Intra-firm trade: the determinants and implications for trade slump

기업내무역의 결정요인과 무역 불황에 대한 시사점

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Contents

List of Figures

List of Tables

Abstract

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With the help of the Information Technology and freer international trade environment, Multinational Corporations have been able to disintegrate their production process physically and geographically. Multinational Corporations that intend to distribute parts of their production process abroad face the choice of ownership: whether to operate internally or to assign to unrelated local companies. A firm's choice of vertical integration involves intra-firm trade, while its choice of international outsourcing involves arm's length trade. Exploiting the firm-level data of Korean manufacturing industry, this study contributes to existing knowledge of two important topics on intra-firm trade: the determinants and implications for trade slump.

In the first analysis, this study focuses on the property rights model predictions that are raised from Antras and Helpman (2004) and Antras and Helpman (2006). This study investigates the determinants of extensive and intensive margins of intra-firm trade by separating the international ownership structure between Outward FDI and Inward FDI. The overall results indicate that Korea's empirical evidence only supports the prediction of productivity, but not headquarter intensity and contractibility.

The implications of this analysis can be summarized as the following. First, the determinants of intra-firm trade may considerably differ from coun-

try to countries. Second, the simple distinction between headquarter-producer and intermediate input supplier in the property rights theories may not explain the complex nature of global value chains. Third, the imports under Inward FDI, which is not explained by the property rights theory, maybe mainly dominated by the transaction of final goods for sale to Korean consumers. Fourth, the significant and negative coefficients of distance suggest that distance-related factors such as transportation costs or cultural differences between countries can be important for a firm's organizational choices.

In the second analysis, this study delves further into the role of intra-firm trade in times of Korea's trade slump (2012-2016). The fixed-effects panel regression reveals that firms with high intensity in intra-firm trade are more likely to suffer lower trade growth but the negative effect is significantly reduced during the trade slump. When the descriptive statistics are considered together, the regression results may imply that intra-firm trade has a stabilizing effect and is more resilient compared to the arm's length trade.

Keyword: intra-firm trade, determinant, property rights theory, multinational corporations, firm organizational choice, trade slump
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Chapter 1

Introduction

The role of Multinational Corporations (MNCs) in international trade has attained importance over the last two decades in the international trade literature. Multinational firms have spread their production process physically and geographically, and transfer of goods and services within a firm's boundary accompanied a large volume of cross-border shipments, which is the intra-firm trade. Intra-firm trade refers to the international flow of goods and services within a firm's boundary, between parent firm and its affiliates or among affiliated parties (Lanz and Miroudot, 2011). The development of Information Technology (IT), decrease in transportation costs, and freer global trade environment have enabled firms to rely on the fragmentation of production in pursuit of lower production cost or easier access to foreign markets (Helpman, 2011).

MNCs have constantly adapted to new business environments by disintegrating their production process, which has left MNCs with two choices: ownership of the production process and its geographical location. The first question involves strategically choosing which processes to operate internally or which to assign to an independent company. When a firm acquires some goods or services from an unaffiliated supplier, whether it is domestic or foreign, it is defined as "outsourcing". The second question concerns whether a firm will obtain intermediate inputs at home or abroad. The acquisition of goods or services from a foreign country, either from a related or unrelated party, is classified as "offshoring" (Helpman, 2011).

A firm's choice of sourcing mode is closely related to the form of trade. The figure 1.1 in Lanz and Miroudot (2011) displays the classification of a

Figure 1.1: Classification of sourcing strategies

		Domestic country	Foreign country
Outsourcing	*Inside the firm*	Domestic in-house production	Vertical foreign direct investment
	Independent supplier	Domestic outsourcing	Offshore-outsourcing

(Offshoring →)
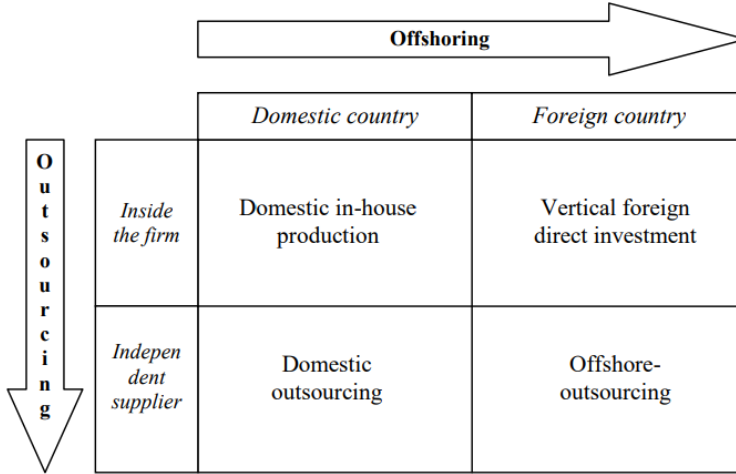
Source: Lanz and Miroudot (2011)

firm's sourcing strategies. When a firm decides to offshore some of its intermediate inputs, the transportation of goods or services, by definition, entails trade between countries. If a firm chooses to operate foreign affiliates and acquire intermediate inputs within a firm's boundary, the vertical integration of the production process involves intra-firm trade. On the contrary, if a firm depends on the independent supplier in the foreign country, the cross-border shipment between two parties is classified as arm's length trade.

The intra-firm transaction is a common phenomenon in global trade. It is reported that about half of US imports and one-third of US exports in 2009 are traded in intra-firm (Lanz and Miroudot, 2011). In the case of Korean manufacturing industry, intra-firm trade represents 39.9% of exports and 29.1% imports in 2016. Although it is difficult to produce an accurate average for world trade, as only the United States and a few OECD countries collect statistics on intra-firm trade, available data suggest that considerable share of the global trade is also intra-firm trade (Lanz and Miroudot, 2011). MNCs and intra-firm trade have therefore drawn much attention not only

from OECD countries where most headquarters are located but also from low-wage emerging economies where production plants have mainly relocated (Corcos et al., 2013).

In recent years, there has been much interest in investigating the determinants of intra-firm trade, which is not answered in the traditional theories of international trade. At the center of discussion lies Dunning (1981)'s "internalization question": when MNCs choose to offshore some part of their production chain, what makes MNCs keep foreign production within a firm's boundary rather than outsourcing to local companies? Recent theoretical developments emphasize the "hold-up" problem in the context of property rights model. In the partial equilibrium model of property rights approach, headquarter intensity, contractibility, and productivity are the key determinants that affect the MNCs' "make-or-buy" decision (Antras, 2003; Antras and Helpman, 2004; Antras et al., 2006). A growing number of empirical studies have examined the determinants of intra-firm trade, while most of them are focused on US data (Bernard et al., 2010; Lanz and Miroudot, 2011; Nunn and Trefler, 2013; Ramondo et al., 2016).

Another aspect of intra-firm trade that draws academic interests is the resilience of intra-firm trade. The sharp trade decline during the 2008 financial crisis raised a controversial issue of whether the vertically integrated global production network propagated or stabilized the transmission of demand shocks. Recent findings on this issue highlight the different behaviors between intra-firm trade and arm's length trade. Bernard et al. (2009) and Lanz and Miroudot (2011) suggest some evidence implying the resilience of intra-firm trade in times of crisis, while Altomonte et al. (2012) and Choi and Eum (2019) argue that intra-firm trade was more volatile under demand shocks during the 2008 financial crisis. While most studies on this topic have been limited to short-term analysis, Lakatos and Ohnsorge (2017) find, in the mid-term perspectives, that intra-firm trade is more resilient than arm's length trade in the post-crisis period.

Exploiting the Korean firm-level data of the manufacturing industry,

this study attempts to enhance our understanding of intra-firm trade in two aspects. The first objective is to evaluate the determinants of intra-firm trade, mainly based on the theoretical background of property rights theory in Antras and Helpman (2004, 2006). Our findings reveal that Korea's microdata is only partially consistent with predictions in the property rights model. The second objective is to examine the role of intra-firm trade on trade growth during the post-crisis trade slump. The results imply that intra-firm intensity is related to a lower growth rate of trade, but the negative effects are reduced when Korea experience trade slump.

The contribution of this paper can be summarized as follows. First, this study presents analytic descriptions of intra-firm trade and organizational structure of Korean manufacturing industry. Second, this study adds to the literature on the determinants of intra-firm trade by providing new evidence from Korea, and especially by distinguishing the ownership structure between Outward FDI and Inward FDI. Third, this study presents new evidence that the firm's active involvement in intra-firm trade may have a stabilizing effect on the times of trade slump.

The rest of the paper is organized as follows. Chapter 2 displays a review of the literature on this topic and theoretical frameworks. Chapter 3 provides descriptive data on intra-firm trade and ownership structure of the Korean manufacturing industry. Chapter 4 describes the econometric specification for two separate analysis - analyzing the determinants of intra-firm trade and investigating the role of intra-firm trade during the trade slump period. Chapter 5 presents the conclusion and some limitations of this study.

Chapter 2

Literature review

2.1 The determinants of intra-firm trade

The intra-firm trade of MNCs has attracted widespread academic attention in both economics and international business. An important contribution among the early studies on the fundamentals of intra-firm trade is Dunning (1981)'s eclectic OLI framework. Dunning proposed that three aspects of advantages are needed for a firm to become a multinational enterprise: ownership, location, and internalization. A firm may obtain an ownership advantage and overcome the cost of foreign operation by getting access to markets or raw materials, or by possessing a higher level of skills or intangible assets. Another advantage of locating affiliates overseas stems from reducing material and labor cost, or by getting closer to consumers. Finally, there has to be some internalization advantage resulting from keeping the foreign production inside the firm's boundary rather than outsourcing to an independent entity. For example, a firm may prefer vertical integration to ensure the stability of certain input's supply or to protect the company's name. Although Dunning's eclectic theory has provided new insights to analyze different types of FDI, his theory is criticized as being too broad to develop into models with sharp prediction (Helpman, 2011).

At the heart of understanding intra-firm trade lies Dunning (1981)'s "internalization" question: why some companies choose the foreign production in-house while others choose to contract with an independent supplier? This question has attracted considerable interest among scholars studying international trade. Recent theoretical advances have been made in the property

rights approach that builds on the theory of incomplete contracts (Antras, 2003; Antras and Helpman, 2004, 2006). The property rights model, motivated by seminal works of Grossman and Hart (1984) and Hart and Moore (1988), focuses on the role of "hold-up problem" in affecting MNCs' sourcing strategies. The hold-up problem refers to a situation where two parties, final goods manufacturer and the intermediate input supplier, might underinvest as both parties worry about the counter party's opportunistic behavior and taking advantage of them (Lanz and Miroudot, 2011). The key assumptions and theoretical predictions of the main literature will be reviewed in the following section.

2.1.1 Theoretical backgrounds

Antras and Helpman (2004, 2006) suggest a model of international trade with two-country, two-sector, and two-inputs, where incomplete contacts play an important role. A firm produces a variety of products and faces a demand function generated by CES preferences. The production of output q requires two inputs, the headquarter services X_h and intermediate input X_m, both of which have to be designed specifically for a certain brand. It is assumed that the final-good producer produces the headquarter services X_h and it has to employ a supplier for the intermediate input X_m. The productivity θ is assumed to vary across firms, and η_h and η_m represent the headquarter intensity and intermediate input intensity, respectively. The production function assumes a Cobb-Douglas formula and is specified as follows:

$$q = \theta \left(\frac{X_h}{\eta_h} \right)^{\eta_h} \left(\frac{X_m}{\eta_m} \right)^{\eta_m}, \quad 0 < \eta_h < 1, \quad \eta_m = 1 - \eta_h \qquad (2.1)$$

Two important assumptions that lead to the hold-up problem are the relation-specific investments and incomplete contracts. In the model, both headquarter services and intermediate inputs require highly customized investments, so once the investments are made, these components are of no

value elsewhere. It is also assumed that some of the activities related to inputs are non-contractible since the nature of inputs is very complex or difficult to specify in the ex-ante contract. While Antras (2003) and Antras and Helpman (2004) develop model upon perfect non-contractibility of two inputs, this assumption is relaxed in Antras and Helpman (2006) by allowing partial contractibility in the model. The faction of activities μ_j, $j = h, m$ are assumed to be contractible, and the rest $1 - \mu_j$ are non-contractible.

A firm and its intermediate input supplier have different expected revenues depending on the type of organizational form. Regardless of whether it is integration or outsourcing, the intermediate input supplier earns zero revenue if the bargaining fails since the intermediate input produced is specialized for a certain relationship. On the other hand, the final-good producer has a non-zero revenue for integration and zero revenue for outsourcing. The difference comes from the fact, under vertical integration, the property rights of produced input X_m belong to the final-good producer, while, under outsourcing, the supplier has ownership of the produced inputs. It is assumed that even if the bargaining breaks down the final-good producer is still able to produce outputs, albeit less efficiently than when it cooperates with the supplier.

