

# When Does Auto-Parts Suppliers' Innovation Reduce Their Dependence on the Automobile Assembler?

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## Abstract

**Purpose** – This study is to investigate the determinants of suppliers' dependence on buyers in the home country by developing a theoretical model of innovative activities. The high dependence of auto parts suppliers on a single local buyer in South Korea due to firm ownership issues and incremental innovation is examined using data from a set of organizations that supply intermediate goods to this automotive manufacturer. Furthermore, we tested the moderating effect of FDI and global knowledge sourcing on the relationship between firm ownership and suppliers' dependence on the local buyer.

**Design/methodology** – To test the hypotheses, we examined a sample of 101 suppliers over 10 years in the Korean automobile parts industry. In this empirical analysis, we utilized a fixed-effects generalized least squares model using panel data.

**Findings** – In this study, domestic firms (automobile parts suppliers) were more dependent on a single local buyer (automobile assembler) than foreign-owned suppliers operating in Korea. In addition, incremental innovation was the mediating mechanism between domestic firms and dependence on the local buyer. To reduce this dependence on the buyer, we suggest two different international strategies: geographical diversification through FDI and global knowledge sourcing.

**Originality/value** – Previous studies showed that asymmetric dependence between firms has many adverse effects. This study proved that domestic and foreign-owned suppliers have different levels of dependence on local buyers due to their heterogeneous characteristics and business strategies. We distinguish two different types of innovation – radical innovation and incremental innovation – that previous studies have often treated as equal when it comes to firm autonomy. Finally, we propose that both FDI and international knowledge sourcing as global strategies to weaken suppliers' asymmetric dependence on a single buyer.

**Keywords:** Asymmetric Dependence, Buyer-Supplier Relationship, Internationalization, Incremental Innovation, Korea Auto Industry

**JEL Classifications:** F23, L62

## 1. Introduction

Asymmetric dependence between suppliers and buyers has attracted widespread attention from researchers (Lee Seung-Hyun, Mun Hee-Jin and Park Kyung-Min, 2015; Pfeffer and Salancik, 1978). Asymmetric dependence triggers opportunism among firms, which in turn increases transaction costs, making it difficult to establish mutually beneficial relationships between buyers and suppliers (Lee Seung-Hyun, Mun Hee-Jin and Park Kyung-Min, 2015). Vulnerability to opportunistic behavior of partners deteriorates long-term development of

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both industries and firms. Therefore, investigating the causes of asymmetric dependence between buyers and suppliers is important not only for promoting long-term economic development of companies, but also for fostering industry-related growth. Several previous studies related to resource dependence theory (RDT) have examined these issues and concluded that asymmetric dependence has a negative impact on firms with higher dependence. These studies suggest firm-level strategies paired with governmental policies to reduce asymmetric dependence between firms (Hoetker, Swaminathan and Mitchell, 2007; Lee Seung-Hyun, Mun Hee-Jin and Park Kyung-Min, 2015; Nienhüser, 2008; Pfeffer and Salancik, 1978). However, further light can be shed on which types of firms become more easily dependent on buyers and which strategic decisions may reinforce path dependence.

Three important unanswered questions on asymmetric dependence are addressed in this study. First, we examine the effect of ownership (domestic suppliers versus foreign-owned suppliers) on the dependence of supplier firms on buyers. Previous studies have identified strategic differences between domestic firms and foreign-owned firms. For example, domestic firms engage aggressively in local business activities and respond quickly to market opportunities (Peng, Tan and Tong, 2004), invest more in external R&D (Un and Cuevros-Cazurra, 2008), and focus more on local markets than foreign markets (Mata and Freitas, 2012). On the other hand, little is known about the mechanisms underlying relationships between domestic suppliers and dependence on buyers in the home country. In this study, we posit that domestic firms are more likely to depend on local buyers than foreign-owned firms. In particular, domestic ownership promotes a home-based strategic orientation, which is exacerbated by insufficient international resources. This relates to the 'liability of localness' concept (Un, 2016). This research is among the earliest theoretical and empirical efforts to provide a more precise examination of the effect of ownership on suppliers' dependence on buyers.

The second problem addressed in this study is the persistence of high levels of dependence over time. Previous studies have argued that technological innovation of suppliers is critical for reducing dependence on buyers (Kamath and Liker, 1990). This study suggests that technological innovation of suppliers can deepen their dependence on buyers in some cases. We divide innovation into two different types – radical innovation and incremental innovation. While radical innovation is technological development in which the properties of a product suddenly change, incremental innovation is improvement based on existing capabilities and knowledge (e.g., patents based on self-citation). When path dependence leads a firm back to the current buyer, suppliers are likely to pursue innovation that gradually improves and develops their existing technology, rather than making radical changes, for the sake of maintaining a partnership with the buyer. This study suggests that this incremental innovation strategy strengthens the supplier's existing relationships with the buyer, thereby increasing dependence. In previous research, all innovation was perceived positively regardless of its type. Our findings demonstrate that incremental innovation can in fact exacerbate the supplier's asymmetric dependence on the current buyer in the home country.

Finally, we ask, what international strategies may reduce suppliers' dependence on a certain buyer? The findings of our empirical analysis reveal that suppliers can reduce their path dependence by changing their international strategic orientation and diversifying the geographic scope of their business activities in two different ways: through foreign direct investment (FDI) and knowledge sourcing. Our research provides support for the findings and an extension of other studies in international business (e.g., Kim Min-Young, 2016).

