Effects of Trust Determinants on Firm Performance in the Buyer-Supplier Relationships: Empirical Evidence from the Warehousing firms in Busan, South Korea

Sinje Sung* · Sangmok Kang**

구매자와 공급자 관계에서 기업의 성과에 대한 신뢰 결정요인의 영향: 부산시 창고업을 대상으로

Abstract: This paper provides an empirical analysis of the effects of trust determinants on firm performance in the buyer-supplier relationships by considering warehousing firms in Busan, South Korea. We employed AVAS transformation regressions to address the limitations of linear regressions and found nonlinear relationships between firm performance and trust determinants. Specifically, “long-term and repeated interactions,” “geographical proximity,” and “cultures and norms of firms and formal institutions” had positive linear relationships with firm performance, and “information sharing and reciprocity” induced an increasing pattern in firm performance. Finally, “interdependence and asset specificity” and “uncertainty removal” led to a decreasing pattern in firm performance. These results suggest that the relationship between trust and firm performance is contingent on the trust determinants that are important source of trust in buyer-supplier relationships and the influence of trust determinants on firm performance varied according to their levels.

Key Words: trust determinants, firm performance, buyer-supplier relationships, warehousing firms, Busan, AVAS

요약: 본 연구는 부산시 물류창고업을 대상으로 구매자-공급자간 관계에서 신뢰의 결정요인과 기업의 성과의 관계를 밝히기 위해 설문자료를 이용하여 신뢰의 결정요인의 영향을 분석한 결과, 기업의 성과는 "장기적 반복적 상호작용", "지리적 근접성", "기업의 문화 및 규획과 공식적 제도" 등의 요인과 대체적으로 정의의 비례관계를 형성한다. 둘째, 기업의 성과는 "정보공유와 호혜성"과 체증적 정의의 관계를 보인다. 마지막으로, 기업의 성과는 "상호의존성과 자산전용성" 및 "불확실성 제거"의 관계를 형성한다. 이러한 결과는 신뢰와 기업의 성과 간 관계는 구매자-공급자 관계에서 신뢰의 결정요인을 통해 결정되며, 기업의 성과에 대한 신뢰 결정요인의 영향은 신뢰 결정요인의 수준에 따라 다르게 나타난다고 보여준다.

주요어: 신뢰 결정요인, 기업성과, 구매자-공급자 관계, 창고업, 부산, AVAS

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1. Introduction

With the increasing importance of supply chain management, the buyer-supplier relationship in supply chain management has received considerable attention from management scholars, logistics scholars, business scholars, economists, and economic geographers. In general, buyers and suppliers place great emphasis on cooperative relationships to survive in competitive environments characterized by rapid product commoditization and evolving customer needs. Firms that form strong relationships with their suppliers can better align their interests and goals with those of their suppliers (Yang, 2009). Such firms tend to pursue growth and competitiveness by working with their partners based on effective cooperation, which can lead to the development of new products and skills and a decrease in competition (Londe and Maltz, 1992; Varadarajan and Cunningham, 1995; Weitz and Jap, 1995; Doel, 1999; Mentzer et al., 2000; Gertler, 2003; Bathelt and Glückler, 2003; Glückler, 2005; Panayides and Lun, 2009). In most cases, cooperative buyer-supplier relationships are a prerequisite for long-term benefit, that is, firm performance (Landeros and Monczka, 1989).

However, firms with cooperative buyer-supplier relationships still face some problems in achieving growth. First, because evolving markets require a short and quick product life cycle, firms face more competition than ever before. Second, an information imbalance and a lack of resources can lead to inefficient buyer-supplier relationships. Previous studies have used the concept of “looseness” to describe inefficiencies in buyer-supplier relationships (Luo, 2005). Weitz and Jap (1995), Moore (1998), Mentzer et al. (2000), and Murphy (2003) suggested that a cooperative network is a potential strategy for offsetting this looseness for improved buyer-supplier relationships. A cooperative network requires the exchange of information and resources to maintain relationships and facilitate success for both sides. Thus, firms, by this, can share financial risk, improve service quality, increase productivity, and reduce costs.

