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Skills and Wages of Public Employees: Investigating Korean Bureaucracy through PIAAC

M. Jae Moon, Ju-Ho Lee, Jin Park, Jieun Chung, Junghee Choi

Abstract

Korea's public employees have made significant contributions to the country's rapid economic growth and social development. In recent years, however, there has been growing concern that the competitiveness of Korea's public employees is lagging behind Korea's private sector employees as well as the public employees of other countries. We use the OECD PIAAC (Program for the International Assessment of Adult Competencies) data to empirically analyze Korean public employees' skill level, skill-use, and learning, with emphasis on comparison with public employees of OECD countries and the domestic private sector. Also, we analyze the skill-wage gap and the returns to skills of public employees to observe whether the wage system of public employees provides sufficient incentives for human capital investment.

I. Introduction

Korea's public employees have made significant contributions to the country's rapid economic growth and social development. In recent years, however, there has been growing concern that the competitiveness of Korea's public employees is lagging behind Korea's private sector as well as the public employees of other countries. In the 1960's, Korea pursued a government-led model of growth in which the public sector, with relatively more skilled workers than the private sector, played an active and leading role in the economic development process. However, as market liberalization and political democratization took place since the 1980's, Korea's public sector has been criticized for deterring the development of the private sector through excessive regulations and government control. Additionally, since the 2000's, the public sector has been criticized as 'weak' for its inability to successfully pursue important reform agendas deemed crucial for the long-term development of the country.

We use the OECD PIAAC (Program for the International Assessment of Adult Competencies) database to empirically analyze Korean public employees' skill level, skill-use, and learning, with emphasis put on comparison with public employees of OECD countries and the domestic private sector. Also, in order to observe whether the wage system of public employees provides sufficient incentives for human capital investment, the returns to skills and skill-wage gap is analyzed. These analyses are followed by policy implications for Korea's public sector reform.

This paper is organized as follows. Section 2 introduces the data used for empirical analyses. By using the PIAAC database, Section 3 empirically analyzes Korean public employees' skill level and Section 4 empirically analyzes Korean public employees' skill-use and learning, with the analyses centered on international comparison and comparison with the domestic private sector. Section 5 discusses the problems of Korean public employees' lack of incentives for human capital investment by comparing the public employees' returns to skills and skill-wage gap with those of other OECD countries. Section 6 concludes by summarizing the empirical results of the previous chapters and suggesting policy implications.

II. The PIAAC Data

The main data source we use is the OECD PIAAC, developed and collected by the OECD between 2011 and 2012. PIAAC provides internationally comparable data on the key information-processing skills of the adult population aged between 16 and 65. Such skills are considered essential for processing and utilizing information in a variety of social contexts in today's information society, including education, training, and the workplace. In addition to the level of skill, PIAAC also contains information on level of education, occupation, and wage, as well as data on the use of various skills. The minimum sample size for each country is 5,000 and the final sample size for Korea is 6,667 (OECD, 2013). A total of 24 countries participated in PIAAC, among which 22 are OECD members[1] and are included in our research.

Designed to allow for international comparison, PIAAC assesses numeracy, literacy, and problem solving in technology-rich environment (PSTRE) on a 500-point scale. While the standard survey method is computer-based assessment, for those who lack computer experience the survey was conducted through the paper method and thus their PSTRE scores were not assessed.[2] The definition for each skill domain is as follows (OECD, 2013). Literacy refers to the ability to understand, evaluate, use and engage with written texts. Numeracy is the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage mathematical demands in various situations. Problem solving in technology-rich environment (PSTRE) is the ability to use digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks.

The main sample of this research is composed of full-time male workers, between the ages 25 and 65, working in either the public or private sector.[3] The public sector includes the

[1] The countries included in this research are the following OECD-member countries: Australia, Austria, Belgium (Flanders), Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherland, Norway, Poland, the Slovak Republic, Spain, Sweden, the United Kingdom, and the United States.

[2] On average for each country, 77.5% chose the computer method while 22.5% chose the paper method. For France, Italy, and Spain, the PSTRE scores were not assessed.

[3] In addition to the public and private sectors, PIAAC also includes those in the non-profit sector (religious groups, philanthropic institutions, etc.), but considering its unique nature and relatively small sample size (less than 2% among full-time workers), those in the non-profit sector were excluded from the sample.

central and regional governments, public corporations, and public schools and hospitals. Full-time worker refers to those who classify themselves as working 'full-time' and work more than 30 hours a week as paid employees. In order to maintain homogeneity of the sample and limit the effects of outliers, those that are self-employed or are at the top or bottom 1% of the wage distribution in their respective countries are excluded from the sample. To take into account college enrollment, the sample only contains those who are aged 25 and above, and considering the different labor market participation rates of Korean females for different age groups, only males were included in the sample.[4] Descriptive statistics are provided in Table 1 and Table 2.

Table 1. Descriptive Statistics: Returns to Skills of Public Employees

(a) All Countries

Variable	Obs.	Mean	Standard Dev.
Numeracy (Standardized)	30804	-0.089	1.037
Work Experience	30766	21.67	11.24
Public	30804	0.200	0.400

(b) Korea

Variable	Obs.	Mean	Standard Dev.
Numeracy (Standardized)	1313	-0.178	0.851
Work Experience	1313	15.82	10.06
Public	1313	0.167	0.373

Notes: Sample: Male, full-time employees of the public and private sector, aged 25-65. Full-time employees are those who report their work status as 'full-time' and work at least 30 hours a week. *Numeracy (Standardized)*: PIAAC Numeracy score standardized to have a mean of 0 and std. dev. of 1 across the entire international sample. *Work Experience:* Total years of work experience. *Public*: indicator dummy for the public sector.

[4] Analysis on the skills of female full-time employees is available in the Appendix.

Table 2. Descriptive Statistics: Skill-Wage Gap of Public Employees

(a) All Countries

Variable	Obs.	Mean	Standard Dev.
Numeracy (Standardized)	7401	-0.0476	1.006
Work Experience	7393	22.85	11.04
Education	7401	2.495	0.627
Parent's Education	7099	2.072	0.770
Books	7360	129.8	144.0
Computer-use	7396	0.970	0.169

(b) Korea

Variable	Obs.	Mean	Standard Dev.
Numeracy (Standardized)	232	-0.137	0.834
Work Experience	232	19.45	10.88
Education	232	2.669	0.560
Parent's Education	231	1.559	0.738
Books	232	101.3	125.1
Computer-use	232	0.961	0.194

Notes: Sample: Full-time male employees of the public sector, aged 25-65. Full-time employees are those who report their work status as 'full-time' and work at least 30 hours a week. *Numeracy (Standardized)*: PIAAC Numeracy score standardized to have a mean of 0 and std. dev. of 1 across the entire international sample. *Work Experience:* Total years of work experience. *Education*: highest education level of respondent (middle school graduate or below=1, high school graduate=2, college graduate or above=3). *Parent's Education*: highest education level of either mother or father (middle school graduate or below=1, high school graduate=2, college graduate or above=3). *Books*: number of books held in household at age 16. *Computer-use*: indicator dummy for whether or not respondent has computer-use experience.

III. The Skill Level of Korea's Public Employees

By using the PIAAC data, we compare the skill level of Korea's public employees with that of the employees of Korea's private sector and the public employees of other countries. The skill domains measured by PIAAC are cognitive skills and only represent a single dimension of the entire set of skills required by workers. Nonetheless, cognitive skills are shown to have a significant role in various socioeconomic outcomes, including labor, education, and health (Heckman et al., 2006). Also, as PIAAC measures internationally comparable key information-processing skills required in the information-based society, it can bring about meaningful implications for the skills of the adult population (Hanushek et al., 2015).

First, we compare the skill level of Korea's public employees with those of other countries. As shown in part (a) of Figure 1 and Figure 3, the numeracy, literacy, and PSTRE levels of Korean public employees are lower than the OECD public sector average levels. In the older

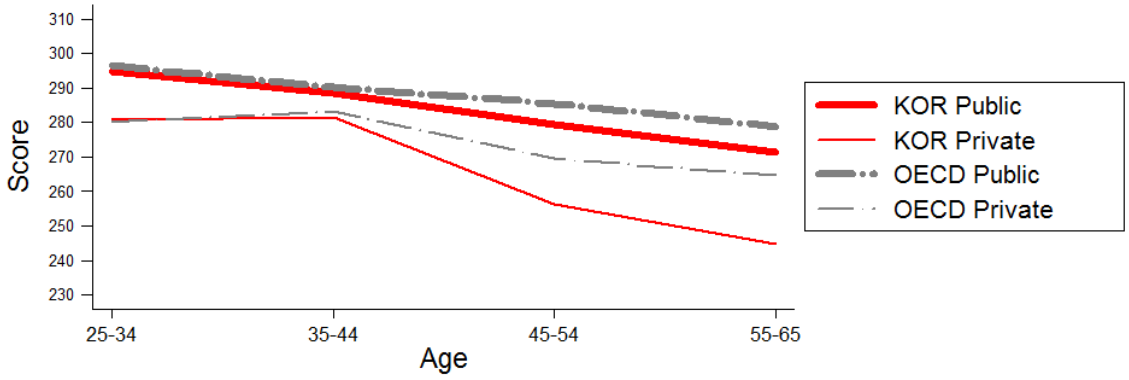
age groups, the difference between the numeracy level of Korean public employees and the OECD public sector average becomes widened, and with the exception of the 55-65 age group, the PSTRE levels of Korean public employees are significantly lower than the OECD public sector average.

In addition to the OECD public sector average levels, the skill level of Korea's public employees is compared with that of the public employees of four major countries: Germany, Japan, the United States, and the United Kingdom. These countries allow for regional comparison among Europe (Germany, the U.K.), North America (the U.S.) and Asia (Japan); political system comparison between the presidential system (the U.S.) and the parliamentary system (Germany, Japan, the U.K.); comparison of bureaucratic human resource systems between the positional classification system (the U.S.), rank system (Japan) and a mixture of the two systems (Germany, the U.K.). As shown in part (b) of Figure 1 and Figure 3, the skill level of Korean public employees is significantly lower than that of public employees of Germany, Japan and the U.K.

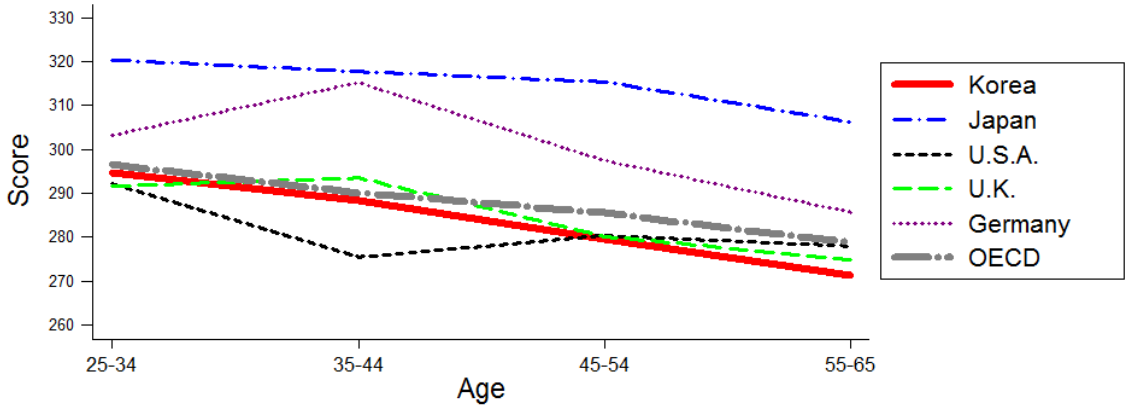
Compared to the public employees of the U.S., the skill level of Korea's public employees is higher for the 25-34 and 35-44 age groups, but lower for all other age groups. The fact that the skill level of Korea's public employees is lower than the OECD public sector average and also lower than that of public employees of major countries is very disappointing, especially when considering the fact that on the PISA (Program for International Student Assessment), an international academic assessment for 15 year-old students, Korean students rank at the very top.

Figure 1. PIAAC Numeracy Scores of the Male Full-time Employees

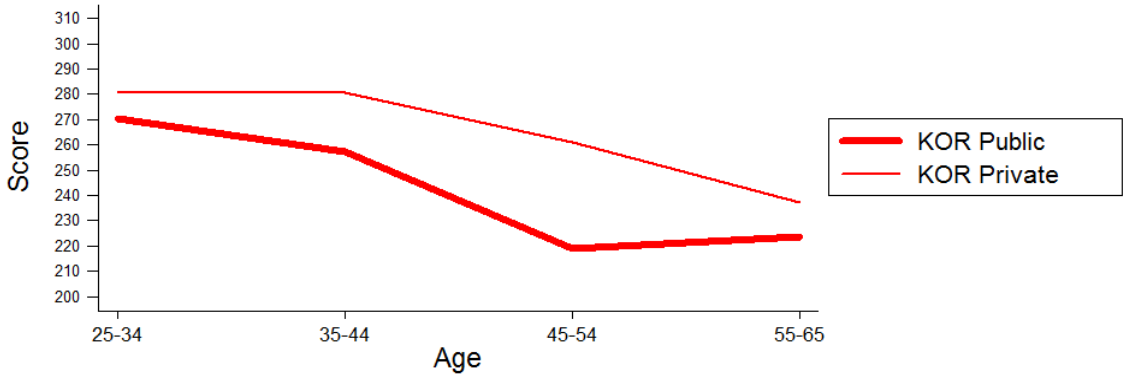
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



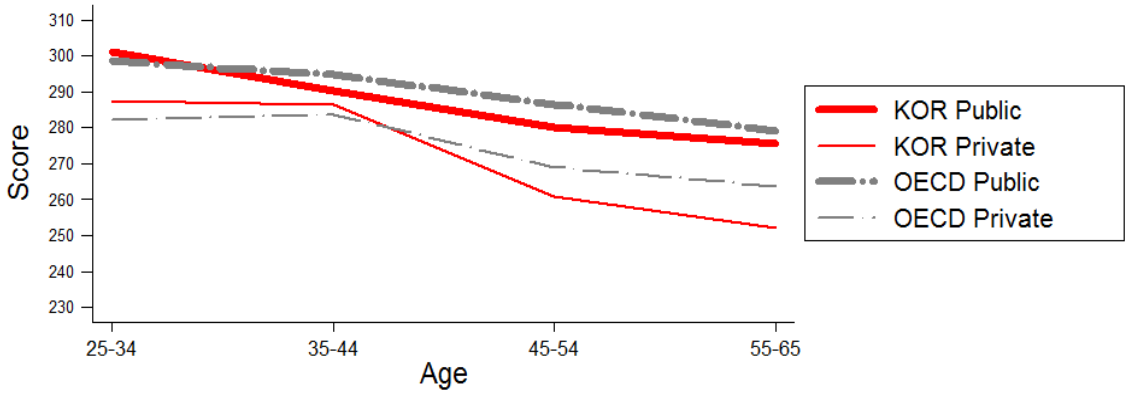
(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



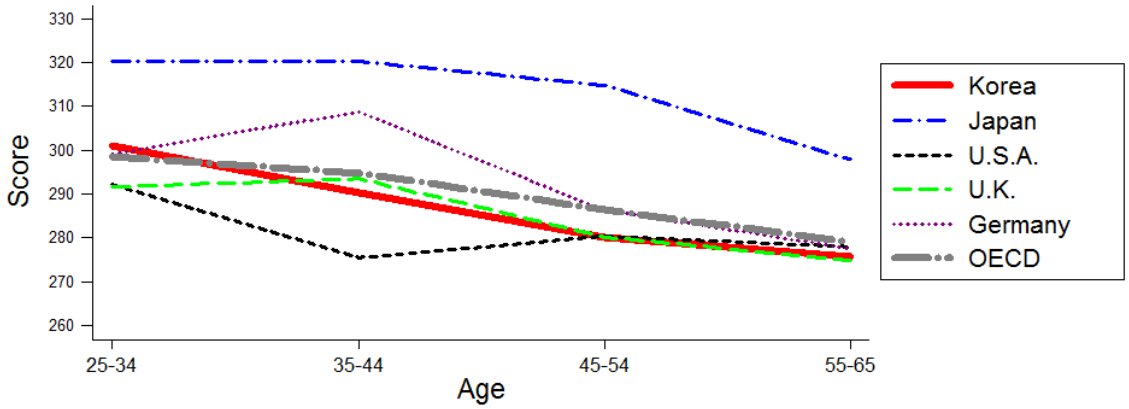
Source: PIAAC.