The automobile industry was chosen as the background for our empirical research. The automobile and automobile parts industries make up one of the largest sectors in the world economy; these industries are highly integrated (Taylor and Taylor, 2008). There has been an

increasing emphasis on the role of suppliers and building cooperative relationships between partners (Lettice, Wyatt and Evans, 2010). The theoretical arguments of previous research were tested on a sample of 101 auto parts suppliers in South Korea over a 10-year sample period. Since auto parts suppliers in South Korea are mostly small firms suffering from asymmetric dependence on the single giant buyer, Hyundai Motor Group (The Economist, 2019), we feel that this is an appropriate context for this empirical study.

The remainder of this paper is organized as follows. We begin by reviewing previous literature on resource dependence theory and providing some background on the Korean auto industry. We then provide an overview and justification of the research model used in this study. In the next section, we describe the research design and methodology used to verify the hypotheses. Finally, we discuss the results of this study and provide a conclusion including its limitations.

## 2. Literature Review and Hypothesis Development

### 2.1. Asymmetric Dependence in Buyer–Supplier Relationships

To ensure firm survival, access to critical resources is crucial. RDT is premised on the notion that no firm can have all the resources it needs at any given time, so all firms must depend on other firms for the acquisition of pivotal resources (Pfeffer and Salancik, 1978). By engaging in collective activities with other firms, external uncertainty can be effectively mitigated (Handfield, 1993). Collaboration with other firms reduces uncertainty and stabilizes the external business environment, but mutual reciprocal partnerships are only possible if firms involved maintain an equal standing. When resource exchange occurs between two unequal firms, an asymmetric dependence structure may develop. Firms with low autonomy tend to be more asymmetrically dependent on other firms (e.g., in cases when one party possesses greater assets than the other) (Buchanan, 1992). Dependent firms are also at a disadvantage in terms of inter-organizational power. Firm A's dependence on firm B is causally linked to the resistance power of firm A over firm B (Emerson, 1962). When the resistance power of firm A is weaker than that of firm B, firm A occupies a lower position in the contract, has fewer bargaining advantages in negotiations, and is vulnerable to the partner's opportunistic behavior (Hoetker, Swaminathan and Mitchell, 2007). On the other hand, firms with less dependence can exert power to exploit their counterparts.

Since asymmetric dependence is driven by the availability of resources, those firms with limited alternatives tend to have greater dependence on those with more alternatives. RDT also assumes that each firm in a given industry wants to increase its autonomic power by reducing its dependence upon others (Nienhüser, 2008). This is especially true when the parties are in a vertical relationship rather than in a horizontal relationship. This study's empirical setting provides an exemplary case of this: the automobile parts suppliers in South Korea, with their sole link to one major car maker. When taking into consideration the value of each resource owned by this buyer and its suppliers, we see that auto parts makers with asymmetric ties have less flexibility in making their own decisions due to their dependence on one single assembler.

Studies based on RDT have argued that asymmetric dependence leads to dysfunctional relationships between buyers and suppliers because of the possibility that power will be exercised by more independent organizations over more dependent organizations (Caniels and Gelderman, 2005). For suppliers, therefore, avoiding or at least partially reducing asymmetric dependence is vital (Gulati and Sytch, 2007). Some studies have investigated ways

to minimize asymmetric dependence. While research in this area has shown that innovation may improve firms' autonomy, empirical evidence on this issue is sparse and mixed (Jean, Kim and Sinkovics, 2012). Innovative activity can increase the value and essentiality of a product, but the theoretical linkage between innovation and dependence is uncertain. Manufacturing of innovative products can make suppliers more attractive to buyers, which can either reduce dependence on the buyer or increase the buyer's dependence on the supplier (Kamath and Liker, 1990). Many auto parts companies produce innovative products, but specifically those suppliers with unique technology such as Robert Bosch, Denso Corp, and Magna International, Inc. have greater bargaining power than car assemblers.

## 2.2. Korean Automobile Parts Industry

The South Korean automobile parts industry was chosen as our research context for the following reasons. First, the automotive industry is typically a pyramid-structured industry that consists of a few carmakers and many parts suppliers. In fact, there is only one major car manufacturing firm in South Korea: Hyundai Motor Group, which controls Hyundai and Kia. Therefore, most Korean domestic suppliers have partnerships with this one assembler. Although this sole partnership might guarantee their profitability in the short term, the high level of dependence on this single car maker causes significant problems for suppliers, making them vulnerable to buyers' opportunistic behaviors as well as crises in times of reduced production (Casciaro and Piskorsk, 2005). Second, among the various problems in the relationships between this buyer and its suppliers, lack of transparency and exclusivity have been identified (Dyer and Chu, 2011). In this business environment, making new contracts with other global buyers is extremely difficult. It is also difficult for domestic suppliers to achieve economies of scale and use new information for the purpose of innovation. As a result, Korean auto parts suppliers have remained comparatively small in scale and lagged behind their global counterparts. The Economist (2019) diagnosed the Korean auto industry as follows:

*Korean parts producers are being squeezed. More have filed for bankruptcy protection since last autumn than at any time since the financial crisis in 2008... suppliers are fighting for survival... At the industry's center is a single giant firm: Hyundai Motors. (The Economist, 2019)*

## 2.3. Liabilities of Domestic Suppliers

The resource dependence between suppliers and buyers is influenced by supplier ownership, which is an important determinant influencing corporate strategic decision-making, according to RDT. Many previous studies in the international business and strategic theory literature suggest that firm ownership may affect firm strategy because different owners or boards have different temporal interests, incentives, and values (George et al., 2005; Sander and Carpenter, 1998). Domestic firms think of the home country as their primary market, and even in some cases as the only market (Mata and Freitas, 2012). This is known as the 'liability of localness', a term firstly applied to domestic firms relative to foreign subsidiaries operating in the same country (Un, 2016). Applying this concept to the buyer-supplier relationship in the Korean automobile industry, we see that domestic suppliers rely solely on the buyer in the home country. Domestic auto parts suppliers have relatively little information about foreign markets, skills, and resources and therefore little opportunity to reach out to foreign car makers. It is also apparent that they lack certain critical resources, including financial resources, human capital, professional management skills, and marketing

resources, especially compared to foreign firms (Xia and Walker, 2015). They also lack the necessary international experience or foreign language skills to do business abroad. All these factors contribute to the tendency of domestic firms to engage in a deeper relationship with the local buyer. This relationship typically goes beyond financial dependence and extends to the provision of managerial expertise and technical collaboration.

Foreign-owned firms, on the other hand, are affiliated with headquarters in the home country and also with subsidiaries in other countries. Thus, through their global networks foreign-owned firms have greater access to technologies developed by the parent firm and information about other markets obtained by foreign subsidiaries (Un, 2011). These advantages, which domestic suppliers do not have, afford foreign-owned suppliers with greater bargaining power against the buyer and give them more alternatives than the local buyer.

Domestic suppliers and foreign-owned firms deal with uncertainty differently as well. Firms must reduce uncertainty either by choosing to focus on one specific way (e.g., commitment) or to compete effectively in a variety of ways (e.g., flexibility) (Ghemawat and Sol, 1998). Flexibility is supported by a large pool of capital and a wide range of alternative options (Aaker and Mascarenhas, 1984; Lau, 1996). On the other hand, commitment implies the desire to cultivate long-lasting exchange relationships featured by implicit and explicit agreements that are beneficial in the long term for all partners involved (Rylander, Stratton and Pelton, 1997). A flexible investment strategy allows foreign-owned firms to change partners and countries of manufacture in response to changing technology, international manufacturing costs, and other market demands (Aaker and Mascarenhas, 1984). Foreign-owned firms can increase profits by moving their production facilities to more cost-effective locations (Tang and Tikoo, 1999). For example, environmental change in the form of escalated labor costs in the local market may cause a global manufacturer with organizational flexibility to relocate where labor costs are lower.

In contrast, it could be more effective for domestic firms to pursue a commitment strategy since they are confined to their home country (Allen and Pantzalis, 1996). Frequent changes in partners (e.g., other foreign buyers) can lead to instability in networks and harm firm reputations, which can negatively affect future relationships between domestic firms and local buyers (Lambert and Peppard, 1993). For that reason, a commitment strategy may be more valuable for domestic firms than for foreign firms. We therefore hypothesize as follows:

H1: *Ceteris paribus*, domestic suppliers will depend on local buyers more than foreign-owned firms.

## 2.4. Incremental Innovation and Supplier Dependence

Relationships between domestic suppliers and buyers in the home country are reinforced over time as both parties become dependent on each other for profits. In our research setting, both the auto parts suppliers and the vehicle manufacturer have taken proactive steps to cultivate this partnership and retain a long-term perspective. Such a long-term partnership can greatly decrease transaction costs for individual firms (Williamson, 1975) while allowing them to continue following their previous routines. This trend is possible because networks take on the features of a clan over time (Ouchi, 1980) and because of inter-organizational cooperation (Park Tae-Hoon and Kim Il-Gwang, 2019). Member firms in a network have built a common culture, minimized opportunism, and achieved low transaction costs through continued renewal of contracts under the same terms.

However, these path-dependent behaviors of firms create habits; firms tend to remain in the same niche they already occupy, disregarding other technologies of which they have no prior knowledge (Yuan and Pangarkar, 2010). This path dependence is more common among

domestic suppliers that are highly dependent on a single buyer in the home country. Most domestic suppliers want to maintain existing partnerships with local buyers in the absence of new buyers. Therefore, compared to foreign-owned firms, domestic suppliers are likely to focus on incremental innovation to enable them to continue supplying similar parts to existing buyers. Although incremental innovation may reduce transaction costs by facilitating development of organizational routines with current buyers, this type of innovation activity may deter learning that would lead to development of new technologies, thereby promoting inertia.

The concept of the liability of localness implies that domestic firms have less experience acquiring resources embedded in other countries. Domestic firms are largely hard to receive any kind of support from overseas sources compared to foreign firms. To use their limited resources efficiently, domestic suppliers may struggle to develop new types of technology that require considerable investment of finances and time. Therefore, domestic firms may choose to improve their existing skills incrementally rather than engaging in radical innovation. This path-dependent strategy hinders diversification to new buyers and increases asymmetric dependence on current buyers. When incremental innovation is high, then the tendency toward asymmetric dependence may also be high. Therefore, we hypothesize as follows:

H2: The positive relationship between domestic firms and dependence on a buyer is mediated by incremental innovation.

