The Effects of School Education and Job Training on Wages in South Korea

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Abstract

This study aims to find the reason behind the bias in Korea concerning human capital investment, whereby Koreans invest too much in school/university education, while neglecting job training. The study estimates the effects of school education and job training on wages and compares these effects in different educational settings and in job training. The empirical finding is that the effects of a university education or a junior college education on wages are much more profound than those of lower educational levels. The effect of job training turns out to be marginal compared with the effect of school education. This tends to lead Koreans to invest so much in school and university education whilst holding job training in low esteem. The data employed in this study are taken from the 'Korean Labor and Income Panel Study (KLIPS)'. By means of the Heckman 2 step method and the fixed effect method, we estimated the effects of education and job training on wages. The increase in wages brought about by a junior college education is 15-16% and the effect of holding a bachelor degree leads to a 30% higher wage when compared to a senior high school education. There are significant wage differences between people who quit education after completing senior high school and those who proceeded to a higher level of school. Job training results in a wage increase of between 2.2-2.6% compared to no job training. The difference seems to be higher than is to be expected if one considers time invested, which is on average only 4.8 weeks. However, the frequency of job training, 6.5%, is also too low. Job training in Korea is not regarded as an alternative to school and university education which could result in a similar return on human capital investment.

Keywords: School education, Job training, Human capital, Wages

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1. Introduction

In Korea[1], 83.8% of all high school graduates went on to university or junior college in 2008. This number is more than five times as high as it was in 1980. However, merely 69% of graduates from general universities found a job in 2008.[2] Among these, only 70% of graduates have a regular job. In spite of the fact that university graduates are oversupplied in the labor market, the desire for a university degree continues to grow. On the other hand, the number of vocational high school graduates continues to fall although their employment rate has always been higher than that of university graduates. It is, in general, rather rare in Korea that people have any form of job training - either an apprenticeship or further training - after completing their school education: Only about 5% of all adults participate in any kind of job training. Why then does Korea invest so much in school/university education while neglecting job related education and training?

A positive correlation between earnings and the level of skills - school education and on-the-job training - and, similarly, the reduction of the rate of unemployment with the increasing level of skills were introduced as the stylized fact in human capital theory by Becker (1962, 1964). However: in contradistinction to this fact, a high level of education, such as university graduation, does not assure a job in Korea. Mincer (1962), in parallel with Becker's development of human capital theory, studied on-the-job training investment as distinguished from more formal education. He proved the great importance of on-the-job training in comparison with formal education in the US economy. The economic effect of on-the-job training, which is virtually neglected in Korea, is critical to the theory of human capital investment. With these clear contradictions, one could raise the question as to the reasons behind this phenomenon and how this can be explicated by the use of Becker's theory.

Research into human capital investment in Korea has been revitalized since the late 1990's, when the Asian crisis severely hit the Korean economy: The unemployment rate increased greatly between 1997 and 1998. In the month of December 1997 alone, approximately 3,000 companies went bankrupt, which led to a massive increase in the number of unemployed from 500,000 to 1,300,000. The unemployment rate, which had remained under 3% since 1988, grew to 6.95% in 1998. Job training became for the first time ever an important political measure to combat the high unemployment rate. Even at that time, empirical research on human capital investment was considered necessary for the purpose of estimating the effects of job training on the economy.

[1] This study uses Korea instead of South Korea.
[2] Korean Educational Development Institute (2009)

Reviewing the researches concerning human capital investment in Korea, Lyu (1995) first attempted to determine the economic effects of job training. He analyzed the data contained in the "Financial Statement Analysis" merging it with the wage data from the Ministry of Labor. Despite this pioneering effort, he could not find a single significant result concerning the effect of education and job training on wages. Kang and Noh (2000) estimated the effect of job training on employment and wages, using the 1998 data from the 'Korean Labor and Income Panel Study (KLIPS)'. Employing the Heckman 2 step model in their analysis, they found that job training resulted in an increase in wages of approximately 20% while the effect of further education on wages, according to their analysis, was unexpectedly negative. They interpreted this negative impact of school education on wages as an anomaly, and attributed it to the economic crisis of 1997 and 1998. Kim (2001) studied the productivity and efficiency of job training and its wage effect. In pursuit of this analysis, he convened the 'Skill Formation Survey' and the 'IT Industry Manpower Survey' of the Korea Labor Institute as a panel. Employing Almon's polynomial lagged model and the stochastic frontier model, he found a significant effect due to education and job training on a firm's productivity and efficiency. Following his analysis, however, the individual wage effect was determined to be insignificant. Kim (2002) further explored the individual wage effect of job training using data supplied by the 1998 and 1999 KLIPS panel. The job training effect on individual wages was found to be about 5% utilizing the first difference method, but the result was statistically insignificant at the 10% level. Further studies of job training effects on wages proceeded in the field of 'skill biased technical change'. Kim and Kim (2007) and Kim (2009) analyzed the effect of job training on wage inequality. They concluded that job training has an influence on the growth of wage inequality. In the research, Kim and Kim (2007) found a 4-6% significant wage premium relating to job training using the 1998-2005 KLIPS panel data. Kim's research (2009) revealed a 6.6% significant wage premium attributable to job training by means of the switching regression model, using the 2005 and 2007 data from the Human Capital Corporate Panel (HCCP).

In the field of 'skill biased technical change', the earnings/wage inequality problem relating to education has been plentifully researched since the end of the 80's. The educational effect on wages was also indirectly discussed.[3] However, attention has seldom been paid to the educational effect on wages in a human capital framework. Recently, Lee and Lee (2006) have analyzed the wage determinant in the Korean labor market using the 'Korean Labor and Income Panel Study (KLIPS)' by means of quantile regression. They found that age and education play important roles in the determination of wages in Korea. Kwack, Lee and Choi (2007) studied gender earn-

[3] See Yoo (1989), Kwark and Rhee (1993), Ryoo (1993), Nam (1996), Choi, Jeong, and Jung (2005), and Kim (2005) etc.

ings gaps and return to schooling using the Mincer earnings function. They used data from the 'Survey Report on Wage Structure' (1993-2002) supplied by the Ministry of Labor. By means of OLS, male and female workers with university and higher education earn 1.8 and 2.9 times more respectively than those with a middle school or lower education in 2002. In these studies, however, the estimation problems of the Mincer earnings function by OLS - measurement error, omitted ability bias and selection bias – are not generally considered at all. In order to reduce the biases from the previous estimation results and make them more precise, we need to begin to confront these estimation problems, which I attempt to do in this study.

The plan of the study is as follows. In Section 2, hypothesis, purpose and contribution of this study are presented. Section 3 introduces the education system in Korea. Section 4 outlines Becker's human capital theory and the Mincer earnings function, and present the estimation problems of his earnings function by OLS. Considering the Korean educational system and other social factors, I assume certain plausible facts, related to the estimation problems. Section 5 introduces the data. This study employs the 'Korean Labor and Income Panel Study'. Descriptive statistics are shown in Section 6. In Section 7, the estimation methods are outlined and the estimation results are interpreted. The Heckman 2 step method and the fixed effect method are used in this study. Section 8 summarizes the estimation result and Section 9 concludes this study.

2. Hypothesis, Purpose, Contribution

Regarding the question, why Korea invests so much in school/university education while neglecting job training, I would suggest some possible answers as follows: Korea gives a great deal of weight to school and university education, because the effect of graduating university and junior college on wages is much greater when compared with that of other lower educational levels. So, Koreans in general aggressively invest in school education with the intention of proceeding to university or at least on to junior college. In comparison with the effect of school education on wages, the effect of job training is considered to be marginal. Wage inequality between different educational levels can not be compensated for with job training after the completion of formal schooling. Education is the decisive factor on wage levels when considering all the factors involved with human capital which have an influence on wages. Koreans do not recognize job training as an alternative human capital investment factor. This is the primary force that leads people to invest so much in school and university education and to consider job training to be of no account.

The purpose of this study is to find the economic reason for the biased human capital investment behavior of Koreans. For this purpose, we will compare different wage effects between different educational levels. To this end we focus on the wage differences between senior high school graduation and junior college/university graduation. Finally, the comparison between the effect of school education on wages and the effect of job training will prove my hypothesis in this study. Earnings inequality caused by an unequal educational level and the effect of job training on wages has been the primary focus of many studies in Korea. But a comparison of the effects on wages between two main human capital factors - school education and job training - Is a relatively new area of study. Considering the problems of educational inequality and excessive investment in university education in Korea, in this study I ask whether job training has a potential economic power which could compensate for the wage inequality between the different educational levels. This study thus tries to compare the wage effects of school education and job training, thereby offering another point of view in reference to the educational wage inequality.

3. Education system in Korea

In the eighteenth century, the modernization movement in Korea was begun by the Practical Scientists, the so-called: 'Shil-hak-ja' in the Age of 'the Chosŏn dynasty'. But their movement was hindered by the conservative politicians and ended in failure. They were branded as Catholics and suppressed by the State for denying the dominant Confucian political ideology. In the aftermath of this historical incident, a policy of seclusion against any outside influence was prevalent. In 1876, however, Japan directly forced Korea to open politically. After that, Korea had to adopt western culture and modernize its society in order to conform to western formalities. In 1894, the Chosŏn dynasty began to modernize the education system, establishing the modern Ministry of Education but abolishing 'Yecho' - the traditional Ministry of Culture and Education - and 'Kwagŏ' - the highest state examination used to recruit high ranking officials during the Chosŏn Dynasty. The leaders of the Chosŏn dynasty began to cultivate men of talent in the western fashion and to educate the common people in modern schools. It was in this period that the current college education and the 6-year-elementary school education were first founded.

The Present School System in Korea

After the Japanese colonial period between 1910 and 1945, the Republic of Korea was first established in 1948. The present school system, which is a single ladder system influenced by America, was established in the following year when the Law of Education for the Republic of Korea was enacted. The school system in Korea mainly consists of 6 years elementary school, 3 years junior

high school, and 3 years senior high school prior to taking either 2-3 years junior college or 4 years bachelor course. It proceeds then with a 2 years master course and a further 3 years and more for the doctorial course.

Table1] School System in Korea

<table>
<tr><th>Age</th><th>Class</th><th colspan="2">Korean single ladder school system</th><th colspan="2">ISCED-97 level</th></tr>
<tr><td>26</td><td>21</td><td rowspan="3">Doctorial course</td><td rowspan="8"></td><td rowspan="3">6</td><td rowspan="8"></td></tr>
<tr><td>25</td><td>20</td></tr>
<tr><td>24</td><td>19</td></tr>
<tr><td>23</td><td>18</td><td rowspan="2">Master course</td><td rowspan="2">5A (2nd)</td></tr>
<tr><td>22</td><td>17</td></tr>
<tr><td>21</td><td>16</td><td rowspan="4">Bachelor course</td><td rowspan="4">5A (1st)</td></tr>
<tr><td>20</td><td>15</td></tr>
<tr><td>19</td><td>14</td><td rowspan="2">Junior college</td><td rowspan="2">5B</td></tr>
<tr><td>18</td><td>13</td></tr>
<tr><td>17</td><td>12</td><td rowspan="3">Academic Senior High school</td><td rowspan="3">Vocational Senior high school</td><td rowspan="3">3A</td><td rowspan="3">3C</td></tr>
<tr><td>16</td><td>11</td></tr>
<tr><td>15</td><td>10</td></tr>
<tr><td>14</td><td>9</td><td colspan="2" rowspan="3">Junior high school</td><td colspan="2" rowspan="3">2</td></tr>
<tr><td>13</td><td>8</td></tr>
<tr><td>12</td><td>7</td></tr>
<tr><td>11</td><td>6</td><td colspan="2" rowspan="6">Elementary school</td><td colspan="2" rowspan="6">1</td></tr>
<tr><td>10</td><td>5</td></tr>
<tr><td>9</td><td>4</td></tr>
<tr><td>8</td><td>3</td></tr>
<tr><td>7</td><td>2</td></tr>
<tr><td>6</td><td>1</td></tr>
<tr><td>5</td><td rowspan="3">0</td><td colspan="2" rowspan="3">Kindergarten</td><td colspan="2" rowspan="3">0</td></tr>
<tr><td>4</td></tr>
<tr><td>3</td></tr>
</table>

Sources: 1) OECD (1999), 2) Kim, A.Ch. et. al. (2006)

The Korean elementary school is equivalent to the *Grundschule* in Germany, which are both classified as the primary level of education defined as 'International Standard Classification of Edu-

cation-97' level 1 (ISCED-97 level 1)[4]. Three years junior high school, which is approximately identical to *Hauptschule, Realschule* or *Gymnasium* in Germany, is equivalent to the lower secondary level of education, ISCED-97 level 2. Senior high school is the upper secondary level of education classified as ISCED-97 level 3. This level of education is divided again into academic high school (ISCED-97 level 3A) and vocational - technical or business- high school (ISCED-97 level 3C). The academic high school is comparable to the *Gymnasiumoberstufe* or *Fachgynasium* in Germany and vocational high school to the *Berufschule, Beruffachschule, Berufsoberschule* or *Fachoberschule*. After completing academic high school, most students enter either 2-3 years junior college or 4 years university. Junior college is classified as ISCED-97 level 5B, which is the first stage of tertiary education with practical technical and occupational specifics in a short curriculum. Its German counterpart is the *Fachhochschule*. Classified as ISCED-97 level 5A, bachelor courses at the university constitute the first stage of tertiary education with a strong theoretical foundation in a medium level curriculum, which is equivalent to the bachelor education in the new German system at the university. Some faculties, for instance, the medical faculty, have a curriculum of 6 years at this level of education. A postgraduate education consists of a 2-year master course and a further 3-year and more doctorial course. The former is equal to the master course in Germany, which is the first stage of an extended tertiary education, ISCED-97 level 5A. This level provides sufficient qualifications for entry into advanced research programs and professions with high skills requirements. The doctoral degree constitutes the second stage of tertiary education (ISCED-97 level 6), which corresponds to the doctoral course in Germany.

