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Economic integration in a Chamberlinian-Ricardian world

Abstract

Based on a many-industry Chamberlinian-Ricardian trade model with iceberg trade costs, this note examines the impact of two modes of economic integration: (1) a reduction in trade costs, and (2) technical standardization due to information spillover. It is shown that these two modes of economic integration have opposing effects on specialization patterns: while trade liberalization narrows the range of industries with intra-industry trade, technical standardization widens the same range.

Keywords: monopolistic competition, technical heterogeneity, trade costs, economic integration.
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Introduction

Two of the most important trends in the global economy in recent decades have been (1) the dramatic decrease in cross-border transaction costs such as transport and communication costs, and (2) the proliferation of economic integration through both multirateral and regional agreements[1]. Both reductions in transaction costs and economic integration have been associated with an increase in the flow of goods and technical information across national boundaries.

As a result of these changes, a vast literature on the impact of economic integration under various settings has been developed. Among several competing trade models, Chamberlinian monopolistic competition models have been extensively investigated since the groundbreaking work of Krugman (1979). To focus on the role of increasing returns and imperfect competition, many scholars adopt a standard one-factor monopolistic competition trade with cross-country technical homogeneity. In such a model, each firm in the monopolistically competitive sector incurs an identical fixed labor requirement and a constant marginal labor requirement. As a result, there has been little investigation into the impact of economic integration under technical heterogeneity among countries[2].

However, Ricardian comparative advantage, which plays a basic role in the traditional international-trade context, is worthy of more attention. To address this point, Kikuchi et al. (2008) explore cross-country technical heterogeneity in both fixed and variable labor requirements as a determinant of trade patterns. Within a two-country, many-industry framework, they show that the extent of cross-country technical heterogeneity among industries plays an important role as a determinant of intra-industry trade (i.e., two-way trade of differentiated products). However, they assume away trade costs, and the impact of deeper economic integration is downplayed in the analysis.

The present note takes the work of Kikuchi et al. (2008) as its point of departure, and extends their analysis to include iceberg trade costs. In each industry, the fixed labor requirement can differ between countries. These differences generate comparative advantage in the sense that the range of export industries is determined endogenously[3]. Based on this model, I will examine the impact of two modes of economic integration: (1) a reduction in iceberg trade costs, and (2) technical standardization (i.e., narrowing technical heterogeneity between countries) due to information spillover. It will be shown that these two modes of economic integration have contrasting influences on specialization patterns: while trade liberalization narrows the range of industries with intra-industry trade, technical standardization results in a widening of the same range.

This note is organized as follows: Section 1 sets up the model of monopolistic competition. Section 2 examines the impact of trade liberalization. The last section concludes the paper.

1. The model

Suppose there are two countries in the world, Home and Foreign. Each country is endowed with L units of labor and the only source of income is the wage, w $(\tilde{w})$. There is a continuum of Dixit-Stiglitz monopolistically competitive industries indexed by $i \in [0,1]$. Consumers have Cobb-Douglas preferences and spend equal amounts on the output of all industries. The quantity index of industry i takes the form:

[1] Another important aspect of the global economy is the emergence of international production sharing (or fragmentation). See, for example, Jones and Kierkowski (1990), Sim (2004), and Long et al. (2005).

[2] Venables (1987) explores the influence of cross-country technical heterogeneity on trade patterns. However, his results are dependent on the asymmetric preferences among countries. Introducing *within industry* technical heterogeneity into the two-good model of economic geography, Forslid and Wooton (2003) examine the impact of trade liberalization on location of production.

[3] In what follows, I use the terms "technical heterogeneity" and "comparative advantage" interchangeably.

$$X(i) = \left(\sum_{k=1}^{n(i)} (d(i)_k)^{(\sigma-1)/\sigma} + \sum_{\tilde{k}=1}^{\tilde{n}(i)} (d(i)_{\tilde{k}})^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}, \sigma > 1 \quad (1)$$

where $n(i)$ ($\tilde{n}(i)$) is the number of products produced in industry i in Home (Foreign), $d(i)_k$ ($d(i)_{\tilde{k}}$) is the quantity of product k ($\tilde{k}$) in the Home market, and $\sigma > 1$ is the elasticity of substitution between every pair of products.