The formation of a buyer-supplier relationships can be explained through the following three theories: First, social exchange theory suggests that firms form relationships as a strategy for acquiring necessary resources, learning new technical skills, and sharing information (Varadarajan and Cunningham, 1995; Eisenhardt and Schoonhoven, 1996). According to this theory, when partners provide each other with reciprocal benefits over time, social relationships are formed and maintained based on strong enterprise cultures and norms (Gouldner, 1960; Storper and Venables, 2004). However, if partners provide no reciprocal benefits, then such social relationships are not likely to exist (Lawler et al., 2000). Recently, Yang (2009) suggested that social capital derived from social networks and organizational linkages plays an important role in the formation of buyer-supplier relationships. In particular, buyers and suppliers in a cooperative social capital network are closely integrated through voluntary, informal, and reciprocal relationships and the exchange of resources (Das and Teng, 2000). Also, trust enhances flexibility and adaptability so that firms can quickly react in a rapidly changing economic environment. This is because trust fosters successful collaborations between buyers and suppliers (성신제·이희열, 2009; Uzzi, 1997; Park, 1999; Darr and Talmud, 2003; Nam, 2003; Uzzi and Lancaster, 2003).

Second, the formation of buyer-supplier relationships can be explained by interdependence theory. The basic premise of this theory is that how goal interdependence is structured determines how individuals interact, which in turn determines outcomes. There are three types of interdependence: cooperative, competitive, and individual (Deutsch, 1949; Johnson and Johnson, 2005). In particular, when cooperative
interdependence is structured, one’s actions facilitate others’ goal achievement. That is, cooperative interdependence exists when individuals perceive that they can achieve their goals if and only if other individuals with whom they are cooperatively linked also reach their goals. Thus, these individuals help one another to achieve goals. By inducing firms to take an interest in the profitability of their partners, buyer-supplier relationships based on cooperative interdependence allow partners to perceive shared fate and engage in supportive behaviors. Ultimately, such relationships have a long-term orientation, emphasizing loyalty, information sharing, and uncertainty removal (Ellram and Cooper, 1990). When partners share their experiences and insights, they can facilitate each other’s growth (Burt, 1992; Kogut and Zander, 1996; Hennart and Larimo, 1998; Gulati et al., 2000; Wang and Zajac, 2007). Specially, trust lets firms learn and innovate through “know-how” sharing between buyers and suppliers (Bigley and Pearce, 1998; DiMaggio and Louch, 1998; Mizruchi and Stearns, 2001; McEvily et al., 2003). One of the important purposes in building relationships between buyers and suppliers is to develop know-how regarding management and technologies through trading firms. The firms that learn create innovation by combining their own know-how with the know-how from other trading firms.

Third, knowledge-based theory emphasizes the importance of knowledge integration based on the formation of buyer-supplier relationships. In other words, firms form relationships to realize synergistic effects through combined knowledge (Grant, 1996). Knowledge-based theory recognizes firms as a conceptual framework or an agency for integrating knowledge (Roper and Crone, 2003; Nielsen, 2005). Venkatraman and Tanriverdi (2004) found that the synergistic effect of integrated knowledge derived from relationships between firms is stronger than that of the sum of individual firms’ knowledge. At this time, trust can achieve a higher synergy between buyers and suppliers (Carney, 1998; Sako, 1991; Sako and Helper, 1998). Firms try to focus on the specialization of their core competencies, and to complement all other aspects through relationships between buyers and suppliers. The firms that make up the complementary relationships can foster synergy by integrating their mutual core competencies through trust relationships.

According to social exchange theory, interdependence theory, and knowledge-based theory, the essence of strong relationship between buyers and suppliers is trust, which in turn affects the firm performance. Economic geographers also consider ‘trust’ as an important contributing factor to firm development with regard to the creation of clusters, learning regions, and institutionally ‘thick’ places, and the creativity and innovation of firms (Dicken and Malmberg, 2001; Winder, 2001; Bathelt and Taylor, 2002; Mollering, G., 2002; Murphy, 2002; Boggs and Rantisi, 2003; Ettlinger, 2003; Aoyama et al., 2006; Aoyama and Ratick, 2007).

On the whole, trust between firms was determined by the determinants of the trust (성신제·이희열, 2007). The following determinants are likely to influence the characteristics of trust between firms: 1) long-term and repeated interactions, 2) information sharing and reciprocity, 3) interdependence and asset specificity, 4) uncertainty removal, 5) geographical proximity, and 6) cultures and norms of firms & formal institutions (Dasgupta, 1988; North, 1990; Ensminger, 1997, 2001; Rowthorn, 1999; Peng, 2004). Thus, these are major factors not only sources of trust between buyers and suppliers but also influencing buyer-supplier relationships (성신제·이희열, 2009; Moore, 1998; Sako and Helper, 1998; Spekman and Carraway, 2005; Ploetner and Ehret, 2006).

