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How labour market
outcomes reflect age,
gender and skills in Korea

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HOW LABOUR MARKET OUTCOMES REFLECT AGE, GENDER AND SKILLS IN KOREA

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By Jon Pareliussen

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ABSTRACT/RÉSUMÉ**How labour market outcomes reflect age, gender and skills in Korea**

Using micro-data from the OECD Survey of Adult Skills (PIAAC), this paper seeks to answer how age, gender and childbirth are reflected in literacy proficiency, employment prospects and pay, and to which extent labour market outcomes are determined by these demographic profiles rather than education, skills and experience. It finds that literacy skills and tertiary education, objective measures of skills, which are highly correlated with employment and productivity in most OECD countries, do not significantly affect the likelihood of employment in Korea. Work experience and educational level are highly correlated with pay. Age, gender and parenthood are strongly correlated with both pay and employment. The weak link between objective skills and labour market outcomes points to a misallocation of human capital and likely a substantial loss of productivity.

This Working Paper relates to the 2022 Economic Survey of Korea

<https://www.oecd.org/economy/korea-economic-snapshot/>

Key words: Skills, gender gaps, labour market

JEL codes: J13, J16, J21, J24

*** **

L'impact de l'âge, du genre et des compétences sur le marché du travail en Corée

À l'aide de microdonnées de l'Enquête de l'OCDE sur les compétences des adultes (PIAAC), cette étude cherche à déterminer comment l'âge, le genre et la maternité se reflètent dans les niveaux de compréhension de textes, les perspectives d'emploi et les rémunérations, et dans quelle mesure les résultats sur le marché du travail sont déterminés par ces profils démographiques, plutôt que par l'éducation, les compétences et l'expérience. Il montre que les compétences en compréhension de textes et un niveau d'études supérieur, mesures objectives des compétences fortement corrélées à l'emploi et à la productivité dans la plupart des pays de l'OCDE, n'affectent pas de manière significative la probabilité d'emploi en Corée. L'expérience professionnelle et le niveau d'études sont fortement corrélés au salaire. L'âge, le genre et la parentalité sont fortement corrélés à la fois au salaire et à l'emploi. Le faible lien entre les compétences objectives et les résultats sur le marché du travail suggère une mauvaise allocation du capital humain et probablement une perte substantielle de productivité.

Ce document de travail concerne l'Étude économique du Corée de 2022

<https://www.oecd.org/economy/korea-economic-snapshot/>

Mots clés : Compétences, écarts entre les genres, marché du travail

Codes JEL : J13, J16, J21, J24

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How labour market outcomes reflect age, gender and skills in Korea

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Introduction

Korea's exceptional journey from one of the poorest countries in the world in the 1950s to the 10th largest economy in 2020 saw per capita GDP rise from around 1% of the OECD average to surpassing the average in 2020. GDP growth and access to health care have pushed life expectancy well above the OECD average, and was accompanied by a transition from authoritarian rule to democracy. This rapid development was founded on an export-oriented growth strategy, sound macroeconomic policies with an investment-friendly climate and heavy investments in education. Large family-run business groups (chaebol) focussed on manufacturing acted as engines of growth, supported by subsidies, favourable access to credit, tax incentives and trade protection, notably throughout the 1960s and 1970s, after which this support was scaled back (Jones, 2021). However, the very drivers of Korea's economic miracle also gave ground to pronounced gaps in business and society.

The 2022 *OECD Economic Survey of Korea* documents that large productivity gaps between large and small companies underpin gaps in income, social protection and working standards. Large business groups are still dominant today in terms of national sales, and even more so in exports. These firms typically offer highly educated workers well-paid jobs, good working conditions, regular employment and social insurance coverage. However, they no longer drive broader Korean prosperity as in the past. Their share of employment has fallen as their production has become ever more internationalised, and capital- and technology intensive.

In contrast, Korean SMEs – defined as firms with less than 300 employees – accounted for 80% of business sector employment in 2016, the second highest share in the OECD. Their productivity has increasingly lagged behind, and is now approximately one third of that of large companies. Low-productivity SMEs, often in the domestic-oriented service sector, hire a larger share of non-regular workers, pay less, and offer less job protection jobs. These companies often experience difficulties to attract the skills needed to boost productivity, for example by adopting digital technologies (Pak, 2021).

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As a result of this, and of large skill gaps between young and old generations and the practice of honorary retirements around the age of 50, old-age poverty in Korea is the highest in the OECD. Productivity gaps and labour market duality imposes notable costs to Korean youth, parents and society, as considerable efforts, time and money are invested in pursuing a golden ticket to attractive employment in large companies and the public sector, slowing down employment and family formation (OECD Economic Survey 2022).

Women have gained opportunities to prosper in the workplace, as access to education and jobs has become increasingly equal between genders. After considerable public investments in childcare and parental leave, difficulties in combining career and family are increasingly reflecting gender norms and an unforgiving work culture (Doepke et al., 2022; Myong et al., 2020). Combining career and children is often not an option because demands from working life are tough, with a culture of long work hours and relatively little flexibility. Following up on their children's education to help them win their own golden ticket costs time and money. Expensive housing and higher demands to meet material standards adds to the cost (OECD Economic Survey 2022).