Trade between countries is costly. We assume that, for every t units shipped, only one unit arrives. Thus, the price of importing a differentiated product for Home consumers will be $t\tilde{p}(i)_{\tilde{k}}$, where $\tilde{p}(i)_{\tilde{k}}$ is the producer's price for the $\tilde{k}$ th Foreign product in industry i. The price index of industry i can be obtained as:

$$P(i) = \left(\sum_{k=1}^{n(i)} (p(i)_k)^{1-\sigma} + \sum_{\tilde{k}=1}^{\tilde{n}(i)} (t\tilde{p}(i)_{\tilde{k}})^{1-\sigma} \right)^{1/(1-\sigma)}, \quad (2)$$

where $p(i)_k$ ($\tilde{p}(i)_{\tilde{k}}$) is the price of the k ($\tilde{k}$)-th differentiated product produced by industry i in Home (Foreign). Home consumers' demand for a Home industry i variety and a Foreign industry i variety are:

$$d(i)_k = (p(i)_k)^{-\sigma} (P(i))^{\sigma-1} E(i), \quad (3)$$

$$d(i)_{\tilde{k}} = (t\tilde{p}(i)_{\tilde{k}})^{-\sigma} (P(i))^{\sigma-1} E(i), \quad (4)$$

where $E(i)$ is the expenditure level for industry i varieties ($\int_{i=0}^{1} E(i)di = wL$).

Now turn to the cost structure of firms. In each industry in a country, technology is identical among firms. To produce $x(i)$ units of products, $\alpha(i) + \beta x(i)$ units of labor are required. While the marginal labor requirement β is identical among industries, the fixed labor requirement $\alpha(i)$ differs among industries. I allow that for cross-country technical heterogeneity in fixed labor requirements. I also assume that industries can be ranked unambiguously in terms of their fixed labor requirements. In this note I concentrate on one convenient special case in which the fixed labor requirements in both country vary linearly with i. The fixed labor requirements can be written as follows:

$$\alpha(i) = (\alpha + \gamma) + (1 - 2\gamma)i, \quad (5)$$

$$\tilde{\alpha}(i) = (\alpha + 1 - \gamma) - (1 - 2\gamma)i \qquad 0 \le \gamma \le 1/2. \quad (6)$$

Figure 1 illustrates these relationships.

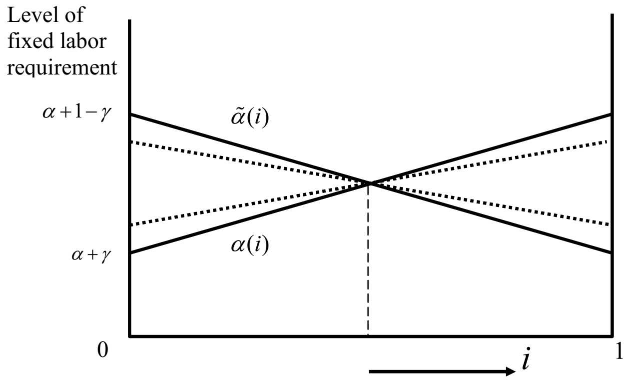

Fig. 1. Home and Foreign technology distribution

I concentrate on the case of "symmetric comparative advantage"[1]. Parameter γ measures the degree of technical standardization: an increase in γ corresponds to the case in which technology becomes more standardized, which is depicted as a movement from the solid lines to the dotted lines in Figure 1.

