Determinant of the asymmetric alliances in Taiwan-based semiconductor (SC) firms: Influences of technological network position and dyadic firm resources

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Accepted 24 September, 2010

This study examines the effect of network-based technology position and dyadic firm attributes on the formation of asymmetric alliances from the perspective of Social Network Analysis (SNA) approach. Drawing on data from 141 Taiwan-based semiconductor (SC) firms, which formed inter-firm alliances during 1998-2002, this study finds that most small- and medium-sized firms in the sample are keenly interested in forming asymmetric strategic alliances in order to gain complementary strategic resources, and their particular interest or ability in forming asymmetric alliances are affected by their inequivalent technological network positions and complementary firm capabilities in terms of size, performance, and financial structure. The results suggest that a synthesis of network theory and organization theory provides a better explanation for the existence of asymmetric alliances in the SC industry in Taiwan.

Key words: Structural equivalence, strategic alliance, network, firm capability.

INTRODUCTION

There have been numerous theoretical and empirical accounts of the formation of strategic alliances. Prior research of organization theory has studied various aspects of alliance formation, including strategic needs (Eisenhardt and Schoonhoven, 1996a), complementarity (Chung et al., 2000), isomorphic pressure (Koh and Loh, 1994) and mimicking behavior (Garcia-Pont and Nohria, 2002), to explain how firm, no matter big or small, benefits from external resources.

Researchers have focused on two explanations of what drives firms to form a strategic alliance. First, scholars in resource-based view have emphasized firm resource (Das and Teng, 2000) and resource complementarity (Richardson, 1972). They argued that firms form an alliance when they are capable of doing so (Gulati, 1995; Eisenhardt and Schoonhoven, 1996b) or enjoy pooling synergy (Nohria and Garcia-Pont, 1991). Secondly, other scholars emphasized the role of external opportunities like social network (Gulati, 1995). Because of the role of network, two firms’ prior interorganizational relationship facilitates their formation of future ties (Gulati, 1999).

Stressing the importance of endogenous firm resources and exogenous environmental opportunity, Gulati (1995) combines endogenous and exogenous factors in analyzing alliance formation and implied the importance of incorporating both streams in understanding the formation of alliances. Besides, Chung et al. (2000)
argues that firms will also consider the status of potential partners when forming alliances and are likely to ally with firm of similar status. Eisenhardt and Schoonhoven (1996a) finds the importance of external strategic position (that is, new market, many competitors, and technology status) and strong firm competence in terms of large, well-connected top management team in predicting alliance formation in high-velocity industries such as semiconductors.

Although, the conceptual and empirical arguments shed important light on the relevancy of the principle of firm resources (Das and Teng, 2000) and complementarity (Chung et al., 2000) for the formation of symmetric strategic alliances. The mainstream research of ‘complementarity’ is overwhelmed by pervasive concept of mostly ‘symmetric’ complementarity in developed countries that firms stand on equivalent bargaining power and complementary resource so as to exchange resource; and it implies that firm are better to be big enough to have resource for getting resource (Eisenhardt and Schoonhoven, 1996b: 137). The literature has left relatively less explored the asymmetric alliances formed by firms possessing disparity firm resources or having asymmetric bargaining power, particularly in the newly industrialized countries.

Take semiconductor (SC) industry in Taiwan, a success industry of a newly industrialized economics, as an example, most SC firms in this industry are mostly small- and medium- sized firms (SMFs) that limit by firm size and resources, and thereby, these SMFs have no parti-cular ability in forming horizontal alliances but conduct asymmetric alliances (Chen and Chen, 2002). The critical purpose of asymmetric alliance is, therefore, not aimed at controlling competitive uncertainties but to gain access to new markets and new technologies (Chen and Chen, 2002).

As a result, the dubbed “dragon enterprises” are vibrant and successful in their appearance in the world economy (Mathews, 2006) and SC industry are famous by the name ‘industry of Taiwan Silicon Valley’. Thus, the reasons determining the formation of asymmetric alliances that allows such SMFs in SC industry to transcend their inherent limitations to gaining technology or market are important. Yet, to our knowledge, no explanations centering on streams of endogenous firm capability and exogenous network status capture the determining factors of alliances of those SMFs. Therefore, this paper aims to fill out the gap.