Women who have left the labour force for a few years to care for young children tend to find the return to the labour market an unattractive proposition, and are discouraged to do so by traditional gender norms. Strict seniority-based career and earnings progression makes it challenging for mothers to resume a career after a break for childbirth. The same seniority-based system has been blamed for excessive “honourable” retirements and second careers in low-productivity jobs when workers reach around 50 years of age and their productivity no longer matches their step on the career and earnings ladder. In general, regular employment opportunities are hard to find for “mother returners”, for whom low-paid non-regular jobs are the only opportunities available. As a result, mothers are three times more likely to be in non-regular employment than fathers (OECD, 2021; OECD, 2019). These factors lead young women to postpone family formation and to have fewer children over their lifetime than before. The average age of first childbirth has increased from 26.2 to 32.3 in less than three decades. The total fertility rate, which was at six children per woman on average in 1960, dropped to just below one child per woman in 2019 (OECD, 2019), and has stayed below one since.

To the extent companies' decisions to hire, promote, remunerate and retire staff are determined on the basis of gender, age and family situation rather than workers' efficiency in their tasks, this has a direct cost to society in terms of lost productivity. Furthermore, a high career cost of family choices also affects fertility rates (Doepke et al., 2022).

Using micro-data from the OECD Survey of Adult Skills (PIAAC), this paper seeks to answer the following questions: i) how age, gender and childbirth are reflected in literacy proficiency; ii) to which extent labour market outcomes are determined by these demographic profiles rather than education, skills and experience; and iii) how Korea compares with other OECD countries in terms of how labour market outcomes reflect skills versus demographic profiles. It finds that literacy skills and tertiary education, objective measures of skills, which are highly correlated with employment and productivity in most OECD countries, do not significantly affect the likelihood of employment in Korea. Work experience and educational level are highly correlated with pay. Age, gender and parenthood are strongly correlated with both pay and employment. The weak link between objective skills and labour market outcomes points to a misallocation of human capital and likely a substantial loss of productivity.

This paper is structured as follows: the second section presents the PIAAC database and key variables used for this analysis; the third section outlines a model of human capital formation; the fourth section presents and discusses the results, while the fifth and final section summarises and concludes.

Data

The PIAAC micro-dataset includes test scores in literacy, numeracy and problem-solving in technology-rich environments as well as a rich set of background variables for individuals aged 16-64 residing in 24

participating regions and countries at the time of data collection in 2011 and 2012. Trained interviewers supervised the test and filled in the background questionnaire. Tests were completed either on a computer or on paper, depending on the respondents' computer skills and preferences. Respondents with very low skills took a test of basic reading skills instead of the full test. The required sample size was 4 500-5 000 based on the sampling design, but actual samples in the different countries and regions ranged from approximately 4 500 to 27 300. The total sample size for Korea is 6 667, which reduces to 4 428 when removing full-time students. A detailed description of the dataset can be found in OECD (2013).

A note of caution relates to the fact that the data were collected 10 years ago. Even though the main issues described in this paper are likely to still be relevant, Korea is evolving rapidly on a number of fronts of relevance, for example with the large-scale rollout of publicly funded childcare and the newly introduced 52-hour cap on weekly work hours (including overtime). See the 2022 *OECD Economic Survey of Korea 2022* for further details.

Skill-related variables

Education refers in this paper to the highest completed level of education, and is divided into five dummy categories: tertiary education at master level or above, tertiary academic education at bachelor level, tertiary professional bachelor-level education, upper-secondary and below upper-secondary education¹.

Literacy is measured on a 500-point scale; a higher score corresponds to higher proficiency. Literacy measures both language skills and processing skills, as participants in the survey have to read and understand texts of varying complexity before answering to assignments corresponding to different proficiency levels, all in the native language of the country where the test was taken.

Work experience is for the purpose of this analysis measured as years of work experience minus the individual's age. The aim of this variable is to capture the loss of human capital from periods out of work relative to peers in terms of age and education level. Work experience in general builds human capital. Absences from work caused by childbirth or other reasons can therefore be manifested in inferior labour market outcomes compared to individuals at a similar age and with otherwise similar profiles. The inclusion of work experience in the regressions below could potentially induce reverse causality, and could in principle correlate with education level. However, tenure is an important driver of skills and career progression, and the overall results are robust to excluding this variable.

Variables related to demographic profiles

The population is for the purpose of this analysis divided into five working-age cohorts, the first covering ages 16-24, and the rest covering 10-year age groups to the age of 65. Men and women see different labour market profiles over their working age, so these five age cohorts are split into ten gender-specific ones.

Childbirth is defined as an individual having a child less than three years of age. This variable is also gender-specific, reflecting that childbirth affects mothers' and fathers' labour market outcomes differently.

