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Abstract:

This paper examines the determinants of and influence upon corporate joint R&D in Japan since the latter half of the 1990s. Joint R&D behavior is consistent with Resource Dependence and Search Cost Perspectives. It is important to undertake R&D itself and to possess technological competencies for executing joint R&D. Overseas network is also a significant factor for overseas joint R&D. Factors for finding partners have shifted recently from market-oriented evaluation of R&D resources to dependence on corporate group network. Moreover, the size and overseas ratio of joint R&D improve corporate performance. The effects upon performance have changed from size to network recently. These results suggest for joint R&D in Japan that companies should extend and cooperate with high-performing overseas companies, and search for partners that possess suitable R&D resources in order to achieve a combination of optimal division of labor and scale expansion within R&D activities.

Keywords: Corporate joint R&D, Resource dependence approach, Search cost approach, Firm performance, Japanese manufacturers

JEL Codes: D21, D23, L21, L60

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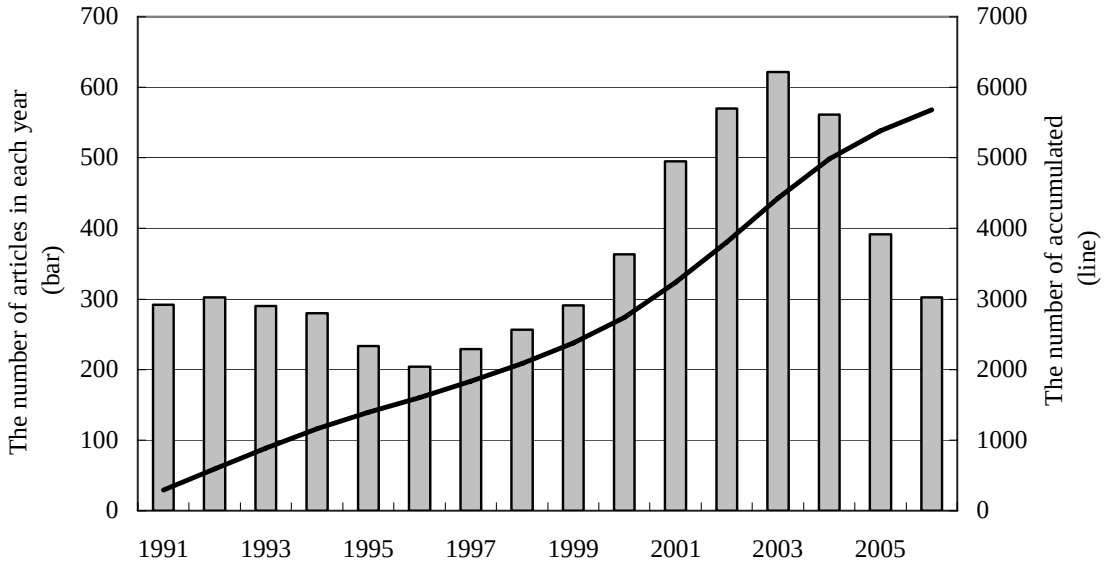
1. Introduction

Today, markets have changed drastically and rapidly due to diversification of demand and the advance of globalization. It is difficult for most companies, including huge multinationals, to acquire all the resources that are required for their business activities (Doz and Hamel 1998). To adapt quickly and appropriately to these changes in terms of management, companies concentrate resources on the fields in which they have a competitive advantage, and supplement them by cooperating with other companies, e.g., through alliances and joint ventures. Especially, in the field of research and development (R&D), joint activities are also important for risk sharing owing to the high investment costs and the uncertainty of profit. Moreover, in Japan, where natural resources are limited, the influence of technological progress on national growth and corporate R&D activities is more pronounced. Consequently, joint R&D activities occupy a significant position within corporate strategy. Previous studies into joint R&D in Japan, however, are limited, for instance, case studies on the top companies in certain industries and analyses of economic effects through industry-level macro data (e.g. Okamuro 2001, Odagiri 2003).