Figure 2. PIAAC Literacy Scores of the Male Full-time Employees

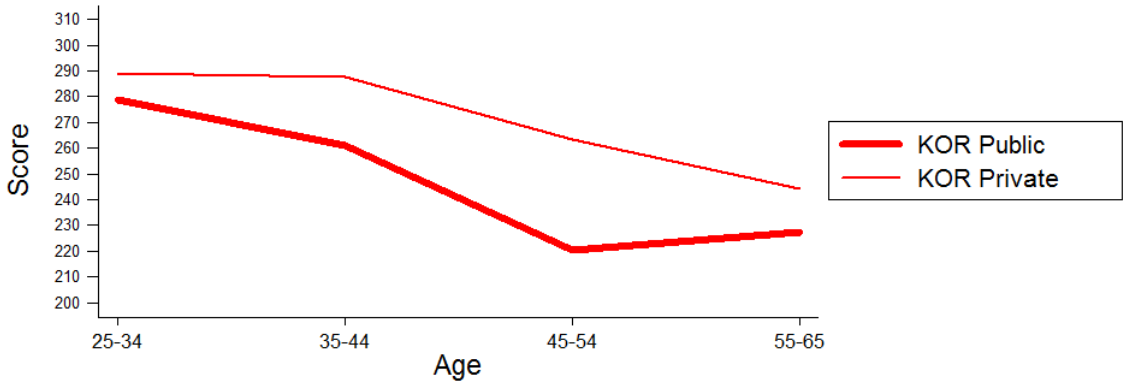
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



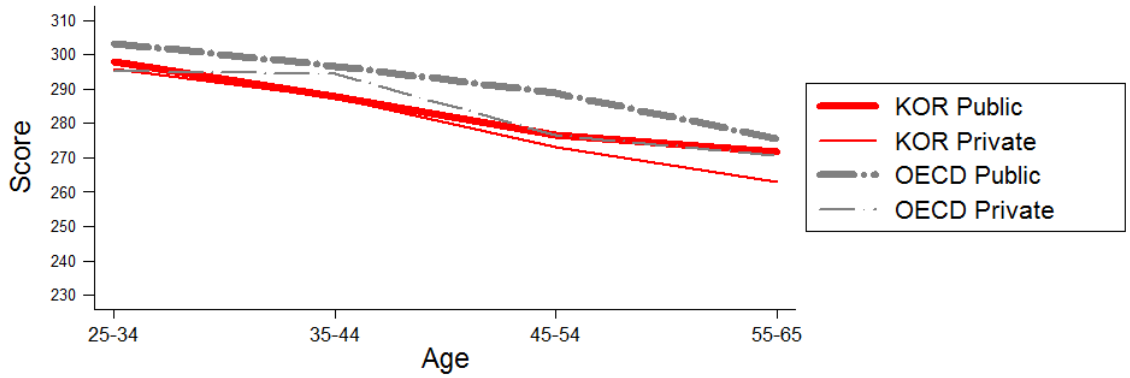
(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



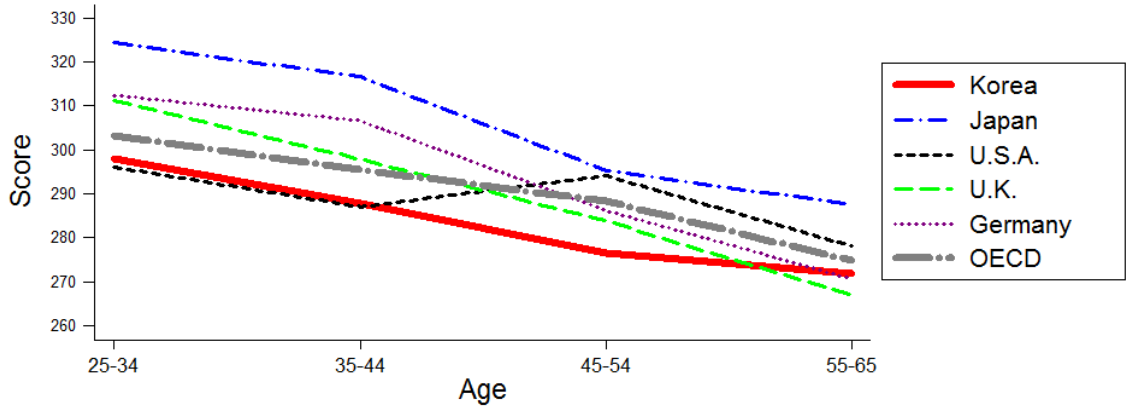
Source: PIAAC.

Figure 3. PIAAC PSTRE Scores of the Male Full-time Employees

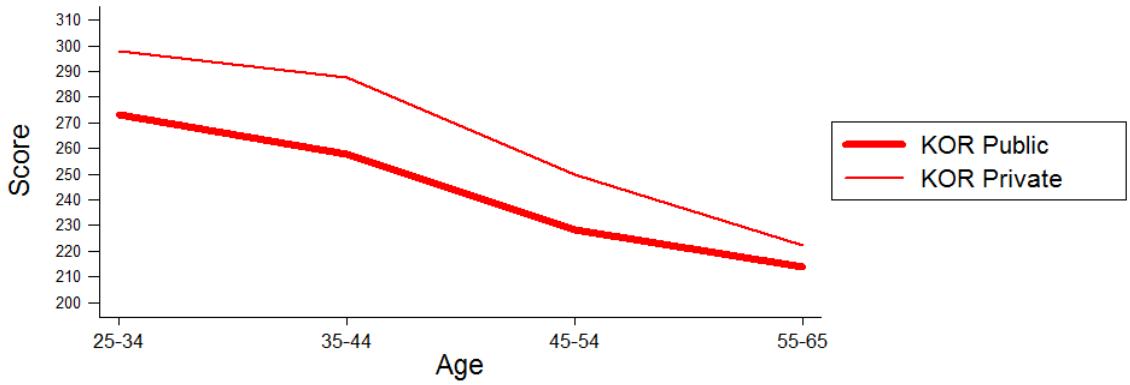
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



Source: PIAAC.

Next, we will compare the skill level of the employees of Korea's public and private sectors. As shown in part (a) of Figure 1 and Figure 2, the numeracy and literacy level of Korea's public employees is higher than those of their private sector counterparts. For the level of PSTRE, as shown in part (a) of Figure 3, although the scores of Korea's public employees are higher than that of Korea's private sector employees, the difference is marginal.

However, the difference in skills between Korea's public and private sectors may be due to the difference in distribution of occupations within each sector for the given sample. For this reason, a separate analysis is conducted after the reducing the sample to those whose occupations simultaneously exist for both the private and public sectors and assuming an identical distribution of occupations for the two sectors.[5] This was done by multiplying the average skill level of each occupation for each age group and sector with the median value of the proportions each occupation takes up in each age group and sector.[6] As shown in part (c) of Figure 1, Figure 2 and Figure 3, when assuming for identical distribution of occupations for the public and private sectors, the skill level of Korea's public employees is lower than their private sector counterparts in all three skill domains. In particular, the difference in skill level for numeracy and literacy is quite large for the 45-54 age group.

For analysis on the causes of such low skill levels of Korea's public employees, we

[5] When implementing this standard, the number of occupations becomes 33 (before: 40), the sample size becomes 1,241 (before: 1,313). The occupations only existing in the private sector and thus excluded from the sample are 'Hospitality, retail and other services managers' (11 persons), 'Information and communications technicians' (7 persons), 'Handicraft and printing workers' (9 persons), 'Food processing, wood working, garment and other craft and related trades workers' (8 persons), and 'Assemblers' (29 persons). The occupations only existing in the public sector and thus excluded from the sample are 'Commissioned armed forces officers' (2 persons) and 'Non-commissioned armed forces officers' (6 persons). The 2-digit occupation classification of the International Standard Classification of Occupations (ISCO) is used.

[6] For this analysis, only the plausible value 1 for each skill domain was used. The model used is as below.

$$\overline{y_{as}} = \sum_{j=1}^{n_j} (\overline{y_{jas}} \times w_{ja}) \qquad a = 2, \dots, 5 \quad s = s_1, s_2$$

$$w_{ja} = \frac{1}{2}\left(\frac{n_{jas_1}}{n_{as_1}} + \frac{n_{jas_2}}{n_{as_2}}\right) j = 1, \dots n_j \quad a = 2, \dots, 5$$

$$\overline{y_{jas}} = \frac{1}{n_{jas}}\left(\sum_{i=1}^{n_{jas}} y_{ijas}\right) \qquad j = 1, \dots, n_j \quad a = 2, \dots, 5 \quad s = s_1, s_2$$

$\bar{y}$ is the average skill level. i represents 'individual' and a represents 'age group' (age 25-34=2; age 34-44=3; age 45-54=4; age 55-65=5) j represents 'occupation' and s is the economic sector (s_1 =public, s_2=private).

observe two major factors. Considering the fact that skills are accumulated over one's lifetime through the use of skills and learning, the first factor is the levels of skill-use and learning of public employees. The second factor is how the wage system provides incentives for investment in human capital.

IV. Skill-use and Learning of Korea's Public Employees

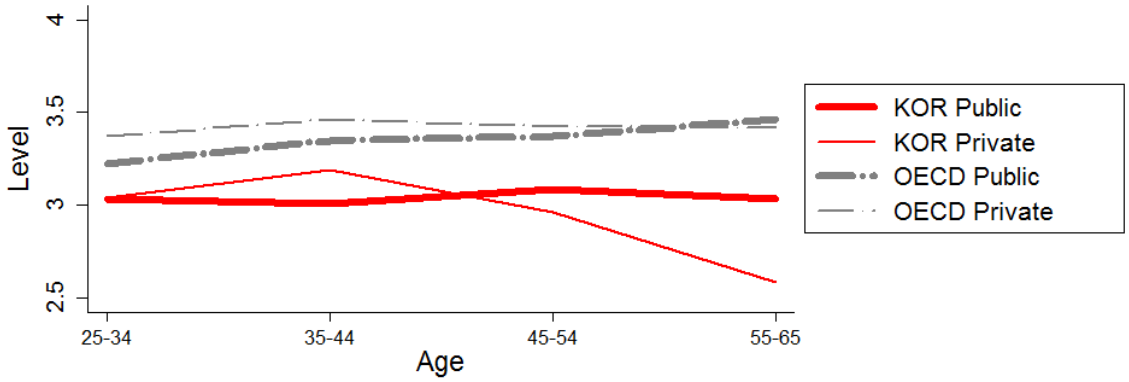
As skills are accumulated throughout one's lifetime through the use of skills and learning, we observe how the levels of skill-use and learning of Korea's public employees compare with those of the public employees of other countries and Korea's private sector. Through a background survey, PIAAC measures the level of skill-use at the workplace. To compare and analyze the level of skill-use, we use the following PIAAC indexes: 'Task discretion at work ("Task discretion")', 'Influencing skills at work ("Influencing skills")' and 'complex Problem Solving at work ("Problem solving")'. Task discretion is defined as the degree to which one can adjust the method, order and speed of tasks at work. Influencing skills refers to the frequency of activities such as training, persuading, advising, and negotiating in the workplace. Problem solving is defined as the frequency with which one is confronted with a workplace situation that requires at least 30 minutes of contemplation to find a solution.[7]

Figure 4, Figure 5, and Figure 6 show the levels of each skill-use index by age group. First, Figure 4 shows the results of the comparison on the level of task discretion. As shown in parts (a) and (b), the level of task discretion of Korea's public employees is much lower than the OECD public employee average as well as that of public employees of Germany, Japan, the U.K. and the U.S. As shown in part (c), under the assumption of identical distribution of occupations, the task discretion level of Korea's public employees is lower than that of Korea's private sector employees, particularly for the 35-44 and 45-54 age groups. This may be due to the Korean public sector's tendency toward a strict system of top-down command, which works to limit the level of individual discretion over conducted tasks.

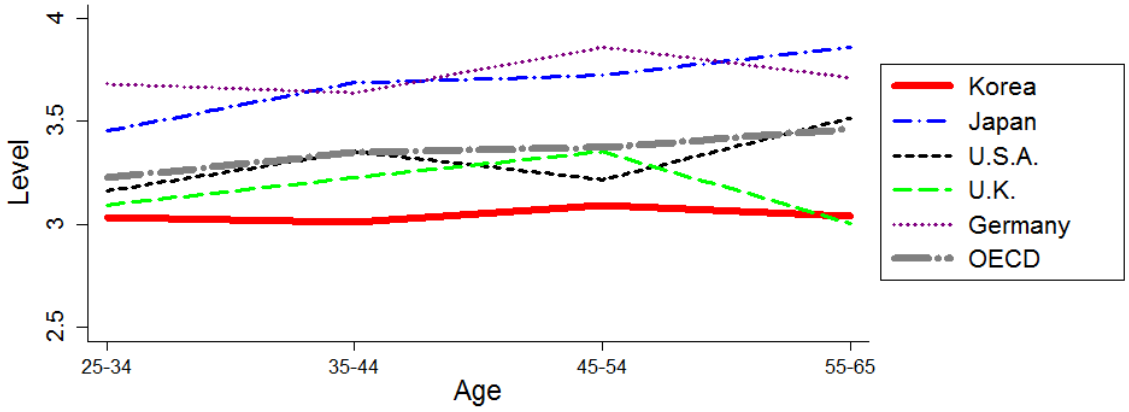
[7] These indexes are composed of 1~6 sub-questions, each of which are measured on a 5-point Likert scale. The average value of the answers to the sub-questions is treated as the average value of each skill-use index.

