = p_i^{-\sigma} P_i^{\sigma-1} \mu E_i, \tag{2}$$

$$c_{ij} = (t_I t_i p_i)^{-\sigma} P_i^{\sigma-1} \mu E_i, \tag{3}$$

where E_i is the total income in Country i.

The homogeneous good is produced with constant returns, using only labor as an input. Units are chosen so that one unit of labor produces one unit of output. As usual in new geography models, no transport costs exist for the homogeneous good, which serves to tie down the wage rate. Also assume that the parameters of the model are such that both countries produce the homogeneous good; thus, constant, identical wages for labor hold (hereafter set to unity).

The production of each variety of high-tech product requires one unit of capital to develop the product and β units of labor per unit of output. As in Martin and Rogers (1995) and Martin and Ottaviano (1999), one of the central assumptions is that the capital is firm specific, but it moves freely between countries: if a variety developed by Country 1's capital is produced in Country 2, the operating profits are repatriated to Country 1. Given a Dixit-Stiglitz specification with constant elasticity σ, each firm sets its price as $p_1 = p_2 = (\beta\sigma)/(\sigma - 1)$. By choice of units, one can set $\beta = (\sigma - 1)/\sigma$ to have

$$p_1 = p_2 = 1. \tag{4}$$

Given that one unit of capital is required to develop a variety, the payment for each unit of capital employed in Country i, r_i, must satisfy,

$$r_i = p_i x_i - \beta x_i = x_i/\sigma, \tag{5}$$

where x_i is the output of a representative firm in Country i. When capital mobility is unrestricted, the payment for capital will be equalized between

[5] Rousslang and To (1993) point this out.

countries, which implies that $r_1 = r_2$ and thus

$$x_1 = x_2. \tag{6}$$

3 Distribution Costs and Industrial Location

Now consider the firms' location decisions. The product market equilibrium in Country i requires that supply equals demand for each variety: $x_i = c_{ii} + t_I t_j c_{ji}$. Substituting (2), (3), and (4) into this condition and setting $\mu E_i = \mu(rK + L) = 1$ yields the following equilibrium condition:

$$x_1 = \frac{1}{n_1 + \tau_I \tau_1 n_2} + \frac{\tau_I \tau_2}{\tau_I \tau_2 n_1 + n_2}, \tag{7}$$

$$x_2 = \frac{\tau_I \tau_1}{n_1 + \tau_I \tau_1 n_2} + \frac{1}{\tau_I \tau_2 n_1 + n_2}, \tag{8}$$

where $\tau_i \equiv t_i^{1-\sigma}$ $(\tau_i \leq 1)$ measures the freeness of domestic distribution for imports, which directly related to the quality of Country i's distribution sector. Also, $\tau_I \equiv t_I^{1-\sigma}$ $(\tau_I \leq 1)$ measures the freedom of international trade.

Using (5), (6) and (7), the equilibrium share of Country 1 firms, s_1 can be obtained:

$$s_1 \equiv \frac{n_1}{n_1 + n_2} = \frac{1}{2}\left[1 - \frac{\tau_I(\tau_1 - \tau_2)}{(1 - \tau_I \tau_1)(1 - \tau_I \tau_2)}\right], \quad (\partial s_1 / \partial \tau_1) < 0. \tag{9}$$

Equation (9) implies the surprising feature of distribution costs.

Proposition: *An improvement in the quality of distribution sector in a country will induce a diversion of high-tech products away from that country.*

Now, let us explain the impact of the improvement in the quality of Country 1's distribution sector (i.e., τ_1 increases) more precisely. This change induces two effects. First, it shifts demand curves for Country 1's varieties downward: a lower distribution costs implies an increase in the *effective* number of imported variety, $\tau_I \tau_1 n_2$, which leads to a fall in local demand for locally produced varieties in Country 1 (see equation (7)). Second, it shifts demand curves for Country 2's varieties upward: an easier access to Country 1 market increases the advantage of locating in Country 2 (see equation (8)).

The above two effects reinforce each other and induce high-tech firms' (i.e., capital) outwards flow from Country 1. It is also important to note that lower international trade costs (i.e., a higher τ_I) raise the magnitude of this outward flow.

This result has important policy implications for national economies. Improvements in one country's distribution sector can divert firms in high-tech industries over to another country. This lowers the incentive to improve the quality of distribution sector. Although a higher quality of distribution sector reduces import transaction costs, it also induces industrial diversion and might raises the transaction costs of receiving products from those industries that relocate elsewhere. The possibility that industries will be diverted provides some theoritical grounds for the coordination of investment for distribution sectors among national economies. Further research should focus on these policy implications.

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