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Management Practices and Firm Performance in Japanese and Korean Firms -An Empirical Study Using Interview Surveys-

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Management Practices and Firm Performance in Japanese and Korean Firms -An Empirical Study Using Interview Surveys-*

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Abstract

To compare management practices between Japanese and Korean firms, we conducted interview surveys on organizational and human resource management based on Bloom and Van Reenen (2007). The average management scores resulting from the interview surveys in Japanese firms were higher than in Korean firms. The gap in the scores between Japan and Korea can be explained by more conservative human resource management practices in Korean small and medium sized firms. We regressed some indicators representing management practices on firm performance. Estimation results suggest that human resource management affects firm performance in Korean firms. In Japanese firms, we expect that organizational reform plays a role in improving firm performance in the service sector.

Keywords: Intangible assets, Management practices, Organizational capital, Human resource management, Factor analysis

JEL classification numbers: D21, L23, M11, M12, M15, M51

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1. Introduction

The US economy had marked accelerated economic growth from the late 1990s to the first half of 2000s. At first, many economists and policymakers believed that the rapid growth in the IT industry and IT investment contributed to the acceleration in US economic growth. Therefore, many advanced countries supported the IT industry and encouraged IT investment in their own countries. However, the gaps in rates of economic or productivity growth between the US and other advanced countries have remained intact even in the early 2000s. Since then, many economists have paid attention to the complementary role of intangible assets in productivity growth. That is, they started to believe that without intangible assets, IT assets do not contribute to productivity growth at the firm and aggregated level.[1]

Corrado, Hulten and Sichel (hereafter referred to as CHS) (2005, 2009), and estimated the investment in intangible assets at the aggregate US economy level, classifying intangible assets into three categories: computerized information, innovative property, and economic competencies. Following CHS (2009), many researchers in other advanced countries tried to estimate intangible investment.[2] Comparing the estimation results in Japan with those in the US and the UK, Fukao et al (2009) found the following characteristics of Japanese intangible

[1] Economic Report of the President 2007 stated 'Only when they (businesses) made intangible investments to complement their IT investments did productivity growth really take off.' (p. 56)

[2] See Marrano, Haskel and Wallis (2009) for the UK, Hao, Manole and van Ark (2008) for Germany and France, and Fukao et al. (2009) for Japan.

investment.

(1) Investment in computerized information measured as a share of GDP in Japan is almost the same as that in the US and the UK.

(2) Due to the large R&D investment levels in Japan, the ratio of investment in innovative property to GDP in Japan is greater than that in the US and the UK.

(3) As for investment in economic competencies, the investment/GDP ratio in Japan is much smaller than that in the US and the UK.

The third category includes investment in brand equity, firm-specific human capital, and organizational reform. Among these, the investment in firm-specific human capital and organizational reform in Japan is much smaller than that in the US and the UK. However, it is difficult to estimate these investment amounts at the aggregate level and to compare these among advanced countries.[3] In addition, these investments depend on management practices at the firm level. Therefore, recent studies on intangible investment have focused on management practices on human resource management and organizational reform at the firm level using micro-data.

Black and Lynch (2005) categorized organizational capital into three components: accumulation in human capital, how employees' voices are reflected in the workplace, and

[3] For example, CHS (2009) does not account for the investment in firm specific human capital through on-the–job training while this type of investment is very important in Japanese and Korean firms.

organizational design. Bloom and Van Reenen (2007) examined the effects of management practices on firm performance based on interview surveys of plant managers. Management practices were converted to scores based on interview results, and these scores were included as independent variables when they estimated the production function. According to their study, US firms got the highest score of the four countries studied (France, Germany, the UK, and the US). They believed that the low score in continental European firms was partly explained by weak competition and the prevalence of many family-owned firms.

In Japan, Kurokawa and Minetaki (2006), Kanamori and Motohashi (2006), and Shinozaki (2007) examined the effects of organizational reform resulting from IT investment on firm performance by using the *Basic Survey on Business Enterprise Activities* and *IT Workplace Survey*. Their studies suggested that organizational reform resulting form IT investment was partially responsible for improving firm performance.

While our paper also focuses on the effects of organizational reform and human resource management on firm performance, there are three different features from the previous studies in Japan. First, we examined more comprehensive management practices on organizational and human resource management than earlier studies in Japan. Second, we studied the effects of management practices on firm performance using not only official surveys but also interview surveys following Bloom and Van Reenen (2007). Third, we compared the interview scores and

firm performances between Japanese and Korean firms.

In the next section, we describe our interview survey. Although our interview survey basically follows Bloom and Van Reenen (2007), we incorporate some questions that were not included in Bloom and Van Reenen (2007) to capture some unique features of Japanese and Korean firms. In the third section, we construct a management score by quantifying the interview results of Japanese and Korean firms, and compare the management practices in firms of the two countries. In the fourth section, using management scores and financial statements in Japanese and Korean firms, we estimate a production function and examine the effects of management practices on firm performance. In the last section, we summarize our studies.

2. The Interview Surveys in Japan and Korea

Why did we conduct the interview survey?

Recently, it has been recognized that qualitative factors in management practices not captured by official surveys are affecting firm performance. At first, many researchers conducted their own mailed surveys to examine these qualitative factors within firms. However, the response rates to the surveys were very low. For example, the response rate to the mailed survey conducted by Ichikowski (1990) -- who tried to examine the effect of human resource management on Tobin's Q or labor productivity-- was only 10%. In the US, researchers and statistical agencies have adopted interview surveys to improve the response rate. For example,

the response rate of the interview survey in the National Employers Survey conducted by the National Bureau of Census was 66% in the manufacturing sector and 61% in the non-manufacturing sector. Much of the recent research on human resource management has also incorporated interview surveys. Bloom and Van Reenen (2007) conducted interview surveys by telephone to examine management practices in firm and attained a 54% response rate. Following the above experiences, we also decided to conduct an interview survey.

How did we design our interview survey?

In our research, we followed the interview survey conducted by Bloom and Van Reenen. However, we conducted the survey by meeting the managers of the planning departments of firms face-to-face, while Bloom and Van Reenen (2007) conducted their survey by telephone. The reason why we conducted face-to-face interviews is that we were concerned about low response rates. In Japan and Korea, when we want to ascertain qualitative features in firms, face-to-face communication is a more useful tool than telephone interviews.

Bloom and Van Reenen (2007) classified their eighteen interview questions into four categories: product management, monitoring, the firm's target, and incentives for workers. While their survey was extended to only manufacturing plants, our survey was also extended to firms in the service sector. Thus, we excluded questions about product management, as they would not apply to all firms. Instead, we asked questions about organizational change and

on-the-job training. As a result, we can classify our questions into two categories: organizational management and human resource management.

The first category covers the first four questions (Questions 1 to 4). In this category, we wanted to examine the managerial vision of the firm, the organizational goals, communication within the firm, and organizational reform. In the remaining questions (Questions 5 to 13) that focused on human resource management, we added a question about on-the-job training (OJT) to the questions in Bloom and Van Reenen (2007), because the effects of OJT in Japanese and Korean firms are considered significant to firm performance. The detailed interview questions are shown in Appendix 1.

We quantify the responses to the above questions as follows: In each question, we have three sub questions. If the firm manager responds negatively to the first sub-question, we give the response a 1 and move to the next question. If he responds positively to the first sub-question, we move to the second sub-question. If the manager responds negatively to the second sub-question, we mark a 2 and move to the next question. If he responds positively to the second sub-question, we move to the last sub-question. In the last sub-question, the positive response of the manager is given a 4, while a negative response is given a 3.

Our survey focused on four industries in the manufacturing sector (Electric machinery, Information and communication equipment, Motor vehicle, and Precision machinery) and three

industries in the service sector (Internet-based services and information services, Media activities, and Retail service). In Japan, we obtained our data from 573 firms. As the total sample was 1086 firms, the response rate in Japan was 52.8%. In Korea, we obtained the data of 350 of the sample 591 firms, thus the response rate was 59.2%[4].

