

To Outsource or Not To Outsource in North-South Trade

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Abstract

This paper investigates outsourcing and foreign direct investment (FDI) decisions based on factor price differentials in North-South trade when the production is fragmented into two independent processes. It is shown that (a) when the Southern firm does not have the Northern firm-specific technology for a fragmentable process and capital is imperfectly (perfectly) mobile between countries, the Northern firm produces the final product by outsourcing the other fragmentable process from the South via FDI (either FDI or outsourcing to a Southern outsourcee); (b) when the Southern firm acquires the Northern firm-specific technology for the fragmentable process and capital is imperfectly (perfectly) mobile, only the Northern firm produces the final product by outsourcing the other process via FDI and drives out the Southern firm from the world market (both the Northern and Southern firms produce the final product); (c) in all the cases, outsourcing is unidirectional from the North to the South.

Keywords: outsourcing, north-south trade, foreign direct investment, fragmentable process

JEL Classification : F1, F2

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1 - Introduction

Today many industrial production activities in developed economies are being outsourced to firms in developing countries. While R&D activities may occur in developed countries, many production processes are outsourced to China and India to take advantage of lower manufacturing costs. As Abraham Lincoln (1863) once said, “Government of the people, by the people and for the people shall not perish from the earth,” but the product of the people, by the people and for the people of a single nation may “perish” in a world bent on globalization. For instance, an electronic dictionary may be designed by Japanese firms for the Japanese people, but the entire product may be produced in China where the labor cost is lower.

Outsourcing is by no means a recent invention. Philip II of Macedon hired a Greek philosopher to tutor his son, who eventually conquered most of the Middle East then known to Europeans. Rome outsourced military operations to hired mercenaries. (Saunders, 1963) In 53 BC, Julius Caesar employed Teutonic mercenaries to carry out his conquest of Gaul, eventually subduing Vercingetorix. By the time of Constantine the Great, the majority of the Roman troops were mercenaries.

The literature on “international outsourcing” or “offshoring” (a consensus on the standard terminology has yet to emerge) has risen sharply over the past few years. In the large and still growing body of literature, several sources have made noteworthy contributions to the present study. Chao and Yu (1993) divided outsourcing or fragmentation of an industry into two stages. Utilizing a model in which there is an industry producing an intermediate good using primary inputs in the first stage and a final good in the second stage, they analyzed the welfare effects of domestic content protection which limits outsourcing. Feenstra (1998) compared several different measures of foreign outsourcing, and considered the implications of globalization for employment and wages for low-skilled workers, and for trade and regulatory policy, such as labor standards. Bhagwati, Panagariya and Srinivasan (2004) defined outsourcing as the services trade conducted principally via electronic media such as the telephone, fax and the Internet – the so called Mode 1 services in the World Trade Organization (WTO) terminology, and demonstrated that offshore outsourcing of Mode 1 service raises no new analytical issues, contrary to popular fears. Helpman, Melitz and Yeaple (2004) developed a model of international trade and investment in which firms can choose to serve their domestic market, to export or engage in

foreign direct investment (FDI), and showed that with-in sectoral heterogeneity of the firms plays an important role in the structure of foreign trade and investment. Kohler (2004a) developed a two-factor model with a dual representation of the technology of international fragmentation for an industry, and investigated the role of outsourcing in the adjustment to a decline in the final output price of the multistage industry and the attendant factor price effect. Kohler (2004b) introduced a specific-factors framework to show efficiency and distributional implications of international fragmentation which is driven by a low foreign wage rate. Long (2005) considered incomplete or partial outsourcing based on cheap foreign labor. He showed that due to the training cost needed to maintain quality, the head office may retain some production activity at home and outsource the rest. Görg and Hanley (2005) found some evidence of partial outsourcing in the Irish electric industry. Grossman and Rossi-Hansberg (2006) proposed a conceptualization of the global production process that focuses on tradable tasks to explore how falling costs of offshoring affect factor prices in the source country. Recently, Choi (2007) demonstrated conditions for partial outsourcing under price uncertainty.³

The purpose of this paper is to investigate intra-industry outsourcing and FDI decisions of regional firms in North-South trade when the production activity can be fragmented into two or more independent processes. Since technology and factor endowment are two major determinants of international patterns of production, we construct a model in which (i) the North is abundant in capital but scarce in labor relative to the South, and (ii) a Northern firm initially produces its final product by combining two fragmentable processes. One process can be outsourced and the other initially is not outsourced to the South due to its use of a Northern firm-specific technology. We utilize the model to analyze the role of factor price differentials arising from the differences in factor endowment and factor mobility between the countries, to investigate the Northern firm's outsourcing and FDI decisions. We then extend the model to the case where the Southern firm can produce the final product by learning the Northern firm-specific technology, and examine the international patterns of outsourcing and FDI.

