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Analyzing the Relationship between Cost of Living and Nominal Wages and Real Income Inequality in Korea

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Abstract

Analyzing the Relationship between Cost of Living and Nominal Wages and Real Income Inequality in Korea

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This study analyzes the relationship between the cost of living and nominal wages in Korea and investigates whether there are compensating wages depending on different living costs. Taking into account of the relationship between the cost of living and nominal wages, we compare the real income inequality with nominal income inequality at three different stages, namely, cross-sectional, short-term, and long-term. The cross-sectional income inequality analysis is limited to a specific period of time; the short-term income inequality analysis focuses on the time period of one generation; finally, the long-term income inequality analysis extends the time period to more than one generation.

Keywords: nominal income, cost of living, real income inequality, compensating wage differentials, transitory income
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Ⅰ. Introduction

The notion of nominal income has been conventionally used to signify the economic well-being of individuals. However, the difference in the cost of living among different regions may cause different economic standards of living, even in cases when individuals receive the same nominal income. This is because, depending on a region's cost of living, the same nominal income can have a different purchasing power across different regions. If the living cost varies considerably among regions, then, with the same amount of money, the amount or the quality of product that can be purchased would be different as well. For example, with the same nominal income, if a worker lives in an area with a high cost of living, then his/her real earnings would be lower than those of a worker who lives in an area with a lower cost of living. Therefore, the income adjusted to the cost of living, i.e. the real income, becomes a more appropriate measure of well-being of individuals.

Similarly, with regard to the distribution of the actual well-being of individuals, the income inequality in real terms also becomes a better measure than the income inequality in nominal terms. For example, in the case when low-income workers live in high-cost regions, while high-income workers live in low-cost regions, nominal income inequality would not be properly showing the distribution of the real standard of living of individuals. In that case, the income inequality in real terms might be higher than the income inequality in nominal terms. This prediction becomes even more reasonable if we consider low-income workers living in high-cost regions: these workers would have an even lower standard of living.

Analyzing the income and income inequality in real terms is crucial, because,

for example, low-income workers, who are eligible for a subsidy in real terms, may end up not receiving such a subsidy, as they do not qualify for receiving a subsidy as measured in nominal terms. As a result, difficulties may arise for these low-income workers, as they do not receive subsidies they need, which further broadens the income inequality gap.

In case of Korea, the cost of living in the Seoul Metropolitan Area (SMA)[1] is significantly higher than the corresponding living costs in other areas. For example, *The Detached House Posted Price Index of 2005*[2] by the Korea Appraisal Board provides relevant evidence for this point: the price of a detached house in Seoul is ten times higher than that of a house in other metropolitan regions. Therefore, since the living cost considerably varies across different regions in Korea, the real income is a better measure of economic well-being and standard of living. Furthermore, income inequality in real term also becomes a better measure than the income inequality in nominal terms.

Against this background, this study aims to analyze the relationship between the cost of living and nominal wages and investigate whether there is a compensating wage of living costs in Korea. A compensating wage is a wage premium given to workers for non-wage characteristics that cause risk. For example, if a worker has a risky job, then his/her employer offers a wage premium to compensate for the danger and prevent the worker from leaving his/her jobs. A high cost of living can also be considered to be a risk, since it causes disutility to people. Therefore, if there is a positive correlation between the cost of living and nominal income, then the question arises whether or not here is a compensating wage depending on the living costs.

Moreover, taking into account the relationship between the cost of living and

[1]The Seoul Metropolitan Area (SMA) includes three different administrative districts: Seoul Special City, Incheon Metropolitan City, and Gyeonggi Province.
[2]In this study, the analysis is based on the 2005 data, as only the cost of living index 2005 is available.

nominal income, this study compares the real income inequality with nominal income inequality. Since the living cost varies across different regions of Korea, the analysis of income inequality without considering the cost of living (what we conventionally analyzed) is not entirely adequate. In response to this problem, the present study analyzes the income inequality in real terms and compares it with the income inequality analyzed in nominal terms.

More specifically, we analyze the income inequality at three different stages, namely, cross-sectional, short-term and long-term. The cross-sectional analysis is limited to a specific period of time; in this study, the data from 2005 were used for the analysis. Both short-term and long-term analyses are dynamic studies. The difference between the short-term and long-term analysis is that, while the former is limited to the time period within one generation (intra-generation), the latter is inter-generational and spans the time across two generations. Unlike the cross-sectional analysis, short-term and long-term analyses assume that regional movement is available.

The remainder of this paper is structured as follows. Section 2 introduces some of the previous studies related to the compensating wage of the cost of living. Section 3 discusses the empirical method used in the present study and Section 4 describes the data. Section 5 presents the estimation results. Section 6draws the conclusion.

Ⅱ. Literature Review

A variety of studies have attempted to analyze the relationship between the cost of living and nominal wages. The relationship is usually shown by using a conventional Mincer equation[3] and the Oaxaca wage decomposition method[4].

Coelho and Ghali (1971) analyzed the wage difference between the northern and southern (10 cities) parts of the United States. The datasets used in the study were the Census of Manufacturers 1963 and the Handbook of Labor Statistics 1968. These datasets showed that wages in the South were about 12.4 percent lower than in the North, but this difference disappeared when the wages were considered in real terms. This result suggests that the differences in the nominal wages between the two regions had been completely compensated by the differences in the cost of living.

