

Experience-Based Outsourcing:

East Asian Middlemen-Manufacturers in a Triadic Concord

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Abstract

The rapid expansion of China's trade owes much to the procurement of Western firms for home demand and the migration of industries from Taiwan and Hong Kong to China as sources for production. The catalytic participation of East Asian middlemen-manufacturers, pending their disintermediation, is like a moving front acculturating Chinese producers to world market conditions. Our paper focuses on this new phenomenon, based on a unique data source of Taiwanese exporting firms. It studies the features of export outsourcing, explores its theoretic landscape in a triadic framework, verifies its empirical significance, and sheds light on the world market in transition.

Keywords: China, East Asia, export outsourcing, FDI, globalization, middleman, triadic arrangement

JEL Classification: F02, F14, F23, L14, L23, M55

In the recent literature on international economics, two branches of studies merit special attention. On the theory side, the rise of the ‘New New Trade Theory’ focuses upon the heterogeneity among firms and identifies many of the factors responsible for the activities in outsourcing and foreign direct investment (Baldwin and Okubo, 2005). On the empirical side, the re-orientation of Asian trade and investment caused by the rapid Chinese growth (Eichengreen and Tong, 2005) takes on new significance, as foreign-invested companies play important and expanding roles in the Chinese economy. While there naturally appears much scope to apply this new tool to this emerging phenomenon of export outsourcing, on closer inspection, it seems that there is a need for further research to make such an application a reality. This paper seeks to play a useful role in this direction.

The growth of the economy of China, the world’s most populous nation, as it becomes the workshop of the world is breathtaking. It is only matched by the even more stunning gap in per capita income that separates China from the industrial countries.¹ What has caused such a gap is the historic isolation of the Chinese state. Yet what has overcome the institutional barrier for China to participate in the world trade owes much to the catalytic role played by firms based in Hong Kong and Taiwan, which have invested and traded intensively with China in the last decade despite a longer economic relationship with Southeast Asia. Going against the conventional wisdom, the importance of these firms stems from neither size nor technological leadership.² However, their experience and access to the world markets allow them to serve as an excellent go-between. One special institution invaluable for such interaction is what shall be referred to here as export outsourcing by Taiwanese manufacturing firms that have outsourced the orders they receive to China or Southeast Asia, often at the request of their clients in America and elsewhere (Liu, Lu and Tung, 2007).

In export outsourcing, an up-and-coming business mode in this age of globalization, an exporting firm chooses between producing domestically and subcontracting to its own foreign subsidiary or an independent producer abroad to take advantage of lower wages. Such export outsourcing differs in significant ways from other forms of outsourcing studied in the literature both in nature and in terms of impact. In particular, it serves as a transforming agent for the metamorphosis of the Chinese economy. Like a shockwave spearheading an explosion, its

¹ In 2004, for example, the ratio between the nominal GDP per capita in Japan and China was 24 to 1, while the income ratio between Luxembourg and Latvia, with the highest and the lowest per capita incomes in the European Union, respectively, was only 12 to 1 (calculated from World Development Indicators).

² Note that small and medium-sized enterprises have been the backbone of Taiwan. In 2005, 96.86 percent of all manufacturing firms in Taiwan were small or medium in scale, accounting for 32.83 percent of total sales or 20.37 percent of total exports, according to the Ministry of Economic Affairs in Taiwan.

importance far outweighs its relative size at any particular instant. Moreover, export outsourcing from super-exporters like Taiwan should be valuable to other transition economies like Vietnam and Cambodia that are noted for their isolated past.

Given the central importance of the middleman-manufacturer firms, this paper looks specifically into the decision to outsource export orders on the part of such firms. A three-fold kaleidoscopic interrelationship is examined. First, the wage differential, a main factor affecting the choice of producing at home or abroad, is balanced against the outsourcers' reluctance to outsource due to possible future rent dissipation. Second, while the interrelationship between outsourcing and foreign direct investment (FDI) is complicated and dynamic in nature, the export-outsourcing decision is seen as a choice based on the FDI history as a first approximation. Finally, cultural affinity, working mainly but not exclusively through the differential cost of trouble-shooting, adds a further consideration regarding the location choice of offshore production.

Our study is based upon a unique data source of Taiwanese exporting firms with the following distinct characteristics from similar studies. First, it deals with firms in countries which are not advanced. This corresponds closely to the important question of whether exports promote catching-up or not. Secondly, it covers a rather broad range of firms with respect to size, including those with modest scales of employment. Thirdly, it deals with a triadic set-up that is not focused upon by other studies. Finally, the survey provides otherwise unavailable information, for example, cost saving is shown to be the reason for a triadic relationship and requests from customers are its source.

Because parallel studies in the literature are few and far between, every effort must be made to test the reliability of the thesis. This is done here by formulating a rather detailed microeconomic model, distinguishing between three different kinds of fixed labor costs: a fixed cost associated with past FDI, a fixed cost arising from current export outsourcing, and a quasi-fixed cost due to a firm-specific minimum employment requirement. Testable implications are then derived. One striking result is the prediction that the domestic labor size of a firm is negatively associated with the tendency to outsource, meaning that small firms are not excluded in the game of globalization. Other findings, such as the scale economies with respect to total order sizes and the complementarity with former FDI, are consistent with the conventional wisdom.

The remainder of the paper is organized as follows. Section I presents the path-dependent microeconomic foundations of export outsourcing in a tripartite structure, focusing on the decision-making of the middleman firm. Four testable propositions are derived. Section II reviews the data set and Section III presents the empirical evidence econometrically. In concluding the paper, Section IV discusses the implications concerning the world market in transition.

I. Theoretical Considerations

A. *Nature of Export Outsourcing*

Export outsourcing refers to the case when an exporting firm subcontracts at least some of the orders it receives to a final outsourcee in a lower-wage country, whether the latter is its own subsidiary or an independent supplier. This new mode of outsourcing is triadic by structure, and thus differs significantly from the three other types of traditional foreign outsourcing. All three traditional types involve dyadic relations – the outsourcer subcontracts with the outsourcee to supply either (a) services, such as backroom services for banks (Garner, 2004), or (b) outputs, either for the home market (Sharpston, 1976) or for a third market as an export platform (Ekholm, et al., 2003), or (c) inputs, such as intermediate inputs for General Motors (Hummels, et al., 2001), which has been the focus of the New New Trade Theory (Grossman, et al., 2006). These three types are called service outsourcing, output outsourcing and input outsourcing, respectively.

By contrast, export outsourcing – a new type of outsourcing – has the following characteristics (Liu, Lu and Tung, 2007). First, the middleman firm, the client and the outsourcee interact not just in a pairwise manner, but in a triadic framework. To be more specific, the middleman firm takes into account its own relationship with either the client or the outsourcee when it interacts with the other.³ Secondly, the basis of middlemanship is manufacturing experience. Thirdly, the setup is transient, and disintermediation is expected in the long run. Finally, the function of the middleman is to acculturate the inexperienced outsourcee, rather than to provide the headquarter services usually offered by the outsourcer in a traditional type of outsourcing.

The relations between export outsourcing and FDI are at once complementary and substitutive. If the middleman-manufacturer firm decides to outsource abroad, it can either commit its own resources and invest in an overseas subsidiary, or contract with a foreign independent supplier and retain flexibility. These two courses are substitutes for each other, much in the same way as FDI and input outsourcing of type (c) are (Antràs and Helpman, 2004).⁴ However, having made foreign investment in the past would reduce the cost of outsourcing in the present, thus making the two practices complementary over time. These complicated relationships will become clearer later in the study.

³ See Basu (2000) for the distinction between dyadic and triadic relations.

⁴ If the outsourcing to one's own subsidiary is excluded from the strict definition of export outsourcing, then one finds a substitutive relationship between sending orders to one's own subsidiary (FDI) and outsourcing to an outsider.