“Long-term and repeated interactions” reflect consistency, continuity, and effectiveness and play a critical role in the development of trust-based relationships.
from opportunistic relationships. Therefore, buyer-supplier relationships formed based on trust are closely related to short-term improvements in productivity and a long-term competitive advantage in the market (Stuart, 1997). The competitiveness of a buyer-supplier relationship can be influenced by the quality of the relationship, which is highly dependent on the presence of trust (Hsu, 2005). A stable and collaborative buyer-supplier relationship based on long-term and repeated interactions represents a source of competitive advantage for firms, particularly in this era of information and globalization, in which firms can focus on their core business activities as well as obtain opportunities for market development (Dyer and Singh, 1998; Anslinger, 2004). However, the main reason why buyer-supplier relationships can fail over time is because of changes in relationship-building strategies.

“Information sharing and reciprocity” reflect the effectiveness of information sharing between buyers and suppliers for the coordination of various business activities (Sanders and Premus, 2005; Hung et al., 2011). Information sharing can remove the distrust caused by an information imbalance between partners. Reciprocity can be easily formed through trust between buyers and suppliers (Nelson and Cooprider, 1996). Ultimately, information sharing and reciprocity can help enrich a firm’s knowledge resources by extending its access to its partner’s information and knowledge.

“Interdependence and asset specificity” reflect the value of a firm’s network of relationships with customers, suppliers, and alliance partners (Gulati and Kletter, 2005). That is, if a firm believes that its partner has valuable resources, then the firm has strong motives to build trust with the partner through control of opportunistic behaviors and the proliferation of assets. By doing so, the firm can form and maintain an interdependent relationship with its partner (Helper, 1990; Smitka, 1991; Gerlach, 1992; Uzzi, 1997). Kale et al. (2000) suggested that interdependence and asset specificity can form the basis for learning and knowledge transfer between buyers and suppliers. Firms tend to treat their relationships as valuable assets. In dynamic markets, firms that form trust-based relationships with their key partners place great emphasis on maintaining interdependent relationships by expanding their assets for their mutual benefit (Dyer and Singh, 1998).

“Uncertainty removal” suggests that a firm implicitly and explicitly pledges ongoing relationships with its partner (Dwyer et al., 1987). In addition, uncertainty removal can be explained as a firm’s strong willingness to ensure the continuity of relationships (Anderson and Weitz, 1989; Morgan and Hunt 1994). Removing the uncertainty between buyers and suppliers brings mutual respect and drives out the need for competition. Therefore, a decrease in the level of uncertainty in the buyer-supplier relationship increases the level of trust, resulting in increased profits (Lee et al., 2004; Wang et al., 2011).

“Geographical proximity” pointed out to the physical distance between firms in a relationship. Geographical proximity plays a critical role in the formation of relationships between firms. In this regard, Daniel et al. (1995) verified that if buyers and suppliers are located nearby, then they can more easily form their relationships based on trust and reduce logistics and inventory costs. MacKinnon et al. (2004) paid close attention to geographical proximity in buyer-supplier relationships to examine ‘industry district and learning region and found that geographical proximity can facilitate individual contracts and thus buyer-supplier relationships.

“Cultures and norms of firms and formal institutions” can help embed buyer-supplier relationships in the social space (Granovetter, 1985). A firm is more efficient when its culture and norms are based on trust instead of competition (Smitka, 1991; Sako and Helper, 1998; Kidd et al., 2010). In addition, formal institutions can help establish a macro-foundation for
the formation of buyer-supplier relationships (Sako, 1992; Knack et al., 1997; Hodgson, 1998; Temple and Johnson, 1998; Ensminger, 2001; Helmsing, 2001; Arnulf et al., 2005).

Meanwhile, several studies on the relationship between trust and firm performance have attracted a fair amount of attention. However, there is no overall agreement as to the evidences of trust’s effect on firm performance in buyer-supplier relationships. That is, these are roughly categorized as 1) no relationship between trust and firm performance (Aulakh et al., 1996; Fryxell et al., 2002, Nielsen and Nielsen, 2009), 2) negative relationship (McEvily et al., 2003; Krishnan et al., 2006; Patzelt and Shepherd, 2008), and 3) positive or inverted U shaped relationships (Dyer and Chu, 2003; Tzafrir, 2005; Fink and Kessler, 2010; Gaur et al., 2011; Wang et al., 2011). So far, the inconclusive and partial findings in the existing studies suggest that there is need to explore the contingency factors which may decrease or increase the effect of trust on firm performance (Gaur et al., 2011). In this perspective, Dyer and Chu (2011) state that the relationship between trust and firm performance is contingent on the trust determinants that are important source of trust in buyer-supplier relationships.