3. Management Practices in Japan and Korea

In this section, we compare the management practices between Japanese and Korean firms based on interview surveys.[5] Table 1 shows the distribution of firms in Japan and Korea by industry. While the share of manufacturing firms in the total number of firms in Japan is 33.9%, the share of manufacturers in Korea is 84.9%. In particular, the firms in the motor vehicles industry in Korea account for 40.0% of the total number of firms. In Japan, the share of firms in the retail services is also 40.1%.

(Place Table 1 here)

Table 2 shows the distribution of firms in Japan and Korea by size as measured by the number of employees. In Japan, the number of small and medium sized firms with fewer than 300 employees in the survey is 313 of the total 573. In Korea, the number of firms with fewer than 300 is 260 out of the 350. The share of small and medium sized firms in Korea is larger than that in Japan.

[4] The Japanese survey was conducted from February, 2008 to September, 2008. The Korean survey was conducted from May, 2008 to July, 2008.
[5] The results in the Korean interview surveys are based on Lee et al. (2009).

(Place Table 2 here)

As explained in the previous section, we assigned scores to the management practices based on the interview surveys. Figure 1-1 shows the distribution of scores in all firms and all interview questions in Japan and Korea by using Kernel density. In Japan, the mean value of the distribution average score for all firms is 2.73 and the variance is 0.23. The average scores in many firms fall between 2.5 and 3.5. In Korea, the mean value of the distribution is 2.33 and the variance is 0.32. The mean and the median values in Korea are lower than those in Japan and the variance of scores in Korea is higher. The average scores in most of the Korean firms range from 1.5 to 2.5.

(Place Figure 1-1 here)

However, the difference in the distribution of scores in Japan and Korea may reflect the difference in the industry composition in the samples. Thus, we examined the distribution of scores by industry. Figures 1-2, 1-3, and 1-4 show the distribution of scores in the manufacturing sector, the information-related services sector, and the retail sector respectively.[6] In Figure 1-2, we find that the mean value of the distribution in the Japanese manufacturing sector is almost the same as that in all firms. We also find that the distribution of scores of all firms in Korea is affected by the distribution of scores in the manufacturing sector. While the

[6] The information-related services sector consists of internet-based services and information services, and media activities.

mean values of the distributions in the manufacturing and information-related services sectors in Korea are smaller than those of Japan, the mean value in the retail sector in Korea is the same.

(Place Figure 1-2 to Figure 1-4 here)

We classify our interview questions into two categories: one category consists of questions about organizational management and the other questions about human resource management. We show the distribution of scores in organizational capital from Figure 2-1 to Figure 2-4. In both countries, the mean value of the distribution in organizational management is higher than that of all questions together. The scores in Japan are higher than in Korea. These results imply that the organizational targets are clear to all employees in Japan in more cases than in Korea, or Japanese firms improve their organizational structures more aggressively than Korean firms, because high scores in organizational management indicate a greater degree of transparency of organizational goals or aggressive organizational reform.

(Place Figure 2-1 to Figure 2-4 here)

We also show the distribution of scores in human resource management in Figures 3-1 to 3-4. The average scores in human resource management are lower than those in organizational management in both countries. The average scores in Japanese firms are higher than those in Korean firms in all sectors. In Korea, the low score in the manufacturing sector pulls down the score in all firms. As a score in this category indicates flexibility in human resource

management, the results imply that Japanese firms are more flexible in their human capital management than Korean firms.

(Place Figure 3-1 to Figure 3-4 here)

As seen in Table 2, the Korean sample consists of more small and medium sized firms than the Japanese sample. Thus, we examine the distribution of average score in both countries by size in Figures 4-1 and 4-2. In Figure 4-1, where the distributions of average scores in firms with more than 300 employees are shown, we find a gap in the mean value of the two distributions in Japan (2.81) and Korea (2.57). The median value (2.87) in Japanese firms is also higher than that (2.57) in Korean firms.

(Place Figure 4-1 & 4-2 here)

As for firms with fewer than 300 employees, the peak of the distribution for Japanese firms was at a point higher than the 2.5 mark, while for Korean firms, it was around 2. The difference in the distribution leads to a wider gap in the average score in firms in medium and small sized firms in both countries than that in large firms. In contrast to the relatively high mean in the distribution of Japanese firms (2.64), the mean in Korean firms is 2.25. This gap in the mean can be explained by the difference in the distribution in the average score in human resource management. The mean in the average score in resource management in Korean firms is very low (2.00), while the corresponding mean in Japanese firms is 2.45. These results imply

that human resource management practices in Korean small and medium sized firms are more conservative than those in Japan.[7]

4. Do Management Practices Affect Firm Performance?

Using the scores indicating management practices explained in the previous section, we examine the effects of management practices on firm performance. Following Bloom and Van Reenen (2007) we estimate the following equations:

$$(1)\quad \ln Y_i = const. + \alpha_1 \ln L_i + \alpha_2 \ln K_i + \alpha_3 \ln M_i + \alpha_4 Z_i + Dummy_i + \varepsilon_i$$

$$(2)\quad FP_i = const. + \sum_{j=1}^{2} \beta_j W_{ij} + \beta_3 Z_i + \beta_4 E_i + Dummy_i + u_i$$

Equation (1) is a standard production function including the management score (*Z*). *Y* is output, *L* is labor input, *K* is capital input, and *M* is intermediate input. Because we have information about recent organizational reforms from the interview survey, we make a dummy variable (Dummy) that indicates that organizational reform was conducted in the past 10 years. We also include a country and an industry dummies in the estimation. *E* is the logarithm of employees, which controls the firm size.

In Equation (2), the measure of firm performance (*FP*) is the dependent variable. We take labor productivity or TFP as a measure of firm performance. TFP is a Tornqvist measure, which

[7] However, all differences in means in distributions between Japanese firms and Korean firms are not significant.

is expressed as follows.

(3) $\ln TFP_t = \ln Y_t - s_L \ln L_t - s_K \ln K_t - s_M \ln M_t$,

where s_X ($X = L, K, M$) denotes the share of each production factor.

W represents both the capital labor ratio (*K/L*) and the intermediate input labor ratio (*M/L*).[8] We include the same dummy variables as used in Equation (1).

As for *Z*, we use two types of variables as explanatory variables: one is the average score in each firm and the other is the first principal factor calculated by factor analysis. If some of the questions focus on a specific management factor in our survey, an average score may overstate that specific management factor. Therefore, using factor analysis, we extract a neutral measure that reflects each management factor evenly and include it in the estimation. The results in factor analysis in Japan and Korea are shown in Appendix 2. Because the Kaiser=Meyer= Olkin measures in Japan and Korea are 0.81 and 0.87 respectively, the application of factor analysis is appropriate in both countries.

4.1 Estimation Results Using All Samples in Japan and Korea

We estimate Equations (1) and (2) using the average score in all questions in the interview surveys and all samples in Japan and Korea and show the estimation results in Table 3-1. Because we have only cross-section data, the estimation method utilized is OLS. The

[8] When TFP is a dependent variable, we exclude *W* from the estimation.

results in Table 3-1 show that the average score has neither the expected sign nor a significant effect on firm performance. Coefficients in the organizational dummy in Table 3-1 are positive but insignificant in many estimation results.

(Place Table 3-1 here)

As seen in Section 3, we divide the interview scores into two categories: those in organizational capital indicating organizational management and those in human capital indicating human resource management. Table 3-2 shows estimation results using the average score in organizational capital. In Table 3-2, coefficients in the average score in organizational capital do not show stable signs these results imply that the organizational management including manifestation of organizational goals or better communication within an organization does not contribute to firm performance. However, it is organizational reform that improves firm performance in Japan.