Kindergarten education is not acknowledged as an official school education in Korea yet. Education at the elementary school and the junior high school are compulsory. Further school education requires students to pass the appropriate entrance exam and to pay schooling fees. After graduating an academic high school education, students go on to university or junior college. But graduates from a vocational senior high school can also enter either junior college or university. i.e. Independently of the high school route (academic or vocational high school), senior high school graduates can receive a higher level of education if they pass the entrance examination. Due to the growing number of applications, entrance to university has become more and more difficult in recent years. This fierce competitiveness leads young teen-agers to prepare for the entrance exam in advance in order to increase the probability of their acceptance by a (good) university. Concerning vocational senior high schools, 67% of graduates go on to junior college. The remaining students take a 1-6 month practical vocational training in a company and normally undergo an

[4] ISCED-97 stands for the International Standard Classification of Education 1997 by UNESCO. ISCED is a framework to collect and report data on educational programs varying widely between countries with a similar level of education. It helps with the compilation of internationally comparable education statistics and indicators.

exam to obtain a vocational qualification in their 12th school year. Yet this practical training with little importance is merely a part of the curriculum of vocational high schools. After finishing school education, job training is generally carried out by the company, the government or on one's own initiative.

Issues of Education in Korea

Excessive competitiveness for University entrance has become one of the most pressing social problems in recent years in Korea. Most households are economically and mentally burdened with the problem of the education of their children. They sacrifice their own living expenditure and cultural activities in order to enable their children to have the chance of a good education. In 2005, supplementary educational expenses for the average Korean family reached 2.79% of GDP, with the result that private lessons for teenagers has been a rapidly growing area of the underground economy in Korea. This economic sector absorbs unemployed university graduates, thereby forming a big black market. Such private education imposes a tremendous burden on the family and discriminates against poor children. Formal educations usefulness is undermined and this leads to the uniformity of secondary education. One doubts the efficiency of this educational fever and fierce competitiveness for university entrance. Paul Krugman (1994) pointed out that increasing input growth with the upgrading education and a powerful mobilization of economic resources in East Asia has not been accompanied by a corresponding growth in efficiency.

In spite of all such criticisms, however, these educational problems in Korea have been neither resolved nor lessened. Since 2004, more than 80% of all high school graduates have gone on to university or junior college. On the other hand, the participation rate in non-formal job training reached only 4.67% in 2002 in Korea[5] as compared with 18% on average in the OECD in the same period[6]. Experts said that the structure and quality of labor supply is the inadequately adjusted demand for labor supply.[7] Confronted with these problems, some educational experts are concerned about the impact of the single ladder school system. They have discussed whether this single ladder system has overstressed the value of a university education and caused an overinvestment in school education in general. Furthermore, they further question whether this system impacts on the minimal interest in vocational education and job training.[8] The German educational system is well-known in Korea with its tradition of long job training dating back to the Middle Ages together with an apprentice training system (i.e. *Duales System*) at school. Respecting these concerns, the German dual ladder educational system has begun to be seriously studied

[5] See Lee, B.H. et al. (2006), p. 38
[6] See OECD (2007), p. 354
[7] See Woo, Ch. S. and Kim, H.M. (2004)
[8] See Korean Educational Development Institute (2006)

in Korea.

4. Theory, Model and Problems of Estimation

Becker's Theory and Mincer's Model

Becker (1962, 1964) formulates the general theory of human capital, on which this study is based. He illustrates the dependency of earnings on various factors of human capital such as on-the-job training, school education, other knowledge and information, emotional and physical health, ability etc. According to the theory, earnings are the gross return on human capital investment, so there is a positive correlation between the amount of investment in human capital and the amount of earnings. School education, on-the-job training and other human capital investments enhance productivity, and positively influence the future earnings of a worker. In an individual's lifetime, human capital investments reduce earnings at younger ages because costs are deducted from earnings, but raise earnings at older ages because the returns of these investments are added to earnings then. As regards ability, Becker writes, an abler person tends to invest in human capital more than others, the distribution of earnings could be very unequal and skewed, although ability may be equally distributed. With respect to on-the-job training, any increased profitability through investment in on-the-job training is shared between an employer and an employee, depending on who finances the investments and who collects their returns.

Mincer (1974) develops in his seminal work "Schooling, Experience and Earnings" his human capital earnings function in the following way to explain the differences in earnings of people who differ in terms of schooling and ages:

$$\ln y = \beta_0 + \beta_1 s + \beta_2 EX + \beta_3 EX^2 + u$$

The dependent variable ln *y* is the logarithmic earnings of the individual under consideration. The independent variable *s* is a measure of their schooling whilst *EX* is equal to their labor market experience, which leads earnings to vary along with age. Schooling determines one's skill level, which consists of school education and on-the-job training, following Becker (1962). School education is measured either by the duration of school attendance or by the level of school education. The measure of on-the-job training is represented by either the duration of the training or by a dummy variable indicating whether people have any training or not. Labor market experience on the job is measured by a proxy variable which is equal to an individual's current age minus their years of schooling minus their age at the beginning of schooling, if actual experience cannot be quantified. Experience and its quadratic form determine a concave age-earnings profile varying

with one's skill. Mincer's proxy variable for experience is only appropriate for males, but not for females, whose labor market experience is interrupted due to bringing up children. The age-earnings profile for married women is usually much flatter than that of never-married working women. To complement this proxy variable for labor market experience, studies additionally include tenure and its quadratic form of present employment. u is a random disturbance term. It contains the unobserved determinants of earnings, such as ability. The coefficients, β show the percentage changes in earnings.

Although the wage effect of human capital provides an appropriate explanation of the age-earnings profile, individual earnings can not be solely explained by human capital variables. Wages are differentiated by other socio-economic factors, for instance, some native social status attributed to individuals such as gender and race; some family characteristics such as marital status and responsibility for family - household head and having children; some firm characteristics for an employee such as industry, firm size and working contract, and some institutional factors such as minimum wages and trade unions.[9] Such influences are controlled by means of a vector of socio-economic explanatory variables so far as this is possible

The model in this study, based on the Mincer earnings function and complemented by some additional socio-economic factors, is presented in the following way:

$$\ln(wage) = \alpha School + \beta JobTrain + \chi EXP + \delta Tenure + \phi Family + \varphi WorkPlace + \gamma Industry + u,$$

where $\ln(wage)$ stands for natural log wages, $School$ for school education level, $JobTrain$ for job training, EXP for labor market experience, $Tenure$ for tenure, $Family$ for a variable vector with family characteristics, $WorkPlace$ for a variable vector with work place characteristics, $Industry$ for industry attributed to the firm and u for error components.

In numerous studies at different times and in different countries, Mincer's human capital earnings function has successfully explained the 'age-earnings profile', a widely accepted empirical specification in economics. In the practical application of Mincer's model, however, the exact estimation of human capital effects on earnings is not totally unproblematic. His function suffers from the following problems.

[9] See Kalleberg, A.L. and Sorensen, A. B. (1979), Kalleberg, A.L. (1988), DiPrete, T.A. and McManus, P. A. (1996), and Hollister, M.N. (2004).

Measurement error, Omitted ability bias, Selection bias and some plausible Assumptions concerning Korea

Measurement error, omitted ability bias and selection bias have been noted as difficulties in the evaluation of the consistent schooling effect on wages in the OLS estimation. Various solutions have been proposed, for example: using a proxy variable or an instrumental variable, employing the fixed effect method, the Heckman 2 step method or the control function method etc. However, their success mainly depends on the availability of an appropriate dataset or the necessary variables. Still, researchers who want to obtain accurate estimations for the possible returns on human capital investment continue to meet with these problems. On the other hand, the gravity of these problems - measurement error bias, omitted ability bias and selection bias – depends on the systems of education and law, social standards and cultural assumptions in the countries under consideration, and varies according to the particular social environment. So, an understanding of these dependencies could offer some helpful guidance in the precise estimation of these results, which are more or less biased because of limitations of data or estimation methods. I begin by assuming certain plausible facts, related to the estimation problems of the Mincer earnings function, connected to social factors in Korea and use these as a plausible basis for this study.

A measurement error is generated by incorrect self-reporting about the level or duration of schooling or if the actual duration of schooling is not available. This type of error usually generates a downward bias on the OLS estimate of the schooling coefficient.[10] To remove measurement error, we could use an instrumental variable for schooling if we can find an appropriate instrument, which is often unsuccessful. The dimension of the bias caused by this kind of error could vary and be dependant on the system of education and social values in different countries or cultural areas. In Korea as well as in East Asia generally, school education is a factor that not only has an influence on wages but can also confer cultural status and social power on the individual. It is regarded as an important matter concerning one's own dignity as well as that of the family. People who have a minimal educational level are often unwilling to reveal their true level of schooling. Due to such cultural circumstances, one is led to suspect that the data concerning educational levels in Korea contains, owing to incorrect self-reporting, a slightly higher level of measurement error than other data gathered in other countries in different cultural areas. Overstatements of educational attainments could be prevalent in the generation of people aged between 60 and 70 who underwent social and political difficulties in Korea - the Korean War and its consequential poverty - in their youth, and hence, many of them could not afford to attain a certain level of education. Considering such social conditions, the proportion of junior and senior

[10] See Griliches, Z. (1979), Ashenfelter, O. and Krueger, A. (1992), and Ashenfelter O. and Zimmerman D.J. (1993) etc.

high school graduates, considered as the common level of education reached by people in the generation between the ages of 60 and 70, might be slightly larger in this data than the proportion in the population as a whole. These Individuals would generate some more measurement errors in the estimation of the educational level than those of other generations in self-reported questionnaire data. Unlike the education variable, the measurement error due to job training is usually attributable to losing sight of the fact of whether people have any job training or not. There is no general motivation to overstate one's job training. It does not lead to a downward bias on the wage earned.

Another measurement error which is generated due to unavailability of the actual duration of schooling has an intimate connection to the educational system prevalent in their countries. In the German education system, individuals are permitted a variable number of years to complete the same level of education. In particular, years of schooling spent in tertiary education largely differ between individuals according to their own particular social environment or level of ability. Hence, the mean value concerning years of schooling as a measure of educational level may generate the measurement error. In this case, the proxy variable of labor market experience measured using years of schooling also generates a measurement error. In Korea, the completion of a school education depends on years of schooling. The students are considered to have completed their school education after a given number of years, independent of the quality of learning. The level attained by students is then measured, and it is thus determined whether one can enter high school education or not and in which rank of college or university one can enter. In the case of Korea, the completion of a specific degree and the years of schooling themselves may not lead to a problematic measurement error.

Omitted ability bias is a well-known problem in the estimation of the education effect on wages. Becker[11] already pointed out that an abler person tends to invest more in human capital than others. Choice of job training could also be correlated with an unobserved ability. Usually the unobserved ability in the disturbance term is positively correlated with schooling and earnings in the OLS estimation. This omitted ability generally biases the return to schooling upwards.[12] Countermeasures against this bias could be to use a proxy variable of ability or an instrumental variable of schooling. For example, a study using the data of monozygotic twins shows us an interesting method to counter the bias of omitted ability.[13] The problem of this approach, however, lies in how to find an appropriate variable. In the panel dataset, the fixed effect model has been pro-

[11] See Becker, G.S. (1962), p. 48
[12] See Behrman, et.al. (1980), Blackburn, M.L. and Neumark, D. (1991), and Ashenfelter, O. and Zimmerman, D.J. (1993) etc.
[13] See Miller et. al. (1995)

posed as an alternative to deal with this omitted ability bias whilst assuming that the omitted ability variable is constant in the observed period of time.

Ashenfelter and Zimmerman (1993, 1997) estimate returns attributable to schooling with data on brothers and on fathers and sons from the National Longitudinal Survey. They compared differences in schooling between brothers, fathers and sons with the differences in their respective earnings. The sample was selected to ensure similar innate ability and family backgrounds, therefore, controlling unobserved family attributes in a straightforward fashion. A 25% upward bias was attributable to the impact of omitted family background and a 25% downward bias to the effect of measurement errors for siblings. The conclusion was drawn that the omitted ability and the oppositely directed measurement error offset their respective biases in a sample of the same size.

Selection problem can be sub-divided into a sample selection problem and the self-selection of schooling. Unlike the standard omitted variable, the problem of sample selection bias arises due to the dependent variable: earnings are not randomly missing in our dataset. As a countermeasure, Heckman (1979) developed his 2-step estimation. The self-selection bias of schooling is generated if the greater earnings of individuals with higher educational levels arise not because of this higher education, but because individuals with greater earnings capacity choose to acquire more schooling. It leads to an upward bias on earnings. Garen (1984) and Heckman and Robb (1985) developed the control function approach to correct self-selection bias.