## 2.5. Supplier Dependence and Diversification through Internationalization

Firms choose strategies that rely on incremental innovation rather than radical innovation because most firms are genetically conditioned to preserve the status quo (Stringer, 2000). Domestic suppliers often tend to be less creative, as they are often embedded in industries in which a single institution (or even a single buyer) inhibits radical innovation (McLaughlin et al., 2008).

International diversification can provide firms with opportunities to innovate radically. Global diversification may enhance a firm's technical potential by allowing it to encounter new markets, local clients, local networks, valuable information, and cheaper resources (Filatotchev and Piesse, 2009; Un, 2016). Firms can expand their business locations through FDI, which creates genuine opportunities for innovation. It broadens both the geographical and product scope by offering new sales channels and new business opportunities (Caves, 1996; Porter, 1986). These incentives have the potential to bring better returns for small and medium-sized firms with scarce capital. To overcome a shortage of financial and non-financial capital, many small and medium-sized suppliers try to make global strategic alliances through FDI (Fernandez and Nieto, 2005).

Secondly, FDI increases learning opportunities because suppliers can learn how to implement innovative business strategies and business practices, thereby allowing them to overcome local growth obstacles and increasing incentives to undertake broad R&D investment that will potentially maximize future returns. As a result, decision-makers in domestic firms may achieve growth by encouraging internationalization even when their businesses are unable to realize the maximum benefit of new ventures in a foreign country immediately. Therefore, we argue that international diversification can mitigate asymmetric dependence by providing alternative channels.

Internationalization brings new possibilities, information, and experiences with network partners (customers, customers, agents, etc.) in global markets. Such advantages can provide the basis for diversification of buyers and reduce market uncertainty arising from the

company's external role in business networks. However, employees of foreign-owned firms may have had that exposure and learning already. Thus, they may learn less from FDI than domestic firms. Therefore, we hypothesize as follows:

H3: International diversification will weaken domestic firms' dependence on a single buyer.

## 2.6. Supplier Dependence and Diversification through Knowledge Sourcing

Technology is defined as compound knowledge or application of knowledge that is socially and culturally formed from scientific advances (MacKenzie and Wajcman, 1999). In other words, technology is knowledge created in a given country that was generated by the demands and needs of the region, where specific patents were processed and registered in accordance with the laws and institutions of that country. Therefore, if a firm is utilizing the technological knowledge of a given country, its products will be within the range or level required by the buyers of that country. However, when technologies are developed using knowledge from many countries, the range of markets that suppliers can access expands. A firm with novel complex knowledge can meet demands in several countries since it has a sustainable advantage in a diverse area (Oviatt and McDougall, 2005). Recombination of technology with knowledge acquired through use of other countries' patents may make their products more attractive and versatile to global buyers. This may be especially true for domestic suppliers, who have limited international experience and poor technological capabilities. We posit that the positive effects of such knowledge combination would be larger among domestic firms than among foreign-owned firms. Although domestic firms are more committed to buyers in their home country, developing technologies that are more versatile and attractive may allow them to expand globally. In contrast, foreign-owned firms already have patents involving knowledge combination because they are embedded in networks created by their MNEs. Foreign-owned firms can obtain information and knowledge from other countries through those links (Ghoshal and Bartlett, 1990). In addition, prior studies have shown that lack of organizational searching inhibits radical innovation (Junarsin, 2009; Watts, 2001). This is definitely true for domestic firms. For foreign-owned firms, knowledge sourcing from diverse countries allows these organizations to conduct extensive exploration and research and; innovate in completely different ways. Therefore, we hypothesize as follows:

H4: Diversification through geographic knowledge sourcing weakens domestic firms' dependence on a single buyer.

## 3. Empirical Methods

### 3.1. Data and Sample

To test our hypotheses, we used data from 2005 to 2015 to develop a 10-year panel database of relationships between Korean auto parts suppliers and their associated car maker. The data used in this study were obtained from different sources. The main source of data about the suppliers was the annual report published by KAICA (Korea Auto Industries Cooperation Association), the only auto parts industry organization in Korea that supports members' exports and global market entry. This annual report contains information on the suppliers' main products, financial data, foreign subsidiaries, number of employees, and the sales ratio. The PASTAT, a database of more than 100 million patent applications from major developed

and developing countries, was another source used to collect patent information. Finally, we used financial records from DART, the Korean electronic financial monitoring program. These records were needed to gather FDI data, which was crosschecked by visiting each supplier's webpage and checking KINDS, the database of news synthesized from the South Korean Press Promotion Association.

Among the 243 firms in the supplier list of KAICA's annual reports, 91 firms were dropped due to missing data for any of the variables including experience in FDI and forward citation. Second, only Tier 1 suppliers were considered in this study. Thus, 46 suppliers who did not supply their components directly to the single car maker were not considered. Third, to prevent distorted results in the analysis, 5 firms were excluded – Hyundai Mobis, Hyundai Wia, Hyundai Dymos, Hyundai Industrial, and Hyundai Synthetic, Co., all of which are affiliated with Chaebols. These firms' motivations and dependence on the single buyer differ from those of the independent suppliers. Thus, they were intentionally omitted to ensure the objectivity and credibility of the results of this study. After exclusion of these firms, 101 firms remained for the final analysis.