(Place Table 3-2 here)

In Table 3-3, we show the effects of the average score with respect to human capital on firm performance. In contrast to the previous results, the results in Table 3-3 show that the average score in human capital affects firm performance significantly.

(Place Table 3-3 here)

Finally, we use the first principal factor of factor analysis using all interview scores on

firm performance instead of average score as independent variables in the estimations. The results shown in Table 3-4 are similar to those in Table 3-1. Although coefficients in the first principal factor show positive signs in all estimations, they are not significant.

(Place Table 3-4 here)

4.2 Estimation Results by Country

We estimate Equations (1) and (2) by country and show estimation results in Tables 4-1 and 4-2. In Table 4-1, the average score shows neither the expected sign nor a significant effect on firm performance in Japanese firms. However, in Korean firms, the average score is positive in all estimations and significant when TFP is a dependent variable. Some coefficients in the organizational dummy in Japanese firms are positive and significant, while they are negative and insignificant in Korean firms.

(Place Table 4-1 here)

Using the first factor of factor analysis as an independent variable in the estimations, we find more clear difference between Japanese and Korean firms in Table 4-2. While the results for Japanese firms show that organizational reform affects firm performance significantly, we find that the first principal factor improves Korean firm performance significantly. The factor analysis in Korea implies that the first principal factor represents human resource management. Thus, the improvement in human resource management in Korean firms contributes to

enhancing firm performance.

(Place Table 4-2 here)

4.3 Estimation results in the manufacturing sector

As seen in Table 1, the industry structure in the Japanese samples is different from that in Korean sample. Thus, we focus on manufacturing firms in both countries and conduct similar estimations to those in the previous sections. First, we estimate Equations (1) and (2) using the whole sample in the manufacturing sector in both countries. The estimation results in Table 5-1 are almost similar to those in Table 3-1. While the coefficients of the average score and organizational reform dummy are positive, they are insignificant.

(Place Table 5-1 here)

Second, we conduct the same estimations using the score with respect to human capital. We also find that estimation results in Table 5-2 are similar to those in Table 3-3. Almost all coefficients in the average score are positive and significant. These results imply that improvements in human resource management within a firm enhance firm performance in Japanese and Korean manufacturing firms.

(Place Table 5-2 here)

Finally, we estimate Equations (1) and (2) by country. In Table 5-3, we find that some of the coefficients in the average score are positive and significant in Korean manufacturing firms,

while all coefficients in the average score are positive but insignificant in Japanese firms. These results make us confirm that the improvement in human resource management leads to better firm performance in Korea. Unlike Table 4-1, organizational reform does not affect firm performance significantly in Japanese manufacturing firms. From these results, we expect that organizational reform is effective for better performance in the service sector in Japan.

(Place Table 5-3 here)

4.4 Summary of the Estimation Results

Using the samples in Japanese and Korean firms, we examine the effect of the interview score indicating management practices and organizational reforms on firm performance. As for the interview score measuring management practices, we find that the measure indicating human resource management improves firm performance. Although all coefficients in organizational reform are positive, we do not find that it affects firm performance significantly.

Estimating a production function by country, we find that improvement in human resource management leads to better performance in Korean firms. In contrast to Korean firms, Japanese firms are not affected by management practices. However, organizational reform improves firm performance in Japanese firms.

Estimation results using the samples in the manufacturing sector are almost similar to the previous results. However, we find that organizational reform does not affect firm performance

in Japanese manufacturing firms. The results imply that organizational reforms play a significant role in improvement in firm performance in the service sector in Japan.

5. Conclusions

Intangible assets have played a key role in productivity growth in the information age. Among several kinds of intangibles, management skills and human capital are crucial to the improvement in a firm's performance. Bloom and Van Reenen (2007) examined the effects of organizational and human resource management on firm performance using interview surveys conducted in France, Germany, the UK, and the US. Following their study, we conducted the interview survey on organizational and human resource management in Japan and Korea.

Based on Bloom and Van Reenen (2007), we constructed scores on management practices in each firm based on the interview surveys. For organizational management, firms that have clear organizational targets, better communication amongst employees, and conduct organizational reforms would have a higher score. For human resource management, firms that evaluate human resources flexibly and strive to keep employees motivated would mark high scores.

When we compared the distributions in average management scores between Japanese and Korean firms, the mean value in Japan was higher than that in Korea. Even when we study the distribution in the average score in the manufacturing firms only (which dominate the

sample in the Korean survey) the result is similar to that in all firms. Comparing the distributions in the average score between Japan and Korea by size, we found that the gap in the mean value in firms with fewer than 300 employees is higher than that of firms with more than 300 employees. This gap between Japanese and Korean small and medium sized firms is explained by the difference in the score of human resource management between both countries. As a result, we conclude that in Korea, small and medium sized firms are more conservative in human resources management than in Japan.

Using these scores, we examined the effects of management practices on firm performance in Japan and Korea. Estimation results using the whole sample showed that the measure indicating human resource management contributed to better firm performance. Estimating a production function by country we found that the effect of human resource management on firm performance appeared in Korean firms. These results in Korean firms are consistent with our findings in the score distribution in Korean firms in Section 3. In Japanese firms, organizational reform contributed to improvements in firm performance in the service sector in Japan.

Our study suggests that organizational reform and human resource management are key factors to improve firm performance. In the next step, we will try to examine what factors stimulate organizational reform and how firms improve human resource management.

References

Black, S. and L. Lynch (2005), "Measuring Organizational Capital in the New Economy," in C. Corrado, J. Haltiwanger, and D. Sichel (eds.), *Measuring Capital in the New Economy*, The University of Chicago Press, Chicago.

Bloom, N. and J. Van Reenen (2007), "Measuring and Explaining Management Practices across Firms and Countries," *Quarterly Journal of Economics* 122, pp.1351-1408.

Corrado, C., C. Hulten, and D. Sichel (2005), "Measuring Capital and Technology: An Extended Framework," in C. Corrado, J. Haltiwanger, and D. Sichel (eds.), *Measuring Capital in the New Economy*, The University of Chicago Press, Chicago.

Corrado, C., C. Hulten, and D. Sichel (2009), "Intangible Capital and U.S. Economic Growth," *The Review of Income and Wealth* 55, pp. 661-685.Fukao, K., T. Miyagawa, K. Mukai, Y. Shinoda, and K. Tonogi (2009), "Intangible Investment in Japan: Measurement and Contribution to Economic Growth," *The Review of Income and Wealth* 55, pp. 717-736..

Hao, J., V. Manole, and B. van Ark (2008), Intangible Assets in Europe: Measurement and International Comparability," paper presented at the final conference of EUKLEMS Project held at Groningen.

Ichikowski, C. (1990), "Human Resources Management System and the Performance of U.S. Manufacturing Businesses," *NBER Working Paper* No. 3449.

Kanamori, T. and K. Motohashi (2006), 'Centralization or Decentralization of Decision Rights? Impact on IT Performance of Firms,' *RIETI Discussion Paper Series* 06-E-032.

Kurokawa, F. and K. Minetaki (2006), "How Can IT Raise Productivity Linked with Workplace Re-organization and Human Capital in Japan?," (in Japanese), *The Economic Analysis* No. 178, pp. 54-95.

Lee, K., T. Miyagawa, S. Kabe, J. Lee, H.Kim., and Y. Kim (2009), "Management Practices and Firm Performance in Japanese and Korean Firms," *JCER Discussion Paper* No. 120.

Marrano, M. G., J. Haskel, and G. Wallis (2009), "What Happened to the Knowledge Economy? ICT, Intangible Investment and Britain's Productivity Record Revisited," The Review of Income and Wealth 55, pp. 686-716.

Miyagawa, T., M. Ozaki, A. Kawakami, and K. Edamura (2008), "Organizational Reform and Firm Performance in Japan," (in Japanese), *RIETI Discussion Paper Series* 08-J-062.