Bellante (1979) also analyzed the wage differentials between the northern and southern parts of the United States. This study also supports the results of Coelho and Ghali (1971). Bellante decomposed the factors determining the wage differences between the north and the south, and suggested that the more than 62 percent of the wage differences can be explained by the cost of living, and the other 38 percent by demographic characteristics related to human capital.

Gerking and Weirick (1983) verified if the interregional wage differentials can

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[3] The Mincer earnings function is a single-equation model that explains the earnings with the function of education and experience (Borjas, 2013).

$$lnW = as + bt - ct^2{}_i + \varepsilon$$

$$s = number\ of\ years\ of\ schooling$$

$$t = number\ of\ years\ of\ experience\ in\ labor\ market$$

t^2=square term of number of years of experience in labor market

[4] The Oaxaca method decomposes wages into explained/unexplained variations. For example, it decomposes the wages into explained variations, such as education, and unexplained variations, such as any kind of discrimination.

be explained by the compensating wage with the 1976 PSID data, and supported the previous studies by showing the results of no difference of full-time worker's real wages or earnings between the regions in the United States.

Winters (2009) showed the elasticity between wages and the general price level, and the results support the full compensation hypothesis.

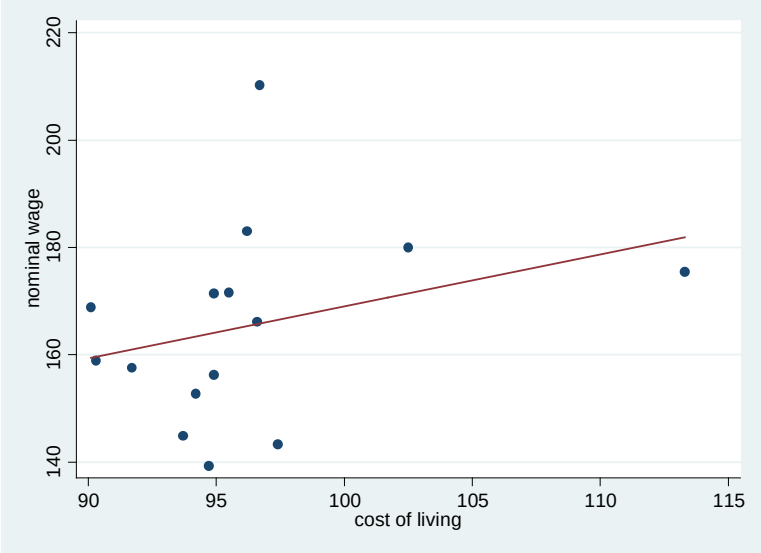
There are many domestic studies examining wage determinants and wage differentials in Korea. For instance, Yoo (2003) analyzed the gender wage differentials and Kwark and Rhee (1993) analyzed the educational wage differentials. Kim (1995) also studied the compensating wage differentials for job attributes and working conditions in Korea, and showed that there were compensating wage differentials for bad working environments in Korea. This wage premium was estimated to be approximately 5 percent.

However, there are not many studies on the regional wage differentials, analyzing the regional cost of living and their relation to wage differentials. One of the studies is Park (1988), which conducted research by using the 1986 data from the Report on Occupational Wage Survey. This research suggested that there is a compensating wage for the living cost in Korea, but it is limited to the manufacturing industry.

Ⅲ. Empirical Method

3.1. Conceptual Background

Since the primary goal of this study is to investigate the relationship between the nominal wages and the cost of living, I will start by looking at the simple correlation just between the nominal wages and the cost of living in 2005.



[Figure 1] Cost of Living vs. Nominal Wage (Data: KLIPS 8th WAVE)

The graph above shows the positive correlation between the nominal wages and the cost of living. This indicates that if people live in a place with a high cost of living, then they tend to receive higher nominal wages as compared to people living in a place with a low cost of living. One of the theoretical interpretations for this phenomenon could be the compensating wage differentials depending on the cost of living. I will give a brief explanation of the compensating wage differentials in the next section. Then, this study will progress in a way to verify the relationship between the cost of living and the nominal wages.

3.1.1. Compensating Wage Differentials

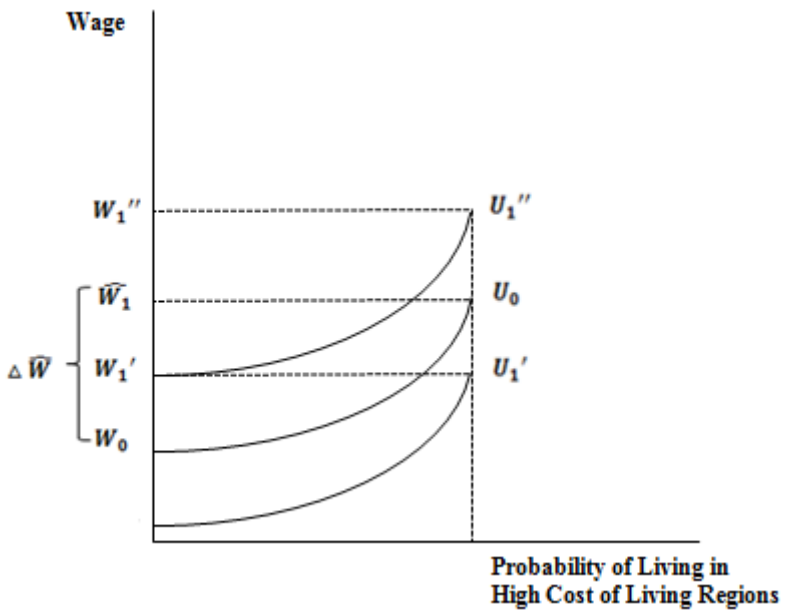
As shown above, in Korea the nominal wages has a positive correlation to the cost of living, which may be explained by the compensating wage differentials.

