Post-Production Services and Optimal Integration Strategies for the Multinational Firm

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Abstract

This paper examines integration strategies that Korean multinational firms can choose to serve foreign markets. Given Korea's middle-income status, I study how firms in a middle-income country choose optimal strategies to integrate production and post-production services in different locations. Then, I examine how firms provide services through different types of service managers when serving geographically separate markets: high-income and low-income countries. In the theoretical model, heterogeneous firms must provide services for products through their subsidiaries abroad, but can produce output in different locations. The model shows that the firm's equilibrium decision depends on its productivity level and economic factors that affect production location and providing services. Using plant- and firm-level data, I use a bivariate probit model that links firms' optimal strategies with their productivity, conditional on industry and country characteristics. The empirical results are consistent with the model's predictions, showing that firms entering high-income countries are concerned primarily with the transport cost and their own productivity level whereas firms investing in low-income countries choose optimal strategies on the basis of productivity level and the degree to which service managers are internationally mobile between countries.

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1   Introduction

Recent literature on international trade has discussed the role of product quality as a determinant of trade patterns (Schott (2004); Hallak (2006); Crino and Epifani (2009)). These studies have concentrated on testing Linder's theory (1961), who was the first to argue that rich (poor) countries have a comparative advantage in producing high-quality (low-quality) goods and have relatively higher demand for these goods.[1] They have contributed to the trade literature by examining product quality to explain a large volume of bilateral trade between countries with similar income levels. Notably, however, the analysis has been restricted to developed countries and cannot adequately explain trade between heterogeneous countries, particularly outward foreign direct investment (FDI) flows from developing countries to developed countries.

As noted, developed countries have superior technology and rich endowments to produce and upgrade product quality to serve foreign markets. What kind of measures, then, can multinational firms in developing countries take to enter foreign markets and compete against high-quality products? In this work, I start to explore the idea that improving post-production services for products may be a tactical strategy for such firms. To study firms' strategies to serve global markets, this paper uses micro-level data for Korea, a middle-income country that have undergone remarkable growth in outward FDI in last few decades.

Much evidence exists to support the fact that providing post-production services is a crucial strategic decision for firms, specifically firms in emerging countries seeking to extend foreign market share. For example, Hyundai Motors, one of the largest multinational firms in Korea, is known worldwide for its post-production services. By providing high-quality service that is distinguishable from other foreign automobile makers producing high-quality vehicles, Hyundai has shown steady growth in its market share worldwide.[2] Although recent evidence indicates that the quality of services can be a comparative advantage for firms serving foreign markets, traditional theories of international trade have neglected to study the role service quality plays in firms' strategic decisions.

Recently, the literature has incorporated post-production services into firms' decisions to serve foreign markets, specifically examining what determines a firm's choice of providing services through outsourcing or providing services themselves through FDI. In particular, theoretical work has developed a duopoly model to formalize the role of distribution costs as a determinant of firms' choices on providing services in foreign markets (Qiu (2010); Ishikawa et al. (2010)). These models share two important features. First, domestic and foreign firms compete in the domestic market to provide services. Second, foreign firms' entry mode depend not only on distribution costs, but also on industry characteristics.[3]

In contrast to studying one aspect of firms' business activities to serve global markets, this paper studies the optimal strategies of multinational firms in a middle-income country to integrate production and post-

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[1] For example, Hallak (2006) develops an empirical framework to identify the effect of quality on the demand-side by studying the relationship between a country's income and its aggregate demand for quality. On the other hand, showing a positive correlation between export unit values and exporter per capita income, Schott (2004) supports Linder's (1961) theory predicting the impact of quality on the supply-side.

[2] Post-production services provided by Korean firms mostly involve repair and maintenance services after production. For example, Hyundai offers America's best warranty, which provides free repair and maintenance services for 10 years or 100,000 miles and 24/7 roadside assistance. Alternatively, CAS, a small Korean multinational firm that manufactures electronic scales, provides services by establishing numerous service centers and hiring service agents to provide maintenance service everyday (Dong-A Business Review, 2009).

[3] Conditional on the plant setup costs, Qiu (2010) show that foreign firms either merge with domestic firms (cross-border M&A) or establish local subsidiaries (greenfield FDI) under the high distribution cost. Also, see Nocke and Yeaple (2007) that stress the importance of marketing and distribution costs in affecting firms' foreign market entry modes between cross-border M&A and greenfield FDI.

production services in different locations. Then, I examine how firms provide services through different types of service managers for serving different foreign markets: high-income and low-income countries.[4]

To organize the discussions of firms' decisions to produce and provide services abroad, I introduce service quality differences into the heterogeneous firms trade model developed by Grossman et al. (2006), that analyze a complementary strategy of firms that choose different organizational forms to integrate producing intermediate goods and conducting assembly operations in different locations. In this paper, I introduce a one-stage production model in which firms can produce final outputs in different locations. After production, firms provide services by employing local or bringing home service managers to their local subsidiaries. The model shows that the decision a firm makes to produce and provide post-production services depends on its own productivity, market size, as well as industry and country characteristics.

Given that firms' optimal strategies to serve foreign markets are likely to differ based on the market size relative to the home country, I estimate the model separately for firms serving high-income countries and firms serving low-income countries. The empirical findings are consistent with the predictions of theoretical model. The results show that firms entering high-income countries choose optimal strategies based on their own productivity levels and the transport cost, a crucial element for firms' production location decision. Alternatively, for firms investing in low-income countries, their choice of strategies depends on productivity levels and the degree to which home service managers are mobile between countries which plays a key role in how firms decide to provide services.

This paper makes notable departures from trade literature on firms' production location choice and post-production services. In contrast to recent work on post-production services, this paper focuses on three concepts. First, I focus on maintenance and repair services as the firm's primary activity when providing post-production services in global markets. Second, firms must provide these services by establishing their own facilities abroad. Rather than studying firms' choice between outsourcing and FDI, this paper examines the determinants that affect firms' choice of international organization forms in different locations. Third, service managers provide post-production services in the company. These managers exert their abilities, which differ across countries, to demonstrate the service quality of final products.

On the other hand, in contrast to Grossman et al. (2006), this paper examines two additional phenomena. First, I study firms' strategies to integrate producing final outputs and providing post-production services. Second, I study the decisions that firms make to serve geographically separate foreign markets. Dividing the present study into two scenarios in which firms serve each type of foreign market, this paper aims to examine the determinants of firms' optimal strategies when facing different markets.

This paper makes two main contributions to the trade and FDI literatures. First, by adding the firm's decision to provide post-production services to its production location decision, I introduce a new pattern of FDI – service FDI, in which firms locate service subsidiaries to provide service of products that are imported from headquarters – in equilibrium. Second, in the line with Aw and Lee (2008), I analyze firms in a middle-income country that seek to serve global markets. In contrast to their model, which focuses on the effects of firm heterogeneity on Taiwanese firms' production location choices between U.S. and China, I concentrate on Korean firms' integration strategies related to post-production services when serving high- and low-income countries separately. This provides implications for how firms choose an optimal integration strategy when

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[4]Analyzing firms that provide post-production services through service managers are consistent with findings from the strategic management literature, which emphasizes the importance of service managers providing services through regular visits, routine conversations and promotions with buyers (Parasuraman et al. (1985); Anand and Delios (2002); Rouleau (2005)).

they serve the market from the perspective of a rich country and from the perspective of a poor country. To my knowledge, this concept has not been studied. Given Korea's income status, one of my goals is to provide insights into different forms of FDI that firms in a developing country can choose if they seek to serve developed countries.

The remainder of this paper is organized as follows. Section 2 presents recent FDI activities among Korean firms. Section 3 develops a model illustrating firms' choices for different integration strategies. Section 4 describes the data and variables for the empirical specification. Section 5 contains the empirical results of testing predictions from the model, and Section 6 concludes and proposes future work.

2   Data Facts

This section presents recent activities of Korean multinational firms worldwide using plant-level data from 2002 through 2009. This data include the full list of Korean worldwide investments during the sample period. All local subsidiaries abroad in which Korean firms hold at least 10% ownership share are included in the sample. The data was obtained from the Overseas Direct Investment Statistics from the Export-Import Bank of Korea. While the Export-Import Bank of Korea has collected data officially on Korean affiliates abroad since 2002, these figures are restricted from the public by the Ministry of Strategy and Finance of Korea for confidentiality reasons.

This plant-level data are very useful in that they provide information on individual foreign affiliates that are disaggregated by industry sectors and destination countries in a given year. The most interesting feature of the data is that they not only provide information on affiliates' balance sheets, but also on total sales divided by: (i) sales made from the local market, (ii) sales made from exporting back to the parent country, and (iii) sales made from exporting to third countries.[5] With information on affiliate sales, it is possible to distinguish plants based on whether they engage in horizontal, vertical, or export-platform FDI.

The data also provide information on the employment of each foreign affiliate, divided by the worker's nationality and occupation. Decomposed into employees from home country and host country, the data provide occupations, which are divided into top managers, middle managers, service managers, and production workers.[6] The data therefore show how Korean firms with different forms of FDI do business with various types of managers and production workers worldwide.

Table 1 presents the distribution of Korean multinational firms in manufacturing industries that engage in specific FDI type (first row) and the employee demographic in their local subsidiaries (last two rows) that are established between 2002 and 2009. Firms are divided based on the purpose of investment and by income-level of destination countries relative Korea in order to show how they use their subsidiaries and organize employees to serve different foreign markets.

In the table, horizontal FDI is defined as a firm investment in a foreign production facility that is designed to serve consumers in the foreign market. In the data, it involves firms that use subsidiaries to make sales only

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[5]In particular, sales made by each foreign affiliates can be divided within each category into sales to other Korean affiliates or foreign joint ventures and sales to unaffiliated customers.

[6]According to the data, top managers are defined as managers delegated from headquarters to appoint the overall performance of affiliates, whereas middle managers are defined as managers in charge of supervising production workers and, specifically, in charge of contracting with local production workers and sales of the products. Service managers are defined as managers outside the production line who are in charge of after-service of the products.

Table 1: New Korean affiliates serving local markets between 2002 and 2009

	High-income countries		Low-income countries	
	Horizontal FDI	Service FDI	Horizontal FDI	Service FDI
Production location				
% of facilities in specific FDI type	52.9	47.1	85.7	14.3
Employee demographic				
% of production workers	0.719	0	0.867	0
% of service managers	0.273	0.976	0.131	0.935
Service management				
% of local managers	98.3	99.2	50.9	46.3
% of Korean managers	1.7	0.8	49.1	53.7
affiliate size	133.53	48.53	296.14	105.21
# of entry firms	442		1198	

Note: High-income and low-income countries are divided according to real GDP per capita with respect to Korea in a given year.

from the local market by producing output through local production workers. On the other hand, service FDI is defined as a firm investment in a foreign service facility that is designed to provide post-production services of products in the foreign market. In the dataset, it involves firms that use subsidiaries to make sales only from the local market with products that are produced and shipped from Korea.[7]

The second row in Table 1 shows that when Korean firms invest in production facilities, they include not only production workers to produce outputs but also service managers to provide post-production services whereas service facilities do not include any of production workers but only with service managers. In particular, the third row shows that firms have different approach to service management in different markets. When serving high-income countries, most of Korean firms tend to employ service managers from host countries, whereas firms in low-income countries are more likely to either employ service managers from host countries or send managers from headquarters to provide services.