Model

A simple model of human capital adapted from Bussi and Pareliussen (2017) can help explore to which extent labour market outcomes are determined by measurable human capital rather than employer bias. It is assumed that the productivity of a worker is a linear function of her human capital (h), determined by her education level (s), basic skills (b) and work experience (x). Age, gender and parental status are assumed to only affect human capital through s , b and x . ε_i (white noise) accounts for individual characteristics other than age, gender and parental status. Person i 's human capital can be expressed as:

$$h_i = \alpha_0 + \alpha_1 s_i + \alpha_2 b_i + \alpha_3 x_i + \varepsilon_i$$

Productivity π would furthermore depend on the production structure of the employer including capital structure and managerial skills, in the context of country-specific institutions, here defined as a constant (a):

$$\pi_i = ah = a(\alpha_0 + \alpha_1 s_i + \alpha_2 b_i + \alpha_3 x_i + \varepsilon_i)$$

$$\pi_i = \beta_0 + \beta_1 s_i + \beta_2 b_i + \beta_3 x_i + \varepsilon_i$$

Earnings (w) is defined by productivity, but also allowing employers to systematically apply a premium or discount based on societal norms or biases according to gender (g) and parental status (p):

$$(1) \quad w_i = (\beta_0 + \beta_1 s_i + \beta_2 b_i + \beta_3 x_i + \beta_4 g_i + \beta_5 p_i + \varepsilon_i)$$

Individuals have the choice between accepting this earnings proposal or pursue outside options which could include parenthood, unpaid household work, leisure and self-employment. This outside option has positive utility defined in monetary terms as \bar{w} . The individual will choose employment if $w_i > \bar{w}$. This can be defined in the function E_i , which takes the value 1 if the individual is employed, 0 if not:

$$E_i = \begin{cases} 1 & (\beta_0 - \bar{w}) + \beta_1 s_i + \beta_2 b_i + \beta_3 x_i + \beta_4 g_i + \beta_5 p_i + \varepsilon_i \\ 0 & \text{else} \end{cases}$$

Expressing this as a logistic regression, we define the indicator function I_{Ei} as follows, with k as the constant, encompassing both β_0 and \bar{w} :

$$(2) \quad I_{Ei} = \ln \left(\frac{P(E_i = 1)}{1 - P(E_i = 1)} \right) = k + \beta_1 s_i + \beta_2 b_i + \beta_3 x_i + \beta_4 g_i + \beta_5 p_i + \varepsilon_i$$

Biases based on gender and parental status may lead to equivalent labour market outcomes, but the nature of the bias matters. A negative bias towards women as such reduces expected earnings and thereby makes outside options relatively more attractive than a career, thus discouraging work but encouraging parenthood. A negative bias triggered by childbirth would have the opposite effect before parenthood. Such a bias reduces the value of parenthood as an outside option in line with the net present value of earnings lost, thus discouraging parenthood and encouraging work.

Results

Literacy skills follow a clear generational profile in Korea, with the youngest 10-year cohort (16-24) having the highest skills and falling literacy by age for each cohort. This reflects the rapid expansion of the educational system since the end of the Korean war. Women in older cohorts have considerably lower literacy proficiency than men in the same cohort when not controlling for education and work experience. The age pattern remains clear and significant when controlling for the highest level of formal education as well as years of work experience relative to age, indicating considerable improvements to the quality as well as quantity of education over time. No significant gender differences survive when controlling for education and experience, indicating that lower literacy skill of women relative to men in older generations is a direct consequence of lower access to education and less work experience. As expected, being a parent has no significant correlation with literacy skills (Table 1).

Table 1. Literacy follows a clear age profile, but no gender differences
OLS regression results, literacy proficiency scores

	All controls	Demographics only
Mother of child below 3 years of age	0.04	0.09
	[0.1]	[0.09]
Father of child below 3 years of age	0.06	0.1
	[0.08]	[0.09]
Man less than 24	0.54	0.32
	[0.09]**	[0.07]**
Man 25-34	0.18	0.23
	[0.06]**	[0.06]**
Man 45-54	-0.23	-0.43
	[0.05]**	[0.06]**
Man 55-64	-0.25	-0.69
	[0.06]**	[0.07]**
Woman less than 24 (difference to same-age man)	-0.1	-0.03
	[0.09]	[0.06]
Woman 25-34 (difference to same-age man)	-0.07	-0.05
	[0.06]	[0.06]
Woman 35-44 (difference to same-age man)	-0.07	-0.15
	[0.05]	[0.05]**
Woman 45-54 (difference to same-age man)	0.03	-0.18
	[0.06]	[0.05]**
Woman 55-64 (difference to same-age man)	-0.03	-0.36
	[0.07]	[0.07]**
Max lower secondary education	-0.69	
	[0.05]**	
Tertiary education	0.5	
	[0.03]**	
Work experience (years)	0.01	
	[0]**	
Constant	6.67	6.72
	[0.07]**	[0.04]**
R2	0.31	0.19
	[0.01]**	[0.01]**
Number of observations	5786	6651

Note: * Denotes significance at the 5% level, ** at the 1% level. The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

The log likelihood of being employed is mostly associated with demographic profiles rather than objective measures of skills. Literacy scores have no impact on employment, and only the lowest education category has a significant (negative) impact at the 5% level. Work experience (relative to age) is the only objective skill measure positively correlated with employment at the 1% significance level. Men's employment profile is concave with the likelihood of employment lower in younger and older age groups. The pure gender-based difference in employment rates is approximately 0 in the youngest group, but widens considerably in age groups 25-34 and 35-44, before narrowing in the oldest age group. Having a young child is associated with a large and significant drop in the log likelihood of employment for women and a large and significant increase in the log likelihood of employment for men (Table 2).