³ For related papers on fragmentation, see Deardorff (2001), Jones and Kierzkowski (2001) and Zhao (2001). Bond (2001) used a specific factors model and delineated the conditions under which partial or full outsourcing is optimal.

In this paper Section 2 outlines the basic model and its assumptions. Section 3 assumes that the South does not have the Northern firm-specific technology, and compares the relative advantages of three alternative modes for the Northern firm to produce outputs of a fragmented process: in-house production, outsourcing to a Southern firm (i.e., outsourcee), and outsourcing via FDI to the South.⁴ Section 4 assumes that the Southern firm learns the Northern-firm-specific technology, and investigates outsourcing decisions for the Southern firm. Section 5 explores international patterns of outsourcing and trade. Finally, Section 6 offers concluding remarks.

2 - The model and its assumptions

Consider a monopoly firm in the North that produces its final output by combining two processes, 1 and 2. The production cost of each process is independent of the other process.⁵ This allows us to focus attention on one process at a time and consider whether each process should be outsourced to a foreign outsourcee or a foreign subsidiary which can be established by FDI. For example, automobile production activity can be fragmented into two processes such that the engine block is produced in the first process and the rest of the car body in the second. Under certain conditions, the Northern firm may outsource both processes and become a “hollow corporation.”⁶ For simplicity, assume that one unit of the final output requires one unit of the intermediate output from each of the two processes. Process i uses a_{Li} units

⁴ There is some confusion in the definition of the “outsourcer.” In this paper, the outsourcing firm is called the outsourcer, and the firm that provides the outsourcing service is called the outsourcee. For example, infertile would-be mothers who would rent the uteri of young mothers (outsourcees) in developing countries are outsourcers.

⁵ If the production cost of one process depends on another process, the division is not well defined. In this case, the two processes can be combined to form a single process.

⁶ An example is a “hollow” corporation that shifts its manufacturing base overseas or buys parts and intermediate products from abroad while maintaining its management base in the home country. For more about hollow corporations, see Truett and Truett (2001).

of labor and a_{ki} units of capital ($i = 1, 2$), and the integrated process uses $a_{L1} + a_{L2}$ units of labor and $a_{K1} + a_{K2}$ units of capital.⁷

The Northern firm must determine whether it is cheaper to produce the first process in-house, outsource it to a Southern outsourcee, or outsource it to its FDI subsidiary in the South. To find an optimal policy for the Northern firm, assume that the technology used for the second process is specific to the Northern firm, and hence no Southern firm can produce the second process and the final product. This assumption is relaxed in Section 4. Further, assume constant returns to scale (CRS) technologies to ensure constant unit cost, since decreasing or increasing costs can obscure the nature of outsourcing and FDI decisions based on factor price differentials.⁸

If production technologies are identical and factor prices are equalized between countries, there are no gains from outsourcing or FDI to replace in-house production of any process. Gains from outsourcing or FDI exist only if production technologies or factor prices are different between countries. In these cases, unit costs of a fragmentable process may or may not be more costly abroad. However, technologies are easily transferable between countries by multinational firms, and hence any technological gap can be bridged sooner or later. Thus, we assume that the Northern and the Southern producers have identical technologies capable of carrying out the first process. If production technologies are identical, outsourcing and FDI can occur only if factor prices are different between countries.⁹

As for the cause of factor price differentials, we adopt the conventional assumption that factors are less mobile between countries than within a country, and international factor price differentials exist because

⁷ The results in this paper are not materially affected as long as the Leontief production function, requiring a fixed ratio between the outputs of the two processes, is used.

⁸ Under non-constant returns to scale, trade and outsourcing can occur with identical technologies and identical factor prices between countries because unit cost of production changes with the level of output.

⁹ This assumption follows the tradition of the Heckscher-Ohlin model.

factors are not perfectly mobile between countries.¹⁰ Since labor is internationally immobile without an agreement between governments, we assume that labor is an immobile input between countries. Compared with labor, however, capital is more mobile between countries, albeit less mobile between countries than within a country. In recent decades, due to increasing globalization brought about by improved transportation and communication technologies, capital has become increasingly more mobile between countries. Therefore, we initially assume that capital is an imperfectly mobile input between countries, and subsequently, the case of perfectly mobile capital is treated as a special case.