The most distinguishable feature of Korean firms from the table is that there exist large number of firms that invest in subsidiaries that make sales from the local market without producing goods in host countries; in particular, the first row in the table shows that nearly half of new facilities established in high-income countries are not designed to be involved in production facilities, but rather in service facilities. These stylized facts are consistent with the theoretical model which introduces a service FDI strategy for heterogeneous firms.

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[7]Consistent with affiliates' sales, data provide information on their imports from the local market, Korea, and third countries, which also can be divided within each category into imports from other Korean affiliates or from unaffiliated suppliers. Investigating imports made from affiliates that are designed to provide post-production services, I find that in both high- and low-income countries, these affiliates import products mostly from their headquarters in Korea. (On average, 98.6% of imports were from headquarters in high-income countries whereas 94.9% account for imports made from headquarters in low-income countries.)

3   Theoretical Framework

This section develops a simple model in which firms serving global markets face decisions regarding where to integrate production and services and how to provide services through different types of service managers. To capture the fact that Korean firms choose various strategies in different markets, I divide the analysis into two scenarios when they enter high- and low-income countries.

Firms in the Home produce final outputs and provide their services in foreign markets: North (n) or South (s). Each firm produces a differentiated variety. Consumers in all countries have a Dixit-Stiglitz preference over differentiated goods:

$$U \;\; = \;\; \left[\int_0^n q(\omega)^{1-\rho} x(\omega)^\rho d\omega \right]^{1/\rho} \qquad 0 < \rho < 1 \tag{1}$$

where n is mass of varieties available to consumers, indexed by ω; $x(\omega)$ is consumption of variety; and $q(\omega)$ is service quality of variety ω, as perceived by the consumer; and ρ is a measure of substitutability. Each variety is therefore a Cobb-Douglas bundle of physical quantity and perceived service quality.[8] Consumers maximize utility function subject to budget constraints

$$y = \int_0^n p(\omega) x(\omega) d\omega \tag{2}$$

where y is the exogenously given per capita income. Solving consumer's maximization problem yields the following demand for variety ω

$$x(w) \;\; = \;\; q(w) \frac{p(w)^{-\sigma}}{P^{1-\sigma}} R \tag{3}$$

where $\sigma = 1/1 - \rho > 1$ is the elasticity of substitution between varieties; $R = Ny$ is a national income with N as exogenously given population of a country; and P is the ideal price index of the country.[9] To capture the role of service managers, I assume that consumer's perceived service-quality takes the following form:

$$q \;\; = \;\; \lambda \alpha(z) \qquad \alpha(z) > 0, \;\; \alpha'(z) > 0 \tag{4}$$

where $\lambda \in (1, \infty)$ is the true service quality of variety and $\alpha(z)$ is a function capturing the exogenous skill-level (z) of service managers.[10] This form therefore indicates that consumer's perceived service-quality is affected by true service quality of the product and the manager's ability to demonstrate its quality to consumers.[11]

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[8]Perceived service quality is defined as the consumer's assessment of the overall excellence or superiority of the service (Zeithaml, 1998). Incorporating perceived service quality into the utility function implies that consumers rely on their expectation of services that will be provided by each variety and choose the brand that will fulfill their expectation.

[9]$P = \left[\int_0^n q(w) p(w)^{1-\sigma} dw \right]^{\frac{1}{1-\sigma}}$.

[10]λ implies inner service value of the product, for example, a 10-year service warranty for an automobile. Alternatively, the skill-level of service managers implies the manager's ability to demonstrate and perform the service value of the product, such as communication skills or other specific skills related to providing product maintenance and repair services. The value of service quality differs from the physical product quality studied by prior research (Hallak (2006); Johnson (2012)).

[11]By assuming that the managerial ability, rather than per capita income, affects the consumer's preference for the service quality of products, I do not address the effect of differences in the income distribution on demands. See Fajgelbaum et al. (2011) and Crino and Epifani (2009) for the analysis of the effect of product quality on the pattern of trade between countries based on non-homotheticity of preferences.

On the production side, a continuum of firms exist in the home country that differ in their productivity levels indexed by θ. A firm uses only labor to produce variety ω. Firm technology is represented by the constant marginal cost of production, is assumed to be mobile internationally, and can be replicated by its subsidiary. The unit variable cost of firm with productivity level θ that serves foreign markets by producing in country k is denoted by C_k:

$$C_k = w_k t / \theta \tag{5}$$

where w_k is the wage-level of production workers in country k and $t \geq 1$ is the melting-iceberg transport cost of shipping products to the destination market. As in Melitz (2003), the marginal cost is inversely related to firm productivity level and is independent of service quality. Each country differs in factor prices. Following the idea from Aw and Lee (2008), I assume that wage-level is highest in the North and lowest in the South such that $w_n > w_h > w_s$.[12] In addition to variable costs, multinational firms entering a foreign country via FDI incur the fixed investment costs of setting up plants.

To produce final outputs, firms face two choices for locating their plants. Firms can produce outputs at home and ship them to the destination market. This strategy incurs transport costs of shipping the products ($t > 1$), but saves the fixed cost of establishing facilities in the foreign country. On the other hand, firms can establish production facilities in the host country to serve local markets. This strategy would impose a fixed cost of FDI (f), but conserve transport costs of shipping products from the headquarters ($t = 1$).[13]

If cost differences across countries are the main factor that affects firms' decisions to choose between different production locations, proximity to consumers is a crucial element for firms needing to provide post-production services. To provide services of post-production outputs, therefore, all firms must establish service facilities in the destination market which incur the fixed costs of setting up plants (s). Firms then hire local managers or bring service managers from headquarters, whose decision depends on the managerial ability to provide services which is assumed to be exogenous and differs across countries. Following the idea from Nocke and Yeaple (2007), service managerial ability takes the following form:

$$\alpha(z) = \max \{z_k, \delta z_h\} \quad \text{for} \quad k = n, s \tag{6}$$

where $\delta \in (0, 1)$ is the degree of international mobility of home managers, capturing the idea that service managers are more effective in their home country than abroad.[14]

Given the fact that education level, which is used to proxy manager's ability in trade literature (Antras et al. (2006)), in Korea lies between that of developed countries and developing countries, I assume that managerial ability is highest in the North, lowest in the South and intermediate in Home, i.e. $z_n > z_h > z_s > 1$. Figure 3 in the Appendix shows the relationship between the country's per capita income and

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[12]According to LABORSTA, average wage rate per hour for manufacturing between 2002 and 2009 is \$16.81 in developed countries (higher-income countries relative to Korea in data set), \$11.29 in Korea, and \$3.88 in developing countries (lower-income countries relative to Korea in data set).

[13]Since my primary interest is to study firm strategies to serve countries that are richer or poorer relative to the home country by using two-country model, I exclude the possibility of firms producing outputs in third countries; for example, possibility of firms producing outputs in the South and ship them to their service facilities in the North to serve its market. In the Appendix, however, I discuss for this possibility.

[14]Indeed, Maurin et al. (2002) show that domestic firms are more competitive than foreign firms in marketing activities in their country. By assuming that managerial ability to provide service takes the following form, firms will either hire or send high-ability managers to provide services in the destination market.

service managerial ability, which is measured by the percentage of agents in the relevant age range enrolled in tertiary education. Managerial ability differences are also consistent with empirical findings that studied the role of managers in the company as international skill transfer from developed to developing countries (Gupta and Govindarajan (1994); Harzing and Noorderhaven (2006)).

When firms provide services through different types of managers, each firm bears a fixed cost of managing service managers, which can be interpreted as a fixed coordination cost in Nocke and Yeaple (2007). Because the service manager's role is to demonstrate the service quality of post-production outputs, the cost of managing these service managers are not proportional to the products that the company sell. This is the term "distribution cost" used by Qiu (2010). Instead, I assume that the management cost is proportional to the managers' abilities, which are given exogenously in the model.[15]

3.1   The international organization of production and post-production services

In this subsection, I derive firm's profit from serving foreign market as a function of its productivity level and economic factors that affect the decision on locating production and providing post-production services.

Within an industry, profit of a firm i that serves country k is as follows:

$$\Pi_{ik} \quad = \quad p_{ik}x_{ik} - C_{ik}x_{ik} - F_{j,k} \tag{7}$$

where $F_{j,k}$ is firm's fixed entry costs consisting of plant setup cost, denoted by subscript $j = H, S$ (H, for horizontal FDI; S, for service FDI) and the cost of managing service managers, denoted by subscript $k = n, h, s$. Solving for the firm's profit maximization problem, the optimal price is a constant mark-up ($\sigma/\sigma - 1 = 1/\rho$) over marginal cost:

$$p_{ik} \quad = \quad \frac{C_{ik}}{\rho} \tag{8}$$

Using country's demand level and optimal price, the profit of firm i producing variety to serve country k can be written as a function of firm productivity level and service quality

$$\Pi_{ik} \quad = \quad B_k(\overline{w}_k)^{1-\sigma}\theta^{\sigma-1}q_{ik} - F_{j,k} \tag{9}$$

where $B_k = (1 - \rho)R_k/(\rho P)^{1-\sigma}$. If firm i produces and serves country k via FDI, then $\overline{w}_k = w_k$. If firm i serves country k by producing in the home country and export, then $\overline{w}_k = w_h t$.

After producing variety, each firm provides post-production services. To capture the idea that upgrading service quality after production requires more activities such as fixed cost of opening additional service shops, I follow Crino and Epifani (2009) by assuming that upgrading the service quality of the product (λ) requires a fixed cost equal to $\frac{1}{\eta}\lambda^\eta$, where $\eta > 0$ is the elasticity of the fixed cost to service quality of the product.[16]

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[15]For expositional simplicity, this paper assumes that fixed managing cost takes the following functional form, $w(z)$ where $w(z) > 0$, $w'(z) > 0$.

[16]Recent studies have analyzed product quality as a source of firm heterogeneity by assuming that product quality is endogenous (Crino and Epifani (2009); Hallak and Sivadasan (2009); Johnson (2012)). This paper follows their idea by assuming that each firm chooses the level of service quality which incurs the fixed costs of upgrading. For example, firms can establish an additional service shop or hire additional managers for maintenance and repair services.

Firms therefore solve the following problem:

$$\max_\lambda \quad B_k(\overline{w}_k)^{1-\sigma}\theta^{\sigma-1}\alpha(z)\lambda - \frac{1}{\eta}\lambda^\eta - F_{j,k}$$

Solving this problem yields optimal service quality, λ^*:

$$\lambda^* \;=\; \left[\overline{\lambda}\theta^{\sigma-1}\right]^{\frac{1}{\eta-1}}, \qquad \overline{\lambda} = B_k(\overline{w}_k)^{1-\sigma}\alpha(z) \tag{10}$$

where $\eta > 1$ by the second-order condition for a maximum. Optimal service quality implies that, holding other factors constant, more productive firms choose higher service quality in all destination markets to which they provide services. The intuition for this result is that only the more productive firms are profitable enough to pay the additional fixed cost of upgrading service quality, which is consistent with Crino and Epifani (2009) who studied the relationship between product quality and firm productivity. Using optimal service quality (λ^*) into firm's profit yields:

$$\Pi_{ik} \;=\; \frac{\eta-1}{\eta}[B_k(\overline{w}_k)^{1-\sigma}\alpha(z)]^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{j,k} \tag{11}$$

$$\;=\; \frac{\eta-1}{\eta}(\overline{\lambda}\theta^{\sigma-1})^{\frac{\eta}{\eta-1}} - F_{j,k} \tag{12}$$

Equations (11) and (12) imply that firm's profit will differ depending not only on the firms' productivity level, but also on the industry and country characteristics; in particular, marginal costs of production and service managers' abilities.