In relation to ***sample selection***, a special kind of sample selection problem in Korea should be mentioned here. As stated earlier, university graduates in Korea suffer from a high unemployment rate. This group is overrepresented in the official labor market. On the other hand, fierce competition for a university place in Korea has created a market for private lessons for high school students to prepare them for the entrance examination. This market is a magnet for students and unemployed university graduates, especially female graduates, by virtue of its flexible working conditions and (high) earnings with the possibility of evading the payment of taxes. Despite all these advantages, which would raise the reservation wage for some university graduates, this population officially has no wages as employees. As a consequence, values for wage data are incomplete, which may strengthen the sample selection bias.

Self-selection bias of schooling occurs if some highly-educated individuals have high earnings because individuals with greater earnings capacity choose higher schooling. Such a capacity could be partly attributable to social networking or nepotism. Someone who has a good family background or a good network enabling them to secure a qualified job would choose higher

schooling appropriate to such a highly qualified job hence attaining high earnings. This self-selection process regarding education could usually arise from the choice of educational level and the choice of a particular route and faculty of education. This choice of educational level depends, however, not only on self-selection. It is also influenced by the education system, for example, the law on compulsory education and other social circumstances.

In Korea, compulsory education requiring 6-years of schooling at the elementary level was introduced in 1948 but only put into practice after the Korean War in 1953. Between 1984 and 2004, compulsory education was extended to include 3-years of junior high school, so together 9 years of schooling. After these 9 years of compulsory education, 84.5% of junior high school graduates went to senior high school in 1980, 90.7% in 1985 and 95.7% in 1990. This proportion increased to 99.8% in 2006. During these time periods, the entrance rate to junior college and university also increased rapidly: In 1980 the entrance rate to junior college and university was 23.7%, rising to 51.4% in 1990, and reaching 68% in 2000. Since 2004, the entrance rate to junior college and university has remained steady at more than 80%.[14] The data reveals a rapid upward tendency in schooling. Since the end of the 80s, the common educational level has risen from senior high school to junior college or university.

In connection with the self-selection problem, this kind of enhancement of educational level does not cause a self-selection bias on wages and further reduces the potential of any self-selection bias in the dataset. Having successfully finished their high school education, people choose either to find a job or to attend junior college for 2 years or university for 4 years. It depends on the grade of the entrance exam and the economic resources of a family, that is, their ability to pay the college/university tuition fees, which is quite distinct from a self-selection process. Choosing which route to take in an advanced education among students entering either an academic senior high school or a vocational senior high school in the period of secondary education depends also on the results of a final examination and one's school records. In the 40 + generation, the economic resources of the family were a decisive factor in the choice of senior high school and in whether teenagers entered either an academic or a vocational senior high school. The self-selection process for higher schooling actually arises after the completion of a bachelor degree in Korea. Approximately 12.9% of bachelor graduates proceeded to a master course and 1.4% of master graduates proceeded to a doctorial course in 2008. In job training, self-selection bias may occur in cases where participation in training increases one's chances of getting a job or of being promoted and thereby enhancing one's earnings. Related to the self-selection bias, one should pay attention to which kind of variable for schooling or job training is relevant. The estimates of the

[14] Korean Educational Development Institute (1980-2007)

effects of a master or doctorial degree and job training should be prudently interpreted in the Korean dataset in reference to the self-selection bias.

Table2] Biases of Mincer Earning Estimation in Education level and Job training of Korea

Education level/Job training	**Measurement error bias**	**Omitted ability bias**	**Self-Selection bias**
Compulsory level	no	no	no
Low level	no	weak	no
Common level	strong	middle	no
High level	no	strong	strong
Job training	no	strong	strong

Concluding this section, Table2 presents some plausible assumptions related to the estimation problems of the Mincer earnings function for the Korean dataset. Considering the Korean case, we can easily confirm that there is generally no measurement error, omitted ability bias or self-selection bias at the compulsory level of education, when the effects of educational level on wages are estimated. The measurement error would be relatively strong in the common level of education. Some people with minimal education might exaggerate their achievements and claim to possess a common level of education when responding to questionnaires in Korea. The omitted ability bias generally becomes stronger when considering a higher level education, because an abler person tends to invest more in higher level education. Self-selection bias may be just a problem at this higher level of education. Koreans usually try hard to attain at least the common level of education without any selective consideration. The job training variable does not plausibly suffer from any systematic measurement error. There is no motivation to overstate one's job training in Korea.

5. Data: Korean Labor and Income Panel Study

To test the hypotheses of this study, the ‘Korean Labor and Income Panel Study (KLIPS)’ published by the *Korea Labor Institute*, is used. KLIPS is a longitudinal survey of the labor market and income activities of households and individuals who live in cities and urban areas. Being the first survey produced by a domestic panel on labor-related issues, it has served as a data source for the microeconomic analysis of labor market activities and transitions, thereby contributing to the development and evaluation of labor market policies. In designing and managing KLIPS, its role models were a set of successful longitudinal surveys, conducted in industrialized countries, such as NLS (National Longitudinal Surveys), NLSy (National Longitudinal Survey of Youth),

and PSID (Panel Study of Income Dynamics) in the USA, SLID (Survey of Labour and Income Dynamics) in Canada, BHPS (British Household Panel Survey), and GSOEP (German Socio-Economic Panel), among many others.

Questionnaires were sent out to 5,000 households, constituting 13,321 household members in 1998 in 7 big cities and urban areas in 8 provinces. Respondents comprised 4,012 employees, 2,415 self-employed individuals and 7,315 unemployed people. The panel took into account a variety of variables concerning social and economic backgrounds: Family, housing, income, consumption, education, job training, working contract, vocations, working conditions, job-seeking experience, mobility on the labor market, health, marital status, job contentment, etc. Income is divided into wages, earned income for the self employed, financial income, immovable income, transfer income and other types of income.

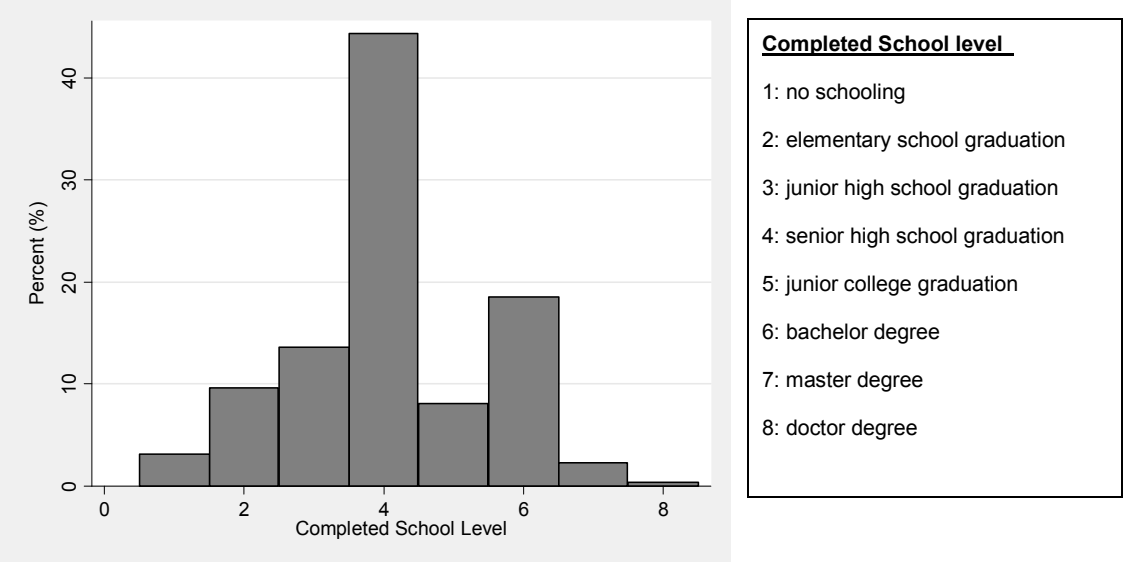
In 1998, when this survey was launched, Korea was faced with an economics crisis for the first time in its post-industrial history. Job training was a main government policy to tackle mass unemployment. The negative income shocks experienced by Korea between 1997 and 1998 increased the number of the unemployed who participated in job training programs in 1998 and 1999 more than 80 fold. This number of participants reached 163,000 in 1998 and further increased to 171,000 in 1999 (it was just 1,947 in 1997). At that time, job training was financed out of government funds as an exceptional measure against mass unemployment. When studying job training, the exceptional economic situation in the years around 2000 means that a comparable estimate of any job training effect on wages in other periods is skewed. On the other hand, variables in KLIPS often changed at the beginning of the survey, or some of them were excluded from the questionnaire. The required variables employed in this study, date only from 2002. For these reasons, this study uses the KLIPS dataset between 2002 and 2006.

6. Descriptive statistics

In this study, we analyze 28,913 individual observations concerning 7,208 male adults taken between 2002 and 2006. Women were excluded from the analysis. As previously mentioned, the proxy variable for labor market experience, used in this study, is not an appropriate proxy for females. The mean age of the subjects is about 42 for all adult males. The individual observations specifically concerning wage earners within the total sample of 28,913 observations number 12,336. Narrowing the sample to those aged between 26 and 55, the mean age falls to 39 and the number of wage earners is now constitutes 10,183 among 17,974 observations.

The main variables used in this study are: wages of the main job, education and job training. The mean value of the real monthly net wage of the employees is approximately 1,662,608 Won (i.e. 1,471 US$, base year: 2000) in the dataset. The natural log of the real wage demonstrates an approximately normal distribution with a mean value of 4.97.[15] Standard deviation is about 0.55. Concerning education for all adult males within the sample, approximately 3.1% of the individual observations had no schooling, 9.6% had completed an elementary school education, 13.6% junior high school education, 44.3% senior high school education, 8.1% junior college education, 18.5% had received a bachelor degree and 2.3% a master's degree. About 0.35% of them had completed a doctoral degree as illustrated in Figure 2.[16]

Figure 2] Completed School Level in the Dataset



With the development of an industrial economy, the average level of education has rapidly increased in Korea. Comparing the level of education between different age groups - individuals in their 30s, 40s, 50s and 60s - those in their 60s have, on average, the lowest level of education. Approximately 58% of the 60 year olds did not even graduate from senior high school. 8.5% of them did not receive any kind of schooling and 29% had only completed an elementary school education. Only 12.5% of those in their 60s progressed beyond senior high school in their education. Among those in their 50s, 42.4% had a lower level of education, while 18.4% possessed a higher level of education than that to be expected from attending senior high school. The social trend towards a higher degree of education begins to emerge when we consider that 29.7% of

[15] See Figure 1 in the appendix.
[16] See Table 3 in the appendix

people in their 40s finished at least junior college, whilst only 22.1% of individuals in the same age group had a level of education lower than senior high school. The level of education continues to increase rapidly as the age decreases. The data shows a large educational gap between those in their 40s and those in their 30s. Only 7% of individuals surveyed in their 30s did not graduate senior high school. About 50% of them had attained at least a junior college level education.[17]

Regarding job training, we have a figure of 1,931 observations for those who completed any form of job training. i.e. 6.7% of all adult males surveyed. The average period for completed job training is approximately 4.8 weeks. Classifying these 1,931 observations of individuals who have completed job training according to their educational level, 38.1% had completed senior high school, 34.1% had obtained a bachelor degree, 12% had finished junior college, 6% junior high school and 5.3% had obtained a master's degree.[18] Job training is concentrated on those educational groups who finish senior high school, junior college or those who obtain a bachelor degree. A positive correlation was observed between the level of education and the completed job training in the sample data.

Concerning experience, the average labor market experience of employed wage earners is 19.7 years while the experience of all male adults is about 25 years. Average experience is 17.5 years among employed wage earners aged between 26 and 55. In this study, the effect of experience on wages is measured by the use of 10 dummy variables, which are approximately classified in a decile form in 10 experience groups. The average tenure of all employed wage earners is 6.47 years. It increases to 6.7 years for employed wage earners between the ages of 26 and 55. The tenure effect on wage is also measured by 10 dummy variables in the same way as the experience.[19]

This study additionally uses other variables such as 5 year dummies, household head dummy, children dummy, 16 residence dummies, 202 industry dummies, 19 firm type dummies, 8 firm size dummies, regular worker dummy, part time dummy, 5 casual worker dummies, overtime dummy, union dummy, shift work dummy, 4 house ownership dummies, natural log household sustenance allowance for parents, natural log non household labor income, natural log household financial wealth and natural log household debt. The definition and descriptive summary of the aforementioned variables are contained in the appendix.[20]

[17] See Table 3 and Figure 3 in appendix.
[18] See Table 4 and Figure 4 in appendix
[19] Table 5 in appendix presents how to divide the experience and the tenure in 10 categories.
[20] See Table 6 and Table 7 in appendix

7. Estimation

This study employs the Heckman 2 step method and the fixed effect method in order to estimate the effects of education and job training on wages. As stated previously, the labor supply of university graduates has been increasing although their employment rate remains lower than other educational groups. It is necessary for us to clarify whether this rather ironic feature of labor supply is related to sample selection bias, before estimating the effects of education on wages. In this context, we have chosen the Heckman 2 step method in order to correct the expected sample selection bias. As is known, the KLIPS data, which consist not only of the data of wage earners, but also of the self-employed, the unemployed and the economically inactive population, serves to justify our use of the Heckman 2 step approach quite well. Besides correcting sample selection bias, the Heckman 2 step method offers another advantage: In the second step of the estimation, measurement error and the omitted ability bias of the education variable cancel each other out by means of OLS, following Ashenfelter and Zimmerman (1993, 1997).[21] The remaining limit of the Heckman 2 step approach is the self-selection bias problem concerning the education variable.