Shinozaki, A. (2007), "Effective Reforms with Information Technology: Logit Model Analysis on Business Process Reengineering, Business Unit Restructuring, and Human Resource Management," (in Japanese), *The Economic Analysis* No. 179, pp. 36-54.

Table 1. The Distribution of Firms in Japan and Korea by Industry

	Japan		Korea	
Industry	Number of Firms		Number of Firms	
Electric machinery	44	(7.7%)	51	(14.6%)
Information and communication machinery	73	(12.7%)	96	(27.4%)
Motor vehicles	52	(9.1%)	140	(40.0%)
Precision machinery	25	(4.4%)	10	(2.9%)
Internet-based services	135	(23.6%)	15	(4.3%)
Information service			11	(3.1%)
Media activities	14	(2.4%)	9	(2.6%)
Retail	230	(40.1%)	18	(5.1%)
Total	573		350	

Table 2. The Distribution of Firms in Japan and Korea by Numbaer of Employee

Industry	Japan						Korea					
	Number od Employee						Number of Employee					
	50-99	100-299	300-499	500-999	1000-	Total	50-99	100-299	300-499	500-999	1000-	Total
Manufacturing	25	63	31	32	43	194	42	180	31	30	14	297
Information related services	43	59	13	17	17	149	5	22	3	0	5	35
Retail	43	80	42	40	25	230	0	11	1	0	6	18
Total	111	202	86	89	85	573	47	213	35	30	25	350

Table 3-1 Estimation results of production function (all firms in Japan and Korea)

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
Average score (all scores)	0.011		0.008		0.029		0.022		0.014		0.01	
	[0.860]		[0.609]		[0.683]		[0.511]		[1.266]		[0.874]	
Dummy			0.022				0.054				0.031	**
			[1.528]				[1.398]				[2.444]	
lnK	0.036	***	0.035	***								
	[4.676]		[4.581]									
lnL	0.149	***	0.15	***	0.014		0.016		0.005		0.007	
	[10.159]		[10.147]		[0.885]		[1.024]		[1.070]		[1.305]	
lnM	0.817	***	0.817	***								
	[67.587]		[67.688]									
ln(K/L)					0.127	***	0.126	***				
					[6.985]		[6.848]					
ln(M/L)					0.367	***	0.368	***				
					[11.993]		[12.030]					
Constant	2.142	***	2.144	***	0.856	***	0.846	***	-0.076	*	-0.077	*
	[14.009]		[13.972]		[5.149]		[5.091]		[-1.793]		[-1.749]	
Observations	866		866		857		857		846		846	
R2	0.998		0.998		0.986		0.986		0.016		0.024	
Adusted-R2	0.998		0.998		0.986		0.986		-0.002		0.005	
F value	59189.6		55365.2		4142.8		3934.7		1.9		2.2	

Note 1. Robust t statistics in brackets.

2. Dummy variables for country × industry are included in the regression, but the estimates of the coeffiicients are not reported here.

3. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3-2 Estimation results using average score with respect to organizational capital (all firms in Japan and Korea)

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
Average score (organizational capital)	-0.006		-0.01		-0.015		-0.025		0.008		0.003	
	[-0.498]		[-0.833]		[-0.417]		[-0.669]		[0.771]		[0.272]	
Dummy			0.026	*			0.063				0.032	**
			[1.750]				[1.628]				[2.513]	
lnK	0.036	***	0.036	***								
	[4.737]		[4.641]									
lnL	0.15	***	0.151	***	0.018		0.02		0.006		0.007	
	[10.294]		[10.290]		[1.167]		[1.324]		[1.269]		[1.508]	
lnM	0.817	***	0.818	***								
	[67.432]		[67.575]									
ln(K/L)					0.128	***	0.127	***				
					[7.046]		[6.909]					
ln(M/L)					0.368	***	0.369	***				
					[12.027]		[12.073]					
Constant	2.162	***	2.165	***	0.935	***	0.927	***	-0.069		-0.069	
	[14.307]		[14.268]		[5.707]		[5.659]		[-1.605]		[-1.542]	
Observations	866		866		857		857		846		846	
R2	0.998		0.998		0.986		0.986		0.015		0.023	
Adusted-R2	0.998		0.998		0.986		0.986		-0.003		0.004	
F value	58621.3		54755.9		4109.1		3913.4		1.8		2.2	

Note 1. Robust t statistics in brackets.

2. Dummy variables for country × industry are included in the regression, but the estimates of the coeffiicients are not reported here.

3. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 3-3 Estimation results using average score with respect to human capital (all firms in Japan and Korea)

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
Average score (human capital)	0.028	**	0.027	**	0.075	**	0.073	**	0.015	*	0.014	
	[2.319]		[2.260]		[2.190]		[2.148]		[1.668]		[1.534]	
Dummy			0.022				0.054				0.032	**
			[1.528]				[1.391]				[2.511]	
lnK	0.036	***	0.035	***								
	[4.726]		[4.624]									
lnL	0.147	***	0.148	***	0.006		0.008		0.005		0.006	
	[10.004]		[9.993]		[0.429]		[0.533]		[0.955]		[1.131]	
lnM	0.816	***	0.816	***								
	[68.284]		[68.364]									
ln(K/L)					0.127	***	0.126	***				
					[7.026]		[6.878]					
ln(M/L)					0.366	***	0.367	***				
					[11.978]		[12.004]					
Constant	2.122	***	2.121	***	0.798	***	0.779	***	-0.127	***	-0.132	***
	[13.830]		[13.790]		[5.134]		[5.003]		[-2.743]		[-2.841]	
Observations	866		866		857		857		846		846	
R2	0.998		0.998		0.986		0.986		0.017		0.026	
Adusted-R2	0.998		0.998		0.986		0.986		-0.001		0.007	
F value	59760.2		56037.4		4255.8		4044.4		2		2.3	

Note 1. Robust t statistics in brackets.

2. Dummy variables for country × industry are included in the regression, but the estimates of the coeffiicients are not reported here.

3. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 3-4 Estimation results using the first pricipal factor as an explanatory variable (all firms in Japan and Korea)

	lnY				ln(Y/L)				lnTFP (Tornqvist index)		
The first pricipal factor	0.002		0.001		0.006		0.004		0.003	0.002	
	[0.768]		[0.483]		[0.635]		[0.437]		[1.252]	[0.815]	
Dummy			0.023				0.054			0.031	***
			[1.533]				[1.397]			[2.434]	
lnK	0.036	***	0.035	***							
	[4.679]		[4.585]								
lnL	0.149	***	0.15	***	0.014		0.016		0.005	0.007	
	[10.167]		[10.154]		[0.904]		[1.048]		[1.079]	[1.325]	
lnM	0.817	***	0.817	***							
	[67.570]		[67.676]								
ln(K/L)					0.127	***	0.126	***			
					[6.989]		[6.853]				
ln(M/L)					0.367	***	0.368	***			
					[11.994]		[12.032]				
Constant	2.168	***	2.161	***	0.928	***	0.899	***	-0.04	-0.053	
	[14.588]		[14.582]		[6.391]		[6.193]		[-0.899]	[-1.158]	
Observations	866		866		857		857		846	846	
R2	0.998		0.998		0.986		0.986		0.016	0.024	
Adusted-R2	0.998		0.998		0.986		0.986		-0.002	0.005	
F value	59116.1		55281.4		4136.4		3929.2		1.9	2.2	

Note 1. Robust t statistics in brackets.

2. Dummy variables for country × industry are included in the regression, but the estimates of the coeffiicients are not reported here.

3. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 4-1 Estimation results of the production function by country

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
	Japan		Korea		Japan		Korea		Japan		Korea	
Average score (all scores)	-0.012		0.009		-0.045		0.009		-0.01		0.009	**
	[-0.757]		[1.477]		[-1.222]		[1.477]		[-0.670]		[2.063]	
Dummy	0.029	*	-0.015		0.052		-0.015		0.034	**	-0.004	
	[1.898]		[-0.788]		[1.606]		[-0.788]		[2.500]		[-0.277]	
lnK	0.03	***	0.032	**								
	[4.836]		[2.023]									
lnL	0.191	***	0.132	***	0.009		0.0228	*	0.008		0.017	*
	[14.711]		[5.549]		[0.694]		[1.959]		[1.407]		[1.921]	
lnM	0.779	***	0.858	***								
	[69.427]		[41.16]									
ln(K/L)					0.067	***	0.0323	**				
					[5.012]		[2.023]					
ln(M/L)					0.467	***	0.858	***				
					[19.086]		[41.16]					
Constant	0.979	***	1.505	***	0.603	***	1.505	***	-0.076		-0.105	**
	[17.819]		[7.056]		[4.379]		[7.056]		[-1.436]		[-2.114]	
Observations	520		349		520		349		510		340	
R2	0.991		0.983		0.832		0.954		0.018		0.083	
Adjusted-R2	0.991		0.983		0.829		0.952		0		0.058	
F value	6026.6		1491		256.6		379		1.8		3	

Note 1. Robust t statistics in parentheses.

2. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 4-2 Estimation results using the first pricipal factor as an explanatory variable by country

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
	Japan		Korea		Japan		Korea		Japan		Korea	
The first pricipal factor	-0.004		0.009		-0.012		0.01	*	-0.002		0.008	**
	[-1.012]		[1.477]		[-1.455]		[1.742]		[-0.681]		[2.063]	
Dummy	0.03	*	-0.015		0.054	*	-0.013		0.035	**	-0.004	
	[1.964]		[-0.788]		[1.685]		[-0.661]		[2.534]		[-0.277]	
lnK	0.03	***	0.032	**								
	[4.847]		[2.023]									
lnL	0.192	***	0.132		0.009		0.024	**	0.008		0.017	*
	[14.722]		[5.549]		[0.758]		[1.991]		[1.414]		[1.921]	
lnM	0.779	***	0.858									
	[69.449]		[41.16]									
ln(K/L)					0.067	***	0.033	**				
					[5.026]		[2.103]					
ln(M/L)					0.467	***	0.85	***				
					[19.109]		[39.44]					
Constant	0.944	***	1.505		0.475	***	1.595	***	-0.111	**	-0.105	**
	[21.076]		[7.056]		[4.257]		[7.233]		[-2.449]		[-2.114]	
Observations	520		349		520		342		510		340	
R2	0.991		0.983		0.833		0.952		0.018		0.083	
Adjusted-R2	0.991		0.983		0.829		0.95		0		0.058	
F value	6014.1		1491		256.4		364		1.8		3	

Note 1. Robust t statistics in parentheses.

2. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 5-1 Estimation results of production function (all firms in the manufacturing sector in Japan and Korea)

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
Average score (all scores)	0.021		0.019		0.051		0.048		0.01		0.008	
	[1.620]		[1.462]		[0.796]		[0.744]		[0.939]		[0.734]	
Dummy			0.014				0.023				0.014	
			[0.906]				[0.412]				[1.197]	
lnK	0.017		0.016									
	[0.980]		[0.942]									
lnL	0.153	***	0.153	***	0.045	*	0.046	*	0.024	***	0.024	***
	[6.856]		[6.854]		[1.742]		[1.758]		[5.463]		[5.527]	
lnM	0.846	***	0.846	***								
	[47.292]		[47.132]									
ln(K/L)					0.194	***	0.193	***				
					[4.327]		[4.290]					
ln(M/L)					0.292	***	0.293	***				
					[6.178]		[6.177]					
Constant	1.801	***	1.803	***	4.758	***	4.76	***	-0.175	***	-0.173	***
	[10.396]		[10.368]		[8.436]		[8.420]		[-4.185]		[-4.049]	
Observations	473		473		465		465		460		460	
R2	0.999		0.999		0.982		0.982		0.092		0.095	
Adusted-R2	0.999		0.999		0.982		0.982		0.074		0.075	
F value	77651.4		71707.9		4655.9		4402.8		5.1		5.4	

Note 1. Robust t statistics in brackets.

2. Dummy variables for country × industry are included in the regression, but the estimates of the coeffiicients are not reported here.

3. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 5-2 Estimation results using average score with respect to human capital (all firms in the manufacturing sector in Japan and Korea)

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
Average score (human capital)	0.028	**	0.027	**	0.085	*	0.084	*	0.01		0.01	
	[2.093]		[2.053]		[1.807]		[1.788]		[1.314]		[1.205]	
Dummy			0.015				0.024				0.014	
			[0.982]				[0.432]				[1.243]	
lnK	0.017		0.017									
	[1.002]		[0.961]									
lnL	0.151	***	0.151	***	0.038		0.038		0.024	***	0.024	***
	[6.816]		[6.814]		[1.486]		[1.492]		[5.453]		[5.479]	
lnM	0.846	***	0.846	***								
	[47.630]		[47.472]									
ln(K/L)					0.194	***	0.193	***				
					[4.356]		[4.315]					
ln(M/L)					0.293	***	0.294	***				
					[6.206]		[6.197]					
Constant	1.8	***	1.8	***	4.737	***	4.736	***	-0.172	***	-0.172	***
	[10.459]		[10.441]		[8.552]		[8.534]		[-4.190]		[-4.125]	
Observations	473		473		465		465		460		460	
R2	0.999		0.999		0.982		0.983		0.093		0.097	
Adusted-R2	0.999		0.999		0.982		0.982		0.075		0.077	
F value	77780.8		71978.9		4765		4503.4		5.1		5.5	

Note 1. Robust t statistics in brackets.

2. Dummy variables for country × industry are included in the regression, but the estimates of the coeffiicients are not reported here.

3. * significant at 10%; ** significant at 5%; * significant at 1%.**

Table 5-3 Estimation results of the production function in the manufacturing sector by country

	lnY				ln(Y/L)				lnTFP (Tornqvist index)			
	Japan		Korea		Japan		Korea		Japan		Korea	
Average score (all scores)	0.016		0.037	*	0.013		0.037	*	0.014		0.019	
	[0.882]		[1.770]		[0.292]		[1.770]		[0.891]		[1.248]	
Dummy	0.007		-0.033		-0.015		-0.033		0.01		-0.01	
	[0.416]		[-1.391]		[-0.342]		[-1.391]		[0.615]		[-0.705]	
lnK	0.020	*	0.009									
	[1.662]		[0.393]									
lnL	0.188	***	0.15	***	0.036	*	0.027	*	0.027	***	0.018	**
	[8.130]		[4.771]		[1.889]		[1.854]		[5.162]		[2.337]	
lnM	0.808	***	0.868	***								
	[53.049]		[36.01]									
ln(K/L)					0.064	*	0.009					
					[1.938]		[0.393]					
ln(M/L)					0.524	***	0.868	***				
					[15.920]		[36.01]					
Constant	0.721	***	1.535	***	-0.059		1.535	***	-0.254	***	-0.155	***
	[13.773]		[6.036]		[-0.390]		[6.036]		[-5.204]		[-3.347]	
Observations	180		296		180		296		177		287	
R2	0.997		0.981		0.898		0.949		0.18		0.059	
Adjusted-R2	0.997		0.981		0.893		0.947		0.151		0.039	
F value	11471		1336		167		346		7.1		2	

Note 1. Robust t statistics in parentheses.