B. From Dyads to Triads

The complex nature of export outsourcing may be understood better within the following simplified framework with three parties:

The outsourcee (Party Z , say, an inexperienced firm in China), located in a low-wage country, seeks maximum utility, which is the difference between the utility of monetary reward and the disutility of work.

The middleman-manufacturer (Party Y , say, an exporting firm in Taiwan), a long-term outsourcee of Party X who now faces keener competition with the entry of firm Z , seeks the maximum expected present value of the profit stream.

The outsourcer (Party X , say, a branded firm in America) seeks maximum profit, by entering into a tripartite relationship X - Y - Z , or by working with only one of the other two parties – either to continue with X - Y or to shift to X - Z .

The triadic relationship usually begins with a two-party arrangement between X and Y . After the entry of Z into the world market (which may result from the increase in the wage rate for Y), X explores the feasibility of X - Y - Z or X - Z . The cause of the triadic setup is the inexperience of the low-wage firm Z . Specifically, without the trouble-shooting service of the experienced Y , Z would find the production job challenging over a portion of the time r . The outcome depends on both the effort of Z and the state of nature, which varies randomly between being bad, b , and good, g . Note that since X may not be able to tell the states, it is advantageous for Z to save effort under the good state by always reporting the state as bad. In working alone with Z , X would be subject to moral hazard due to information asymmetry. Thus, Y would render service to both X and Z for a fee.

With repeated exposure to trouble-shooting, however, the portion r will decrease over time through the learning by Z . When r becomes sufficiently small, X may contract directly with Z , bypassing Y . Therefore, as a rational decision-maker with foresight, Y would charge a fee schedule that includes a premium covering the erosion of its future bargaining position.

In short, the accumulated experience of Y ushers in the triadic relationship, and the accumulation of experience by Z foretells that such a relationship is heading to an end at some time. For X , the outsourcing history is expected to develop as follows:

- Stage 1: X - Y (under traditional output or input outsourcing)
- Stage 2: X - Y - Z (under export outsourcing)
- Stage 3: X - Z (under traditional output or input outsourcing).

The evolution through the three stages shows both the transient nature of the arrangement and the catalytic role played by *Y*. In the real world, the development of the triadic relations is more complicated. On the part of *X*, it may stick with the more costly *X-Y* mode, if *Z* has a lower wage rate but is not yet capable of meeting the requirement of punctual and reliable delivery. Or it may engage simultaneously in any one or several modes of outsourcing, varying from order to order. On the part of *Y*, it will accept *X*'s request to outsource to *Z*, either partially or entirely, if the payoff as a middleman is reasonable. Otherwise, *Y* may reject and lose the business right away, or bargain for a better deal while running the risk that *X* turns to *Z* or another *Y*.

A survey of Taiwanese exporting firms, which will be discussed in more detail later, shows that the triadic arrangement has often been initiated *on request*. The urge for *X* to make a request reflects the value of *Y*'s participation, while the need for *Y* to be requested suggests its vulnerability. Since there are many firm *X*'s and firm *Y*'s in the real world, the contract terms are therefore decided by the market, regardless of whether or not a particular transaction involves a formal request.

Moreover, among the *Y* firms in multiple sites with production experience (say, Taiwan and South Korea) and *Z* firms in multiple sites with low costs (say, China and Southeast Asia), it is interesting to note that predominantly more Taiwanese firms outsource to China than to Southeast Asia, while Taiwanese firms also appear to outsource a higher amount of orders to China than do South Korean firms.⁵ This suggests that Taiwan's qualification in the triadic relationship is based not only on its production experience, but also on its cultural relationship with China. Obviously, this cultural affinity is important when China is the most populous country in the world, and also one with a very low labor cost.

C. The Benchmark Models

To make clear the logic of our analysis, it is crucial to introduce the core building blocks before bringing out the details. With such a purpose in mind, we set up a basic model in which the *Y* firms differ in terms of the sizes of the orders they receive. We then allow for more types of heterogeneity among the *Y* firms, and consider a case where the *Z* firms are located in various countries. These extensions fit the reality better and indicate that the Taiwanese firms' role as the middleman-manufacturers is based upon both their production experience and the 'China connection'.

⁵ There is little information on whether and how much Korean firms engage in export outsourcing. However, it goes without saying that Taiwanese firms invest more to China than do Korean firms – up until the end of 2005, the accumulated FDI in China from Taiwan amounted to USD41.8 billion, as compared with USD31.1 billion from South Korea (Ministry of Commerce of the PRC).

A Basic Model

Each Y firm, seeking to maximize the present value of its expected profit stream, has to balance the current gains against the erosion of future profit potential. The current gains are composed of either the middleman's fee, or the outsourcee's profit, or both, while the erosion of future profit occurs with export outsourcing. As the contract terms are determined by the market, each Y seeks to minimize the total cost, which includes the costs of production and monitoring, as well as an imputed cost of profit erosion through outsourcing.

Now consider the case where Y receives an order of size q from X , with a probability density distribution $h(q)$, and has the choice of producing at home or abroad – the former involves higher variable costs while the latter involves additional fixed costs.

To produce the homogeneous product, one unit of labor is required per unit of output, and the total cost depends on the history of the firm, namely, its FDI and its required minimum employment, as well as its current decision concerning *whether, where and how much* to outsource. To simplify the analysis, the locational choice of export outsourcing is left aside for the moment, and both FDI status and the size of the core labor force are treated as a *fait accompli*, which shapes the cost structure of the firm. Two subtypes of firm are distinguished, the Y_I firms that have previously invested abroad, and the Y_J firms that do not own foreign subsidiaries.

There are three kinds of 'fixed' labor cost – a quasi-fixed cost with regard to core workers, a fixed cost related to current outsourcing, and a fixed cost associated with past FDI. All three are measured in domestic labor units at the domestic wage rate w , which is normalized to one. The quasi-fixed cost arises because the firm keeps a core workforce M at home to minimize the adjustment cost during business cycles.⁶ This implies a minimum employment requirement, and the firm may choose to hire beyond M , such that $L \geq M$, where L is total domestic employment. The quasi-fixed cost M allows the firm to supply any output up to $\underline{q}(M)$, which is a continuous and increasing function. Without loss of generality, we assume that $L \geq M > 0$ and $\underline{q}(M) = M$. The other two fixed costs involve non-productive workers in the home country. If the firm chooses to engage in export outsourcing and hire foreign productive workers L^f , it bears an extra fixed cost of O units of home labor for 'communication and governance' (Grossman, et al., 2006). There are no outsourcing costs when the firm produces only in the home facility. Furthermore, a Y_I firm bears a fixed overhead cost of F units of

⁶ The labor hoarding hypothesis rejects the assumption that labor is a freely variable factor due to explicit or implicit contractual commitments, the minimization of adjustment and transaction costs, and so on (Solow, 1968; Fay and Medoff, 1985).

home labor in maintaining the foreign subsidiary, whether or not it outsources abroad; and a Y_j firm is free of such cost.⁷

Regarding the variable costs, we assume that the marginal cost depends upon (i) the presence or absence of past FDI, and (ii) whether the type of workers used consists of domestic core labor, domestic temporary workers, or foreign workers. For firms using only the core labor M at home, the marginal cost per unit of output is 0. To hire domestic workers beyond the core workforce, the marginal cost is 1 per unit of output, as already mentioned. The marginal cost of hiring foreign labor through export outsourcing, L^f , is $\alpha + \gamma$ for Y_j firms, and $\alpha\beta + \gamma$ for Y_l firms. The parameter α refers to the cost ratio of the foreign wage rate relative to the domestic wage rate, after accounting for the necessary efforts in monitoring and trouble-shooting. β is the ratio of using foreign labor under the firm's own management; and γ is the ratio of the present value of the imputed risk of future profit erosion associated with export outsourcing.⁸ Note that $1 - \alpha$ reflects the cost saving ratio from outsourcing, and $1 - \beta$ represents an extra cost saving from previous FDI. Assume that $0 < \alpha < 1$, $0 < \beta < 1$ and $\gamma > 0$. To exclude the case where no outsourcing is possible, we further assume that $0 < \alpha + \gamma < 1$, which also implies that $0 < \alpha\beta + \gamma < 1$.