A compensating wage is a wage premium given to workers for non-wage characteristics that cause risk. For example, if a worker has a risky job, then his/her employer offers a wage premium to compensate for the danger and prevent the worker from leaving his/her jobs. A high cost of living can also be considered to be a risk, since it causes disutility to people.

In order to maintain a certain utility for people from different areas, people living in the high-cost area should be compensated by a wage premium. The equation (1) below is a simple utility function of an indifference curve.

$$U = f(w, c) \tag{1}$$

$$U = \text{utility}, w = \text{nominal wage}, c = \text{cost of living}$$



[Figure 2] Compensating Wage Differentials

For better understanding, I assume that there are only two kinds of regions; low cost of living regions and high cost of living regions. The probability of living in the high cost of living regions can take any value between 0 and 1.

The worker earns a wage of w_0 and receivesU_0 utility if he resides in low-cost region. He would prefer the low-cost region if paid a wage of $w_1^{'}$, but would prefer a high-cost region if paid a wage of $w_1^{''}$. The worker is indifferent between the two regions if he is paid $\widehat{w_1}$. Therefore, the reservation price is$\Delta\ \widehat{w_1}$. (Borjas, 2013) In other words, theoretically, under circumstances where all other conditions are the same, in order for workers to stay in a high-cost region, $\Delta\ \widehat{w_1}$ amount of wage premium should be paid to the workers (Borjas, 2013)[5].

[5] Borjas, G. J. (2013). Labor Economics, Magraw-Hill Irwin.

3.2. Cross-Sectional Income Inequality

There are several ways of measuring the income inequality, of which measuring the variance of the distribution is one. The income distribution shows how the income of individuals is dispersed and the degree of its dispersion can be calculated by measuring its variance. A large income variance implies high income inequality, since it indicates widely spread income. In contrast, small variance implies low income inequality. In this study, I measured the income inequality through the variance. I compared the variance of nominal income, $\mathrm{Var(lnW)}$, with the variance of real income, $Var\left(ln\frac{W}{P}\right)$,to compare the income inequality in nominal terms from the income inequality in real terms. The real income is estimated by dividing the nominal income by the cost of living.

In advance, I showed that the nominal wages has a positive relationship to the cost of living. This relationship can be expressed like equation (2), and starting from this equation (2), I can derive the variance of nominal income (3)[6] and the variance of real income (4)[7].

$$Log\ Scale\ of\ Nominal\ Wage\ (ln\,W) = \beta \times Log\ scale\ of\ Cost\ of\ Living\ (ln\,P) \quad (2)$$

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[6] $\mathrm{Var(lnW) = Var(\beta \cdot lnP) = \boldsymbol{\beta^2 Var(lnP)}}$

[7] $\mathrm{Var}\left(\ln\frac{\mathrm{W}}{\mathrm{P}}\right) = \mathrm{Var(lnW - lnP)} = \mathrm{Var(lnW) + Var(lnP) - 2Cov(lnW, lnP)}$

$= \beta^2\mathrm{Var(lnP) + Var(lnP) - 2\{\,E(lnW \cdot\ lnP) - E(lnW)E(lnP)\}}$

$= \beta^2\mathrm{Var(lnP) + Var(lnP) - 2\{\,E(\beta lnP \cdot lnP) - E(\beta lnP)E(lnP)\}}$

$= \beta^2\mathrm{Var(lnP) + Var(lnP) - 2\{\beta E((lnP)^2) - \beta\left(E(lnP)\right)^2\}}$

$= \beta^2\mathrm{Var(lnP) + Var(lnP) - 2}\beta\left\{E((\mathrm{lnP})^2) - \left(E(lnP)\right)^2\right\}$

$= \beta^2\mathrm{Var(lnP) + Var(lnP) - 2}\beta var(lnP)$

$= \mathbf{(\beta - 1)^2 Var(lnP)}$

$$\mathrm{Var}(\ln W) = \mathrm{Var}(\beta \cdot \ln P) = \beta^2 \mathrm{Var}(\ln P) \quad (3)$$

$$\mathrm{Var}\left(\ln \frac{W}{P}\right) = (\beta - 1)^2 \mathrm{Var}(\ln P) \quad (4)$$

Equation (3) indicates the variance of nominal income and equation (4) indicates the variance of real income. From equations (3) and (4), I can learn that the variance of real income becomes smaller than the variance of nominal income if the value of β is greater than $\frac{1}{2}$ and variance of real income becomes higher than the variance of nominal income if the value of β is smaller than $\frac{1}{2}$. Therefore, $\frac{1}{2}$ can be seen as a threshold. This indicates if there is a strong relationship between the nominal wage and the cost of living (i.e. if the values of β were greater than 0.5), then the real income inequality would be lower than the nominal income inequality (since the variance of real income would be smaller).In turn, if the value of β is equal to $\frac{1}{2}$, than the variance of nominal and real income become the same.

