International Outsourcing, Monopolistic Competition, and Welfare

Chu Ping Lo[*]

Abstract

In this paper, I present a simple North-South model to show that international outsourcing trade, on one hand, decreases product varieties (generated by the South) but increases product varieties (generated by the North) on the other hand. However, the latter dominates the former. As a result, in a world of a mixture of intra-industry and international outsourcing trade, welfare improves with an increase in real wage rates and total product varieties available to consumers. Furthermore, this model also implies that the South's technology catch-up is a driving force for welfare improvement, leading to a greater diversity of consumption and a higher real wage in both the North and South.

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I. Introduction

In recent decades, a new pattern of trade has emerged that revolves around international outsourcing activities. As is well known, innovations in transportation and communication technology have lowered the cost of searching outsourcing partners, and computers and the Internet have facilitated business-to-business matching and reduced the cost of customizing components (Grossman and Helpman, 2005). As a result, international outsourcing activities are encouraged by the improvements in technology, such that many enterprises relocate labor-intensive manufacturing processes to the low-wage regions, while conducting headquarters-service-intensive operations in domestic areas. Grossman and Helpman (2005) simulate their North-South model and find that the general welfare of the North may increase with the outsourcing shift.

In particular, Hummels et al. (2001), using the Input-Output tables for OECD as well as some emerging market countries, documented that international outsourcing accounted for approximately 30% of world exports, growing by more than 30% between 1970 and 1990. The international outsourcing trade, as argued by Feenstra and Hanson (1995), has given a rise to a consequent concentration of production in more skilled labor-intensive activities, leading to a larger skill premium in the countries involved. While the skilled labor benefits from a greater real wage, the unskilled labor may also increase its real wage if the outsourcing activities are not substantial. That is, all of the labor may gain by receiving a higher real wage as the result of an increase in international outsourcing trade.

In recent years, incomplete contracts have been emphasized in terms of international

outsourcing trade between the North and South. In the models of Grossman and Helpman (2002), Antra`s (2003), Antra`s and Helpman (2003) and Antra`s (2005), all present a North-South model of international trade in which differentiated products are developed only in the North. However, it has been well documented that product varieties follow an upward progression on quality ladders, and the innovative varieties are first invented in the North while the mature varieties are produced by the South (e.g., see Vernon, 1966; Grossman and Helpman, 1991).

While it is well known that intra-industry trade improves the welfare of consumers through an increase in the diversity of consumption and higher real wages (Krugman, 1979; Grossman and Helpman, 1991), would the diversity of consumption, then, also increase with international outsourcing trade? Would it still be welfare-improving, if the North exports innovative varieties to the South to exchange for mature varieties (i.e., intra-industry trade) while the North carries out international outsourcing activities to the South (i.e., international outsourcing trade)? This is an issue that, to my understanding, has not been addressed in the trade literature. Therefore, I will present a simple model that incorporates the elements of scale economies, product differentiation, and Chamberlinian monopolistic competition into an international outsourcing trade model, which could be used to demonstrate how the welfare of a nation changes with international outsourcing.

2. The Model

In a world of North and South, there is one industry consists of an array of product varieties that are differentiated by their maturity, as represented by maturity index z and $z \in (0,1)$. A variety with a smaller z is considered to be mature while one with a large z is regarded as immature. The mature products are located in both the North and the South, while the immature products are only located in the North because of technology gaps (which I will address in greater detail later). All of the potential products produced by these firms enter symmetrically into demand. Assume that all consumers share the same utility function,

$$U = \sum_i c_i^\theta \qquad (1)$$

where $0 < \theta < 1$ and c_i is the consumption of the ith good.

Labor is the only production factor in this model. Each firm produces one variety of differentiated good by combining the headquarters services and manufacturing components, so that labor requirement for good z in the North is

$$l = \alpha + x(z) \tag{2}$$

where α represents the amount of labor required to provide the headquarters service and $x(z)$ represents the manufacturing component of the variety z in amount. For simplicity, here I assume that the labor requirement for producing one unit of manufacturing component is one in both the North and South. Assume further that each variety of final-good requires only one unit of manufacturing component as input, so that the $x(z)$ also represents the supply of final-good of variety z. Assume further that w denotes the wage of the North and w^* the South, and $w > w^*$.