(1) Headquarter intensity (Antras and Helpman, 2004, 2006)

The generalized Nash equilibrium concludes that the final-good producer will attain a larger share of revenue under vertical integration. However, this does not mean that integration is always a profit-maximizing option for the final-good producer. Rather, the model predicts that there exists a unique headquarter-intensity cutoff η_{hc} such that firms with $\eta_h > \eta_{hc}$ choose to vertically integrate with the supplier while firms with $\eta_h < \eta_{hc}$ choose to outsource from the supplier.

The logic behind is well illustrated in Helpman (2011). When the expected share of revenue is smaller, the supplier is less motivated to put

efforts in activities that are non-contractible. And similarly, the final-good producer has less incentive to invest in producing high-quality headquarter services if the expected share is smaller. As the underinvestment in either side reduces the total revenue, vertical integration is not always the profit-maximizing strategy for the final-good producer. When the final good production is relatively intensive in η_h, it is important to incentivize the final-good producer, thus vertical integration is optimum. On the other hand, when the final good production is relatively intensive in η_m, it is important to motivate the supplier to work hard by choosing to outsource. This is because outsourcing allows the supplier a higher share of revenue than it would have earned in integration.

(2) Contractibility (Antras and Helpman, 2006)

By relaxing the perfect contractibility assumption, Antras and Helpman (2006) draws an interesting result on the relationship between contractual frictions and the firm's decision on sourcing strategies. The optimal share of revenue taken by the final-good producer is as follows:

$$\beta_h^* = \frac{\omega_h(1 - \alpha\omega_m) - \sqrt{\omega_h\omega_m(1 - \alpha\omega_h)(1 - \alpha\omega_m)}}{\omega_h - \omega_m} \tag{2.2}$$

where $\omega_h = \eta_h(1 - \mu_h)$ and $\omega_m = \eta_m(1 - \mu_m)$. As β_h^* is decreasing in ω_m and increasing in ω_h, it follows that β_h^* is increasing in μ_m and decreasing in μ_h. In other words, improvement in contractibility for intermediate inputs raises the optimal share for the final-good producer while improvement in contractibility for headquarter services lowers the optimal fraction of revenue for the final-good producer. The higher β_h^* is, it is more important to incentivize the final-good producer, thus more firms, i.e., firms with a larger range of headquarter intensities, are likely to choose integration. Similarly, the lower β_h^* is, it is more important to motivate the intermediate input producer and more firms are likely to choose outsourcing.

The intuition behind is that higher contractibility of an input reduces the relative importance of incentivizing the producer of that input. Under better contracting environment for the intermediate input, it is less attractive for the final-good producer to motivate the supplier by allowing a larger portion of the revenue to the supplier through outsourcing, thus more final-good producing firms are likely to choose integration. Under better-contracting circumstances for headquarter services, however, it becomes less important to give incentives to the final-good producer and the contractual friction in the intermediate input becomes relatively more important. The result is that more firms are likely to choose to outsource.

In an extended model of two countries, however, the relationship between contractual improvement and a firm's organizational choice becomes more complicated. In the North-South model, North is a representative country where the final-good producer is located and is characterized by higher wages and good contracting institutions. On the contrary, South is a representative low-cost country with lower quality of the legal system and therefore smaller portion of investment are contractible. The final-good producer is assumed to produce the intermediate input either in the North or South, and either with in-house production or outsourcing. Antras and Helpman (2006) emphasize that the nature of improvement in contractibility is what determines the distribution of a firm's organizational form. More specifically, better contractibility in South towards intermediate input leads more firms to participate in FDI in the South, while enhanced contractibility in South towards headquarter services brings more firms to offshore-outsource in South. In this study, the author assumes that institutional improvement in South is biased toward intermediate inputs and will examine the hypothesis that more firms are likely to integrate in response to a contractual improvement in the South.

(3) Productivity (Antras and Helpman, 2004, 2006)

Antras and Helpman (2004, 2006) relax the firm homogeneity assump-

tion in the traditional international trade literature and adopt heterogeneity across firms' productivity levels. Further assumptions on fixed cost differences between vertical integration and outsourcing are introduced to find the relationship between a firm's productivity level and the firm's organizational choices. While vertical integration can benefit from cost savings through economies of scale, there may be additional costs for final-good producers to manage production abroad. In Antras and Helpman (2004, 2006), it is assumed that additional managerial cost outweighs the cost savings from economies of scale, thus the fixed cost of integration is higher than that of outsourcing.

The final-good producer's profit according to the organizational form i is suggested as follows:

$$\pi_i = Z_i \Theta - w_m - F_i, \quad for \quad i = O, V \tag{2.3}$$

where Z_i is a derived parameter that is proportional to the demand level and $\Theta = \theta^{\alpha/(1-\alpha)}$ denotes an alternative measure of productivity. [1] As previously reviewed, model prediction 1 implies that $Z_O > Z_V$ for firms with $\eta_h < \eta_{hc}$ and $Z_O < Z_V$ for firms with $\eta_h > \eta_{hc}$.

The result from the model is that in case of $\eta_h < \eta_{hc}$ all firms choose to outsource, while for $\eta_h > \eta_{hc}$ only firms with higher productivity choose vertical integration and firms with lower productivity depends on outsourcing. In other words, when the headquarter intensity is higher, there exists a point such that the profit under integration exceeds that of outsourcing as productivity of a firm increases. This is because only productive firms can overcome the higher fixed cost of integration. Meanwhile, firms with below zero profits will leave the market and only those with positive profits will remain.

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[1] α is a parameter controlling demand elasticity. For more details and proofs, see Antras and Helpman (2006).

2.1.2 Empirical studies

Although international trade of MNCs has long drawn the attention of many scholars, little research was conducted before the 2000s due to the scarcity of the data on intra-firm trade. Over the last decades, however, there has been a growing body of literature investigating the determinants of intra-firm trade with the help of increased access to highly disaggregated trade data. It is known that only several OECD countries are gathering data on intra-firm trade, with the United States having the most detailed trade data distinguishing between intra-firm and arm's length transactions. The early empirical studies include the work of Costinot et al. (2009). Using sector-level US import data, Costinot et al. (2009) emphasize the "routineness" as a source of contractual frictions and find that firms in less routine sectors are more likely to trade within a firm's boundaries.

More recent empirical literature is focusing on the theoretical frameworks of property rights model developed by Antras (2003) and Antras and Helpman (2004, 2006). Though Jabbour (2008) find that least productive firms choose vertical FDI, many studies find support for the prediction in the property rights theory; firms of higher productivity tend to trade in intra-firm (Lanz and Miroudot, 2011; Corcos et al., 2013; Nunn and Trefler, 2013; Blanas and Seric, 2018). In Lanz and Miroudot (2011) and Corcos et al. (2013), they also find that intra-firm trade is more likely in the capital- and skill-intensive firms. With data on foreign affiliates in Sub-Saharan Africa, Blanas and Seric (2018) show that intra-firm trade is more likely among foreign affiliates of higher productivity and higher skill intensity in both extensive and intensive margins.

There is still considerable disagreement, however, with regard to the empirical results on contractibility. Lanz and Miroudot (2011) argue that higher contractibility of a product decreases the likelihood of intra-firm trade while Corcos et al. (2013) suggest that intra-firm imports are more likely from countries with a better judicial environment - that is, higher contractibility. In

Nunn and Trefler (2013), they highlight the importance of non-contractibility in headquarter inputs and find that intra-firm trade is more likely for firms whose non-contractible headquarter inputs are relatively more important than non-contractible supplier inputs.

Despite the increasing academic interest on intra-firm trade, empirical research on this topic has been mostly restricted to the United States (Costinot et al., 2009; Bernard et al., 2010; Lanz and Miroudot, 2011; Nunn and Trefler, 2013; Ramondo et al., 2016) and France (Jabbour, 2008; Corcos et al., 2013). The work of Blanas and Seric (2018) is an exceptional case which analyzes data on foreign affiliates in Sub-Saharan Africa. As far as the author knows, no previous work has been able to draw on any systematic research into the determinants of intra-firm trade with Asian countries. Therefore, this work adds to the existing knowledge of intra-firm trade by providing new evidence from Korean manufacturing firms.

Furthermore, a major limitation of previous studies is that they fail to distinguish the organizational structure between Outward and Inward FDI when they assess trade data. It is important to note that the data that precisely fits the models in Antras (2003) and Antras and Helpman (2004, 2006) are the imports from foreign affiliates - that is, imports under Outward FDI. However, most studies fail to take account of this issue and proceed with import or export data that include both Outward and Inward FDI cases. It is only Nunn and Trefler (2013) who take this into consideration, but they were not able to strictly identify the transactions between Outward and Inward FDI [2]. In this respect, this study aims to contribute to this growing area of research by providing separated analysis for determinants of intra-firm trade according to MNCs' ownership structure.

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[2]In Nunn and Trefler (2013), they selected 18 countries for which intra-firm imports are more likely to be from foreign affiliates to a US headquarter.

2.2 Intra-firm trade during the trade slump

In addition to analyzing the determinants of inter-firm trade, a recent topic that has drawn attention from scholars is intra-firm trade and its role during the times of economic recessions. In light of the trade collapse during the 2008-2009 global financial crisis, it has become more difficult to ignore the importance of transmission of shocks through global value chains. Questions have been raised about whether intra-firm trade is more resilient than arm's length trade under the macroeconomic shocks, and if so, what explains the difference between the two types of trade. Several theoretical attempts have been made to explain the difference in reactions between intra-firm and arm's length transactions within global value chains.

2.2.1 Theoretical backgrounds

One explanation involves the inventory effect and the bullwhip effect it causes (Escaith et al., 2010; Lanz and Miroudot, 2011). In a globally integrated production environment, where different production stages take place in different countries around the world, demand volatility faced by upstream producers is even greater than that of downstream producers, thus suppliers hold more inventories as the value chain rises (Escaith et al., 2010). Therefore, when a macroeconomic shock hits the final demand, the negative effect magnifies along the production chain since upstream suppliers hold more inventories, which is known as the bullwhip effect. Lanz and Miroudot (2011) argue that vertical FDI attenuates the inventory effects and trade will decline less compared to international outsourcing as suppliers face relatively smaller demand volatility under vertical FDIs.

Another theoretical attempt relates to trade credit in times of economic crisis. Trade credit is defined as financing within trading partners that arises from the time lag between the delivery of trade goods and payment; this takes place in the form of either delivery-in-advance or payment-in-advance transactions (Lanz and Miroudot, 2011). Lanz and Miroudot (2011) argue that trade

credit is expected to be easier for firms within the MNC's boundaries than for unrelated firms during the economic crisis. Korinek et al. (2010) confirm the importance of credit conditions by showing that they have a significant impact on the shrinkage of trade volume during the crisis.

2.2.2 Empirical studies

The empirical studies on the resilience of intra-firm, however, are rather controversial, and there is no general agreement about as to whether the vertically integrated global production has a positive or negative impact on global trade in response to an economic crisis. The study by Bernard et al. (2009) is one of the earliest studies on this topic. Using US import and export data around the 1997 Asian financial crisis in 10-digit HS product-level, they find that intra-firm US trade with Asia was more resilient than arm's length trade in a response to a crisis. In terms of extensive margin - the number of trading firms -, arm's length trade marked a 16% drop while intra-firm trade declined 7%. In terms of intensive margin - the change in continuing firm-product observation -, arm's length trade experienced 8% drop while intra-firm trade rather increased 9%. Lanz and Miroudot (2011) also find support for the resilience of intra-firm trade under the macroeconomic shock of the 2008 global financial crisis. Analyzing the 6-digit HS US import data of the year 2008-2009, they show that intra-firm trade indeed had a stabilizing effect on the percentage changes in US imports when the US experienced a trade collapse due to domestic demand fall. However, they found no significant results for the industries' reliance on trade credit.

Some studies suggest contrasting evidence that the intra-firm trade with increased volatility proliferates trade collapse in times of crisis. Altomonte et al. (2012) find that contraction of French intra-firm trade was more pronounced compared to arm's length trade during the 2008 global crisis. At the same time, however, they also reveal that intra-firm trade recovered faster than arm's length trade from the negative demand shocks. In recent evidence

by Choi and Eum (2019) find that intra-firm trade of Korea firms was more sensitive to the economic shock during the 2008-2009 crisis in that growth rate of intra-firm trade experienced a considerable drop while that of arm's length trade rather increased. On the other hand, their regression results indicated that the higher a firm's trade intensity, the lower the trade growth rate was, where the negative effect was greater for arm's length trade than arm's length trade.

While most studies limit analysis to short-term macroeconomic shocks such as the 2008-2009 financial crisis, Lakatos and Ohnsorge (2017) delve into the post-crisis trade slowdown with a longer time perspective. Employing 2002-2014 US trade data, they find that a larger fraction of growth deceleration of trade during 2010-2014 is attributed to arm's length trade rather than intra-firm trade. As for the reason, they point out that arm's length trade is more concentrated among EMDEs (Emerging Market and Developing Economies) and curtailed post-crisis economic growth of those countries have contributed to the trade slowdown. Additionally, they argue that international outsourcing is more sensitive than vertical integration to final demand shocks, change in real exchange rates, constrained financial access, and heightened policy uncertainty after the global financial crisis.