Therefore, we are going to explore about how firm performance is influenced by the levels on trust determinants. This study extends previous research by examining the various nonlinear relationships between trust determinants and firm performance. Although trust determinants in buyer-supplier relationships can provide partners with opportunities for learning, acquiring, sharing, and innovation, they may also have discriminative effects on firm performance. Thus, this study differs from previous studies in that this study accounts for nonlinear relationships between trust determinants and firm performance in buyer-supplier relationships.

In addition, previous studies have focused on general business relationships between firms, but this study contributes to the literature by focusing on the relationships between trust determinants and firm performance in the warehousing industry. To the authors’ knowledge, no study has provided an empirical analysis on the different types in firm performance based on the levels of trust determinants in the context of the warehousing industry.

Ultimately, the vital purpose forming buyer-supplier relationships is to maximize profits by accelerating the movement of goods; ensuring that right goods get to the right place in right amounts at the right time; and simultaneously minimizing shipping costs (성신제·강상목, 2011; Aoyama et al., 2006; Bowen, 2008). The role of logistics firms under supply chain management offers solutions for reconciling another firm’s wrong goals (Bowen, 2008). Such solutions typically depend on warehousing firms because these firms play an adjusting role to ensure that required goods get to the required place in required amounts at the required time through buyer-supplier relationships (Klein, 2004; Lasserre, 2004; Quinn, 2005; Bowen, 2008). Busan is logistic hub city in South Korea. Especially, the Busan Port is a representative transshipment hub ports to connect the East and the West in Northeast Asia. It is also the fifth busiest container port in the world. For these reasons, most of domestic and international warehousing firms have their head and branches in Busan. So, we focused on the warehousing firms in Busan. Accordingly, the purpose of this paper is to provide an empirical analysis of the effects of trust determinants on firm performance in buyer-supplier relationships in the context of warehousing firms in Busan, South Korea.
2. Methodology

We consider a nonlinear regression model as an additive model and conduct a survey for trust determinants in buyer-supplier relationships. To check the reliability and collinearity of all variables, we conducted a generalized linear regression analysis by using the ordinary least squares (OLS) method in the first step. In addition, to address the limitations of using a linear regression model in the case of a nonlinear relationship between the dependent variable and independent variables, we employed an AVAS (additivity and variance stabilizing) transformation model as one of the additive models in the second step. Because the AVAS transformation model is a type of nonparametric regression analysis, it assumes no functional form for relationships between variables. Thus, the AVAS transformation model allows the use of a flexible functional form for relationships between variables.

In terms of the survey for trust determinants in buyer-supplier relationships, the questionnaire for trust determinants was composed of items that were measured using a five-point Likert-type scale ranging from “strongly disagree” (1) to “strongly agree” (5). As discussed earlier, the six variables for trust determinants were 1) “long-term and repeated interactions,” 2) “information sharing and reciprocity,” 3) “interdependence and asset specificity,” 4) “uncertainty removal,” 5) “geographical proximity,” and 6) “cultures and norms of firms & formal institutions.” In addition to these six explanatory variables for trust determinants, we employed the firm’s total sales to measure firm performance as the dependent variable and considered the number of employees, fixed assets, and operating expenses as three control variables.

We collected the survey data through door-to-door interviews targeting 310 warehousing firms in Busan, South Korea, from July 25 to November 25, 2008. For the survey, we took “the key-informant approach”, which has been widely used in empirical studies. In general, key informants were general or senior managers with wide access to the firm’s strategic information. Among the 310 firms, 162 (53.6%) responded to the questionnaire through key informants. However, we excluded 10 responses because of errors or missing data, and thus, we considered a total of 152 respondents. Table 1 provides a profile of the respondents. The survey results indicate that all trust determinants scored above 3, with standard deviations ranging