Figure 4. 'Task Discretion at Work' Index of Male Full-time Public Employees

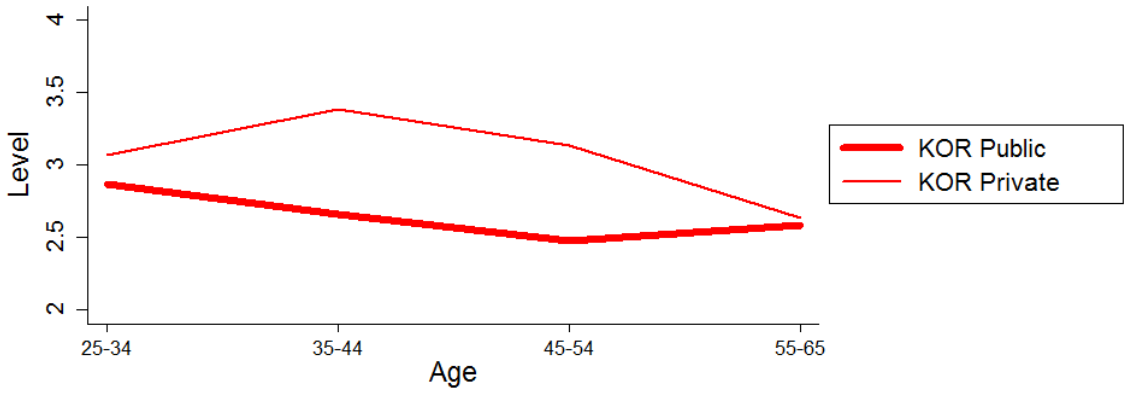
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



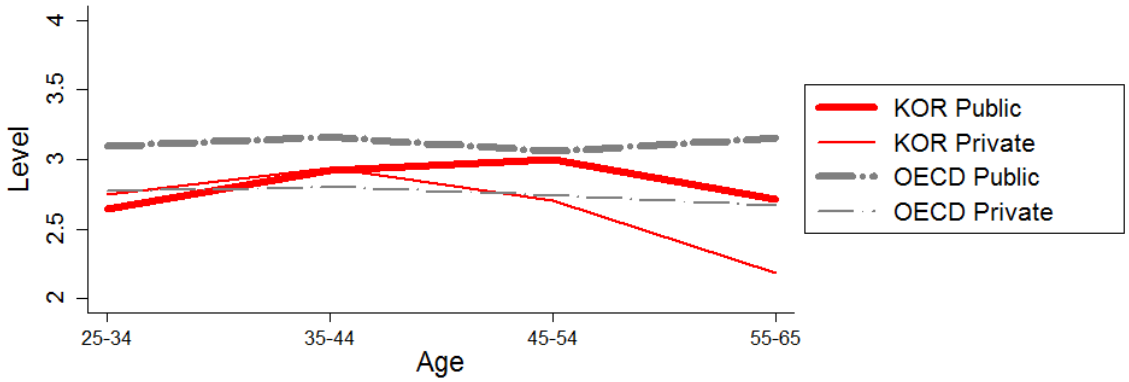
(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



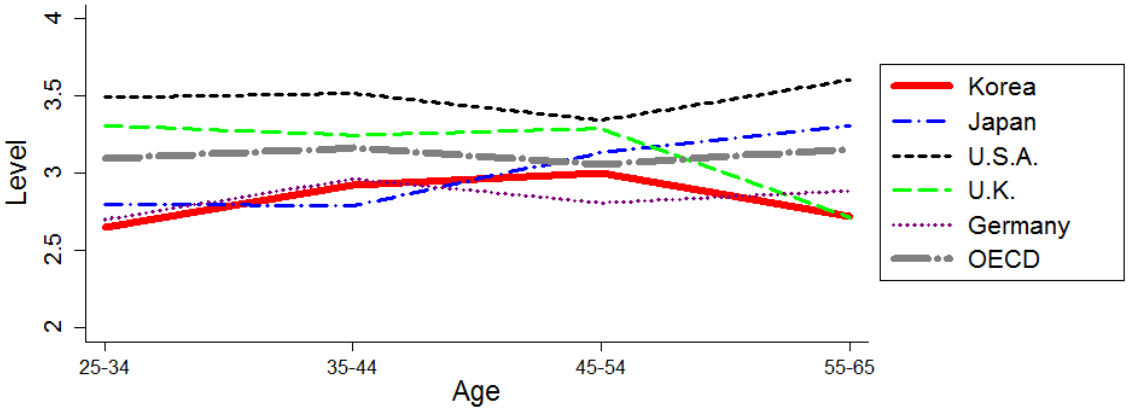
Source: PIAAC.

Figure 5. 'Influencing Skills at Work' Index of Male Full-time Public Employees

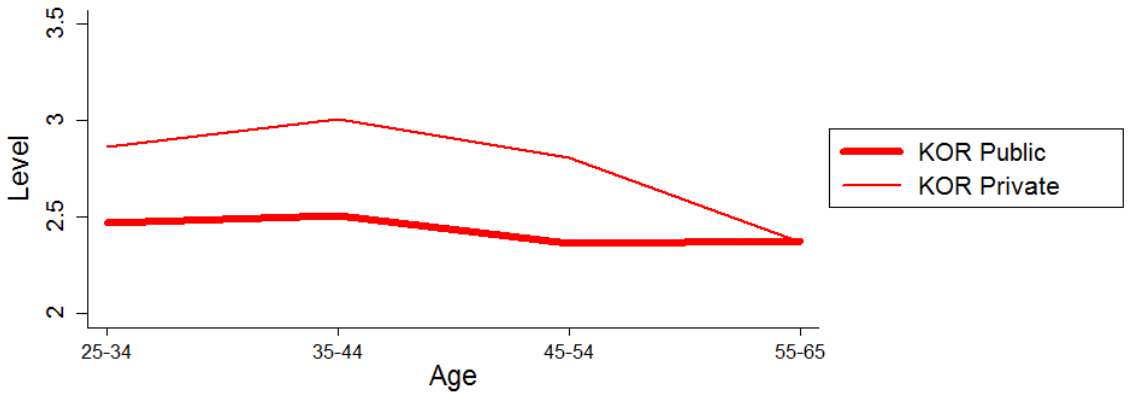
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



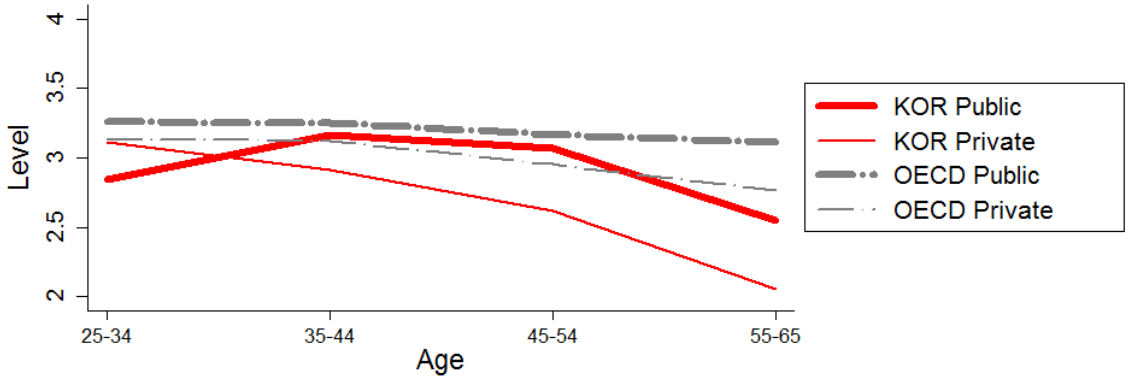
(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



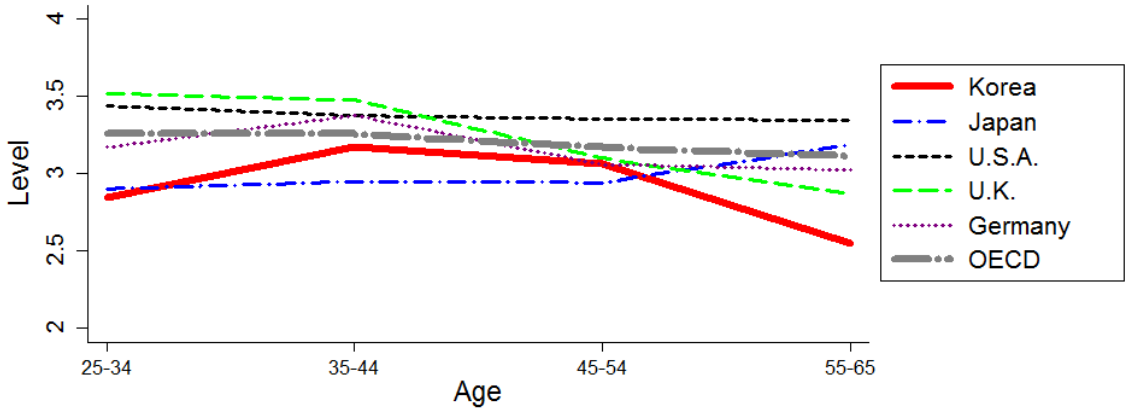
Source: PIAAC.

Figure 6. 'Complex Problem Solving Skills at Work' Index of Male Full-time Public Employees

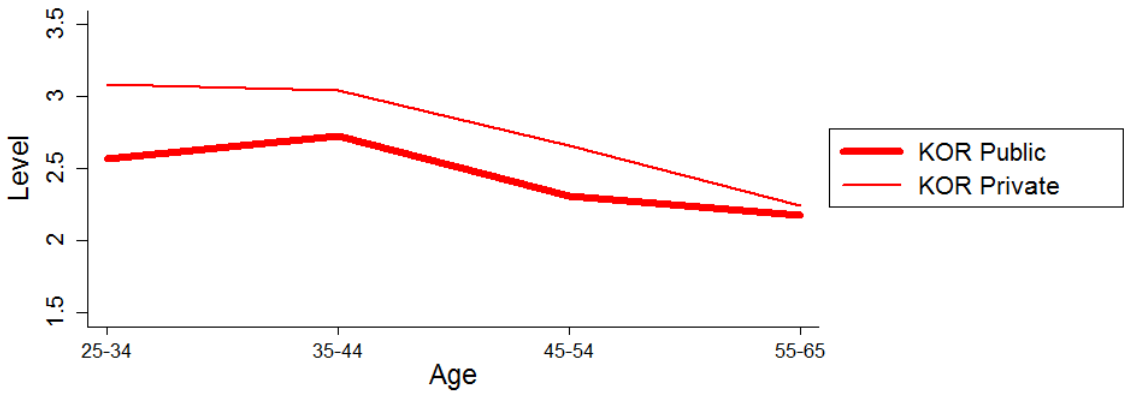
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



Source: PIAAC.

In the case of influencing and problem solving skill-use, as shown in Figure 5 and Figure 6, the level shown by Korean public employees is lower than the OECD average level for public employees. Also, under the assumption of identical distribution of occupations for the public and private sectors, the skill-use levels of influencing skills and problem solving of Korea's public employees are lower than that of Korea's employees in the private sector.

An interesting fact regarding the international comparison of the level of skill-use is that while U.S. public employees display relatively low skill levels, they show one of the highest levels of problem solving skill-use. Compared to Korean public employees, Japanese public employees for the 35-44 and 45-54 age groups display lower levels of problem solving skill-use, and lower level of influencing skill-use for the 35-44 age group. Also, for the 45-54 age group, the influencing skill-use of German public employees is lower than that of Korean public employees. With the exception of these cases, however, it is evident that Korean public employees display lower levels of skill-use than the public employees of the four countries in comparison across all age groups.

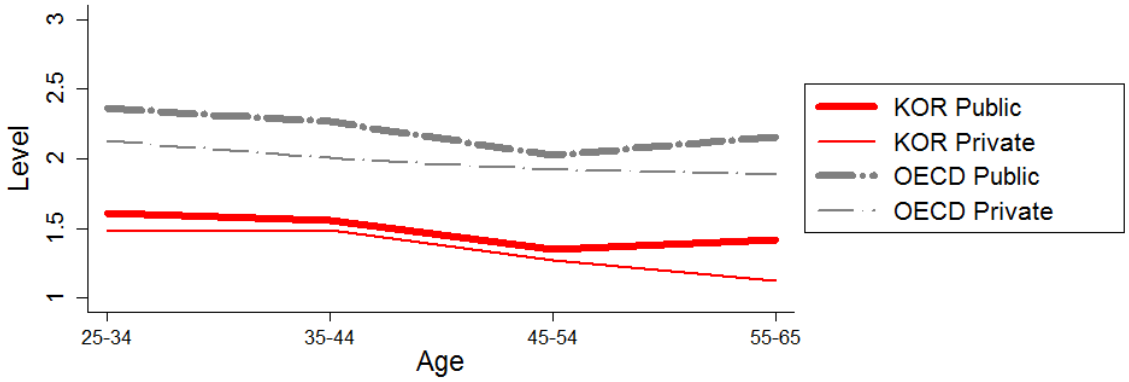
The fact that the level of skill-use is lower for Korean public employees compared to the public employees of other countries may be due to the aforementioned strict system of top-down command among Korean public employees, which works to prevent workers from utilizing their skills to their full potential. Also, such a hierarchical way of working may imply fewer opportunities for on-the-job training, which may lead to lower motivation for learning and skill development.

In order to analyze the level of learning of public employees, we use two PIAAC indexes: 'Readiness to learn' and 'Learning at work'. 'Readiness to Learn' is a summative rating of different aspects of learning, such as the degree of happiness one feels when learning new things and applying them to practical situations, and the degree of effort put forth toward learning things one does not understand. 'Learning at work' is a summative rating of the degree of learning that takes place in the workplace, such as task-related learning through one's supervisors or in the process of conducting tasks.[8]

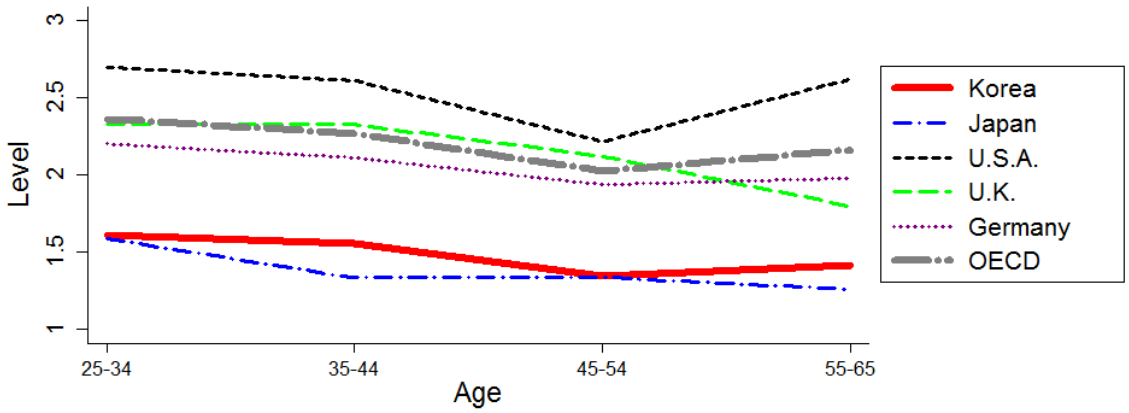
[8] As with the skill-use indexes, the indexes on learning are each composed of a group of sub-questions that are answered on 5-point Likert scales, and the average value of the responses to the sub-questions are defined as the average value of the respective learning index.