2. * significant at 10%; ** significant at 5%; * significant at 1%.**

Figure 1 – 1 Distribution of Management Scores (All firms)

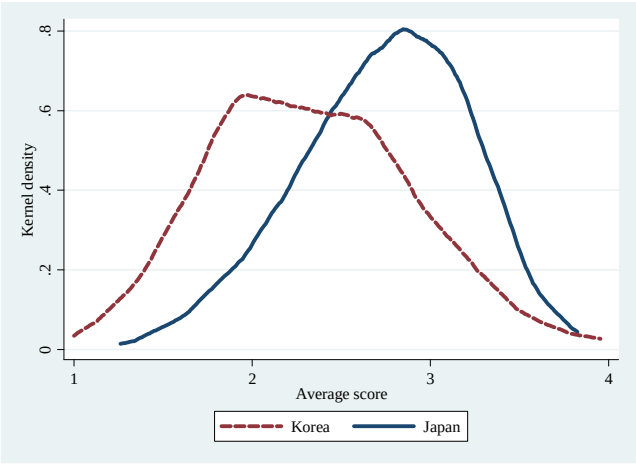


Figure 1 – 2 Distribution of Management Scores (Manufacturing firms)

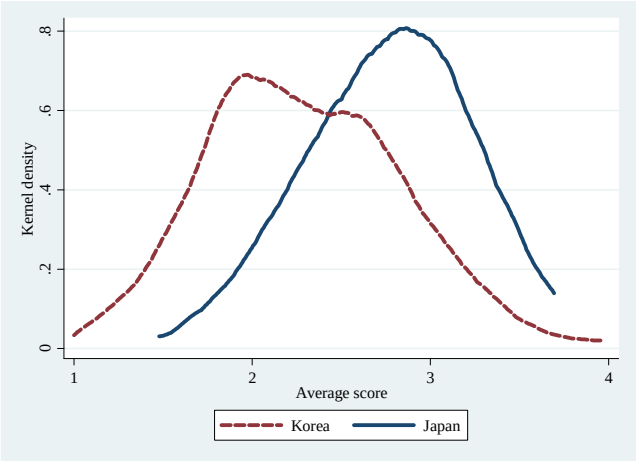


Figure 1 – 3 Distribution of Management Scores (Information-related firms)

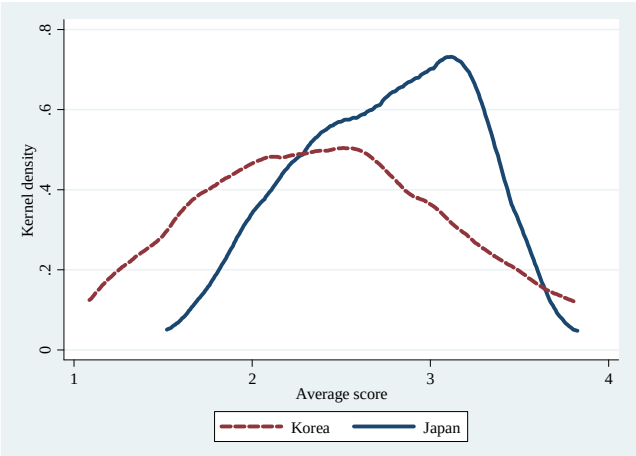


Figure 1 – 4 Distribution of Management Scores (Retail firms)

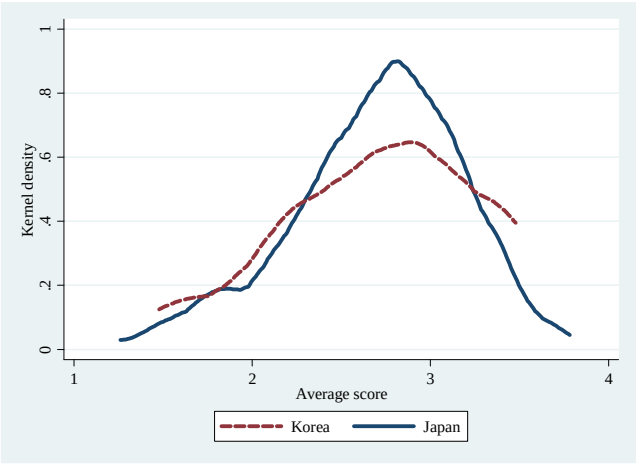


Figure 2 – 1 Distribution of Management Scores in Organizational Capital (All firms)

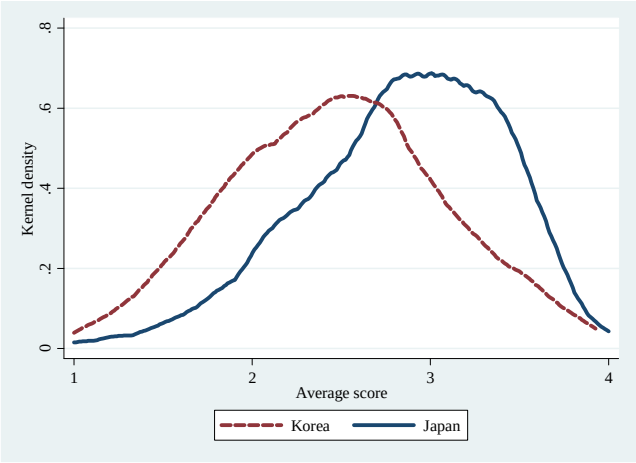


Figure 2 – 2 Distribution of Management Scores in Organizational Capital (Manufacturing firms)

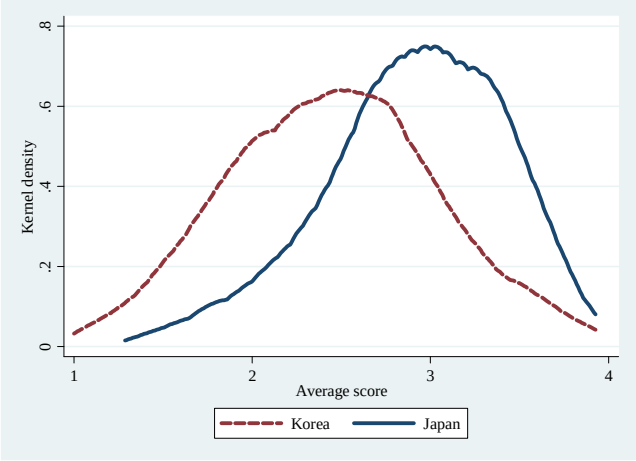


Figure 2 – 3 Distribution of Management Scores in Organizational Capital (Information-related firms)

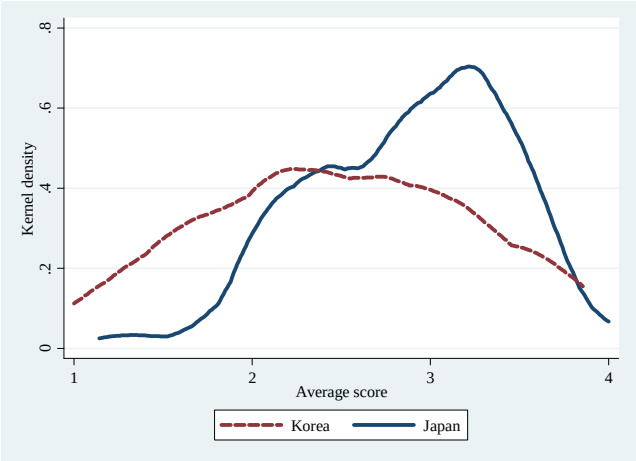


Figure 2 – 4 Distribution of Management Scores in Organizational Capital (Retail firms)

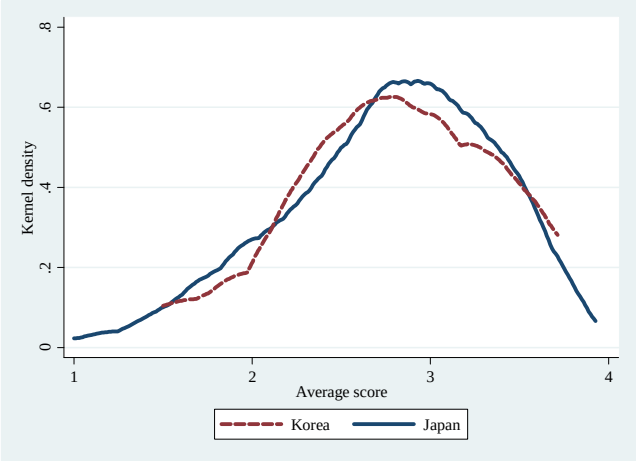


Figure 3 – 1 Distribution of Management Scores in Human Capital (All firms)