However, since this is the result of a simple calculation, the empirical results might be different. The value of β could vary depending on the data of the costs of living, wages and other controlling variables. The limitations of the data give rise to uncertainty. Therefore, the variance of the real income could be smaller than the variance of the nominal income, although the value of β is smaller than $\frac{1}{2}$ (β could be underestimated because of this limitation). Hence, we should carefully interpret this and not strictly judge the value of β when analyzing the empirical results.

Last, but not least, I set up a hypothesis to substantiate the conjecture. In the later section, I shall verify if I can reject the H_0 through regression analysis.

$$H_0: \beta < \frac{1}{2}\left(i.e. Var(W) < Var\left(\frac{W}{P}\right)\right) \quad (5)$$

$$\mathrm{H}_1: \beta \geq \frac{1}{2}\left(i.e. Var(W) \geq Var\left(\frac{W}{P}\right)\right) \tag{6}$$

I can reject the null hypothesis if the coefficient of the cost of living is close to or greater than one half. Otherwise, statistically, I cannot reject the null hypothesis.

3.3. Longitudinal Income Inequality (Short-Term)

The previous section 3.2. suggested the method of analyzing the cross-sectional income inequality. Other than the cross-sectional income inequality, this study also includes the longitudinal income inequality analysis, which assumes the inter-regional migration of people. The longitudinal income inequality analysis is composed of short-term analysis and the long term analysis. As mentioned in the introduction, the short-term income inequality analysis focuses on the time period of one generation; finally, the long-term income inequality analysis extends the time period to more than one generation. Among the longitudinal analysis, I will first start with the short-term income inequality.

For the short-term analysis, I follow the method suggested by Kim et al. (2013). First of all, in this analysis, I decompose the income into permanent and transitory income. Permanent income is the expected average income over a long period of time, and is mostly determined by the initial condition of the workers before entering the labor market. In contrast, transitory income is the income that continuously changes over time, and can vary depending on the worker's outcome, economic condition, etc. For instance, if a worker is highly productive in a particular month, then the firm would pay this worker more money during the month, or during an economic boom, the company may temporarily pay higher income to the workers. This is the concept of transitory income. In this study, I hypothesize that the cost of living is independent from permanent income and correlates only with transitory income, since the cost of living is not the initial condition of the workers and keep changes whenever the workers move from region to region. In other words, regional characteristics (cost of living, in this case) could become a one of the factors which determines the transitory income.

Permanent income can be estimated by regressing the income on the initial conditions of the workers, such as age, gender and years of education, etc. The regression function (7) is as follows[8]:

$$y_i = \beta_0 + \beta_1 edu + \beta_2 age + \beta_3 age^2 + \beta_3 age^3 + \beta_4 age^4 + \beta_5 gender + \beta_6 jobtype + \beta_7 occ_1 + \beta_8 occ_2 + \beta_9 occ_3 + \beta_{10} occ_4 + \beta_{11} occ_5 + \varepsilon_i \quad (7)$$

The variableedu denotes years of education andage denotes the age of the workers.age^2, age^3, age^4 are measured by raising $age$to the second, third, and fourth power, respectively. $gender$ is a dummy variable distinguishing whether the worker is a male of a female. $jobtype$ denotes the type of job, indicating whether the worker is having a permanent job or a temporary job.$occ$is a variable classifying the occupations : 1) professionals; 2) technicians and associate professionals; 3) clerical support workers; 4) service and sales workers; 5) skilled agricultural, forestry and fishery workers, craft and related trades workers, plants and machine operators and assemblers, and elementary occupations.

I define predicted income obtained from the regression as a permanent income and assume that this permanent income is irrelevant from other macroeconomic variables and conditions which are changeable as the time pass (e.g. continuous service year)[9].

Since the total income (y) is the sum of the permanent income (y^p) and the transitory income (y^t), the variance of total income is the sum of the variances of permanent and transitory income (i.e. $var(y) = var(y^p) + var(y^t)$).

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[8] This study does not need to consider the changes in the initial conditions, because this study is limited to the 2005 data.

[9] Hyun (2013), "The connection between inter-generational income mobility and intra-generational income inequality structure in Korea.", p.13

The equation below shows how the income inequality is measured in this study which is following Kim et al. (2013). Equation (8) is the function of nominal income inequality, and Equation (9) is the function of real income inequality, which took cost of living into account.

$$\text{Income Inequality}_{\text{N}} = \frac{var\,(y_N^p)}{var\,(y_N)} = \frac{var\,(y_N^P)}{var\,(y_N^p)+var\,(y_N^T)} \tag{8}$$

$$\text{Income Inequality}_{\text{R}} = \frac{var\,(y_R^p)}{var\,(y_R)} = \frac{var\,(y_R^p)}{var\,(y_R^p)+var\,(y_R^T)} = \frac{var\left(\frac{y_N^p}{p}\right)}{var\left(\frac{y_N^p}{p}\right)+var\left(\frac{y_N^T}{p}\right)} \tag{9}$$

$$(\text{N} = \text{nominal}, \text{R} = \text{real}, \text{P} = \text{permanent}, \text{T} = \text{transitory})$$

If the ratio of permanent income taking part to the total income is large, then this indicates that people's income is not changing very much as time passes. In other words, in this case, it is hard for low-income workers to become high-income workers in the following years (substantially affected by the past income).In this case, it can be said that the income inequality is high in the short-term.