The headquarters service cannot be outsourced. However, the manufacturing processes are allowed to be outsourced internationally if the associated product is sufficiently mature. With the wage gap, the Northern firms are likely to relocate the manufacturing processes to the South. However, many headquarters services, which are intangible and require proximity to the manufacturing process, render the provision of headquarters services to distant manufacturing locations infeasible because of the technology gap.[1] But the technology gap dissolves with standardization of the product. As a result, only the firms who produce the relative mature varieties find it beneficial to carry out their international outsourcing activities.

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[1] For example, some of the business services, such as telecommunications and broadcasting, are heavily regulated because of their economic importance and political sensitivity, to the extent that the access of service providers from abroad has still been largely hurdled (Garner, 2004).

In particular, those varieties along $[0, \hat{z}]$ are mature and the South is able to provide the associated headquarters services. Thus, the workers in the South are familiar with the associated tacit knowhow and are able to take over the manufacturing process. Then, the Northern firms that produce varieties along $[0, \hat{z}]$ find it feasible to relocate the manufacturing process to the South.

To the contrary, in applying the concept developed by Vermon (1966), the immature varieties are quite unstandardized and usually confronted with a number of critical and transitory conditions. While these products are usually newly-invented, the workers in the South are not yet familiar with the associated tacit knowhow. It turns out that the need for a shift and effective communication between the headquarters services and manufacturing process is substantially high, to such an extent that separating the headquarters services and the manufacturing processes into different locations across national borders becomes infeasible. Therefore, in this paper, I assume that the technological barrier is infinite in the immature varieties while virtually nothing in the mature varieties.

For the immature varieties along $[\hat{z}, 1]$, the profit function in the North is

$$\pi = p(z)x(z) - w(\alpha + x(z)) \tag{3}$$

where $p(z)$ is the price of good $z \in [\hat{z}, 1]$. Profit maximization leads to the optimal price and output:

$$p = \frac{w}{\theta} \text{ and } x = \frac{\alpha\theta}{1-\theta}, \ \forall z \in [\hat{z}, 1] \tag{4}$$

International outsourcing activities take place in the mature varieties along $[0, \hat{z}]$, wherein the profit function is

$$\hat{\pi} = \hat{p}(z)\hat{x}(z) - w\alpha - w^*\hat{x}(z) \tag{5}$$

where $\hat{p}(z)$ is the price of goods when $z \in [0, \hat{z}]$. The profit maximization leads to the optimal price and output as

$$\hat{p} = \frac{w^*}{\theta} \quad \text{and} \quad \hat{x} = \frac{\alpha\theta}{(1-\theta)} \frac{w}{w^*}, \quad \forall z \in [0, \hat{z}] \tag{6}$$

Let L be the total labor supply in the North, and with Eq. (3), full employment implies

$$L = \frac{\alpha}{1-\theta} n + \alpha \hat{n} \tag{7}$$

where n denotes the number of product varieties that are completely produced in the North while $\hat{n}$ denotes the varieties co-produced when carrying out international outsourcing, where $\hat{n}(z=0) = 0$ and $\hat{n}(z=1) = L/\alpha$. Obviously, the more international outsourcing activities the North carries out, the more product varieties are generated, but at a decreasing rate. Therefore, we have $\hat{n}'(z) > 0$ and $\hat{n}''(z) < 0$.

Differentiating (7) with z, we obtain $n'(z) = (\theta - 1)\hat{n}'(z)$, which implies $n'(z) < 0$. That is, the number of product varieties of pure Northern lineage is crowded out by the international outsourcing activities. The total number of product varieties provided by the North is then given by $n + \hat{n}$. It is easy to determine that $n'(z) + \hat{n}'(z) = \theta\hat{n}'(z) > 0$, implying that the number of product varieties in the North increases with international outsourcing activities.

In (5), the real wage for the products that cannot be outsourced remains unchanged as $\frac{w}{p} = \theta$. However, in (6), the real wage for the outsourced product is $\frac{w}{\hat{p}} = \theta \frac{w}{w^*} > \theta$. That is, the consumers in the North are better off with a higher real wage in terms of those outsourced products.