Knowing the levels of various fixed costs and mode-specific marginal costs, we can decide the minimum production costs for firm Y at various levels. In analytical terms, a Y_j firm (which is without FDI) solves the problem of

$$C_j^*(q) = \min\{C_1(q), C_2(q)\},$$

where

$$C_1(q) = M + \max(q - \underline{q}, 0) \quad \text{and}$$

$$C_2(q) = M + O + (\alpha + \gamma)(q - \underline{q})$$

are the total cost of producing at home entirely, and the total cost of producing $\underline{q}(M)$ at home then outsourcing the rest abroad, respectively. C_j^* is depicted by the thick solid line in Figure

⁷ It is entirely possible that there exists a similar cost for the domestic plant, as distinct from the quasi-fixed employment cost M . It is not modeled in our parsimonious model.

⁸ It is plausible that γ is smaller for a Y_l firm than a Y_j firm, as losing trade secrets to one's own subsidiary is presumably less serious than to a non-affiliated supplier. The variability of γ , however, does not lead to qualitative differences in our analysis, and is therefore not modeled.

1, in which a special case when $O < F$ is shown.⁹ The corresponding levels of home and overseas employment are illustrated in the Appendix.

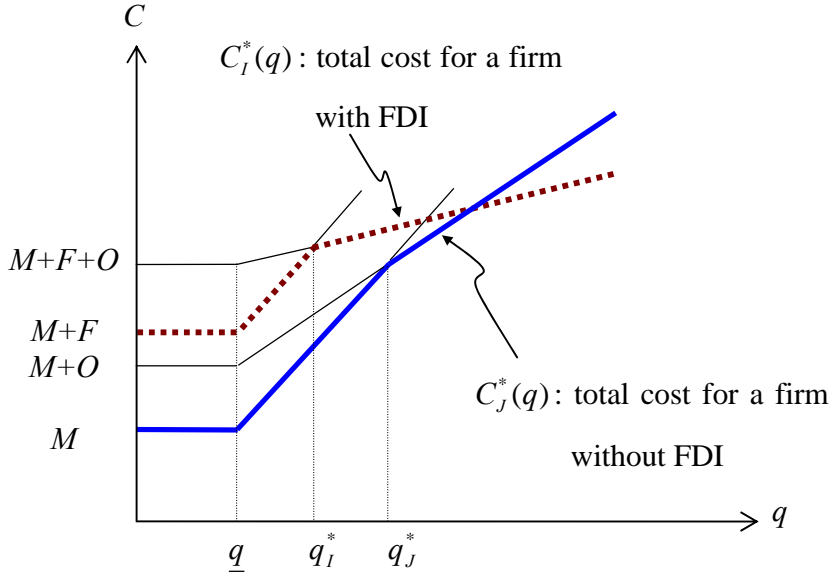


Figure 1 Firm Decisions over Export Outsourcing (When $O < F$)

Analogously, a Y_I firm (with previous FDI) solves the following problem:

$$C_I^*(q) = \min \left\{ \begin{array}{l} M + F + \max(q - \underline{q}, 0), \\ M + F + O + (\alpha\beta + \gamma)(q - \underline{q}) \end{array} \right\},$$

and C_I^* is illustrated by the dotted lines in Figure 1.

The threshold outputs for Y_J and Y_I are $q_J^* = \underline{q} + \frac{O}{1 - \alpha - \gamma}$, and $q_I^* = \underline{q} + \frac{O}{1 - \alpha\beta - \gamma}$, respectively. If the order size is below the threshold, the firm Y produces entirely in home facilities; otherwise, it sends out the portion $q - \underline{q}$ to be produced abroad. Note that within a certain range of the export order above the output related to the core workforce ($\underline{q} < q \leq q^*$), the firm continues to produce at home even though the marginal cost abroad is lower, in order to avoid paying the non-productive fixed cost of outsourcing. The firm starts to engage in

⁹ The basic results still hold (in the less likely case) when $O > F$.

export outsourcing only when the export order is large enough to justify the cost of O . The total costs of both types of Y firms are summarized in Table 1.

Table 1. Total Cost

| | Y_J firms (with $q^* = q_J^*$) | Y_I firms (with $q^* = q_I^*$) |
|----------------------------------|--|---|
| $0 \leq q \leq \underline{q}(M)$ | M | $M + F$ |
| $\underline{q} < q \leq q^*$ | $M + (q - \underline{q})$ | $M + F + (q - \underline{q})$ |
| $q^* < q$ | $M + O + (\alpha + \gamma)(q - \underline{q})$ | $M + F + O + (\alpha\beta + \gamma)(q - \underline{q})$ |

It is interesting to note that, unlike the mode-specific fixed cost O , the fixed labor cost associated with the organization of the foreign subsidiary F has no effect on the current decision of a Y_I firm. Nevertheless, having a foreign subsidiary means a lower threshold output level than being without FDI, other things being equal, such that

$$q_J^* - q_I^* = \frac{O \cdot \alpha(1 - \beta)}{(1 - \alpha - \gamma)(1 - \alpha\beta - \gamma)} > 0.$$

Heterogeneous Firms

Concerning firm heterogeneity, we arrive at two propositions, the proofs of which and later propositions are given in the Appendix. We first define the probability of export outsourcing, or the degree of being export outsourcing-prone,¹⁰ as $\theta(q^*) = \int_{q^*} h(q) dq$, where $q^* = q_J^*$ for a firm of type Y_J , $q^* = q_I^*$ for a firm of type Y_I , and $h(q)$ is the density function of the order q .

Proposition 1 (FDI Facilitates Outsourcing). *Other things being equal, a Y_J firm is less outsourcing-prone than a Y_I firm, that is, $\theta(q_J^*) - \theta(q_I^*) < 0$.*

Following on from the earlier finding that a non-FDI firm has a higher threshold output relative to an FDI-firm, it also has a lower probability of outsourcing. The proposition implies that at some range of q , (q_I^*, q_J^*) , a firm will outsource only when it has previous FDI. This is a strong case of complementarity between FDI and outsourcing. The complementarity here echoes the finding in the literature that firms with outward FDI have both the knowledge to perceive the opportunities to engage in provided by output outsourcing and the resources to take advantage of them (Helleiner, 1981). Although this seems to contradict the substitutive

¹⁰ The parameter θ measures the probability of engaging in export outsourcing, rather than the proportion of orders being outsourced.

relationship typically assumed in the literature on input outsourcing (Grossman and Helpman, 2003), the difference is mainly a matter of modeling as has been explained earlier.

Furthermore, note that in Figure 1 the dotted line cuts the solid line from the left at some point. Thus under expectations of high volumes of future sales, FDI is justified in the long run despite the fixed labor cost F that occurs every period, and is likely to be accompanied by an additional one-time sunk cost in the real world.

Proposition 2 (Product Heterogeneity and Industry Heterogeneity). *Other things being equal, regardless of whether a firm has or does not have FDI, the firm is more outsourcing-prone, if*

(2a) *it has a smaller effective foreign wage ratio, that is, $\frac{\partial \theta(q^*)}{\partial \alpha} < 0$; or*

(2b) *it has a smaller imputed cost of profit erosion, that is, $\frac{\partial \theta(q^*)}{\partial \gamma} < 0$.*

Proposition (2a) is relevant to firms which produce with non-codified knowledge or short lead times.¹¹ In such cases, α is high because much monitoring and trouble-shooting is required to ensure quality and punctuality. When the lead time is extremely short so that the monitoring cost is formidably high, outsourcing may become out of the question. This applies to both the Y_I and Y_J firms.¹²

Proposition (2b) is relevant to firms with a large technology gap over potential imitators, or firms with few business secrets remaining. In either case, γ is small because the firm is relatively less susceptible to the loss of trade secrets through outsourcing. If, instead, the firm has much business expertise to attract imitators but little in way of a technology gap to forestall imitation, its potential loss from being disintermediated by the outsourcee can be large, and hence it is less likely to engage in export outsourcing.