Figure 7. 'Readiness to Learn' Index of Male Full-time Public Employees

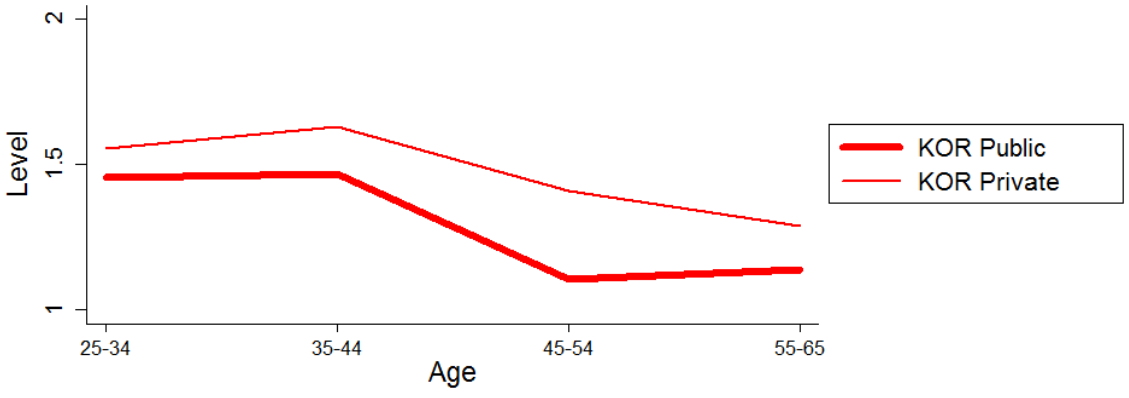
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



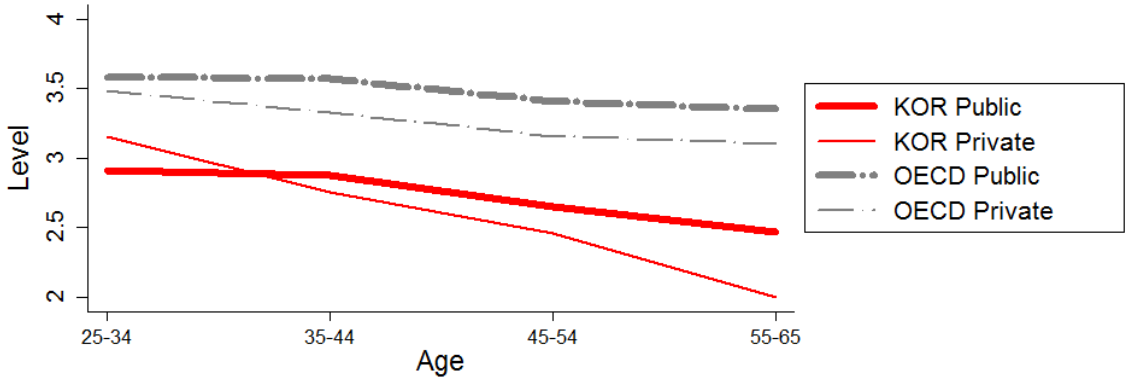
(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



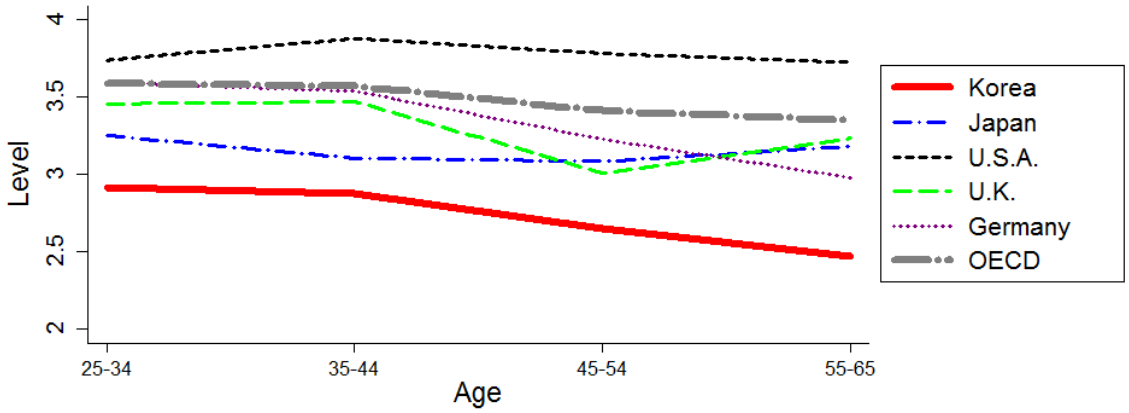
Source: PIAAC.

Figure 8. 'Learning at Work' Index of Male Full-time Public Employees

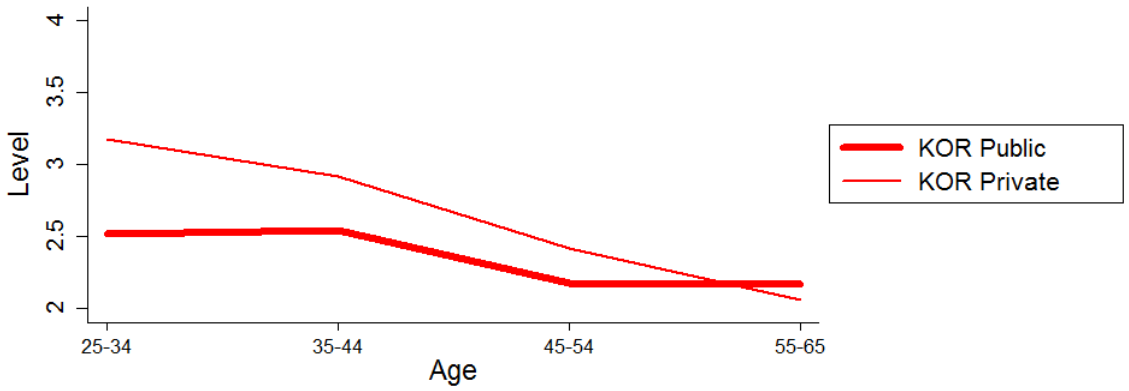
(a) Korea and OECD Average (Public and Private Sectors)



(b) International Comparison of Public Sector (Korea, Major Countries and OECD Average)



(c) Comparison of Korea's Public and Private Sectors, Assuming Identical Occupation Distribution



Source: PIAAC.

Then how are Korea's public employees in terms of their levels of 'Readiness to learn' and 'Learning at work'? As shown in Figure 7 and Figure 8, the level of learning indexes of Korea's public employees are extremely low. Not only compared to the four countries in comparison, but among the entire group of OECD countries, Korea's public employees rank near the very bottom in terms of the levels of learning. In a domestic comparison of the public and private sectors, even without assuming for identical distribution of occupations, the 'Learning at work' level for the 25-34 age group is lower for employees in Korea's public sector. When assuming for identical distribution of occupations, the levels of both 'Readiness to learn' and 'Learning at work' are lower for Korea's public sector than the private sector across all age groups.

The fact that the levels of 'Readiness to learn' and 'Learning at work' of Korea's public employees are lower than their international counterparts and Korea's private sector employees may be related to the Korean public employees' relatively low levels of skill-use observed previously. The lack of opportunity for utilizing one's skills may lower one's desire to learn and reduce opportunities to learn while working. Furthermore, the levels of skill, skill-use and learning may be related to the wage system.

V. Skills and Wages of Public Employees

Empirical analyses thus far show that the skill level of Korea's public employees lags behind the average level of public employees for OECD countries and that the levels of skill-use and learning are both very low for Korea's public employees. By using the PIAAC data, an international comparison of public sector wage systems is conducted to observe how the wage system is associated with employee incentives for human capital investment in relation to the skill level, skill-use, and learning.

1. Returns to Skills of Public Employees

We first estimate each country's public sector returns to skills. Returns to skills is the percentage increase in wage associated with an increase in skill, and thus can be understood as the rewards to skill. In order to estimate the returns to skills, the method of Hanushek et al. (2015) is used, where PIAAC numeracy scores are substituted for 'years of education' in the Mincer equation (Mincer, 1974), which estimates the 'returns to education'. While 'years of

education' is an indirect measure of skill, the PIAAC numeracy score is a more direct measure of actual skill. Numeracy is used because, as mentioned by Hanushek et al. (2015), of the three PIAAC domains, numeracy is deemed most compatible for international comparison. The regression model is as follows:

$$\ln y_{ik} = \beta_{0k} + \beta_{1k} Pub_{ik} + \beta_{2k} Std(Num_{ik}) + \beta_{3k} Pub_{ik} * Std(Num_{ik}) + \beta_{4k} E_{ik} + \beta_{5k} E_{ik}^2 + \varepsilon_{ik} \quad (1)$$

where y_{ik} represents gross hourly wage (excluding bonuses) of individual i in country k; Pub is an indicator variable for the public sector; $Std(Num)$is the PIAAC numeracy score, standardized to have a mean of 0 and standard deviation of 1 across the entire international sample; *E* is the total years of work experience during one's lifetime and ε is the error term. β_{1k} is the log wage differential between the public and private sector in country k, which shows the percentage difference in wages of the public sector compared to that of the private sector. For country k, β_{2k} is the private sector's returns to skills and β_{3k} is the difference between the private sector's returns to skills and that of the public sector. The public sector's returns to skills in country k is thus the sum of $\beta_{2k}$and β_{3k}.

Table 3 and Figure 9 show the log wage differential between the public and private sectors for each country, estimated using model (1). Korea's public-private log wage differential is 0.251, which means that the public sector earns 25.1% more than the private sector. Such a difference is the largest among all countries included in the analysis. Korea's Ministry of Security and Public Administration[9] (2014) announced that Korean government officials earned 84.5% of the private sector earnings in 2013. However, this statistic restricted the private sector employees to those in administrative and managerial positions in firms with 100 or more employees. Thus, when considering the fact that many private sector employees working in small- and medium-sized firms earn low wages in Korea, the results of our analysis does not conflict with that of the Ministry's report. Furthermore, in addition to government officials, the public sector of our analysis also includes teachers and employees of public corporations.

[9] As of Nov. 20th, 2014, the Ministry has been divided into three newly formed ministries: Ministry of Personnel Management, Ministry of the Interior, and Ministry of Public Safety and Security.

Table 3. Regression on Log Wages of Public and Private Sector Employees (Model (1))

	Korea	Japan	U.S.A.	U.K.	Germany	France	Canada	Australia
Pub	0.251***	0.193***	0.063	0.029	0.128***	-0.047***	0.158***	0.086**
	(0.042)	(0.049)	(0.050)	(0.024)	(0.034)	(0.017)	(0.020)	(0.028)
Std(Num)	0.243***	0.201***	0.239***	0.210***	0.214***	0.148***	0.171***	0.162***
	(0.024)	(0.019)	(0.018)	(0.016)	(0.016)	(0.008)	(0.011)	(0.013)
Pub Std(Num)*	-0.133**	-0.077	-0.061	-0.032	-0.103**	-0.019	-0.054**	-0.050***
	(0.055)	(0.052)	(0.048)	(0.028)	(0.040)	(0.015)	(0.025)	(0.019)
E	0.045***	0.051***	0.028***	0.023***	0.022***	0.020***	0.023***	0.026***
	(0.005)	(0.005)	(0.008)	(0.005)	(0.004)	(0.002)	(0.004)	(0.004)
E^2	-0.905***	-0.821***	-0.390**	-0.411***	-0.321***	-0.227***	-0.344***	-0.439***
	(0.140)	(0.118)	(0.168)	(0.100)	(0.098)	(0.053)	(0.000)	(0.083)
R^2	0.220	0.237	0.279	0.229	0.228	0.240	0.222	0.184
N	1313	1326	904	1556	1241	1536	5299	1546

	Austria	Belgium	Czech R.	Denmark	Estonia	Finland	Ireland	Italy
Pub	0.019	0.038*	0.087**	-0.045**	-0.078***	0.005	0.207***	0.163***
	(0.025)	(0.020)	(0.041)	(0.020)	(0.028)	(0.018)	(0.037)	(0.037)
Std(Num)	0.171***	0.145***	0.113***	0.120***	0.193***	0.124***	0.193***	0.126***
	(0.014)	(0.011)	(0.028)	(0.011)	(0.021)	(0.011)	(0.020)	(0.021)
Pub Std(Num)*	-0.051	0.022	-0.004	0.001	-0.051	0.025	-0.071*	-0.044
	(0.032)	(0.021)	(0.056)	(0.021)	(0.040)	(0.019)	(0.038)	(0.052)
E	0.013***	0.022***	0.001	0.017***	0.019***	0.031***	0.036***	0.023***
	(0.005)	(0.003)	(0.007)	(0.003)	(0.005)	(0.004)	(0.006)	(0.005)
E^2	-0.113***	-0.309***	-0.061	-0.259***	-0.561***	-0.554***	-0.527***	-0.275**
	(0.005)	(0.072)	(0.149)	(0.060)	(0.105)	(0.078)	(0.129)	(0.126)
R^2	0.202	0.235	0.071	0.167	0.145	0.216	0.296	0.197
N	1126	1088	990	1722	1302	1270	952	838

	Netherland	Norway	Poland	Slovak R.	Spain	Sweden
Pub	0.060**	-0.020	0.162***	0.024	0.243***	-0.041*
	(0.027)	(0.018)	(0.033)	(0.041)	(0.029)	(0.021)
Std(Num)	0.195***	0.132***	0.180***	0.200***	0.189***	0.109***
	(0.016)	(0.009)	(0.024)	(0.025)	(0.020)	(0.010)
Pub Std(Num)*	-0.015	-0.040**	-0.019	0.018	-0.015	-0.038
	(0.026)	(0.016)	(0.044)	(0.047)	(0.038)	(0.025)
E	0.018***	0.019***	0.014**	0.011*	0.008*	0.018***
	(0.003)	(0.003)	(0.006)	(0.006)	(0.005)	(0.003)
E^2	-0.206***	-0.315***	-0.315**	0.318**	-0.026	-0.277***
	(0.068)	(0.056)	(0.149)	(0.129)	(0.000)	(0.054)
R^2	0.244	0.193	0.156	0.141	0.246	0.177
N	1103	1384	1080	1023	1036	1131

Notes: Least squares regression weighted by sampling weights. Includes country fixed effects and gives same weight to each country. Dependent variable: log gross hourly wage. Sample: Full-time male employees, aged 25-65. Full-time employees are those who report their work status as 'full-time' and work at least 30 hours a week. *Pub*: indicator dummy for the public sector (public=1; private=0). *Std(Num)*: PIAAC Numeracy scores standardized to have a mean of 0 and std. dev. of 1 across the entire international sample. *E*: total years of work experience during lifetime. E2 divided by 1000. R^2 refers to within-country R^2. Jackknife standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01.