Intra-industry trade takes place among the mature varieties along $z \in [0, \hat{z}]$, where the firms in the South can set up their own headquarters services to differentiate products. However, the South cannot carry out any international outsourcing activity since the wage rate

in the North is higher than that in the South. Again, assume symmetry among the differentiated products provided by the South; thus, the profit function of the Southern firms is

$$\pi^* = p^* x^* - w^* (\alpha^* + x^*) \tag{8}$$

where p^* is the price of good x^*. Note that in (8), it takes α^* amount of workers in the South to set up the headquarters service in order to produce one mature variety of differentiated good. It is reasonable to argue that $\alpha w \leq \alpha^* w^*$, which indicates that the North is more competitive in generating the differentiated goods than the South. That is, while the labor requirement for producing one unit of manufacturing component is one in both the North and South in presumption, to distinguish the capability between the North and South, I assume that it demands more workers in the South than the North to generate the differentiate products. Furthermore, for the innovative varieties, it would take the amount of workers in the South that is substantially large, as $\alpha^* \gg \dfrac{\alpha w}{w^*}$, to set up the headquarters services. This is a feasible assumption, while the South usually is not endowed with advanced technology to develop innovative products. With this restriction, the South would only engage in the mature varieties. In other words, the increase in international outsourcing indicates increased ability within the South to produce previously immature goods.

With (2), profit maximization leads to the optimal price and output as

$$p^* = \frac{w^*}{\theta} \quad \text{and} \quad x^* = \frac{\alpha^* \theta}{(1-\theta)} \tag{9}$$

The real wage of the South in terms of its domestic product is given by $\dfrac{w^*}{p^*} = \theta$, while that for the North's product along $[\bar{z}, 1]$ is $\dfrac{w^*}{p} = \theta \dfrac{w^*}{w} < \theta$. They remain unchanged with international outsourcing. However, the real wage of the South for the outsourced products

increases to $\dfrac{w^*}{\hat{p}} = \theta$, which is larger than $\dfrac{w^*}{p} = \dfrac{\theta w^*}{w}$. Obviously, as in the North, the consumers in the South are also better off with a higher real wage for the outsourced products.

Let L^* be the total labor supply in the South, with (6) and (9), we obtain

$$L^* = \frac{\alpha^*}{1-\theta} n^* + \hat{n}\frac{\alpha\theta}{(1-\theta)}\frac{w}{w^*}$$

The number of varieties provided by the South is then given by

$$n^* = \frac{(1-\theta)L^*}{\alpha^*} - \hat{n}\theta\frac{\alpha}{\alpha^*}\frac{w}{w^*} \qquad (10)$$

where the second term is related to engagement in outsourcing activities. In contrast to the North, the number of product varieties provided by the South is decreasing with international outsourcing because $n^{*\prime} = -\hat{n}'(z)\theta\dfrac{\alpha}{\alpha^*}\dfrac{w}{w^*} < 0$.

With regard to the above, we already know that all consumers in both economies are better off with a higher real wage for the outsourced products along $[0, \bar{z}]$. In the following, we discuss how the diversity of consumption changes with international outsourcing:

Case 1: The South specializes in manufacturing process

If the South is a small economy such that $L^* \le \hat{n}\dfrac{\alpha\theta}{1-\theta}(\dfrac{w}{w^*})^2$, we have $n^* = 0$. At this time, the South specializes in the manufacturing process, and the total number of product varieties increases with international outsourcing as $n'(z) + \hat{n}'(z) = \theta\hat{n}'(z) > 0$. That is, the diversity of consumption always increases with international outsourcing. Note that in this case, it implies a cutoff $\hat{z}$ such that $\hat{n}(\hat{z}) \equiv L^*\left[\dfrac{\alpha\theta}{1-\theta}(\dfrac{w}{w^*})^2\right]^{-1}$. Given an outsourcing index, if the

labor supply in the South is relatively small as $L^* \leq \hat{n} \frac{\alpha\theta}{1-\theta}(\frac{w}{w^*})^2$, the South would specialize in international outsourcing activities. The intuition is simple. In this paper, the labor requirement for producing one unit of manufacturing component is one in both the North and South while the latter requires much more labor to generate new varieties. This implies that the South is relatively comparative in producing the manufacturing inputs compared to generating now varieties. With restricted labor resources, the South should allocate more of its labor resource in manufacturing activities than in innovation.