An Extended Model with Two Low-wage Countries

Recall that the basic purpose of our study is to explain the essential role of Taiwan's middlemen-manufacturers in the trade expansion of China, which is having such a huge impact on the entire world. Such a role is characterized both by the transient nature and the catalytic position of the Y firms in Taiwan. While the basic model has clarified the cost-saving

¹¹ Lead time is the period between a customer's order and delivery of the final product.

¹² The α parameter can also vary by destination. A more detailed treatment on destination heterogeneity is presented in Part C of Section I., with an emphasis on China as opposed to all other destinations.

advantages for Y to serve as the middleman between X and Z , we now deploy an extended model where China is not the only possible destination of outsourcing, but is definitely the most frequently used one, presumably due to the shorter cultural distance between Taiwan and China. Parenthetically, the fact that China is late historically in introducing an outward-oriented strategy may be the reason why there has also been Taiwanese FDI in countries other than China.¹³ In some circumstances, previous FDI outside of China may have been so effective in terms of cost saving that it offsets the cost disadvantages arising from longer cultural distances.

We assume, for lack of more detailed data, that any previous FDI would have gone either to China or a non-China region, but not to both. By leaving the detailed treatment to the Appendix, we can report that, corresponding to Propositions 1 and 2 for the basic model, there are three general principles for the extended framework, which are stated in the following proposition:

Proposition 3 (Cultural Connection and FDI Connection of Outsourcing). *The location choice of an outsourcing firm among two low-wage countries is determined by the relative strength of the cultural connection and the FDI connection such that*

(3a) *for a Y_j firm, any outsourced order goes to China due to the cultural connection;*

(3b) *for a Y_l firm, any outsourced order goes to China, if China is the destination of the previous FDI, since the cultural connection and the FDI connection work in the same direction;*

(3c) *for a Y_l firm investing in a country other than China, China may still receive the outsourced order, provided that the advantage of having previous FDI is offset by the advantage in terms of the cultural connection.*

In the real world, a firm may subcontract with overseas producers at multiple sites, due to risk diversification, market considerations,¹⁴ or simply an extra minimum employment constraint in the foreign subsidiary. In the last case, the firm will produce in both its high-cost plants at home and in the foreign subsidiary in a non-China region to meet the employment constraints, and will send the rest of the order to the low-cost facilities in China to minimize total cost. A detailed treatment is presented in the Appendix.

¹³ In 1991, 38.6 percent of Taiwan's outward FDI (in value) went to the ASEAN countries, but only 9.52 percent went to China. In 2005, 1.97 percent went to the former countries, while 71.05 percent went to China, according to the Ministry of Economic Affairs.

¹⁴ It is possible that the middleman-manufacturer firm Y will outsource to a non-Chinese, low-wage country which is located in the delivery market, even if the firm has prior investment in China.

An Additional Testable Implication

After addressing issues with direct economic concerns, we derive an additional testable implication for our study. The presence of a core labor force implies a hurdle for the firm before it can make use of cheaper foreign labor. It follows that firms facing a higher (lower) minimum employment constraint should have both a larger (smaller) size of domestic workers and a smaller (larger) tendency to outsource. In other words, the probability of outsourcing is negatively related to the size of total home employment. This implication is important because the level of domestic employment L is observable while the size of core labor M is not. The non-refutation of such an implication in the econometric results enhances our confidence regarding both the assumptions underlying the analytical model and the veracity of the empirical data.

The adverse relationship between the domestic employment and outsourcing propensity seems to contradict the conventional wisdom that a larger firm is more likely to invest or outsource, usually with size measured by total sales (Lall, 1986).¹⁵ In the present context, the probability of outsourcing is positively related to the size of the total sales orders, but is negatively related to the size of the domestic core labor. These results prevail in both the basic and the extended models.

Proposition 4 (Scale Economies and Diseconomies for Outsourcing). *In a pairwise comparison between two firms s and t of the same type regarding past investment, other things being equal, firm s is more outsourcing-prone than firm t , that is $\theta(s) > \theta(t)$, if*

(4a) it receives a larger order than firm t does, such that $q(s) > q(t)$, or

(4b) it employs a smaller domestic workforce than firm t does, such that $L(s) < L(t)$.

II. Survey Data and Descriptive Analysis

Although export outsourcing has been quite prevalent in East Asia, there remains a scarcity of reliable data. A firm-level survey, the “Export Orders Survey, 2001,” conducted by the Ministry of Economic Affairs in Taiwan, serves as a valuable source for us to explore the novel practice of export outsourcing. After excluding some two hundred firms with no manufacturing capacities, we study the export outsourcing and FDI behavior of a total of 1,443 exporting firms. Cost minimization behavior is assumed, since 76.95 percent of all outsourcing

¹⁵ Larger firms are usually seen as having more managerial and technological advantages to engage in FDI or outsourcing (Lall, 1986). An exception is found in Chen (2003), who shows that small and weak Taiwanese firms are still able to undertake FDI, provided that they can manage the network relations thus involved.

firms specified that cost reduction was an important motivating factor for export outsourcing.¹⁶ In particular, the dynamic and unusual nature of the practice makes such costs of disintermediation and monitoring central to the behavior of the firm. Cost details, however, are not available. It is the rich set of information on firm and industry characteristics made available by the survey that enables an in-depth exploration of the firm decision concerning export outsourcing to take place.

To look more carefully into the data set, the 1,443 exporting firms are further broken down by various criteria in Table 2. The first two columns report the numbers of exporting firms and outsourcing firms, and the last column shows the percentage of firms engaging in export outsourcing. Not surprisingly, a higher proportion (46.65 percent) of firms receiving large annual sales orders (greater than NTD30 million) engaged in export outsourcing than those with total orders below NTD10 million (25.04 percent). Yet firms hiring different numbers of domestic workers were found to have similar outsourcing ratios. Firms with previous investments abroad have a higher percentage (51.24 percent) that outsource than those without foreign subsidiaries (15.29 percent). With regard to the length of lead time, firms manufacturing products with delivery in extreme haste (5 days or less) are much less likely to outsource (16.67 percent) than otherwise (33.03~35.24 percent). Finally, firms in those industries with best and worst export performance are more likely to outsource than medium-performing firms. Detailed definitions and summary statistics are tabulated in the Appendix.

The location distribution also deserves attention. As explained above, some firms outsource to multiple regions. In Table 3, firms are classified by outsourcing locations: China only, somewhere else, and both China and somewhere else. China is obviously the favored destination of export outsourcing. Among the 486 outsourcing firms, an overwhelming majority (427 firms) of these firms sent orders to China, and China is the sole destination of outsourced orders for 349 firms. In addition, firms tend to outsource to the region where there is previous FDI, especially among firms with 'principal'¹⁷ FDI in China.¹⁸

¹⁶ The buyer's request is the second important factor, chosen by 54.94 percent of the 486 firms. It is then followed by the existence of FDI (53.50 percent), the need for flexibility (36.42 percent), and so on.

¹⁷ The survey only asked firms to report the principal site of FDI, so that a firm listing China as the principal investment site may nonetheless have a subsidiary in another economy.

¹⁸ In Table 3, 35 of 69 firms whose main subsidiaries were located outside of China were in Southeast Asia, and most of the remaining 34 firms were in the industrialized economies. While these two groups of firms may behave differently, they are not presented separately due to the small number of observations.