Despite the increased importance of intra-firm trade, our knowledge of intra-firm trade and its implications for economic recessions is very limited, especially on mid- or long-term perspectives. Furthermore, no study, to the best of the author's knowledge, was able to analyze the role of intra-firm trade under different FDI types. In this respect, this study aims to examine the role of inter-firm trade during the economic recession using relatively longer panel data ranging from 2006 to 2016. This period is noteworthy in particular since Korea's trade data is demonstrating a unique feature: Korea's export steadily increased until 2011 then turned into a steady decline. This study is the first to analyze Korea's post-crisis trade slump in terms of intra-firm trade and its resilience by MNC's organizational structures.

Chapter 3

Data and descriptive statistics

All the firm-level data used in the analysis is from The Survey of Business Activities (SBA), published by Statistics Korea of the Korean government. This database covers all firms located in Korea with at least 50 employees and 300 million Korean won of equity capital. Since international trade in goods and services is expected to differ in various aspects, this study focuses on the trade of products, especially of the manufacturing sector. For the period 2006 to 2016, the SBA data comprises 64,723 firm-year observations or 9,607 firms, of which 23,813 firm-year observations or 3,839 firms are MNCs. In this analysis, firms that are owned by foreign parents or own at least one foreign affiliate are classified as MNCs. As the objective of this analysis is to compare a firm's organizational choice between international outsourcing and vertical integration, only MNCs are considered for the econometric analysis.

The SBA data provides information on trade as well as overall business activities of Korean firms such as sales, cost, employment, and financial structure. The total value of imports and exports and intra-firm imports and exports of each firm are directly observed from the data. Based on this information, the amount of arm's length imports and exports are computed as the remaining value of trade that is not intra-firm. Furthermore, firms are asked to declare the existence of foreign parents and affiliates, and if applicable, the company's nationality and industry classification as well. One limitation of this data is that the intra-firm trade is only available as the aggregated value of trade between its foreign parent and all its foreign affiliates.[1] There-

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[1]More specifically, Statistics Korea defines intra-firm trade as trade between its foreign parent and foreign subsidiaries or affiliates. A firm is defined as a subsidiary if the parent

fore, the exact value of the transaction between each party is not identifiable. Despite this limitation, it is important to note that SBA data enables the separation of intra-firm transactions by MNC's ownership structures - Outward and Inward FDIs.

3.1 Trends of Korean intra-firm trade

This section displays key features of intra-firm trade structure of Korean manufacturing firms. Figure 3.1 shows Korea's total export and import trends from 2006 to 2016 according to transaction types - intra-firm and arm's length trade. It is apparent from the figure [1] that Korea's total exports have experienced a steady increase during the year 2006-2011, but have been declining since 2012. In contrast to the arm's length exports showing a marked increase and decrease, the intra-firm trade is somewhat stable and slightly increasing even when the total trade is declining. The figure [2] reveals that there has been a gradual increase in total imports during 2006-2013 except for a drop in 2009, but the import volume has been declining since 2013. Similar to the export side, intra-firm imports has been stable while the arm's length imports being more volatile. Such trends suggest that intra-firm trade, i.e. vertically integrated production network tend to be more resilient than arm's length trade during the economic recession.

Figure 3.2 presents the volume of exports and imports for manufacturing firms according to MNC's ownership structures. What can be clearly seen is that Korean-owned MNCs lead most of the trade volumes of the Korean manufacturing industry, in both exports and imports. Specifically, trade by Korean-owned firms accounts for about 83% of total exports and 74% of total imports, respectively. It is also observed that Korean-owned MNCs attributes

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firm owns more than 50% of its shares and as an affiliate, if the parent firm more than 20% of its shares. Since the data on intra-firm trade is only available in the aggregate value, this analysis will not distinguish between subsidiaries and affiliates and both will be referred to as affiliates or affiliated parties in a comprehensive sense.

the most to the fluctuations in Korea's trade. In contrast, international trans-
actions by foreign-owned MNCs display rather steady growth even when the
overall trade is declining in both exports and imports.

Figure 3.1: Total exports and imports of manufacturing industry (2006-2016)
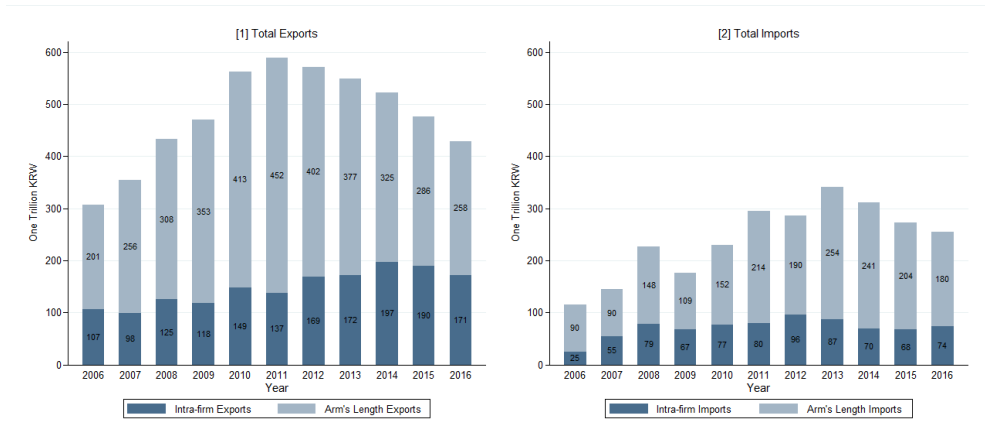
Figure 3.2: Composition of trade by ownership structure (2006-2016)
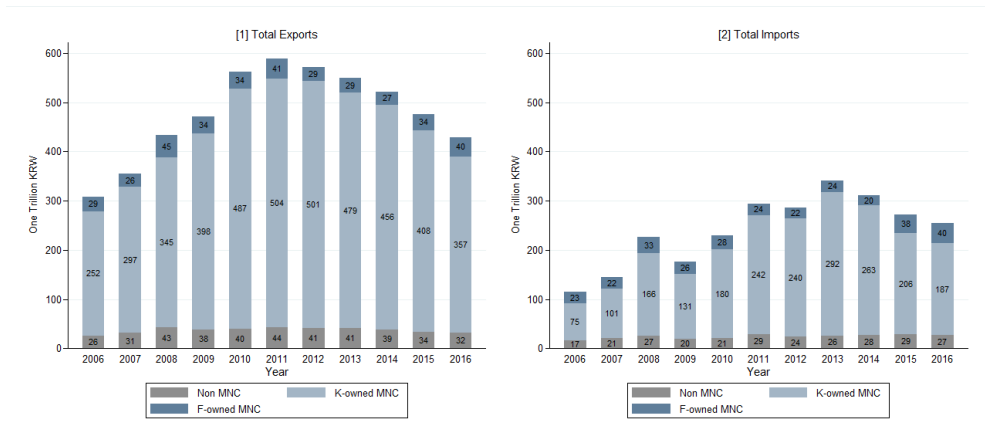
Figure 3.3 provides distributions of firms engaging in the intra-firm
trade. Figure [1] and [2] present the total number of firms in the Korean

manufacturing industry over the period 2006 to 2016 divided into seven categories according to the share of intra-firm trade in total trade. Only a small fraction of firms, less than 20% of the total firms, participate in intra-firm trade on both export and import side during the entire observation period. Figure [3] and [4] reconstruct the preceding graphs by focusing on firms participating in intra-firm trade. Although there are some fluctuations in the total number of firms taking part in intra-firm transactions over the observation period, it is interesting that the majority of firms are involved in both intra-firm and arm's length trade. In other words, only a small fraction of firms choose to exclusively rely on vertical integration for their international transactions. It is also observed that a larger number of firms depend entirely on intra-firm imports than intra-firm exports.

Figure 3.4 presents a detailed look at the composition of firms by trade type and their industry classification. As can be seen in figure 3.4, there exists a considerable heterogeneity in the intensity of intra-firm trade across industries. Among all firms in the manufacturing sector, only 2% of total firms rely solely on intra-firm trade, 15% carry on both intra-firm and arm's length trade, and more than half (52%) of firms perform arm's length trade only. Except for the tobacco industry, the proportion of firms depending exclusively on intra-firm trade is less than 3% for all sub-industries. The proportion of firms participating in both types of trade are particularly high in the tobacco, coke and petroleum products, and chemicals and chemical products industries. In contrast to these sectors, more than 70% of firms in drugs and pharmaceuticals are counting only on arm's length trade, revealing the industry's high dependence on foreign outsourcing. In the case of the printing industry, the share of companies with no trade at all account for more than half, and only a little fraction of firms (3%) are engaged in intra-firm transactions.

Figure 3.3: Distribution of firms by intra-firm trade share (2006-2016)
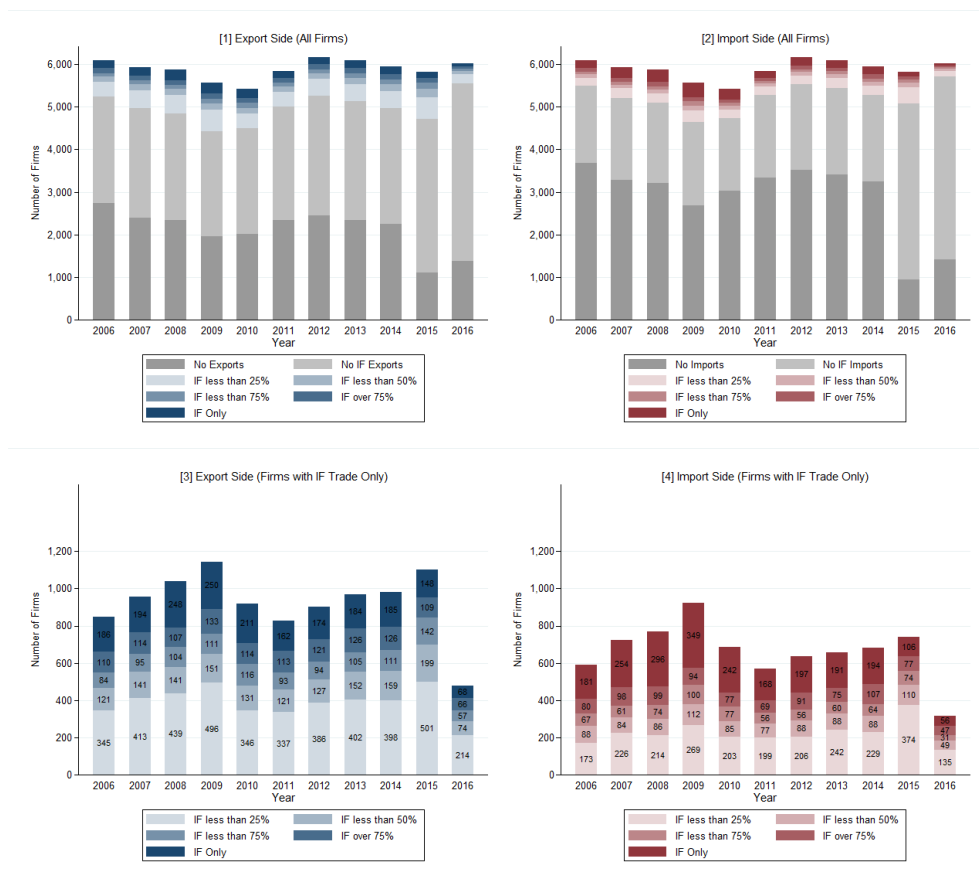
Note: The categories in figure [1] and [2] are all exclusive. For example, firms with share of intra-firm trade to total trade less than 50% but more than 25% fall in to the "IF less than 50%" category.
Source: The Survey of Business Activities, Statistics Korea