Table 2. Employment and earnings clearly reflect gender, age and parenthood

	Employment (Logit)	Log hourly earnings (OLS)
Literacy score	-0.03 [0.06]	0.07 [0.02]**
Mother of child below 3 years of age	-1.31 [0.18]**	0.03 [0.09]
Father of child below 3 years of age	1.24 [0.49]*	0.16 [0.04]**
Man less than 24	-1.63 [0.43]**	-0.98 [0.06]**
Man 25-34	-1.02 [0.28]**	-0.28 [0.03]**
Man 45-54	-0.1 [0.31]	0.2 [0.03]**
Man 55-64	-1.15 [0.28]**	0.07 [0.05]
Woman less than 24 (difference to same-age man)	0.03 [0.46]	-0.12 [0.11]
Woman 25-34 (difference to same-age man)	-1.31 [0.2]**	-0.32 [0.04]**
Woman 35-44 (difference to same-age man)	-1.72 [0.27]**	-0.44 [0.04]**
Woman 45-54 (difference to same-age man)	-0.97 [0.24]**	-0.61 [0.05]**
Woman 55-64 (difference to same-age man)	-0.55 [0.21]**	-0.22 [0.08]**
Max lower secondary education	-0.25 [0.12]*	-0.18 [0.05]**
Tertiary education	0.02 [0.09]	0.38 [0.03]**
Work experience	0.08 [0.01]**	0.02 [0]**
Constant	5.3 [0.52]**	8.05 [0.12]**
(Pseudo) R2	0.18	0.39
Number of observations	5539	3160

Note: * Denotes significance at the 5% level, ** at the 1% level. The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

Contrary to employment, earnings of those in employment are correlated with objective skill measures. Literacy scores, education dummies and work experience are all significant at the 1% level. However, there are also considerable and significant gender differences in all but the youngest age group, and fathers obtain an earnings premium which is not obtained by women (Table 2).

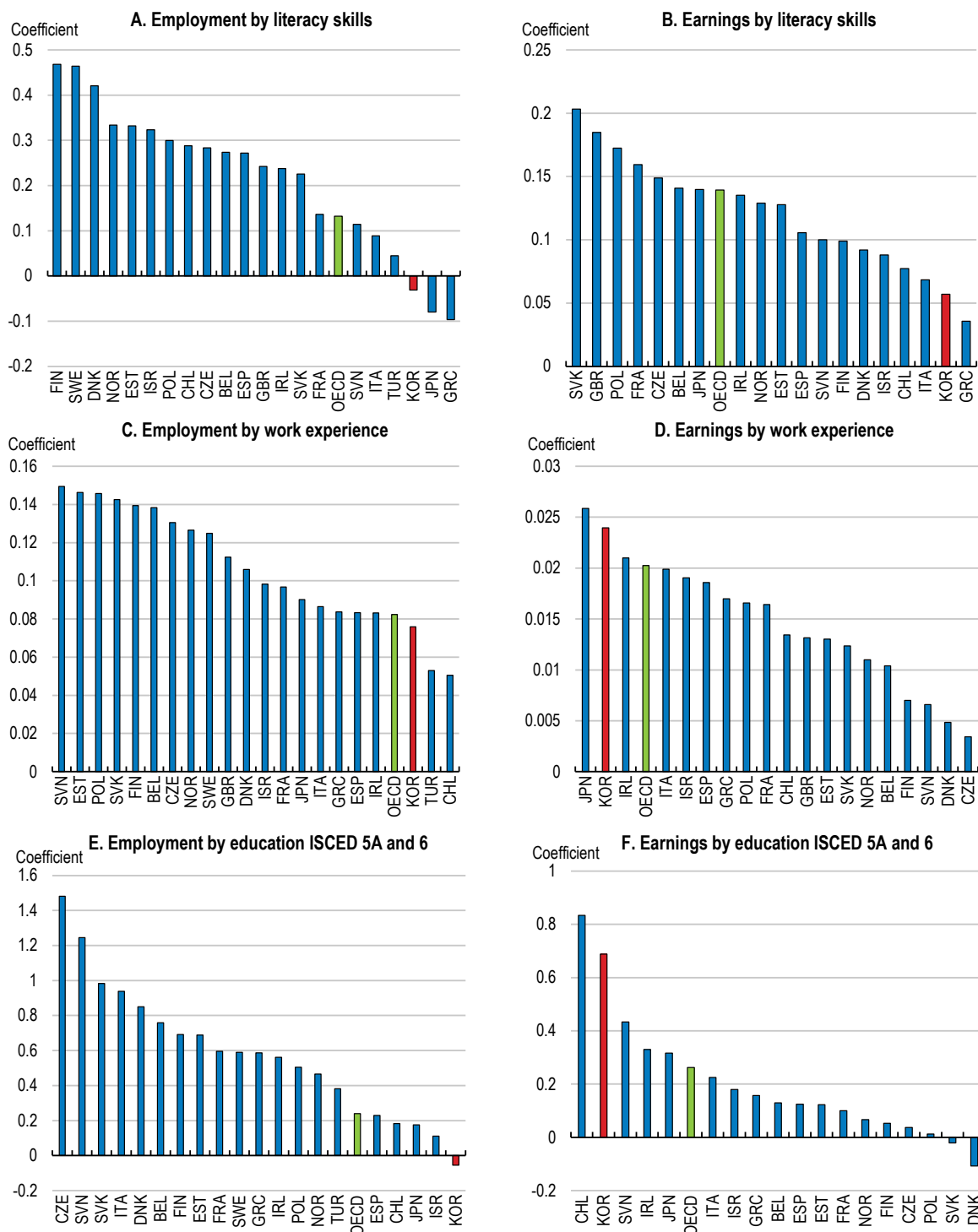
Benchmarking these findings to other OECD countries reveals that literacy skills is highly correlated with employment in most other OECD countries. The correlation between literacy and earnings in Korea is also the second-lowest in the sample. Work experience and education are also relatively weakly correlated with employment in Korea, but these variables are highly correlated with earnings. This is consistent with the stylised facts that career progression and pay in Korea are largely functions of seniority and formal qualifications (Figure 1).