Figure 9. Public-Private Log Wage Differential for Male Full-time Employees

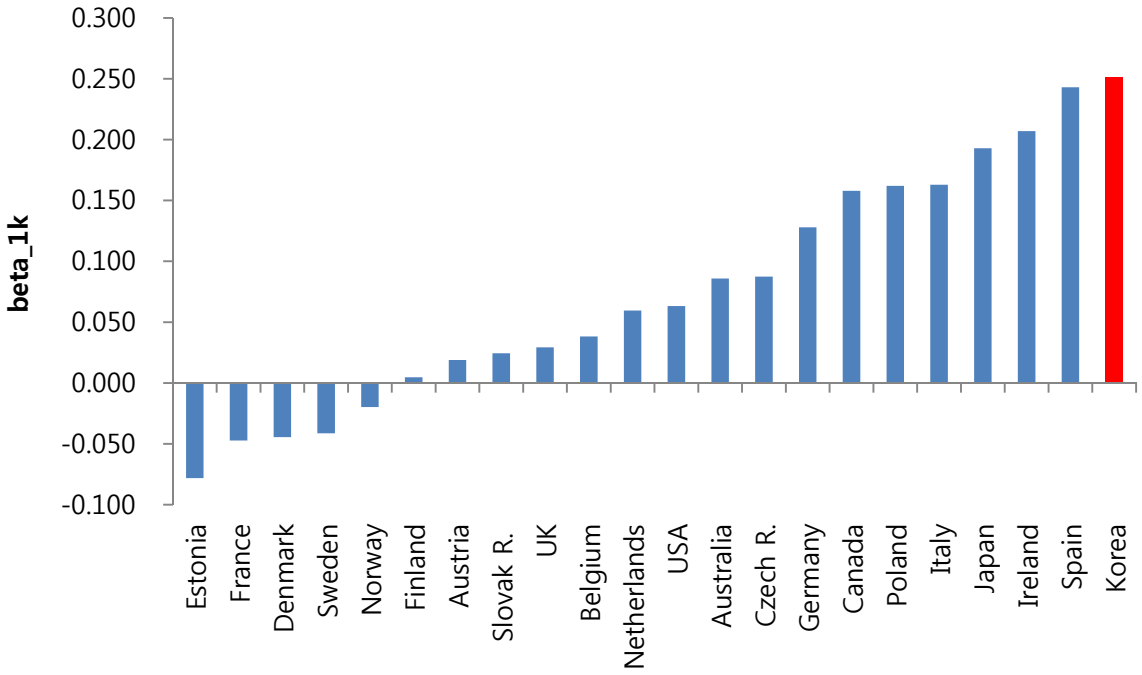
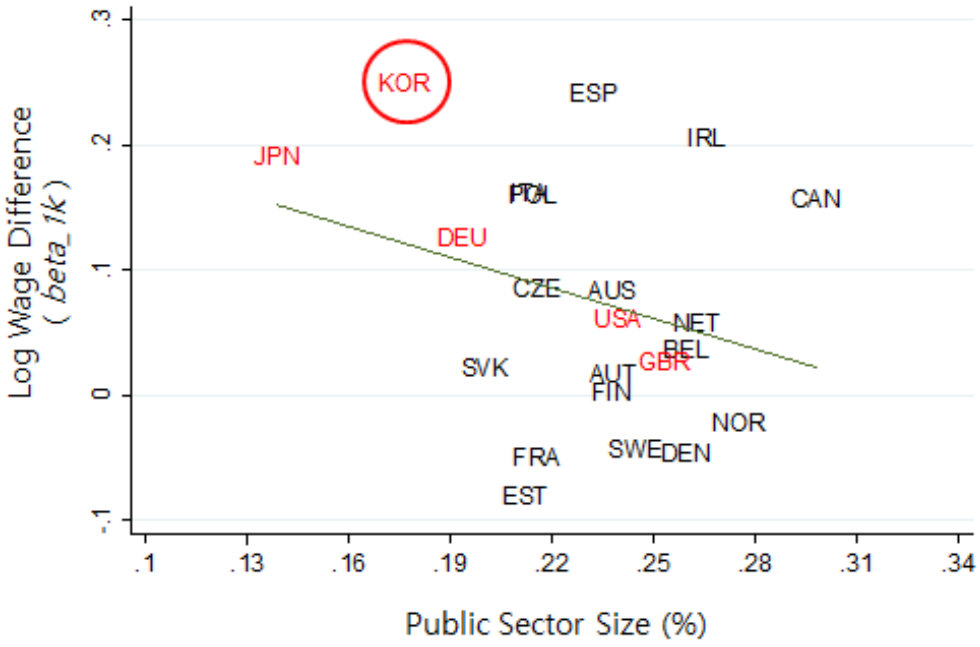


Figure 10. Public-Private Log Wage Differential for Male Full-time Employees and Public Sector Size (%)



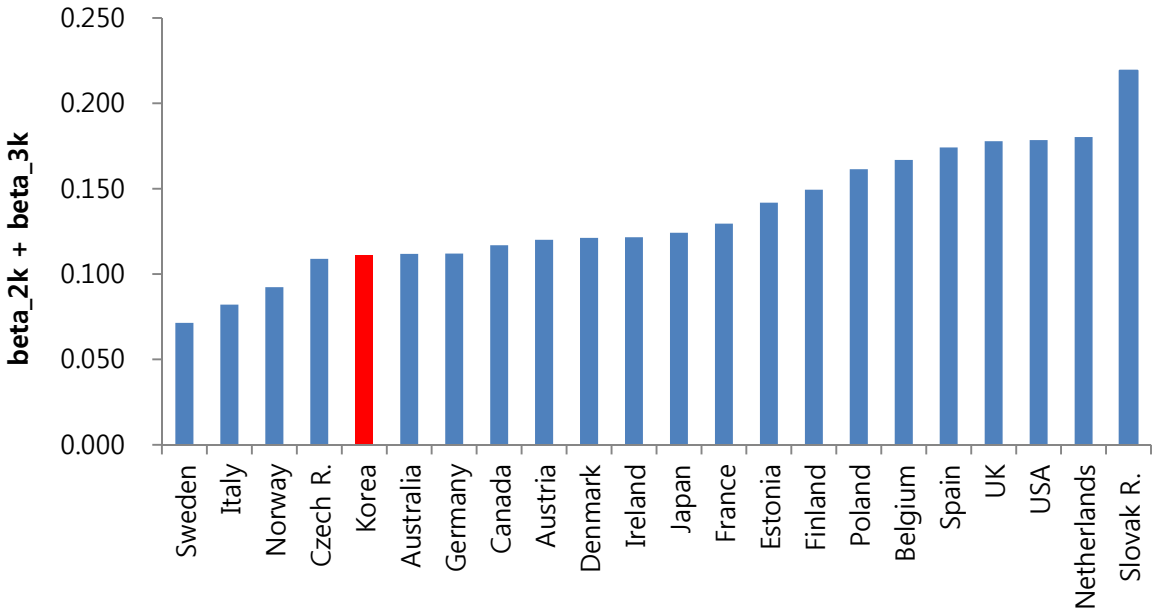
Note: Line represents regression line.
Source: PIAAC.

The reason why Korea's public sector wage is higher than that of the private sector could be due to the fact that the size of the public sector[10] is smaller than the size of the private sector. Figure 10 shows that public sector size and public-private log wage differential are negatively correlated. However, compared to Japan, Korea's public sector share is larger and yet shows a wider wage differential. This shows that the small size of the public sector alone cannot fully explain the reason why Korea shows a very high degree of public-private differential in wage. We focus more on the public-private difference in returns to skills, rather than on levels of wage, because the former has more direct implications than the latter in skill formation of employees.

For each country, the estimates for the returns to skills of the private and public sectors are shown in Table 3. For country k, β_{2k} is the private sector's returns to skills and β_{3k} is the difference in returns to skills of the public sector from the private sector. The sum of β_{2k} and β_{3k} is the returns to skills of the public sector. The returns to skills of Korea's private sector is 0.244, meaning that a single standard deviation increase in skill is associated with an increase in wage of 24.4%. The returns to skills of Korea's public sector is 13.3 percentage points less than that of Korea's private sector. Although for most countries in the analysis (18 out of 22), the returns to skills of the private sector is greater than that of the public sector, through Figure 11, Figure 12, and Figure 13 it is evident that the marginal difference in returns to skills is greatest for Korea.

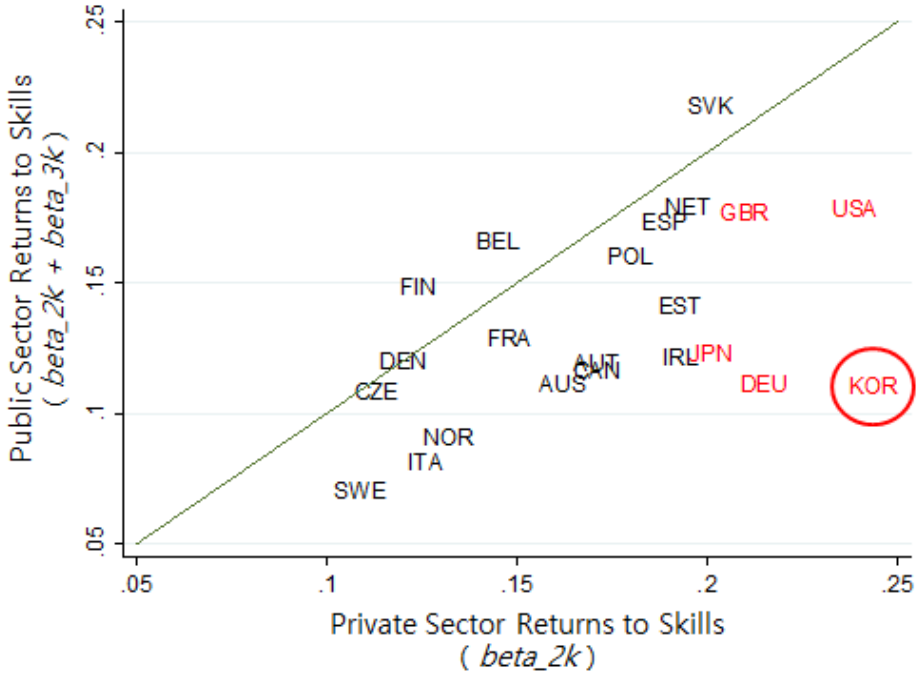
[10] 'size of the public sector' refers to the proportion of those working for the public sector in each country in the sample of this research.

Figure 11. Public Sector Returns to Skills of OECD Countries



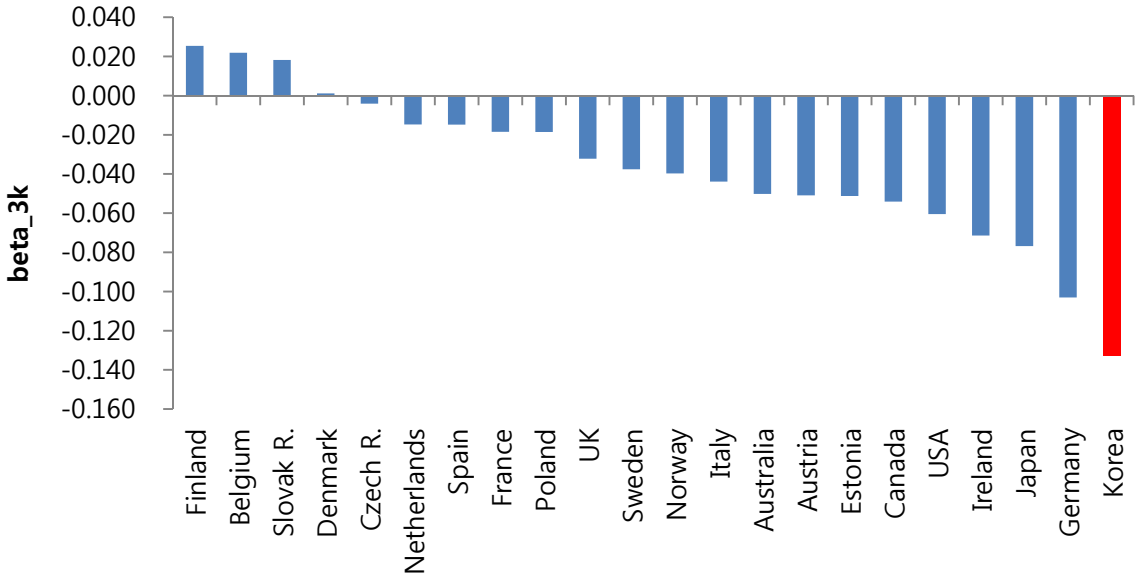
Source: PIAAC.

Figure 12. Public Sector and Private Sector Returns to Skills for Male Full-time Employees



Note: Line represents 45-degree line.
Source: PIAAC.

Figure 13. Public Sector's Marginal Difference in Returns to Skills for Male Full-time Employees



Source: PIAAC.

Figure 11 shows the returns to skills of the public sector for each country, and at 11.1%, the returns to skills of Korea's public sector is ranked 19th out of 22 countries. As shown in Figure 12, in most cases, countries with relatively higher private sector returns to skills compared to other countries tend to show relatively higher returns to skills for the public sector, and those with relatively lower private sector returns to skills have relatively lower public sector returns to skills. However, in the case of Korea, a peculiar pattern is shown where the returns to skills of the private sector is the highest among all countries, but the public sector returns to skills is one of the lowest. It is for this reason that Korea's public-private differential in returns to skills is the greatest.

Such a pattern in returns to skills for Korea's private and public sectors may be due to the difference in between- and within-firm wage differences for the two sectors. While the wage distribution tends to be more compressed for Korea's public sector, this is not the case for Korea's private sector. As is the case between large-sized and small- and medium-sized firms, large differences in wages exist between Korea's private firms. Also there is a greater degree of within-firm wage difference in the private sector than the public sector. For example, there is generally a large wage gap between full-time and temporary workers. However, the focus should be put on the fact that lower returns to skills can deter human capital investment for skill development and negatively affect one's desire to learn and the amount of learning done at work. The fact that the levels of skills and learning indexes of Korea's public employees tend to be lower than the OECD public sector averages and those of Korea's private sector employees reinforces the concern that lower returns to skill of Korea's public employees may reduce the level of human capital investment.

2. 'Skill-Wage' Gap for Public Employees

The wage scheme of Korea's public employees has been heavily criticized for its strong reliance on salary class. In general, individual salary class rises automatically with seniority, and thus results in a wage scheme that is heavily based on seniority. We observe how such a seniority-based wage scheme may negatively affect human capital investment. The first step is to observe the relationship between age and wage among public employees. For the following analyses, only the public sector employee sample for each country is used, and the regression model is as follows:

$$\ln y_{ik} = \beta_{0k} + \beta_{1k} AG_{ik} + \varepsilon_{ik} \quad (2)$$

where for individual $i$from country k, y_{ik} is gross hourly wage, excluding bonuses. $AG$is an indicator variable for the age groups (base group: age 25-34, age 35-44, age 45-54, age 55-65).$\varepsilon$is the error term. β_{1k}represents the log wage difference between the 25-34 age group and the other age groups for country k. Thus β_{1k} shows the relative increase (or decrease) in wage for older age groups compared to the 25-34 age group.

In order to observe the 'age-wage' profile after controlling for the effects of education and work experience on wage, the respective variables are controlled for in model (3) as follows:

$$\ln y_{ik} = \beta_{0k} + \beta_{1k} AG_{ik} + \beta_{2k} Edu_{ik} + \beta_{3k} E_{ik} + \beta_{4k} E_{ik}^2 + \varepsilon_{ik} \quad (3)$$

In model (3), Edu_{ik} is an indicator variable for the respondent's highest education level (base group: middle school graduate, high school graduate, college graduate and above) for individual i fromcountry k. $E$is the total years of work experience during one's lifetime, and ε is the error term.