Figure 1. Transition of newspaper articles on joint R&D in Japan: 1991-2006



Notes: Results of retrieval by keywords: company, joint research and development, in 4 major papers of Nikkei

To show the recent transition of joint R&D in Japan, the number of major Japanese newspaper articles on the joint R&D of companies is plotted each year in Figure 1.[1] This transition shows that this number reaches its lowest point in 1996, peaks in 2003, and decreases to the level of the first half of the 1990s in 2006. It is in the early 2000s that companies actively executed joint R&D. This figure suggests that joint R&D in Japan has fluctuated since the latter half of the 1990s.

This paper focuses on corporate joint R&D activities in Japan and aims at investigating determinants of and influence upon corporate performance using large-sample, company-level data covering the fluctuation period. Finally, the direction of joint R&D in Japan is presented through a discussion based on the findings.

The contents of this paper are as follows. Next section explains the data used in this paper, and reconfirms the situation of joint R&D in Japan. The third section executes empirical analyses on the factor and the performance analyses including the development of the theoretical frameworks. The fourth section shows the findings and discussions. Concluding remarks is given in the fifth section.

2. Data for the Analyses

The data for the analyses in this paper is taken from the "*Basic Survey of Japanese Business and Activities* (*Kigyo Katsudo Kihon Chosa*, in Japanese)" conducted by the Ministry of Economy, Trade, and Industry (METI) of Japan. This survey, one of the largest datasets of Japanese corporate business activity, covers companies with an employee base larger than 50 or with a capital of 30 million yen. A specific feature of this large dataset is that it includes comprehensive information on domestic and overseas business activities. The data from the 1995–2004 surveys, which reflects corporate data of fiscal years from 1994 to 2003, is provided for these analyses. The number of subject companies and the sample size for each year are approximately 37,000 and 27,000 (response ratio 70%), respectively. The information on joint R&D activities obtained from these datasets includes the number of domestic and overseas partner companies within joint R&D for only three years of data, i.e., 1997, 2000, and 2003, when the questionnaires on joint R&D were introduced. However, the limited data of these three years is useful for this research because it covers the fluctuation period of joint R&D in Japan, as shown in Figure 1. After the elimination of data for non-manufacturing companies, the pooled data from the three years contains 7,261 samples.[2]

Table 1 shows the changes in joint R&D behavior in Japan according to these

datasets. The number and ratio of companies that undertook joint R&D have decreased; on the other hand, the average number of partners has increased since 1997. The same tendency is established for overseas joint R&D behavior. This observation indicates that the transition in Figure 1 displays mixed changes and that behavior of companies has polarized.

Table 1. Joint R&D activities in Japan: 1998-2004

	Sample	Firms that do joint R&D			Partner firms		
	size	Num.	Ratio		Total num.	Ratio	
Year	(A)	(B)	(B)/(A)	(*)	(C)	(C)/(B)	(*)
1998	2479	943	**0.380**	0.054	2826	**3.00**	**2.12**
2001	2502	854	**0.341**	0.058	2900	**3.40**	**2.20**
2004	2280	702	**0.308**	0.044	2543	**3.62**	**2.56**
3 years pooled	7261	2499	**0.344**	0.052	8269	**3.31**	**2.27**

Data source: Ministry of Economy, Trade and Industry of Japan, "Basic Survey of Japanese Business Structure and Activ
Notes: (*): Data from firms that do overseas joint R&D

3. Empirical Analyses

3.1. Theoretical frameworks of factor analyses

Factors for joint R&D are explained from the point of view of several theoretical frameworks, e.g., transaction cost, strategic management, and industrial organizations.[3] This paper discusses the factors for joint R&D from two theoretical perspectives: the Resource Dependence Perspective (RDP), and the Search Cost Perspective (SCP).