Since the firms are regional monopolists, we further assume that there is no factor price equalization resulting from free commodity trade. As is usual in the literature of economic development, we assume that the North is scarce in labor and abundant in capital (vice versa for the South), such that $w > w^*$ and $r < r^*$, where w and r respectively denote the Northern wage and rent, and the asterisk (*) indicates Southern variables.¹¹

The assumptions are summarized below:

- (1) The technology for the second process initially is specific to the Northern firm, and is not available to the South. However, both the North and the South have identical CRS technologies to produce the first process.
- (2) The North is abundant in capital but scarce in labor (vice versa for the South) such that $w > w^*$ and $r < r^*$. The factor price differentials exist due to the imperfect mobility of capital between the countries.
- (3) One unit of the integrated output requires one unit of output from each of the two processes, and the cost of one process is independent of the other.
- (4) There are no assembly or transportation costs.

¹⁰ For factor price differentials and factor mobility within a country and between countries, see Pugel and Lindert (2000).

¹¹ Unlike the model of comparative advantage, the present model is based on absolute advantage. Therefore, if factor prices (w and r) in a country are both higher or lower than those in the foreign country, only one country exports all traded goods to the other country.

3 - In-house production, outsourcing and FDI

3.1 In-house production versus outsourcing

Consider a monopoly firm in the North contemplating outsourcing of the first process. The second process is produced in-house due to its use of firm-specific technology (e.g., special entrepreneurial talents or engineering skills). Let $p(Z)$ denote the inverse world demand function for the firm's final output (Z), and $R(Z) = p(Z)Z$ the revenue function. Marginal revenue is denoted by $m = R'(Z) = p + Zp'(Z)$. Unit production cost of each process, $g_i(w, r, X_i)$, depends on factor prices and its output level (X_i), for $i = 1, 2$. However, under CRS technologies, the unit cost of each process is independent of output, i. e., $\partial g_i / \partial X_i = 0$, and hence can be denoted by $g_i(w, r)$. If produced in-house, unit production costs of the two processes are:

$$\begin{aligned} g_1(w, r) &= a_{L1}(w, r)w + a_{K1}(w, r)r, \\ g_2(w, r) &= a_{L2}(w, r)w + a_{K2}(w, r)r, \end{aligned} \tag{1}$$

where g_i is the firm's unit cost of integrated process i , and $\partial a_{Li} / \partial w < 0$, $\partial a_{Ki} / \partial w > 0$, $\partial a_{Li} / \partial r > 0$, and $\partial a_{Ki} / \partial r < 0$.

In the absence of uncertainty, the firm decides whether to integrate the two processes and produce the entire product in-house, or to outsource the first process. Let $X = X_1$ denote the number of the output of the first process (engine blocks) produced in-house, and Y the number of engine blocks outsourced to a foreign sourcee.

If the two processes are integrated in-house ($X = Z$), the firm's profit (π) is:

$$\pi = p(X)X - (g_1 + g_2)X, \tag{2}$$

where $g_2(w, r)$ is the in-house unit production cost of the second process. The first order condition for integrated production is:

$$m(X) - g_1(w, r) - g_2(w, r) = 0. \quad (3)$$

That is, the output of the vertically integrated firm is determined at a point where marginal revenue equals marginal cost, $g_1 + g_2$.

Consider the production and outsourcing decisions when the Northern firm outsources the first process to a Southern outsourcee and pays p_1^* per unit of the outsourced output. The outsourcer's problem is to choose X and Y to maximize the profit

$$\pi = p(Z)(X + Y) - g_1(w, r)X - p_1^*Y - g_2(w, r)(X + Y),$$

where Y is the number of the output of the first process outsourced from the South, and $Z = X + Y$.

There are three possible solutions. First, the firm produces nothing in-house ($X = 0$) and outsources the entire first process. Second, the firm outsources nothing ($Y = 0$) and produces the entire first stage output in-house. The firm then becomes an integrated producer and its profit function reduces to (2). Third, the firm may produce some output of the first process in-house and outsource the rest overseas ($X > 0, Y > 0$). To produce some output of the first process in the home country, the first order condition is:

$$m - g_1(w, r) - g_2(w, r) = 0, \quad (4)$$

which is the same condition as in (3) for the integrated production.

On the other hand, the first order condition for the firm to outsource some output of the first process ($Y > 0$) to a Southern outsourcee is:

$$m - p_1^* - g_2(w, r) = 0. \quad (5)$$

Assume that the Southern outsourcee sells its output of the first process to the Northern firm at cost (i.e., $p_1^* = a_{L1}^* w^* + a_{K1}^* r^*$). Then, it follows that:

$$Y = 0, \text{ if}$$

$$g_1 = a_{L1}(w, r)w + a_{K1}(w, r)r < a_{L1}^*(w^*, r^*)w^* + a_{K1}^*(w^*, r^*)r^* = p_1^*.$$

That is, outsourcing to a Southern outsourcee is inferior to in-house unit production.