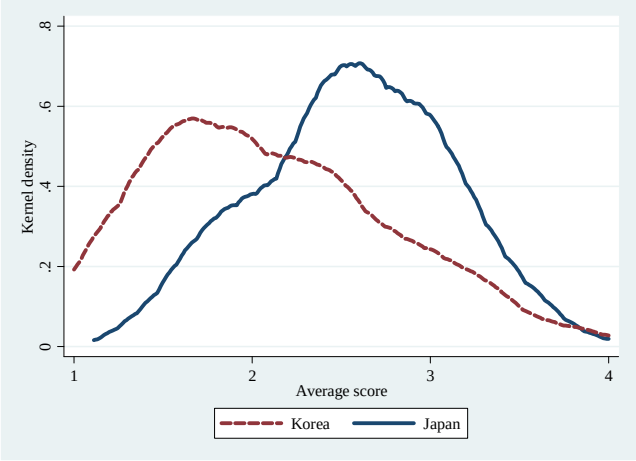


Figure 3 – 2 Distribution of Management Scores in Human Capital (Manufacturing firms)

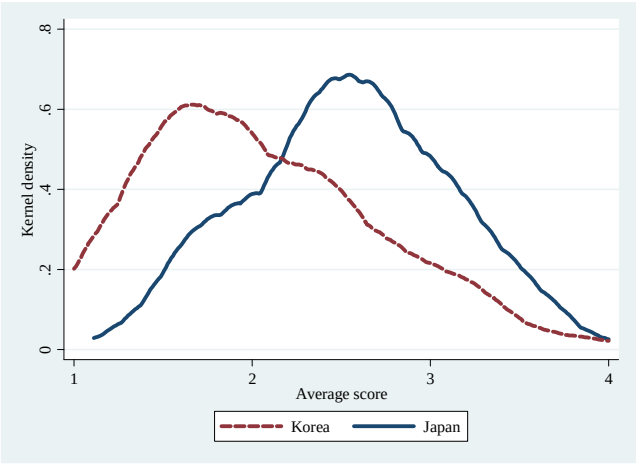


Figure 3 – 3 Distribution of Management Scores in Human Capital (Information-related firms)

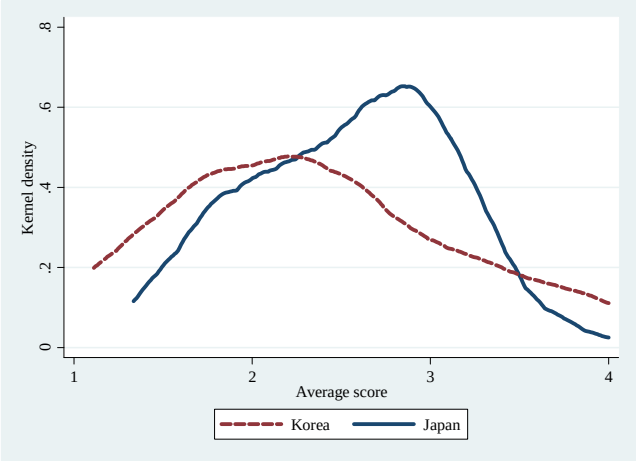


Figure 3 – 4 Distribution of Management Scores in Human Capital (Retail firms)

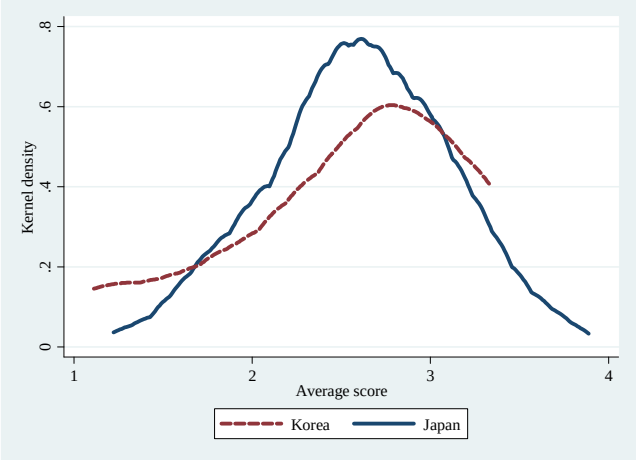


Figure 4 – 1 Distribution of Total Scores of Firms with 300 or More Employees (All firms)

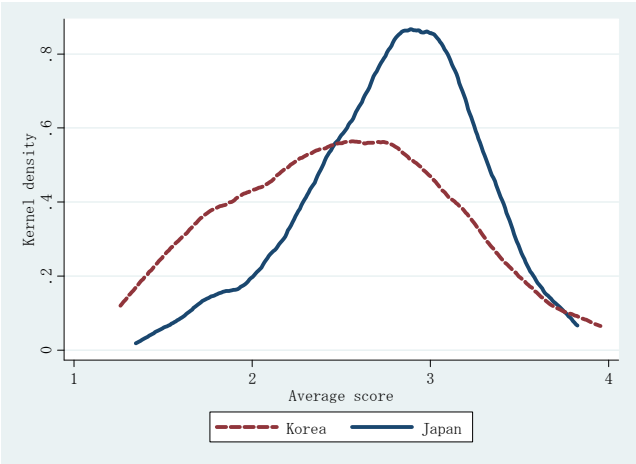
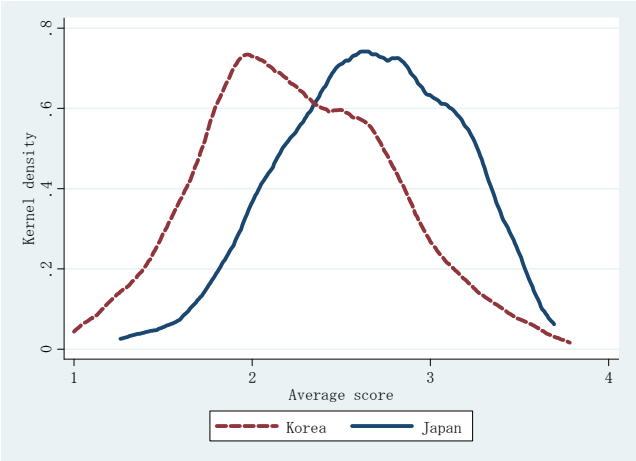


Figure 4 – 2 Distribution of Total Scores of Firms with Fewer than 300 Employees (All firms)



Appendix 1. Questionnaire

About the scoring **Quantitative accompanying information**

1. Permeation of management principles (vision)

2 Does your company have management principles that it has upheld for many years?

3 What kind of schemes are in place to have those management principles shared by all employees? (For example, announcing them at the morning assembly, or making them portable by writing them on cards or such like.)

4 Are the management principles also supported by parties such as external partners or the shareholders?

2. Implementation of organizational goals

2 Are there specific numerical goals on multiple levels that go beyond being just a vision or a slogan, regardless of the level of the goals (such as company-wide or divisional or sectional goals)?

3 Are the goals of each division adjusted in each division to ensure consistency between divisions?

4 Is consistency maintained between these goals and the goals of the management principles or of the long-term company-wide goals?

2-1. Implementation of organizational goals (setting target levels)

2 For example, are the settings for the divisional or sectional target levels simply given to you from the division or section above you? Or are they given to you while considering the opinions of your division or section?