Profit function therefore suggests that when making decisions to serve foreign markets, firms have four strategies from which to choose. Firms can engage in horizontal FDI with either home or local service managers, implying that firms integrate production processes and providing services in a single location by establishing manufacturing and service facilities. This integration strategy would impose the highest fixed costs of establishing plants ($f+s$) and managing different service managers, but conserve the transport costs. Alternatively, firms can undertake service FDI with either of home or local service managers, indicating that firms produce in the home country and export products to a service facility established in the destination market. This integration strategy imposes fixed costs of setting up a service facility (s) and managing different types of service managers, and the transport costs.

In the following, I will analyze the firms' optional strategies when they serve consumers in high-income countries and in low-income countries, respectively. For each market, I will examine the determinants of firms' choices among different strategies that maximize the profit.

3.1.1 Firms serving high-income countries

When firms enter the North, the profit functions of 4 strategies are as follows:

$$\Pi_n^{HH} \;=\; \frac{\eta-1}{\eta}(B_n\delta z_h w_n^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{H,h} \tag{13}$$

$$\Pi_n^{HL} \;=\; \frac{\eta-1}{\eta}(B_n z_n w_n^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{H,n} \tag{14}$$

$$\Pi_n^{SH} = \frac{\eta - 1}{\eta} (B_n \delta z_h (w_h t)^{1-\sigma})^{\frac{\eta}{\eta-1}} \theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{S,h} \tag{15}$$

$$\Pi_n^{SL} = \frac{\eta - 1}{\eta} (B_n z_n (w_h t)^{1-\sigma})^{\frac{\eta}{\eta-1}} \theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{S,n} \tag{16}$$

The first and second strategies (Equations (13) and (14)) represent horizontal FDI with home service managers and with local service managers to provide services, respectively. These strategies illustrate the market-access incentives for firms serving the North. The third and fourth strategies (Equations (15) and (16)) represent service FDI with home service managers and with local service managers, respectively. In contrast to horizontal FDI, relatively low production costs and plant setup costs are key motivations for these firms to undertake service FDI. All of these strategies are consistent with the stylized facts from Table 1.

Now, I compare the profits attainable for a firm with the measure of productivity, θ, from different strategies listed above. Given that $z_n > z_h > z_s$ and $\delta \in (0,1)$, it is straightforward to find that the profit from providing services through local managers dominates the profit from sending home managers under the same type of FDI strategy. That is, I can eliminate firms' strategies on providing services by sending home service managers and only consider strategies that involve local service managers to provide services. With two possible integration strategies: horizontal FDI and service FDI (Π_n^{HL}, Π_n^{SL}), which integration strategy to choose depends not only on the firm's productivity level, but also on the relative magnitudes of transport costs, fixed costs and relative wage.

Taking strategies underlying Equation (14) and (16), it is straightforward to see that as long as transport cost is larger than the wage differentials between the North and the Home, such that $t > w_n/w_h$, horizontal FDI strategy is more profitable than service FDI strategy at every productivity level, θ, in the absence of fixed investment costs. Conditional on fixed plant setup costs, it follows that:

$$0 < \frac{d\Pi_n^{SL}(\theta)}{d\theta} < \frac{d\Pi_n^{HL}(\theta)}{d\theta}, \tag{17}$$

and

$$\Pi_n^{HL}(0) < \Pi_n^{SL}(0) < 0 \tag{18}$$

Therefore, there exist (unique) thresholds θ_n^1 and θ_n^2 such that firms with productivity $\theta \in (0, \theta_n^1)$ will not enter the foreign market via FDI; firms with productivity $\theta \in (\theta_n^1, \theta_n^2)$ engage in service FDI with local managers; and firms with productivity $\theta > \theta_n^2$ engage in horizontal FDI with local managers.[17] This result is consistent with Helpman et al. (2004) model that more productive firms can afford to pay higher fixed investment costs to produce a high volume of products in the host country, whereas less productive firms export. Our model indicates, however, that more productive firms pay higher fixed costs to upgrade service quality, while less productive firms also participate in upgrading the service quality of products that are imported from headquarters by establishing service subsidiaries in the host country.

On the other hand, as long as transport cost is smaller than the wage differential between the North and

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[17]Because all profit functions are continuous with respect to firm productivity level, we can also use the intermediate value theorem to prove that there exist unique threshold $\bar{\theta}$ that cuts off two profit functions. Further, in the Appendix, Figure 4 depicts the operating profits attainable from possible integration strategies, for different levels of productivity, in different locations.

the Home, such that $(t \in (1, w_n/w_h))$, it is clear that choosing service FDI strategy is more profitable than choosing horizontal FDI strategy at every productivity level. In particular, it follows that:

$$0 < \frac{d\Pi_n^{HL}(\theta)}{d\theta} < \frac{d\Pi_n^{SL}(\theta)}{d\theta}, \tag{19}$$

and

$$\Pi_n^{HL}(0) < \Pi_n^{SL}(0) < 0 \tag{20}$$

In this case, a unique threshold θ_n^3 exists such that firms with productivity $\theta \in (0, \theta_n^3)$ will not enter the foreign market via FDI, whereas firms with productivity $\theta > \theta_n^3$ engage in service FDI with local managers. In other words, when serving countries that incur relatively low transport cost, firms will either not enter the market or engage in service FDI, and will never choose to undertake horizontal FDI. In contrast to prior trade literature that focused on examining FDI flows between Northern countries or from North to South, this model proposes that if FDI flows from South to North, then firms' activities are affected largely by the transport cost.

Given the same FDI strategy, with large managerial ability differentials between the North and the Home, firms find it more profitable to provide services with local service managers when serving high-income countries. However, if transport costs are sufficiently high, the most productive firms will choose horizontal FDI strategy, whereas less productive firms will choose service FDI strategy and the least productive firms will not enter the market via FDI. Alternatively, if transport costs are sufficiently low, firms never choose horizontal FDI strategy. Instead, more productive firms will undertake service FDI strategy, whereas less productive firms will not enter the market.

3.1.2 Firms serving low-income countries

When firms enter the South, the profit functions of 4 strategies are as follows:

$$\Pi_s^{HH} = \frac{\eta - 1}{\eta}(B_s \delta z_h w_s^{1-\sigma})^{\frac{\eta}{\eta-1}} \theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{H,h} \tag{21}$$

$$\Pi_s^{HL} = \frac{\eta - 1}{\eta}(B_s z_s w_s^{1-\sigma})^{\frac{\eta}{\eta-1}} \theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{H,s} \tag{22}$$

$$\Pi_s^{SH} = \frac{\eta - 1}{\eta}(B_s \delta z_h (w_h t)^{1-\sigma})^{\frac{\eta}{\eta-1}} \theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{S,h} \tag{23}$$

$$\Pi_s^{SL} = \frac{\eta - 1}{\eta}(B_s z_s (w_h t)^{1-\sigma})^{\frac{\eta}{\eta-1}} \theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{S,s} \tag{24}$$

Consistent with previous subsection, first two strategies (Equations (21) and (22)) indicate integrating production and service in the South with different types of service managers, whereas last two strategies (Equations (23) and (24)) indicate integrating business activities in different locations and involving different types of managers in the service department.

Comparing profits attainable for firms with different productivity levels from different strategies, in contrast to serving high-income countries, firms have to make a decision on providing services with different types of managers. In particular, depending on the degree of international mobility, it is clear that as long

as the degree of international mobility is higher than the managerial ability differential between the South and Home, such that ($\delta \in (z_s/z_h, 1)$), firms will find it more profitable to send home service managers than hiring local service managers under the same type of FDI strategy. Alternatively, as long as the degree of international mobility is lower than the managerial ability differential between South and Home, such that ($\delta \in (0, z_s/z_h)$), the profit from providing services through local service managers dominates the profit from sending home managers under the same FDI strategy. For each country, therefore, which FDI strategy to choose depends on the firm's productivity level and fixed plant setup costs.

Given that $w_n > w_h > w_s$ and $t > 1$, it is straightforward to see that firms are more profitable to choose horizontal FDI strategy over service FDI strategy at every productivity level, θ, in the absence of fixed costs. Conditional on plant setup costs, it can be seen that the most productive firms will bear high fixed costs of establishing manufacturing and service facilities in the South and produce varieties with low marginal cost, whereas less productive firms will export products to their service facilities abroad. Figure 5 in the Appendix depict the profits attainable for firms with different levels of productivity in countries with a low degree of international mobility (Fig. 5a) and in countries with a high degree of international mobility (Fig. 5b).

Figure 5 shows that in both types of countries, more productive firms will undertake horizontal FDI strategy, whereas less productive firms will choose service FDI strategy and the least productive firms will not enter the foreign market via FDI. It is the measure of service managerial ability that affects firms to choose between different strategies. In particular, the model shows that depending on the degree of mobility between countries, firms will provide services with local service managers in locations with low mobility, whereas send home service managers in countries with high mobility from Home.

To summarize, firms with different productivity level will choose different strategies to serve global markets, where more productive firms will choose FDI whereas less productive firms stay Home. Among FDI firms, their optimal strategies, however, differ depending on which market they are targeting to. In particular, when firms serve the North, the model predicts that their strategies are concerned primarily with integrating production and service in different locations, such that transport costs and productivity level play an important role in firms' decision. Alternatively, when firms enter the South, the model predicts that firms' strategies are concerned primarily with providing services. Depending on the degree to which home service managers are mobile between countries, firms choose different managers to provide services. The sorting of strategies by firms' productivity levels and industry and country characteristics provides the building block for the empirical specification presented in next sections.

4   Data

The theoretical framework presented in the previous section suggests that multinational firms choose different strategies when they serve different foreign markets. The sorting of firms doing business in high-income or low-income country based on their productivity level depends on industry and country characteristics: in particular, transport costs and the degree of international mobility. The following analysis illustrates the impact of these economic factors on firms' choice by using a sample of Korean multinational firms.

4.1 Data Analysis

To test predictions of firms' optimal strategies in foreign markets, this paper requires data that vary across industry sectors and countries. Specifically, data must fall into the following categories: showing cross-border activities of foreign affiliates and representing characteristics of parent firms, industry sectors, and host countries. As noted in Section 2, this paper uses plant-level data of Korean multinational firms from 2002 through 2009. This dataset provides information on individual foreign affiliates doing business in host countries including each company's balance sheet, date of establishment, sales and imports from different markets, ownership, and composition of employments.

Since data specify the owner of each subsidiary through its unique firm identification number, I also use parent firm-level data for the analysis, which was obtained from the Financial Supervisory Service of Korea and the Korea Information System (KIS) database of the Korea Investor's Service Co., Ltd. This data include all Korean firms registered as a corporation in different industries and contain detailed information of interest, including balance sheets, profit and loss statements, sales from domestic production and exports, total output, status on FDI, and the composition of employment. Each firm is classified by the Korean Standard Industrial Classifications (KSIC), which are defined by the Korea National Statistical Office. Because firm-level data itself do not provide information on local subsidiaries, this paper merges firm-level data from KIS with plant-level data from the Export-Import Bank of Korea.