Figure 3.4: Composition of firms by trade type and industry classification (2006-2016)
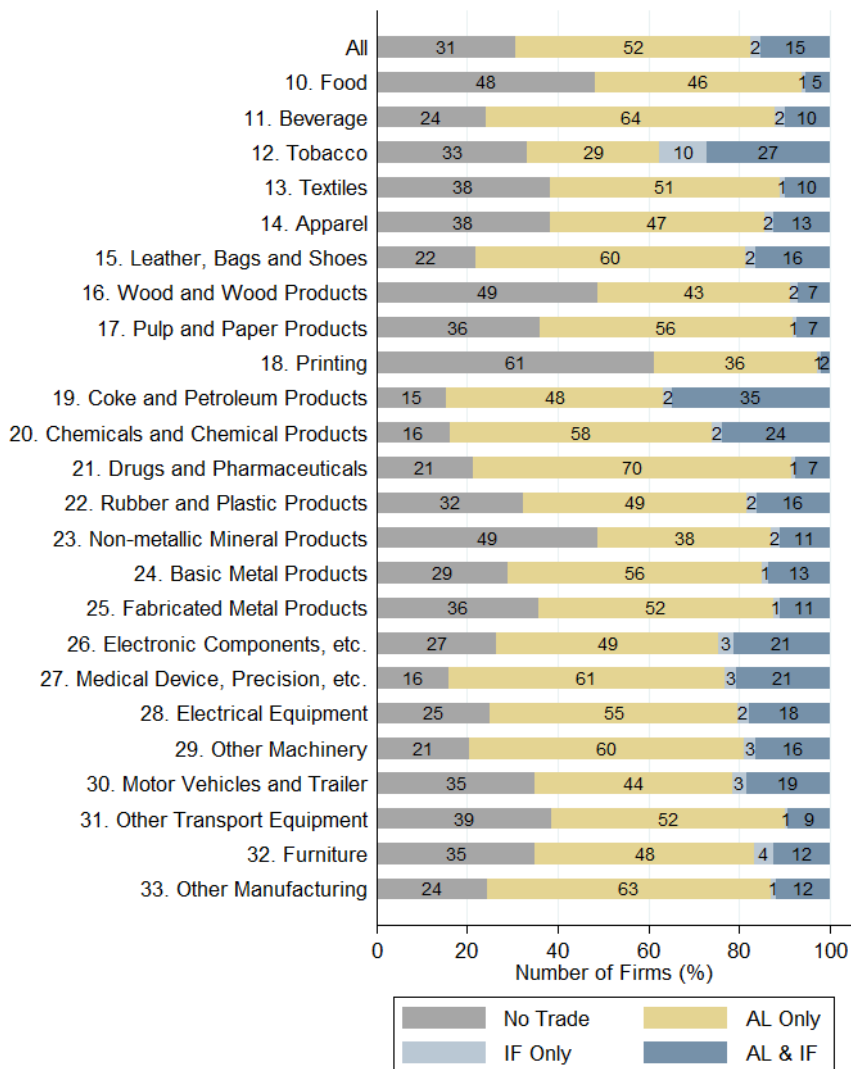
Note: In order to capture the average trend over the entire observation period, all firm observations during the year 2006-2011 were considered and were counted as individual entities. The sub-industry classification in the figure follows that of Korea Standard of Industry Classification (KSIC)
Source: The Survey of Business Activities, Statistics Korea

3.2 International ownership structure of Korean firms

This section provides descriptive information that enhances our understanding of the structure of Korean Outward and Inward FDIs. Figure 3.5 displays the composition of Korean manufacturing firms under the type of organizational structure. FP Only and FA Only indicate that a firm has only either foreign parents or foreign affiliates, respectively. The category FP & FA refers to a situation where a Korean firm is owned by a foreign parent and has overseas affiliates at the same time. Non-MNC implies that a firm is not related to foreign ownership. The figure reveals that the ownership structure in Korean manufacturing industry remained stable during the observation period (2006-2016). On average, 36.8% were classified as MNCs, of which 1.2% corresponds to having both foreign parent and foreign affiliates, 5.4% to being controlled by the foreign parent, and the remaining 30.3% to owning foreign affiliates.

Figure 3.6 and 3.7 provide an overview of countries that are closely linked to Korea within the global value chains. Top seven countries are selected, where most foreign parents and affiliates are reported to belong to during the entire observation period (2006-2016). Figure 3.6 reports that the countries with the largest number of affiliates in Korea are Japan, the United States, Germany, the Netherlands, France, the United Kingdom, and Switzerland, all of which are OECD members. As of 2016, 128 out of about 401 overseas parent companies are Japanese owned, implying the strong economic interdependence between Korea and Japan. Overall, foreign parents of Japan and the United States account for about half of total foreign parents, and there have been no significant fluctuations in the total number of Inward FDI over the observation period.

Figure 3.7 reports that the top seven countries where the largest number of Korean-owned overseas affiliates are located are China, the United States, Vietnam, Japan, India, Hong Kong, and Indonesia. What stands out the figure is the notable growth of the total number of Korean-owned foreign affili-

Figure 3.5: Composition of firms by the type of organizational structure (2006-2016)
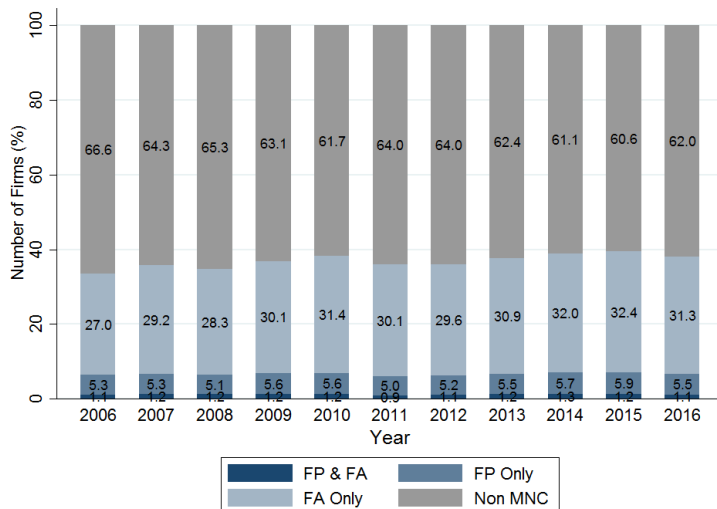
Source: The Survey of Business Activities, Statistics Korea

ates. While the total number of foreign-owned Korean firms remained around 400, that of Korean-owned foreign affiliates have shown a steady increase from less than 4000 in 2006 to over 5000 in 2016. The figure is also revealing interesting changes in the composition of Korea's Outward FDI target countries. In the mid-2000s, China accounted for approximately half of the total Outward FDI cases, but the subsequent growth in the number of foreign affiliates mainly focuses on countries such as Vietnam and the United States. Such change may capture the Korean manufacturing MNCs' strategy to reduce economic dependence on China and risks by diversifying foreign suppliers.

Figure 3.6: Nationality distribution of foreign parents
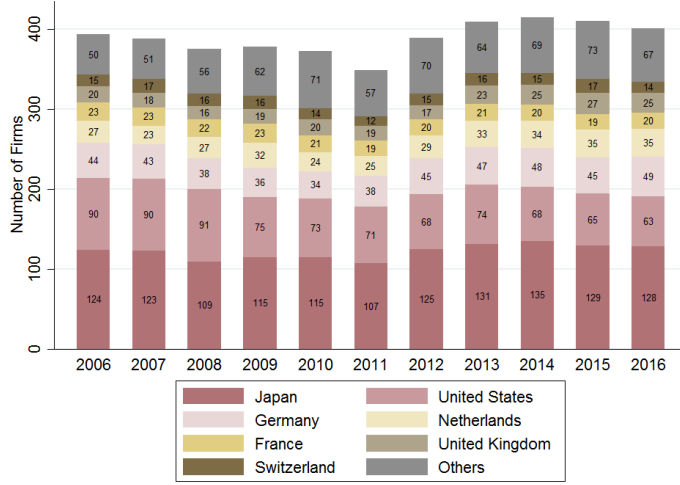
Figure 3.7: Nationality distribution of foreign affiliates
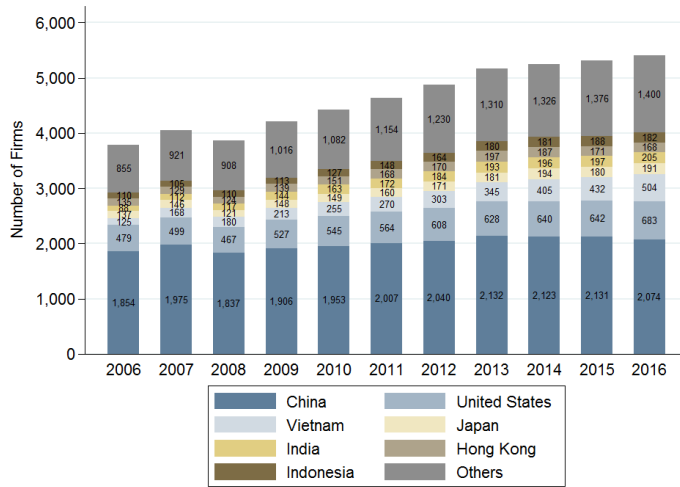
Figure 3.8 and 3.9 provide a detailed sector breakdown of composition of countries where foreign parents and foreign affiliates are located. Similar to the results in figure 3.4, both figure 3.8 and figure 3.9 find substantial heterogeneity in the intensity of global investment across industries. As highlighted in figure 3.8, some industries reveal a high concentration of Inward FDI in certain countries. For example, Japanese-owned companies account for more than 70% of Inward FDI in the apparel industry, and the German-owned firms account for more than 70% in the leather, bags, and shoes industry. On average, firms whose headquarter is located in Japan takes the largest portion of total Inward FDI operations (31%), and firms with a parent firm located in the US takes the second largest fraction (19%).

Figure 3.9 also report cross-industry heterogeneity in Outward FDI but is less pronounced than Inward FDI. In all sectors, except the tobacco and drugs and pharmaceuticals, the number of foreign affiliates located in China accounts for more than one-third of the total overseas affiliates. In some industries, such as non-metallic mineral products, electrical equipment, and furniture, Korean MNCs are particularly dependent on China, with over half of their foreign affiliates located. On average, throughout the entire observation period, 43% of the total Outward FDI take place in China, 12% in the US, 6% in Vietnam, followed by Japan, Hong Kong, Indonesia, and India. This finding suggests that Korean manufacturing MNCs prefer to set up overseas production facilities in Asian countries, which are in general geographically close to Korea and have relatively lower labor costs.

Figure 3.8: Composition of foreign parents' countries by industry classification (2006-2016)
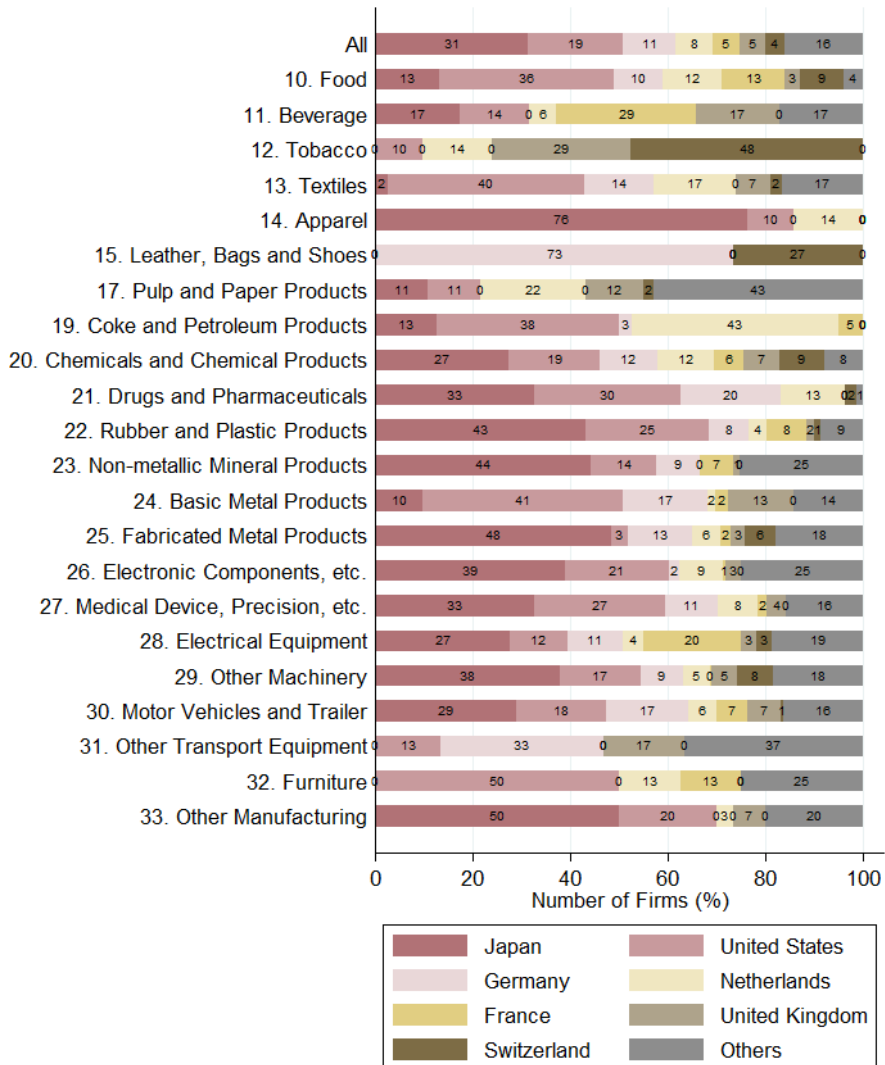
Note: In order to capture the average trend over the entire observation period, all firm observations during the year 2006-2011 were considered and were counted as individual entities. The sub-industry classification in the figure follows that of Korea Standard of Industry Classification (KSIC). There were no firms with foreign parents for industry "16. Wood and Wood Products" and "18. Publications"
Source: The Survey of Business Activities, Statistics Korea