In order to control for the effect of PIAAC skill on the 'age-wage' profile, model (4) includes individual PIAAC numeracy scores as a control variable. In model (4), $Std(Num_{ik})$ is the PIAAC numeracy score, standardized to have a mean of 0 and standard deviation of 1 across the entire international sample, for individual i from country k.

$$\ln y_{ik} = \beta_{0k} + \beta_{1k} AG_{ik} + \beta_{2k} Std(Num_{ik}) + \varepsilon_{ik} \quad (4)$$

In terms of skills and wages, it is possible that higher skills lead to higher earnings, but it is also possible that those who work in high-paying jobs have a higher probability of developing higher skills. In order to deal with such an issue of reverse causality, we first estimate the standardized PIAAC numeracy score using the variables that may affect skill development (education level, parents' education level, the number books in the household at age 16, computer-use experience). Then this estimated standardized numeracy score is included in model (5b) as a control variable. The respective regression models are as follows.

$$\widehat{Std(Num_{ik})} = \widehat{\alpha_{0k}} + \widehat{\alpha_{1k}} Edu_{ik} + \widehat{\alpha_{2k}} Parentedu_{ik} + \widehat{\alpha_{3k}} Books_{ik} + \widehat{\alpha_{4k}} Comp_{ik} \quad (5a)$$

In model (5a), Edu_{ik} is the highest education level (base group: middle school graduate; high school graduate; college graduate and above) of individual i from country k, $Parentedu$ is an indicator variable for the parents' highest level of education (the highest level of education between the mother and father; base group: middle school graduate, high school graduate, college graduate and above), $Books$ is the number of books that existed in the household at age 16, and $Comp$ indicates whether or not one has experience in using a computer. $\widehat{Std(Num)}$is the estimated value of the standardized numeracy score using the variables mentioned above.

The estimated standardized numeracy score, estimated using model (5a), is included as a control variable in model (5b):

$$\ln y_{ik} = \beta_{0k} + \beta_{1k} AG_{ik} + \beta_{2k} \widehat{Std(Num)} + \varepsilon_{ik} \quad (5b)$$

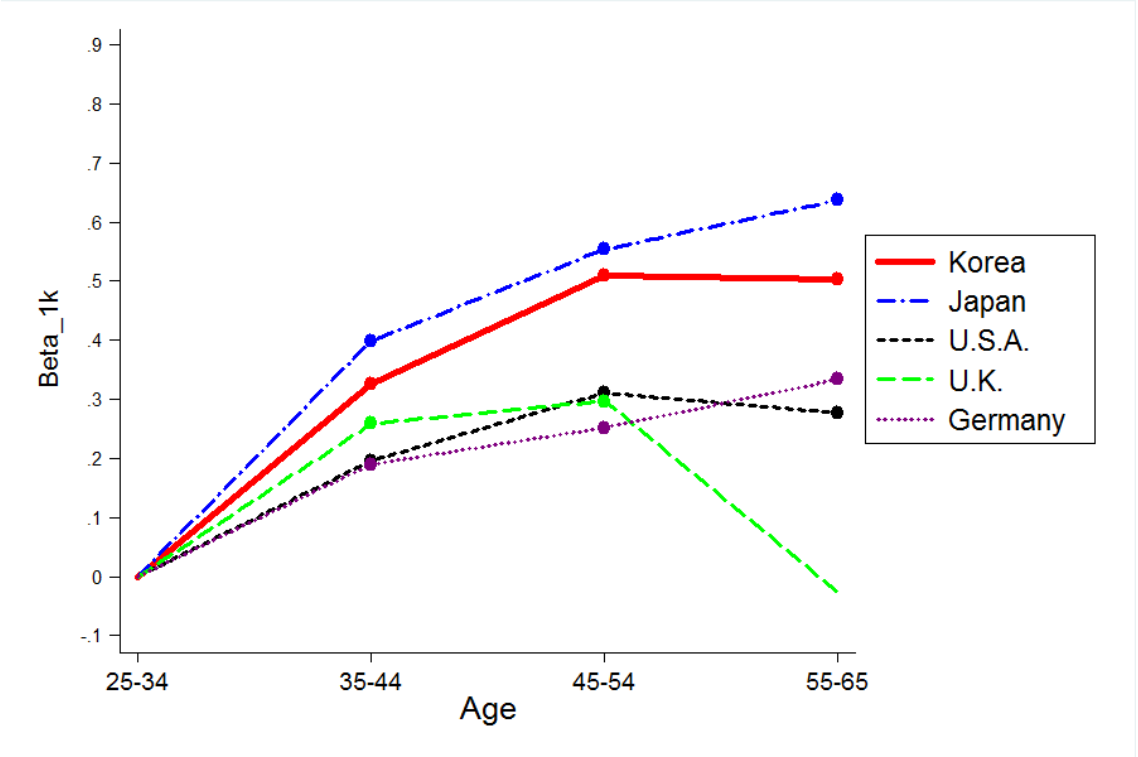
Figure 14 shows the 'age-wage' profile of public employees, estimated using each of the models explained above. First, the 'age-wage' profile of public employees, estimated using model (2) is shown in part (a). It is evident that for Korea's public employees, higher age groups receive higher wages, and among the countries compared, the steepness of the wage increase is the second highest after Japanese public employees.

Part (b) of Figure 14 shows the 'age-wage' profile of public employees after controlling for the effects of education level and work experience, estimated using model (3). Unlike the pattern shown in part (a) of Figure 14, Korean public employees display the slowest increase in wage for older age groups compared to that of the public employees of other countries. It can be interpreted that in the case of Korean public employees, the number of years of work experience has a strong influence on wage determination.

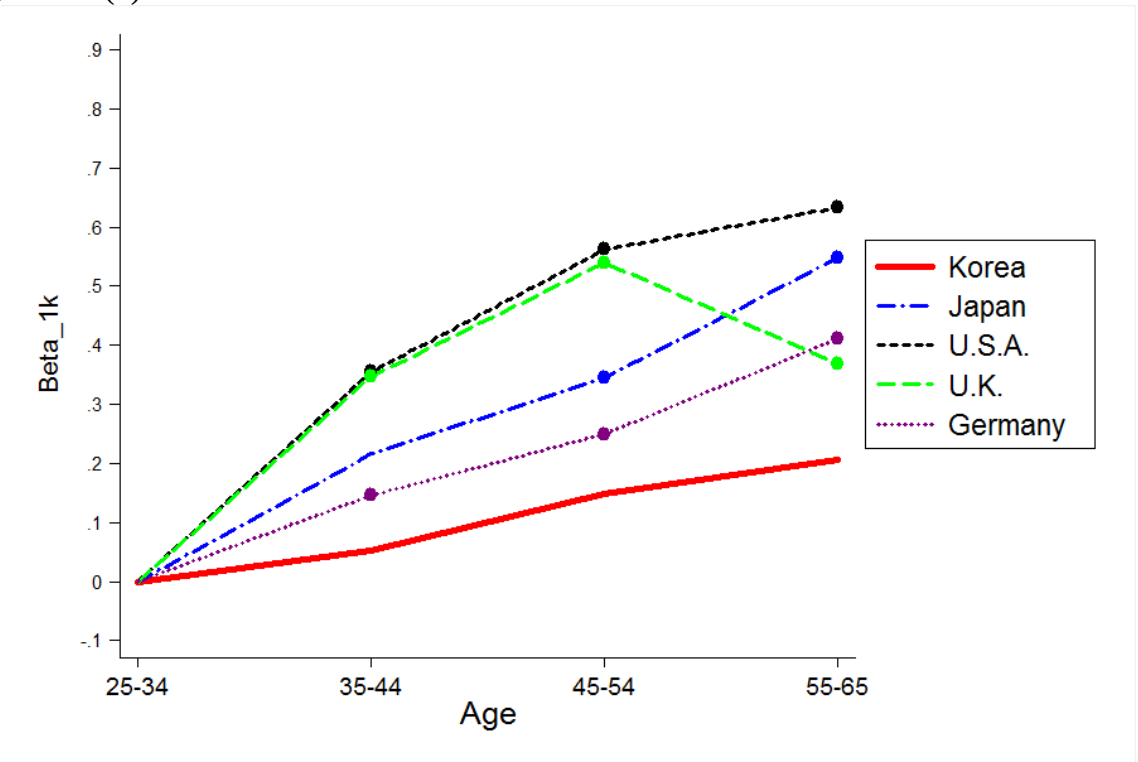
On the other hand, instead of level of education and years of work experience, which can be viewed as indirect measures of skill, part (c) of Figure 14 displays the results of model (4), which controls for PIAAC numeracy score, a direct measure of skill. Among the countries in comparison, the public employees of Korea display a very steep increase in wage for older age groups, second only to Japan among the countries in comparison.

Figure 14. Age-Wage Profile of Male Full-time Public Employees

(a) Model (2)



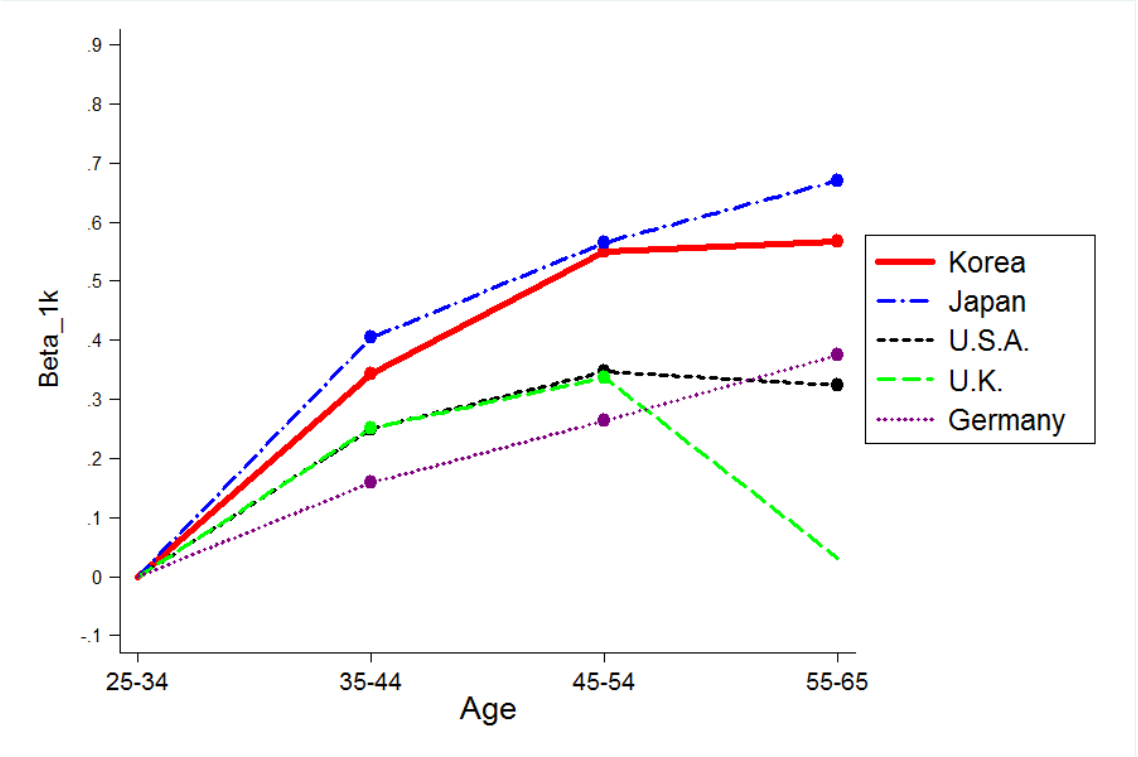
(b) Model (3)



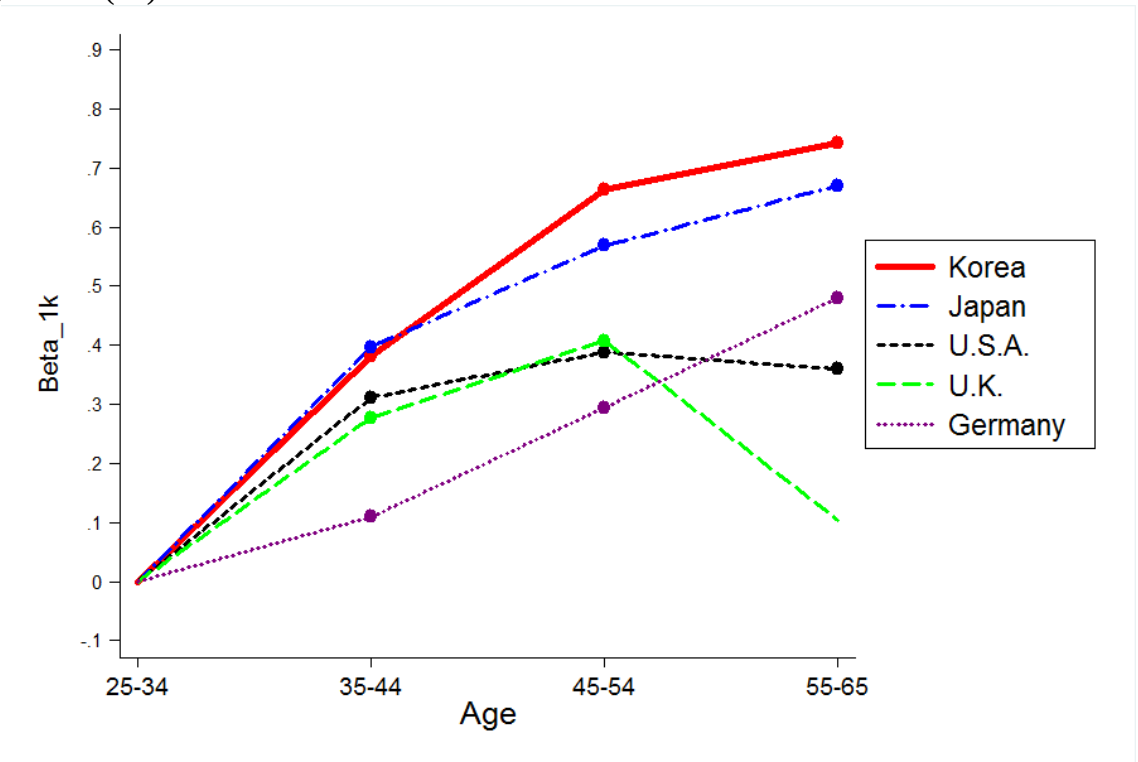
Note: Dots indicate those whose p-values are below 0.1.
Source: PIAAC.

Figure 14 cont'd

(a) Model (4)



(b) Model (5b)



Note: Dots indicate those whose p-values are below 0.1.
Source: PIAAC.

Part (d) of Figure 14 displays the 'age-wage' profile estimated through model (5b). In the case of Korean public employees, the log wage differential between the 25-34 age group and the 35-44 age group is similar to that of Japan's public employees. However, for the older age groups the log wage differential with the 25-34 age group is the greatest among the public employees of the compared countries. Such results empirically confirm that for Korea's public employees, an increase in age is associated with a very steep increase in wage, regardless of the level of skill.

In the case of Korea's public employees, the salary class, which is highly related to age, plays a strong role in determining individual wage.[11] Also, as observed above, the returns to skills of Korea's public employees is quite low, and thus the influence of skill on wage is much weaker than it is for public employees of other countries in comparison. Such circumstances are likely to weaken investment in human capital for the development of skills for Korean public employees.

If it is the case that the productivity of the public sector is more influenced by the years of work experience rather than the skill level of employees, the salary class-based wage scheme can be said to reflect such a feature of the public sector. However, the relative importance between the length of work experience and skill on public sector productivity will vary depending on what it is that the public sector produces. If indeed the productivity of the public sector is more influenced by years of work experience, this may imply a more serious fundamental problem regarding the state of the public sector; rather than working and making decisions based on high skills, the public sector can be focused merely on maintaining the status-quo through knowledge gained from experience.