<table>
<thead>
<tr>
<th>Variable</th>
<th>Average</th>
<th>Standard deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term and repeated interactions</td>
<td>3.1053</td>
<td>0.943</td>
<td>152</td>
</tr>
<tr>
<td>Information sharing and reciprocity</td>
<td>3.0329</td>
<td>0.767</td>
<td>152</td>
</tr>
<tr>
<td>Interdependence and asset specificity</td>
<td>3.1118</td>
<td>0.802</td>
<td>152</td>
</tr>
<tr>
<td>Uncertainty removal</td>
<td>3.1842</td>
<td>0.938</td>
<td>152</td>
</tr>
<tr>
<td>Geographical proximity</td>
<td>3.1447</td>
<td>0.952</td>
<td>152</td>
</tr>
<tr>
<td>Cultures and norms of firms &amp; formal institutions</td>
<td>3.1842</td>
<td>0.887</td>
<td>152</td>
</tr>
<tr>
<td>Employees(number)</td>
<td>40</td>
<td>95</td>
<td>152</td>
</tr>
<tr>
<td>Average fixed assets($1,000)</td>
<td>3.354</td>
<td>8.469</td>
<td>152</td>
</tr>
<tr>
<td>Annual operating expenses($1,000)</td>
<td>17.650</td>
<td>105.700</td>
<td>152</td>
</tr>
<tr>
<td>Annual total’s sales($1,000)</td>
<td>23.224</td>
<td>138.000</td>
<td>152</td>
</tr>
</tbody>
</table>

Note: The values of trust determinants are the average scores expressed by five-point scale.
from 0.767 to 0.952. On average, the 152 firms had 40 employees, USD 3.354 million in fixed assets, USD 17.650 million in operating expenses, and USD 23.224 million in sales.

3. The Linear Model

Before modeling the relationship between trust determinants and firm performance in buyer-supplier relationships, we evaluated the reliability and collinearity of all variables. First, we conducted a reliability analysis for all variables to confirm the consistency of the respondents. Cronbach’s alpha (α) was 0.872, implying acceptable reliability for all the scales. Second, we conducted a Pearson correlation analysis for each variable to determine the multicollinearity between the variables. As shown in Table 2, no correlation coefficient exceeded 0.5, indicating no multicollinearity between the variables.

In the first step, we conducted a linear regression analysis using the ordinary least squares (OLS) method to model the relationship between trust determinants and firm performance. That is, we regressed firm performance (Y) as the dependent variable on “long-term and repeated interactions” (LOREIN), “information sharing and reciprocity” (NSHRE), “interdependence and asset specificity” (INAS), “uncertainty removal” (UNRE), “geographical proximity” (GEPR), and “cultures and norms of firms and formal institutions” (CUNOFO). In addition, we included three control variables—the number of employees (NUEM), fixed assets (FIAS), and operating expenses (OPEX)—in the regression to reflect the effects of buyer-supplier relationships on firm performance. Table 3 shows the regression.

With the parameters in Table 3, we constructed the following regression function:

Table 2. Correlation matrix of measurements

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.402(**)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.399(**)</td>
<td>0.396(**)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0.412(**)</td>
<td>0.285(**)</td>
<td>0.367(**)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.466(**)</td>
<td>0.290(**)</td>
<td>0.340(**)</td>
<td>0.462(**)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>0.316(**)</td>
<td>0.340(**)</td>
<td>0.318(**)</td>
<td>0.453(**)</td>
<td>0.491(**)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>0.412(**)</td>
<td>0.116</td>
<td>0.138</td>
<td>0.400(**)</td>
<td>0.488(**)</td>
<td>0.357(**)</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>0.360(**)</td>
<td>-0.022</td>
<td>0.011</td>
<td>0.468(**)</td>
<td>0.291(**)</td>
<td>0.249(**)</td>
<td>0.340(**)</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>-0.142(*)</td>
<td>-0.228(**)</td>
<td>-0.300(**)</td>
<td>-0.136(*)</td>
<td>-0.127(*)</td>
<td>-0.065</td>
<td>-0.126(*)</td>
<td>0.499(*)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Notes: a. A: long-term and repeated interactions, B: information sharing and reciprocity, C: interdependence and asset specificity, D: uncertainty removal, E: geographical proximity, F: cultures and norms of firms & formal institutions, G: number of employees, H: fixed assets, I: operating expenses  
b. ** Correlation is significant at the 0.01 level (2-tailed)  
c. * Correlation is significant at the 0.05 level (2-tailed).
The results indicate that \( R^2 \) was 0.724, that is, 72.4% of the total variation in \( Y \) (firm's performance) was explained by the nine independent variables, including the three control variables. F-statistics (41.412) confirmed that the linear regression model was generally significant. All the independent variables except for NUEM and OPEX were significant at the 5% level.