Running the employment and earnings regressions presented above on PIAAC countries, pooled and individually (subject to data availability for individual-country samples), shows that gender employment gaps controlling for skills, education and work experience are larger in Korea than in the OECD average country for all but the youngest cohorts. Earnings gaps, conditional on employment and the other covariates, are roughly in line with the OECD average (Figure 2). As having young children and the objective loss of work experience from childbirth are controlled for separately, these gaps can be interpreted as imperfectly illustrating the differences between men and women existing purely based on gender (abstracting from potential missing variable bias).

The dummy for having young children compounds gender gaps in earnings and employment. Across the countries in the sample, childbirth is associated with lower female employment and higher male employment. Korea stands out with the highest male employment premium combined with the fifth largest female employment penalty. Fathers also have higher earnings than men without children in most countries in the sample, while the picture is more mixed for women. The fathers' earnings premium is among the largest in the OECD in Korea, while mothers' earnings premium is not significantly different from zero (Figure 3). It should be noted that fathers' employment and earnings premiums to childless men are susceptible to reverse causality, as economic security is a determinant of parenthood (Doepke et al., 2022).

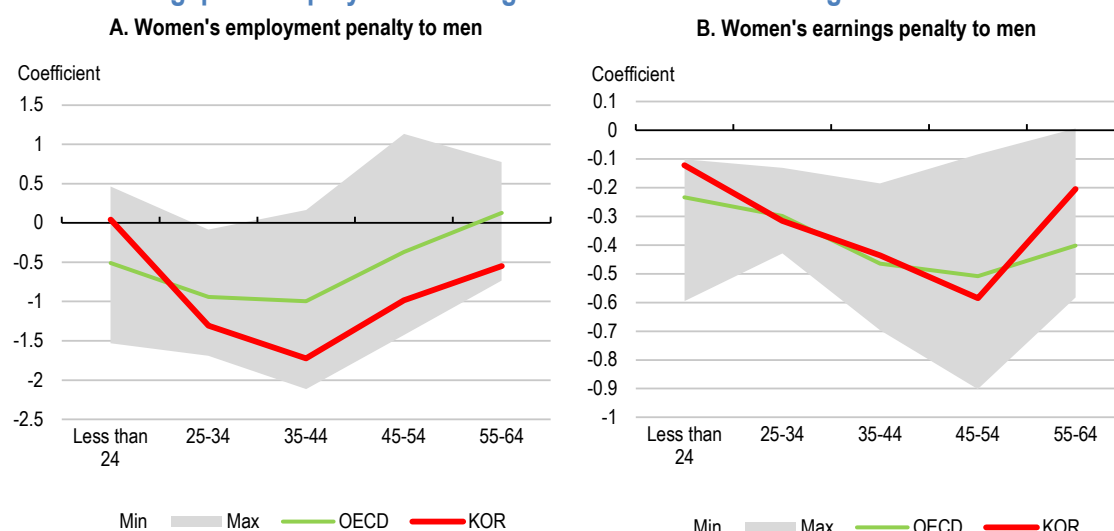
Adding the childbirth coefficient to the age specific gender gaps reveals that the employment gap in Korea is the largest of the OECD countries covered in the sample. The only exception is in the youngest age group, where the gap is still considerably higher than the OECD average. The earnings penalty is less clear-cut, and it does not seem that there is any systematic difference between Korea and the OECD average (Figure 4).

Figure 1. Objective skill measures correlate more strongly with employment in other OECD countries