With the number of firms being very large, the elasticity of demand for each product becomes σ. Thus, each product is priced at a markup over marginal cost:[2]

$$p(i) = \frac{\sigma\beta\omega}{\sigma - 1}, \quad (7)$$

$$\tilde{p}(i) = \frac{\sigma\beta\tilde{\omega}}{\sigma - 1}. \quad (8)$$

I chose units so that $\beta = (\sigma - 1)/\sigma$, which implies that $p(i) = w$ and $\tilde{p}(i) = \tilde{w}$. Free entry ensures that the equilibrium output per firm is constant, but differs across countries, and independent of the level of trade costs:

$$x(i) = \alpha(i)\sigma, \quad (9)$$

$$\tilde{x}(i) = \tilde{\alpha}(i)\sigma. \quad (10)$$

The production technologies are mirror images of each other. By virtue of market symmetry, factor prices will be equalized among countries: $w = \tilde{w}$. I chose this equalized wage rate as unity.

Product market equilibrium requires that supply equals demand for each product: $x(i) = d(i) + t\tilde{d}(i)$. By substituting (3), (4), and (9) into this equilibrium condition and denoting $\tau \equiv t^{1-\sigma}$ ($0 \le \tau \le 1$) yields the following equilibrium condition for a Home product and its Foreign counterpart in industry i:

[1] Based on a general oligopolistic equilibrium model, Neary (2003) also explores the case of symmetric comparative advantage.

[2] Hereafter, the subscript k is dropped for simplicity.

$$\alpha(i)\sigma = \left[\left(\frac{1}{n(i)+\tau\tilde{n}(i)}\right)+\left(\frac{\tau}{\tau n(i)+\tilde{n}(i)}\right)\right]L, \quad (11)$$

$$\tilde{\alpha}(i)\sigma = \left[\left(\frac{tau}{n(i)+\tau\tilde{n}(i)}\right)+\left(\frac{\tau}{\tau n(i)+\tilde{n}(i)}\right)\right]L. \quad (12)$$

Its solution is:

$$n(i) = \left[\left(\frac{1}{\sigma[\alpha(i)-\tau\tilde{\alpha}(i)]}\right)+\left(\frac{\tau}{\sigma[\tilde{\alpha}(i)+\tau\alpha(i)]}\right)\right]L, \quad (13)$$

$$\tilde{n}(i) = \left[\left(\frac{1}{\sigma[\tilde{\alpha}(i)-\tau\alpha(i)]}\right)+\left(\frac{\tau}{\sigma[\alpha(i)+\tau\tilde{\alpha}(i)]}\right)\right]L. \quad (14)$$

Let us suppose that the following condition is satisfied for industry i:

$$\tau < \min\left[\frac{\alpha(i)}{\tilde{\alpha}(i)}, \frac{\tilde{\alpha}(i)}{\alpha(i)}\right]. \quad (15)$$

Then all the denominators in (13) and (14) are positive. The difference in the number of firms in industry i is:

$$n(i)-\tilde{n}(i) = \frac{[\tilde{\alpha}(i)-\alpha(i)](1+\tau)^2}{\sigma[\alpha(i)-\tau\tilde{\alpha}(i)][\tilde{\alpha}(i)-\tau\alpha(i)]}L. \quad (16)$$

It is positive when $\tilde{\alpha}(i) > \alpha(i)$ and (15) are satisfied. This implies that the degree of specialization will depend on both the level of trade cost t, and the level of differences in the fixed labor requirement (or technical heterogeneity).

2. The impact of economic integration

By combining (15) and (16), we can obtain two cutoff points determining specialization patterns:

$\underline{i}$ $[\tau = \alpha(\underline{i}) / \tilde{\alpha}(\underline{i})]$,

$\bar{i}$ $[\tau = \tilde{\alpha}(\bar{i}) / \alpha(\bar{i})]$.

Only Home will produce products for industries in the range $0 \le i \le \underline{i}$, while only Foreign firms are active in industries in the range $\bar{i} \le i \le 1$. Within the range of $\underline{i} < i < \bar{i}$, both countries' firms are active and intra-industry trade occurs between countries. In contrast to the findings in the previous literature, we found that intra-industry trade occurs in the middle range of industries.