In order to eliminate non-response bias, we compared 25% of the surveys (252 observations) collected during the early period of data collection and 25% of the surveys (252 observations) collected during the last period of data collection (Dalecki et al., 1993). In addition, a t-test conducted on two independent samples showed no significant difference between the two groups for all variables, including demographic variables and main variables ( $p < 0.01$ ).

The distribution of observations in terms of size was as follows: firms with 1-500 employees: 41.6%, 500-1000 employees: 38.7%, 1001-1500 employees: 15.3%, and 1501-2000 employees: 4.4%. The total percentage of domestic firms was 68.2% and that of foreign-owned firms was 31.8%. Each supplier had an average of 1.03 FDI experiences and on average, cited technologies from 1.77 countries when developing patents.

## 3.2. Variables

### 3.2.1. *Dependent Variable*

The dependent variable is supplier dependence on the local buyer. In alignment with previous literature, supplier dependence was measured by calculating the proportion of each supplier's total revenues deriving from the major buyer (Kamath and Liker, 1990; Yenyurt, Henke and Yalcinkaya, 2014). Annual reports published by KAICA provide each supplier's sales ratios with relation to their top major buyer. The focus was not on whether a supplier had several customers, but on whether that supplier could reduce its excessive dependence on the single buyer. When a buyer accounts for most of a supplier's total revenue, that supplier is more dependent on that buyer (Crook and Combs, 2007). As a supplier's dependence on a specific buyer increases, they become very threatened by the loss of revenue that would result if they did not continue as a supplier as the buyer develops new vehicles. Therefore, a reduction in the share of a single buyer in a supplier's total sales indicates that asymmetric dependence has been mitigated and the supplier's power has increased.

### 3.2.2. *Independent Variable*

The independent variable of interest is firm nationality. Firm nationality was measured as a variable that took the value of 1 if the percentage of foreign shareholding was less than 10% and 0 otherwise (Un, 2016). This bivariate approach to measuring the nationality of a firm as being domestic or foreign is in the same line as that of previous studies (Mata and Freitas, 2012; Un, 2016).



### 3.2.3. *Mediating Variable*

Radical innovation is invention that dramatically changes and fundamentally alters market dominance, the industrial environment, and firm competitiveness. On the other hand, incremental innovation involves slightly improving existing technologies of organizations and applying current knowledge. The mediating variable of this study is incremental innovation. We defined incremental innovation as development of patents based on existing patents. Previous researches measured incremental innovation using the self-citation ratio, calculated by the average number of citations of patents of a firm citing its own previous patents. If a supplier has a high self-citation ratio, the firm is assumed to favor incremental innovation (Tseng, 2009).

### 3.2.4. *Moderating Variable*

There are two moderating variables in this study: international diversification through FDI, calculated by counting the number of foreign direct investments of a given firm in other countries per year, following the protocol in previous studies (Lu and Beamish, 2001; Tallman and Li, 1996). The other moderating variable was knowledge sourcing, calculated by determining the average number of countries from which there were patents cited by supplier firms in publishing their patents each year. This measurement method also follows the protocol in previous research (Kim Min-Young, 2016). To eliminate possible truncation bias, we allowed a five-year window when measuring the number of forward citations.

### 3.2.5. *Control Variables*

Several factors were controlled for that might have detracted from the main factors in the original model. Larger, older organizations tend to have more experience, resources, and skills (Coombs et al., 2006; McNamara and Baden-Fuller, 2007). In this study, basic firm characteristics such as firm age, size, assets, and ROA that might affect supplier autonomy were therefore controlled for (Baum and Oliver, 1991; Pfeffer and Salancik, 1978). These variables were calculated using the natural logarithm for firm  $i$  at time  $t$  because of the significant association between the variables and external dependence. Hamel and Prahalad (1993) found that product diversification can be a source of firm autonomy because it requires accumulation of new knowledge and the ability to advance into new business areas. Therefore, the number of different types of products produced by a given firm was also included. Furthermore, Bowen (2002) suggested that organizational slack may affect firm strategy, both unabsorbed slack and absorbed slack (Singh, 1986; Tan and Peng, 2003). Therefore, we controlled for these factors. As a firm's R&D investment is also highly correlated with its overall strategy (Baysinger and Hoskisson, 1989), R&D intensity was included in measuring R&D investment as a percentage of total sales.

## 4. Empirical Analysis and Results

### 4.1. Method of Analysis

Three separate regression analyses were run to verify the effects of the mediating variable and the two different moderating variables. The first analysis tested whether differences in asymmetric dependence between domestic firms and foreign-owned firms were significant by setting the independent variable to firm nationality. The next analysis examined whether incremental innovation mediates the relationship between domestic firms and their high

dependence on a single buyer. In the final analysis, the effects of the two moderating variables on supplier dependence on the single buyer were tested. In all analyses, the dependent variable was a percentage variable, specifically, the sales ratio of each supplier's top major buyer in a given year.