On the other hand,

$$X = 0, \text{ if}$$

$$g_1 = a_{L1}(w, r)w + a_{K1}(w, r)r > a_{L1}^*(w^*, r^*)w^* + a_{K1}^*(w^*, r^*)r^* = p_1^*. \quad (6)$$

That is, if the unit outsourcing cost is less than the in-house unit production cost, the Northern firm has a cost disadvantage in the first process, and full outsourcing is superior to in-house production.

Finally, if $g_1(w, r) = p_1^*$, then the firm is indifferent between outsourcing and in-house production of the first process, and hence there is no need to fragment the production activity.¹²

In a special case where capital is perfectly mobile between the North and the South ($r = r^*$), the inequality in (6) holds true, and the Northern firm will find it more advantageous to outsource the entire first stage output to the South rather than to produce it in-house. With the identical capital rent in the North and South, the lower Southern wage by assumption 2 ($w^* < w$) necessarily entails a lower unit cost of production in the South (i.e., $\partial g_1 / \partial w > 0$). Thus, the following proposition can be stated:

Proposition 1: Under assumptions (1) - (4), the Northern firm may not choose full outsourcing to a Southern outsourcee over in-house production.

¹² In this case, partial outsourcing also is a feasible solution in a mathematical sense. However, for an integrated firm, there is no need to fragment the production activity.

In the presence of perfectly mobile capital between the countries ($r = r^*$), however, the Northern firm always chooses full outsourcing over in-house production.

We have singled out the first process and considered its outsourcing decision. However, it is evident that the same argument applies to any fragmented process where the production cost is independent of other processes. The acid test of outsourcing a process is whether the firm has a cost disadvantage in that process. The firm outsources any process whose in-house production cost is higher than its outsourcing cost. Moreover, it results in full outsourcing of that process as in Bond (2001).

3.2 Outsourcing versus foreign direct investment

If the unit outsourcing cost is less than the in-house unit production cost, the firm engages in full outsourcing of that process instead of producing some output in-house. However, the firm has a remaining option. Now consider the Northern firm's choice between outsourcing and FDI. That is, the Northern firm may outsource the first process to a Southern outsourcee or to its Southern subsidiary via FDI. However, FDI is required to establish a foreign subsidiary, and hence the FDI firm is simply a foreign production plant. Here, we investigate only intra-industry FDI as in Baldwin (2001), and assume that the Southern FDI subsidiary firm does not sell its output to other markets. That is, the FDI firm specializes only in the production of the first process and delivers the output to the Northern parent firm at cost.

The governments of many countries protect their capital markets from foreign market influence by using a variety of policy measures (such as fiscal, monetary, trade, and/or foreign exchange policies), and this reduces international capital mobility. Concomitantly, those governments attract foreign capital to promote economic development and growth of their countries. Meanwhile, private investment loans are directed mainly to domestic rather than foreign firms. Hence, we assume that each firm pays rent equal to the opportunity cost of using capital input to its national market such that the outsourcee in the South pays the Southern rent (r^*) for its use of capital, while the Southern FDI subsidiary of the Northern firm pays the Northern rent (r). Moreover, these capital inputs are transported between countries at zero cost.

Let Q denote the output produced by the FDI subsidiary using Northern capital and Southern labor inputs. Since the FDI subsidiary sells its output to the Northern firm at cost, the Northern firm's total profit in the presence of outsourcing and FDI is

$$\pi = p(Z)(Y + Q) - (p_1^*Y + g_1(w^*, r)Q) - g_2(w, r)(Y + Q), \quad (7)$$

where $Z = Y + Q$ is total output. The first order conditions are

$$m - p_1^* - g_2(w, r) \geq 0, \quad \text{for } Y > 0 \quad (8)$$

$$m - g_1(w^*, r) - g_2(w, r) \geq 0, \quad \text{for } Q > 0.$$

Recall that that the production technologies are identical in the Northern and Southern plants, $g_1(w, r) = g_1^*(w, r)$. Since $r < r^*$, and the outsourcee and the FDI firm pay the same Southern wage (w^*), we obtain

$$p_1^* = a_{L1}^*(w^*, r^*)w^* + a_{K1}^*(w^*, r^*)r^* > a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r = g_1(w^*, r). \quad (9)$$

That is, the FDI subsidiary has an absolute cost advantage over the outsourcee. The reason is that with the identical technology and the Southern wage, the lower rent for the FDI firm ($r < r^*$) necessarily entails a lower unit cost for the FDI firm than the Southern outsourcee (since $\partial g_i / \partial r > 0$).