First, RDP requires that companies cooperate with other companies to supplement the necessary resources and abilities that are not available in-house (Pfeffer and Salancik 1978). To examine such a complementary relationship of resources, it is necessary to secure information on the extent of the technological resources of a company and its partners. Such detailed information, unfortunately, is not included in our datasets. However, in order to supplement each other's resources, each company must possess certain unique resources. A company lacking R&D resources is not selected as a partner, since a company that does not possess R&D resources is not an attractive joint R&D partner for another company. Accordingly, the following two hypotheses are proposed from the discussion on RDP:

H1 (quantity of resources):

A company that possesses a large amount of R&D resources executes joint R&D.

H2 (quality of resources):

A company that possesses R&D resources of high quality executes joint R&D.

Next, SCP is often used in labor market analyses such as job search theory (Stigler 1962, Mortensen 1984). This analytical framework is useful for the factor analyses of joint R&D that examine a company's search behavior for partners. Search behavior, such as information gathering on the R&D resources of other companies and negotiating for partners, generates costs, including opportunity costs, and companies select suitable partners based on the considerations of search costs. When search costs are high compared to expected returns, companies opt to subscribe to corporate networks, or establish new ones in order to reduce them. Actually, the selection of alliances and joint business activity of the partner is strongly influenced by the networks to which the companies belong and also by experiments involving transaction (Gulati 1998, Ahuja 2000).

In Japan, many corporate networks based on capital relationships involving business connections have existed for a long time. According to our dataset, the proportion of companies that possess subsidiaries (extent of ownership: 50–100%) including affiliates (25–50%) is approximately 60%. The ratio whereby a parent company exists is 30% (15% of these are parent companies themselves), and 25% of the sample are independent companies. In Japan, three quarters of manufacturing companies belong to a network of corporate groups.

To derive hypotheses from SCP, this paragraph discusses the relationship between corporate group networks and search costs. A parent company controls its subsidiaries and utilizes the information that they possess. A parent company that possesses many subsidiaries ends up reducing the search costs involved in finding joint R&D partners (including subsidiaries) possessing suitable R&D resources, while utilizing the corporate group as a network of information gathering on partners outside the group, e.g., overseas subsidiaries that have information on markets and influential companies in the region. A parent company with a large and region-wide corporate group facilitates the search for joint R&D partners. On the other hand, subsidiaries are restricted in their decision making concerning joint R&D because they are controlled by the parent company. Shimotani (1993) points out that many Japanese corporate groups consist of hierarchy structures, where a parent company is at the top and that many Japanese subsidiaries do not make important management decisions

autonomously. In particular, some parent companies manage the information technology of a corporate group owing to the security surrounding R&D activities. Therefore, three hypotheses are as follows:

H3: A company that possesses a large corporate group executes joint R&D.
H4: A company, whose corporate group develops overseas, executes joint R&D.
H5: A company strongly controlled by a parent company has restricted joint R&D.

3.2. Factor analyses and results

In this section, the previous five hypotheses are examined using a probit model. The dependent variable is a dummy variable such that a company that cooperates with a joint R&D partner becomes "1."To examine the differences between domestic and overseas joint R&D, two dependent variables are established as domestic and overseas joint R&D dummy variables, respectively.

Next, the independent variables are as follows: H1 for the quantity of R&D resources adopting the R&D ratio (R&D costs/sales; RDR) as an index that shows the accumulation of R&D resources; H2 for the quality of R&D using the average market values of patents owned (total revenues from technology transfer/the number of patents owned; AMVP). The dependent variables of H3, H4, and H5 for SCP employ the relative corporate group size (the number of corporate group companies/employment size; RCGS), the overseas company ratio of the corporate group (ORCG), and the parent company's stock share (PCSS), respectively. To facilitate causality, there is a one-year lag between the independent and the dependent variables. In order to account for past information, the dependent variables for these hypotheses are the average values for three preceding years. This is because companies do not accumulate R&D resources and construct the corporate group network in a short time. Three years of pooled data (1997, 2000, and 2003) and cross-sectional data for each year are used in these factor analyses. Estimation results are as follows (see Table 2).