Throughout this paper, we define ‘the asymmetry of alliance’ by the disparity in firm resources or network status of partners. We do not define the asymmetry by the alliance content since the variety of the contractual context and the contingency of the allying content make it difficult to judge the asymmetry. Consequently, the asymmetric alliance is the voluntary and contractual cooperative agreement between firms that are allied by partners who are characterized by disparity in resources or network position.

LITERATURE AND THEORETICAL DEVELOPMENT

In the past, the study of firm-specific imperatives has focused on identifying some of the inducements likely to lead firms to enter alliances (e.g., Harrigan and Newman, 1990). At firm level, scholars of organization theory have looked at firm’s attributes, such as age, size, product diversity, and financial resources, as important predictors of their capability to enter strategy alliances (Shan, 1990; Barley et al., 1992; Powell and Brantley, 1992; Shan et al., 1994). Das and Tang (2000) defines the resource (dis)similarity and argues that the inter-partner resource alignment can be supplementary or complementary accordingly. Therefore, we further extend the concept of firm resources to the dyad perspectives to capture the resource difference (dissimilarity) between firms. Insofar as differences in control of financial or slack resources may result in complementarities that leads to strategic alliances; the control of difference of firm performance and other firm attributes like age also can be discussed as an additional way of capturing possible sources of interdependence between firms.

Several studies have illustrated the importance of resource complementarity, Doz (1988) finds that complementary assets are the first motivation to form alliance. Chung et al. (2000) finds that the likelihood of investment banks’ alliance formation is positively related to the complementarity of their capabilities. Moreover, Shan and Hamilton (1991) reports that complementarity affects the formation of alliance in biotechnology industry. Yet, the underlying logic of how to analyze the asymmetric complementarity of firm capability from a dyadic view is needed.

The choice of partner of alliances is also influenced by the concept of social network (Granovetter, 1985; Burt, 1992; Baum and Dutton, 1996; Zukin and DiMaggio, 1990). An embeddedness perspective on alliance formation suggests that firms ally with those whom they are highly embedded with. Several arguments explain why social network is very important in forming alliances. For instance, Gulati (1999) finds that firms rely on information from the network of prior alliance to determine with whom to cooperate. Gulati and Gargiulo (1999) proves that firms are more likely to enter into new alliances when they have more focused network. Stuart (1998) proves that network position influences the propensity to collaborate in high-technology industry. Network approach is in the logic of a collection; that is, network consists by every dyadic relationship of every two firms. The endogenous firm attributes and exogenous network factors influencing alliance formation can be synthesized and captured at the dyad level rather than firm level (Gulati, 1995).

It is of high importance to offer an integrated investigation of the determinant of asymmetric alliance under the vulnerable strategic position characterized by the competition in emergent industries or the attempt in pioneering technical strategies since entering asymmetric.
alliances helps firms to acquire technological resources or new market (Chen and Chen, 2002). Therefore, we propose a conceptual model that associates the formation of strategic alliances with two major determinants: dyadic firm resources and technological network positions (Figure 1). We argue that the disparity in firm attributes, such as age, size, performance and financial resources, and partners’ relative technological network status are greatly associated with the alliance formation, and thereby there are the asymmetric alliances.

Firm attributes in dyads

Firm attributes, such as financial and slack resource, age and performance are adopted from dyad perspectives to see how the (dis)similarity of firm attributes affect the formation of the alliances.

Disparity in financial resource

Since firms have a choice of raising new capital through issuing new debt or equity, the debt ratio is an indicator of the capital structure of the firm. Quick ratio, otherwise, indicates the firm solvency (liquidity). A firm’s debt ratio (that is, debt over asset ratio) and quick ratio (that is, current asset minus inventory, divided by current liabilities), therefore, reflects firm’s long-run and short-run financial obligations. Barclay et al. (1992) argued that firms with relatively lower debt and quick ratio are considered to have high potential for growth because they consume most of their current resources for future growth; while firms with high debt and quick ratio are typically those engage in low productivity and slow growth because they have strong short cash flows and are thus able to take on large amounts of debts. Since alliances are often growth-related and cost economizing, firms incline to choose partners with complementary resources. Firms who consume most their current resources have stronger incentives to partner with firms of more finance resources; while firms who have abundant slack resource are likely to ally with firms of more growth opportunities. For instance, many fast-expanding small firms ally to enjoy the complementarity. Therefore, asymmetric alliances exist to facilitate firm growth.

\[ H_{1-1} \]: Firms of disparity (complementary) financial resources are more likely to form alliances.