However, the Heckman 2 step method does not offer the same advantage in the estimation of the effect of job training on wages. Though this method corrects the sample selection bias related to job training in the first step, using OLS in the second step does not lessen the measurement error bias and the omitted ability bias of job training.[22] Thus, returns to job training suffer not only from self-selection bias but also from the omitted ability bias. In order to confront this omitted ability bias, this study employs the fixed effect method, although this method has difficulties in estimating the effect of further education on wages. The self-selection bias problem of job training could not be solved utilizing this method as was also the case with the Heckman 2 step method. Thus, the estimation results obtained in this study suffer from self-selection bias to a greater or lesser degree, which biases the wage effect upward.

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[21] Critically Reviewing the study of Ashenfelter and Zimmerman (1993, 1997), their assumption - that the true levels of explanatory variables and measurement error are uncorrelated with each other - seems to be implausible. They may be negatively correlated: The lower the education level the higher the measurement error. This critical assumption partially invalidates their theoretical model and referential test, but not their main result. Moreover, as they mention themselves, ability must also be considered, which is not connected to family affiliation. But, in general, they used the representative national sample, the National Longitudinal Survey, taken between 1996 and 1981 in the USA. Data were collected at a time when schooling level and wages were increasing with industrial development, comparable to the Korean dataset. The basic idea and the main result for siblings in their study are usable for the Korean case, even if the lack of comparable studies for different time and location means that one can not generalize their result.

[22] See Table 2.

7.1. Heckman 2 Step estimation

The Heckman 2 step method

Concerning the counterintuitive low employment rate of university graduates in Korea, Heckman's theory offers a possible explanation. According to his theory, some people decide not to participate in the labor market, because the market wage is lower than their reservation wage. The reservation wage is that level of wage, which just motivates people to take a job in the labor market. In this case, the low employment makes wages not randomly missing in the dataset. So, the problem of sample selection bias arises, if we just use the existing wage data for the analysis of the human capital earnings function. In order to solve this problem, one computes the causality and probability of a sample selection. Then, the missing data problem of dependent variable is reformulated as an ordinary omitted explanatory variable problem using the inverse Mill's ratio.

In order to correct this sample selection bias, Gronau (1974) developed the following labor supply model. Following Gronau, the market wage, $w_i^0 = \exp(x_{i1}\beta_1 + u_{i1})$, is observed only if one works. Herewith, x_{i1} is the variable vector for any person *i*, which has an effect on one's market wages. An individual will considers whether the market wage is larger than the at least expected wage, that is to say, the reservation wage, before deciding to work. $w_i^r = \exp(x_{i2}\beta_2 + \gamma_2 a_i + u_{i2})$, the level of which is influenced by one's nonwage income a_i and the other variable vector x_{i2}.
A person decides to participate in the labor market only if market wage is larger than reservation wage: $\log w_i^0 - \log w_i^r = x_{i1}\beta_1 + u_{i1} - x_{i2}\beta_2 - \gamma_2 a_i - u_{i.2} > 0$.

Let $y_1 \equiv \log w_i^0 = x_{i1}\beta_1 + u_{i1}$ and y_2 be the binary labor force participation indicator, then Gronau's model can be written

$$y_1 = x_{i1}\beta_1 + u_{i1},$$
$$y_2 = 1[x_i\delta_2 + v_{i2} > 0],$$

where $x_i\delta_2 + v_{i2} \equiv \log w_i^0 - \log w_i^r$ and x_i is the variable vector, which describes the labor market participation. Thus, the selection function y_2 is incidentally truncated. The observations are concentrated around the zero wage point. This violates the Gauss–Markov assumption of zero correlation between independent variables and the error term.

Ignoring index *i*, we find

$$E(y_1 \mid x, y_2) = x_1\beta_1 + \gamma_1 E(v_2 \mid x, y_2) = x_1\beta_1 + \gamma_1 h(x, y_2),$$

where $h(x, y_2) = E(v_2 \mid x, y_2)$. Because the selected sample has $y_2 = 1$, we need only $h(x,1)$. $h(x,1) = E(v_2 \mid v_2 > -x\delta_2) = \lambda(x\delta_2)$ is the inverse Mills ratio used by Heckman (1979). The inverse Mill's ratio is the ratio of the probability density function over the cumulative distribution function of the truncated standard normal distribution:

$$\lambda(x\delta_2) = \phi(x\delta_2 / \sigma_2) / \Phi(x\delta_2 / \sigma_2),$$

where σ_2 is the standard deviation of the error of y_2. What we estimate in the Heckman 2step approach is the wage equation,

$E(y_1 \mid x, y_2 = 1) = x_1\beta_1 + \gamma_1\lambda(x\delta_2)$, as follows:

First, estimate the probit function by means of maximum likelihood in order to acquire the estimates of δ_2. For each observation in the selected sample, calculate the inverse Mill's ratio. Estimate β_1 and $\gamma_1 = \rho\sigma_1$ by OLS regression y_1 on $x_1, \lambda(x\delta_2)$, where σ_1 is the standard deviation of the error of y_1 and ρ the correlation of σ_1 and σ_2.

Following the Heckman 2 step estimation procedure, this study derives the selection equation and the wage equation in the following way: As the binary labor force participation indicator, we use the wage dummy in the selection equation. The explanatory variables are indicators of years, individual characteristics such as experience, education, job training, marital status and household head dummy; and household characteristics such as children dummy, type of house ownership, residence, sustenance allowance for the parents, non labor income, financial wealth and debt. In the wage equation, the log wage is the dependent variable and independent variables are indicators of years; individual characteristics such as experience, education, job training, tenure and marital status; household characteristics such as household head dummy, children dummy and residence; and firm characteristics such as firm size, type of firm ownership, industry, regular work dummy, temporary work dummies, part time dummy, shift dummy and union dummy.

Estimation Result

Table 10 presents the main results of estimations obtained by means of the Heckman 2 step method in comparison with OLS. The results are presented in two groups, all male adults and those aged between 26 and 55. At the age of 26, Korean male university graduates usually begin vocational life, completing 3 years of compulsory military service. Early retirement is an option

from the age of about 55. Therefore, we differentiate between the wage effects of school education and job training in the data concerning main vocational life in Korea and the effects of all adult data. The base group of education dummies is the dummy variable that concerns the completion of senior high school education. The base group of job training dummies is the dummy that deals with the absence of job-training in the last period under consideration. The second and third column firstly show us the estimation result obtained by employing OLS with 7,758 observations for all adults and 6649 observations between the ages of 26 and 55. The R-squares are 61.49% and 57.1% respectively. The estimates of education are statistically significant at the level of 1% with the heteroskedasticity-robust standard error. The effect of completed elementary school education on wages is approximately 11.22% lower for all adults and 17.47% lower between the ages of 26 and 55 than the effect observed in the base group. In the case of a completed junior high school education, it is approximately 8.5 % and 11.56 % lower than that of the base group of education respectively. The effect is 7.7% and 8% higher for those who graduated junior college, about 21.01% and 21.26% for those with a bachelor degree, 41.4% and 43% for those with a master degree and 53.87% and 53% for those with a doctoral degree compared to the base group. Concerning job training, the wage effect of completed job training is 7% higher than the effect of no job training.

In the fourth and fifth column, the estimation results by means of the Heckman 2 step approach are presented. The number of observations comprises 1,566 for all adults and 1318 between the ages of 26 and 55. 740 from the first group and 549 from the second group are withheld. The inverse Mill's ratio ($\gamma_1 = \rho\sigma_1$) demonstrates approximately 26.53% and 20.44% wage effect at the significance level of 1% with the heteroskedasticity-robust standard error respectively. It means there is a considerable sample selection bias in the result by OLS. The probit estimation of the selection equation presents the following statistically significant results[23]: 1. The log non labor income of a household has a negative influence on the labor market participation with a value of -0.038 for all adult, 2. The log sustenance allowance for parents has a positive influence with a value of 0.074 for all adult and 0.097 between the ages of 26 and 55, 3. The log debt has a negative impact with a value of -0.25 and -0.26 respectively. 4. Completed job training has a highly significant influence on the labor market participation with a value of 0.583 and 0.564 respectively, while the education variables have no significant influence on that. 5. In reference to those individuals with less than 5 years market experience, an experience of 5-9 years positively influences their participation in the labor market, but 14 years plus experience negatively influences this participation for both age groups. 6. A household head dummy gives an approximately 40.1% and 37% positive effect on labor market participation respectively. 7. Most residence dummies

[23] See Table 10 in appendix for more detail

relative strongly impact on labor market participation. Related to the base group, located in Seoul, other residences demonstrate strong negative effects. Only Ulsan, a major industrial city, has a strong positive effect on the labor market participation in comparison to Seoul.

Analyzing the effect of education on wages by using the Heckman 2 step method, the estimate of elementary school graduation gives us a much lower value than the estimate obtained by OLS. It is approximately -23% and -47%, so, about 10% and 30% lower than the OLS estimate respectively. i.e. if we include the unemployed, self-employed, or economically inactive population in the analysis, elementary school graduates receive a 23% and 47% lower wage than senior high school graduates. This education group, made up of those who only attended an elementary school is often comprises observations involving individuals in their 60s or older. Excluding these generations, the effect of elementary schooling on wages drops deeply. The wage effect of attending junior college is 13.6% and 14.7% higher than the effect observed in the base group, which is more than 6% higher than that given by OLS. The wage effects are 26% higher for those with a bachelor degree in both age groups and 43.8% and 52% higher for those with a master's degree than the effect noted for the base group respectively. Compared with OLS estimates, these are 5% higher for bachelor graduates and 2% and 6% higher for master graduates. The estimate of the wage effect of possessing a doctoral degree is about 51.4% and 58.8% respectively, which is about 2% lower for all adults and more than 6% higher compared to the OLS estimate. These results are statistically significant to at least at the 5% level with the heteroskedasticity-robust standard error. Concerning the self-selection bias, the estimates given by the Heckman 2 step analysis are more or less affected by self-selection bias. Especially, master and doctoral degrees are particularly exposed to self-selection bias. If we look a little deeper into these estimates of the master and the doctoral degrees, we see that they suffer less from measurement error and more from omitted ability bias. Thus, the estimates concerning master and doctoral degrees are a bit more upward biased than those concerning other educational groups.

Regarding job training: completed job training demonstrates significantly positive effects on wages with values of 0.087 and 0.062 compared to no job training. This demonstrates an approximately 2% higher wage effect for all adults and a slightly lower effect between the ages of 26 and 55 than those effects according to OLS estimates. Estimates of present job training, according to Heckman 2, have a significant effect on wages equal to 22.04% and 20.5% respectively, which are much higher than the estimates given by OLS. i.e. if we include the non-wage earner data in the analysis, present job training has a strong effect on wages. But any estimates concerning job training, when using both OLS and the Heckman 2step, must be affected by self-selection bias and omitted ability bias. This means that the estimates are upward biased. On the

other hand, the lower job training effects on wages noted for those people between the age of 26 and 55 when compared with the effect for all male adults is derived from the exclusion of the age group between 18 and 25. Those male adults who quit education after completing senior high school and after completing military duty, usually begin their working life at the age of 21 or 22 and participate in job training in order to get a job. As we confirmed, the participation in job training is highly positively correlated with getting a job. Limiting our observations to the main working age group, between the ages of 26 and 55, excludes this effect on wages from the estimates of job training.

Table 9] Effect of School Education and Job Training on Wages

Dependent Variable: ln (monthly net) wage						
	OLS		Heckman 2 step		Fixed effect	
Independent	all adult	age 26-55	all adult	age 26-55	all adult	age 26-55
Elementary school	-.1122109 (-4.81)	-.17467 (-5.99)	-.2297715 (-2.12)	-.47452 (-3.1)	-.075412 (-0.82)	.079524 (1.42)
Junior high school	-.0854346 (-5.29)	-.11651 (-6.12)	.0925749 (1.49)	.038992 (0.58)	-.0388709 (-0.72)	-.05668 (-0.87)
Junior college	.0765734 (6.23)	.079059 (6.06)	.1356538 (3.32)	.147168 (3.71)	.1899651 (1.46)	.259321 (1.5)
Bachelor	.2107191 (15.58)	.214578 (15.39)	.2572366 (7.11)	.264493 (7.53)	.1732632 (1.09)	.293356 (1.42)
Master	.4141789 (14.20)	.434475 (15)	.4381505 (6.86)	.519562 (8.22)	.3549278 (1.94)	.513992 (2.28)
Doctor	.5387437 (8.01)	.529981 (8.52)	.5144591 (3.09)	.587513 (3.75)	1.320175 (6.98)	1.518652 (6.49)
Completed Job training	.0697775 (6.10)	.06567 (5.69)	.0869748 (2.58)	.061464 (1.97)	.0257866 (2.33)	.021798 (1.93)
Present Job training	.0321129 (0.62)	.033696 (0.62)	.2203781 (2.15)	.205218 (2.14)	.0233164 (0.48)	.040709 (0.79)
Mills lambda			.2619831 (3.99)	.204356 (3.33)		
Observations	7758	6649	1566 Cens.:740	1318 Cens.: 549	7751 Groups 2956	6647 Groups 2545
R-sq	.6149	.571			.3713	.3918

t-statistics and z-statistics are presented in parentheses. Base group of education: Completion of senior high school education. Base group of job training: Absence of job-training.