If the skill level of Korea's public employees steeply increases with increase in age, the previously observed patterns of the relationship between age and wage may not pose any problems. Thus it is necessary to analyze the gap between skill and wage of the public sector. For this analysis we first observe the relationship between age and skill level for the public sector of each country. The regression model used is as follows, and the sample is limited to those in the public sector of each country.

$$Std(y_{ik}) = \beta_{0k} + \beta_{1k} AG_{ik} + \varepsilon_{ik} \qquad (6)$$

[11] The salary of a 9thlevel civil servant in the 30th salary class is higher than that of a 5thlevel civil servant in the 10th salary class and is equivalent to the salary of a 1stlevel civil servant in the 3rd salary class.

In model (6), $Std(y_{ik})$ is this PIAAC score, standardized to have a mean of 0 and standard deviation of 1 across the entire international sample. $AG$is an indicator variable for the age groups (base group: age 25-34, age 35-44, age 45-54, age 55-65). $\varepsilon$is the error term. The values of β_{1k} represent the difference in standardize skill level between the 25-34 age group and the older age groups. It allows for the observation of the degree of increase (or decrease) in skills of older age groups compared to the 25-34 age group.

In order to observe the 'age-skill' profile after controlling for variables that can influence skill development, in model (7) we added control variables for the respondent's education level, parents' education level, the number of books in the household at age 16, and an indicator variable for the existence of computer-use experience.

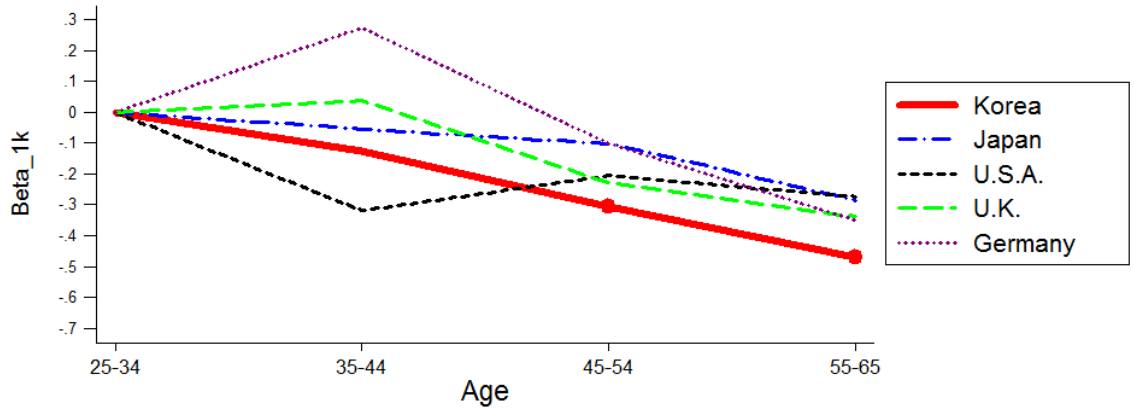
$$Std(y_{ik}) = \beta_{0k} + \beta_{1k}AG_{ik} + \beta_{2k}Edu_{ik} + \beta_{3k}Parentedu_{ik} + \beta_{4k}Books_{ik} + \beta_{5k}Comp_{ik} + \varepsilon_{ik} \quad (7)$$

In model (7), Edu_{ik} is an indicator variable for the highest education level (base group: middle school graduate, high school graduate, college graduate and above) of individual i from country k. $Parentedu$ is an indicator variable for parents' highest level of education (the highest level of education between the mother and father; base group: middle school graduate or less, high school graduate, college graduate and above). $Books$ is the number of books held in the household at age 16. $Comp$ is a variable that indicates the existence of computer-use experience.

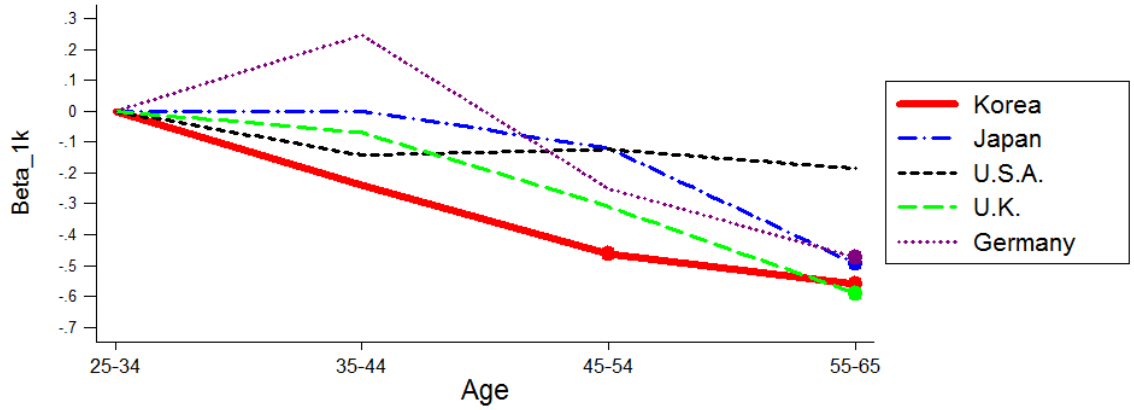
Figure 15 shows the 'age-skill' profile estimated using model (6). The decrease in PSTRE associated with increase in age for Korea's public employees is not as strong as that of the public sector of other countries, but it is evident that the decrease in numeracy and literacy is much steeper than other countries. With the exception of the U.S., the decrease in numeracy for the 35-44 age group is greatest for Korea among public employees of the compared countries. The decrease in literacy for the 55-65 age group is slightly greater for public employees of the U.K. than Korean public employees, but for all other age groups Korea's public employees display the greatest degree of skill decrease.

Figure 15. 'Age-Skill' Profile of Male Full-time Public Employees (Model (6))

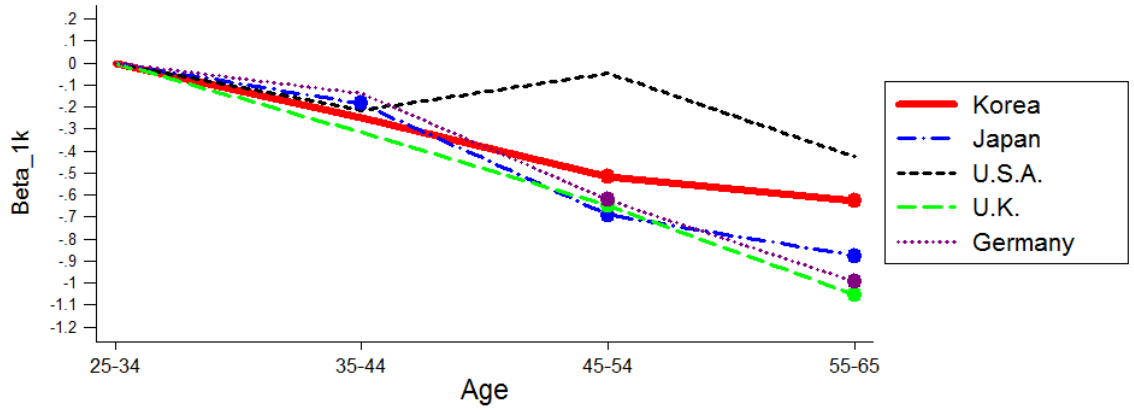
(a) Numeracy



(b) Literacy



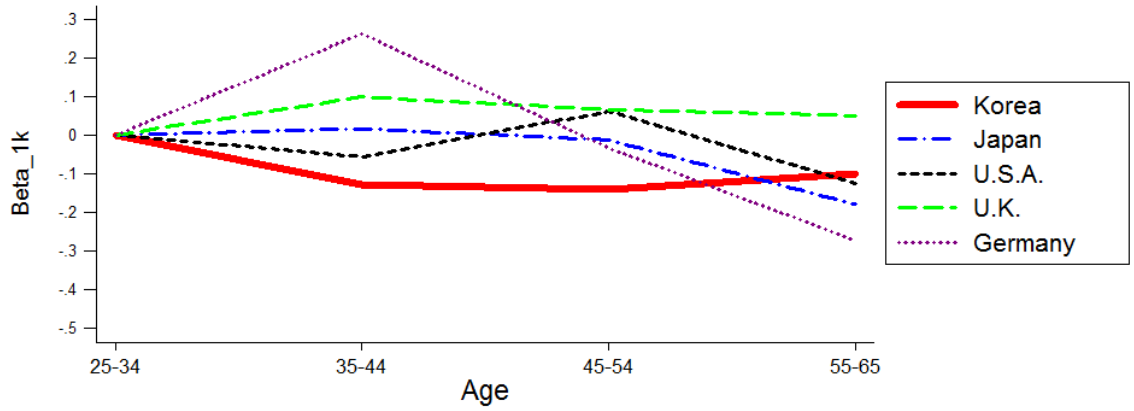
(c) Problem Solving in Technology-rich Environment (PSTRE)



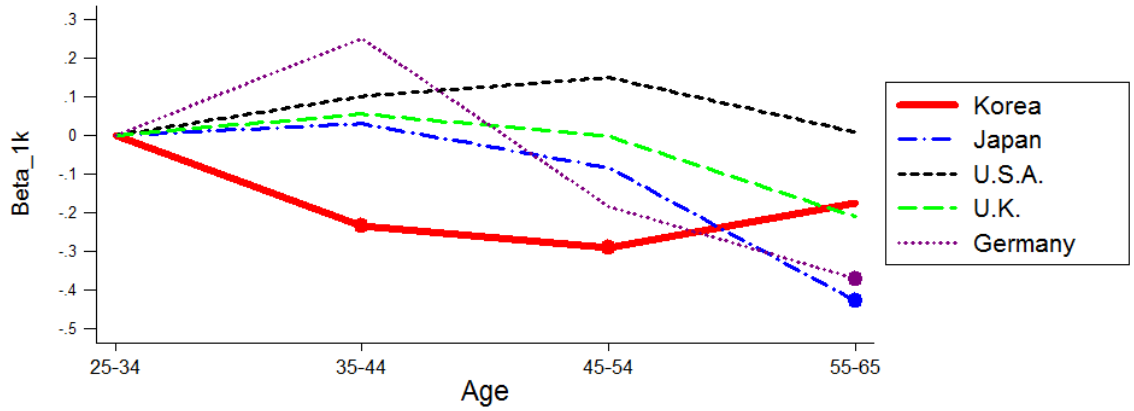
Note: Dots indicate those whose p-values are below 0.1.
Source: PIAAC.

Figure 16. 'Age-Skill' Profile of Male Full-time Public Employees (Model (7))

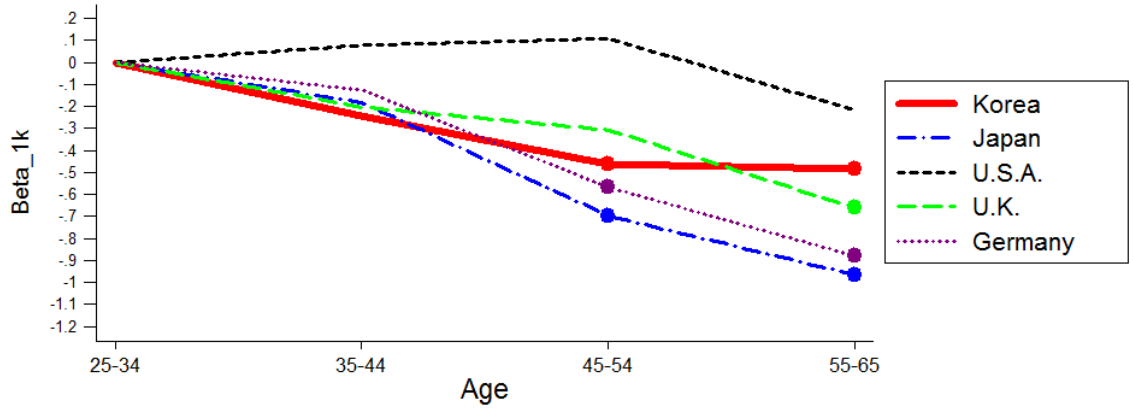
(a) Numeracy



(b) Literacy



(c) Problem Solving in Technology-rich Environment (PSTRE)



Note: Dots indicate those whose p-values are below 0.1.
Source: PIAAC.

The ‘age-skill’ profile estimated using model (7) is shown in Figure 16, and it is evident that with the exception of the 55-65 age group, the decrease in numeracy and literacy for older age groups is greatest for Korea’s public employees.

By integrating the empirical results shown in Figure 14 and Figure 16, the gap between skill levels and wages for public employees is shown in Figure 17. The previously observed ‘age-wage’ profile and ‘age-skill’ profile show the degree of increase or decrease in wages or skill level associated with increase in age compared to the 25-34 age group. The ‘skill-wage’ gap refers to the difference in degree of increase or decrease in skill and wage for older age groups compared to the 25-34 age group. In Figure 17, the x-axis and y-axis each represent the degree of increase or decrease in wage and skill level respectively for public employees of all countries in the analysis. The base group is the 25-34 age group, and the comparative group is the 45-54 age group, as many employees may be in retirement in the 55-65 age group.

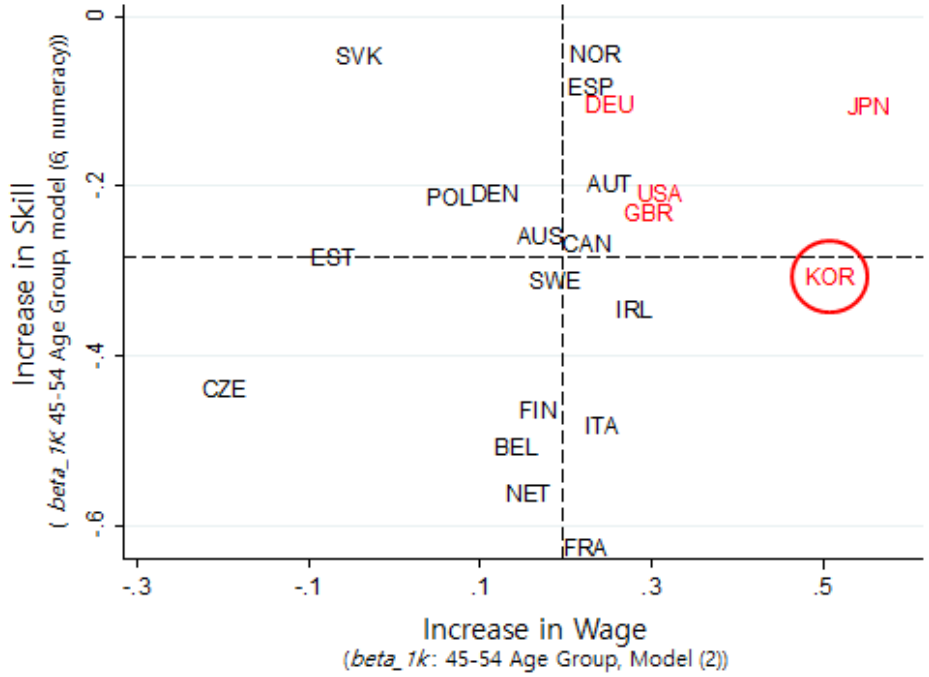
More specifically, part (a) of Figure 17 shows the β_{1k} values estimated using model (2) on the x-axis and the β_{1k} values estimated using model (6; numeracy) on the y-axis. It is evident that for Korean public employees, the increase in wage for the 45-54 age group, compared to that of the 25-34 age group, is much higher than the OECD average, but the increase in skill level is much smaller than the OECD average. Countries that show such a pattern, in addition to Korea, are limited to only Ireland, Italy and France. In the case of Japanese public employees, the degree of increase in wage is similar to that of Korean public employees, but the degree of increase in skill level is greater than that of Korean public employees.