The theoretical model studies firms' strategies of integrating production processes and post-production services. For the econometric analysis, therefore, I consider firms in the manufacturing industry using the three-digit KSIC level. Then, among firms in the manufacturing industry, I use observation of firms that established local subsidiaries abroad between 2002 and 2009. In a related study, a substantial body of work exists that examine firms' incentives to form cross-border mergers and acquisitions with local firms or foreign affiliates as their entry mode. However, because the model focuses on firms' integration strategies of entry, observations only include firms that have sole ownership over local subsidiaries.[18]

Further, because our primary interest is to study firm activities in serving local consumers, FDI firms that make sales by exporting products back to headquarters or to third countries are excluded. To examine Korean firm activities in different foreign markets, I decompose destination countries by developed and developing countries (relative to Korea) based on their income-level measured by real gross domestic product (GDP) per capita from World Development Indicators, 2010. After eliminating observations to make it consistent with the model, the number of firms discovered for analysis is 1,516, with 372 observations from high-income countries and 1,144 from low-income countries.[19]

4.2 Variables

In this section, I discuss the definition of strategies used in the empirical setting and provide detailed information on variables for the econometric analysis. Dependent variables are firm strategies to integrate

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[18]Plant-level data contain information on whether a foreign affiliate is established through sole investment by parent firms, through joint venture with other firms, or through purchasing from other firms, as well as parent firms' share of equity investment. To make observations consistent with the model, I include firms that enter foreign markets through greenfield FDI or firms that have 100% equity investment in their local subsidiaries.

[19]Results using the entire sample of new FDI firms between 2002 and 2009 are very similar to those reported in Section 5 because horizontal investments dominate the sample. Among FDI firms during the sample period, horizontal FDI account for 92% of the observations, whereas vertical FDI account for 2%, and complex FDI (which denotes firm activity of engaging in multiple types of FDI), account for 4% of the sample. Results using the entire sample are available on request.

production and service in different locations and provide post-production services with different types of service managers. Because we only observe each firm's strategy through the composition of employments in the subsidiary, I construct binary variables to capture firms' decisions on production location and providing services. Then, binary choice model will be used to estimate the probability that a firm chooses a specific strategy type.

To capture firms' decisions on integrating production and service abroad, I construct a dummy variable, *manu*, which is equal to 1 if a subsidiary makes sales from the local market by producing outputs through local production workers, whereas zero if it makes sales from the local market without employing any local production workers, but only imports products from the headquarters. On the other hand is firm activity to provide post-production services through different types of managers. In particular, a dummy variable, *local*, is equal to 1 if a subsidiary only includes local managers in the service department and zero otherwise.

Because observations include firms that engage in horizontal FDI or service FDI, a binary variable capturing firm's integration decision, *manu*, takes a value 1 if firms engage in horizontal FDI and zero if undertake service FDI. Firms' decisions to provide services, however, are complicated. In particular, the dataset indicates that most of subsidiaries either include local managers or none to provide services in high-income countries, whereas they include either of local and Korean managers or none in low-income countries. The binary variable, *local*, therefore, takes a value of 1 if a subsidiary includes only local managers to provide services, otherwise zero for the specification of high-income countries. In contrast, I reduce the sample size to firms that include either local or Korean service managers and construct the same binary variable, *local*, which is equal to 1 if a subsidiary employs only local service managers and zero if it employs only Korean service managers for the specification of low-income countries.[20]

The key explanatory variables used for the analysis are firm productivity level, transport cost, and the degree to which service managers are internationally mobile. To measure firm productivity, this paper uses labor productivity. This is because the theoretical model assumes labor as only input to produce the final outputs, with information on capital flow or stock not available in the dataset.[21] For industry characteristics, the model predicts that the transport cost plays a key role in the firm's decision to choose between different integration strategies when entering high-income countries. Because data on transport cost are difficult to obtain, prior trade literature has turned to indirect measures of transport cost using proxies such as distance measured by using the great circle distance between national capitals of the home and destination country and ad-valorem shipping costs calculated as trade partners' CIF/FOB ratio.[22]

When using distance as a proxy for transport cost, however, it also proxies for the technology transfer between trading countries. For example, Keller (2002) examined the geographic distance between countries as a determinant of technology diffusion between countries. He found evidence that knowledge spillover is localized geographically such that productivity effects decline with the geographic distance between sender and recipient countries. Alternatively, the value of using CIF/FOB ratio as a proxy for transport cost has

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[20]This results in a loss of 2.9% of firms investing in low-income countries. Further, according to the data, top and middle managers in the organization are not directly related to the production process or providing service, which are the main interests of the paper. Therefore, the composition of top and middle managers varies for each subsidiary in constructing dependent variables; still, all subsidiaries include either or both top and middle managers.

[21]Following Aw and Lee (2008), I compute labor productivity as $[(lnQ - \overline{lnQ}) - (lnL - \overline{lnL})]$ where $\overline{lnQ}$ and $\overline{lnL}$ are the industry mean levels of the log of total revenue plus net inventory change and log of total employment. Using value-added per worker, as an alternative measure for labor productivity, does not change the empirical results.

[22]Many researchers measured trade costs by comparing the difference of the valuation of the same flow reported by both exporter and importer (Brainard (1997); Helpman et al. (2004); Hummels and Lugovskyy (2006))

been questioned. Indeed, Hummels and Lugovskyy (2006) used data from IMF Direction of Statistics and found that CIF/FOB ratio between countries are not useful to measure cross-commodity variation.

Instead of using data constructed from the matched partner technique, this paper follows Tekin-Koru (2012) on calculating tariff rate as a measure of transport costs by using data from UNCTAD-TRAINS. The data include information on tariff rates and trade data using the six-digit HS industry level for 103 countries. Here, I compute unweighted averages using the five-digit SITC industry level and map these figures into the three-digit KSIC industry level by using Trade Statistics provided by the Korea International Trade Association.[23]

The key explanatory variables also include the degree to which service managers are internationally mobile from the home to the destination country. In the model, the degree of international mobility indicates a country's barrier that hinders the ability of managers from the home country to provide services in the foreign market. Because the model focuses on managers providing post-production services to final consumers rather than examining their role as problem solvers between production workers and top management or technology transfer to production workers, both of which are related to goods trade inside the organization (Garicano (2000); Antras et al. (2006)), I proxy the degree of international mobility as being a cultural differences between home and host countries, in particular, a common language between countries (Rauch (1999); Keller (2002, 2004)).[24]

Suggested by Rauch (1999), I construct a common language dummy variable by assigning countries to language groups on the basis of Ethnologue. However, because the Korean language is not spoken outside Korea, I assume English to be a common language. Thus, I construct a dummy variable, *language*, which is 1 if at least 10% of the population of the host country speaks English at home.[25] Hence, I expect that countries speaking a common language strongly facilitate firms to send home managers, whereas countries with a different language positively affect firms to employ local managers to provide services.

For controls, this paper includes variables representing other firm and country characteristics. To capture firm characteristics that affect the decision to choose an optimal strategy, I add firm-specific assets. First, I use firm's R&D intensity, computed as the firm's total R&D expenditures divided by total sales at the end of the fiscal year. Second, I use firm's international experience, which is measured by the number of previous subsidiaries a firm had worldwide (*experience*), and the total employment (*size*).[26] Broad international experience increases previous knowledge of local markets, connection to bureaucracy, and business culture which facilitate multinational firms to invest abroad (Tekin-Koru (2012)). Therefore, this previous knowledge may influence the firm's decision not only on production processes, but also on providing services. I expect positive signs on all of strategies, even though the strength of this effect on each strategy is ambiguous.

To capture the effects of country characteristics, I measure market size using the country's GDP and state of infrastructure by constructing an index using data on telephone, computer and internet usage (*infra*).[27]

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[23]I also compute weighted averages using the five-digit SITC industry level, but do not report their results due to the reduced number of observations in regressions.

[24]These studies have focused on the cultural differences between countries as one of measurements for knowledge transfers and proposed that country characteristics such as language and religion are important elements in diffusing international technology that is not necessary related to goods trade. Although our model is not related to technology diffusions, it is consistent with their work on studying the role of service managers that are not related to goods trade.

[25]Data obtained from Ethnologue's 16th edition and the CIA's World Factbook shows that, on average, 15.2% of Korea's populace speaks English at home during the sample period.

[26]Firm size is not only an indicator that captures a firm's international experience and its capabilities to overcome investment barriers, but also distinguishes the size effect from firm productivity.

[27]In particular, infrastructure index is constructed as an average of three indicators: fixed line and mobile subscribers per

Furthermore, because managers' abilities across countries play a key role in affecting firms' decision on providing services, following the idea from Antras et al. (2006), I proxy service managerial ability as the percentage of agents in the relevant age range enrolled in tertiary education. All of the country-level data are obtained from the International Financial Statistics of IMF, the World Development Indicators from The World Bank, and LABORSTA from International Labour Organization.

5 Empirical Results

5.1 Estimation method

Dependent variables are binary and include firms' decisions on production location and providing post-production services, which can be interrelated as strategies to serve foreign markets. For the econometric analysis, therefore, I first divide firms into two sets based on income-level of their host countries relative to Korea. For each set, I specify bivariate probit model to test whether the firms' strategies are related and identify the determinants of firms' strategies.

The bivariate probit model provides a test for a positive correlation between firm's decision to locate production facilities in a host country and to provide services through local service managers conditional on the vector of covariates including the explanatory and control variables mentioned in the previous section. Then, I calculate the marginal effects for the joint probability of whether to integrate production and service in the host country and whether to provide post-production services with local managers are chosen simultaneously.[28]

In particular, when the bivariate probit is used, firm i's decisions are:

$$
\begin{aligned}
y_{i,manu}^* &= x_i^{'}\beta_{manu} + \mu_{manu} & (25) \\
y_{i,local}^* &= x_i^{'}\beta_{local} + \mu_{local} & (26)
\end{aligned}
$$

where $y_{i,j}^*$ are unobservable and related to the binary dependent variables $y_{i,j}$ by the following rule

$$
\begin{aligned}
y_{i,j} &= 1 \ \ \text{if} \ \ y_{i,j}^* > 0 & (27) \\
&= 0 \ \ \text{if} \ \ y_{i,j}^* \leq 0 & (28)
\end{aligned}
$$

whereas $x_i^{'}$ is a vector of explanatory variables that account for firm and country characteristics and β_j is a vector of unknown coefficients that are specific to the jth strategy for $j = \{manu, local\}$.

To estimate bivariate probit models, I use a bivariate standard normal distribution function $\Phi(.; \rho)$ by assuming that the mean of error terms (μ_j) is zero and variance-covariance matrix V has values of 1 on the leading diagonal and correlations ρ as off-diagonal elements for all j. The correlation coefficient (ρ) denotes the extent to which the error terms are covary and its sign indicates if firms' decisions on integrating production and service in the host country and choosing local service managers are influenced by unobservable factors whose effects operate in the same direction. If error terms between the two probit models are not

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1000 habitants, internet users per 1000 habitants, and computers per 1000 habitants in a given year.

[28]Because firm strategies involve producing and providing services of products, the main interest in the empirical analysis is to examine the economic factors that affect the likelihood of firms choosing joint strategies. In the appendix, however, I also report the marginal effects for the success probability of each strategy.

correlated such that $Cov[\mu_{manu}, \mu_{local}] = 0$, firms' decisions could be estimated separately through univariate probit models.