The relationships between the dependent and independent variables were generally explained by the linear regression model. As shown in Figure 1, however, these relationships were nonlinear. This clearly confirms that the linear equation based on the OLS method failed to fully explain the relationships between the independent and dependent variables. Thus, we considered an alternative way to address the limitations of the linear regression model, that is, we employed an additive model based on a nonlinear model as follows:

\[
Y = \alpha + \sum_{i=1}^{n} f_i(X_i) + \varepsilon
\]  

(2)

where the error \( \varepsilon \) is independent of \( X_j \), \( E(\varepsilon) = 0 \), and \( \text{var}(\varepsilon) = \sigma^2 \). In addition, \( f_i \) is a univariate arbitrary function (e.g., smoothing function). Commonly used methods for finding the nonlinear function \( f_i \) include the alternating conditional expectation (ACE) (Breiman and Friedman, 1986) and the additivity and variance stabilizing (AVAS) transformation (Tibshirani, 1988). The general form for estimating a nonparametric function is

\[
\theta(Y) = \alpha + \sum_{j=1}^{n} f_j(X_j) + \varepsilon
\]  

(3)

where \( \varepsilon \) has a mean of zero and is independent of \( X_j \). The transformation \( \theta(Y) \) and the function \( f_j(X_j) \) are arbitrary smoothers. The ACE is a nonparametric generalization of additive models that can find the best-fit solution by maximizing the correlated transformation.

### Table 3. The result by OLS regression

<table>
<thead>
<tr>
<th>Dependent variable: ( Y(\text{firm’s performance}) )</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>10.872</td>
<td>1.780</td>
<td>6.109</td>
<td>0.000</td>
</tr>
<tr>
<td>LOREIN</td>
<td>0.325</td>
<td>0.124</td>
<td>0.176</td>
<td>2.621</td>
</tr>
<tr>
<td>INSHRE</td>
<td>0.249</td>
<td>0.119</td>
<td>0.109</td>
<td>2.086</td>
</tr>
<tr>
<td>INAS</td>
<td>0.253</td>
<td>0.115</td>
<td>0.116</td>
<td>2.125</td>
</tr>
<tr>
<td>UNRE</td>
<td>0.318</td>
<td>0.117</td>
<td>0.171</td>
<td>2.707</td>
</tr>
<tr>
<td>GEPR</td>
<td>0.433</td>
<td>0.113</td>
<td>0.236</td>
<td>3.832</td>
</tr>
<tr>
<td>CUNOFO</td>
<td>0.360</td>
<td>0.108</td>
<td>0.183</td>
<td>3.323</td>
</tr>
<tr>
<td>NUEM</td>
<td>-0.030</td>
<td>0.066</td>
<td>-0.021</td>
<td>-0.450</td>
</tr>
<tr>
<td>FIAS</td>
<td>0.270</td>
<td>0.060</td>
<td>0.231</td>
<td>4.464</td>
</tr>
<tr>
<td>OPEX</td>
<td>-0.028</td>
<td>0.047</td>
<td>-0.029</td>
<td>-0.605</td>
</tr>
</tbody>
</table>

\( \text{Adjusted } R^2 : 0.724 \quad \text{F-statistic : 41.412} \quad \text{Sig. : 0.000} \)
Figure 1. The regression lines of dependent variable against independent variables
4. The AVAS Model

We conducted an AVAS transformation analysis to model the relationship between firm performance and trust determinants in buyer-supplier relationships. For this, we employed the AVAS program in S-Plus™, which automatically transforms and plots original values into new ones according to its AVAS algorithm.

By applying transformed values to the AVAS model, we conducted a regression analysis to examine the relationship between firm performance and trust determinants in buyer-supplier relationships. Here the transformed values are denoted as $t_Y$ (firm performance), $t_{LOREIN}$ (long-term and repeated interactions), $t_{INSHRE}$ (information sharing and reciprocity), $t_{INAS}$ (interdependence and asset specificity), $t_{UNRE}$ (uncertainty removal), $t_{GEPR}$ (geographical proximity), $t_{CUNOFO}$ (cultures and norms of firms and formal institutions), $t_{NUEM}$ (the number of employees), $t_{FIAS}$ (fixed assets), and $t_{OPEX}$ (operating expenses). Table 4 shows the regression results.