In the presence of perfectly mobile capital ($r = r^*$), however, the unit costs of production for the FDI subsidiary and the Southern outsourcee become identical, and the cost advantage of the former over the latter disappears. Therefore, the Northern firm remains indifferent between FDI and outsourcing. These results are summarized in the following proposition:

Proposition 2: Under Assumptions (1) – (4), the Northern firm chooses FDI over outsourcing to a Southern outsourcee. In the presence of perfectly

mobile capital between the countries ($r = r^*$), however, the Northern firm is indifferent between FDI and outsourcing to a Southern outsourcee.

3.3 In-house production versus FDI

Under the plausible scenario where the South is abundant in labor but scarce in capital ($w > w^*, r < r^*$), the previous proposition shows that the Northern firm chooses FDI over outsourcing to a Southern outsourcee. Therefore, the option to outsource the first process to an independent Southern outsourcee can be eliminated safely. Still, we must consider in-house production versus FDI decisions.

Recalling that the FDI subsidiary pays the Northern rent (r) for its use of capital, the Northern parent firm's profit in the presence of in-house production and FDI can be written as:

$$\pi = p(Z)(X + Q) - (g_1(w, r)X + g_1(w^*, r)Q) - g_2(w, r)(X + Q), \quad (10)$$

where $Z = X + Q$ is total output. The first order conditions are:

$$m - g_1(w, r) - g_2(w, r) \geq 0, \quad \text{for } X > 0, \quad (11)$$

$$m - g_1(w^*, r) - g_2(w, r) \geq 0, \quad \text{for } Q > 0.$$

Note that $(m - g_2(w, r))$ is common to the two inequalities in (11). In other words, the marginal revenue and the second process production cost are irrelevant to in-house production and FDI decisions on the first process. This irrelevance stems from mutual independence of processing costs. Since the FDI firm in the South pays the Southern wage (w^*) and the Northern rent (r), we obtain

$$g_1(w^*, r) = a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r < a_{L1}(w, r)w + a_{K1}(w, r)r = g_1(w, r). \quad (12)$$

That is, unit production cost of the FDI firm is lower than that of in-house production, and hence FDI is superior to in-house production by the Northern

parent firm. This is because rents paid for in-house production and FDI production are identical, and the lower wage in the South ($w^* < w$) necessarily entails a lower unit production cost for the FDI subsidiary than the parent firm (since $\partial g_1 / \partial w > 0$). It is noteworthy that this superiority of FDI over in-house production continues to hold in the presence of perfectly mobile capital between the countries ($r = r^*$). Thus, the following proposition is immediately apparent.

Proposition 3: Under assumptions (1) – (4), the Northern firm chooses FDI over in-house production, and this result continues to be valid in the presence of perfectly mobile capital between the countries ($r = r^*$).

The Propositions (1) - (3) are shown graphically in Figure 1. In the presence of factor price differentials ($w > w^*, r < r^*$), the two unit value iso-cost lines for the first process in the two countries ($C_1 = C_1^* = 1$) intersect each other at point E. Since the wage-rental ratio is lower in the South, the unit iso-curve $C_1(w, r) = wL_1 + rK_1 = 1$ in the North is steeper than that of the South, $C_1^*(w^*, r^*) = w^*L_1^* + r^*K_1^* = 1$. If an isoquant, labeled X, is tangent to the Northern unit iso-cost curve at point B, to the right of E, outsourcing from the Southern outsourcee is more cost-effective than in-house production since more output can be produced by the outsourcee at the same cost represented by the two unit value iso-cost lines. Note that the output on isoquant Y (that is tangent to the Southern iso-cost curve at B') is greater than the output on isoquant X.

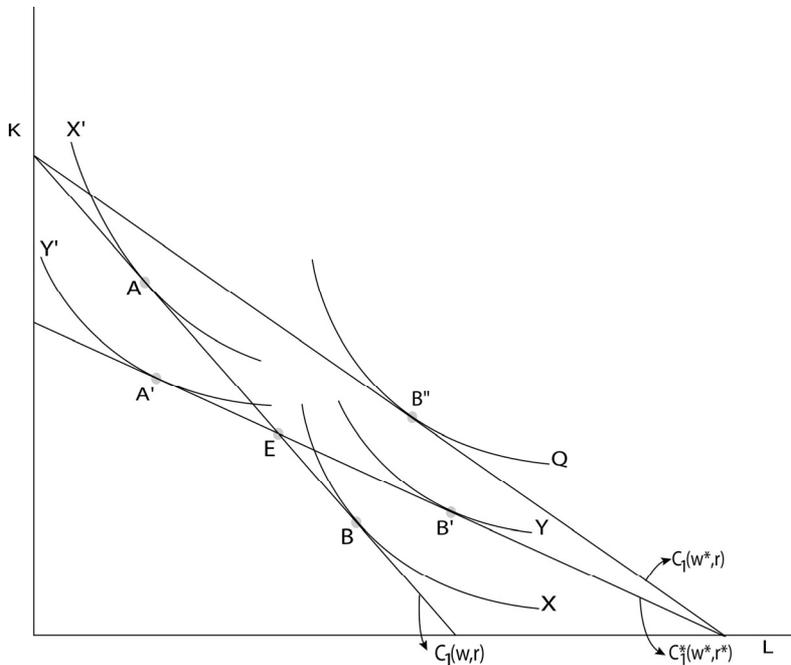
But if an isoquant, labeled X', is tangent to C_1 at point A, to the left of E, then the outsourcing cost is higher than in-house production cost because less output can be generated by the Southern outsourcee at the same cost, and hence no outsourcing occurs. In this case, the output on isoquant Y' (that is tangent to the Southern iso-cost curve at A') is lower than the output on isoquant X'. Further, noting that the capital-labor ratios at A and A' are higher than those at B and B', the cost reduction-effect of outsourcing (vis-à-vis in-house production) is greater when the outsourced product is more labor-intensive.