Given the bivariate standard distribution, the joint probability that firm i's decisions are simultaneously chosen is defined as:[29]

$$Pr(y_{i,manu} = 1, y_{i,local} = 1) \quad = \quad \Phi(x_i' \beta_{manu}, x_i' \beta_{local}; \rho) \tag{29}$$

if $\rho = 0$, then the probability of joint strategies is just the product of marginal probabilities of each strategy.

Furthermore, since firms' choosing strategies on the basis of their productivity level depend on the scale of transport cost and the degree of international mobility, the interaction effects of these two determinants play a crucial role in the empirical analysis. Here, following Ai and Norton (2003) and Greene (2010), we will present the results of the estimated coefficient of interaction terms and calculate the average marginal effects of firm productivity on the success probability of firms' joint strategies. Then we will present figures that provide evidence concerning the statistical and economic significance of the total interaction effects between firm productivity and industry and country characteristics.[30]

5.2   Empirical results

I begin with the maximum likelihood estimates of the bivariate probit models using samples from high-income countries, which are reported in Table 2. Year dummies and industry sector dummies are included to control for year- and industry-specific fixed effects. Robust standard errors clustering for host countries are reported in the parenthesis to account for the possible correlated shocks that might affect all foreign affiliates in the same host country. The table displays coefficient estimates in the first two columns and the average marginal effects of the explanatory variables on the success probability of joint strategies – horizontal FDI with local managers ($y_{i,manu} = 1$ and $y_{i,local} = 1$) and service FDI with local managers ($y_{i,manu} = 0$ and $y_{i,local} = 1$) – in the last two columns.

The correlation coefficient (ρ) in Table 2 implies that no interrelationship exists between firms' decisions related to integrating business activities in the host country and providing service through local service managers. Examining the determinants for different firm strategies, the coefficient estimates on the tariff rate are statistically insignificant, as shown in the first and second columns. This indicates that the transport cost from the home to the destination market do not effect firms' decisions on production location and post-production services independently.

It is interesting to see that productivity is not a significant determinant of firms' decisions to locate production abroad. This is inconsistent with prior empirical studies that have emphasized the importance of firm productivity in affecting firms' entry mode such that more productive firms are more likely to undertake

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[29]Joint probability can also be defined as $\int_{-\infty}^{\mu_{i,manu}} \int_{-\infty}^{\mu_{i,local}} \phi(x_i' \beta_{manu}, x_i' \beta_{local}; \rho) d\mu_{i,manu} d\mu_{i,local}$, where $\phi(.)$ is joint probability density function for two standard-normally distributed error terms.

[30]Arguments exist between whether to interpret interaction terms from estimated probit coefficients or marginal effects. For example, Frant (1991) and Nagler (1991) argued that marginal effects can produce interaction effects an artificial predictions, whereas Meyer (1995) argued that the estimated coefficients only allow the research to state the significance and the sign of an effect, but not on its extent. Recently, Ai and Norton (2003) and Greene (2010) showed that for non-linear models, the total interaction effect may have a different sign and statistical significance from those determined by a t-test on the estimated coefficient of the interaction term alone. To present the practical importance of interaction terms, they proposed presenting graphical evidence to supplement probit regression results, for the purpose of providing further insight into the statistical and economic significance of the interaction.

Table 2: Bivariate probit, high-income countries

Firm strategies	Estimates		Marginal effects on joint probability	
	manu	*local*	*HL*	*SL*
tariff	0.438	0.117	0.058	-0.022
	(0.324)	(0.364)	(0.065)	(0.058)
productivity	-0.256	0.546	0.057	0.109
	(0.522)	(0.585)	(0.042)	(0.136)
R&D intensity	-0.507	-0.043	-0.053	0.039
	(0.394)	(0.446)	(0.071)	(0.081)
experience	0.307**	0.14	0.491*	-0.064
	(0.141)	(0.107)	(0.263)	(0.126)
firm size	-0.114	-0.095	-0.024	-0.004
	(0.102)	(0.062)	(0.018)	(0.004)
language	0.599	0.373	0.095	0.011
	(0.962)	(1.02)	(0.158)	(0.135)
GDP	0.013	0.085	0.013	0.012
	(0.083)	(0.064)	(0.011)	(0.013)
infra	-0.133	0.207	0.018	0.045
	(0.265)	(0.27)	(0.036)	(0.061)
education	0.008	-0.042	-0.005	-0.007
	(0.014)	(0.03)	(0.003)	(0.005)
tariff*productivity	0.167	-0.279		
	(0.283)	(0.347)		
language*productivity	-0.568	0.775		
	(0.934)	(0.964)		
tariff*language	-0.152	-0.15		
	(0.442)	(0.485)		
constant	-3.23^*	-1.44		
	(1.89)	(2.03)		
Observations	351			
Log-likelihood	-315.53			
Success probability			0.109	0.122
ρ	-0.055			
	(0.059)			
LR-test of $\rho = 0$	$\chi^2(1) = 0.862$			

Note: Robust standard errors are in the parenthesis. $***,**,*$ denote significance at the 1,5,10 percent, respectively; regression includes a time, country, firm and industry fixed effects. Testing firms that only include Korean service managers are not available due to the small number of observations.

FDI, whereas less productive firms tend to export from the home country. A possible explanation for this inconsistency is that although service FDI in the model involves firm exports, the firm incurs fixed investment costs to enter foreign countries. This implies that firm productivity does not affect firms' production location choices between FDI firms. Furthermore, the model predicts that the effect of productivity on the firm's location choice is conditional on the transport costs. Insignificant coefficients of firm productivity, therefore, suggest analyzing its impact on firms' integration strategies conditional on the tariff rates.

The interaction term between firm productivity and tariff rate in the first column of Table 2 is positive yet insignificant. As noted, however, one must be cautious in interpreting the interaction terms from coefficient estimates and marginal effects. Table 4 in the Appendix shows the estimates of the average marginal effect of productivity on the joint probability of choosing different strategies based on different tariff rate levels. Figure 1, in contrast, presents the development of marginal effects conditional on tariff rates.

Examining a firm's strategy to choose horizontal FDI with local service managers, Figure 1a illustrates that the marginal effect of firm productivity corresponds to upward direction in tariff rates.[31] Basically, this implies that productivity level becomes more effective in enhancing the probability that a firm will choose horizontal FDI and employ local managers when tariff rates are higher. The marginal effect gains statistical

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[31]Note: 95% level of confidence interval.

significance in the high range of the tariff rates, implying that the positive effect is realized in countries with a higher level of tariff rates. The first three columns of Table 4 confirm that the magnitude gradually increases as the tariff rate increases and holds the statistical significance at the 5% level in the high range of the tariff rates.[32]

(a) Horizontal FDI with local service managers   (b) Service FDI with local service managers
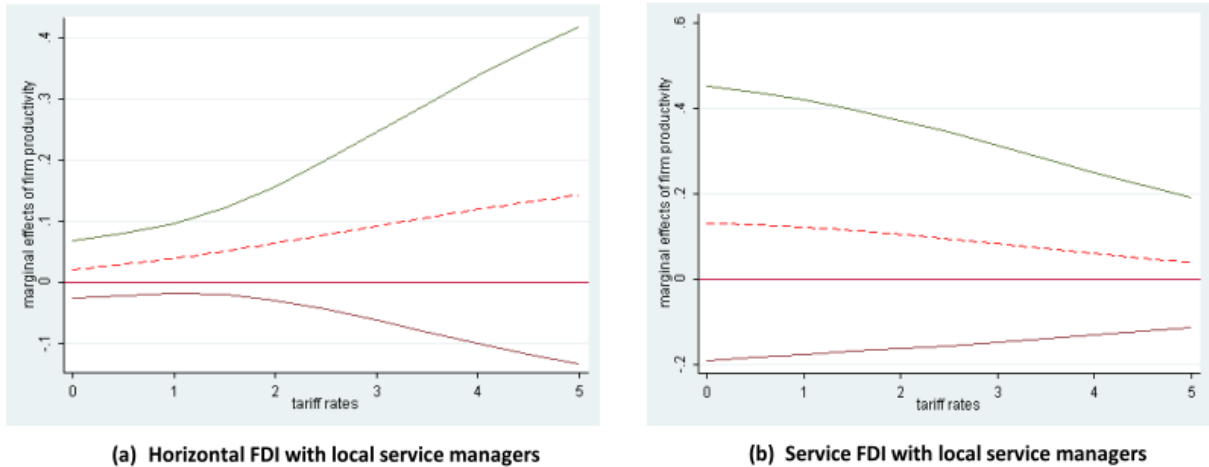
Figure 1: Interaction effects on the joint probability of firm strategies in high-income countries

Turning to firm strategy on integrating business activities in multiple locations, Figure 1b shows that the marginal effect of firm productivity follows a downward direction in tariff rates. This implies that productivity level is more effective in increasing the probability of a firm engaging in service FDI and employing local managers when the tariff rate is lower. The last three columns of Table 4 also indicate that the magnitude of marginal effects decreases as the tariff rate increases. The statistical significance of the marginal effect holds in the low range of tariff rates, whereas the effects are widely insignificant in the high range of tariff rates.

Most of the other covariates exhibit their expected signs, although some exhibit insignificant effects on both of firm strategies. In particular, firm's experience, measured as its number of previous local subsidiaries worldwide, has a positive and significant impact on the production location decision. Calculating the average marginal effects shows that firms' experience increases the odds in favor of choosing horizontal FDI with local service managers at the 10% significance level.

The results in Table 2 show that firms' decisions on production and post-production services are independent as strategies. To gain further insights into the effect of economic factors on firms' decisions, Table 5 in the Appendix display the results from using univariate probit model. The table reports the probit estimate coefficients in the first two columns and the average marginal effects of the explanatory variables on the success probability of each strategy – integrating production and service in the host country (*manu*) and providing services through local managers (*local*) – in the last two columns.

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[32]To examine the interaction effects between the level of firm productivity and the degree of international mobility, I have also computed the marginal effects of firm productivity on the joint probability, conditional on whether the host country shares a common language. The results are reported in the last two columns of Table 6 in the Appendix. This table shows that the marginal effects of firm productivity level are widely insignificant for countries that either share a common language or not.

As expected, the results do not differ significantly from the results of the bivariate probit shown in Table 2. The coefficient estimates of the univariate probit reveal that the tariff rate and firm productivity level do not have significant effects on firms' production location decisions, whereas firms' experience have significant effects on the probability of choosing horizontal FDI strategy to serve high-income countries. Estimating the interaction effect between firm productivity and the tariff rate on the likelihood of firms choosing each strategy showed that the marginal effects of firm productivity were widely insignificant in every range of the tariff rates.