As it is hypothesized that price is only related to the transitory income,var$\left(\frac{\mathrm{y}_N^{\mathrm{p}}}{p}\right)$ should hold constant and only var$\left(\frac{\mathrm{y}_N^{\mathrm{t}}}{p}\right)$ is expected to change

3.4. Regression

In order to clarify the relationship between the cost of living and nominal wages, I use the Ordinary Least Square regression. The base model is introduced as following:

$$\ln W_i = \beta_o + \beta_1 lncol_i + \gamma' X_i + \varepsilon_i \quad (10)$$

The dependent variable,$\ln W_i$, represents the nominal earnings of the employed workers on a log scale. The main independent variable in this study is $\ln col_i$, which is the cost of living for each region. Also, other variables that might be determining the nominal wage are involved inX_i. The previous studies are usually analyzed by including the variables that are related to individual and job characteristics. The variables related to the individual characteristics are education, work duration, experience, gender, marriage, work status, industry, labor union and job type. The job-related variables are occupation and industry.

On the top of these variables, I include additional variables related to regional characteristics into this study. Roback (1982) and Roback (1988) suggest that regional differences in amenities can account for the wage differences. Each region has its own characteristics, and these could be the factors which determine the incomes of the workers of the specific region. Therefore, it is necessary to control regional characteristics as well. The variables I include here are the GRDP (Gross Regional Domestic Product), crime rate, occupational incident rate, unemployment rate, population density, and regional particulate level[10]. Some of the variables I include in this study are the variables suggested by Roback. Since these regional variables could be important factors in determining the income of the workers of the particular region,

[10]Roback (1982), Roback (1988)

measurements without these variables could be biased.

I verify the correlation between the cost of living and the nominal income by the following steps of regression. Model (11) includes no other variables other than just the regional cost of living variable. Model (12) includes the variables related to the individual's characteristics. Model (13) includes the variables related to the job characteristics. Finally, Model (14) also includes the variables related to the regional characteristics.

Here, variables related to the individual characteristics (X_i^{IC}) and the job characteristics (X_i^{JC}) can be classified as the variables that determine the permanent income. In contrast, the variables related to the regional characteristics (X_i^{RC}) are classified as the variables that determine the transitory income.

$$\ln W_i = B_o + B_1 lncol_i + e_i \tag{11}$$

$$\ln W_i = B_o + B_1 lncol_i + B' X_i^{IC} + e_i \tag{12}$$

$$\ln W_i = B_o + B_1 lncol_i + B' \left(X_i^{IC} + X_i^{JC}\right) + e_i \tag{13}$$

$$\ln W_i = B_o + B_1 lncol_i + B' \left(X_i^{IC} + X_i^{JC} + X_i^{RC}\right) + e_i \tag{14}$$

(X_i^{IC} = individual characteristics, X_i^{JC} = job characteristics, X_i^{RC} = regional characteristics)

3.5. Longitudinal Income Inequality (Long-Term)

In Section 3.4., I analyzed the income inequality in the short-term. In this section, I look at the long-term income inequality. This can be measured through intergenerational income elasticity. Having low intergenerational earnings mobility or high intergenerational earning elasticity means that the son's relatively low income is substantially affected by the father's relatively low income. In this case, it can be said that the income inequality is high in the long run, because once a person is born in a poor family, then it is hard for him to get out from that poverty.

Kim (2002) suggests that intergenerational elasticity in nominal earnings and intergenerational elasticity in real earnings would show different values if there were a positive correlation between the nominal income and the cost of living. The model of Kim (2002) is presented below.

$$y_{1i} = \rho_y y_{0i} + \varepsilon_{yi} \tag{15}$$

$$x_{1i} = \rho_x x_{0i} + \varepsilon_i \tag{16}$$

where y_{1i} and y_{0i} denote son's nominal earning and father's nominal earning, respectively. x_{1i} indicates son's real earnings and x_{0i} indicates father's real earnings.

By deflating the local living costs from nominal earnings, I can obtain the real earnings. This equation assumes a compensating differential (α_i) for the high-cost areas. Equation (18) indicates the intergenerational association in the local cost of living.

$$x_i = y_i - \alpha_i \tag{17}$$

$$\alpha_{1i} = \rho_x \alpha_{0i} + \varepsilon_{\alpha i} \tag{18}$$

$$y_{1i} = x_{1i} + \alpha_i = \rho_x y_{oi} + (\rho_\alpha - \rho_x)\alpha_{0i} + \varepsilon_{xi} + \varepsilon_{\alpha i}$$ [11] (19)

$$\therefore \rho_y = \rho_x + (\rho_\alpha - \rho_x)\frac{cov(y_{oi}, \alpha_{oi})}{var(y_{oi})} \quad (20)$$

Regression for the intergenerational income elasticity is as follows. By equation (21), I measure the intergenerational income mobility in nominal terms, and by function (22), I measure the intergenerational income mobility in real terms.

$$y_{1i} = \rho y_{0i} + z_1 sage + z_2 sage^2 + z_3 fage + z_4 fage^2 + \varepsilon_{yi} \quad (21)$$

$$\frac{y_{1i}}{p} = \rho \frac{y_{0i}}{p} + z_1 sage + z_2 sage^2 + z_3 fage + z_4 fage^2 + \varepsilon_{yi} \quad (22)$$

y_{1i} and y_{0i} denote son's earning and father's earning, respectively. $sage$ indicates son's age and $fage$ indicates father's age. ρ stands for intergenerational income elasticity, what this study is ultimately looking for.