When the Northern firm outsources the first process to its FDI subsidiary in the South, the effective factor prices are w^* and r , and hence, the

unit value iso-cost line of the Northern firm shifts further to the right to become $C_1(w^*, r)$. Since the output on isoquant Q that is tangent to the iso-cost line $C_1(w^*, r)$ at B'' is greater than any output on the iso-cost lines, $C_1(w, r)$ and $C_1^*(w^*, r^*)$, FDI is necessarily superior both to in-house production and outsourcing to a Southern outsourcee.

Under perfect capital mobility ($r = r^*$), factor prices facing the Northern firm for both the cases of FDI and outsourcing to a Southern outsourcee are w^* and r , and hence the effective unit

Figure 1. Production costs under in-house production, outsourcing, and FDI



value iso-cost line for both the cases is $C_1(w^*, r)$. Therefore, the Northern firm is indifferent between FDI and outsourcing to a Southern firm. However, the output Q on the unit value iso-cost line $C_1(w^*, r)$ is greater than any output on the in-house unit value iso-cost line $C_1(w, r)$, and hence, for

the Northern firm, both FDI and outsourcing to a Southern firm are superior to in-house production.

4 - Optimal policy for the Southern firm

The two preceding sections assumed that the South lacks the Northern firm-specific technology, and considered why the Northern firm outsources the fragmentable first process to its FDI subsidiary in the South or to a Southern outsourcee. Now suppose that the Southern firm secures the Northern firm-specific technology for the second process, and can produce the second process and the entire final product for itself. Then, the Southern firm (as did the Northern firm) has to identify whether its optimal policy is to produce the first process in-house, or outsource it to a Northern outsourcee or to its FDI subsidiary in the North.

First, consider a Southern firm's decision to produce the first component in-house or to outsource it to a Northern outsourcee. Since both firms have access to the same technologies, $a_{ij}(w, r) = a_{ij}^*(w, r)$. The Southern firm's unit cost of in-house production is $g_1^* = a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^*$, and that of outsourcing is $p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r$.

In the presence of factor price differentials, $w > w^*$ and $r < r^*$ (due to imperfect capital mobility),

(i) if $p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r > a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* = g_1^*$, then no outsourcing occurs,

(ii) if $p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r < a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* = g_1^*$, then full outsourcing occurs, and

(iii) if $p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r = a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* = g_1^*$, then the Southern firm is indifferent between in-house production and outsourcing.

Thus, outsourcing to a Northern outsourcee may be inferior, superior or equivalent to in-house production. In the presence of perfectly mobile capital between the countries ($r = r^*$), we obtain

$$p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r > a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* = g_1^* .$$

Therefore, outsourcing is always inferior to in-house production, and hence, no outsourcing occurs. This is because the South has an advantage in labor cost.

Next, consider a Southern firm's decision to outsource the first process to a Northern firm or to its Northern FDI subsidiary. Note that the FDI subsidiary of the Southern firm pays the opportunity cost of using capital at the Southern rate, r^* . Thus, the unit cost of outsourcing is $p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r$, and that of FDI is $g_1^* = a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^*$. Since $w > w^*$ and $r < r^*$ (in the presence of imperfectly mobile capital),

$$p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r < a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^* = g_1^*.$$

That is, for the Southern firm, outsourcing to a Northern outsourcee is necessarily superior to FDI.

In the presence of perfectly mobile capital ($r = r^*$), however,

$$p_1 = a_{L1}(w, r)w + a_{K1}(w, r)r = a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^* = g_1^*.$$

Therefore, outsourcing and FDI are equivalent options to the Southern firm.