Disparity in firm capability

Another important but less explored factor used to predict proclivity of entering alliance is complementary firm capability. The relationship between the alliances that firms enter and their capability is ambiguous. Some scholars assert the homophily principal (Gulati and Garguilo, 1999) for symmetric alliances: Less capable (under-performing) firms who look for external resources are more easily to ally together; more capable (performing-well) firms who look for external opportunity are inclined to partner together (Eisenhardt and Schoonhoven, 1996b). However, it is also possible that, once a firm is not very capable, it would be more willing to take the risk to surrender its bargaining power to well-performing firm for future growth. For well-performing firm, it enjoys favorable contract terms and is able to retain a large share of collaborative benefit. In the competition market that is featured by high environmental uncertainty and low munificence, the alliances between two asymmetric firms of capability disparity are more prevalent. Therefore, it is expected that complementary firm capability is associated with symmetric alliance formation:

\[ H_{1-2} \]: The greater the complementary firm capability status among firms, the more likely they embrace asymmetric alliances.
Disparity in firm size

There has been much prior research about the impact of firm size on interfirm activities. Firm size is typically treated not only as an exogenous variable that depends on the firm’s economies of scale in production but also as an endogenous variable which is indicative of its relative endowment with managerial and financial resources (Nohria and Garcia-Pont, 1991; Gulati, 1995). Findings on the effects of size have been highly ambiguous, so much that Chen and Chen (2002) argued that in many instances organizational size may capture the main effects of factors determining which kind of alliances are formed and with whom; while the other empirical studies have found no effects of size on interfirm collaborations (Kimberly, 1976).

Large firms having features of greater visibility, attractiveness, and organizational ability enjoy the benefit when allying with smaller firms because large firms are theoretically more capable of dominating the rule of the alliance. For small firms that are often regarded as having less economy of scale but focus on specialization can be the desirable partners for large firms who seek innovation. Small firms themselves benefit from attracting more market attention by being coupled with large firms. Therefore, it is proposed that the greater the complementarity of firm size, the stronger inventive of firms to enter asymmetric alliances.

\[ H_{1,2}: \text{The greater the complementary firm size between Taiwan’s SC firms, the more likely they embrace asymmetric alliances.} \]

Disparity in technological network position

Network position is often expressed by the concept of ‘positional embeddedness’ that the firm’s position in the network affects both its action (Gulati, 1998; Burt, 1992) and interaction among firms (Stuart, 1998). In the technology network, firm placed in high status has advanced technology to disperse to others; while firms placed in lower status receive technology from others. Stuart (1998) proposed that a firm with higher technological status has greater probability to attract alliance partners. We further extend the argument and expect that those high-technology firms aiming for strategically technology- or market- seeking concerns are more willingly to form alliances with low-status firms for the following reasons: First, the strategic concerns, such as the control of a new technology (Stuart, 1998) or new market extension, of most SMFs in SC industries may prompt high-status firms to cooperate with low-status firms so that high-status firm can enjoy the benefits of promulgating industry standards that leads to assurance of critical compatibility among users. Second, superior technological status of high-status firm also help them garner favorable financial terms (Burgers et al., 1993; Chen and Chen, 2002), which is of great help in financial release. Third, unequal technological status implies dissimilar absorptive capability of firms. The high-status firm, therefore, has more confidence in cooperation without worrying about the imitating competition since the dissimilar absorptive capability between partners guarantee the prestige status of high-status firm.

On the contrary, low-status firms are encouraged to ally with high–status firms for acquiring technological resources in a short time period. Moreover, low-status firms enjoy the spillover effect of reputation and visibility from the prestige high-status firms. The disparate bargaining power between partners of different network status also simplifies the negotiation and coordination in alliance (Stuart, 1998).

Of course, it is possible that symmetric alliance guided by the principle of homophile (Gulati, 1997) has its competitive advantages. However, alliances formed by both low-status firms are not prevalent because most of the alliance taken place in SC industry are technology- or R&D-related, and thereby, cooperation incentives are scant for those firm whose pooled R&D capability or technological resources is not affordable to the resource-required and time-pressured technology alliance. Alliances formed by high-status firms are often replaced by consortium encouraged and supported by government institution (Chen, 2003). Particularly under the institutional character that the SC industry is a policy-gearred sector in Taiwan. Thereby, the type of strategic alliances in Taiwan is narrowed into asymmetric ones. Thus we propose that:

\[ H_{2}: \text{Firms of complementary technological network position are more likely to form alliances.} \]

METHODOLOGY

We choose the Taiwan’s SC industry as our research context for the following reasons. First, unlike global large firms that integrate design, manufacturing, package and testing activities, most Taiwan-based SC firms are small- and medium- sized MNEs characterized by high degrees of specialization, vertical disintegration, and quick market responsiveness. The efficiency derived from specialization and flexible adaptation contributes to the important leading position in global production. The statistics in Table 1 show the important leading position of Taiwan-based SC industry in global competition. Therefore, it should be a proper representation to bring the importance of study of alliance formation in developing countries.