[11] $Y_{1i} = x_{1i} + \alpha_i$

$= \rho_x x_{0i} + \varepsilon_{xi} + \rho_\alpha \alpha_{0i} + \varepsilon_{\alpha i}$

$= \rho_x (x_{0i} + \alpha_{0i}) + (\rho_\alpha - \rho_x)\alpha_{0i} + \varepsilon_{xi} + \varepsilon_{\alpha i}$

$= \rho_x y_{oi} + (\rho_\alpha - \rho_x)\alpha_{0i} + \varepsilon_{xi} + \varepsilon_{\alpha i}$

Ⅵ. Data Description

This study uses the Korean Labor and Income Panel Study (KLIPS) data surveyed by the Korea Labor Institute (KLI). KLIPS is an only panel survey in Korea, consisting of both cross-sectional and longitudinal data of individuals and households. The KLIPS data suits this study for two reasons: it consists of the information of the individuals and households from fundamental personal data to specific information about economic activities, such as types of industries in which the individuals work. Also, KLIPS data allows connecting fathers and sons. Since this study consists of an intergenerational analysis where I had to connect fathers and sons, the study is proper for this type of analysis. The KLIPS data is surveyed every year since 1998 and about 5000 households are included in the survey.

For the cost of living variables, I use the regional cost of living index calculated by the CPD (Country-Product-Dummy) method[12] suggested by Aten (2006)[13].I employed this cost of living data, since it is the only data that is available to compare the costs of living among the regions, and has rendered regional comparison available by designating one of them as a national standard. The Ministry of Employment and Labor compiles data on the occupational accident rate and the number of firms in each

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[12] CPI is not designed to compare the prices among the regions. The CPD method can produce a price index that is comparable among the areas.

1) $\ln P_{ij} = \sum_{i=1}^{M} \alpha_i A_i + \sum_{j=1}^{J} \beta_j Z_j + \varepsilon_{ij}$
   Where A_i, Z_i are region dummies and product classification dummies.
   $i = 1, \cdots, M$ (geographic areas) ; $j = 1, \cdots, J$ (classifications)
2) $\ln P_{ik} = \sum_{i=1}^{M} \lambda_i A_i + \sum_{k=1}^{K} \delta_k X_k + \varepsilon_{ik}$
   Where A_i, X_i are region dummies and product classification dummies.
   $i = 1, \cdots, M$ (geographic areas) ; $k = 1, \cdots, K$ (classifications)

[13] I used the regional cost of living index measured by Lee (2010). This regional cost of living index is limited only to year 2005. Lee (2010) constructed this index by using data from 'Monthly Report on the Consumer Price Survey', which is published by Korea National Statistical Office. However, since this 'Monthly Report on the Consumer Price Survey' does not include the information on the housing cost, Lee (2010) used the housing cost data from Korean Labor and Income Panel Study (KLIPS) for the imputation.

region, and Statistics Korea compiles GRDP (gross regional domestic product) data.

In analysis 3.3., 3.4., there are 3,743 observations included in this study. I excluded the data if the income value was outlying or missing[14]. Also, this study only includes workers aged from 15 to 65 years. The Table 1 below is a description of Variables.

In analysis, 3.5., I also excluded the data if the father or son's income value were outlying or missing. The sons in my father-and-son sample are 'son' of 'head' in 1998 who are found to be 'head' in 2012. For the father's income, I used the average of father's earnings in 1998-2000. The sample contains 207 pairs of fathers and sons. Unfortunately, since the cost of living data is only available for 2005, this 2005 living costs data is used for the calculation of the intergenerational income elasticity, under the assumption that the regional living costs is not changing much as the time pass. This study may improve if cost of living data for longer period becomes available.

[14] The estimations with missing values were also carried out, but no significant difference was found.

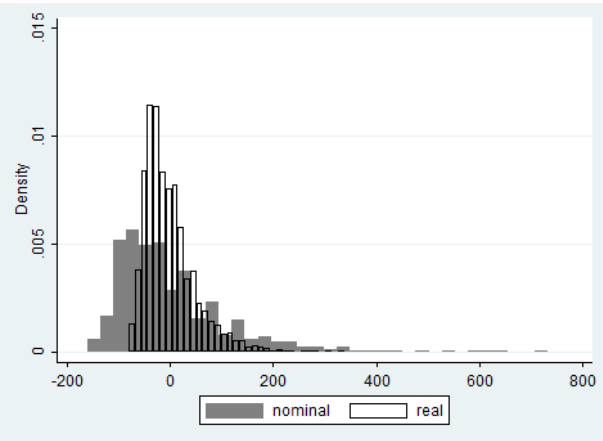
[Table 1]Description of Variables (Data: KLIPS, Ministry of Employment and Labor, Statistic Korea)

Variable	Definition
lnincome	Log Nominal Earnings
lncol	Log Cost of Living (Index measured by CPD Method)
workdur	Years of Working
edu	Years of Education
exp	Years of Experience(age-6-edu-workdur)
gender (dummy)	Gender (male=1, female=0)
marriage (dummy)	Marriage (married=1, not married=0)
jtype (dummy)	Type of Job (Permanent=1, temporary=0)
region (dummy)	16 Region Dummies
union (dummy)	Labor Union (joining=1, if not=0)
occ (dummy)	5 Occupation Dummies
industry (dummy)	8 Industry Dummies
lngrdp	Log GRDP/Number of the Employed
crimer	Crime rate
lnndeath	Log Number of People who faced the Occupational Accident
lnpart	Log Particulate Level
lnpopden	Log Population density
ur	Unemployment Rate

Ⅴ. Estimation Results

5.1. Cross-Sectional Income Inequality

The below graph shows the distribution of nominal income and real income measured by using the KLIPS data (8th wave). The grey-colored income distribution indicates the nominal income inequality, and white-lined income distribution indicates the real-income inequality (cost of living adjusted). The distribution of nominal income shows the larger variance than the distribution of real income. It indicates that in cross-sectional analysis, the income inequality in real terms is lower than the income inequality in nominal terms.