Analyzing labor market experience by using the Heckman 2 step method, an experience of 5-9 years has a statistically significant impact on wage. It is approximately 11% higher than the value obtained when considering experience of less than 5 years. 10-13 years experience has a value of 19.1% for all adults and 21% for those aged between 26 and 55, 14-18 years 17.4% and 21%, 19-23 years 13.5% and 19% higher impact on wages than that of the base group respectively. Between 24-28 years experience gives an effect about 14.6% higher for the age between 26 and 55 at the usual significance level, while this effect, 8%, for all adult deviates from the 10 % significance level. 20-33 years experience presents the effects 6% and 8% respectively, although the results are not significant at the 10% level. More than 33 years experience has a negative effect on wages of -36% for all adults (at the 1% significance level). The results support the typical concave experience-earnings profile. The usual measure of experience - experience and experience squared - shows us a high significant effect on wages with values 0.29 and -0.00094 for all adults and 0.038 and -0.0011 for the ages between 26 and 55 respectively. The tenure dummies present the following significant results: 10-13 years tenure has an approximately 16% higher effect for all adults and 15% higher effect for the ages between 26 and 55, 14-21 years tenure 12% and 13% higher effect, and more than 21 years tenure 41% and 42 % higher effect compared to a tenure of less than a year respectively. Tenure squared shows 0.06%and 0.07% effect on wages (at the 1% significance level) respectively, while the variable tenure has no significant effects.[24]

7.2. Fixed effect estimation

Fixed effect method

The fixed effect method guarantees that one can obtain consistent estimators in the presence of time invariant unobserved omitted variables, which mainly relates to the omitted ability bias in this study. The model with the unobserved effects can be described by the following equation: $y_{it} = x_{it}\beta + c_i + u_{it}$ (1), where x_{it} is a vector of observable independent variables, which change across *t*. Herewith, *i* indexes individuals and *t* time. u_{it} is called the idiosyncratic errors and changes across *t* as well as across *i*. In the fixed effect, the time invariant unobserved variable c_i is arbitrarily correlated with the observed explanatory variables x_{it}. In the estimation of the effect of a school education on wages, for example, ability is correlated with schooling variables. Given that $E(u_{it} \mid x_i, c_i) = 0$, the idea behind the estimation β is to transform the equations in order to remove the unobserved effect c_i. The fixed effect transformation is obtained by means of the first averaging equation, $\bar{y}_i = \bar{x}_i\beta + c_i + \bar{u}_i$ (2), where

[24] See Table 11, Table 12, Figure 5 and Figure 6 in appendix

$$\bar{y}_i = T^{-1}\sum_{t=1}^{T} y_{it}\ ,\ \ \bar{x}_i = T^{-1}\sum_{t=1}^{T} x_{it}\ ,\ \ \bar{u}_i = T^{-1}\sum_{t=1}^{T} u_{it}\ .$$

Subtracting equation (2) from equation (1) for each *t* gives the fixed effect transformed equation without c_i,

$$y_{it} - \bar{y}_i = (x_{it} - \bar{x}_i)\beta + u_{it} - \bar{u}_i \ \text{ or } \ \ddot{y}_{it} = \ddot{x}_{it}\beta + \ddot{u}_{ti}\,,$$

where $\ddot{y}_{it} = y_{it} - \bar{y}_i$, $\ddot{x}_{it} = x_{it} - \bar{x}_i$ and $\ddot{u}_{it} = u_{it} - \bar{u}_i$. Regress $\ddot{y}_{it}$ on $\ddot{x}_{it}$ in order to obtain consistent estimators. However, this fixed effect transformation limits its application to some variables. Without further assumptions, we cannot include time invariant observable variables in x_{it} such as race and gender etc. As far as this study is concerned, education partially fails, because the level of education usually does not change for adults, and this change of educational level does not always enhance the wages as usual - earning potential for adults. Regarding the enhancement of an adult's educational level, we must be careful in our interpretation of estimates.[25] In addition, the greatest change in the level of one's education takes place up to the ages of 18 or 24, whereas the greatest change in the level of one's wage arises on the job mostly when one is older than 24. Measuring the effect of education on wages using the fixed effect method is not always convenient. A specific disadvantage in using the fixed effect method might be that the classical downward bias from measurement error becomes severe through the removal of the omitted ability bias according to the study of Ashenfelter and Zimmerman (1993, 1997).

However, concerning job training, the fixed effect method demonstrates a great advantage. It corrects the omitted ability bias, without burdening the estimation result due to the measurement error as mentioned above. In this study, the fixed effect model is mainly utilized for estimating the effect of job training on wages. This method is formulated with the same variables as are used in Heckman 2 step methods: Log wage is the dependent variable and the independent variables are Indicators of years; individual characteristics such as experience, education, job training, tenure and marital status; household characteristics such as household head dummy, children dummy and residence; and firm characteristics such as firm size, type of firm ownership, industry, regular work dummy, temporary work dummies, part time dummy, shift dummy and union dummy.

[25] Sometimes, people spend money and time on education not because they expect a fiscal advantage from this education, but simply because they enjoy learning. It is important to consider if a change in an adult's educational level and the consequential change in wage are attributable to the usual wage enhancement caused by education. The effect of education on wages for an adult can differ greatly from the usual wage effect. Professor Roland Eisen critically pointed out in his lecture "Arbeitsökonomik" (2003) that education is not only an investment good. People often consume educational programs, which is often neglected in the studies of human capital investment. In many cases, participation in an educational course for an adult does not mean human capital investment in the sense of Becker's theory (1962, 1964).

Estimation Result

Table 10 presents the main estimation results obtained by means of the fixed effect model beside those obtained from the OLS and the Heckman 2 step methods. The sixth and seventh columns present the estimation result arrived at by the fixed effect method. The number of observations is 7,751 for 2,956 all male adult wage earners and 6,647 for 2,545 male wage earners between the ages of 26 and 55. R-square is about 37% and 39% respectively. The education effects on wages from elementary school to bachelor graduates are insignificant at the level of 10% with a heteroskedasticity robust standard error, and some results are implausible in the economic sense. It is derived from the classical problem of the fixed effect estimation: Korea is a society, where the social duties and activities expected from each age group are clearly differentiated. Attending school in later life is seldom possible, especially for adult males who are responsible for the family. So, between elementary schooling and studying for a bachelor, most education dummy variables would be time invariant in the dataset. Students are commonly unemployed and earn no wages up to the completion of their bachelor's degree. So, the dataset could not offer information about their wages, too. The possession of a master degree leads to a 35.5 % and 52.4% higher wage effect respectively for the two samples mentioned above. Those are significant at the level up to 10% and 5%. However, those values suffer from the measurement error and the selection bias. The possession of a doctoral degree leads to an increased wage of 130% for all adults and 152% for those aged between 26 and 55 when compared with the wages of senior high school graduates. It is statistically different from zero at the 1% significance level. This is more than two or three times as high as the results obtained from the OLS and the Heckman 2 step methods. A possible explanation might be that a person who has already attained a relatively high educational level such as a master degree is hardly motivated to overstate their schooling level in the questionnaire. Hence, there is almost no one who consciously overstates their educational level in the education group made up of those who possess a doctoral degree. This would remove the measurement error, which biases the wage effect of education downward. As another explanation, we might guess that the wage gap before and after acquiring a doctoral degree is much larger than the wage gap in other educational groups, so that the transformed wage $\ddot{y}_{it} = y_{it} - \bar{y}_i$ in the case of a doctoral degree is much higher than in the other cases.

As far as job training is concerned, the wage effect of completed job training is approximately 2.6% higher for all adult wage earners and 2.2% higher for wage earners between the ages of 26 and 55 compared to the effect of no job training at around 5% significant level. As we have demonstrated, this value would be upward biased because of the self-selection bias. The difference of the job training effects on wages for two age groups - all male adults and those between the ages of 26 and 55 - is about 0.4 %. It might be derived from exclusion of the age group between 18

and 25. The employed, having left education after finishing senior high school, usually begin their working life at these ages and participate in job training, which is comparable to an apprenticeship on the job. Narrowing sample data to the main working age group, between the ages of 26 and 55, excludes this kind of job training effect on wages from their results.

Using the fixed effect model, we can obtain the experience effect on wages for employed wage earners using 10 dummy variables. Experience in the labor market of 4-7 years constitutes approximately 9% for all adult employed wage earners and 7.6% for employed wage earners between 26 and 55 years old, 8-10 years 9.3% and 6.6%, 11-13 years 12.4% and 9%, and 14-17 years 15.6% and 11.4% significantly higher wage effect compared to an experience of less than 4 years in each of our two samples. The wage effect of 18-21 years labor market experience is 11% higher, 22-26 years 12.5%, and 27-31 years 13.4% higher with 5% significance level compared to less than 4 years experience when considering the sample made up of all adult employed wage earners. This supports the concave trend of the experiential effect on wages. Experience and experience squared present high significant results with values 0.021 and -0.00035 for all adults and 0.015 and -0.00024 for adults between the ages of 26 and 55 respectively. Tenure by the fixed effect method does not demonstrate a clear trend and just 1 years tenure has a value of 2.1% for all adults and 2.7% for those adults aged between 26 and 55, 3 years tenure = 2.9% for all adults, and 14-21 years tenure 6.8% for those aged between 26 and 55, a significantly higher effect on wages when compared to tenure of less than a year (at 10% significance level). Tenure and tenure squared do not show significant results.[26]

7.3. Other Findings

When the attention is focused on family background, the estimates given by a Heckman 2 step analysis demonstrate a 20.5% higher effect for married couples, 45.8% for separated individuals and 39.5% for a divorced person as compared to singles for an all adult sample (at 1%, 5% and 10% significance level respectively). The much higher values attributed to separated and divorced individuals in comparison with married couples are implausible. It might be a measurement error concerning the wage: separated and divorced persons might overstate their wages. The wage of household head is 12 % significantly higher than other household member for all adults at the 5% significance level. A household with children has approximately 7% higher wage than a household without children according to the Heckman 2 step method (at the 10% significance level). In regard to place of residence, most regions of Korea have a significantly negative effect on wage in comparison with Seoul. The sole exception is Ulsan, a major industrial city, which has a 14%

[26] See Table 11, Table 12, Figure 5 and Figure 6 in appendix.

positive effect (5% significance level) according to the Heckman 2 step method. The estimates of residential factors using the fixed effect method are statistically less significant and some estimates give implausible results.[27]

When we consider the working contract and working conditions, the regular labor influences, considered using the Heckman 2 step method, are 14% for all adults (16% for the ages between 26 and 55) stronger and by the fixed effect method 7% (6.1%) stronger where wages are concerned as opposed to irregular labor at the 1% significance level. Day labor demonstrates a 17.6% (16.6%) higher influence according to Heckman 2 step method in reference to non-temporary labor at the10% significance level. No overtime has a 2.2% (2.0%) lower effect by fixed effect method compared to doing overtime at the 1 % significance level. The Presence of a trade union has a 9.5% (10.6%) higher wage effect using Heckman 2 step method at the 1% significance level. The size of a firm has, in most categories, a highly significant influence on wages: The larger the firm, the greater the effect. As regards the type of firm, the Heckman 2 step method presents -11.4% (-9.6%) statistically significant wage effect concerning firms with government investment or public businesses compared to private companies. Once more utilizing the fixed effect method, unattached people, who do not belong to the given firm type, indicate an 11% significantly higher wage effect compared to the base group.[28]

8. Summary

A primary question considered in this study is why people invest so much in school/university education in Korea, while job training is neglected. In order to find the answer, this study initially planned to estimate the effect of school education and job training on wages based on Becker's human capital theory and the Mincer earnings function, and then to compare these effects as they were manifested in different educational levels and in job training. By means of the Heckman 2 step method and the fixed effect method, we obtained the effects of education and job training on wages. Due to the limitations of both estimation methods, the estimation results slightly suffered from selection bias. Summarizing the estimation results, we note the following points:

Education In order to compare the wage effects between different levels of education, we employed the Heckman 2 step method. Therewith, we corrected the sample selection bias by means of the inverse Mill's ratio, which is highly significant. Through correcting sample selection bias,

[27] See Table 13 and Table 16 in appendix
[28] See Table 14 , Table 15 and Table 17 in appendix

we could expand the object of our analysis even to non-wage earners. If we included the unemployed, the self-employed and economically inactive population in our analysis, the wages of junior college graduates and graduates possessing a university degree become higher than the estimated wage effect expected of employed wage earners. According to the estimation result, the wage level of elementary school graduates is approximately 23% lower for all adults and 46% lower for the age group between 26 and 55 (i.e. 21% and 38%, if we calculate exact percentages) than the wage level of senior high school graduates, with all other factors fixed. The wage level of junior college graduates is about 14% and 15% (exactly 15% and 16%) higher than that of our reference group respectively. The wage level of graduates with a bachelor is approximately 26% (precisely 30%) for both groups and the level of those with a master about 44% and 52% (exactly 55% and 68%) higher than that of senior high school graduates. A doctor has about 51% and 59% (precisely 67% and 80%) higher wage than the wage of senior high school graduates respectively. Following the fixed effect estimation, graduates possessing a master degree have approximately 35% and 51% higher wage than senior high school graduates respectively. A doctoral degree has an impact on wages about 132% higher for all adult observations and 152% higher for the observations of those aged between 26and 55 when compared to a senior high school graduation. This is many times higher than the results obtained by the OLS and the Heckman 2 step methods. The reasons for this large gap could be the almost no measurement error in the educational group possessing a PhD and the large wage gap before and after acquiring a doctoral degree.