Table 2. Ratios of Export Outsourcing of Taiwanese Firms

| Categories of firms | Number of firms | Number of outsourcing firms | Percent of outsourcing firms |
|------------------------------------|-----------------|-----------------------------|------------------------------|
| | (1) | (2) | (3)=(2)/(1) |
| All firms | 1443 | 486 | 33.68 |
| By total orders | | | |
| large (\geq USD30 million) | 403 | 188 | 46.65 |
| medium (USD10~30 million) | 461 | 153 | 33.19 |
| small ($<$ USD10 million) | 579 | 145 | 25.04 |
| By domestic employment | | | |
| large (\geq 200 persons) | 650 | 217 | 33.38 |
| medium (100~199 persons) | 371 | 125 | 33.69 |
| small ($<$ 100 persons) | 422 | 144 | 34.12 |
| By FDI status | | | |
| with FDI | 730 | 377 | 51.64 |
| without FDI | 713 | 109 | 15.29 |
| By lead time | | | |
| short (1~5 days) | 42 | 7 | 16.67 |
| medium (6~30 days) | 666 | 220 | 33.03 |
| long (1 month or more) | 735 | 259 | 35.24 |
| By export performance ^a | | | |
| Export-thriving industries | 852 | 326 | 38.26 |
| Export-sluggish industries | 438 | 111 | 25.34 |
| Export-declining industries | 153 | 49 | 32.03 |

^a Firms are grouped according to the long-term export growth rate of their respective industries. See Appendix B for the detail.

Source: Authors' calculations are based on the "Export Orders Survey, 2001" conducted by the Ministry of Economic Affairs, Taiwan, ROC.

Table 3. Location of Export Outsourcing of Taiwanese Firms

| Categories of firms | Number of outsourcing firms | Number of firms by outsourcing location (percent of row total) | | |
|-------------------------|-----------------------------|--|--------------------------|-----------------------|
| | | China Only | Both China and elsewhere | Non-China region only |
| All outsourcing firms | 486 (100) | 349 (71.81) | 78 (16.05) | 59 (12.14) |
| By FDI status | | | | |
| with FDI | 377 (100) | 272 (72.15) | 66 (17.51) | 39 (10.34) |
| principal FDI in China | 308 (100) | 250 (81.17) | 46 (14.94) | 12 (3.90) |
| principal FDI elsewhere | 69 (100) | 22 (31.88) | 20 (28.99) | 27 (39.13) |
| without FDI | 109 (100) | 77 (70.64) | 12 (11.01) | 20 (18.35) |

Source: Same as Table 2.

III. Econometric Analysis

A. The Nested-logit Framework

To model the choice of a Taiwanese manufacturing firm with respect to export outsourcing, a discrete choice analysis is used here. In particular, a two-level nested logit framework is adopted to account for the fact that some options have a higher level of substitution than others (Maddala, 1983). In the upper level, there are two modal choices – not outsourcing, and outsourcing. In the lower level, the ‘outsourcing’ mode is further broken down into three locational choices – to China only, to both China and somewhere else, and to a non-China region only. In this framework, the independence of irrelevant alternatives (IIA) assumption is preserved within the outsourcing group, but is allowed to be violated between the two modal choices of outsourcing and not outsourcing. The structure of the nested logit model is shown in Figure 2.

In the two-level nesting specification, let $k \in \{No, Yes\}$ index the firm’s upper-level decision, and let $j | Yes \in \{China, Both, Elsewhere\}$ and $j | No = (no\ outsourcing)$ index the lower-level decisions. The nested model can be derived from a structural model of random utility maximization. Firms are assumed to choose the alternative from which they derive the highest utility. The utility for alternative (j, k) is specified as:

$$U_{j,k} = x'_{j|k}\mu + z'_k\nu + \varepsilon_{j,k}, \quad (1)$$

which is determined by a set of firm-specific explanatory variables z_k and a set of location-specific explanatory variables $x_{j|k}$, with a random error term $\varepsilon_{j,k}$.

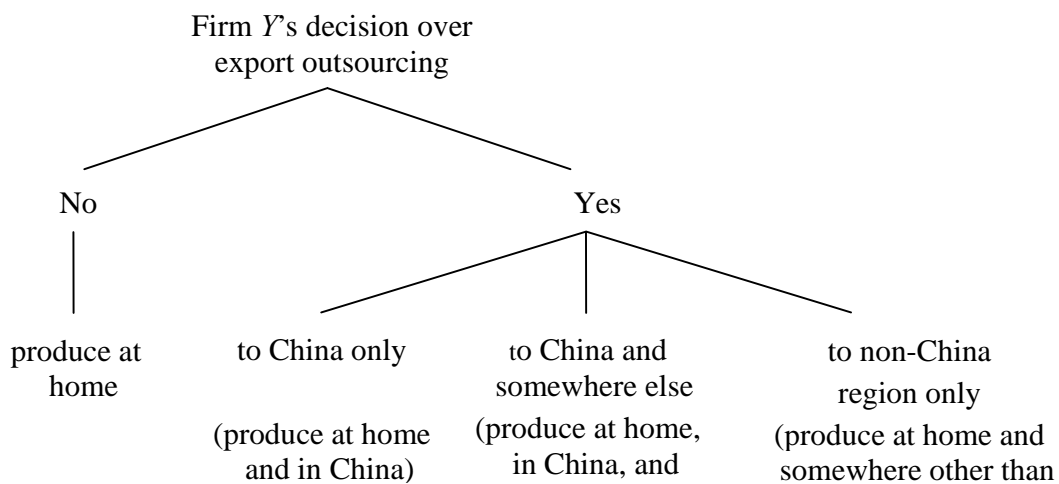


Figure 2 Firm Decisions over Export Outsourcing in a Nested Model

The probability that the final outcome is alternative (j, k) , $P_{j,k}$, is the product of the conditional probability $P_{j|k}$ and the marginal probability P_k :

$$P_{j,k} = P_{j|k} \cdot P_k. \quad (2)$$

$$P_{j|k} = \frac{e^{x'_{jk} \cdot \mu}}{\sum_j e^{x'_{jk} \cdot \mu}}, \quad (3)$$

$$P_k = \frac{e^{z'_k \cdot \nu + \lambda \cdot IV_k}}{\sum_k e^{z'_k \cdot \nu + \lambda \cdot IV_k}} \quad (4)$$

where IV_k is the standard inclusive value for the outsourcing decision, defined as:

$$IV_k = \ln \sum_j e^{x'_{jk} \cdot \mu}. \quad (5)$$

The parameter λ measures the dissimilarity between the alternatives that the firm faces among its location choices.¹⁹ All parameters are estimated by full information maximum likelihood (FIML).

B. The Explanatory Variables

The explanatory variables comprise both firm characteristics z_k and site attributes x_{jk} . In the upper level, the firm decision regarding whether or not to outsource is modeled as a function of six variables: total orders (*ORDER*), domestic employment (*EMP*), the presence of FDI (*FDI*), the industry types (*IND_thriving*, *IND_declining*), and a product dummy based on the length of lead time (*LEAD*). From Proposition 4, the coefficient of the *ORDER* variable is expected to be positive, and that of the *EMP* variable negative. Based on Proposition 1, the presence of FDI (*FDI*=1) is expected to have positive effects on the decision to outsource. The industry and product dummies are meant to capture the firm heterogeneity. The *IND_thriving* dummy takes the value 1 if the firm belongs to the best-performing industries in terms of exports, and 0 otherwise; the *IND_declining* dummy is 1 if the firm belongs to the worst-performing industries, and 0 otherwise. These two dummies are expected to have positive signs following from Proposition 2, as a firm in these industries suffers less from the risk of disintermediation than otherwise. The *LEAD* dummy takes the value 1 if the lead time

¹⁹ If λ takes a value of 1, the nested logit collapses to the standard conditional logit model without a tree structure; if it is estimated to be 0, the outsourcing locations are estimated to be near perfect substitutes inside each modal choice and only the modal choice at the upper level matters.

between order and delivery is extremely short, say, five days or less, and hence the firm may refrain from producing abroad to minimize extra monitoring or trouble-shooting. It is 0 otherwise. A negative sign is expected, based on Proposition 2.