[Figure 3] Nominal Income Inequality vs. Real Income Inequality (Data: KLIPS 8th WAVE)

The variance of nominal income is 10527.4 and the variance of real income is 2578.7. Thus, I conclude that the real-income inequality is lower than the nominal-income inequality in the cross-sectional analysis.

Analyzing the income inequality by just relying on the cross-sectional data could be biased, since it does not consider the regional movements of the individuals. Therefore, in the upcoming section, I conduct a longitudinal analysis of income

inequality that takes into account an individual's movement among the regions. The results of the cross-sectional analysis may differ from those of the longitudinal analysis.

5.2. Longitudinal Income Inequality (Short-Term)

[Table 2] Income Inequality Decomposition (Data: KLIPS)

	Nominal Income	Real Income (cost of living adjusted)
Var (Transitory Income)	4556.489	1112.133
Var (Permanent Income)	5970.908	1466.522
Var (Income)	10527.400	2578.655
Income inequality	**0.567**	**0.569**

The above table shows the estimated income inequality in both nominal and real terms. The left column shows the nominal income inequality and the right column shows the real income inequality. Even though it is not a big difference, the income inequality measured in real terms is higher than the income inequality measured in nominal terms; the difference between the nominal terms and the real terms is 0.002. Other than this difference, we need to carefully look at the ratio of the permanent to the transitory income variance. The ratio of the nominal transitory to the nominal permanent income variance is 0.433:0.567. In contrast, the ratio of real transitory to the real permanent income variance is 0.431:0.569. In the process of converting the income inequality from nominal to real terms, the proportion of transitory income variance decreased. It seems that the cost of living has a correlation with permanent income and/or transitory income. The regression results in the following section show this correlation more clearly.

5.3. Regression Results

As mentioned in the previous section 3.4., I gradually add the variables into the regression. The regression results are shown in Table 3. Since the industry variables and occupational dummies are not the variables of interest, and also to save space, I excluded them from the table.

[Table 3] Regression Results(Data: KPLIS 8th Wave)

VARIABLES	(11) lnincome	(12) Lnincome	(13) Lnincome	(14) Lnincome
lncol	0.492***	0.518***	0.411***	-0.294
	(0.127)	(0.0861)	(0.0842)	(0.364)
edu		0.0467***	0.0308***	0.0316***
		(0.00295)	(0.00320)	(0.00323)
workdur		0.0421***	0.0409***	0.0398***
		(0.00290)	(0.00282)	(0.00285)
workdur2		-0.000770***	-0.000756***	-0.000717***
		(0.000106)	(0.000103)	(0.000104)
exp		-0.00183	0.00253	0.00295
		(0.00194)	(0.00193)	(0.00195)
exp2		-1.96e-05	-9.85e-05**	-0.000101**
		(4.21e-05)	(4.20e-05)	(4.26e-05)
marriage		0.142***	0.123***	0.121***
		(0.0162)	(0.0157)	(0.0159)
gender		0.362***	0.386***	0.384***
		(0.0141)	(0.0148)	(0.0150)
jtype		0.304***	0.302***	0.304***
		(0.0171)	(0.0177)	(0.0180)
union		0.192***	0.191***	0.185***
		(0.0170)	(0.0170)	(0.0173)
region				-0.000741
				(0.00798)
crimer				0.00157
				(0.00961)
lnndeath				0.0576**
				(0.0231)
lnpart				0.0441
				(0.0770)
lngrdp				0.190***
				(0.0462)
lnpopden				0.0131
				(0.0301)
ur				-0.0107
				(0.0341)
Industry dummies	X	X	O	O
Occ dummies	X	X	O	O
Constant	2.689***	1.239***	1.954***	2.431**
	(0.584)	(0.395)	(0.389)	(1.036)
Observations	3,797	3,796	3,796	3,680
R-squared	0.004	0.552	0.586	0.590

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

From the regression, the cost of living shows a positive correlation with the nominal wages from models (11), (12) and (13). However, in model (14), when controlling the regional characteristics, the correlation between the cost of living and the nominal wages seems disappeared. The coefficient shows the value of -0.294 with p-

value exceeding 0.7. It indicates that the coefficient can be statistically seen to be equivalent to zero.

Models (12) and (13) are controlled only by the variables that determine permanent income. However, model (14) also includes the variables that determine the transitory income. This indicates that, statistically, the cost of living seems to be correlated with the nominal earnings through having correlation with the transitory income.

Moreover, this regression suggests that the nominal income is also related to the other regional characteristics, such as occupational incident rate (lnndeath). Conventionally, the compensating wage was given to the risky work. The occupational incident rate indicates the degree of riskiness of the work. Since occupational incident rate is positively related to the nominal income, it suggests that there is some conventional compensating wage for workers with risky jobs in Korea. Also, the nominal income has significantly positive correlation with GRDP. Nominal income also has positive correlation with regional crime rate, particulate level, and population density, but it is not statistically significant.