Since the same subjects were analyzed at different times in this study, there are methodological concerns, which are inherent in panel data; this can cause an autocorrelation problem. Similarly, longitudinal data are also vulnerable to the estimation problem of heteroscedasticity, including non-constant error variances. In such cases, generalized least regression can correct this bias (Greene, 1995; Kim Chang-Su et al., 2012). The Hausman statistic supported adoption of the fixed effects model utilized in this study. A 1-year lagged dependent variable was used due to the nature of asymmetric dependence, which is more likely to be affected by previous events than by current ones. The following specifications were used in the analyses:

$$\begin{aligned} & \text{Asymmetric dependency}_{t+1} \\ &= \beta_0 + \beta_1 * \text{Domestic firm}_t + \beta_2 * \text{Incremental Innovation}_t \\ &+ \beta_3 * \text{age}_t + \beta_4 * \text{size}_t + \beta_5 * \text{asset}_t + \beta_6 * \text{ROA}_t + \beta_7 * \text{diversification}_t \\ &+ \beta_8 * \text{absorbed slack}_t + \beta_9 * \text{unabsorbed slack}_t + \beta_{10} * \text{R\&D intensity}_t + \beta_{11} * \text{year}_t \end{aligned}$$

$$\begin{aligned} & \text{Asymmetric dependency}_{t+1} \\ &= \beta_0 + \beta_1 * \text{Domestic firm}_t + \beta_2 * \text{International diversification}_t \\ &+ \beta_3 * \text{Domestic firm}_t * \text{International diversification}_t \\ &+ \beta_4 * \text{age}_t + \beta_5 * \text{size}_t + \beta_6 * \text{asset}_t + \beta_7 * \text{ROA}_t + \beta_8 * \text{diversification}_t \\ &+ \beta_9 * \text{absorbed slack}_t + \beta_{10} * \text{unabsorbed slack}_t + \beta_{11} * \text{R\&D intensity}_t + \beta_{12} * \text{year}_t \end{aligned}$$

$$\begin{aligned} & \text{Asymmetric dependency}_{t+1} \\ &= \beta_0 + \beta_1 * \text{Domestic firm}_t + \beta_2 * \text{Diversifying geographic scope of knowledge sourcing}_t \\ &+ \beta_3 * \text{Domestic firm}_t * \text{Diversifying geographic scope of knowledge sourcing}_t \\ &+ \beta_4 * \text{age}_t + \beta_5 * \text{size}_t + \beta_6 * \text{asset}_t + \beta_7 * \text{ROA}_t + \beta_8 * \text{diversification}_t \\ &+ \beta_9 * \text{absorbed slack}_t + \beta_{10} * \text{unabsorbed slack}_t + \beta_{11} * \text{R\&D intensity}_t + \beta_{12} * \text{year}_t \end{aligned}$$

## 4.2. Results

Table 1 summarizes the descriptive statistics and provides the correlation matrix for all variables in the model. To reduce the threat of multicollinearity, the innovation and buyer dependence variables were mean-centered. The variance inflation factor (VIF) was carefully calculated for each variable to determine potential multicollinearity. All VIFs were lower than the threshold value of 5 suggested by Studenmund (2001), indicating multicollinearity problems were of no concern.

Similar to Baron and Kenny (1986), we conducted a mediated regression analysis to test Hypothesis 1. In the first step, the relationship between firm nationality and asymmetric dependence was verified. In step two, we examined the relationship between firm nationality and incremental innovation. In step three, the asymmetric dependence variable was predicted by adding the mediator to the equation with firm nationality (i.e., the new equation included both firm nationality and incremental innovation). In the last step, the mediator was expected to be significant, while the previously significant effect of firm nationality should have been reduced or become non-significant.

The regression results for step one are presented in Table 2. Models 1 and 2 provide results for incremental innovation as the dependent variable. The control variables were included in Model 1, and firm nationality was included in Model 2. The regression coefficient for firm

**Table 1.** Descriptive Statistics and Correlations among Variables

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Supplier Dependence	.50	.22	1.00												
2 Domestic Firm	.76	.43	.01	1.00											
3 Incremental Innovation	.03	.08	.00	-.04	1.00										
4 International Diversification	1.03	1.37	-.15	.18	.05	1.00									
5 Knowledge Sourcing	1.77	2.84	.15	-.29	.17	-.10	1.00								
6 Firm Age	3.37	.47	-.17	.09	.01	.20	-.11	1.00							
7 Firm Size	5.61	.78	-.02	-.12	.04	.50	.01	.24	1.00						
8 Firm Assets	11.17	1.11	-.04	-.05	.12	.58	-.03	.24	.34	1.00					
9 ROA	.04	.06	.01	-.08	-.03	-.07	-.03	-.10	-.06	-.06	1.00				
10 Diversification	3.54	3.44	-.11	.01	.12	.12	.01	.27	.23	.24	-.10	1.00			
11 Absorbed Slack	.09	.04	-.14	-.04	.06	.10	.18	.01	-.11	-.10	-.07	-.02	1.00		
12 Unabsorbed Slack	1.28	1.18	-.01	-.11	.09	-.01	-.01	-.03	-.07	.03	.10	-.01	-.03	1.00	
13 R&D Intensity	.01	.01	-.02	-.08	.07	.17	.15	-.06	.19	.25	-.02	.11	.16	.12	1.00