At the lower level, the decision over location is modeled as a function of two site attributes: the *cultural connection* and *FDI connection*. The *FDI connection* variable takes the value 1 if the firm outsources to the same region where its main foreign subsidiary is located; it takes the value 0 otherwise. The *cultural connection* variable takes the value 1, if the firm outsources to a region with close cultural links, that is, China; it is 0 otherwise. Following Proposition 3, these two variables should have positive effects on the location choices.

C. Empirical Results

Table 4 presents the FIML estimates from a two-level logit specification of a Y firm's decision over whether and where to outsource. Three nested logit estimation models are constructed, and the results are shown in Table 4. Model 1 and Model 2 each include one size variable, total orders and domestic employment, respectively, while Model 3 is estimated with both size variables. The results are similar across the three formulations, but the log likelihood ratio tests suggest that Model 3 performs the best. Furthermore, a Hausman test of the IIA suggests that a nested logit specification is more appropriate than a simple multinomial logit regression (Hausman and McFadden, 1984).²⁰

All of the coefficients are significant and have expected signs, lending strong support to our four propositions advanced in Section I. In the lower level concerning locational choice, both the FDI connection and cultural connection have positive effects, confirming the importance of both connections. In the upper level regarding whether to outsource or not, a larger order is strongly correlated with a greater likelihood of engaging in export outsourcing, as expected from the previous literature. The effect of the domestic employment size is negative, suggesting that small firms are more apt to outsource. Firms with previous FDI are more likely to outsource to any foreign site, although the effect is only marginally significant in the statistical sense. Firms in the best-performing industries (e.g., information and communications) or worst-performing industries (e.g., footwear), are found to be more export outsourcing-prone than firms in the medium-performing industries (e.g., machinery), while firms receiving orders with very short lead time are less likely to engage in outsourcing than otherwise.

²⁰ The likelihood ratio tests of homoskedasticity also justify the nested structure by showing that the inclusive values are significantly different from 1. The unreported test results are available upon request.

Table 4. FIML Estimates for the Nested-Logit Model

| | Model 1 | Model 2 | Model 3 |
|----------------------------------|------------------------|------------------------|------------------------|
| <u>Locational Choice</u> | | | |
| <i>Cultural connection</i> | 1.6029 (0.1089)*** | 1.6030 (0.1090)*** | 1.6028 (0.1089)*** |
| <i>FDI connection</i> | 1.5655 (0.2000)*** | 1.5660 (0.2000)*** | 1.5564 (0.2000)*** |
| <u>Export-Outsourcing Choice</u> | | | |
| <i>ORDER</i> | 0.1255 (0.0449)** | | 0.3569 (0.0718)*** |
| <i>EMP</i> | | -0.2870 (0.0914)*** | -0.6531 (0.1276)*** |
| <i>FDI</i> | 0.6214 (0.3640)* | 0.7628 (0.3632)** | 0.7025 (0.3706)* |
| <i>IND_thriving</i> | 0.5812 (0.1433)*** | 0.6628 (0.1428)*** | 0.5562 (0.1452)*** |
| <i>IND_declining</i> | 0.4551 (0.2251)** | 0.4515 (0.2259)** | 0.4452 (0.2277)* |
| <i>LEAD</i> | -1.2719 (0.4681)*** | -1.0519 (0.4420)** | -1.3601 (0.4866)*** |
| Number of observations | 1443 | 1443 | 1443 |
| Log likelihood | -1128.13 | -1125.73 | -1107.35 |

Notes: Standard errors are in parentheses; ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

To summarize, our first proposition that FDI facilitates outsourcing has been confirmed by the positive effect of the *FDI* variable in the upper level, which echoes the conventional wisdom. Among the outsourcing firms, the choice of location depends on the two effects stated in Proposition 3. For the outsourcing Y_i firms that have invested outside of China, their locational choices are split between China only, elsewhere only and both sites, under the rivalry of the FDI and cultural effects. However, for all other firms, with or without previous FDI, China is the most favored destination, due to the strong cultural connection effect, which is further strengthened by the FDI connection in the case of firms with previous investment in China.

Secondly, the impacts of industry heterogeneity and product heterogeneity are verified. According to Proposition 2, firms with small cost savings or large risks of being disintermediated would be less likely to engage in export outsourcing. It follows that firms that need to meet extremely short delivery deadlines are less likely to outsource, as are firms that still have considerable trade secrets at hand but an inadequate technological lead over their competitors.

Finally, the econometric analysis also attests to the scale economies with respect to order size and the diseconomies with respect to the domestic employment constraint proposed in Proposition 4. The latter finding indicates, much against the conventional wisdom, that small enterprises may play an active role in the globalization game and are not necessarily the victims in the rapidly-evolving world.

IV. Concluding Remarks

This paper examines the emergence of the new practice of export outsourcing, with a special focus on East Asian trade in transition. In regard to such outsourcing, it is shown in Liu, Lu and Tung (2007) that export outsourcing has frequently been used, and that production experience forms the basis of the middlemanship involved in the tripartite transaction. By continuing with this theme, the present paper looks into how the firms makes decisions as to whether and where to outsource its export orders, given the FDI status and the extent to which it is necessary to maintain a core workforce. The data are sourced from East Asia, where comparative advantage shifts constantly and rapidly, and market selection operates at full blast.

A key message is that the new practice of export outsourcing does not exclude the participation of small firms. Traditionally, overseas production has been the game played only by large firms in the North, whose sales and employment are both large. Export outsourcing, however, does not necessarily exclude small firms, since it does not provide a full range of headquarter services associated with a typical foreign investment. Moreover, firms facing a smaller core workforce constraint at home have more freedom to employ foreign workers. Export outsourcing therefore becomes an open choice to firms of all sizes in selecting the location of a production site.

A second important point is that China has been a popular destination for Taiwanese exporting firms to outsource. While Taiwan and China are culturally close so that the monitoring costs involved in an export outsourcing activity can be small, as modeled in the benchmark case, the impact of cultural linkages may show up in many more dimensions. This includes advising local government officials in China to interpret regulations in a 'pro-growth' manner, which is obviously more feasible for the Taiwanese merchants who are more adept at developing good *guanxi* than other foreign firms (Hsing, 1996).

The results are to be modified if a longer perspective is taken. To begin with, a rational firm will make the decision to invest abroad and outsource abroad jointly in the long run. FDI and export outsourcing can then be studied as a portfolio choice. If large export orders are expected with adequate stability over time, a firm would be more willing to commit itself to foreign direct investment to capitalize on the FDI advantages. A rational firm will also seek to reduce the size of the domestic core workforce, which is taken as given in the short run. When the firm successfully 'sizes down' its domestic employment, as many Taiwanese firms actually

do, it will become more outsourcing-prone, and may increase its FDI accordingly. These aspects may be extended in future studies.

The discussion on export outsourcing here is crucial to understand the nature of Chinese growth up to this point. As noted by Itoh (2006), the current Chinese growth is qualitatively noteworthy in that the trade sector outgrows the rapidly expanding economy as a whole, and the foreign direct investment plays a far more eminent role in the Chinese trade than is usually the case. As a matter of fact, much of what is listed under FDI represents the migration of Taiwan's industries, either directly, or through Hong Kong, carrying over to China manufacturing experiences and connections order to benefit from the far cheaper labor, water and land. Cultural linkages and scale diseconomies (with respect to domestic core workers) make the influence of Taiwan, dominated as it is by small and medium-sized enterprises, even more influential in China's economic rise than otherwise.

Broadly speaking, the expansion of the Chinese trade and income is the topical issue among academics, decision makers, and the general public at the beginning of the new century. Whether what is happening in East Asia will soon be replicated in South Asia and elsewhere in the developing world surely provides much food for thought.