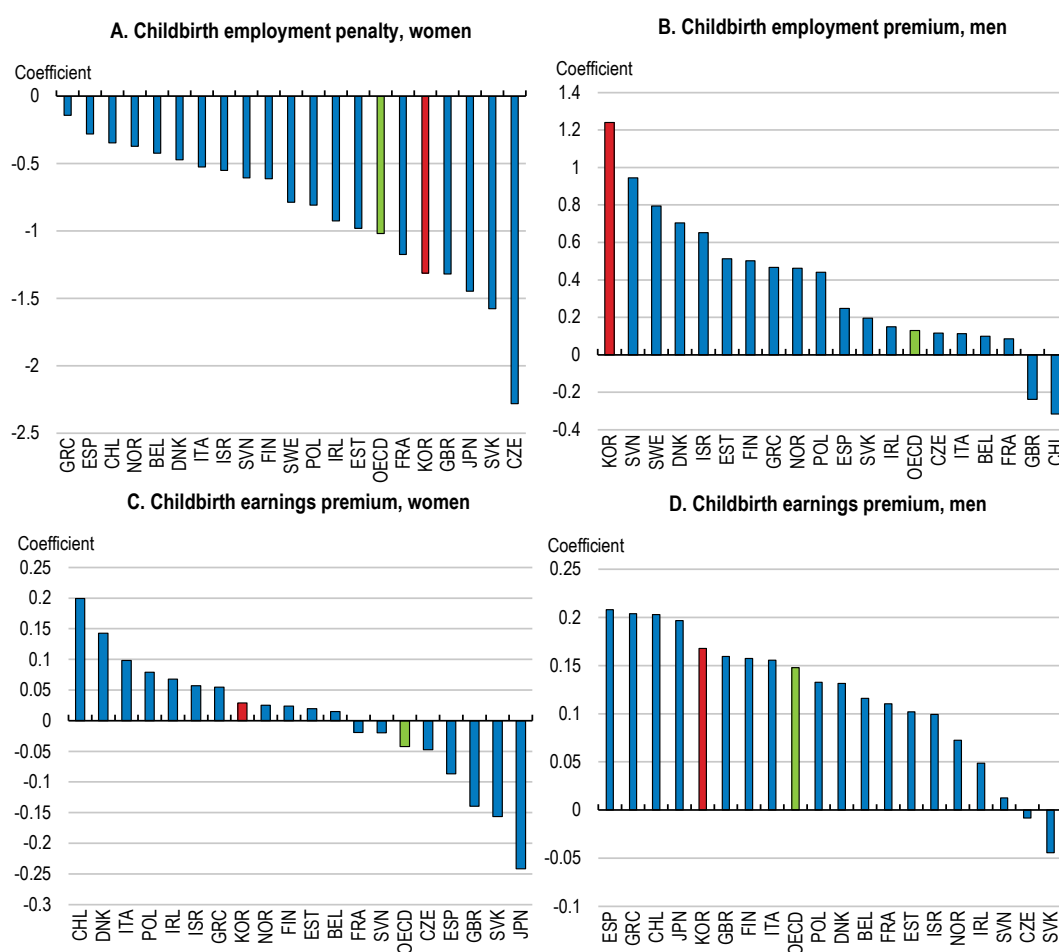
Note: * Denotes significance at the 5% level, ** at the 1% level. The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

Figure 2. Gender gaps in employment are higher than the OECD average

Note: The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

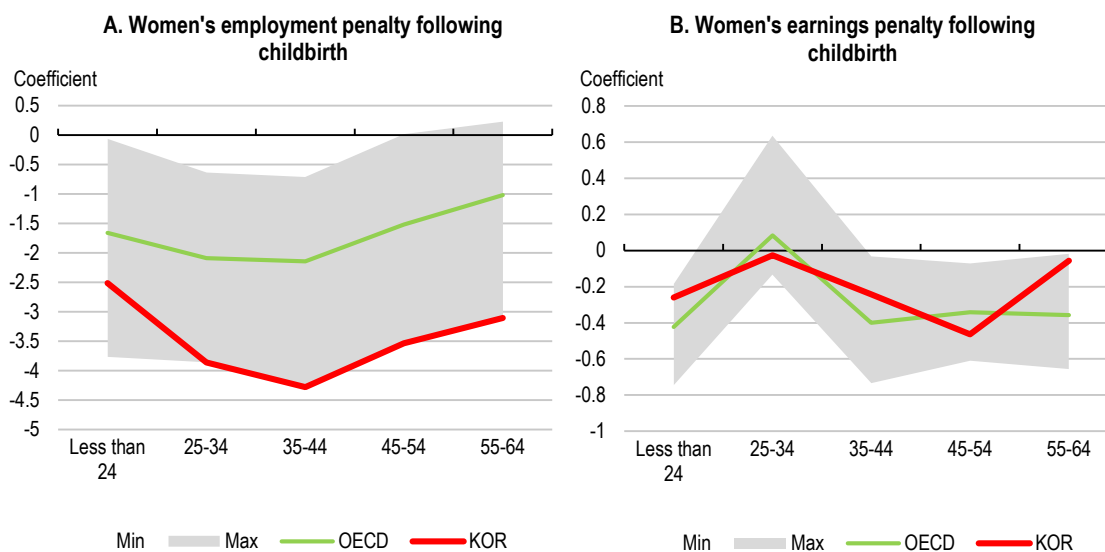
Source: Author's calculations.

Figure 3. Childbirth is associated with high employment and earnings gains for fathers

Note: The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

Figure 4. Childbirth compounds the gender employment gap more in Korea than in the rest of the OECD



Note: The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

Consistency checks

The concept of an “adjusted” gender wage gap takes into account variables such as occupation, employment contract, working time, principal economic activity, enterprise size and geographical location of the enterprise in addition to the controls for tenure and education already included above. Such controls arguably reflect differences in choices between genders. The reason why these variables are not included in the main specifications of this paper is that they can be just as much symptoms of differences of opportunity between genders as evidence that women freely make educational and career choices causing gender gaps. In this sense, a cross-country comparison of gender gaps only accounting for observable skills, as presented above, may give a fairer picture of such gaps.

However, it can be useful to control for some of these variables to explore to which extent gender gaps reflect choices (free or constrained) and the channels through which gender gaps emerge. Korea is characterised by large productivity gaps between large and small companies, and by pronounced labour market duality between regular and non-regular employees. There is also a difference between private and public sector employers, where the latter are perceived as providing better opportunities to combine career and family. As in other countries, more women than men work part-time. Controls for firm size, contract type, weekly work hours and a public sector dummy are therefore added to the regression of hourly pay gaps (Table 3). Even though all the additional controls but the public sector dummy are significant, it is striking how robust the results are to including these variables. The gender-age dummies are reduced somewhat, but changes are minor and they maintain significance at the 99% level.