Table 3: Bivariate probit, low-income countries

Firm strategies	Estimates		Marginal effects on joint probability			
	$manu$	$local$	HL	HH	SL	SH
tariff	0.156	0.114	0.012	-0.019	0.006	0.0005
	(0.119)	(0.082)	(0.014)	(0.012)	(0.005)	(0.001)
productivity	0.238^{***}	-0.006	0.007	0.002	-0.008^{***}	-0.002^{**}
	(0.052)	(0.04)	(0.006)	(0.006)	(0.003)	(0.001)
R&D intensity	0.545^{**}	-0.088^{**}	0.005^{*}	0.017^{***}	-0.02^{*}	-0.003
	(0.273)	(0.035)	(0.003)	(0.006)	(0.011)	(0.002)
firm size	-0.298^{***}	-0.026	-0.015^{**}	0.002	0.01^{***}	0.002^{**}
	(0.045)	(0.037)	(0.007)	(0.005)	(0.003)	(0.0008)
language	-0.31	-0.106	-0.069	0.072	-0.068	0.009
	(0.208)	(0.564)	(0.051)	(0.051)	(0.051)	(0.009)
education	0.303	-0.07	-0.0001	0.013	-0.011	-0.002
	(0.778)	(0.309)	(0.058)	(0.049)	(0.029)	(0.005)
infra	0.112^{***}	0.167^{***}	0.031^{***}	0.026^{***}	-0.003^{***}	-0.002^{***}
	(0.032)	(0.018)	(0.003)	(0.003)	(0.001)	(0.0005)
GDP	-0.567	-0.057	-0.029	0.005	0.02	0.004
	(0.504)	(0.113)	(0.024)	(0.018)	(0.014)	(0.003)
experience	-0.002	0.086^{**}	0.013^{*}	-0.013^{**}	0.004^{***}	-0.0003
	(0.044)	(0.038)	(0.007)	(0.005)	(0.001)	(0.0005)
language*prod	0.117^{***}	0.009				
	(0.041)	(0.158)				
tariff*prod	-0.197	0.225				
	(0.807)	(0.188)				
tariff*lang	0.526^{**}	-0.156^{*}				
	(0.221)	(0.085)				
constant	-1.84^{***}	1.71				
	(0.325)	(2.22)				
Observations	966					
Success probability			0.895	0.087	0.014	0.003
ρ	0.161^{***}					
	(0.054)					
LR-test of $\rho = 0$	$\chi^2(1) = 8.65$					

Note: Robust standard errors are in the parenthesis. $***,**,*$ denote significance at the 1,5,10 percent, respectively; regression includes a time, country, firm and industry fixed effects.

Table 3 reports the results of estimating bivariate probit models using samples from low-income countries. Consistent with the previous specification, the table reports estimate coefficients in the first two columns and the average marginal effects of explanatory variables on the success probability of joint strategies – horizontal FDI with local managers ($y_{i,manu} = 1$ and $y_{i,local} = 1$), horizontal FDI with home managers ($y_{i,manu} = 1$ and $y_{i,local} = 0$), service FDI with local managers ($y_{i,manu} = 0$ and $y_{i,local} = 1$), and service FDI with home managers ($y_{i,manu} = 0$ and $y_{i,local} = 0$) – in the last four columns.[33]

In contrast to the previous specification, the correlation coefficient (ρ) is positive and significant at the 1% level to reject that $\rho = 0$, indicating that a complementary relationship exists between firms' decisions to integrate business activities in the host country and provide services through local managers when serving

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[33]Note that we are testing with the sample of firms that include either type of service managers inside the organization. This accounts for 97.1% of firms serving low-income countries via FDI.

low-income countries.

Turning to coefficient estimates, firm productivity level has a positive and significant influence on the likelihood that firms will integrate production and service in host countries. Calculating the average marginal effect shows that an infinitesimal increase in productivity level significantly reduces the probability of engaging in service FDI by 0.8% for firms that provide services with local managers and by 0.2% for firms that send Korean managers to provide service. Although the marginal effects of productivity level on choosing service FDI with either type of manager is relatively small in terms of absolute magnitude, this is nevertheless economically meaningful compared to the success probability evaluated at the sample means. Consistent with the Table 2, however, insignificant coefficient on the tariff rate and language point out that they are not a determinant of a firm's decision to locate production in different locations or employ different types of service managers.

(a) Horizontal FDI with local managers   (b) Horizontal FDI with home managers

(c) Service FDI with local managers   (d) Service FDI with home managers
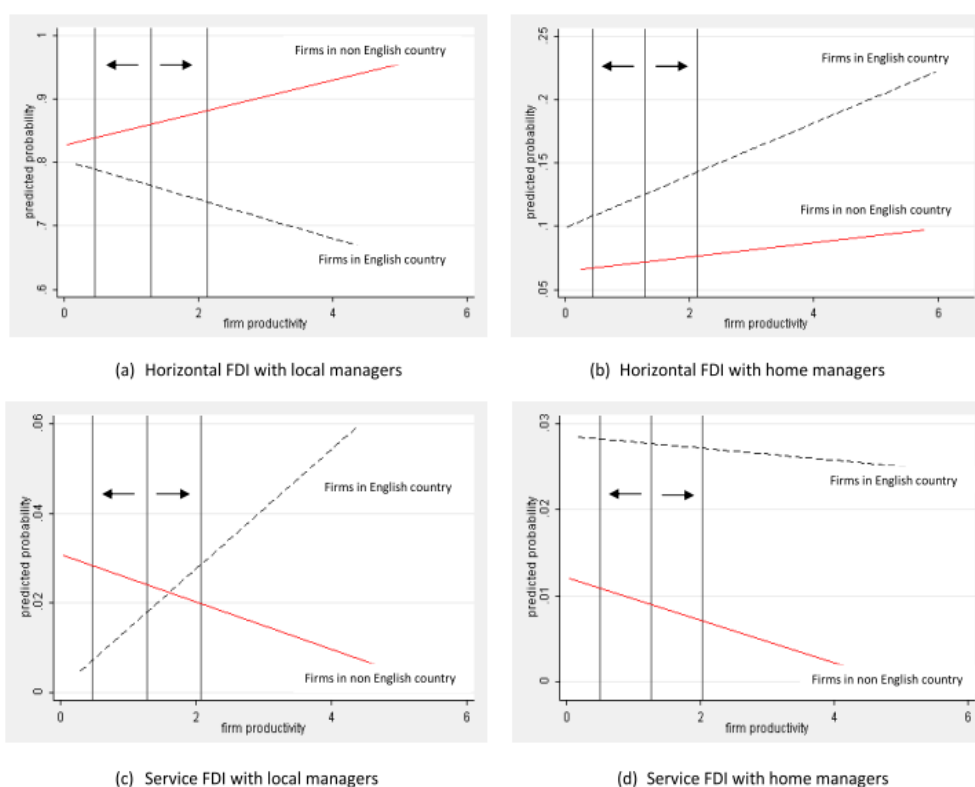
Figure 2: Interaction effects on the joint probability of firm strategies in low-income countries

Computing for the marginal effects of productivity on the joint probability of choosing different strategies conditional on whether the host country shares a common language, results are depicted in Figure 2.[34] Analyzing firm integration strategies that provide services through local managers, Figures 2a and 2c show several implications. First, the figure shows the regression line for firms investing in non-English-speaking

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[34]Estimating the interaction effects between firm productivity level and tariff rates on the joint probability of firms' choosing different strategies, the results showed that the marginal effects of firm productivity were widely insignificant in all ranges of the tariff rates (results are not shown to save space but available upon request).

countries lies above the corresponding line for firms investing in English-speaking countries. This is consistent with the results that establishing facilities in countries that do not share a common language make it more likely that firms will provide services using local managers. Figure 2c, however, indicates that beyond a certain level of productivity, these firms are likely to provide services through local managers in English-speaking countries.

Furthermore, each section of the figure shows regression lines with different slopes. In particular, the line for firms that invest in non-English-speaking countries has a positive slope in Figure 2a, whereas it has a negative slope in Figure 2c. In other words, these results indicate that productivity level becomes more important for firms that engage in horizontal FDI with local service managers, whereas it becomes less important for firms that undertake service FDI with local service managers in non-English-speaking countries.

Finally, increasing a firm's productivity level from one standard deviation below to one standard deviation above the mean from Figure 2a increases the joint estimated probability of engaging in horizontal FDI and including local managers in non-English-speaking countries by approximately 7%. Similarly, it reduces the probability of firms engaging in horizontal FDI with local managers in English-speaking countries by approximately 5%, in which the differences between the two lines are statistically significant at the 5% level. Alternatively, decreasing firm productivity level from the mean to one standard deviation below the mean from Figure 2c increases the estimated probability of firms engaging in service FDI with local managers in non-English-speaking countries by approximately 0.5%. Similarly, it reduces the probability of firms choosing the same strategy in English-speaking countries by approximately 1%, in which the difference between the lines is statistically significant at the 10% level.

Estimations of the average marginal effects of firm productivity are reported in first two columns of Table 6 in the Appendix. The results show that in non-English-speaking countries, firm productivity increases the probability of undertaking horizontal FDI with local managers by 0.4% at the 1% significance level. Alternatively, it reduces the probability of firms engaging in service FDI with local managers by 0.5% at the 1% significance level.[35]

The analysis of choosing different integration strategies for firms that provide services through Korean service managers is consistent with the results of firms that employ local service managers. Figures 2b and 2d show that firms engaging in both types of FDI are more likely to provide services through Korean managers in English-speaking countries. In these countries, firm productivity level becomes important for firms that integrate production and services in their home locations, whereas it is less important for firms that choose to integrate in multiple locations.

Increasing firm productivity level from one standard deviation below to one standard deviation above the mean in English-speaking countries (Fig. 2b) significantly increases the firms' propensity to provide services with Korean managers through horizontal FDI; indeed, it is higher than the increased probability of firms undertaking horizontal FDI in non- English-speaking countries. Although decreasing firm productivity level from one standard deviation above to one standard deviation below the mean in non-English- and in English-speaking countries (Fig. 2d) increases the probability of firms to engage in service FDI with Korean service managers, the difference between the two increases are statistically insignificant.

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[35]Conditional marginal effects of firm productivity are computed at the mean levels of other firm and country characteristics. For more details on computing conditional marginal effects of interaction terms, see Christofides et al. (1997) and Norton et al. (2004).

Computing for the average marginal effects of firm productivity on the joint estimated probability of firms' choosing different strategies (HH, SH), the second column of Table 6 shows that firm productivity increases the probability of firms choosing horizontal FDI with Korean service managers by 0.6% at the 10% significance level in English-speaking countries. Alternatively, firm productivity level reduces the odds in favor of firms undertaking service FDI with Korean managers by 0.5% at the 1% significance level.

Turning to other coefficient estimates in Table 3, firm size has a significant impact on firms' integration strategies, whereas firms' experience has a significant effect on firms' post-production service strategies. In particular, larger size increases the probability of firms choosing service FDI with either type of service managers, whereas firms with more international experience are more likely to provide services with local managers through both types of FDI in low-income countries. On the other hand, firms' R&D intensity and the host country's infrastructure have significant effects on both firms' production and service strategies. Calculating their average marginal effects show that firms have a high propensity to undertake horizontal FDI with either type of service managers as they are highly R&D intensive or in countries with a rich infrastructure. Consistent with previous specifications for high-income countries, education has no effect on firms' strategies to provide services with different types of managers in low-income countries.

Table 7 in the Appendix reports the univariate probit estimates of firm and country characteristics on firms' decisions to choose production locations and different types of service managers. The results do not differ significantly from the results of the bivariate probit shown in Table 3. For example, the coefficient estimates on the univariate probit reveal that the firm productivity level and its size have significant effects on firms' production location decision, such that firms with higher productivity levels and smaller size are more likely to choose horizontal FDI in a host country. Firm experience has positive and significant impacts on the strategy to provide services through local managers. However, the coefficient estimate on the tariff rate shows that it has a positive and significant impact on the probability of firms choosing horizontal FDI.[36]

Overall, the empirical results from testing firms in low-income countries suggest that firms' decisions on locating production facilities in the host country and providing services through local managers are complementary. Supplementing the graphical analysis with the bivariate probit regression provides evidence that firm productivity level has a significant effect on the joint probability of choosing different strategies when interacted with a language. In particular, in countries that share a common language, firms that are more productive are more likely to undertake horizontal FDI with Korean service managers, whereas firms that are less productive tend to engage in service FDI with Korean service managers. Alternatively, in countries that do not share a common language, horizontal FDI with local service managers is more likely to be chosen by firms that are more efficient. Service FDI with local service managers, on the other hand, tends to be performed by firms that are less efficient. All of these results support the predictions from the theoretical model.