Figure 3.9: Composition of foreign affiliates' countries by industry classification (2006-2016)
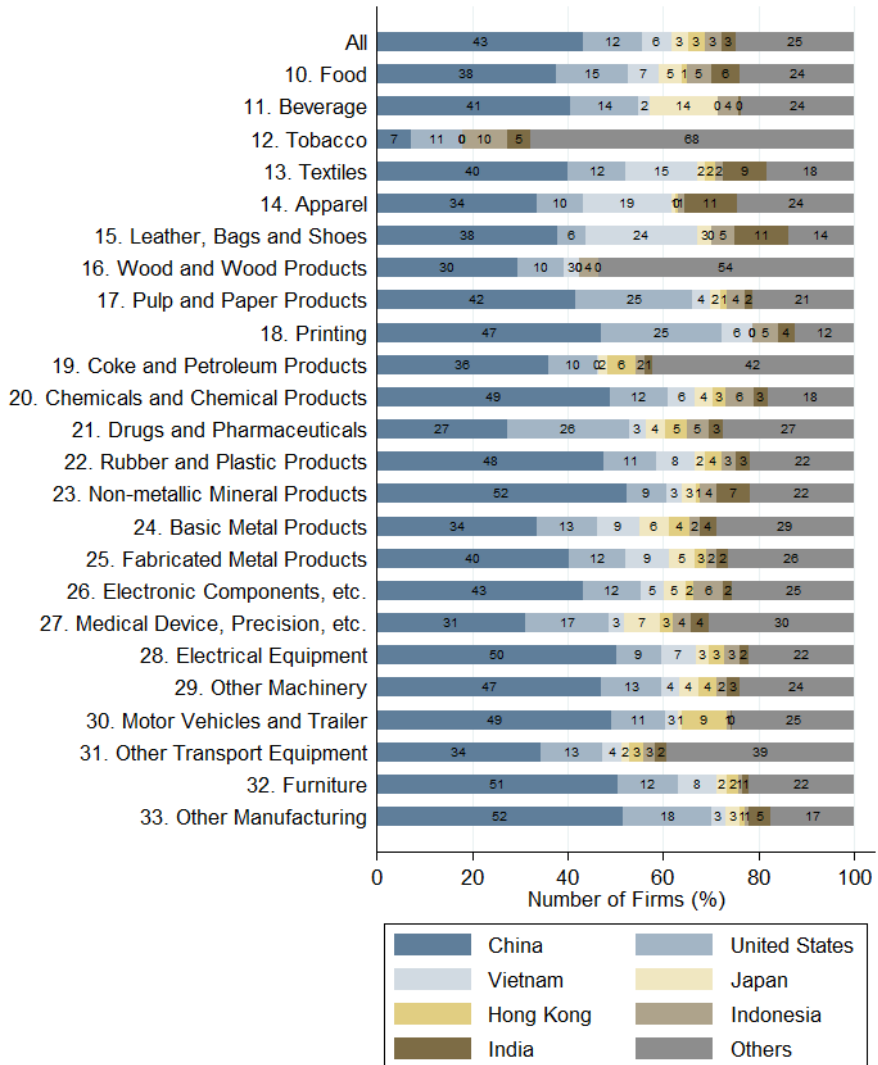
Note: In order to capture the average trend over the entire observation period, all firm observations during the year 2006-2011 were considered and were counted as individual entities. The sub-industry classification in the figure follows that of Korea Standard of Industry Classification (KSIC).
Source: The Survey of Business Activities, Statistics Korea

Chapter 4

Econometric specification and result

4.1 Analyzing the determinants of intra-firm trade

The objective of this section is to examine the predictions of property rights model based on incomplete contract theories (Antras and Helpman, 2004, 2006). Exploiting the Korean firm-level trade data, this study attempts to figure out what determines a firm 's organizational choice between vertical integration and international outsourcing, and therefore, the choice between intra-firm trade and arm's length trade. Out of 23,813 firm-year unit of observations, the analysis was performed using only samples with positive exports or imports when analyzing intra-firm exports or imports, respectively. This is because the purpose of this study is to investigate a firm's sourcing strategies between FDI and outsourcing. The main predictions in Antras and Helpman (2004, 2006) to be analyzed are as follows:

1. Firms with higher headquarter intensity are more likely to engage in intra-firm trade.
2. Firms are more likely to rely on intra-firm trade with countries of better contractibility.
3. More productive firms are more likely to trade choose intra-firm trade.

The important feature of the SBA data is that it provides information on the international ownership structure of each firm - whether a firm is Korean-owned or Foreign-owned. Therefore, for in-depth analysis of the determinants

of intra-firm trade under different FDI types, this study divides the observation sample into two groups: The first group corresponds to the case of Outward FDI, where Korean firms have ownership of overseas affiliates. The second group is for the case of Inward FDI, where foreign MNCs hold ownership of affiliates in Korea. As available information differs for each group, econometric models and results will be presented, respectively.

4.1.1 Estimation strategy for Outward FDI

Closely following the estimation strategy in Bernard et al. (2010), Lanz and Miroudot (2011), and Blanas and Seric (2018), this study analyzes the extensive margin (existence) and intensive margin (share) of intra-firm trade. The following two models are analyzed with exports and imports data, respectively.

$$D_{ijt} = \alpha + \beta_1 Z_{ijt} + \beta_2 FA_t + \beta_j D_j + \epsilon_{ijt} \tag{4.1}$$

$$S_{ijt} = \alpha + \beta_1 Z_{ijt} + \beta_2 FA_t + \beta_j D_j + \epsilon_{ijt} \tag{4.2}$$

Two dependent variables are estimated for the same set of explanatory variables. The dependent variable D_{ijt} in the first equation denotes a dummy variable which takes value 1 if a firm i of industry j in year t has positive intra-firm trade transactions, and 0 otherwise. This dummy variable aims to examine the extensive margin of intra-firm trade, i.e. the existence of intra-firm trade. The dependent variable S_{ijt} in the second equation is the share of intra-firm trade in the total trade volume of a firm i of industry j in year t, capturing the intensive margin of intra-firm trade, i.e. the intensity of intra-firm trade.

The key explanatory variables can be divided into two groups: firm-level variables and country-level variables. Z_{ijt} denotes a vector of firm-level variables. FA_t is a vector of variables that reflects the characteristics of countries

Figure 4.1: Korean exports and imports under Outward FDI
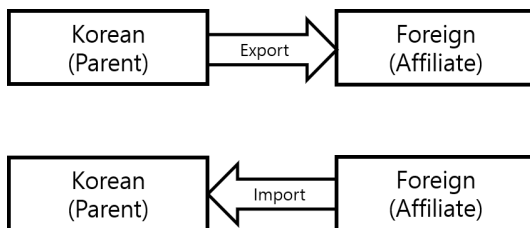
Note: As Nunn and Trefler (2013) argues, export in outward FDI is not consistent with models by Antras and Helpman (2004, 2006). Only import in inward FDI is consistent with models by Antras and Helpman (2004, 2006).

where foreign affiliates are located. D_j is dummy variables to control for unobserved heterogeneity across industries.

The vector of firm-level variables Z_{ijt} includes total factor productivity (TFP), firm size, and headquarter intensities. All the firm-level variables are from the SBA panel data (2006-2016). The total factor productivity is estimated following the method in Olley and Pakes (1996) with the estimator proposed by Rovigatti and Mollisi (2018). Olley-Pakes method assumes Cobb-Douglas technology and exploits firm investment levels as a proxy to capture unobserved productivity shocks. [1] While traditional Olley-Pakes method relied on two-steps estimation procedure, Rovigatti and Mollisi (2018) suggested a consistent estimator in a single-step GMM framework. [2] As for the measure of firm size, the log of the total number of regular employees of a firm is considered.

In regard to variables that potentially capture headquarter intensity, the author considers capital intensity, skill intensity, R&D intensity, and advertisement intensity following Yeaple (2006), Corcos et al. (2013), and Nunn and Trefler (2013). In this study, capital intensity is measured as the log of

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[1]As measures of a free variable, state variable, and proxy, the total number of full-time employment, capital, and the value of tangible assets acquired current year were adopted, respectively.

[2]This estimation is available with -prodest- in STATA.

(capital/total number of full-time employees $+ 1$). Skill intensity is computed as the log of (total labor cost/total number of full-time employees). R&D intensity is calculated as log of (total R&D cost/total sales $+ 1$). [3]. Lastly, the advertisement intensity is formulated as the log of (total advertisement cost/total sales $+ 1$). The addition of 1 when creating some variables earlier is to avoid log of zero observations.

The vector of country-level variables FA_t includes contractibility, GDP per capita, and distance from Korea. In this analysis, the contractibility is measured with "Rule of Law (RL)" index by Kaufmann et al. (2010) following the estimation strategy in Corcos et al. (2013). The rule of law index represents the level of trust among members of society in the legal and institutional aspects; the quality of contract enforcement, property rights, the court, the police, the likelihood of crime, etc. The rule of law data is provided by the World Bank in the Worldwide Governance Indicators ranging from 1996 to 2017 on 215 economies. In addition to the contractibility following the theoretical predictions, this study further considers GDP per capita and distance from Korea, which are key variables in the traditional gravity model literature (Tinbergen, 1962; Anderson, 1979). The data on GDP per capita and distance is available from the World Bank National Accounts and CEPII, respectively. [4]

One important feature of SBA data is that it provides information on intra-firm trade only as in aggregated volume, i.e. the total amount of trade between a Korean firm and all of its foreign affiliates. Therefore, analysis of transactions between a Korean firm and each foreign affiliate is not available. Instead, this study analyzes the determinants of intra-firm trade with the aggregated transaction data, by creating an investment-weighted index of country-level variables. The investment-weighted index is as follows:

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[3]The total R&D cost includes the cost of own R&Ds and R&Ds that a firm entrusted to other companies. However, this study excludes the cost of R&Ds a firm is entrusted by other businesses since the technology gained from such R&D belongs to other companies.

[4]As for the GDP per capita of Taiwan, which is not available from the World Bank, is obtained from National Statistics, Republic of China (Taiwan).

$$WeightedFA_i = \sum w_{ik} FA_{ik}$$
$$s.t. \quad \sum w_{ik} = 1 \tag{4.3}$$

In the equation 4.3, w_{ik} is the share of investment toward foreign affiliate k of a firm i in total amount of FDI of the firm i. The information on the amount of investment for each foreign affiliate is available from the SBA data. Therefore, $WeightedFA_i$ represents the weighted average contractibility, GDP per capita, and distance from Korea of firm i's overseas affiliates.

Separate estimation strategies are applied for equation 4.1 and 4.2, since the two equations have different dependent variables. The first equation 4.1 is estimated with Random Effects Panel Probit regressions as the dependent variable is binary. The estimation strategy between Random Effects (RE) and Population-Averaged (PA) are determined by LR tests. The second equation 4.2 is, instead of OLS as in Blanas and Seric (2018), estimated with PPML(Poisson pseudo-maximum likelihood) estimator, which is widely used in estimating gravity models in the international trade literature. Under the presence of heteroskedasticity, log-linearized OLS estimation may result in significantly biased estimates (Silva and Tenreyro, 2006). PPML estimator proposed by Silva and Tenreyro (2006) is known to be effective when estimating log-linear models to control for potential heteroskedasticity.

4.1.2 Estimation results for Outward FDI

The results of the econometric estimation are presented in table 4.1 for the sample of intra-firm exports under Outward FDI. Columns (1) to (3) report regression results for the extensive margin of intra-firm exports, and columns (4) to (6) for the intensive margin of intra-firm exports. In columns (1) and (4), the total factor productivity is the only regressor, and firm-level variables and country-level variables are additionally included in the rest of the

columns. However, the country variables have been estimated separately, as the rule of law and GDP per capita reveal a high correlation over 0.8. The weighted rule of law is included in column (2) and (5), and the gravity variables - the weighted GDP per capita and the weighted distance - are included in column (3) and (6).

It is important to note, however, that theoretical hypothesis from Antras and Helpman (2004, 2006) are based on restricted circumstances. As Nunn and Trefler (2013) point out, the key assumption of the model is that intermediate inputs are produced overseas and are imported to the country where headquarter is located. Therefore, the predictions of the model may not apply to exports under Outward FDI.

The columns (1)-(5) in table 4.1 report significant and positive coefficients for total factor productivity. This result may confirm that the vertical integration entails higher fixed costs compared to international outsourcing, although this trade type does not exactly match the theoretical hypothesis. It is also observed that firm size is a significant positive impact on the intra-firm transactions, in both extensive and intensive margins of exports, as identified in Blanas and Seric (2018).

The results for headquarter intensities are found to be rather inconsistent. Column (2)-(3) reveal that firms of higher skill intensity and higher R&D intensity are more likely to engage in intra-firm trade in the extensive margin, but find no significance with the intensive margin of intra-firm exports. On the other hand, column (5)-(6) indicate that firms with lower capital intensity are more likely to export in intra-firm with higher intensity, which is contrary to findings in Lanz and Miroudot (2011).