3 Are the target levels appropriately set as non-binding chanllenges?

4 Are target levels checked to ensure there is fairness between divisions or sections? Please give an example of how they are checked. ( )

2-2. Implementation of organizational goals (permeation of goals)

2 Do all employees know about the goals?

3 If goals exist on various levels (such as company-wide, divisional and sectional goals), do all employees understand the level of priority of the goals? ( )

4 Do all employees accept the target levels? Please give an example if possible. ( )

2-3. Implementation of organizational goals (degree to which goals are achieved, checks on performance)

2 Are checks made to see how far goals have been achieved? Please give an example of how such checks are made. ( )

3 Are such checks made on a periodic basis rather than being made as necessary? And how frequently are such checks made? ( )

4 Are additional checks made that are decided by the section or department involved itself, rather than just being fixed checks?

2-3-1. Implementation of organizational goals (permeation of degree to which goals are achieved, and results of checks on performance)

2 Are the results of such checks made openly available within your division?

3 Are the results of such checks made openly available within not only your division but also between relevant divisions?

4 Are adjustments made to ensure that the degree to which goals have been achieved at different divisions is fairly compared? (for example, utilizing common scales such as overtime hours?)

2-3-2. Implementation of organizational goals (results of checks - handling when goals have not been achieved)

2 Is a meeting consisting of managerial staff and employees promptly held as soon as it is known that the goals were not achieved?

3 After investigations, are points to revise spread throughout the division, and are measures for handling the failure to achieve the goals promptly implemented? (In this case, exclude personnel matters.)

4 Are problematic issues and countermeasures made thoroughly known throughout the relevant division, and if necessary, other divisions? Please give an example if possible.
( )

2-3-3. Implementation of organizational goals (results of checks - handling when goals have been achieved)

2 When goals are achieved are investigations made so that those goals renewed on a continuous basis or so that higher goals are set?

3 How long is it between the setting of higher goals and the operation / implementation of those goals?

4 Are these measures institutionalized on a company-wide level?

3. Non-stylized communication within the organization

2 Are measures and activities other than stylized meetings used to increase informal communication? (for example, informal meetings consisting only of key personnel)? Please give an example. ( )

3 Are informal meetings held between divisions?

4 Are informal meetings held with persons of various ranks?

4. Implementation of organizational reform

2 Has your company undergone any organizational reforms in the last ten years? When did it occur? ( )

3 Did your company use a consulting company at that time? How much did it cost? ( )

4 Did you determine the results of the reform in a quantified manner? By what percentage did profits increase or by what percentage were costs reduced?
( )

4-1. Period of organizational reform or strategic change

2 Did it take time to implement the organizational reform over one year? How many years were spent including preparation period?
( )

3 Why was the organizational reform necessary? Was is to do with the leadership of the top management?

4 During the organizational reform, did the mid-level management also strive to achieve the reform, thereby giving a sense of unity in the company?

4-2. Scope of the effects of organizational reform

2 Were the effects of the reform shown in the divisions or sections? If they were, please give an example of the effects.
（Write the example here）

3 Were the effects of the reform shown between divisions, and not just within one division? If they were shown between divisions, please give an example of the effects.
( )

4 Were the effects of the reform shown between the company and the business partners, and not just within the company? If they were, please give an example of the effects.
( )

4-3. Details of the organizational reform (delegation of authority)

When a company undergoes organizational reform, sometimes the employees' decision-making authority is also revised. In the case of your company,

2 Was decision-making authority given to those in a lower position as a result of the organizational reform?

3 Were posts simplified in conjunction with decision-making authority being given to those in a lower position?

4 As a result, was there a change in the details of the job or the way of doing the job? Please give an example. (　　)

4-4. Details of the organizational reform (IT activities)

2 Did the IT system make your company more streamlined, for example by reducing the amount of paper-based documentation ?

3 In the last decade, did your company launch organizational reform, rather than raise business efficiency, by utilizing the IT system ?

4 Did an opportunity to earn new profits arise as a result of the organizational reform by the organizational reform baseo on the IT system? Please give an example. (　　)

5. Promotion system

2 Does your company mainly have a performance-based promotion system?

3 If the promotion system is mainly a performance-based one, does your company have a management-by-objectives system? If it does, when did that system begin?

4 Did the performance of the employees improve as a result of using the management-by-objectives system and introducing a performance-based promotion system?

6. Schemes to improve motivation

2 Are there any schemes other than promotion-related or pay-related systems to increase the motivation of the employees? Please give an example. (　　)

3 Is that scheme used on an institutional basis throughout the company?

4 Do you monitor when the employees' motivation, retention rate or job performance increases as a result of such scheme?

7. Handling employees that perform poorly

2 Are they handled in some specific way other than by giving them oral warnings?

3 Does that handling include measures that are implemented faster than the average term of office?

4 Are the measures implemented as soon as a problem is confirmed (before a routine rotation) ?

8. Handling employees that perform well

2 Is it made clear within the division that the employee's performance is good, for example by management praising employees at meetings?

3 Is there a system to connect good performance to things such as financial reward or promotion?

4 Was the motivation of the employees raised through introducing such system?

9. Securing good manpower

2 Can you identify the high perfomance and core employees, mentioned in the question 9, in your company? Please give an example. (　　)

3 Such excellent employees are treated well comparede with ordinary employees? If so, how they are treated? (　　)

4 Could you prevent the loss of such excellent employees?

10. Evaluating the interpersonal skills of the managers

2 Do the managers give clear criteria such as the degree to which persons of a lower position should be nurtured?

3 Is there an incentive system, such as a pay-related or promotion-related system, to reward managers that have nurtured excellent staff of a lower position?

4 Did the motivation of the managers increase as a result of introducing such system?

11. Nurturing human resources through training

2 Is there training on an occupational ability basis or an assignment basis, aiming to improve the work skills of the employees? Over the course of one year, on average how long is spent on training? ( )
(Training on an occupational ability basis means training in specialist capabilities that are required in each field, such as management, business, research and development, and manufacturing. Assignment-based training means training in areas such as languages, OA, computing, and acquisition of official certifications.)

3 Do those training activities help to improve business results? Please give an example. ( )

4 Are the effects of those training activities adaptable to other companies?

12. Nurturing human resources through OJT

2 Is OJT performed on a daily basis? What percentage of the supervisor's working time is spent on giving instructions to those in a lower position? ( )

3 Does OJT contribute to business results? Please give an example. ( )

4 Are the effects of OJT monitored? Please give an example of the methods used. ( )

13. Employees' expertise

2 Are employees rotated in a fixed schedule, such as once every two or three years?

3 To improve the expertise of the employees, are they assigned to a set position for a long time?

4 Is there a systematic program in place to ensure the employees acquire some expertise?

Appendix 2 The results of principal component analysis

Questions	Japan		Korea	
	1st component	2nd component	1st component	2nd component
q1	0.19	0.11	0.17	0.16
q2	0.24	0.12	0.20	0.19
q2_1	0.19	0.06	0.17	0.10
q2_2	0.23	0.13	0.25	0.24
q2_3	0.23	0.15	0.20	0.25
q2_3_1	0.19	0.17	0.19	0.22
q2_3_2	0.24	0.23	0.25	0.22
q2_3_3	0.19	0.15	0.20	0.15
q3	0.19	0.04	0.23	0.01
q4	0.24	-0.41	0.19	-0.46
q4_1	0.29	-0.44	0.20	-0.41
q4_2	0.27	-0.38	0.24	-0.34
q4_3	0.22	-0.20	0.20	-0.20
q4_4	0.26	-0.30	0.24	-0.36
q5	0.14	0.15	0.25	0.05
q6	0.21	0.17	0.20	0.01
q7	0.18	0.07	0.22	0.02
q8	0.18	0.22	0.19	0.04
q9	0.13	0.08	0.22	-0.07
q10	0.20	0.14	0.20	0.08
q11	0.18	0.19	0.19	0.02
q12	0.18	0.10	0.20	0.03
q13	0.12	0.05	0.18	0.08