The results indicate that $R^2$ was 0.743. That is,

| Table 4. The result of AVAS transformation regression analysis (1) |
| --- | --- | --- | --- |
| Dependent variable: $t_Y$ (transformed firm’s performance) | Unstandardized Coefficients | Standardized Coefficients | t value | Sig. |
| | B | Std. Error | Beta |  |  |
| (Constant) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $t_{LOREIN}$ | 1.035 | 0.046 | 0.132 | 0.406 | 0.000 |
| $t_{INSHRE}$ | 0.974 | 0.078 | 0.077 | 0.052 | 0.001 |
| $t_{INAS}$ | 0.768 | 0.077 | 0.048 | 1.938 | 0.029 |
| $t_{UNRE}$ | 1.763 | 0.097 | 0.332 | 5.03 | 0.004 |
| $t_{GEPR}$ | 1.398 | 0.096 | 0.244 | 0.982 | 0.000 |
| $t_{CUNOFO}$ | 1.124 | 0.088 | 0.204 | 0.674 | 0.000 |
| $t_{NUEM}$ | -1.001 | 0.038 | -0.221 | -0.605 | 0.089 |
| $t_{FIAS}$ | 1.254 | 0.071 | 0.240 | 7.261 | 0.000 |
| $t_{OPEX}$ | -0.107 | 0.073 | -0.107 | -0.235 | 0.166 |

Adjusted $R^2$ : 0.743 F-statistic : 31.864 Sig. : 0.007
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74.3% of $tY$ was explained by the nine transformed variables. F-statistics (31.864, p<0.01) confirmed that the regression results for the AVAS transformation model were significant. In addition, all the transformed explanatory variables except for $tNUEM$ and $tOPEX$ were significant at the 5% level. Based on the estimated coefficients, we derived the following AVAS transformation regression model:

$$tY = 1.035tLOREIN + 0.974tNSHRE + 0.768tINAS + 1.763tUNRE + 1.398tGEPR + 1.124tCUNOFO - 1.001tNUEM + 1.254tFIAS - 0.107tOPEX$$

To derive an AVAS transformation model including only significant variables, we removed those variables that were nonsignificant at the 5% level by using backward stepwise. Table 5 shows the results.

The results indicate that $R^2$ was 0.724, and the coefficients of all explanatory variables were significant at the 5% level. F-statistics (30.434) confirmed that the AVAS transformation model was significant. Thus, the estimation equation with only significant variables can be expressed as

$$tY = 1.443tLOREIN + 1.210tNSHRE + 1.123tINAS + 1.910tUNRE + 1.798tGEPR + 1.491tCUNOFO + 1.616tFIAS$$

Because the AVAS transformation regression model derived from transformed values was meaningful, we plotted smooth curves to investigate the causal relationships between original and transformed values. Figure 2 shows the individual smooth curves for the original (x-axis) and transformed (y-axis) values of both the dependent variable (firm performance) and the independent variables (long-term and repeated interactions, information sharing and reciprocity, interdependence and asset specificity, uncertainty removal, geographical proximity, cultures and norms of firms and formal institutions, the number of employees, fixed assets, and operating expenses). In Figure 2, the y-axis and the x-axis of plot A indicate transformed and original values, respectively, for firm performance. In the seven remaining plots, the y-axis and the x-axis

<table>
<thead>
<tr>
<th>Table 5. The result of AVAS transformation regression analysis (2)</th>
</tr>
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<tbody>
<tr>
<td><strong>Dependent variable: $tY$(transformed firm’s performance)</strong></td>
</tr>
<tr>
<td>Unstandardized Coefficients</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>(Constant)</td>
</tr>
<tr>
<td>tLOREIN</td>
</tr>
<tr>
<td>tNSHRE</td>
</tr>
<tr>
<td>tINAS</td>
</tr>
<tr>
<td>tUNRE</td>
</tr>
<tr>
<td>tGEPR</td>
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<tr>
<td>tCUNOFO</td>
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<tr>
<td>tFIAS</td>
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</tbody>
</table>

Adjusted $R^2$: 0.724 F-statistic: 30.434 Sig.: 0.000
show transformed and original values for the level of importance of each trust determinant.

As shown in Figure 2, firm performance (Y) had a positive linear relationship with transformed firm performance (tY). The results for the AVAS transformation regression equation (5) indicate that the transformed independent variables (tLOREIN, tNSHRE, tINAS, tUNRE, tGEPR, tCUNOFO, and tFIAS) had positive linear relationships with tY. In addition, these transformed independent variables had positive linear relationships with Y, as indicated by the positive linear relationship between Y and tY (plot A in Figure 1). Thus, we regarded the y-axis as Y and substituted tY for Y in Figure 2. As a result, Figure 2 shows more detailed relationships between firm performance and trust determinants. That is, the results of the original
OLS regression show only positive (+) or negative (-) relationships between the dependent and independent variables, but those of the AVAS transformation regression concretely indicate various nonlinear relationships between the dependent variable and some independent variables.