The table 4.1 further reports that there is no statistically significant association of extensive and intensive margins of intra-firm exports with advertisement intensity, rule of law, and GDP per capita. The only significant result with country-level variables is the weighted distance in column (2), suggesting that more firms are likely to export in intra-firm, the closer it is from its foreign affiliates.

The table 4.2 displays the estimation results for intra-firm imports under Outward FDI. The same explanatory variables have been used to analyze the extensive and intensive margins of intra-firm imports. As for the total factor productivity and firm size, similar results are obtained for intra-firm imports as in exports under Outward FDI. Firms with higher total factor productivity and larger size are more likely to trade within a firm's boundary.

As for the headquarter intensity, however, the results are contradictory to those of intra-firm exports. The results in column (2)-(3) and (5)-(6) indicate that capital intensity, skill intensity, and R&D intensity do not have any significant impact on existence and intensity of intra-firm imports under Outward FDI. Instead, the column (2)-(3) report significant and negative coefficients for advertisement intensity in the extensive margin of intra-firm imports. These results do not support the model predictions in Antras and Helpman (2004, 2006) that MNCs of higher headquarter intensity are more likely to choose vertical integration to incentivize the final-good producer.

Turning to country-level variables, the column (2) and (4) of table 4.2 show significant and negative coefficient for the weighted rule of law, suggesting that Korean MNCs are more likely to depend on vertical integration when importing from countries where legal institutions are weaker and contractibility is lower. Again, this result does not accord with the model predictions. The estimation results of GDP per capita and distance are similar to those of exports. The weighted GDP per capita is found to have no significant impact on intra-firm imports, while the distance from foreign affiliates is a significant factor negatively affecting a firm's choice of vertical integration.

To sum up, analysis with Korean manufacturing industry's Outward FDI suggests that only the total factor productivity is consistent with the theoretical predictions in Antras and Helpman (2004, 2006), but results for the headquarter intensity and contractibility do not support them. Especially, the results for headquarter intensity in table 4.2 is somewhat surprising since imports under Outward FDI is the consistent condition as in the model assumptions (Antras and Helpman, 2004, 2006). This finding

suggests that headquarter intensity may not be a major determinant for intra-firm transaction in some countries including Korea.

Table 4.1: Determinants of intra-firm export - Outward FDI

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Intra-firm Export(Dummy)			Intra-firm Export(Share)		
TFP	0.120***	0.098**	0.090**	0.098**	0.077*	0.065
	(3.72)	(3.02)	(2.69)	(2.75)	(2.05)	(1.70)
Employee		0.285***	0.278***		0.100***	0.091***
		(13.45)	(12.94)		(4.87)	(4.34)
Capital Intensity		-0.028	-0.030		-0.094***	-0.089***
		(-1.32)	(-1.36)		(-4.01)	(-3.72)
Skill Intensity		0.194***	0.194***		0.074	0.067
		(4.24)	(4.15)		(1.37)	(1.25)
R&D Intensity		0.464*	0.416*		-0.867	-0.971
		(2.26)	(2.00)		(-1.15)	(-1.25)
Advertisement Intensity		-0.493	-0.488		0.999	1.065
		(-0.40)	(-0.39)		(0.86)	(0.89)
Rule of Law (FA)		-0.034			-0.023	
		(-1.46)			(-0.80)	
GDP per capita (FA)			0.019			0.014
			(0.88)			(0.56)
Distance (FA)			-0.053*			0.005
			(-2.14)			(0.16)
Constant	-1.134***	-3.252***	-2.967***	-2.091***	-2.479***	-2.537***
	(-7.71)	(-13.59)	(-10.22)	(-10.57)	(-8.84)	(-7.95)
Observations	16413	16413	15394	16413	16413	15394
Sub-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimation Method	RE Panel Probit	RE Panel Probit	RE Panel Probit	PPML	PPML	PPML

Note: t statistics in parentheses. $*p < 0.05$ $**$ $p < 0.01$ $***$ $p < 0.001$

Table 4.2: Determinants of intra-firm import - Outward FDI

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Intra-firm Import(Dummy)			Intra-firm Import(Share)		
TFP	0.210***	0.166***	0.172***	0.090*	0.065	0.060
	(5.37)	(4.18)	(4.20)	(2.18)	(1.56)	(1.42)
Employee		0.293***	0.294***		0.119***	0.116***
		(11.75)	(11.56)		(4.69)	(4.58)
Capital Intensity		0.023	0.030		-0.036	-0.030
		(0.86)	(1.09)		(-1.30)	(-1.07)
Skill Intensity		0.085	0.083		-0.048	-0.059
		(1.48)	(1.41)		(-0.76)	(-0.93)
R&D Intensity		-0.001	0.006		-0.354	-0.464
		(-0.00)	(0.01)		(-0.45)	(-0.58)
Advertisement Intensity		-5.671**	-5.226**		-4.308	-3.794
		(-2.92)	(-2.63)		(-1.51)	(-1.32)
Rule of Law (FA)		-0.172***			-0.214***	
		(-5.77)			(-6.07)	
GDP per capita (FA)			-0.008			-0.044
			(-0.32)			(-1.59)
Distance (FA)			-0.185***			-0.100**
			(-6.02)			(-3.03)
Constant	-1.798***	-3.701***	-2.166***	-2.292***	-2.570***	-1.359***
	(-9.93)	(-12.56)	(-6.18)	(-9.86)	(-7.75)	(-3.72)
Observations	13087	13087	12280	13087	13087	12280
Sub-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimation Method	RE Panel Probit	RE Panel Probit	RE Panel Probit	PPML	PPML	PPML

Note: t statistics in parentheses. *$p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

4.1.3 Estimation strategy for Inward FDI

The analysis proceeds with the sample of intra-firm trade under Inward FDI, where foreign parents are holding ownership of Korean firms with shares over 50% of the affiliate. The econometric specification is as follows:

$$D_{ijt} = \alpha + \beta_1 Z_{ijt} + \beta_2 FP_t + \beta_j D_j + \epsilon_{ijt} \tag{4.4}$$

$$S_{ijt} = \alpha + \beta_1 Z_{ijt} + \beta_2 FP_t + \beta_j D_j + \epsilon_{ijt} \tag{4.5}$$

The two equations 4.4 and 4.5 are constructed and estimated similarly to the earlier equations 4.1 and 4.2. As previously presented, the dependent variables D_{ijt} and S_{ijt} represent the existence of intra-firm trade and intensity of intra-firm trade, respectively. Also, Z_{ijt} is a vector of firm-level variables including total factor productivity, size, and headquarter intensities. To capture the marginal effects of headquarter intensities, this analysis includes the capital intensity, skill intensity, R&D intensity, and advertisement intensity.

There are, however, some additional considerations for the analysis of Inward FDI that stem from data characteristics. The first thing to note is that the transaction data under Inward FDI is based on the sum of the Korean firm's trade with its foreign parent and the Korean firm's trade with all of its foreign affiliates if any. The international flow of goods is illustrated in figure 4.2. This is in contrast to the transaction data under Outward FDI that include only trade between the Korean parent firm and its foreign affiliates. Therefore, the interpretation of the results under Inward FDI requires more cautions. In an attempt to capture the potential effects of foreign affiliates, this analysis additionally considers a dummy variable for the existence of overseas affiliates in addition to the existing firm-level variables. This dummy variable takes value 1 if the Korean firm is owned by a foreign parent and has ownership of some foreign affiliates at the same time, and 0 otherwise.

The second point is that a foreign parent can be identified as one country, unlike foreign affiliates. Therefore, there is no need to use investment-weighted country-level variables as in the analysis of Outward FDI. In the equation 4.4 and 4.5, FP_t is a vector of country-level variables that reflects the characteristics of the country of the parent company. Three variables - the rule of law, GDP per capita, distance - are included, not by weighted-index, but by each variable itself. The econometric models in this analysis do not include the vector of foreign affiliates to focus on the relationship between Korean firms and their parent companies.

Figure 4.2: Korean exports and imports under Inward FDI
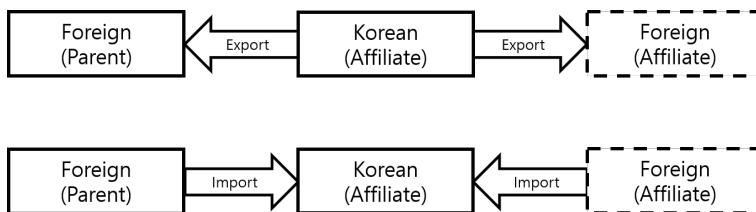
Note: As Nunn and Trefler (2013) points out, only export in Inward FDI is consistent with models by Antras and Helpman (2004, 2006) and import in Inward FDI is not. For Inward FDI, this study additionally considers the existence of foreign affiliates owned by Korean firms.

4.1.4 Estimation results for Inward FDI

The table 4.3 demonstrates the estimation results for the extensive and intensive margins of intra-firm exports under Inward FDI. Contrary to expectations, the results reveal that the key variables closely relevant to model predictions do not have significant associations with intra-firm exports. In all columns, the coefficients of the total factor productivity and rule of law show no significance. As for the variables capturing headquarter intensities, the results are not robust, even though the skill intensity displays a significant and positive coefficient in column (3), and the R&D intensity has a significant and negative coefficient in column (5). These findings are quite unanticipated con-

sidering that exports from affiliates in Korea to its foreign parent is the type of trade consistent with the theoretical assumptions in Antras and Helpman (2004, 2006).

Instead of the key regressors, some significant results are observed with the additionally introduced firm-level variable. In column (1)-(3), the significant and positive results of *FP & FA* dummy variable suggests that Korean firms with both foreign parents and foreign affiliates are more likely to engage in intra-firm trade in extensive margin. This finding may imply that the increasing complexity of ownership structure within the global value chain is contributing to the rise of intra-firm trade.

The results also suggest that firm size and distance are significant determinants affecting intra-firm exports under Inward FDI. The coefficients of firm size in column (2)-(3) indicate that firms of large size are more likely to engage in intra-firm exports, but only in the extensive margin. The negative coefficients of distance in column (3) and (6) suggest that foreign parents are more likely to rely on vertical integration if they are closer from Korea, and on international outsourcing, if they are farther away from Korea.

The table 4.4 reports estimation results for the sample of intra-firm imports under the Inward FDI. The columns (4)-(6) reveal that firms of higher productivity are more likely to import intra-firm under Inward FDI. Although the imports from a foreign parent is not an environment consistent with the assumptions in Antras and Helpman (2004, 2006), this finding suggests that the theoretical prediction of the higher fixed cost of vertical integration may explain imports under Inward FDI as well.

Interesting results are found in columns (5)-(6) that firms with a smaller size, lower R&D intensity, and higher advertising intensity are more likely to rely on vertical integration. At first glance, it may seem strange that R&D intensity and advertisement intensity have the opposite sign of coefficients. However, it should be recalled that imports under Inward FDI do not correspond to the model assumptions, thus the results need to be interpreted in different perspectives.

One possible explanation for this is that the estimation results may reflect a situation where imports from foreign parents are mainly composed of final goods that are for sale to Korean consumers. In other words, affiliates in Korea function as overseas distribution networks established for the sale of final goods, rather than as a production base. This may explain the positive coefficient for the advertisement intensity, and the negative coefficient for the firm size and the R&D intensity as well.

Turning to the empirical evidence on country-level variables, the estimation results confirm that the traditional gravity variables may play an important role in a firm's organizational choices. The GDP per capita shows a significant and positive coefficient in intensive margin, and the distance displays significant and negative coefficients in both extensive and intensive margins. However, as in the results of exports under Inward FDI, the quality of institutions of the country where the parent firm is located does not have a significant effect on the intra-firm imports.

Overall, the analysis of exports and imports under Inward FDI differ from each other in several important ways. As for the exports, firms with foreign affiliates and of large size are more likely to engage in vertical integration. On the other hand, firms of high productivity, small size, low R&D intensity, and high advertisement intensity are more likely to import intra-firm in terms of intensity. All of these findings, however, reveal that theoretical predictions in Antras and Helpman (2004, 2006) do not seem to explain the empirical evidence from Korea.