**Table 2.** Results of the Empirical Analysis

	Incremental Innovation			Supplier Dependence				
	M1	M2	M3	M4	M5	M6	M7	M8
<b>Main Variables</b>								
Domestic Firm	(H1: +)	.03*** (3.05)	.06** (2.54)	.20*** (3.34)	.05* (2.28) .19*** (3.14)	.08** (3.12)	.06** (2.74)	.09** (0.02)
Incremental Innovation	(H2: +)							
<b>Interaction Variables</b>								
International Diversification (ID)	(H3: -)					-.01 (-0.39)		-.02 (0.01)
Domestic X ID						-.02** (-1.91)		-.02** (0.01)
Knowledge Sourcing (KS)							-.01 (-0.37)	-.01 (-0.14)
Domestic X KS	(H4: -)						-.06** (-2.04)	-.04** (-2.04)
<b>Control variables</b>								
Firm Age	.01*** (0.70)	.01*** (0.74)	-.01*** (-3.72)	-.01*** (-3.62)	-.01*** (-3.32)	-.01*** (-3.34)	-.01*** (-3.42)	-.01*** (-3.44)
Firm Size	.03** (2.56)	.02 (1.48)	.03 (1.44)	.01 (1.20)	.03 (1.44)	.03 (1.34)	.02 (1.27)	.02 (1.38)
Firm Assets	-.02 (-1.55)	-.01 (-1.25)	-.01* (-0.73)	-.02 (-0.51)	-.01 (-0.61)	-.01 (-0.05)	-.01 (-0.03)	-.02 (-0.34)
ROA	.07*** (1.26)	.01*** (0.22)	.31*** (3.47)	.01** (3.42)	.30*** (3.17)	.28** (2.59)	.27** (2.51)	.24** (2.28)
Diversification	.01 (0.05)	.01 (0.26)	-.01 (-0.61)	-.005 (-0.52)	-.01 (-0.53)	-.01 (-1.50)	-.08 (-1.56)	-.05 (-1.33)
Absorbed Slack	.18* (1.67)	.09 (1.33)	-.08 (-0.68)	-.01 (-0.93)	-.05 (-0.53)	-.22 (-1.03)	-.24 (-1.16)	-.22 (-1.07)
Unabsorbed Slack	-.001 (-0.54)	-.001 (0.28)	-.001 (-0.15)	-.001 (-0.09)	-.001 (-0.15)	-.001 (-0.16)	-.001 (-0.15)	-.001 (-0.08)
R&D Intensity	-.08 (-0.27)	.14 (0.53)	1.01** (2.16)	-.01 (2.04)	.92** (1.86)	.85 (1.52)	.92 (1.66)	.83* (1.24)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	.02 (0.01)	.01 (0.05)	.73 (2.1)	.74 (2.1)	.71 (2.1)	.69 (2.1)	.70 (2.1)	.73 (2.1)
$\sigma_u$	.05	.05	.08	.08	.08	.08	.07	.08
$\sigma_e$	.52	.53	.88	.88	.88	.87	.88	.88
rho								
R-squared	0.03	0.04	0.12	0.13	0.12	0.15	0.17	0.24
Hausman Test	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
Observations	1010	1010	1010	1010	1010	1010	1010	1010

Notes: 1. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .  
2. Parentheses denotes t-values.

ownership was significant ( $\beta = 0.03, p < 0.001$ ) in Model 2. Models 3 to 7 provide results for suppliers' dependence on the local buyer as the dependent variable. In Model 3, the regression coefficient for firm nationality was significant ( $\beta = 0.06, p < 0.01$ ). To recap, overall, the results suggest that domestic firms had a positive association with incremental innovation and suppliers' dependence on the local buyer.

Results for the next steps are presented in Models 4 and 5. In Model 4, incremental innovation was added to the regression equation. The results from Model 4 suggested that incremental innovation was positively related to suppliers' dependence ( $\beta = 0.20, p < 0.001$ ). In Model 5, incremental innovation was added as the mediator to the Model 3 equation. The results indicated that incremental innovation was significant ( $\beta = 0.19, p < 0.001$ ), while the effect and significance of the main variable diminished ( $\beta = 0.05, p < 0.05$ ).

The next test measured the moderating effects of international diversification and knowledge sourcing (whether these strategies can reduce a supplier's path dependence or not). The independent variable and moderating variables were added to Models 6 and 7 to test hypotheses 3 and 4, respectively. The results revealed full support for hypotheses 3 and 4, which indicated that international diversification and knowledge sourcing negatively moderated the positive relationship between firm nationality and asymmetric dependence, because the coefficients of both moderating variables are negative and statistically significant ( $\beta = -0.02, p < 0.01$ ;  $\beta = -0.06, p < 0.01$ ). Model 8 is a total model that considers the moderating effects of the two international strategies; the results are the same as the results of Models 6 and 7.

### 4.3. Robustness Tests

Several robustness tests were conducted to ensure that our results were valid. Firstly, the t-test was undertaken to double check for differences in the degree of dependence between domestic suppliers and foreign-owned ones. The results of the t-test revealed that domestic suppliers (mean = 53.41, SD = 0.12) showed statistically higher dependence on the single buyer than foreign-owned suppliers (mean = 39.04, SD = 0.11). This result is consistent with the main argument ( $t = -1.08, p < 0.05$ ).