First of all, the results of domestic joint R&D for the pooled data analyses show positive effects for H1 to H3. In the estimation using theoretical perspectives, H5 shows a negative effect. Next, based on the results of the cross-section analyses, H1 of both domestic and overseas joint R&D and H4 of overseas joint R&D indicate consistent effects in each year. Other dependent variables show that H2 is significant in 1997, and both H3 and H5 are significant in 2004. From these results, joint R&D behavior in Japan is consistent with both RDP and SCP. H1 and H4 of the overseas

analyses show stable effects for the analysis periods. On the other hand, the effects changed within some factors from the 1990s to the 2000s. In particular, it is suggested that the domestic joint R&D behavior shifts the importance of the search for a partner from market-oriented R&D quality to a dependence on corporate group networks.

Table 2-1. Results of determinants analyses 1

	3 years Pooled Data (1998, 2001, and 2004)								
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Dependent Variable: Joint R&D with **domestic** partners (=1)									
H1: RDR	4.9468	0.7307	**	4.5817	0.6423	**			
H2: AMVP	0.0525	0.0248	*	0.0405	0.0198	*			
H3: RCGS	2.6348	1.2568	*				2.0370	1.2096	+
H4: ORCG	-0.0218	0.0643					0.0097	0.0626	
H5: PCSS	-0.00004	0.00005					-0.00009	0.00005	+
Firm_size 1	0.1403	0.0476	**	0.1087	0.0426	*	0.1317	0.0455	**
Firm_size 2	0.1982	0.0696	**	0.1490	0.0644	*	0.2414	0.0667	**
Firm_size 3	0.4113	0.0723	**	0.3855	0.0670	**	0.5377	0.0676	**
Trend	-0.0261	0.0076	**	-0.0275	0.0071	**	-0.0206	0.0074	**
Number of obs	5155			5941			5374		
Log likelihood	-3131.0			-3592.1			-3322.2		
Pseudo R2	0.044			0.040			0.033		
Dependent Variable: Joint R&D with **overseas** partners (=1)									
H1: RDR	4.9981	0.9336	**	4.5682	0.8223	**			
H2: AMVP	-0.0036	0.0079		-0.0038	0.0079				
H3: RCGS	0.3015	2.4849					0.5749	2.3775	
H4: ORCG	0.3588	0.1025	**				0.3791	0.0980	**
H5: PCSS	-0.00017	0.00010	+				-0.00017	0.00009	+
Firm_size 1	0.2292	0.1040	*	0.2221	0.0922	*	0.2311	0.0963	*
Firm_size 2	0.5685	0.1236	**	0.5964	0.1114	**	0.6208	0.1157	**
Firm_size 3	1.0289	0.1209	**	1.0622	0.1078	**	1.1501	0.1105	**
Trend	-0.0195	0.0131		-0.0153	0.0123		-0.0153	0.0126	
Number of obs	5155			5941			5374		
Log likelihood	-935.8			-1040.2			-1003.2		
Pseudo R2	0.161			0.155			0.145		

Notes: + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$. All results controlled by 2 digits-industry level.

Firm_size is a dummy variable categorized by regular employment:

1, 100-499; 2, 500-999; 3, 1000 and above. A reference group is under 99.