Second, SC industry in Taiwan consists of a heterogeneous population of firms that vary in size, scope, age, and innovation strategy. Many firms in the SC industry have entered strategic alliances over the past two decades so as to compete more effectively in the increasing competitive global markets. For technology seeking, there are numerous asymmetric alliances with foreign firms (Chen and Chen, 2002) or among small- and medium-sized domestic firms. Thus, it offers ample variation for testing the hypotheses.

Third, during 1998-2002, 90% of the SC firms are located inside Hsin-Chu Science Park (HCSP, hereafter), also dubbed “Tawanese Silicon Valley” (Chen, 2003). The HCSP is a good empirical network
for the reasons that it meets the requirements of common ties, identical attributes, and shared events (Marsden, 1988; Knoke, 1994) since the HCSP is famous with identical human resources attributes, common inward ties of international technology transfer, and shared R&D events held by government institutions—ITRI (Industrial Technology Research Institution).

Sample and data collection

In our empirical analysis, we compiled a dataset consisting 576 alliance cases among the 141 SC firms residing inside the park in our study period—1998-2002. To identify data of strategic alliances formed by the sample firms during our study period, we searched through firm annual reports, Year books of SC, the database of Science Park Administration Bureau, Press, websites and SC magazines and got 576 publicly or privately released cases. Most of the strategic alliances (90%) consist of two partners (Chen, 2003). We deleted the 58 alliance consisting of more than two partners; there were 518 cases included. The data of firm age, size, etc., were collected from annual firm report, science park database, and Infotimes dataset.

Measurements

Complementary technological network status

The concept of network status is mostly illustrated by structural equivalence (Burt, 1992). Firms are technologically structural equivalent only when they receive (send) technology from (to) the same blocks of senders (receivers) in the network (Lorrain and White, 1971; Faust, 1988; Burt, 1982). Using the tie of technology licensing, we build up a matrix denoting technology sending-receiving. The cell \( i,j \) of the matrix were coded 1 where firm \( i \) received technology from firm \( j \) (This can be done by using “affiliation” function in UCINET 6.0, (Borgatti et al., 2002)). We further adopt the Euclidean distance calculating (Burt, 1982) to measure the value of structural equivalence between every dyadic firm (This can be done by using “structural equivalence” function in UCINET 6.0). The larger the Euclidean distance, the greater the extent that two firms are not structural equivalent, and thereby the more complementary technological status between the paired firms.

Disparity in dyad firm resources

Many empirical studies of inter-firm relationships use firm attributes as explanatory factors to indicate endogenous firm resources (Gulati, 1999). We, first, adopt firm D/E ratio—long-term debt divided by current asset and Quick ratio—current asset minus inventory, divided by current liabilities—to measure long- and short-term financial resources (Gulati, 1995). Second, the ratio of firm real capital over annual sales is used for the measurement of firm size. Third, firm capability is captured in firm performance—ROE—to reflect the overall resources that a firm possess as its growth and profitability. To measure the disparity of those firm resources we calculate the extent to which two firms are (dis)similar using “absolute difference” between every two firms in their size, quick ratio, D/E ratio, and ROE. Therefore, we have another three matrices denoting the dissimilarity (disparity) in firm resources. For example, the value of cell \( i,j \) of the size matrix is, therefore, the “absolute difference” of the size of firm \( i \) and firm \( j \). The greater the value, the greater the disparity (dissimilar) between firm \( i \) and firm \( j \).

Dependent variable

The dependent matrix is the formation of interfirm strategic alliance in a given observation years. The types of alliances include in this study contains joint product development agreements, joint R&D, facility-sharing, capacity-sharing, co-marketing, and other resources exchange. The wide inclusion of alliance types is intended to avoid the tautology resulted from only using technological alliance to test the influence of relative technological position upon alliance formation. The cell of \( i,j \) of the dependent matrix is coded 1 if there is an alliance between firm \( i \) and firm \( j \), otherwise it is coded 0.