Table 4.3: Determinants of intra-firm export - Inward FDI

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Intra-firm Export(Dummy)			Intra-firm Export(Share)		
TFP	0.069	0.066	0.074	0.004	-0.018	-0.005
	(1.13)	(1.06)	(1.21)	(0.08)	(-0.34)	(-0.09)
FP & FA	0.284**	0.264**	0.224*	0.045	0.062	0.027
	(2.99)	(2.75)	(2.38)	(0.59)	(0.82)	(0.37)
Employee		0.092*	0.105*		0.042	0.053
		(2.05)	(2.39)		(1.19)	(1.50)
Capital Intensity		0.001	-0.013		-0.033	-0.041
		(0.03)	(-0.33)		(-0.99)	(-1.25)
Skill Intensity		0.139	0.195*		0.047	0.121
		(1.67)	(2.34)		(0.62)	(1.54)
R&D Intensity		-1.113	-0.852		-4.690*	-3.483
		(-1.15)	(-0.89)		(-2.19)	(-1.82)
Advertisement Intensity		-1.597	-1.406		0.540	0.922
		(-0.77)	(-0.70)		(0.31)	(0.53)
Rule of Law (FP)		0.016			0.046	
		(0.20)			(0.64)	
GDP per capita (FP)			0.036			0.161*
			(0.52)			(2.34)
Distance (FP)			-0.205***			-0.164***
			(-4.82)			(-5.08)
Constant	-0.357	-1.326*	-0.097	-1.336***	-1.599**	-2.156*
	(-1.00)	(-2.39)	(-0.10)	(-3.41)	(-3.06)	(-2.39)
Observations	3656	3656	3656	3656	3656	3656
Sub-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimation Method	RE Panel Probit	RE Panel Probit	RE Panel Probit	PPML	PPML	PPML

Note: t statistics in parentheses. $^*p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

44

Table 4.4: Determinants of intra-firm import - Inward FDI

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)
	Intra-firm Import(Dummy)			Intra-firm Import(Share)		
TFP	0.108	0.128	0.148*	0.117*	0.121*	0.139**
	(1.65)	(1.92)	(2.27)	(2.11)	(2.25)	(2.90)
FP & FA	0.124	0.143	0.110	-0.100	-0.019	-0.054
	(1.21)	(1.36)	(1.07)	(-1.23)	(-0.23)	(-0.70)
Employee		0.011	0.027		-0.095**	-0.086*
		(0.24)	(0.58)		(-2.61)	(-2.45)
Capital Intensity		-0.014	-0.031		-0.040	-0.057
		(-0.35)	(-0.78)		(-1.19)	(-1.76)
Skill Intensity		0.181*	0.248**		0.145	0.245***
		(2.05)	(2.83)		(1.95)	(3.34)
R&D Intensity		1.475	1.796		-4.723**	-3.236**
		(1.03)	(1.27)		(-3.23)	(-2.59)
Advertisement Intensity		2.713	3.068		3.362**	3.908**
		(1.37)	(1.60)		(2.83)	(3.23)
Rule of Law (FP)		0.110			0.003	
		(1.25)			(0.04)	
GDP per capita (FP)			0.135			0.157*
			(1.80)			(2.08)
Distance (FP)			-0.242***			-0.214***
			(-5.36)			(-6.89)
Constant	-0.459	-1.509**	-0.953	-1.873***	-1.900***	-2.112*
	(-1.35)	(-2.66)	(-0.98)	(-5.21)	(-3.62)	(-2.24)
Observations	3448	3448	3448	3448	3448	3448
Sub-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Estimation Method	RE Panel Probit	RE Panel Probit	RE Panel Probit	PPML	PPML	PPML

Note: t statistics in parentheses. $*p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

4.2 Analyzing the intra-firm trade and the trade slump

In this section, the implications of intra-firm trade during the times of trade slump will be discussed. As presented in Chapter 3, the figure 3.1 reveals that the Korean manufacturing industry is experiencing a trade slump for the latter half of the entire observation period (2006-2016). To be specific, the total exports displays a marked trade decline since 2012, and the total imports also show a gradual decrease since 2013. It is also evident from the figure that the mid-term trade fall is more severe than the temporary shock during the global financial crisis.

4.2.1 Estimation strategy

This study constructs a model that captures the potential role of intra-firm trade during mid-term the trade slump. The analysis will be presented separately for the sample of Outward and Inward FDI, respectively. The econometric specification is as follows:

$$\hat{X}_{ijt} = \alpha + \beta_1 Z_{ijt} + \beta_2 S_{ijt} + \beta_3 S_{ijt} \times R + \beta_4 R + \beta_j D_j + \epsilon_{ijt} \tag{4.6}$$

$$\hat{X}_{ijt} = \alpha + \beta_1 Z_{ijt} + \beta_2 S_{ijt} + \beta_3 S_{ijt} \times R + \beta_t D_t + \beta_j D_j + \epsilon_{ijt} \tag{4.7}$$

In the above equations. the dependent variable X_{ijt} is the growth rate of total exports or imports of a firm i of industry j in year t. The growth rate is formulated based on Davis et al. (1998):

$$\hat{X}_{ijt} = \frac{X_{ijt} - X_{ijt-1}}{(X_{ijt} + X_{ijt-1})/2} \tag{4.8}$$

Z_{ijt} denotes a vector of firm-level variables, including the total factor productivity and firm size. The dummy variable *FP&FA* is additionally included for the analysis of Inward FDI. These firm-level variables are included to control for potential factors that might affect the growth rate of trade. S_{ijt} is the log of intra-firm exports or imports share, which is the key regressor of this analysis.

In an effort to account for heterogeneity across time, a recession dummy and individual year dummies are considered in the equation 4.6 and 4.7, respectively. R represents a recession dummy variable that is equal to 1 if the observation unit belongs to the period 2012 to 2016, and 0 otherwise. Based on the exports data, the author defines the period ranging from 2006 to 2011 as "pre-recession", and period ranging from 2012 to 2016 as "post-recession". D_t denotes dummy variables for each year.

An interaction term between S_{ijt} and R attempts to capture the impact of intra-firm trade during the post-recession period compared to the pre-recession period. The coefficient of this term reports the additional effects of intra-firm trade on the growth of total trade during the trade slump. The industry dummy variables D_j are also considered to control for unobserved heterogeneity across industries.

The equation 4.6 and 4.7 are estimated with Fixed Effects Panel Regression for exports and imports, respectively. The estimation strategy between Fixed and Random Effects are determined by Hausman tests. Finally, as in the earlier analysis, the firm-year unit of observations with positive total exports and imports are considered only.

4.2.2   Estimation results

The table 4.5 presents the estimation results for the sample of Outward FDI, where Korean MNCs have ownership of foreign affiliates. Column (1)-(2) report the regression results for the growth rate of exports, and column (3)-(4) for the growth rate of imports.

All columns in table 4.5 display significant and positive coefficients for the total factor productivity, suggesting that more productive firms are more likely to experience a higher growth rate of trade. On the other hand, the firm size is found to be not significant in all cases.

The coefficients of S_{ijt} are significant and negative for both exports and imports. This finding indicates that firms that are actively involved in intra-firm trade with higher intensity are more likely to suffer lower growth rate of total trade. A possible explanation for this result is that the international transaction within a firm's boundary reduces the volatility and is more stable when compared to the transactions between independent entities.

What stands out in this table is the positive and significant coefficients of the interaction term in all columns, suggesting that higher intensity of intra-firm trade during the times of trade slump mitigates the decline of total exports and imports. This result confirms the existence of the stabilizing effects of intra-firm trade in times of economic recession. Overall, the coefficients do not differ significantly depending on the use of recession dummy or year dummies.

The table 4.6 shows the estimation results for the ownership structure where Korean firms are under the control of foreign parent companies. The existence of foreign affiliates is additionally considered in this analysis but is not significant. For all other explanatory variables, table 4.6 reports similar results as table 4.5: The higher the share of intra-firm trade, the lower the firm is likely to experience a low growth rate of total trade. However, this negative effect is mitigated during the mid-term trade slump.

Table 4.5: Analyzing intra-firm trade and post-crisis recession - Outward FDI

	(1)	(2)	(3)	(4)
	Export	Growth Rate	Import	Growth Rate
Dependent variable				
TFP	0.390***	0.389***	0.320***	0.313***
	(11.92)	(11.92)	(6.86)	(6.73)
Employee	0.055	0.062	0.056	0.063
	(1.70)	(1.90)	(1.22)	(1.35)
Recession	-0.227***		-0.224***	
	(-10.78)		(-7.43)	
Intrafirm Export Share	-0.823***	-0.827***		
	(-15.54)	(-15.61)		
Recession x Intrafirm Export Share	0.271***	0.258***		
	(3.93)	(3.72)		
Intrafirm Import Share			-0.827***	-0.823***
			(-11.83)	(-11.70)
Recession x Intrafirm Import Share			0.312**	0.284**
			(3.27)	(2.93)
Constant	-0.889	-0.832	-0.262	-0.260
	(-1.47)	(-1.38)	(-0.35)	(-0.35)
Observations	12496	12496	8980	8980
Firm FE	Yes	Yes	Yes	Yes
Sub-Industry FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Estimation Method		FE Panel OLS		

Table 4.6: Analyzing intra-firm trade and post-crisis recession - Inward FDI

	(1)	(2)	(3)	(4)
	Export	Growth Rate	Import	Growth Rate
TFP	0.179**	0.182**	0.225***	0.227***
	(2.72)	(2.75)	(3.46)	(3.49)
FP & FA	-0.114	-0.114	0.158	0.154
	(-1.09)	(-1.08)	(1.47)	(1.43)
Employee	0.057	0.058	0.019	0.019
	(0.74)	(0.74)	(0.24)	(0.24)
Recession	-0.252***		-0.203***	
	(-5.58)		(-4.24)	
Intrafirm Export Share	-0.429***	-0.426***		
	(-4.75)	(-4.67)		
Recession x Intrafirm Export Share	0.338**	0.310*		
	(2.82)	(2.51)		
Intrafirm Import Share			-0.486***	-0.501***
			(-5.30)	(-5.39)
Recession x Intrafirm Import Share			0.220	0.236
			(1.86)	(1.92)
Constant	-0.984	-0.909	-0.580	-0.440
	(-1.40)	(-1.28)	(-0.84)	(-0.63)
Observations	2781	2781	2564	2564
Firm FE	Yes	Yes	Yes	Yes
Sub-Industry FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Estimation Method		FE Panel OLS		

Note: t statistics in parentheses. $^*p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Chapter 5

Conclusion

Assessing the firm-level data of Korean manufacturing industry, this study contributes to existing knowledge of two important topics on intra-firm trade: the determinants and implications for trade slump. This study employs the firm-level panel data of Korean manufacturing industry ranging 2006 to 2016.

In the analysis of the first topic, this study provides an empirical assessment of the property rights theory in Antras and Helpman (2004, 2006). The present study appears to be the first to compare the determinants of intra-firm trade depending on the type of ownership organization - Outward and Inward FDI -, and on the type of trade - exports and imports. Overall, the results of this study do support the theoretical prediction on productivity, but is not in line with the headquarter intensity and contractibility.

The implications of this study can be summarized as the following. First, the determinants of intra-firm trade may considerably differ from country to countries. Second, the simple distinction between headquarter-producer and intermediate input supplier in the property rights theories does not seem to be enough to explain the complex nature of global value chains; Despite the great achievement of the model of property rights theories, it has yet to explain more complex type of international transactions, such as the case where intermediate goods are imported and then exported again after some processing. Third, the imports under Inward FDI, which is not explained by the property rights theory, maybe mainly dominated by the transaction of final goods for sale to Korean consumers. Fourth, distance, the traditional gravity variable, is found to be a significant determinant of intra-firm trade for both Outward and Inward FDIs, suggesting that distance-related factors such as

transportation costs or cultural differences between countries can be important for a firm's organizational choices.

In the analysis of the second topic, this study contributes to the understanding of the role of intra-firm trade in times of post-crisis trade slump. The Korean manufacturing industry, which once led the high export growth, is experiencing a steady decline since 2012. The descriptive statistics report that intra-firm trade is relatively more stable during the entire observation period, and the arm's length trade accounts for most of the volatility in the total trade volume. The econometric analysis reveals that firms with a higher intensity of intra-firm trade are more likely to show a low growth rate, but such negative effect is significantly mitigated in times of trade slump. When the empirical fact is considered together, the regression results may imply that intra-firm trade has a stabilizing effect and is more resilient compared to the arm's length trade.

There are two limitations to this study. The first is that trade data used in this study was only accessible in the aggregated value; the sum of the Korean firm's trade with its foreign parent and the Korean firm's trade with all of its foreign affiliates. Therefore, analysis with each transaction between Korean firms and foreign parent or affiliates were not available. The second is that it was not possible to identify the intra-firm trade whether it is in final goods or intermediate inputs. As property rights theory by Antras and Helpman (2004, 2006) assumes intra-firm trade only in intermediate inputs, this study is limited in examining the model predictions precisely. In spite of its limitations, the study certainly adds to our understanding of the intra-firm trade and has thrown up many questions in need of further investigation. Especially, the empirical results in this study reveal that further theoretical studies need to be carried out to explain the complex nature of global value chains and intra-firm trade.