Following on from this, we come to a realization of the wage inequality existing between different educational levels in Korea. Above all, we notice the wage differences between senior high school graduates, junior college graduates and those with a bachelor, which constitutes the principal focus of interest for this study. Although the estimates of the education variables in general more or less suffer from self-selection bias, as considered in the previous section, this self-selection problem does not problematically influence the estimates of senior high school graduation as well as junior college and bachelor graduation. In contrast to the possession of a master degree or a doctorate, these levels of education are considered to be a common level of education for the general Korean populace, which people should seek to attain without an undue consideration of special financial reward. This lessens the self-selection bias of these education groups. The estimation results, the 15-16% higher wage effect of a junior college graduation and the 30% higher wage effect of a bachelor degree as compared to the effect of a senior high school graduation, supports the hypothesis of this study: The wage of junior college and university graduates is significantly higher than the wage of senior high school graduates or of those with other lower levels of education. So, people are eager to go on to university or at least on to junior college in Korea, although the employment rate of university graduates in the labor market is commonly

lower than other educational groups.

Job training. Using the fixed effect method, we arrive at an estimate = 2.6% for all employed adult males and 2.2% for employed males aged between 26 and 55 when considering the significant effects of completed job training on wages. Using this method, we cannot expand the object of our analysis to non-wage earners as was the case with the Heckman 2 step method. However, the fixed effect method has corrected the omitted ability bias of job training without burdening the result due to the measurement error, as we saw in the earlier section. The remaining problem is that the estimate may be burdened with the self-selection bias as are some estimates of the education variables. So the estimate is possibly upward biased. It means the real effects of job training on wages might be slightly lower than the 2.6% and the 2.2%.

By means of Heckman 2step, we estimate approximately 8.7% and 6.1% significant effects of completed job training on wages in each group respectively. Related to the variable, being job trained, its effect is estimated to be 25% and 23% (5% significant level) while the fixed effect and the OLS methods indicate insignificant and lower effects on wages for this variable. In general, this high job training effect on wages is due to the fact that the Heckman 2step method included the effect of getting a job on wages thanks to job training. On the other hand, these estimation results are biased due to the omitted ability bias and self-selection bias upward.

Education vs. Job training As we have seen, 2 years of junior college education increases one's wage by 15%-16%, and 4 years of bachelor education enhances the wage by 30% for male adult in our sample. On the other hand, completed job training increases the wage up to 2.2%-2.6% for the employed males. Completed job training positively effects on individuals chances of getting a job. As shown in the descriptive statistics, the mean duration of job training for all participants is 4.8 weeks. So, the wage effect of job training is, based on the time invested, much higher than the effect of education. In this respect, my hypothesis - that the effect of school education on wages is much stronger in comparison with the effect of job training on wages – is falsified. However, if we consider the frequency of job training, people who completed any job training in the last period comprise just 6.7% of the sample, i.e. 1,931 individual observations out of 28,913 observations. We can thus calculate that the average duration of job training for all male adults is approximately 0.5 weeks. The opportunity of participating in any job training is too low to expect a wage boost through job training. Furthermore, we must consider how long the effect of job training on wages lasts. As asserted by Becker (1962), the influence of educational level on wage could increase throughout an individual's entire working life, but the effect of 4.8 weeks job train-

ing on wage might endure for only a few years.[29] The effect of school education on wages is clearly stronger in comparison with the effect of job training on wages in accordance with the hypothesis of this study. Thus, job training is hardly recognized as a useful way to enhance one's wage in Korean society.

Experience and Tenure The effect of working experience on wages is a primary interest in the study of human capital investment. This study demonstrates that experience significantly impacts on wages. By using the Heckman 2 step method, it was determined that wage rapidly increases up to an experience of 13 years. With 10-13 years experience a level of about 19%-20% is reached. With an experience of more than 13 years, the marginal effect on wages slowly decreases but still stays higher than 14%. Then it diminishes and manifests a negative effect with more than 34 years experience. In the fixed effect model, we find a similar trend. The marginal effect rapidly increases up to 14-17 years experience. It reaches 15.6%. Then, it decreases with experience of between 18 and 31 years. More than 31 years experience demonstrates an insignificant result. After controlling for experience, the tenure demonstrates no noticeably significant trend using either the fixed effect or the Heckman 2 step method. The estimated labor market experience in this study significantly explains the age-earning profiles in Korea, where the development of individual wages is highly age-dependent.

Other findings Concerning working contracts and working conditions, the wage earned is greater for regular labor when compared to irregular labor. On the other hand, someone who works very hard earns more money independently in contract form. So, a day laborer who usually works very hard earns a higher wage than non-temporary labor, and people who work overtime have higher wages than others. Moreover, the existence of a trade union in the firm leads to wage enhancement. The size of a firm, in most categories, positively influences on wage. This describes industrial relations in Korea quite well: Workers who work in a big company with an organized trade union enjoy high wages and better working conditions. Related to family background, married couples, people with children and heads of households earn a significantly higher wage as compared to singles, people without children and non household heads. So, the wage distribution benefits the traditional family. Regarding residence, the capital city, Seoul, has the highest wage level compared with other cities and urban areas. Only Ulsan, the major industrial city, has a higher average wage than Seoul. According to human capital theory, we could find a reason why one-fourth of the population in Korea lives in Seoul and its peripheries, which is rec-

[29] According to the OLS estimation of wages in 2006 on job training from 2002 to 2006, the effect of job training in 2003 on wages in 2006 is the strongest, followed by the job training effect in 2006 and, finally, the effect in 2005. The job training effect in 2002 presents negative values in most variations of the model. For the dataset, used in this study, we see that job training effects on wages are evident for about 4 years.

ognized as a very serious social problem. Undisputably, Seoul offers the best chance of education and the best chance of getting a qualified job in Korea. This study shows us that Seoul has approximately 10-40% significantly higher wages than other cities and urban areas.

9. Conclusion

As we have seen, there are significant wage differences between people who quit education after completing senior high school and those who proceed to a higher level of school. A junior college education increases the expected wage by 15-16%, and a bachelor education enhances the wage by 30% for adult males in comparison to a senior high school education. Although the 2.2-2.6% wage effect of job training seems to be higher than the effect of education considering only time invested. However, the frequency of job training, 6.5%, is too low and its effect on wages has a shorter duration in comparison to education. Thus, job training is not regarded as an alternative for human capital investment, which can balance the wage differences generated by the attainment of different educational levels. In concluding this study, I have obtained numerical values proving my hypothesis that the effect of university education or junior college education on wages is much higher when compared with that of other lower educational levels. I verified that the effect of school education on wages is much stronger in comparison with the effect of job training on wages. Undoubtedly, we know that there are other social factors, which attract people to university. Setting aside this fact, job training is not recognized economically as a valued factor in human capital investment in Korea. So, people invest a great deal in school/university education, neglecting job training.

Beyond proving the hypothesis, however, this study might have revealed that job training has some economical potential to balance the wage inequality between educational levels. Job training is directly oriented to labor market demand and to the increase of productivity. Reflecting this, the wage effect of job training as measured by time invested is much higher than the effect of education. Concluding this study, I raise a new question as a possible future area of study: The effect of education and job training on wages in Germany, where more weight is given to job related education and vocational training.

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Appendix

Figure 1] Histogram: Log monthly net real wage (Base year: 2000)

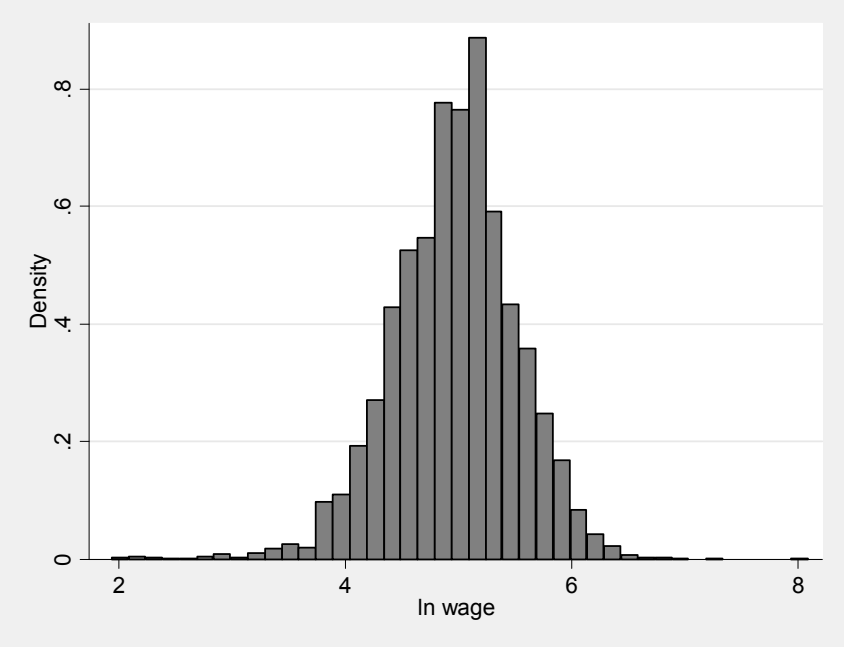
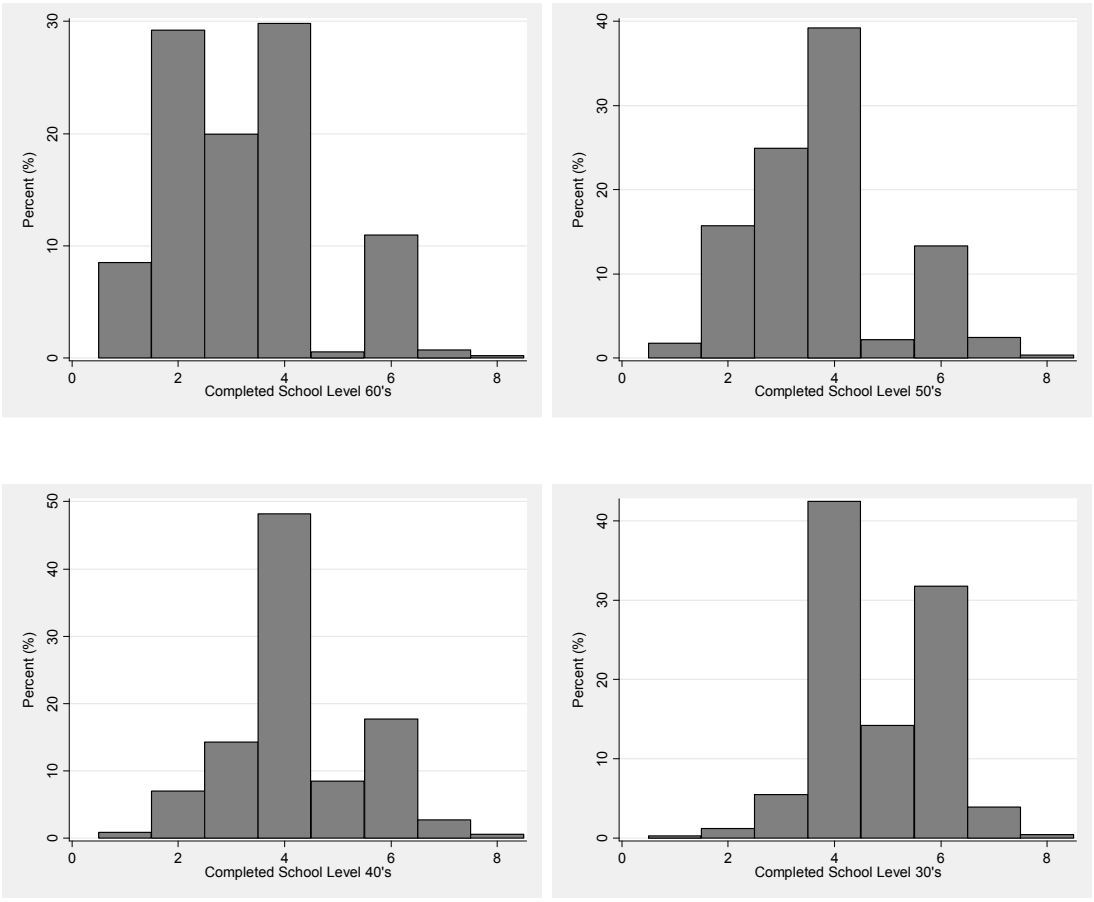


Table 3] Completed Schooling for each age group (%)

Completed school level	60s	50s	40s	30s	Total
No schooling	8.53	1.8	0.87	0.32	3.09
Elementary	29.2	15.7	7	1.26	9.62
Junior high school	19.96	24.91	14.27	5.52	13.64
Senior high school	29.81	39.21	48.19	42.47	44.34
Junior college	0.57	2.19	8.46	14.26	8.13
Bachelor	10.96	13.33	17.74	31.77	18.51
Master	0.75	2.46	2.81	3.97	2.3
Doctor	0.21	0.39	0.67	0.43	0.35
Total	100	100	100	100	100