6   Conclusion and Future Work

In this paper, I examine integration strategies of Korean firms that involve producing final outputs and providing post-production services to serve foreign markets. In the theoretical model, consumers in all

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[36]Estimating the average marginal effects of firm productivity on the probability of choosing each strategy, conditional on a language, the results showed no interaction effects between these factors. The marginal effects of productivity level were widely insignificant for countries that either share a common language or not.

countries perceive the service quality of products based on the inner value of service and the ability of managers that demonstrate the products' service value. On the other hand, firms must provide services for products through their subsidiaries abroad, but can produce output in either their home or host country.

The model shows that the equilibrium decision of a firm depends on its productivity and other economic factors that affect decisions on integrating business activities and providing services. By adding service quality differences into the heterogeneous firms trade model, I introduce that a new pattern of FDI – service FDI – appears as one of the available strategies firms can use to serve global markets. To my knowledge, this has not been studied before.

Using Korea's middle-income status, I examine two scenarios separately; that is, when firms choose optimal strategies to serve high- and low-income countries. Then, I estimate a model of firms' strategies using a rich set of plant- and parent firm-level data of Korean multinational firms from 2002 through 2009. The empirical results indicate that firms' optimal strategies are affected not only by its productivity level, but also by different factors for each scenario. In particular, the results show that firms entering high-income countries are concerned primarily with the transport cost, a crucial element for firms' production strategies. Alternatively, firms serving low-income countries are affected mostly by the degree to which service managers are internationally mobile between countries, which plays an important role in firms' post-production service strategies.

The main goal of this paper was to study firms' optimal integration strategies to serve foreign markets by incorporating decisions on providing services after production. As such, a range of questions including other options in the firms' decision are not addressed in this paper. I have not considered various possibilities to serve foreign markets that are important for a full account of firm strategies, such as outsourcing providing service to foreign firms through contracting or cross-border mergers and acquisitions, or possibility of investing in physical product quality. Furthermore, given this paper's focus on studying firm activities to serve foreign markets with different sizes, the analysis was also limited to comparing firm integration strategies to serve between high-income and low-income countries relative to the home country.

In the present study, one of primary interests is to examine the effect of service managers in firms' choice of international organization forms. The basic premise of the model, therefore, is that the preference for the service quality of products by a consumer in all countries is affected by the managers' abilities. Put differently, this assumption implies that consumer's preference is homothetic with respect to per capita income. Indeed, prior trade literature have analyzed the effects of non-homotheticity of demand on physical product quality and found that the relative demand for high-quality products is higher in high-income countries. For future research, therefore, it would be interesting to study how the non-homotheticity of demand for service quality affects firms' strategies to serve global markets. This would involve extending the model. Furthermore, including both service and product qualities in consumers' preferences would yield various implications on multinational firm activities. These questions are left for future research.

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Appendix

In this appendix, I will discuss firms' optimal strategies when they can also produce varieties in third countries. For simplicity, I assume that there exist a third country with no domestic demand and low production cost (referred to as "South" without domestic demand) where firms can only use it as an export-platform. Here, I will study the effects of third production location on firms' optimal strategies to serve high-income country.[37] For expositional simplicity, I assume that transport costs and fixed investment costs of setting up plants are symmetric across countries.

For firms that serve high-income country, they can now produce varieties in the South and ship them to the service facilities located in the North. This integration strategy would impose transport costs and fixed investment costs of setting up plants in multiple locations, but conserve the production cost. In this case, the profits from choosing possible strategies to serve the North are:

$$\Pi_n^{HH} = \frac{\eta-1}{\eta}(B_n\delta z_h w_n^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{H,h} \tag{30}$$

$$\Pi_n^{HL} = \frac{\eta-1}{\eta}(B_n z_n w_n^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{H,n} \tag{31}$$

$$\Pi_n^{SH} = \frac{\eta-1}{\eta}(B_n\delta z_h (w_h t)^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{S,h} \tag{32}$$

$$\Pi_n^{SL} = \frac{\eta-1}{\eta}(B_n z_n (w_h t)^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{S,n} \tag{33}$$

$$\Pi_n^{CH} = \frac{\eta-1}{\eta}(B_n\delta z_h (w_s t)^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{C,h} \tag{34}$$

$$\Pi_n^{CL} = \frac{\eta-1}{\eta}(B_n z_n (w_s t)^{1-\sigma})^{\frac{\eta}{\eta-1}}\theta^{\frac{\eta(\sigma-1)}{\eta-1}} - F_{C,n} \tag{35}$$

where equations (30) to (33) represent firm profits made from engaging in horizontal FDI and service FDI with different types of service managers, which are consistent with profit functions in Section 3.1.1. On the other hand, equations (34) and (35) represent firm profits made from undertaking complex FDI with home and local service managers, respectively.[38]

Under the assumption on managerial abilities across countries, it can also be seen that between firms that choose complex FDI strategy, the profit made from providing services through local managers dominates the profit made from sending home managers to the North. Therefore, among three possible integration strategies to serve the North ($\Pi_n^{HL}, \Pi_n^{SL}, \Pi_n^{CL}$), which integration strategy to choose depends not only on firm productivity level but also on the transport costs.

Figure 6 shows the profits attainable for firms with different levels of productivity, θ: in case of high transport cost ($t > w_n/w_s$) in Figure 6a and low transport cost ($t \in (1, w_n/w_s)$) in Figure 6b. Both figures depict profit functions reflected underlying equations (31), (33), and (35). The steeper Π_n^{CL} relative to Π_n^{SL} from both figures reflect lower marginal cost of production involved for firms that produce in the South than produce in the home country. This implies that more productive firms are affordable to pay higher fixed

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[37]This assumption reduce the number of cases that must be considered. For example, firms will never use a third production location to serve the South since it is never profitable to have export sales from this location by bearing additional fixed investment cost and transport cost. Alternatively, if a third country incurs high production cost (North or Home), firms have no reason to engage in export sales to either South or North with same additional costs.

[38]Complex FDI indicates firm's integration strategy to produce varieties in the South by investing in production facility and ship products to service facility in the North to provide post-production services.

costs and take advantage of higher returns generated by the lower production cost in the South.

However, Figure 6a shows that due to the high transport cost, the profit from engaging in horizontal FDI dominates the profit from undertaking complex FDI for firms in the all range of productivity levels. Consistent with the results from prior section, more productive firms will integrate business activities in the North, whereas less productive firms undertake service FDI, and all firms will provide services by employing local service managers. It is never profitable to integrate business activities in multiple locations. Alternatively, if transport costs are relatively low, Figure 6b shows that firms are never profitable to engage in horizontal FDI, which is also consistent with the results from the prior section. More productive firms are now in the position to overcome the highest fixed costs and produce a large volume of varieties with the lowest unit cost of production in the South and ship to the North, whereas less productive firms undertake service FDI.

To summarize, when firms have an option to establish production facilities in the South and use them as an export-platform to the North, they would only choose this alternative integration strategy when transport cost is low. In this case, the model shows that more productive firms will bear high fixed costs of establishing facilities in multiple locations and produce varieties with low marginal cost. However, if the transport cost is relatively high, firms will find that it is never profitable to choose an alternative option.

Table 4:

Marginal effect of firm productivity level on firm integration strategies and the level of tariff rates, high-income countries

	HL			SL	
tariff rate level	marginal effects of firm productivity	95% Confidence interval	tariff rate level	marginal effects firm productivity	95% Confidence interval
0	0.021 (0.023)	-0.025/0.067	0	0.131** (0.066)	-0.191/0.452
1	0.039 (0.029)	-0.018/0.097	1	0.121* (0.063)	-0.176/0.419
2	0.064 (0.047)	-0.028/0.157	2	0.104* (0.059)	-0.163/0.371
3	0.092* (0.048)	-0.061/0.245	3	0.082 (0.051)	-0.148/0.312
4	0.119** (0.058)	-0.099/0.338	4	0.059 (0.042)	-0.132/0.25
5	0.142** (0.067)	-0.132/0.417	5	0.038 (0.035)	-0.113/0.19

Note: Standard errors using delta method are in the parenthesis. $***,**,*$ denote significance at the 1,5,10 percent, respectively.

Table 5: Univariate probit, high-income countries

Firm strategies	Estimates		Marginal effects	
	manu	*local*	*manu*	*local*
tariff	0.427	0.122	0.171	0.042
	(0.333)	(0.368)	(0.133)	(0.129)
productivity	-0.255	0.536	-0.101	0.187
	(0.521)	(0.576)	(0.208)	(0.198)
R&D intensity	-0.507	-0.044	-0.202	-0.015
	(0.393)	(0.444)	(0.156)	(0.155)
experience	0.306**	0.142	0.122**	0.497
	(0.142)	(0.104)	(0.056)	(0.362)
firm size	-0.114	-0.094	-0.045	-0.032
	(0.101)	(0.063)	(0.04)	(0.022)
language	0.585	0.381	0.228	0.127
	(0.976)	(1.04)	(0.365)	(0.324)
education	0.007	-0.042	0.003	-0.014
	(0.014)	(0.03)	(0.005)	(0.01)
GDP	0.012	0.084	0.004	0.029
	(0.082)	(0.062)	(0.033)	(0.021)
telephone	-0.134	0.207	-0.053	0.072
	(0.264)	(0.271)	(0.105)	(0.095)
tariff*productivity	0.166	-0.312		
	(0.282)	(0.35)		
language*productivity	-0.565	0.128		
	(0.929)	(0.073)		
tariff*language	-0.142	0.108		
	(0.449)	(0.316)		
constant	-3.13^*	-0.67		
	(1.77)	(0.431)		
observations	351	354		
pseudo R^2	0.1531	0.1267		
Log L	165.45	-150.21		
success probability			0.502	0.811

Note: Robust standard errors are in parenthesis. $***$, $**$, $*$ denote significance at the 1,5,10 percent, respectively; all regressions include a constant, time, country, firm and industry fixed effects. Testing firms that only include Korean managers are not available due to small number of observations.

Table 6: Conditional marginal effects of firm productivity level

Conditional marginal effects	Low-income countries		High-income countries	
	$language = 0$	$language = 1$	$language = 0$	$language = 1$
$\frac{\partial \mathrm{HL}}{\partial \mathrm{productivity}}$	0.004***	0.064	0.027	0.073
	(0.001)	(0.097)	(0.046)	(0.059)
$\frac{\partial \mathrm{HH}}{\partial \mathrm{productivity}}$	0.002	0.006*		
	(0.006)	(0.003)		
$\frac{\partial \mathrm{SL}}{\partial \mathrm{productivity}}$	−0.0054***	-0.065	0.104	0.106
	(0.002)	(0.098)	(0.171)	(0.126)
$\frac{\partial \mathrm{SH}}{\partial \mathrm{productivity}}$	-0.001	−0.005***		
	(0.0006)	(0.001)		
Observations	947		349	

Note: Conditional marginal effects of firm productivity are computed at the mean levels of firm and country characteristics.
Estimation of marginal effects on joint probabilities of firms' choosing different integration strategies with Korean service managers
when serving high-income countries are excluded due to small number of observations.