Case 2: Intra-industry and international outsourcing trade coexist

If being sufficient large, the South engages in both the manufacturing process and headquarters services as well. As in (7) and (10), the number of total product varieties is $n + \hat{n} + n^*$. Upon differentiating $n + \hat{n} + n^*$ with respect to z, we obtain $n' + \hat{n}' + n^{*'} = \theta(1 - \frac{\alpha}{\alpha^*}\frac{w}{w^*})\hat{n}'(z) \geq 0$. It is interesting that the total number of varieties in the world is not decreasing with international outsourcing trade in a world with a mixture of intra-industry and international outsourcing trade. Furthermore, as mentioned above, $\hat{n}'(z) > 0$ and $\hat{n}''(z) < 0$ imply that, in this case, there exists an optimal $1 \geq z^* \geq 0$ to maximize product varieties such that $\hat{n}'(z^*) = 0$. Note that the $\hat{n}$ denotes the varieties that are generated when carrying out international outsourcing. This implies that there exists an optimal level of outsourcing $z^* \in (0,1)$, such that intra-industry and international outsourcing trade coexist and no countries specialize.

Case 3: The North specializes in headquarters services ($z^* = 1$)

From the above analysis, if $z^* = 0$, there are no international outsourcing at all in the world, and then we return to the Krugman's pure intra-industry trade model. However, if it happens that $z^* = 1$, it shows that the North specializes in headquarter services as the following.

Rewrite (7) as $L = \alpha\hat{n}$ when $n = 0$. Plug $L = \alpha\hat{n}$ into (10), we obtain

$n^* = \dfrac{(1-\theta)L^*}{\alpha^*} - \dfrac{L\theta}{\alpha^*}\dfrac{w}{w^*}$. The number of total product varieties in the world becomes

$\hat{n} + n^* = \dfrac{(1-\theta)L^*}{\alpha^*} - \dfrac{L}{\alpha^*}(\theta\dfrac{w}{w^*}-1)$, which leaves no room for further outsourcing because of

$z=1$. It is easily observed from above equations that a reducing wage gap between the South

and North (i.e., a smaller $\dfrac{w}{w^*}$) is welfare improving for not only the South but also the North

in terms of greater diversity of consumption and a higher real wage of outsourced goods as in

Cases 2 and 3. It is also true for Case 1 because of a higher real wage of outsourced goods.

2. Conclusions

I have presented a simple model to show that the international outsourcing trade on one hand decreases the product varieties (generated by the South) but increases the product varieties (generated by the North) on the other hand, and the latter dominates the former. As a result, in a world with a mixture of intra-industry and international outsourcing trade, welfare improves with an increase in real wage rates and total product varieties available to consumers.

Furthermore, while international outsourcing encourages the North to generate more immature varieties and the South to scale down the mature varieties, the basket of consumers is upgraded in terms of quality. Therefore, in a real world with non-homothetic preferences, this model implies that the international outsourcing is always welfare improving with respect to a concern for variety.

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國際代工，壟斷性競爭和福利

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摘　要

　　本文建立一簡單的南國—北國貿易模型，在此模型中，當產業內貿易和代工貿易共存時，代工貿易的增加雖則降低了產品價格因而提高了勞工的實質工資，卻減少了消費者的產品多樣性 (南國所生產)。然而，這並不必須表示消費者的福利因代工貿易而減少，因為北國所生產的產品多樣性會因代工南國而增加。結果，消費者的總產品多樣性淨增加。特別的是，南國在技術上超趕北國而導致的代工貿易的增加，會使得二國消費者的福利都增加：因其一方面使南國和北國勞工的實質工資都提高，另一方面也增加了消費者的產品多樣性。

關鍵詞：國際代工貿易、產品多樣性、福利
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