Table 2-2. Results of determinants analyses 2

	Cross-Sectional Data								
	1998			2001			2004		
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Dependent Variable: Joint R&D with **domestic** partners (=1)									
H1: RDR	4.2887	1.1948	**	5.6719	1.3437	**	5.2798	1.2947	**
H2: AMVP	0.0602	0.0350	+	0.0286	0.0414		0.0813	0.0535	
H3: RCGS	0.7359	2.0739		2.2933	2.2457		5.7450	2.3056	*
H4: ORCG	-0.1126	0.1158		0.0421	0.1116		-0.0275	0.1102	
H5: PCSS	0.00005	0.00009		-0.00006	0.00009		-0.00014	0.00008	+
Firm_size 1	-0.0223	0.0788		0.3645	0.0855	**	0.0937	0.0866	
Firm_size 2	-0.0390	0.1126		0.4396	0.1254	**	0.2739	0.1288	*
Firm_size 3	0.2025	0.1156	+	0.7632	0.1281	**	0.3138	0.1407	*
Trend									
Number of obs	1902			1678			1562		
Log likelihood	-1194.4			-1004.0			-888.6		
Pseudo R2	0.039			0.064			0.065		
Dependent Variable: Joint R&D with **overseas** partners (=1)									
H1: RDR	5.2260	1.5123	**	6.3860	1.7281	**	3.9402	1.7902	*
H2: AMVP	0.0380	0.0257		-0.0231	0.0322		-0.0148	0.0159	
H3: RCGS	-0.4556	4.3639		-0.1860	4.1404		2.1783	4.8384	
H4: ORCG	0.4798	0.1764	**	0.3706	0.1694	*	0.3000	0.1622	+
H5: PCSS	-0.00030	0.00017	+	-0.00013	0.00016		-0.00017	0.00020	
Firm_size 1	0.2085	0.1657		0.1414	0.1694		0.5815	0.2893	*
Firm_size 2	0.4436	0.2020	*	0.3490	0.2092	+	1.3429	0.3128	**
Firm_size 3	0.9185	0.1972	**	0.9895	0.1966	**	1.6089	0.3149	**
Trend									
Number of obs	1902			1678			1562		
Log likelihood	-352.0			-328.9			-221.5		
Pseudo R2	0.150			0.184			0.249		

Notes: + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$. All results controlled by 2 digits-industry level.
Firm_size is a dummy variable categorized by regular employment:
1, 100-499; 2, 500-999; 3, 1000 and above. A reference group is under 99.

3.3. Performance Analyses and results

Companies expect an eventual improvement in corporate performance through joint R&D. If companies do not accomplish this final goal, there is only a weak incentive for them to actively execute joint R&D. This section therefore examines the improvement effects upon corporate performance of joint R&D.

Joint R&D influences corporate performance through two channels. One is economies of scale. Expansion of R&D scale via joint R&D reduces the costs of some business activities and improves cost efficiency. The other channel is economies of networks. Joint R&D utilizes the resources of other companies, promotes the sharing

Table 3. Results of performance analyses

	Dependent Variable: ROA (next 3 years average %)					
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
2 years Pooled Data						
RDSZ	0.0686	0.0442	0.0737	0.0442 +		
JOOR	0.0117	0.0053 *			0.0121	0.0053 *
R&D_ratio	0.1117	0.0310 **	0.1189	0.0308 **	0.1147	0.0309 **
Trend	-0.0002	0.0005	-0.0002	0.0005	-0.0002	0.0005
Firm_size 1	-0.0055	0.0020 **	-0.0054	0.0020 **	-0.0058	0.0020 **
Firm_size 2	-0.0092	0.0030 **	-0.0090	0.0030 **	-0.0097	0.0030 **
Firm_size 3	-0.0129	0.0030 **	-0.0121	0.0030 **	-0.0135	0.0030 **
Number of obs	3543		3543		3543	
Sum of S.Residual	8.090		8.101		8.095	
Adj R-squared	0.033		0.032		0.033	
Cross Sectional Data						
Fiscal Year 1998						
RDSZ	0.1280	0.0704 +	0.1353	0.0711 +		
JOOR	0.0073	0.0066			0.0080	0.0065
R&D_ratio	0.0992	0.0422 *	0.1040	0.0420 *	0.1021	0.0422 *
Firm_size 1	-0.0033	0.0027	-0.0032	0.0027	-0.0038	0.0027
Firm_size 2	-0.0053	0.0039	-0.0050	0.0039	-0.0061	0.0038
Firm_size 3	-0.0108	0.0039 **	-0.0103	0.0039 **	-0.0118	0.0038 **
Number of obs	1960		1960		1960	
Sum of S.Residual	4.059		4.062		4.064	
Adj R-squared	0.029		0.029		0.028	
Fiscal Year 2001						
RDSZ	0.0461	0.0542	0.0500	0.0542		
JOOR	0.0176	0.0090 *			0.0179	0.0089 *
R&D_ratio	0.1221	0.0458 **	0.1323	0.0456 **	0.1251	0.0457 **
Firm_size 1	-0.0077	0.0031 *	-0.0075	0.0031 **	-0.0079	0.0031 *
Firm_size 2	-0.0136	0.0047 **	-0.0134	0.0047 *	-0.0139	0.0047 **
Firm_size 3	-0.0145	0.0048 **	-0.0130	0.0047 *	-0.0149	0.0048 **
Number of obs	1583		1583		1583	
Sum of S.Residual	3.977		3.987		3.979	
Adj R-squared	0.035		0.033		0.035	