Figure 3] Completed Schooling for age groups in their 60s, 50s, 40s and 30s

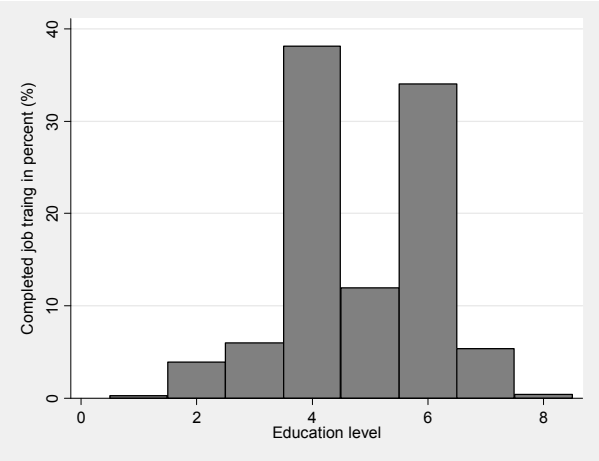


Completed School level] 1: no schooling, 2: elementary school graduation, 3: junior high school graduation, 4: senior high school graduation, 5: junior college graduation, 6: bachelor degree, 7: master degree, 8: doctor degree

Table 4] Participation Rate in Job Training for each educational group

Completed school level	Frequency	Percent
No schooling	5	0.26
Elementary	75	3.89
Junior high school	116	6.01
Senior high school	735	38.1
Junior college	230	11.92
Bachelor	657	34.06
Master	103	5.34
Doctor	8	0.41
Total	1,929	100

Figure 4] Participation Rate of Job Training for each educational group



Completed School level

1: no schooling

2: elementary school graduation

3: junior high school graduation

4: senior high school graduation

5: junior college graduation

6: bachelor degree

7: master degree

8: doctor degree

Table 5] Classification of Labor Market Experience and Tenure of the Present Job

Group	**10 experience dummies according to decile**		**10 tenure dummies according to decile**
	employed male adult wage earner	all male adult	employed male adult wage earner
1	less than 4years	less than 5years	less than 1 year
2	4-7years	5-9 years	1year
3	8-10years	10-13 years	2 years
4	11-13years	14-18 years	3 years
5	14-17years	19-23 years	4 years
6	18-21 years	24-28 years	5-6 years
7	22-26 years	29-33 years	7-9 years
8	27-31 years	34-40 years	10- 13 years
9	32-38 years	41-48 years	14-19 years
10	39 years and more	49years and more	20 years and more

Table 6] Definition of variables

Dependent variable	
lnwage	natural log of monthly net wages for an employee *i* in year *t*: dependent variable of wage equation
dwg	Wage dummy (Having wage or not): dependent variable of selection equation for Heckman 2 step method
Independent variables	
dyr	5 year dummies for years 2002, 2003, 2004, 2005 and 2006
dex exym, exymsq	• 10 experience dummies • Experience and experience square
dsch_h	7 dummies of completed education level: elementary school, junior high school, senior high school, junior college, bachelor, master, doctor
dtenure tenure, tenur-esq	• 10 tenure dummies • Tenure and tenure square
dvt	3 dummies for job training: completed vocational training, being vocational training, no vocational training
dmart	5 marital status dummies: single, married, separated, divorced, bereaved
rel10	Household head dummy
dchid	Children age under 18 dummy
dresid	16 residence dummies
dindst	197 industry dummies for male wage earner, 202 industry dummies for all males
dfrmtyp	19 firm type dummies: private company, foreign company, government invested and public business, government, corporate body, civil- and religious corporation, unat-tached, U.S. troops, superintendent's office of apartment houses, church and religious organization, school, social welfare organization, dispatch worker service firm, coopera-tive association, the U.S. Army Headquarters, firm and organizations for the disabled, music organizations, educational institutions and others
dfrmgrkl	8 firm size dummies: 1-4 persons, 5-9, 10-29, 30-99, 100-299, 300-499, 500-999, 1,000 and more
dreglab	regular worker[30]dummy
dparttim	part time dummy
dtemplab	5 casual worker dummies: not temporary worker[31], casual worker, day worker, self-

[30] Regular worker means a worker who is not outsourced and not temporary worker with a standard work contract.
[31] Non-temporary worker means a worker who has a contract of more than 1 year.

	employee, (unpaid) family worker
dovrtime	overtime dummy
dunion	union dummy
dshift	shift work dummy
dwhnty	4 house ownership dummies: one's own house, the lease of a house on a deposit basis, monthly rent and others
leltminus	natural log of household sustenance allowance for parents
lnonlabek	natural log of household non labor income
lfvermoeg	natural log of household financial wealth
ldebt	natural log of household debt

Table 7] Descriptive Statistics of Variables for all male adults

Variable	Observation	Mean	Std. Dev.	Min	Max
ln wage	12264	5.070801	.558396	2.08	8.1
year dummies	28,913				Percent(%)
2002					18.96
2003					19.89
2004					20.24
2005					20.26
2006					20.64
experience dummies	22193				Percent(%)
less than 5years					10.28
5-9 years					10.73
10-13 years					8.95
14-18 years					10.99
19-23 years					9.90
24-28 years					9.99
29-33 years					9.00
34-40 years					10.78
41-48 years					9.56
49years and more					9.81

Variable	Observation	Mean	Std. Dev.	Min	Max
experience in year	22195	25.24041	16.41711	0	86.42
school degree dummies	25943				Percent(%)
elementary school					12.72
junior high school					13.64
senior high school					44.34
junior college					8.13
bachelor					18.51
master					2.30
doctor					0.35
tenure dummies/wage earner	18223				Percent(%)
less than 1 year					11.27
1year					14.85
2 years					10.87
3 years					8.63
4 years					6.91
5-6 years					9.85
7-9 years					8.89
10- 13 years					8.48
14-19 years					10.81
20 years and more					9.45
tenure in year/wage earner	18227	7.945064	9.565166	0	70
job training dummies	25954				Percent(%)
completed job training					7.44
present job training					0.66
no job training					91.90
job training duration in week	25917	0.5198463	5.543397	0	424.7143
marital status dummies	25954				Percent(%)
single					26.57
married					68.31
separated					1.64
divorced					1.55
bereaved					1.93
household head	28913				66.58 (%)
children age u.d. 18 dummy	28913				40.37 (%)

Variable	Observation	Mean	Std. Dev.	Min	Max
residence dummies	25954				Percent(%)
Seoul					23.05
Busan					9.47
Daegu					6.30
Deajeon					3.38
Incheon					6.62
Gwangju					2.98
Ulsan					2.69
Gyunggi					20.00
Gangwon					2.02
Chungbuk					2.22
Chungnam					2.92
Jeonbuk					3.84
Jeonnam					2.53
Gyungbuk					5.09
Gyungnam					6.86
Jejudo					0.05
firm type dummies	12316				Percent(%)
private company					76.69
foreign company					1.15
government invested and public business					4.17
body corporate					3.86
government					8.21
unattached					5.07
civil- and religious corporation					0.54
U.S. troops					0.05
superintendent’s office of apartment houses					0.01
church and religious organization					0.13
school					0.02
social welfare organization					0.02
dispatch worker service firm					0.01
others					0.01
cooperative association					0.01
the U.S. Army Headquarters					0.03
firm and organization for the disabled					0.01

Variable	Observation	Mean	Std. Dev.	Min	Max
music organization					0.01
educational institution					0.01
firm size dummies	11786				Percent(%)
1-4 persons					23.58
5-9					13.80
10-29					16.77
30-99					14.39
100-299					9.34
300-499					3.17
500-999					3.24
1,000 and more					15.70
regular worker	12217				77.60(%)
part time	12282				3.74(%)
temporary worker dummies	18289				Percent(%)
labor with non-temporary contract					54.34
casual labor					4.80
day labor					8.23
self-employed					31.10
family worker					1.53
having overtime	10340				32.18(%)
having union	12336				23.67(%)
shift worker	12277				12.79(%)
having wage	28,913				42.60(%)
house ownership dummies	28890				Percent(%)
one's own house					65.50
the lease of a house on a deposit basis					21.62
the lease of a house with monthly rent					8.68
others					4.21
ln household (hh) sustenance allowance for parents	11424	4.42182	1.097968	0	13.45884
ln hh non labor income	14654	5.371609	1.756956	0	11.51843
ln hh financial wealth	18261	6.980954	1.468599	0	12.31143
ln hh debt	15825	7.885174	1.260997	.6931472	13.12236

The description of **202 industry dummies** with 18214 observations, which are not variables of interest for this study, is omitted.

Table 8] Estimation Result of Selection Function by the Heckman 2 step method (All male adults)

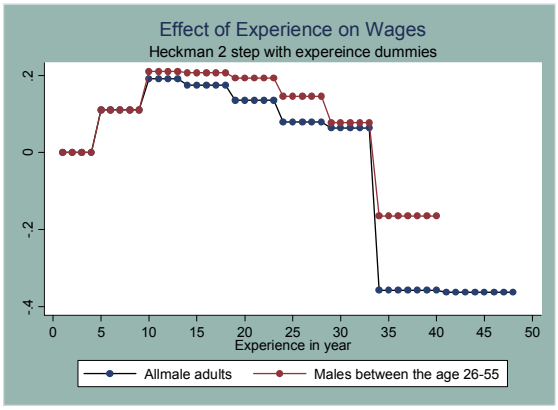
Dependent Variable: Dummy Wage (dwg)					
Independent	**Coefficient**	**z-statistics**	**Independent**	**Coefficient**	**z-statistics**
yr2	0.063812	0.49	dresid6	-0.11419	-0.55
yr3	0.046631	0.39	dresid7	0.546545	2.1
yr4	0.148276	1.25	dresid8	0.140554	1.25
yr5	0.231276	1.96	dresid9	-0.6734	-1.64
Dex2	0.405821	2.42	dresid10	-0.28461	-1.12
Dex3	-0.0722	-0.43	dresid11	-0.3837	-2.16
Dex4	-0.52906	-3.11	dresid12	-0.41351	-2.4
Dex5	-0.68475	-3.68	dresid13	-0.40879	-2.02
Dex6	-0.71282	-3.71	dresid14	-0.48158	-2.72
Dex7	-1.13475	-5.15	dresid15	0.08763	0.59
dex8	-1.12567	-4.75	dmart2	0.193339	0.83
dex9	-1.4067	-5.11	dmart3	-0.02116	-0.04
dex10	-7.73869	.	dmart4	0.1916	0.35
dsch_h2	-0.03481	-0.14	dmart5	-6.04938	.
dsch_h3	-0.02525	-0.16	rel10	0.400979	2.22
dsch_h4	-0.02908	-0.23	dchid1	0.034693	0.31
dsch_h5	-0.00934	-0.09	dwhnty2	0.02592	0.28
dsch_h6	0.004471	0.02	dwhnty3	-0.12745	-0.71
dsch_h7	-0.48519	-0.95	dwhnty4	-0.43233	-1.83
dvt1	0.582764	5.34	leltminus	0.073967	2.14
dvt2	0.271991	0.77	lnonlabek	-0.03879	-1.67
dresid2	-0.55593	-3.36	lfvermoeg	0.033091	1.24
dresid3	0.093078	0.46	ldebt	-0.24684	-8.01
dresid4	-0.4113	-2.65	_cons	1.618719	4.63
dresid5	-0.338	-1.37			

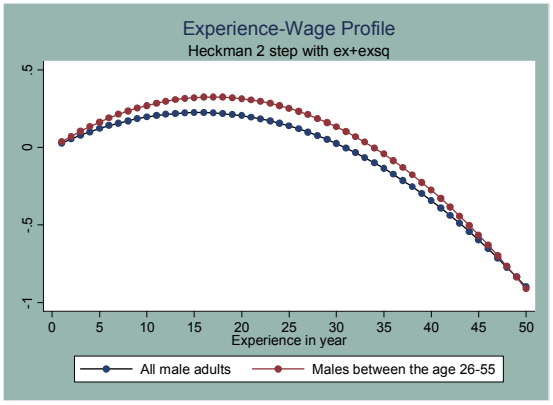
Table 10] Effect of Experience on Wages

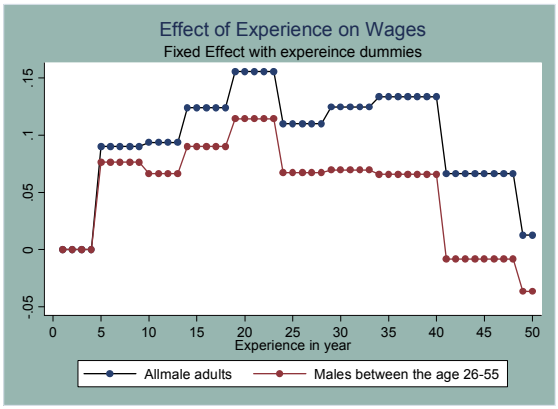
Dependent Variable: ln wage					
Experience (year)	**Heckman 2 step (z-statistics)**		**Experience (year)**	**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**		**All adult**	**Age 26-55**
5-9	0.1104337	0.1107246	4-7	0.090043	.0764636
	(2.40)	(2.55)		(4.46)	(3.49)
10-13	0.1907029	0.2099908	8-10	0.093602	.0664772
	(3.94)	(4.56)		(3.55)	(2.30)
14-18	0.1743367	0.2064966	11-13	0.124133	.0901687
	(3.16)	(3.86)		(3.87)	(2.63)
19-23	0.1351201	0.1927583	14-17	0.155614	0.1142694
	(2.09)	(3.10)		(4.07)	(2.80)
24-28	0.07911	0.1457734	18-21	0.109999	0.067386
	(1.18)	(2.25)		(2.46)	(1.43)
29-33	0.0635963	0.077241	22-26	0.12469	0.0694895
	(0.70)	(0.87)		(2.39)	(1.27)
34-40	-0.3578091	-0.1650037	27-31	0.133753	0.0657898
	(-3.71)	(-1.64)		(2.15)	(1.01)
41-48	-0.3632287		32-38	0.066525	-.0082612
	(-2.95)			(0.94)	(-0.11)
49-			39-	0.012582	-.0365256
				(0.16)	(-0.42)
Experience	0.0290978	0.038419	Experience	0.0210757	.0151741
	(5.78)	(6.24)		(4.10)	(2.68)
Experience squared	-0.0009413	-0.0011328	Experience squared	-0.0003471	-0.0002409
	(-8.07)	(-6.95)		(-3.93)	(-3.04)

Base group of Heckman 2 step: less than 5 years, Base group of fixed effect: less than 4 years.