Finally, compare the firm's choice between in-house production and FDI. The Southern firm's unit cost of in-house production is $g_1^*(w^*, r^*) = a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^*$, and that of FDI is $g_1^*(w, r^*) = a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^*$. Since $w > w^*$ and $r < r^*$ (in the presence of imperfectly mobile capital),

$$\begin{aligned} g_1^*(w^*, r^*) &= a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* \\ &< a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^* = g_1^*(w, r^*). \end{aligned}$$

Therefore, in-house production is necessarily superior to FDI for the Southern firm.

It is notable that under perfectly mobile capital ($r = r^*$) between the countries,

in-house production continues to be superior to FDI for the Southern firm. These results are summarized in the following proposition:

Proposition 4: Under assumptions (1) - (4), if the Southern firm acquires the Northern firm-specific technology, either in-house production of the first process or outsourcing it to a Northern outsourcee can be the optimal policy over outsourcing it via FDI, but the ranking between the first two policies is indeterminate. In the presence of perfect mobility of capital between the countries, however, in-house production is superior to both FDI and outsourcing to a Northern outsourcee, and hence in-house production becomes the optimal policy for the Southern firm.

5 - International outsourcing and trade

If the Southern firm produces the final product, what will be the pattern of international outsourcing and trade? Specifically, can the Southern firm outsource the fragmentable first process to the North such that reciprocal outsourcing occurs? If a Southern firm enters the market previously dominated by a Northern firm, a duopoly market may emerge where world price depends on the outputs of two producers. However, in the present model of a homogenous product and constant average costs, regardless of the emerging market structure, the Southern firm makes in-house production and outsourcing decisions solely on the basis of the production costs relative to those of the Northern firm.

Recall that under imperfectly mobile capital where $w > w^*$ and $r < r^*$, the optimal policy for the Northern firm is FDI, while the optimal policy for the Southern firm can be either in-house production or outsourcing to its Northern outsourcee.

We first compare the unit cost of FDI by the Northern firm to its Southern subsidiary, $g_1^*(w^*, r) = a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r$, with that of in-house production by the Southern firm, $g_1^*(w^*, r^*) = a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^*$. In the presence of $w > w^*$ and $r < r^*$ (due to imperfectly mobile capital), we obtain

$$\begin{aligned} g_1^*(w^*, r) &= a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r \\ &< a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* = g_1^*(w^*, r^*). \end{aligned} \quad (13)$$

That is, the unit cost of FDI by the Northern firm is lower than that of in-house production by the Southern firm.

Next, compare the unit cost of FDI by the Northern firm, $g_1^*(w^*, r) = a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r$, with that of outsourcing to a Northern outsourcee by the Southern firm, $p_1 = a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^*$. With $w > w^*$ and $r < r^*$, we obtain

$$\begin{aligned} g_1^*(w^*, r) &= a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r \\ &< a_{L1}(w, r^*)w + a_{K1}(w, r^*)r^* = p_1. \end{aligned} \quad (14)$$

That is, the unit cost of FDI by the Northern firm is lower than that of the Southern firm's outsourcing to a Northern outsourcee.

From the results in (13) and (14), it is obvious that *the Northern firm's optimal FDI policy is superior to both the possible optimal policies of the Southern firm of in-house production and to outsourcing to a Northern outsourcee*. Therefore, if trade opens up between the two countries, the lower cost of the Northern output can effectively drive out the Southern output from the international markets. This implies that the Northern firm becomes an international monopolist that produces its final output by outsourcing the first process component to its FDI subsidiary in the South, and exports some of the output to the South. Meanwhile, in the South, no firm produces the final output, but the Northern FDI subsidiary in the South produces the first process component using Southern labor and sends it to the Northern parent firm. Therefore, *the patterns of outsourcing and export of the final good are both unidirectional from the North to the South*.

In the presence of perfectly mobile capital ($r = r^*$), the two optimal policies for the Northern firm (i.e., FDI to the South and outsourcing to a Southern outsourcee) yield the same unit production cost as that of the optimal policy for the Southern firm (i.e., in-house production) since

$$g_1^*(w^*, r) = a_{L1}(w^*, r)w^* + a_{K1}(w^*, r)r$$

$$= a_{L1}(w^*, r^*)w^* + a_{K1}(w^*, r^*)r^* = g_1^*(w^*, r^*).$$

In this case, the Northern firm produces its final output by outsourcing the first process to its FDI subsidiary or to a Southern outsourcee, and the Southern firm produces its final output via in-house production, but the pattern of trade for the final good depends on the demand conditions of the two countries. Therefore, outsourcing is unidirectional from the North to the South, while the direction of export of the final product is indeterminate.¹³

Proposition 5. In the presence of imperfectly mobile capital between the countries ($w > w^*$ and $r < r^*$), if free trade opens up, only the Northern firm produces the final product by outsourcing the fragmented process via FDI, and drives the Southern firm from the world market. Therefore, the South does not produce or export any final output, but only provides labor to the Northern FDI subsidiary in the South. In the presence of perfectly mobile capital, however, both the Northern and Southern firms produce the final product: the Northern firm outsources the fragmented process via FDI to the South and/or outsources to a Southern firm while the Southern firm produces the final product in-house.