Notes: + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$. All results controlled by 2 digits-industry level.

of technological information, and improves productivity, e.g. through synergy effects. Therefore, companies improve corporate performance, based on these results. In the latter case especially, greater demographic heterogeneity and diversity within the R&D teams lead to higher organizational performances (Ancona and Caldwell 1992, Reagens and Zuckerman 2001).

This section tries to examine the effects of these two channels by using two dependent variables. One is a relative joint R&D size which is the number of total joint R&D partners/employees (RLSZ), and the other is the joint R&D partners' overseas ratio (JOOR) as a heterogeneous joint R&D index. Joint R&D influences corporate performance by actualizing new technology and implementing it as a new production system and developing new products. The effects on corporate performance are apparent for some time. These effects continue over the mid／long term while R&D outputs accumulate within companies as technological knowledge and become subjacent technology for further technological development. It is therefore necessary to examine these effects by using mid／long-term indices. These analyses adopt three-year future average values of return on assets as dependent variables. Estimation results are as follows (see Table 3).

According to the results of the pooled data analyses, both joint R&D size as well as the overseas ratio show consistently positive effects. Next, according to the cross-section results, only joint R&D size is significant in 1998; the overseas ratio is, however, significant in 2001. This suggests that the channel of influence shifts from size in 1998 to network in 2001.

4. Findings and Discussions

Main findings in this paper are as follows. Corporate joint R&D in Japan is consistent with Resource Dependence and Search Cost Perspectives. Above all, it is important to undertake R&D itself and to possess technological competencies for executing joint R&D. In other words, it is difficult for companies without in-house R&D bases to execute joint R&D. Overseas networks are an important factor for joint R&D with overseas companies. Factors for finding partners have shifted recently from market-oriented evaluation of R&D resources to strong dependence on corporate group networks, i.e., corporate group size facilitates joint R&D and a subsidiary strongly controlled by its parent company has limited execution of joint R&D. Moreover, the size and overseas ratio of joint R&D improve corporate performance. The analytical results, however, suggest that the effects upon corporate performance have changed from size to network.

The some discussions here consider the relationships among these findings. First, overseas joint R&D has recently improved corporate performance. It is thought that overseas corporate group networks limit search costs in finding overseas partners, and that joint R&D within a heterogeneous organization fosters economies of networks.

Secondly, domestic joint R&D contributed to improved performance through the expansion of R&D scope in the latter half of the 1990s. Companies evaluated partners' R&D competencies, in order to supplement suitable technological resources considering that market-oriented patent values facilitate joint R&D. As a result, corporate performance improved through a combination of optimal division of labor within R&D and economies of scale. Since the 2000s, companies might have concentrated on reducing search costs rather than on optimal division of labor within R&D. As a result, they cannot obtain performance scale merits of R&D. It seems that one of the backdrops for changes to joint R&D behavior was that the style of the financial statements of Japanese companies has been revised to consolidated accounting of the corporate group since 2000, and that parent companies have been more strongly aware of the existence of the corporate group.