Additionally, part (b) of Figure 17 shows the results of a comparison of the ‘age-wage’ and ‘age-skill’ profiles using regression models that includes various control variables. More specifically, β_{1k} values for the 45-54 age group, estimated using model (5b) and model (7; numeracy) are each shown in the x-axis and y-axis respectively. Here, Korean public employee’s degree of increase in wage is the highest among OECD countries, but the increase in skill level is quite low.

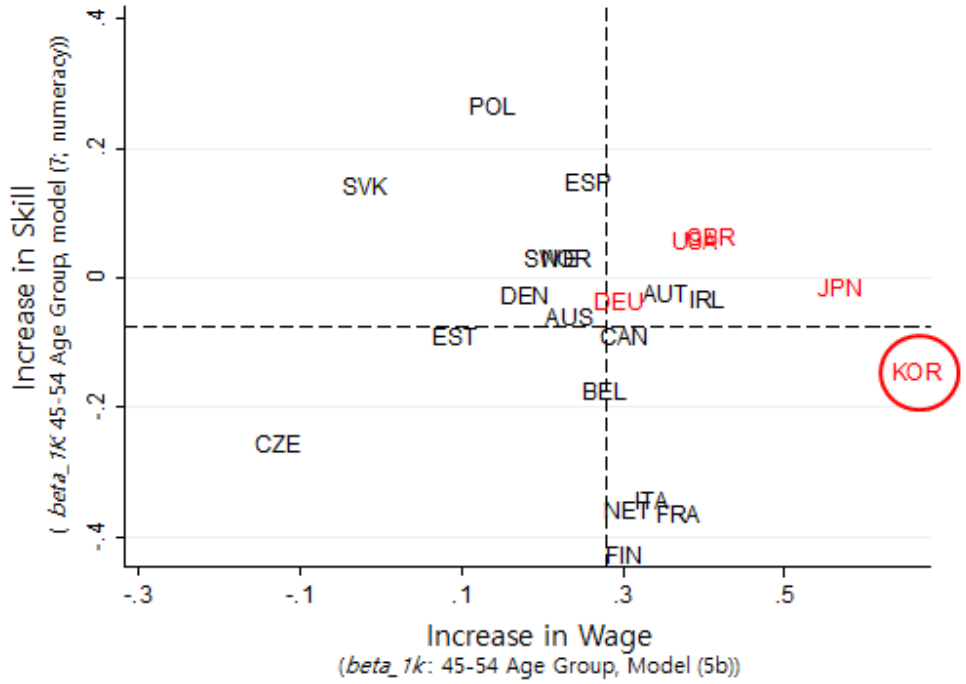
It is evident that the ‘skill-wage’ gap is much larger for Korean public employees than that of the public employees of other countries. This is due to the fact that while the skill level declines with age at a more rapid rate than the OECD average, the salary class-based wage system increases the level of wage at a more rapid rate than that of the OECD average. This can be very problematic as in such a wage scheme that is greatly affected by age, which is not necessarily related to or perhaps even negatively related to skill level, the incentive for human capital investment cannot but be low for Korea’s public employees.

Figure 17. 'Skill-Wage' Gap of Male Full-time Public Employees

(a) Model (4)



(b) Model (5b)



Note: The axis intercepts of the dotted lines are the international means of the respective *beta_1k* values.
Source: PIAAC.

VI. Conclusion

Through empirical analysis of PIAAC data we confirm that the skill level of Korea's public employees is lower than that of the OECD public employee average, and also lower than that of public employees of major countries like Germany, Japan and the U.K. Also, when assuming for identical distribution of occupations for both sectors, results show that the skill levels of Korea's public employees are lower than their private sector counterparts. In particular, the gap in skill level is particularly large for the 45-54 age group. Regarding such results, this research focuses on the following factors.

First, the skills of Korea's public employees are not be sufficiently utilized in the workplace. Analysis of the PIAAC skill-use variables indicate that the skill-use levels of Korean public employees are lower than those of the OECD public employee average levels and also lower than those of Korean private sector employees when assuming for identical distribution of occupations for both sectors. The Korean public sector's vertical order of rank and strict system of top-down command works to prevent employees from fully utilizing their skills.

Second, the levels of learning indexes for Korea's public employees are quite low. The 'Readiness to learn' and 'Learning at work' levels of Korea's public employees are the lowest among major OECD countries. When assuming for identical distribution of occupations between the public and private sectors, the levels of both indexes are lower for Korea's public employees than that of Korea's private sector employees. When considering the fact that skills are accumulated over one's lifetime through skill-use and learning, such low levels of both for Korean public employees partly explain why their skill levels are lower than that of public employees of other OECD countries, particularly for the 45-54 age group.

Third, the skills of Korean public employees are not properly rewarded. In particular, for the returns to skills of public employees, that of Korea is among the lowest among OECD countries. A more serious problem is that the gap in returns to skills between the public and private sectors is the largest for Korea among all countries included in our analysis. Also, as Korea's public sector operates a very strict seniority wage system, the increase in wage associated with increase in age for Korea's public employees is the strongest among the public sectors of OECD countries. On the other hand, empirical results indicate that the decline in skill level associated with increase in age for Korean public employees is greater than the average public employee level of OECD countries. Such a wage system of Korea's

public sector, with low returns to skills and high wage-skill gaps for older workers, poses the problem of not providing proper incentives for human capital investment.

In conclusion, as a counter-measure to the problems pertaining to skills and wages of Korea’s public employees revealed through our analyses, an innovative reform is needed in Korea’s public sector; the public sector must drastically change their ways of working to allow for active utilization of its workers skills and reform the wage system so that the skills of its workers are better rewarded.

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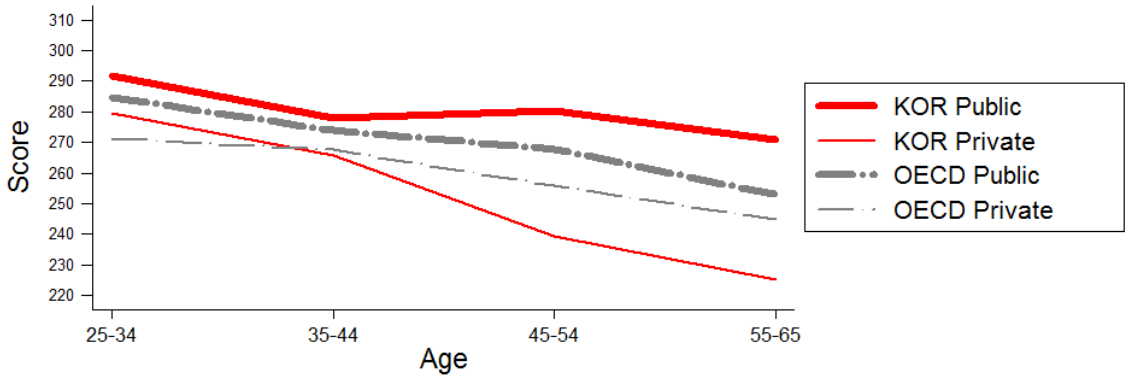
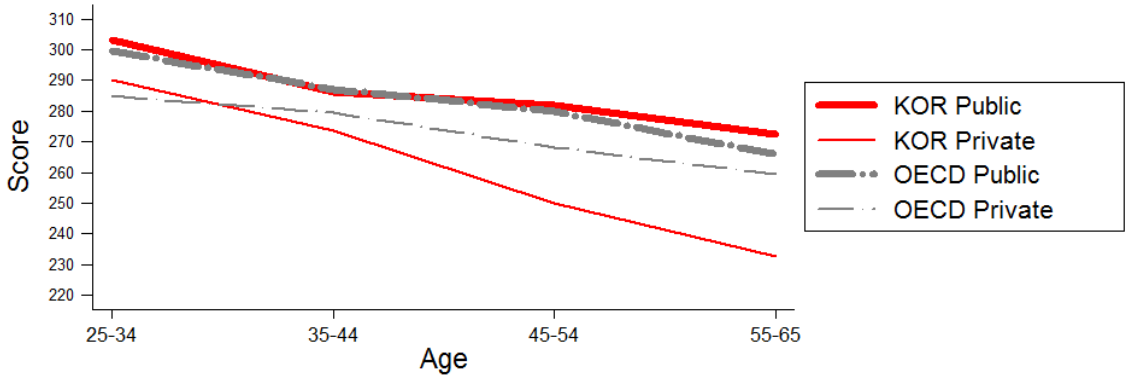
Appendix

Figure 1A. PIAAC Scores of Female Full-time Employees; Korea and OECD Average (Public and Private Sectors)

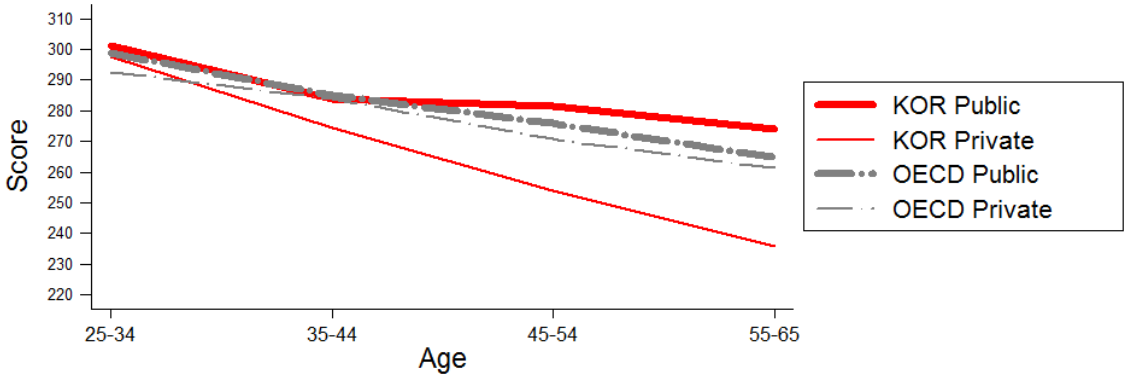
(a) Numeracy



(b) Literacy



(c) Problem Solving in Technology-rich Environment (PSTRE)



Source: PIAAC.

Table 1A. Regression on Log Wages of Public and Private Sector Employees (Model (2) - Model(5b))

(a) Model (2)

		Korea	Japan	USA	UK	Germany
AG	35-44	0.325***	0.399***	0.196**	0.259***	0.190***
		(0.079)	(0.085)	(0.098)	(0.070)	(0.051)
	45-54	0.509***	0.554***	0.311***	0.297***	0.252***
		(0.083)	(0.088)	(0.105)	(0.072)	(0.056)
	55-65	0.504***	0.637***	0.277***	-0.027	0.334***
		(0.131)	(0.117)	(0.097)	(0.080)	(0.066)
R^2		0.159	0.247	0.057	0.134	0.118
N		232	184	217	394	240

(b) Model (3)

		Korea	Japan	USA	UK	Germany
AG	35-44	0.052	0.216	0.355***	0.347***	0.146*
		(0.102)	(0.135)	(0.108)	(0.083)	(0.076)
	45-54	0.149	0.345*	0.562***	0.540***	0.250**
		(0.140)	(0.186)	(0.154)	(0.126)	(0.118)
	55-65	0.207	0.548**	0.633***	0.369**	0.411***
		(0.171)	(0.270)	(0.191)	(0.157)	(0.137)
Edu	HS Grad	0.396**	-0.082	0.283*	0.223***	0.179
		(0.189)	(0.193)	(0.158)	(0.075)	(0.317)
	Coll Grad	0.823***	-0.015	0.675***	0.446***	0.411
		(0.183)	(0.176)	(0.171)	(0.071)	(0.323)
E		0.041**	0.041**	-0.004	-0.005	0.012
		(0.019)	(0.020)	(0.019)	(0.013)	(0.013)
E^2		-0.001	-0.001*	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2		0.409	0.277	0.257	0.367	0.273
N		232	184	217	394	240

Notes: Least squares regression weighted by sampling weights. Includes country fixed effects and gives same weight to each country. Dependent variable: log gross hourly wage. Sample: Full-time male employees of the public sector, aged 25-65. Full-time employees are those who report their work status as 'full-time' and work at least 30 hours a week.*AG*: variable indicating 'age group' (base group: age 25-34, age 35-44, age 45-54, age 55-65). *Edu*: variable indicating respondent's highest education level (base: middle school graduate or less, high school graduate ("HS Grad"), college graduate or above ("Coll Grad"). *E*: total years of work experience during lifetime. R^2 refers to within-country R^2. Jackknife standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01.

Source: PIAAC.

Table 1A cont'd

(a) Model (4)

		Korea	Japan	USA	UK	Germany
AG	35-44	0.342***	0.404***	0.250**	0.252***	0.159***
		(0.081)	(0.083)	(0.104)	(0.057)	(0.054)
	45-54	0.550***	0.566***	0.347***	0.337***	0.264***
		(0.083)	(0.085)	(0.090)	(0.055)	(0.054)
	55-65	0.566***	0.670***	0.324***	0.032	0.375***
		(0.130)	(0.112)	(0.100)	(0.066)	(0.071)
$Std(Num)$		0.132***	0.120**	0.173***	0.173***	0.115***
		(0.042)	(0.047)	(0.042)	(0.022)	(0.035)
R^2		0.206	0.288	0.187	0.352	.212
N		232	184	217	394	240

(b) Model (5b)

		Korea	Japan	USA	UK	Germany
AG	35-44	0.381***	0.397***	0.312***	0.277***	0.110*
		(0.085)	(0.092)	(0.105)	(0.073)	(0.061)
	45-54	0.663***	0.569***	0.389***	0.408***	0.295***
		(0.089)	(0.094)	(0.085)	(0.066)	(0.066)
	55-65	0.742***	0.670***	0.360***	0.105	0.480***
		(0.126)	(0.121)	(0.097)	(0.082)	(0.095)
$Std\widehat{(Num)}$		0.507***	0.123	0.330***	0.336***	0.370***
		(0.094)	(0.115)	(0.062)	(0.048)	(0.088)
R^2		0.331	0.255	0.223	0.353	0.228
N		231	178	213	341	235

Notes: Least squares regression weighted by sampling weights. Includes country fixed effects and gives same weight to each country. Dependent variable: log gross hourly wage. Sample: Full-time male employees of the public sector, aged 25-65. Full-time employees are those who report their work status as 'full-time' and work at least 30 hours a week.*AG*: variable indicating 'age group' (base group: age 25-34, age 35-44, age 45-54, age 55-65). *Std(Num)*: PIAAC Numeracy score standardized to have a mean of 0 and std. dev. of 1 across the entire international sample. $Std\widehat{(Num)}$: Estimated standardized numeracy score, estimated using model (5a). R^2 refers to within-country R^2. Jackknife standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01.

Source: PIAAC.

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