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Appendix

Appendix A   Summary statistics

Table A.1: Summary statistics: determinants of intra-firm trade

	(1) K-Parent F-Affiliate				(2) F-Parent K-Affiliate			
	mean	sd	min	max	mean	sd	min	max
Intrafirm Export (Dummy)	0.3952	0.4889	0	1	0.4711	0.4992	0	1
Intrafirm Export (Share)	0.1727	0.3192	0	1	0.2678	0.3892	0	1
Intrafirm Import (Dummy)	0.2572	0.4371	0	1	0.4664	0.4989	0	1
Intrafirm Import (Share)	0.1367	0.3101	0	1	0.2897	0.4021	0	1
FP & FA	0	0	0	0	0.1763	0.3811	0	1
TFP	2.375	0.5575	-3.395	8.317	2.392	0.6243	-8.36	5.813
Employee	5.32	1.033	2.079	11.53	5.281	0.9301	3.045	9.803
Capital Intensity	4.65	0.9821	0	9.319	4.387	1.093	0	8.982
Skill Intensity	3.708	0.4543	-2.977	8.651	3.931	0.4582	-1.93	6.041
R&D Intensity	0.0229	0.0646	0	6.569	0.0119	0.0334	0	0.8825
Advertisement Intensity	0.0050	0.0161	-0.0001	0.4344	0.0058	0.0251	-0.0002	0.3183
Rule of Law(FA)	0.0116	0.7453	-1.83	2.1	-0.0785	0.6585	-0.9551	1.861
GDP per capita(FA)	8.965	1.059	5.913	11.69	8.8	0.9553	6.659	11.19
Distance(FA)	7.698	0.8898	6.05	9.818	7.427	0.7609	6.862	9.312
Rule of Law(FP)	.	.	.	.	1.519	0.3946	-2.241	2.1
GDP per capita(FP)	.	.	.	.	10.64	0.4681	6.54	11.69
Distance(FP)	.	.	.	.	8.423	0.9773	6.862	9.581
Observations	19536				4277			

Table A.2: Summary statistics: intra-firm trade and recession

	(1) K-Parent F-Affiliate				(2) F-Parent K-Affiliate			
	mean	sd	min	max	mean	sd	min	max
Export Growth Rate	.06781	1.034	-2	2	.0798	1.001	-2	2
Import Growth Rate	.1376	1.293	-2	2	.08664	1.058	-2	2
TFP	2.375	.5575	-3.395	8.317	2.392	.6243	-8.36	5.813
Employee	5.32	1.033	2.079	11.53	5.281	.9301	3.045	9.803
FP & FA	0	0	0	0	.1763	.3811	0	1
Intrafirm Export Share	.13	.2284	0	.6931	.1965	.2751	0	.6931
Intrafirm Import Share	.1002	.2198	0	.6931	.2114	.2838	0	.6931
Recession	.48	.4996	0	1	.473	.4993	0	1
Observations	19536				4277			

Appendix B   List of manufacturing sub-sectors

Table B.1: List of manufacturing sub-sectors

KSIC	Industrial Subdivision
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles, except apparel
14	Manufacture of wearing apparel, clothing accessories and fur articles
15	Manufacture of leather, luggage and footwear
16	Manufacture of wood and of products of wood and cork; except furniture
17	Manufacture of pulp, paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke, briquettes and refined petroleum products
20	Manufacture of chemicals and chemical products; except pharmaceuticals and medicinal chemicals
21	Manufacture of pharmaceuticals, medicinal chemical and botanical products
22	Manufacture of rubber and plastics products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and furniture
26	Manufacture of electronic components, computer; visual, sounding and communication equipment
27	Manufacture of medical, precision and optical instruments, watches and clocks
28	Manufacture of electrical equipment
29	Manufacture of other machinery and equipment
30	Manufacture of motor vehicles, trailers and semitrailers
31	Manufacture of other transport equipment
32	Manufacture of furniture
33	Other manufacturing

Source: The 10th Korean Standard Statistical Classification, Statistics Korea.

Appendix C   List of trading countries

Table C.1: List of trading countries

Region	Country	ISO	Country	ISO
Asia(31)	Taiwan	TWN	Lebanon	LBN
	Afghanistan	AFG	Sri Lanka	LKA
	United Arab Emirates	ARE	Malaysia	MYS
	Bangladesh	BGD	Nepal	NPL
	China	CHN	Oman	OMN
	Hong Kong SAR, China	HKG	Pakistan	PAK
	Indonesia	IDN	Philippines	PHL
	India	IND	Qatar	QAT
	Iran, Islamic Rep.	IRN	Saudi Arabia	SAU
	Iraq	IRQ	Singapore	SGP
	Israel	ISR	Syria	SYR
	Japan	JPN	Thailand	THA
	Kazakhstan	KAZ	Uzbekistan	UZB
	Cambodia	KHM	Vietnam	VNM
	Kuwait	KWT	Yemen, Rep.	YEM
	Lao People's Democratic Republic	LAO	-	
Rest of Asia(13)	Armenia	ARM	Maldives	MDV
	Bahrain	BHR	Myanmar	MMR
	Brunei Darussalam	BRN	Mongolia	MNG
	Bhutan	BTN	Tajikistan	TJK
	Georgia	GEO	Turkmenistan	TKM
	Jordan	JOR	Timor-Leste	TLS
	Kyrgyz Republic	KGZ	-	
Africa(29)	Angola	AGO	Madagascar	MDG
	Botswana	BWA	Mauritius	MUS
	Cote d'Ivoire	CIV	Niger	NER
	Cameroon	CMR	Nigeria	NGA
	Congo, Dem. Rep.	COD	Sudan	SDN
	Algeria	DZA	Senegal	SEN
	Egypt, Arab Rep.	EGY	Eswatini	SWZ
	Ethiopia	ETH	Togo	TGO
	Gabon	GAB	Tunisia	TUN
	Ghana	GHA	Tanzania	TZA
	Guinea	GIN	Uganda	UGA
	Kenya	KEN	South Africa	ZAF
	Liberia	LBR	Zambia	ZMB
	Libya	LBY	Zimbabwe	ZWE
	Morocco	MAR	-	
Rest of Africa(22)	Burundi	BDI	Lesotho	LSO
	Benin	BEN	Mali	MLI
	Burkina Faso	BFA	Mozambique	MOZ
	Central African Republic	CAF	Mauritania	MRT
	Congo, Rep.	COG	Malawi	MWI
	Comoros	COM	Namibia	NAM

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Table C.1 – *Continued from previous page*

Region	Country	ISO	Country	ISO
	Cabo Verde	CPV	Rwanda	RWA
	Djibouti	DJI	Sierra Leone	SLE
	Gambia, The	GMB	Sao Tome and Principe	STP
	Guinea-Bissau	GNB	Seychelles	SYC
	Equatorial Guinea	GNQ	Chad	TCD
Europe(32)	Albania	ALB	Croatia	HRV
	Austria	AUT	Hungary	HUN
	Azerbaijan	AZE	Ireland	IRL
	Belgium	BEL	Italy	ITA
	Bulgaria	BGR	Lithuania	LTU
	Switzerland	CHE	Luxembourg	LUX
	Cyprus	CYP	Netherlands	NLD
	Czech Republic	CZE	Norway	NOR
	Germany	DEU	Poland	POL
	Denmark	DNK	Portugal	PRT
	Spain	ESP	Romania	ROU
	Estonia	EST	Russian Federation	RUS
	Finland	FIN	Slovenia	SVN
	France	FRA	Sweden	SWE
	United Kingdom	GBR	Turkey	TUR
	Greece	GRC	Ukraine	UKR
Rest of Europe(14)	Andorra	AND	Macedonia, FYR	MKD
	Bosnia and Herzegovina	BIH	Malta	MLT
	Belarus	BLR	Montenegro	MNE
	Faroe Islands	FRO	San Marino	SMR
	Iceland	ISL	Serbia	SRB
	Latvia	LVA	Slovak Republic	SVK
	Moldova	MDA	Kosovo	XKX
Northern America(2)	Canada	CAN	United States	USA
Latin America and the Caribbean(23)	Argentina	ARG	Jamaica	JAM
	Bahamas, The	BHS	Mexico	MEX
	Bolivia	BOL	Nicaragua	NIC
	Brazil	BRA	Panama	PAN
	Chile	CHL	Peru	PER
	Colombia	COL	Puerto Rico	PRI
	Costa Rica	CRI	Paraguay	PRY
	Dominica	DMA	El Salvador	SLV
	Ecuador	ECU	Trinidad and Tobago	TTO
	Grenada	GRD	Uruguay	URY
	Guatemala	GTM	Venezuela, RB	VEN
	Honduras	HND	-	
Rest of Latin America and the Caribbean(11)	Antigua and Barbuda	ATG	Haiti	HTI
	Belize	BLZ	St. Kitts and Nevis	KNA
	Barbados	BRB	St. Lucia	LCA
	Cuba	CUB	Suriname	SUR
	Dominican Republic	DOM	St. Vincent and the Grenadines	VCT
	Guyana	GUY	-	

Table C.1 – *Continued from previous page*

Region	Country	ISO	Country	ISO
Oceania(2)	Australia	AUS	New Zealand	NZL
Rest of Oceania(13)	Fiji	FJI	Papua New Guinea	PNG
	Micronesia, Fed. Sts.	FSM	Solomon Islands	SLB
	Kiribati	KIR	Tonga	TON
	Marshall Islands	MHL	Tuvalu	TUV
	Northern Mariana Islands	MNP	Vanuatu	VUT
	Nauru	NRU	Samoa	WSM
	Palau	PLW	-	

Note: The SBA data by Statistics Korea reports the information of countries where the foreign parent and foreign affiliates of Korean firms are located. While most countries are identified as an individual entity, some economies with little trade with Korea are only identifiable as in region classification. Therefore, the author selected some countries whose GDP per capita information is available on the World Bank National Accounts database and classified those countries in the "rest of countries" category for each region classification. Then the author formulated the average value of GDP per capita and distance for those in the "rest of countries" category.

국문초록

기업내무역의 결정요인과 무역 불황에 대한 시사점

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정보기술(IT)의 발달과 보다 자유로운 국제 무역환경을 바탕으로 다국적 기업들의 생산공정은 물리적이고 지리적인 해체가 가능해졌다. 해외에서 생산공정의 일부를 실시하려는 다국적 기업들은 생산공정을 기업 내부적으로 운영할 것인지 혹은 독립적인 해외 현지 기업에게 위탁할 것인지와 관련하여 소유권 선택의 문제를 직면하게 되었다. 다국적 기업이 해외 생산 공정의 수직적 통합(Vertical Integration)을 선택한다면 기업내무역(Intra-firm Trade)이 이루어지고, 해외 위탁생산(International Outsourcing)을 선택한다면 독립기업간무역(Arm's Length Trade)가 발생하게 된다. 한국 제조업의 기업단위 데이터를 활용하여 본 연구는 기업내무역의 결정요인 분석과 기업내무역이 무역침체기에 가지는 함의 분석이라는 두 가지 주제를 중점적으로 다루었다.

첫번째 분석으로 본 연구는 Antras and Helpman (2004) 와 Antras and Helpman (2006)의 재산권 이론(Property Rights Theory)에서 나타나는 기업내무역에 대한 이론적 예측들을 검증하였다. 해외직접투자(Outward FDI) 및 외국인직접투자(Inward FDI)에 따른 기업지배구조를 구분하여 표본을 구성하였고, 각각의 표본에 대하여 기업내 무역의 외연(Extensive Margin) 및 내연(Intensive Margin)효과의 결정요인을 분석하였다. 한국 제조업 자료를 활용한 실증분석 결과, 생산성 변수의 경우 이론의 예측과 일치하는 것을 확인할 수 있었다. 그러나 본부집약도(Headquarter Intensity)와 계약가능성(Contractibility) 변수는 이론의 예측과 일치하지 않았다.

첫번째 분석을 통해 다음과 같은 함의를 도출할 수 있었다. 첫째, 기업내무역의 결정요인은 국가마다 상당히 다를 수 있다. 둘째, 재산권 이론에서는 기업을 본사 생산자와 중간재 공급자 두 가지로 단순하게 구분하는데 이는 글로벌 가치사슬의 복잡한 특성을 제대로 설명하지 못할 수 있다. 셋째, 재산권 이론은 외국인직접투자자에 의한 기업구조에서 발생하는 수입을 이론적으로 설명하지 못하고 있으나, 이러한 수입의 상당 부분은 한국 소비자에게 판매하기 위한 최종재일 수 있다. 넷째, 거리 변수에 대하여 유의한 음의 계수를 얻었는데, 이는 운송비 또는 국가 간 문화적 차이와 같은 거리 관련 요인들이 기업의 구조 선택에 중요한 역할을 할 수 있음을 시사한다.

두 번째 분석에서 본 연구는 무역 침체(2012 2016년) 시기의 기업내무역의 역할을 탐구하였다. 고정효과 패널 회귀 분석은 기업내무역의 비중이 높은 기업들이 낮은 무역 성장률을 보일 가능성이 더 높지만, 무역 침체기에는 이와 같은 기업내무역의 부정적인 영향이 크게 줄어든다는 것을 보여주었다. 기업내무역의 그래프 자료를 함께 고려하였을 때, 패널분석 결과는 기업내무역이 무역침체 시기에 무역감소를 안정화시키는 효과를 가질 수 있으며 독립기업간무역에 비해 회복력이 더 높은 것으로 해석할 수 있다.