Control variable

We also included the disparity of firm age. Aged SC firms is more probable to have splendid alliance experience and credits in Taiwan because a lot of interfirm consortiums are supported by government in accessing to financial, technological and institutional resources in the early stage of SC industry development (1970s-1980s). However, aged firms also have the dark side of more serious organizational inertia (Hannan and Freeman, 1989). Therefore aged firms are more interested in choosing younger partner whose agile organizational culture can be stimuli to refill their innovative element during the cooperation. On the other hand, younger firms who are often limited in stock of social capital seek the spill-over effect of social capital from allying with aged firms (Nelson and Winter, 1982). Consequently we control the effect of difference of firm age by building a matrix denoting difference in firm age.

Method of analysis

We used a social network analysis tool—UCINET 6.0 (Borgatti et al., 2002) to construct network-based matrices to answer questions about how firm resources in dyad and technological network status equivalence associate with the formation of alliances. UCINET has

<table>
<thead>
<tr>
<th>Taiwan’s SC industry</th>
<th>Production value (B$)</th>
<th>Global market share (%)</th>
<th>Rank</th>
<th>Leading competitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Foundry</td>
<td>72.5</td>
<td>72.5</td>
<td>1</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Mask ROM</td>
<td>2.53</td>
<td>66.4</td>
<td>1</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Packaging</td>
<td>27.88</td>
<td>32.0</td>
<td>1</td>
<td>Taiwan</td>
</tr>
<tr>
<td>SC Design</td>
<td>43.47</td>
<td>27.8</td>
<td>2</td>
<td>US</td>
</tr>
<tr>
<td>DRAM</td>
<td>27.07</td>
<td>17.8</td>
<td>3</td>
<td>US, Korea</td>
</tr>
<tr>
<td>Testing</td>
<td>9.35</td>
<td>38.1</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>SRAM</td>
<td>1.75</td>
<td>6.9</td>
<td>4</td>
<td>US, Japan, Korea</td>
</tr>
<tr>
<td>SC Manufacturing</td>
<td>111.32</td>
<td>8.5</td>
<td>4</td>
<td>US, Japan, Korea</td>
</tr>
</tbody>
</table>
The aforementioned hypotheses were assessed sequentially in a series of MRQAP methodology presented in Table 2. Results of the model is significant as indicated by the $R^2$ and adjusted $R^2$ test (adj-$R^2=0.38$, $P<0.01$). Most hypotheses are significant. $H_{11}$—disparity financial resources ($β=0.03$, $p<0.1$) shows significant result to our expectation that firms characterized by complementary short-term financial resources are more willing to enter alliances. $H_{12}$ (disparity firm capability, $β=0.04$, p-value$<0.05$) has the result as predicted indicating that disparity in firm capability appear to have positive effect on their alliance behavior. $H_{13}$—disparity firm size shows significant result ($β=0.09$, p-value$<0.05$). Disparity in slack resource shown in complementary firm size positively affects the formation of asymmetric alliances between firms as we expected. In other words, firm of less resource is likely to rally with firm of more resources. The disparity in firm resource encourages the complementary alliance. Hypothesis 2 tests the influence of technological structural inequivalence. The significant coefficient ($β=0.39$, p-value$<0.05$) implies that complementary technological structural status has significant and greater propensity to influence entering alliances.

We also examine the hierarchical regression that variables are included sequentially into the baseline model. These models have no significance difference on our main results and so, in the interest of parsimony, we omitted them from our final analysis.

**RESULTS**

The academic contribution of this paper is threefold. Firstly and most importantly, this research extends the stream explaining the alliance formation to go beyond simple symmetric bargaining power and pay explicit attention to the distinctive asymmetry ones. This extension brings important understanding that the failure to recognize different alliance looks and complex context creates an impoverished view of alliance formation for SMFs in developing countries.

Second, we redirect the logic of fundamental irony of alliances that ‘firms must have resources to get resources’ (Eisenhardt and Schoonhoven, 1996b; 137) into a new fashion that some alliances among SMFs are, therefore, cooperative relationships driven by a different logic that alliances form because they are constrained or encouraged by strategically leverage the resource disparity and social resource opportunities.

Lastly, our sample of firms also contributes to avoid tautology because sample included is drawn independently of whether firms engaged in alliances or not. This sampling of the entire group of the SC firms within a geographically propinquity network could avoid the bias of research finding by the fact that only firms entering alliances are included and firm not entering alliances are ignored. The Taiwan-based SC industry offers abundant testing materials since it is characterized by its leading status in global competition and prevalence of alliances.