Table 3. Gender wage gap adjusted for work hours and job characteristics

	Log hourly earnings (OLS)
Literacy	0.05 [0.01]**
Mother	0.01 [0.08]
Father	0.17 [0.04]**
Man less than 24	-0.73 [0.06]**
Man 25-34	-0.28 [0.03]**
Man 45-54	0.18 [0.04]**
Man 55-64	0.09 [0.04]*
Woman less than 24	-0.14 [0.08]
Woman 25-34	-0.19 [0.04]**
Woman 35-44	-0.34 [0.04]**
Woman 45-54	-0.53 [0.04]**
Woman 55-64	-0.22 [0.07]**
Max lower secondary education	-0.12 [0.05]**
Tertiary professional degree	0.31 [0.02]**
Work experience	0.02 [0]**
Firm size 1-10	-0.09 [0.03]**
Firm size 51-250	0.08 [0.02]**
Firm size 251-1000	0.1 [0.03]**
Firm size > 1000	0.38 [0.04]**
Work contract - fixed term	-0.25 [0.02]**
Work contract - other	-0.23 [0.03]**
Part time worker	-0.32 [0.06]**
Public sector	-0.01 [0.02]
Weekly work hours	0 [0]**
Constant	7.92 [0.13]**
Pseudo R2	0.51
Number of observations	3154

Note: * Denotes significance at the 5% level, ** at the 1% level. The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

The way parenthood is defined is well-suited to explore how gender gaps differ between age cohorts. However, defining parenthood as having children below the age of three could be a source of bias, as the labour market penalty women experience after childbirth are likely diminishing gradually as children grow older. To test the validity of the results and explore how the age of children affects labour market outcomes, an alternative specification does not separate age cohorts in genders, but rather introduces gender-specific dummies for the age of the youngest child (Table 4). The results are qualitatively similar as in the main specification, with a significant employment penalty for being a childless woman, a sizeable and significant employment penalty for being a mother to young children, diminishing with the age of the child. As in the main specification, fathers see a significant employment premium compared to men without children (the reference category). This premium peaks for fathers of children aged three to five and is no longer significant for children aged 13 and above. Conditional on being employed, fathers see an earnings premium compared to childless men. This premium is stable over the age of the child. Women (if employed) are less paid than childless men whether they have children or not.

Table 4. Gender gaps by age of the youngest child

	Employment (Logit)	Log earnings (OLS)
Literacy	-0.02 [0.06]	0.07 [0.02]**
Age less than 24	-0.41 [0.23]	-0.78 [0.07]**
Age 25-34	-0.39 [0.16]*	-0.21 [0.03]**
Age 45-54	0.26 [0.15]	0.08 [0.04]
Age 55-64	-0.52 [0.18]**	0.07 [0.05]
Father of child below 3	1.43 [0.48]**	0.2 [0.05]**
Father of child 3-5	2.68 [0.71]**	0.18 [0.04]**
Father of child 6-12	0.98 [0.39]*	0.18 [0.05]**
Father of child 13 or older	0.4 [0.23]	0.19 [0.05]**
Childless woman	-0.42 [0.19]*	-0.26 [0.05]**
Mother of child below 3	-2.62 [0.21]**	-0.12 [0.07]
Mother of child 3-5	-1.62 [0.23]**	-0.28 [0.08]**
Mother of child 6-12	-0.83 [0.22]**	-0.41 [0.06]**
Mother of child 13 or older	-0.38 [0.24]	-0.29 [0.06]**
Max lower secondary education	-0.24 [0.12]	-0.17 [0.05]**
Tertiary education	0.06 [0.09]	0.38 [0.03]**
Work experience	0.08 [0.01]**	0.02 [0]**
Constant	4.34 [0.48]**	7.94 [0.13]**
(Pseudo) R2	0.20	0.39
Number of observations	5538	3159

Note: * Denotes significance at the 5% level, ** at the 1% level. The reference category is a man aged 35-44 without children, holding an upper secondary degree.

Source: Author's calculations.

Finally, the PIAAC Survey also measures numeracy skills and problem-solving in technology-rich environments. These variables are highly correlated with numeracy, and can therefore not be included in the same regression without causing multicollinearity issues. Robust results to different choices of skill proficiency measures would however strengthen the validity of the findings. Exploring the drivers of skills, the results are qualitatively very similar, except that some small but statistically significant gender differences are found in numeracy for the three youngest cohorts and on the cohorts from 25 to 44 years of age for digital problem-solving. Results for employment and pay control for these proficiency scores, and are still close to identical across skill measures (Table 5). It should be noted that people directed to the paper based assessment because of a lack of computer skills did not take the test of problem-solving in technology-rich environments. These results are therefore not necessarily fully comparable to results in literacy and numeracy and should be treated with care.