Appendix A: Employment at Home and Abroad

An interesting result in the basic model is that the level of foreign workers hired, whether in the firm's own subsidiary or in the plant of an independent supplier, jumps from zero to $q - \underline{q}$ after the order size exceeds the threshold level. The example of a Y_J firm is tabulated

in Table A1, where $q_J^* = \underline{q} + \frac{O}{1 - \alpha - \gamma}$. The employment of a Y_I firm can be derived

analogously, with $q_I^* = \underline{q} + \frac{O}{1 - \alpha\beta - \gamma}$.

Table A1. Home and Foreign Employment of a Y_J Firm

| | Total Cost | Home Employment | Foreign Employment |
|----------------------------------|--|---------------------------|---------------------|
| $0 \leq q \leq \underline{q}(M)$ | M | M | 0 |
| $\underline{q} < q \leq q_J^*$ | $M + (q - \underline{q})$ | $M + (q - \underline{q})$ | 0 |
| $q_J^* < q$ | $M + O + (\alpha + \gamma)(q - \underline{q})$ | $M + O$ | $q - \underline{q}$ |

Appendix B: Proof of Proposition 1.

Since $\theta(\cdot)$ is a decreasing function, other things being equal, if $q_J^* - q_I^* > 0$, then $\theta(q_J^*) - \theta(q_I^*) < 0$.

Appendix C: Proof of Proposition 2.

For a Y_J firm, other things being equal, as $\frac{\partial q_J^*}{\partial \alpha} > 0$, and $\frac{\partial \theta}{\partial q_J^*} < 0$, the smaller α is, the larger the probability of engaging in export outsourcing. By the same reasoning, as $\frac{\partial q_J^*}{\partial \gamma} > 0$, the smaller γ is, the higher will be the probability of outsourcing. The case for the Y_I firms can be proven analogously.

Appendix D: Minimization Problems with Two Low-wage Countries

Consider that there are low-wage firms located in two countries, A and B , and that the home country has a closer cultural affinity with Country B . The effective unit labor cost is α in A , and $\alpha\delta$ in B , where δ is the ratio of using foreign labor in B and in A , such that $1 - \delta$ reflects the saving due to cultural affinity. Assume that $0 < \delta < 1$. A Y_J firm solves the following problem,

$$C_J^* = \min \left\{ \begin{array}{l} M + \max(q - \underline{q}, 0), \\ M + O + (\alpha + \gamma)(q - \underline{q}), \\ M + O + (\alpha\delta + \gamma)(q - \underline{q}) \end{array} \right\}.$$

The first option means producing entirely at home, the second option means producing \underline{q} at home and then outsourcing the rest to A , and the third option means producing \underline{q} at home and then outsourcing the rest to B .

A Y_A firm (with FDI in A) also has three options, and it solves the following problem:

$$C_A^* = \min \left\{ \begin{array}{l} M + F + \max(q - \underline{q}, 0), \\ M + F + O + (\alpha\beta + \gamma)(q - \underline{q}), \\ M + F + O + (\alpha\delta + \gamma)(q - \underline{q}) \end{array} \right\}.$$

Similarly, a Y_B (with FDI in B) firm solves the following problem:

$$C_B^* = \min \left\{ \begin{array}{l} M + F + \max(q - \underline{q}, 0), \\ M + F + O + (\alpha + \gamma)(q - \underline{q}), \\ M + F + O + (\alpha\beta\delta + \gamma)(q - \underline{q}) \end{array} \right\}.$$

The threshold outputs for each of the three types are:

$$q_J^* = M + \frac{O}{1 - \alpha\delta - \gamma},$$

$$q_A^* = \begin{cases} M + \frac{O}{1 - \alpha\beta - \gamma} & \text{if } \beta < \delta \\ M + \frac{O}{1 - \alpha\delta - \gamma} & \text{otherwise} \end{cases} \quad \text{and}$$

$$q_B^* = M + \frac{O}{1 - \alpha\beta\delta - \gamma}.$$

For simplicity, the special case when $\beta = \delta$ is demonstrated graphically in Figure A1. The total costs of a non-FDI firm, a firm with FDI in A , and a firm with FDI in B are shown by the solid line, the dotted line and the dashed line, respectively.

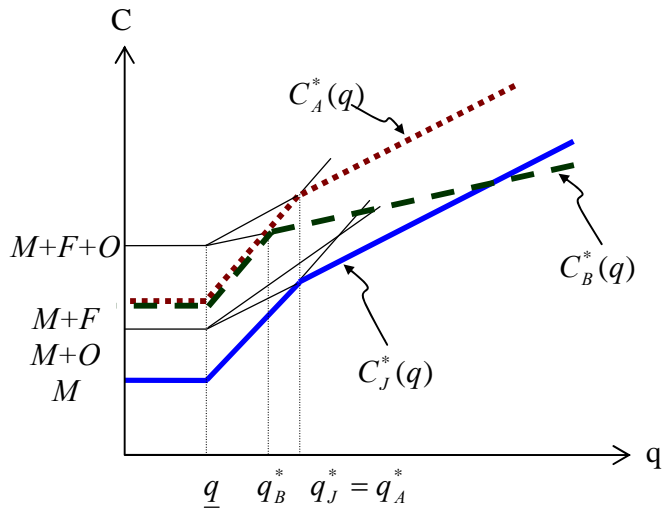


Figure A1 Firm Decisions over Export Outsourcing with Two Destinations (When $\beta = \delta$)

Appendix E: Proof of Proposition 3

(3a) A Y_J firm engages in export outsourcing when the order it receives exceeds the threshold level $q_J^* = M + \frac{O}{1 - \alpha\delta - \gamma}$. In such a case, the firm will send the export order to China (Country B) rather than elsewhere, given that China is culturally closer ($1 > \delta$).

(3b) A Y_B firm with previous FDI in China (Country B) engages in export outsourcing when the order it receives exceeds the threshold level $q_B^* = M + \frac{O}{1 - \alpha\beta\delta - \gamma}$. In such a case, the firm will send the export order to China, rather than elsewhere, due to both the cultural linkage ($\delta < 1$) and the FDI connection ($\beta < 1$).

(3c) A Y_A firm with FDI in a non-China region will send export orders to a supplier in China if two conditions hold: the saving from the cultural connection exceeds that from the FDI connection such that $1 - \delta > 1 - \beta$, and the order it receives exceeds $q_A^* = M + \frac{O}{1 - \alpha\delta - \gamma}$.

If the order size exceeds $q_A^* = M + \frac{O}{1 - \alpha\delta - \gamma}$, but the advantage of the FDI connection dominates, such that $1 - \delta < 1 - \beta$, the firm will outsource the order to its own overseas subsidiary in A . If the order size is below the threshold level, it will produce entirely at home.

Appendix F: An Example of Multiple Outsourcing Sites

Under certain circumstances, a Y_A firm with FDI in A may choose to outsource to both A and B simultaneously. The following is a set of sufficient conditions:

(i) The firm is subject to minimum employment constraints both at the home site (M) and in the overseas subsidiary (M_A), which are paid 1 and $\alpha\beta + \gamma$ per unit of labor, respectively. Together, these core workers allow the firm to produce any amount up to $q(M + M_A) = M + M_A$ in the domestic plant and the overseas subsidiary.

(ii) Because of the existence of the core workforce at the foreign site, the firm bears both the fixed cost F in maintaining the overseas subsidiary, as well as the fixed cost O of outsourcing.

(iii) An additional O is incurred if the firm outsources to B .