Finally, there is a possibility that dependence on group networks has led to a polarization within joint R&D in Japan. Companies with broad networks can find overseas joint R&D partners of higher heterogeneity and improve their performance. They execute joint R&D more actively. On the other hand, companies with narrow networks try to specialize in domestic joint R&D and restrict search costs through a high level of dependence on such narrow networks. They cannot improve performance and continue joint R&D.[4]

5. Concluding Remarks

This paper focuses on joint R&D activities since the latter half of the 1990s in Japan, and examines the determinants of and influence upon joint R&D. As consequences of the foregoing discussions, this paper suggests two interesting points for joint R&D in Japan as companies execute R&D activities themselves and possess R&D resources in-house. One is that companies should extend and cooperate with high-performing overseas companies, and the other is that companies should search for partners that possess suitable R&D resources in order to achieve a combination of optimal division of labor and scale expansion within R&D activities rather than a decrease in search costs.

Notes:

1 It seems that the number of newspaper articles is moderately effective as an index that reflects the time series change of joint R&D in Japan though not all joint R&D is reported in the newspapers.

2 See detailed statistical summary in Attached Table 1

3 See Hagedoorn, Link, and Vonortas (2000) and Caloghirou, Hondroyiannis, and Vonortas (2003) for detailed discussions of theoretical frameworks.

4 Naturally the discussion in this paper should be examined by using more detailed analyses, e.g., the functions of corporate group networks and the profit-making structures of overseas joint R&D. In addition, though empirical analyses were executed from various other viewpoints, those discussions will be introduced at another chance. These are subjects for future research.

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Appendices:

Attached Table 1. Statistical summary

Variable			Obs	Mean	Std. Dev.	Min	Max
R&D_ratio	RDR	H1	6979	0.019	0.031	0.000	0.768
Patent value	AMVP	H2	6972	0.169	2.715	0.0	133.9
Group relative size	RCGS	H3	5644	0.012	0.016	0.000	0.233
Subsidiary overseas ratio	ORCG	H4	6326	0.184	0.305	0.000	1.000
Parent share	PCSS	H5	7261	233.3	389.6	0	1000
Joint R&D relative size	RDSZ		6488	0.005	0.017	0	0.750
Joint R&D overseas ratio	JOOR		7261	0.030	0.148	0	1.000
Number of joint R&D partners			7261	1.139	3.476	0	69
Joint R&D dummy			7261	0.344	0.475	0	1
ROA (Next 3 years average)*			4130	0.008	0.048	-0.967	0.271
Number of regular employment			6489	605	2337	0	71154
Firm_size 1 (100-499)			6489	0.509	0.500	0	1
Firm_size 2 (500-999)			6489	0.108	0.310	0	1
Firm_size 3 (1000 and above)			6489	0.105	0.307	0	1
Establishment year			7257	1958	17.35	1892	2003
Food_d			7261	0.072	0.258	0	1
Drink_tobacco_d			7261	0.013	0.113	0	1
Tex_cloth_d			7261	0.036	0.185	0	1
Wood_d			7261	0.008	0.087	0	1
Furniture_d			7261	0.011	0.106	0	1
Pulp_paper_d			7261	0.022	0.148	0	1
Print_d			7261	0.022	0.145	0	1
Chemical_d			7261	0.111	0.314	0	1
Oil_coal_d			7261	0.006	0.080	0	1
Plastic_d			7261	0.049	0.216	0	1
Rubber_d			7261	0.011	0.102	0	1
Tan_fur_d			7261	0.003	0.055	0	1
Ceramics_d			7261	0.057	0.232	0	1
Steel_d			7261	0.028	0.164	0	1
Nonmetal_d			7261	0.026	0.160	0	1
Fabricated_metal_d			7261	0.072	0.259	0	1
Machinery_d			7261	0.147	0.354	0	1
Electrical_d			7261	0.094	0.292	0	1
Telecom_d			7261	0.023	0.149	0	1
Electronic_d			7261	0.053	0.224	0	1
Transport_d			7261	0.083	0.275	0	1
Precision_d			7261	0.036	0.187	0	1
Others_d			7261	0.018	0.132	0	1

Notes: 3 years (1998, 2001, and 2004) pooled data

* 2 years (1998 and 2001)