Table 5. Consistency checks with numeracy and digital problem-solving

	PIAAC proficiency (OLS)		Employment (Logit)		Log hourly earnings (OLS)	
	Numeracy	Problem solving in technology-rich environments	Numeracy	Problem solving in technology-rich environments	Numeracy	Problem solving in technology-rich environments
PIAAC score			0.04	0	0.07	0
			[0.06]	[0]	[0.02]**	[0]**
Mother of child below 3 years of age	0	0.81	-1.32	-1.3	0.03	0.05
	[0.1]	[3.21]	[0.18]**	[0.19]**	[0.1]	[0.1]
Father of child below 3 years of age	0.1	0.54	1.24	1.31	0.16	0.19
	[0.09]	[3.6]	[0.49]*	[0.59]*	[0.04]**	[0.04]**
Man less than 24	0.43	34.04	-1.65	-2.34	-0.97	-1.04
	[0.08]**	[3.6]**	[0.43]**	[0.49]**	[0.06]**	[0.07]**
Man 25-34	0.11	12.69	-1.03	-1.34	-0.28	-0.29
	[0.06]*	[2.44]**	[0.28]**	[0.33]**	[0.03]**	[0.03]**
Man 45-54	-0.19	-13.43	-0.09	-0.1	0.2	0.3
	[0.06]**	[2.9]**	[0.31]	[0.4]	[0.03]**	[0.04]**
Man 55-64	-0.24	-17.02	-1.14	-1.25	0.06	0.26
	[0.06]**	[4.04]**	[0.28]**	[0.4]**	[0.05]	[0.07]**
Woman less than 24 (difference to same-age man)	-0.18	-5.56	0.04	0.3	-0.12	-0.12
	[0.09]*	[3.73]	[0.46]	[0.47]	[0.11]	[0.12]
Woman 25-34 (difference to same-age man)	-0.16	-6.37	-1.3	-1.44	-0.31	-0.33
	[0.05]**	[2.6]*	[0.2]**	[0.22]**	[0.04]**	[0.04]**
Woman 35-44 (difference to same-age man)	-0.12	-6.53	-1.71	-2.11	-0.44	-0.42
	[0.05]*	[2.2]**	[0.27]**	[0.34]**	[0.04]**	[0.04]**
Woman 45-54 (difference to same-age man)	-0.02	-4.07	-0.97	-1.28	-0.6	-0.6
	[0.07]	[3.2]	[0.24]**	[0.31]**	[0.05]**	[0.07]**
Woman 55-64 (difference to same-age man)	-0.1	-5.05	-0.55	-0.62	-0.23	-0.34
	[0.08]	[5.19]	[0.21]**	[0.4]	[0.08]**	[0.13]**
Max lower secondary education	-0.74	-16.47	-0.2	0.07	-0.18	-0.2
	[0.05]**	[4.04]**	[0.12]	[0.27]	[0.05]**	[0.07]**
Tertiary education	0.54	18.78	-0.02	0.01	0.38	0.38
	[0.04]**	[2.05]**	[0.09]	[0.11]	[0.03]**	[0.03]**
Work experience (years)	0.01	0.35	0.08	0.1	0.02	0.03
	[0]**	[0.11]**	[0.01]**	[0.01]**	[0]**	[0]**
Constant	5.97	279.87	4.84	6.21	8.12	8.29
	[0.06]**	[3.38]**	[0.49]**	[0.76]**	[0.11]**	[0.14]**
R2	0.32	0.25	0.18	0.18	0.39	0.43
N	5786	3909	5539	3673	3160	2331

Note: * Denotes significance at the 5% level, ** at the 1% level. The reference category is a man aged 35-44 without young children, holding an upper secondary degree.

Source: Author's calculations.

Summary and conclusions

Age, gender and parental status are the main variables associated with the likelihood of being employed and the level of earnings in Korea. Of these variables, only age is significantly correlated with literacy skills when relevant controls are applied. Korea stands out in international comparisons with a combination of a low correlation between literacy skills and both employment and earnings. Observable measures of skills are in general less correlated with employment in Korea than in other OECD countries in the sample.

This paper provides evidence of negative employment and earnings biases against women in the Korean labour market. These labour market penalties relate to gender and to parenthood, and they go over and above what could be justified by objective measures of education, work experience and literacy skills.

Female earnings penalties compared with men, conditional on employment, are roughly in line with OECD averages in respective age cohorts, while employment penalties are consistently among the highest in the OECD. This indicates that other factors, like cultural norms or institutional factors, compound monetary incentives for women to reduce labour supply.

The female earnings penalty and other barriers directly attributable to being a woman (as opposed to childbirth) reduce the value of employment relative to other options, including motherhood. In contrast, if women's earnings and employment prospects fall permanently behind men's because of childbirth, this will entail a permanently lower expected income from the birth of the first child. This scarring effect will in turn discourage motherhood, encourage women to postpone having children, and it will discourage women's return to work as their children grow older.

This paper shows that childbirth correlates with widening gender gaps from a combination of considerably lower mothers' employment and higher fathers' employment and earnings. These gaps go beyond what is reasonable based on lost work experience or any objective skill measures, but are consistent with the social norm of unequal gender division of childcare and an inflexible working life. The decision to have a child is therefore indeed a fork in the road for many Korean women, whose decisions between career and motherhood assume too much of a binary nature. A more discretionary intertemporal labour supply choice for mothers and fathers and rewards in line with skills, efforts and results would serve individuals and the country better in the context of a very low fertility rate and relatively low female employment in international comparison. It would also better make use of the considerable human capital investments in Korean women, who are the most highly educated women in the OECD.

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