It is interesting to note that the aspiration to access complementary resources by SMFs results in the formation of asymmetric alliances in the Taiwan’s SC industry and implies the importance of strategic...
consideration of resources leverage. Other strategic concerns, such as duplication avoidance, collusion, or presence in the center of a market (Stuart, 1998), which are significant factors for forming symmetric alliances in developed markets, are found to be less important for those SMFs in developing countries. The result also precipitates a high degree of asymmetric alliances determining by resource interdependency and capability complementarily.

Moreover, the finding of this study further adds to Chen and Chen’s result (2002). Chen and Chen (2002) found that SMFs in Taiwan are keenly interested in allying with larger, reputable firms. We demonstrate a more synthetic result but that initiators are keenly interested in allying with those whom are complementary in firm resources and relative technological position, no matter whether they are foreign or domestic firms.

Burt (1992) asserted that two firms identically positioned in similar status will use each other as a frame of reference for subjective judgments. Gulati (1999) voiced the homophile principle in some alliances. However, the result of complementary technological position implies that competition from structural equivalence is not always a primary force driving interfirm collaboration in every contingency. Instead, firms are more inclined to form an asymmetric alliance to leverage resources when there is limit in firm resources.

Conclusion

At the practical level, the results of the study assure managers of the positive implications of capability firm attributes and technological position when dealing with an alliance partner of asymmetric bargaining power. Moreover, the study suggests that firms who seek to acquire external resource should attempt to increase their linkage to firm that position in different network hierarchy thus to increase effectiveness in inter-firm cooperation.

For policy-makers for firms or industries of developing countries, the encouragement of alliances between asymmetric partners, particularly between foreign leading firms with more advanced technological resource and domestic developing firms, may be a helpful and feasible way to facilitate the technology transfer. Taking Taiwan for an example, the arrangement of science parks embedding with many asymmetric international alliances is a success that SC industry developed and SC firms boosted.

The new industrial clusters such as TFT-LCD, LED, and solar cell start their own age based on the fundamental support of SC industry as well.

RESEARCH CONSTRAINTS AND FURTHER RESEARCH

Although offering important insight into the issue at hand, this study has the following limitations, some of which provide opportunities for future research. First, it is important to acknowledge any biases resulting from this sampling procedure. It is a nearly complete population but does not include all the players inside the industry (for example, the players outside this geographic district may still have intensive interaction with the firms inside the industrial park). One would need to include all the information of interfirm collaborations amongst the entire population. Second, this study focused on the SC industry in Taiwan. Other studies in other high-technology industries may cast a different network context. Therefore, it limits our generalization. Further research can turn to cross-sectional study to realize benefits of sector variety in explaining the formation of strategic alliances. Third, this study is also bounded by certain constraints of the non-exclusiveness of vertical-linked interdependency. There may be a better way to separate influence within industry vertical linkage from influence of technology interdependency and resource dependency by using cross-sections to avoid the pitfall of tautology. Finally, considering the time-varying character of the dynamics, evolving network embeddedness factors are imperative directions for future research.

REFERENCES


APPENDIX

The correlations of firm-level variables that have not been mutually deducted are shown in Appendix: Table 1. The low-value correlations between variables which are supported by different theories are acceptable. Furthermore, the VIF (value of inflation factor) ranged between one and two and shows that there is no serious collinearity problem. Therefore, it further assures the regression of variables created form the deduction of these variables.

### Table 1. Mean, standard deviation and correlation of independent variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Age</td>
<td>5.65</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Sales/capital</td>
<td>22.16</td>
<td>11.97</td>
<td>0.32**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) ROE</td>
<td>13.99</td>
<td>14.89</td>
<td>-0.01</td>
<td>0.09</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Quick ratio</td>
<td>1.94</td>
<td>10.87</td>
<td>-0.04</td>
<td>0.066</td>
<td>0.132**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Debt/asset ratio</td>
<td>17.87</td>
<td>14.58</td>
<td>0.10**</td>
<td>0.52**</td>
<td>0.075**</td>
<td>0.103*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Structural inequivalence</td>
<td>1.00</td>
<td>0.75</td>
<td>0.04</td>
<td>0.21*</td>
<td>-0.102*</td>
<td>-0.083</td>
<td>-0.026</td>
<td>0.163***</td>
</tr>
</tbody>
</table>