In addition, a Sobel test was also conducted in order to verify the significance of the mediating effect of incremental innovation. The Sobel test checks whether the effect of an independent variable is transmitted to a dependent variable through a mediating variable, and whether the indirect influence of a mediating variable is significant (Sobel, 1990). According to Baron and Kenny (1986), a mediating variable with a significant effect should have a Sobel test value greater than +1.96 or less than -1.96. The Sobel test statistic of this model was 2.04, which verified the mediation effect.

## 5. Discussion and Conclusion

In this study, we examined asymmetric dependence on a single buyer in the Korean auto parts industry, focusing on supplier ownership, the importance of auto parts suppliers in global economy, and their role in the Korean automobile industry. We argued that domestic suppliers were more likely to depend on a buyer in the home country at the early stage of establishing a partnership. In addition, domestic firms were inclined to commit their resources to focus on incremental innovation, which reinforces the existing relationship with the local buyer. We also found that suppliers may address the asymmetric dependence problem through two different international strategies: FDI and global knowledge sourcing.

This study makes the following contributions to the RDT literature. First, domestic suppliers were definitively proven to be more heavily dependent on a single home buyer in a sample of firms in the Korean automobile parts industry. Focusing primarily on firm ownership, we provided empirical support for the notion that supplier dependence on the buyer is shaped by firm characteristics and available resources. This extends the argument of Un (2016), who suggested that the liability of localness not only affects the innovative activities of domestic firms, but also their relationships with buyers. In addition, building on Ghemawat and Sol (1998), this study verified that domestic firms favor a commitment strategy over flexibility in terms of dealing with external uncertainty, deepening ties through explicit or implicit agreement with the buyer.

Second, drawing from the broader claims of the RDT, we identified the underlying mechanism of asymmetric relationships between domestic suppliers and buyers. Although several studies have identified the negative effects of asymmetric dependence (Lee Seung-Hyun, Mun Hee-Jin and Park Kyung-Min, 2015), they have not fully paid attention to why suppliers do not acquire autonomy despite their innovative activities and why they remain asymmetrically dependent. In this study, negative aspects of innovation were found. Specifically, incremental innovation makes it increasingly difficult for suppliers to reduce path dependence. These insights and empirical findings illustrate several important points raised in the RDT literature. The high possibility of replacement determines the degree of supplier dependence on the buyer. In previous studies, general innovation was suggested as an offset variable (Kamath and Liker, 1990). This understanding is furthered through the empirical evidence in this study that suppliers may increase their autonomy and bargaining power through radical innovation.

Written from the perspective of the international strategy literature and RDT, this paper found that domestic suppliers require a higher level of internationalization to reduce asymmetric dependence on a certain buyer. Although internationalization alone may not be a panacea to overcome the liability of localness, it still helps them to acquire unique and country-specific knowledge (Hitt et al., 2006). By using this knowledge, suppliers may innovate, gain valuable resources, and diversify foreign buyer options. This is consistent with the main argument of the RDT that as a firm gains more valuable resources, it also gains more power (Emerson, 1962; Nienhüser, 2008). Diversification in terms of geographic scope through knowledge sourcing is an effective strategy to offset asymmetric dependence. This is consistent with the argument of Hall et al. (2005) that additional citations from external organizations raises the company's value by 3% (calculated using Tobin's  $q$ ). In conclusion, markets regard diversity of forward citations as a positive indicator of the quality of firms' knowledge.

This study also has a variety of implications for practitioners. One implication is that there are opportunities for domestic suppliers to improve their understanding of the mechanisms underlying asymmetric dependence. As incremental innovation strengthens a supplier's asymmetric dependence on the buyer, managers of domestic firms must determine why they are more dependent on local buyers than foreign firms despite many attempts at innovation. For those managers who want to mitigate the level of dependence on the current buyer, incremental innovation cannot be an effective strategy. Organizational resources must be allocated towards radical innovation. This may be a totally different area of innovation than they have previously invested in.

In addition, the findings revealed that to reduce dependence on buyers in the home country, suppliers must continue to pursue FDI aggressively until they make new partnerships with foreign buyers. This study also utilized international patent citations as an indirect strategy to make technological innovation more valuable and versatile. This suggests

that managers of suppliers who are asymmetrically dependent on local buyers should concentrate on leveraging international knowledge from foreign patents or cooperating with foreign firms to diversify their buyers.

Although this research aimed to provide support for and advance relevant theories, limitations remain. First, due to difficulties in accessing data, only data for the level of dependence between first-tier auto parts suppliers and a single finished car maker was utilized. In the automobile industry, as mentioned above, networks of firms providing vertically integrated parts are so strong that they are divided into first-tier, second-tier, and third-tier suppliers. Future studies may capture other forms of resource interdependence among suppliers including second- and third-tier suppliers. Second, we failed to categorize the characteristics of the suppliers included in the study. It is important to consider the characteristics of each auto parts supplier to determine their effects on supplier dependence. This limitation was due to the amount of objective criteria available to measure the importance of each part. In future, a carefully designed survey or field interview of the buyer may further validate the findings of this study. Third, the study is set in the Korean automotive industry, where the only a single buyer (Hyundai Motor Group) exists, making it easy to control for heterogeneity among buyer effects. In order to generalize the results of this study, it would be necessary to include western finished car manufacturers and their parts suppliers in a future analysis.

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