Table 7: Univariate probit, low-income countries

Firm strategies	Estimates		Marginal effects	
	manu	*local*	*manu*	*local*
tariff	0.151***	0.114	0.01***	0.02
	(0.051)	(0.082)	(0.003)	(0.014)
productivity	0.28***	-0.005	0.019***	-0.001
	(0.084)	(0.04)	(0.004)	(0.007)
R&D intensity	0.643***	−0.088**	0.045***	−0.015**
	(0.207)	(0.035)	(0.014)	(0.006)
firm size	−0.303***	-0.027	−0.021***	-0.004
	(0.045)	(0.037)	(0.002)	(0.006)
experience	0.036	0.084**	0.002	0.014**
	(0.03)	(0.038)	(0.002)	(0.006)
language	-0.443	-0.113	-0.045	-0.021
	(0.645)	(0.563)	(0.088)	(0.113)
education	-0.045	-0.065	-0.003	-0.011
	(0.359)	(0.313)	(0.025)	(0.055)
GDP	-0.043	-0.059	-0.003	-0.01
	(0.15)	(0.114)	(0.01)	(0.02)
telephone	0.152***	0.168***	0.011***	0.029***
	(0.022)	(0.018)	(0.001)	(0.003)
tariff*productivity	0.154	0.22		
	(0.263)	(0.188)		
language*productivity	−0.965***	0.07		
	(0.174)	(0.157)		
tariff*language	0.162**	−0.157*		
	(0.076)	(0.084)		
constant	4.89***	1.78		
	(1.507)	(2.23)		
observations	1032	966		
pseudo R^2	0.1720	0.072		
Log L	-238.35	-298.28		
success probability			0.968	0.897

Note: Robust standard errors are in parenthesis. $***, **, *$ denote significance at the 1,5,10 percent, respectively; all regressions include a constant, time, country, firm and industry fixed effects.

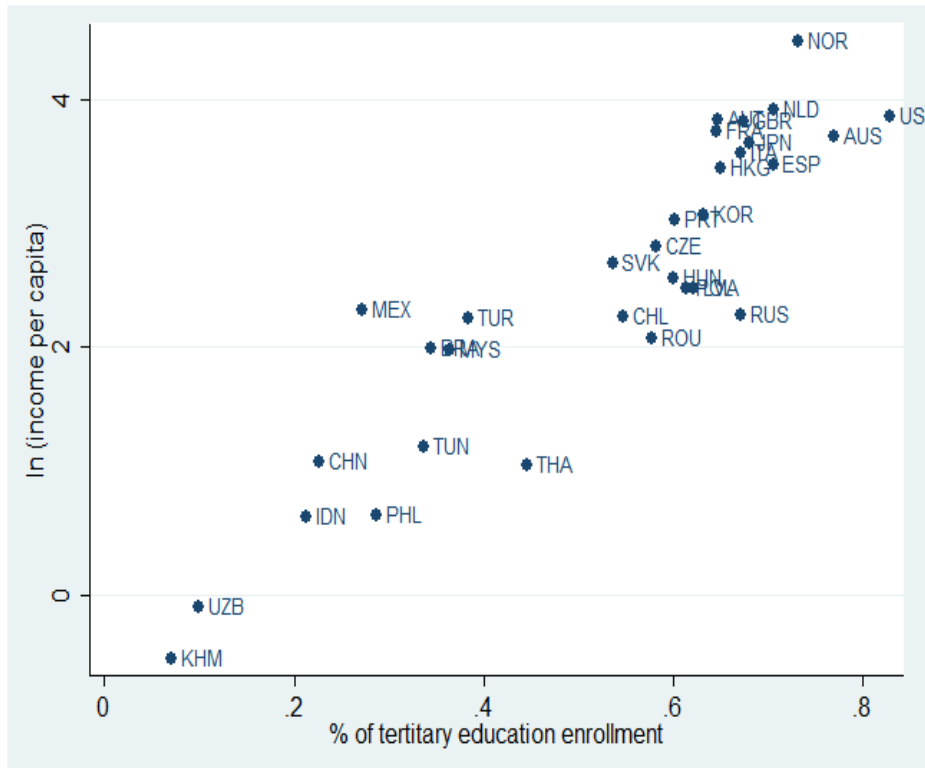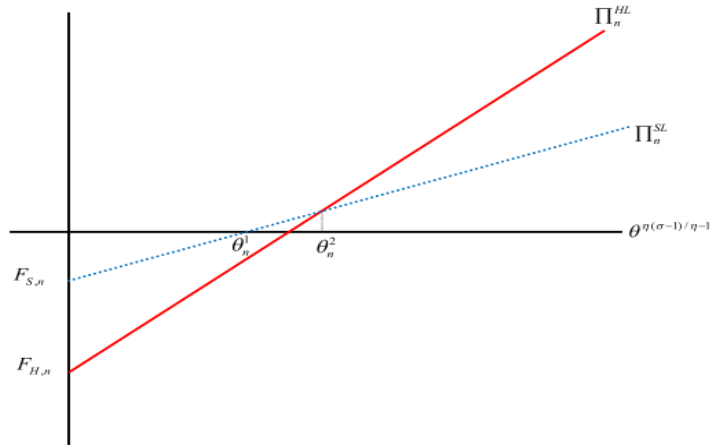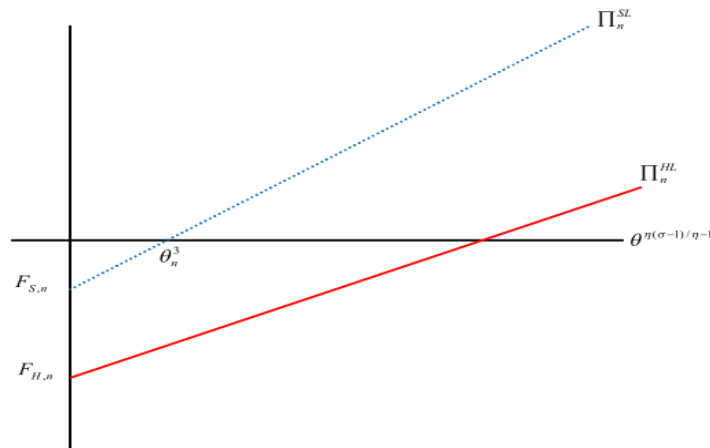Figure 3: Relationship between country's per capita income and education level in 2009

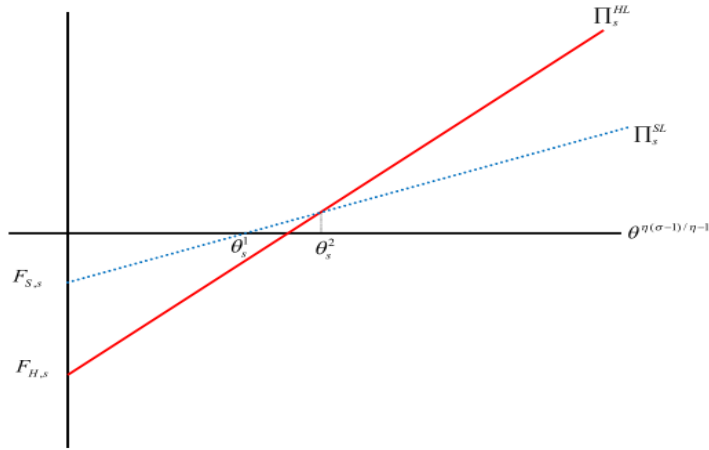Figure 4: Profits from different integration strategies serving high-income countries

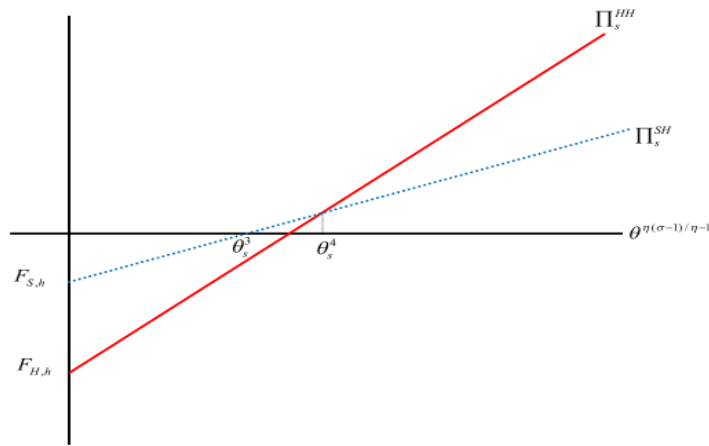(a) Profit function, high transport cost in high-income countries

(b) Profit function, low transport cost in high-income countries

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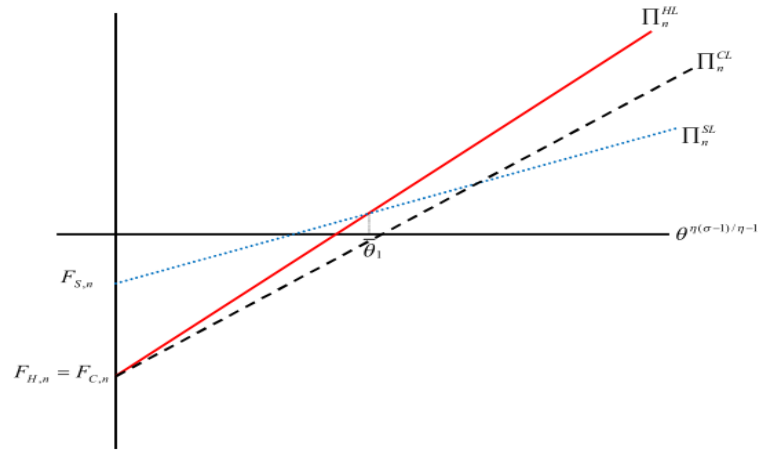Figure 5: Profits from different integration strategies serving low-income countries

(a) Profit function, with low mobility in low-income countries
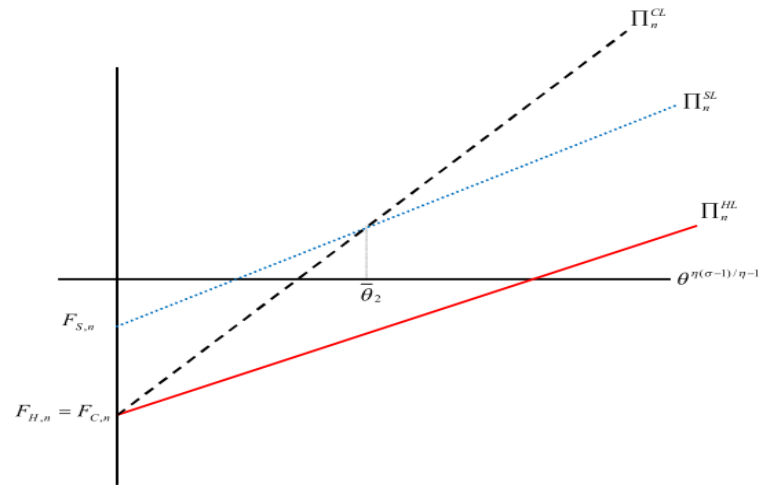

(b) Profit function, with high mobility in low-income countries

Figure 6: Profits from different integration with complex FDI strategy serving high-income countries

(a) Profit function, high transport cost in high-income countries

(b) Profit function, low transport cost in high-income countries