For example, the causal relationships between original values and AVAS-transformed values are illustrated by the quadrants in Figure 3, which plots the transformation process for firm performance and LOREIN. The X, Y, and Z points for tLOREIN (transformed long-term and repeated interactions) corresponded to the A, B, C points for tY (transformed firm performance), respectively, and the A, B, and C points for tY had positive linear relationships with the O, P, and R points for Y (firm performance). In this regard, the X, Y, and Z points for tLOREIN can be matched with the O, P, and R points for Y. The relationships between firm performance and the other trust determinants can be also explained in a similar manner.

Finally, we transformed linear relationships between firm performance and trust determinants into nonlinear relationships, which reported the increasing or diminishing pattern of firm performance according to the levels of importance of trust determinants.

First, as shown in Figure 2, plots B, F, and G show a positive linear relationship, implying that as “long-term and repeated interactions” (LOREIN), “geographical proximity” (GEPR), and “cultures and norms of firms and formal institutions” (CUNOFO) increased, firm performance also increased constantly.

Second, plot C shows an increasing pattern between “information sharing and reciprocity” and firm performance. That is, as “information sharing and reciprocity” increased, firm performance improved slowly at first but faster over time, suggesting that “the gradual intensification of information sharing and reciprocity” can accelerate improvements in firm performance.

Third, plots D and E report a decreasing pattern, indicating that “interdependence and asset specificity” and “uncertainty removal” played critical roles in the initial stages of partner relationships, but that they did not have sustained effects on firm performance. This suggests that it is critical to consider these factors in the initial stages of partner relationships. Thus, “interdependence and asset specificity” and “uncertainty removal” led to decelerating improvements in firm performance.
Fourth, plot I show that the fixed assets induced a decreasing pattern at the first part and a constant pattern at the second part in firm performance.

5. Conclusion

In this paper, we empirically examined the effects of trust determinants on firm performance in buyer-seller relationships by considering a sample of warehousing firms in Busan, South Korea. We investigated the relationships between firm performance and various trust determinants, including “long-term and repeated interaction,” “information sharing and reciprocity,” “interdependence and asset specificity,” “uncertainty removal,” “geographical proximity,” and “cultures and norms of firms and formal institutions.” We first estimated these relationships by conducting OLS regressions and then examined their nonlinear relationships through AVAS transformation regressions to address the limitations of linear regressions. The results can be summarized as follows: First, “long-term and repeated interaction,” “geographical proximity,” and “cultures and norms of firms and formal institutions” had positive linear relationships with firm performance, that is, increases in their factors led to proportional improvements in firm performance. Second, increases in “information sharing and reciprocity” induced an increasing pattern in firm performance. As “information sharing and reciprocity” between partners increased, firm performance improved accelerately. Third, increases in “interdependence and asset specificity” and “uncertainty removal” induced a decreasing pattern in firm performance. That is, these factors made substantial contributions to firm performance in the initial, not mature stages of firm partnerships.

These results suggest that various determinants of trust in buyer-supplier relationships can make substantial contributions to firm performance. This suggests the importance of ensuring trust in buyer-supplier relationships for improving firm performance. In addition, the AVAS analysis indicates that the effects of the trust determinants on firm performance varied according to their levels. This suggests that it is critical to control trust determinants in a step-by-step manner to maximize firm performance.

Social exchange theorists, interdependence theorists, and knowledge-based theorists describe trust as the most important one of the key variables in the relationship between firms. The findings in this article confirm the postulates of social exchange theory, interdependence theory, and knowledge-based theory which considers trust as identifying outcomes of relationship between buyers and suppliers. While the majority of the existing studies suggest that firm performance is influenced by the trust between firms, further findings of this study help us to understand better the trust affecting the firm performance. That is, our study suggests that the relationship between trust and firm performance is contingent on the trust determinants that are important source of trust in buyer-supplier relationships and the influence of trust determinants on firm performance varied according to their levels. Therefore, we can contribute the study contributes to explore the contingency factors which may decrease or increase the effect of trust on firm performance.

Despite these contributions, the limitation of the research is also evident. We considered only suppliers for the survey. Thus, future research should examine dyadic relationships by considering both buyers and suppliers using the qualitative research method. Also, future researchers should expand the research regions. This may enable a better understanding the effect of trust on firm performance.
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Notes

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