2.1. Trade liberalization. Now we turn to the impact of trade liberalization, which is captured by a decrease in t (i.e., an increase in τ). The reduction of trade costs has two effects. First, trade liberalization intensifies import competition: a fall in t reduces the industry price index due to the extra firms competing for a share of a limited domestic market demand ((3)). This leads to a fall in domestic demand for domestically produced products in each country. The industry price indices fall more in less competitive industries (i.e., industries with a relatively high fixed labor requirement) since firms with larger fixed costs are exposed to more import competition than firms with lower fixed costs ((16)). Second, trade liberalization makes it easier to gain access to the export market: a fall in t leads to an increase in exports to each country. The relative strength of the two effects determines equilibrium trade patterns: the import competition effect dominates since sales in the domestic market are more significant than exports in the presence of positive trade costs. Firms with relatively high fixed costs find the gain in exports does not offset the sales lost in the domestic market so the amount of output they can sell is insufficient to cover (higher) fixed costs and this leads to the exit of some firms in the sectors with a comparative disadvantage. The reverse is true for the firms with relatively low fixed costs, so there is entry in the sectors that enjoy a comparative advantage.

Summarizing these changes, the difference in the number of firms becomes larger (see (16)): trade liberalization induces international specialization due to comparative advantage (i.e., technical heterogeneity). Furthermore, due to liberalization, Foreign (resp. Home) firms will be wiped out in sectors around $\underline{i}$ (resp. $\bar{i}$): the range of sectors with intra-industry trade will become narrower (see Figure 2).

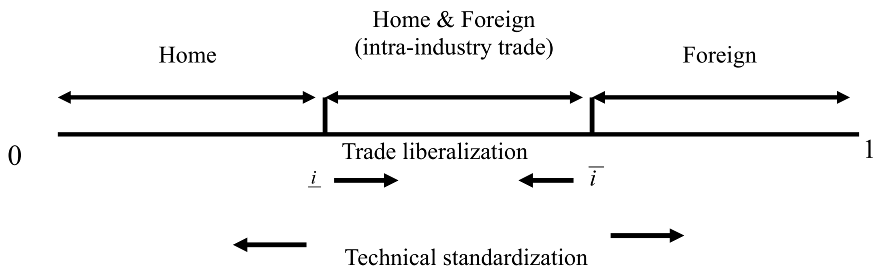

Fig. 2. Economic integration and equilibrium specialization patterns

Proposition 1: Due to trade liberalization, specialization resulting from technical heterogeneity is enhanced and the range of sectors with intra-industry trade becomes narrower.

2.2. Technical standardization. Next, let us consider the effect of increasing information flows across countries and a consequent standardization in production technology. The effect of technical standardization is captured by an increase in γ[1]. From (5), (6) and Figure 1, increases in γ imply less technical heterogeneity among countries. Then, at some marginal industries around $i > \overline{i}$ ($i < \underline{i}$), Home (Foreign) firms begin to produce and export. Thus, this change causes the range of industries with intra-industry trade to widen (see Figure 2).

Proposition 2: Due to technical standardization, the range of sectors with intra-industry trade becomes wider.

Concluding remarks

Based on a many-industry monopolistic competition trade model with iceberg trade costs, this note discusses the impact of two modes of economic integration: (1) a reduction in trade costs, and (2) technical standardization due to information spillover. It has been shown that these two modes of economic integration have contrasting effects on specialization patterns: while trade liberalization narrows the range of industries with intra-industry trade, technical standardization results in the widening of that range. These results cannot be obtained under the assumption that both two-goods and technical homogeneity. This implies that it is important to extend the standard model of monopolistic competition to include both technical heterogeneity and many sectors.

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[1] In the literature on endogenous growth, it is often assumed that closer economic integration can be achieved by increasing trade in goods or increasing the flow of ideas across countries. See, for example, Rivera-Batiz and Romer (1991).