This proposition suggests that regardless of capital mobility, the international pattern of outsourcing the fragmentable process is always unidirectional from the North to the South and that *reciprocal outsourcing* does not occur between the North and the South. While the direction of exports of the final product is always unidirectional from the North to the South under

¹³ To determine the exact pattern of trade in the presence of perfectly mobile capital, it becomes imperative to use an oligopoly model such as the Cournot model, in addition to specifying the domestic demand conditions of the two countries. While this subject is interesting, it is beyond the scope of this paper.

The present result that the southern firm would not choose to outsource stages of production to the North seems to be in contrast to the rising importance of “emerging market multinationals.” However, when we consider the fact that a majority of outsourcing from the South to the North (by emerging market multinationals) has a technological root, our result of unidirectional outsourcing from the North to the South (based on factor price differentials) can be comfortably reconciled with the phenomenon of emerging market multinationals. For an example, Chinese, Indian, and South Korean firms outsource a variety of parts and patented technologies from Japanese, European Union (E.U.), and U.S. firms, mainly for technological reasons (rather than for reasons of factor price differentials).

imperfectly mobile capital, it may be bidirectional under perfectly mobile capital.

6 - Conclusion

This paper investigates outsourcing and foreign direct investment (FDI) decisions in North-South trade when the production activity can be fragmented into independent processes. Several significant results emerged from the investigation. For example, assuming the North is abundant in labor but scarce in capital, if capital is imperfectly (perfectly) mobile between the countries, Northern firms outsource every fragmentable process from the South via FDI (via either FDI and/or outsourcing to a Southern outsourcee). If the Southern firm secures the technology that used to be specific to the Northern firm and capital is imperfectly mobile between the countries, only the Northern firm produces the final product by outsourcing the fragmentable processes via FDI to the South, and drives the Southern firm from the world market. In the presence of perfectly mobile capital, however, both the Northern and Southern firms produce the final good. In this case, while outsourcing is unidirectional from the North to the South, the export direction of the final good is indeterminate because in addition to the supply conditions, it also depends on the demand conditions of the two countries.

Our results can effectively explain the behavioral patterns of typical multinational firms that have emerged with globalization. For example, in the past when capital was less mobile and the Northern firms had more firm-specific technologies, Northern firms dominated the South in the production of many industrial outputs (such as apparel and textiles, automobiles, electronics, and machinery). In this case, the exports of the final goods are unidirectional from the North (e.g., United States, European Union and Japan) to the South (e.g., China, India, South Korea, Taiwan and Vietnam), and outsourcing of intermediate goods generally takes the form of FDI from the North to the South.

As capital has become more mobile, riding the recent tide of globalization, the Southern firms have steadily acquired the production know-how which used to be specific to the Northern firms and now produce the final goods in-house for themselves. Meanwhile the Northern firms, to take advantage of cheap labor in the South, continue to produce those goods by outsourcing the intermediate goods via FDI and/or outsourcing to Southern outsourcees. Therefore, intra-industry bidirectional trade of the final goods

became more common between the North and the South, but the pattern of outsourcing fragmented components generally remained unidirectional from the North to the South.

In the present model, when outsourcing or FDI occurs, the parent firm does not produce any fragmented process in-house. That is, when the South has cheap labor, no partial outsourcing or partial FDI occurs on the part of the Northern firm. However, such extreme decisions are likely to be moderated in the real world. In practice, there may be a high start-up cost for the foreign production stage, which would discourage FDI. In addition, the parent firm may operate under decreasing returns to scale (DRS), or bear risks when operating foreign production plants under conditions of uncertainty. Depending on the source of uncertainty and conditions that prevail in foreign countries, FDI may be riskier than in-house production or outsourcing. Uncertainty may stem from fluctuating exchange rates, unstable political conditions or varying factor prices. The recent literature identifies informational asymmetries and the incomplete contracts as central factors determining firms' choice between arms-length contracting and FDI (Helpman, 2006). These considerations (i.e., non-constant returns to scale, high entry costs, and uncertain foreign environment), albeit not treated in the present study, offer important subject topics for future research.

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