Figure 5] Effect of Experience on Wages and Experience- Wage profiles







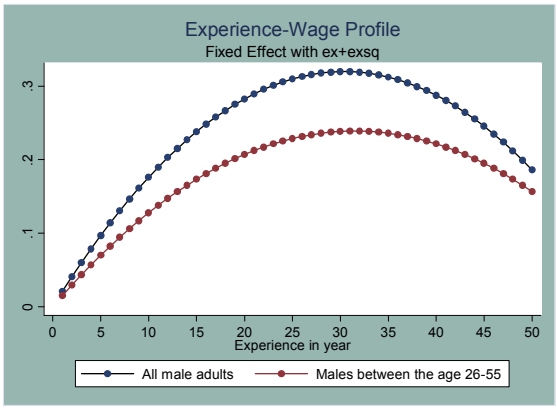
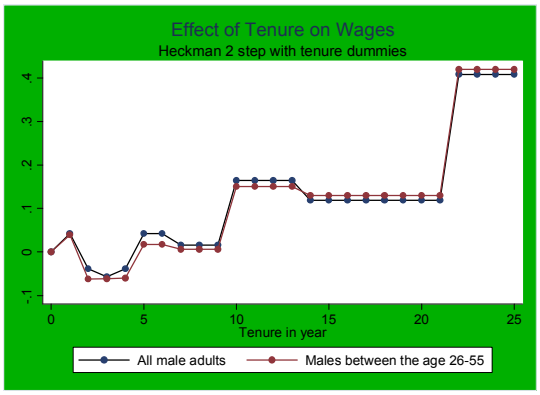


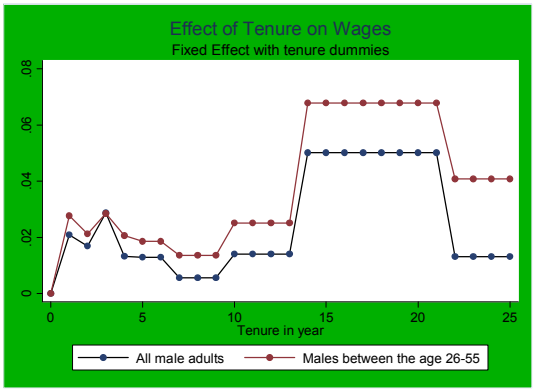
Table 11] Effect of Tenure on Wages

Dependent Variable: ln Wage					
Tenure (year)	**Heckman 2step (z-statistics)**		**Tenure (year)**	**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**		**All adult**	**Age 26-55**
1	0.0427222	0.0392445	1	0.0208737	0.027765
	(0.97)	(0.87)		(1.72)	(1.95)
2	-0.0388009	-0.0629688	2	0.0169629	0.0212068
	(-0.81)	(-1.32)		(1.22)	(1.34)
3	-0.0572233	-0.0615455	3	0.0287669	0.0285162
	(-1.16)	(-1.24)		(1.83)	(1.60)
4	-0.0386805	-0.0604952	4	0.0132378	0.020646
	(-0.73)	(-1.14)		(0.72)	(1.02)
5-6	0.0420934	0.0172288	5-6	0.0128903	0.0186516
	(0.84)	(0.34)		(0.60)	(0.79)
7-9	0.0158466	0.0063877	7-9	0.0055138	0.0136296
	(0.32)	(0.13)		(0.21)	(0.47)
10-13	0.1644159	0.1506621	10-13	0.0141149	0.0251332
	(3.13)	(2.84)		(0.44)	(0.72)
14-21	0.1185893	0.1299339	14-19	0.0502238	0.0678064
	(2.13)	(2.31)		(1.38)	(1.70)
22and more	0.408762	0.4193529	20 and more	0.0131207	0.0408199
	(5.36)	(5.10)		(0.28)	(0.82)
Tenure	0.0009622	-0.00106	tenure	0.0036167	0.0012142
	(0.15)	(-0.17)		(0.93)	(0.28)
tenure	9.0006115	0.000684	tenure	-.0000831	0.000179
squared	(6.40)	(5.97)	squared	(-0.52)	(0.82)

Base group: less than 1 year.

Figure 6] Effect of Tenure on Wages and the Tenure- Wage profiles





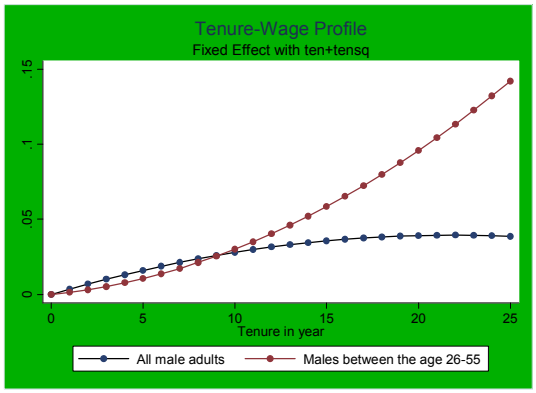


Table 12] Effect of Family Background on Wages

Dependent Variable: ln Wage				
Family background	**Heckman 2 step (z-statistics)**		**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**	**All adult**	**Age 26-55**
Married	0.204926 (2.88)	0.18447 (2.75)	0.061629 (1.77)	0.0386379 (1.06)
Separated	0.458128 (2.25)	0.3804466 (1.93)	0.104245 (1.55)	0.0411746 (0.57)
Divorced	0.394837 (1.89)	0.2865656 (1.45)	0.100986 (1.58)	0.0624516 (0.93)
Bereaved			0.047821 (0.47)	0.0133281 (0.13)
Household head	0.116633 (2.0)	0.1151634 (2.14)	0.031938 (0.85)	0.0501979 (1.28)
Having children	0.068624 (1.8)	.0575943 (1.56)	0.023543 (1.52)	0.0208553 (1.28)

Base group of marital status: Single.

Table 13] Effect of Working Contracts, Working Conditions and Trade Unions on Wages

Dependent Variable: ln Wage				
Working contract, working condition and trade unions	**Heckman 2 step (z-statistics)**		**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**	**All adult**	**Age 26-55**
Regular labor	0.142445	0.1609714	0.070211	0.0638513
(B.G.: Irregular labor)	(2.86)	(3.24)	(4.34)	(3.38)
Casual labor	-0.05904	-0.0764573	-0.04702	-0.0416372
(B.G.: Non-temporary labor)	(-0.82)	(-0.95)	(-1.55)	(-1.01)
Day labor	0.176364	0.1663884	0.002902	-0.0254127
(BG.: Non-temporary labor)	(1.89)	(1.85)	(0.09)	(-0.65)
Part time	0.048047	0.1002707	-0.05703	0.036441
	(0.43)	(0.86)	(-0.64)	(0.31)
No overtime	-0.01883	-0.0186383	-0.02152	-0.0200437
	(-0.82)	(-0.83)	(-2.7)	(-2.37)
Having Shift	0.00423	0.003352	-0.0118	-0.0040888
	(0.11)	(0.09)	(-0.57)	(-0.17)
Having Union	0.094635	0.1058972	-0.01023	-0.0150449
	(3.07)	(3.47)	(-0.73)	(-1.14)

B.G.: Base group.

Table 14] Effect of Firm size (number of employees) on Wages

Dependent Variable: ln wage				
Firm size (number of employees)	**Heckman 2 step (z-statistics)**		**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**	**All adult**	**Age 26-55**
5-9	0.101571 (1.88)	0.1281105 (2.21)	0.046214 (2.53)	0.0459938 (2.24)
10-29	0.260387 (5.28)	0.2591656 (5.06)	0.078927 (3.85)	0.0914951 (3.91)
30-99	0.202079 (3.89)	0.2023745 (3.78)	0.089697 (4.279	0.0963728 (4.01)
100-299	0.24004 (4.26)	0.216123 (3.70)	0.08879 (3.77)	0.0884456 (3.30)
300-499	0.30648 (4.48)	0.2927814 (4.28)	0.089641 (3.35)	0.0880076 (3.05)
500-999	0.45186 (6.6)	0.411155 (5.96)	0.118398 (4.3)	0.1072755 (3.60)
1,000 and more	0.436164 (7.6)	0.4058985 (6.78)	0.121171 (4.59)	0.1041925 (3.58)

Base group: Firm with 1-4 employees.

Table 15] Effect of Residences on Wages

Dependent Variable: ln Wage				
Residence of Family	**Heckman 2 step (z-statistics)**		**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**	**All adult**	**Age 26-55**
Busan	0.017997 (0.26)	-.0259471 (-0.35)	-0.07508 (-1.01)	-0.0630218 (-0.75)
Daegu	-0.30486 (-4.6)	-0.325411 (-5.24)	-0.16898 (-1.98)	-0.1106628 (-1.18)
Deajeon	-0.19202 (-3.31)	-0.2221513 (-3.96)	0.098339 (0.99)	0.1223301 (1.25)
Incheon	-0.18512 (-2.1)	-0.1616038 (-1.96)	-0.12032 (-1.72)	-0.1601722 (-2.23)
Gwangju	-0.16238 (-2.38)	-0.01809772 (-2.83)	-0.25164 (-3.14)	-0.2557539 (-3.15)
Ulsan	0.142583 (2.09)	0.1259951 (1.95)	-0.04583 (-0.53)	-0.0034221 (-0.04)
Gyunggi	0.01434 (0.4)	0.0069006 (0.20)	-0.05106 (-1.59)	-0.0562943 (-1.58)
Gangwon	-0.17502 (-0.92)	-0.2221013 (-1.24)	-0.28195 (-2.65)	-0.2778471 (-2.55)
Chungbuk	-0.28319 (-3.23)	-0.2856596 (-3.43)	0.050709 (0.41)	0.0575205 (0.49)
Chungnam	-0.15295 (-2.56)	-0.1601841 (-2.82)	0.123282 (1.91)	0.113956 (1.68)
Jeonbuk	-0.15843 (-2.73)	-0.2190297 (-3.80)	0.118922 (1.28)	0.1455091 (1.52)
Jeonnam	-0.02481 (-0.37)	-0.0211201 (-0.32)	-0.37274 (-3.9)	-0.435397 (-4.42)
Gyungbuk	-0.21665 (-3.28)	-0.2246407 (-3.62)	-0.09608 (-1.14)	-0.0744991 (-0.87)
Gyungnam	-0.12799 (-2.76)	-0.1509417 (-3.32)	-0.06376 (-0.96)	-0.0641604 (-0.82)
Jejudo			0.306086 (1.23)	0.4762458 (1.68)

Base group: Seoul (Capital city of Korea).

Table 16] Effect of Firm types on Wages

Dependent Variable: ln Wage				
Firm type	**Heckman 2 step (z-statistics)**		**Fixed Effect (t-statistics)**	
	All adult	**Age 26-55**	**All adult**	**Age 26-55**
Foreign company	0.050619	0.0493019	-0.01363	-.0142692
	(0.72)	(0.68)	(-0.40)	(-0.41)
Government invested, public business	-0.11373	-0.0959843	-0.01435	-0.0027505
	(-2.20)	(-1.86)	(-0.50)	(-0.09)
body corporate	0.034511	0.0304231	0.013843	.0135109
	(0.55)	(0.50)	(0.65)	(0.60)
The unattached			0.111366	0.1087513
			(6.44)	(5.79)
Civic-, religious, social groups	-0.60054	-0.5625753	-0.027	0.0168479
	(-1.39)	(-1.35)	(-0.48)	(0.34)
U.S. troops	0.272495	0.4954438	-0.11462	-0.1280441
	(0.98)	(1.77)	(-0.53)	(-0.53)
superintendent's office of apartment houses			0.082907	0.0991183
			(2.29)	(2.65)
civil- and religious corporation			-0.20395	-0.1393545
			(-0.99)	(-0.72)
Social welfare organiza-tion			0.042582	0.0338525
			(0.59)	(0.45)
dispatch worker service firm			0.229918	0.0033648
			(1.35)	(0.02)
the U.S. Army Headquarters			-.0415946	-0.0360298
			(-0.29)	(-0.23)
educational institution			0.21448	0.2215485
			(3.20)	(3.36)

Base group: private company