Under (i)~(iii), a Y_A -type firm solves a problem with three options:

$$C_A^{**} = \min \left\{ \begin{array}{l} [M + (\alpha\beta + \gamma)M_A + F + O] + \max(q - M - M_A, 0), \\ [M + (\alpha\beta + \gamma)M_A + F + O] + (\alpha\beta + \gamma)(q - M - M_A), \\ [M + (\alpha\beta + \gamma)M_A + F + O] + O + (\alpha\delta + \gamma)(q - M - M_A) \end{array} \right\}.$$

In each option, the $M + M_A$ units of output are to be produced at home (M) and in the subsidiary (M_A). The rest is produced at home, in the subsidiary in A and in a plant in B , respectively, in the three options.

Clearly, the second option dominates the first if the order size is above $M + M_A$, because of the advantage of FDI. Between the second and third options, the threshold level is

$$q_A^{**} = M + M_A + \frac{O}{\alpha(\beta - \delta)}.$$

For the third option to be more desirable, two more conditions must hold:

(iv) The advantage of the cultural connection is greater than the advantage of the FDI connection, such that $1 - \delta > 1 - \beta$.

(v) The export order is large, such that $q > q_A^{**}$.

When both (iv) and (v) are satisfied, the firm hires at the minimum employment levels in the home plant and the overseas subsidiary, and subcontracts the amount $q - M - M_A$ to a supplier located in B . The case is demonstrated in Table A2, where the lower panel shows the employment in all three locations.

Table A2. Home and Foreign Employment of a Y_A Firm (When $\beta > \delta$)

| | Total Cost | Employment at home | Employment in A | Employment in B |
|--|--|--------------------|-----------------------------|---------------------|
| $0 \leq q \leq \underline{q}(M + M_A)$ | $M + F + O$ $+ (\alpha\beta + \gamma)M_A$ | $M + F + O$ | M_A | 0 |
| $\underline{q} < q \leq q_A^{**}$ | $M + F + O$ $+ (\alpha\beta + \gamma)(M_A + q - \underline{q})$ | $M + F + O$ | $M_A + (q - \underline{q})$ | 0 |
| $q_A^{**} < q$ | $M + F + O + O$ $+ (\alpha\beta + \gamma)M_A$ $+ (\alpha\delta + \gamma)(q - \underline{q})$ | $M + F + O + O$ | M_A | $q - \underline{q}$ |

Appendix G: Proof of Proposition 4

For Proposition (4a), it is straightforward to deduce the result that a firm receiving a larger output order q is more likely to outsource abroad at a given threshold level.

For Proposition (4b), given that $M(s) < M(t) \rightarrow \theta(s) > \theta(t)$, we shall demonstrate the implication $L(s) < L(t) \rightarrow M(s) < M(t)$ in several steps. Three results are derived first.

Result A1. The domestic employments of a Y_j firm and a Y_l firm are,

$$L_j(k) = \begin{cases} M(k) & q \leq \underline{q}(k) \\ q & \text{if } \underline{q}(k) < q \leq q_j^*(k), \quad \text{and} \\ M(k) + O & q_j^*(k) < q \end{cases}$$

$$L_l(k) = \begin{cases} M(k) + F & q \leq \underline{q}(k) \\ q + F & \text{if } \underline{q}(k) < q \leq q_l^*(k), \quad k = s, t. \\ M(k) + F + O & q_l^*(k) < q \end{cases}$$

Result A2. Given that $\underline{q}(\cdot)$ is a continuous and increasing function, for two firms s and t , both of which are either of type Y_l or of type Y_j , other things being equal,

$$M(s) < M(t) \leftrightarrow \underline{q}(s) < \underline{q}(t) \leftrightarrow q^*(s) < q^*(t) \leftrightarrow \theta(s) > \theta(t).$$

Result A3. The threshold to outsource is higher than the maximum output level related to the core labor constraint, that is, $q^*(s) > \underline{q}(s)$ and $q^*(t) > \underline{q}(t)$.

Consider first the case where both firms s and t are of type Y_l . Based on Results A2 and A3, if $M(s) < M(t)$, then either (i) $\underline{q}(s) < \underline{q}(t) \leq q^*(s) < q^*(t)$ or (ii) $\underline{q}(s) \leq q^*(s) < q(t) < q^*(t)$.

If (i) holds, by result A1, other things being equal,

$$L(s) = \begin{cases} M(s) < M(t) = L(t) & q < \underline{q}(s) \\ q < \underline{q}(t) = M(t) = L(t) & \underline{q}(s) \leq q < \underline{q}(t) \\ q = L(t) & \text{if } q(t) \leq q \leq q^*(s) . \\ M(s) + O < q = L(t) & q^*(s) < q < q^*(t) \\ M(s) + O < M(t) + O = L(t) & q^*(t) \leq q \end{cases}$$

This means

$$M(s) < M(t) \rightarrow L(s) \leq L(t).$$

It can be shown analogously that

$$M(s) = M(t) \rightarrow L(s) = L(t) \quad \text{and}$$

$$M(s) > M(t) \rightarrow L(s) \geq L(t).$$

It follows that $L(s) < L(t) \rightarrow M(s) < M(t)$. The same result can be derived for Case (ii), and for the cases where both firms s and t are both of type Y_j .

We therefore conclude that, other things being equal, a larger observed domestic employment implies a larger domestic employment constraint, which in turn implies a smaller probability of outsourcing, such that $L(s) < L(t) \rightarrow M(s) < M(t) \rightarrow \theta(s) > \theta(t)$.

Appendix H: Definitions of Variables and Descriptive Statistics

| Variable | Definition | Mean | (S.D.) | Min. | Max. |
|--|--|-------|---------|----------------------------|-------|
| <u>Export outsourcing decision</u> | | | | | |
| <i>EO</i> | = 1, if engage in export outsourcing = 0, otherwise | 0.337 | (0.473) | 0 | 1 |
| (<i>EO_China</i>) | = 1, if outsources to China only = 0, otherwise | 0.242 | (0.428) | 0 | 1 |
| (<i>EO_other</i>) | = 1, if outsources to a non-China region only = 0, otherwise | 0.041 | (0.198) | 0 | 1 |
| (<i>EO_both</i>) | = 1, if outsources to both China and elsewhere = 0, otherwise | 0.054 | (0.226) | 0 | 1 |
| <u>Location characteristics</u> | | | | | |
| <i>FDI connection</i> | = 1, if outsources to the region of principal FDI = 0, otherwise | 0.304 | (0.460) | 0 | 1 |
| <i>Cultural connection</i> | = 1, if outsources to China = 0, otherwise | 0.500 | (0.500) | 0 | 1 |
| <u>Firm size and lead time</u> | | | | | |
| <i>ORDER</i> | = total export orders received (in USD100 million) | 0.504 | (1.405) | 9.323* 10 ⁻⁵ | 19.9 |
| <i>EMP</i> | = domestic employment (in 1000 persons) | 0.427 | (0.970) | 0.001 | 16.44 |
| <i>FDI</i> | = 1, if has foreign subsidiary = 0, otherwise | 0.506 | (0.500) | 0 | 1 |
| <i>LEAD</i> | = 1, if the period between receiving the order and delivery is less than 6 days = 0, otherwise | 0.029 | (0.168) | 0 | 1 |
| <u>Industry groups (by annual average export growth rate in 1990~2000)</u> | | | | | |
| <i>IND_thriving</i> | = 1, if in industries whose 10-year average export growth rate is greater than or equal to the world average of 7 percent (electronics, information and communications, chemicals, basic metals, precision instruments, electrical equipment, and plastics and rubber) = 0, otherwise | 0.590 | (0.492) | 0 | 1 |
| (export-sluggish industries) | = 1, if in industries whose 10-year average export growth rate is non-negative but less than the world average of 7 percent (machinery, transportation equipment, textiles, furniture, and miscellaneous manufacturing) = 0, otherwise | 0.304 | (0.460) | 0 | 1 |
| <i>IND_declining</i> | = 1, if in industries whose 10-year average export growth rate is negative (footwear, plywood, household appliances, processed food, toys, games and sports, animal and plant products, leather, and ceramic products) = 0, otherwise | 0.106 | (0.308) | 0 | 1 |

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