5.4. Longitudinal Income Inequality (Long-Term)

The result shows the difference in the intergenerational income elasticity between the nominal and the real terms. The results of the intergenerational income elasticity (ρ) are shown below. The sample contains 207 pairs of fathers and sons.

[Table 4]Intergenerational Income Elasticity(nominal & real) (Data: KLIPS, N=207)

VARIABLES	Nominal earnings	Real earnings	Cost of living
Average of father's nominal earnings in 1998-2000	$\hat{\rho}_y$**=0.312*** **	$\hat{\rho}_x$ **=0.294*** **	$\hat{\rho}_\alpha$ **=0.684*** **
	(0.0568)	(0.0507)	(0.0597)
Son's age	0.191**	0.194**	-0.000127
	(0.0836)	(0.0850)	(0.0134)
Son's age^2	-0.00251**	-0.00260**	-1.65e-05
	(0.00111)	(0.00113)	(0.000178)
Father's age	0.00443	0.0154	0.00894
	(0.0527)	(0.0535)	(0.00831)
Father's age^2	5.81e-05	-2.67e-05	-8.36e-05
	(0.000490)	(0.000497)	(7.70e-05)
Constant	0.149	-0.0909	0.123
	(1.613)	(1.637)	(0.266)
Observations	207	207	207
R-squared	0.167	0.167	0.404

The estimation shows that the intergenerational real income elasticity is smaller than the intergenerational nominal income elasticity. The first column of the table indicates that the intergenerational income elasticity in nominal terms is 0.312. However, the second column of the table shows that the intergenerational income elasticity in real terms becomes 0.294 from 0.312 after adjusting cost of living. At this point, our results also provide evidence for the existence of correlation between the cost of living and nominal wages in Korea. The third column of the table shows that the estimated

intergenerational income elasticity for cost of living is 0.684. This indicates that a high intergenerational persistence in urbanity is observed which leads to a lower intergenerational elasticity for real earnings than for nominal earnings.

This result is coincide with the results of Kim (2002), which is a study of intergenerational income elasticity analyzed by using PSID data[15] and is also consistent with the conjecture as mentioned above.

[15] Kim (2002) shows 0.3930 as a value of intergenerational real income elasticity and 034459 as a value of intergenerational nominal income elasticity.

VI. Conclusion

In this study, we analyzed the relationship between the cost of living and nominal wages and investigated whether there is a compensating wage of living costs in Korea. Our specific focus was the income inequality analysis at three different stages, namely, cross-sectional, short-term, and long-term. The cross-sectional analysis is limited to a specific period of time; in this study, the data from 2005 were used for the analysis. Both short-term and long-term analyses are dynamic, since both focus on a certain period of time. The difference between the short-term and long-term analysis is that, while the former is limited to the time period within one generation (intra-generation), the latter is inter-generational and spans the time across two generations. Unlike the cross-sectional analysis, short-term and long-term analyses assume that regional movement is available.

The results of the present study suggest that there is a correlation between the cost of living and nominal wages in Korea. Specifically, we found that this correlation comes through the cost of living having a relationship with transitory income. A closer look at the results shows that, in the cross-sectional analysis, the real income inequality is lower than the nominal income inequality, suggesting the existence of a compensating wage. However, the results of the short-term analysis, with the underlying assumption of free inter-regional movement of people, shows that the income inequality in real terms is higher than the income inequality in nominal terms. In the short-term analysis, the income was decomposed into permanent income and transitory income and the results demonstrate that the cost of living affects permanent and/or transitory income. The results of a further linear regression support the correlation between the cost of living and transitory income. Furthermore, from the

regression, one can predict the existence of conventional compensating wage on the riskiness of job. Finally, we also analyzed the long-term income inequality measured through the inter-generational income elasticity. Income inequality in real terms appears to be lower than the income inequality in nominal terms. At this point, our results also provide evidence for the existence of correlation between the cost of living and nominal wages in Korea. Moreover, a high intergenerational persistence in urbanity can be observed which leads to a lower intergenerational elasticity for real earnings than for nominal earnings.

Further research can be conducted for a more accurate measurement of the studied phenomena. In the present study, a tacit assumption was that workers live in the same place where they work. However, the place of living and work can be different. Provided additional information is available, further analysis can be performed to produce more accurate results that would take into account this potential difference by considering this fact. Furthermore, this study can be improved by using better data of the costs of living. Since the cost of living data in the present study were limited to the year 2005, our results cannot show the full dynamics of price variations. If the time series data of the cost of living could be constructed, the panel data analysis would become possible and would provide more implications than does this study.

In terms of the minimum wage policy, the cost of living is an important factor. The purpose of the minimum wage is to guarantee an hourly wage to people with the lowest standard of living. As mentioned above, the utility of different living standards is affected by real wages. However, the minimum wage in Korea is determined by the nominal concept and the same minimum wage is applied across the entire nation. Unlike in Korea, some governments in other countries have introduced different minimum wages across the different regions of their respective countries. In these countries, the

minimum wage is determined taking into account the corresponding regional living costs. Thus, workers from the regions with a high living cost receive higher minimum wages, being compensated by receiving wage premiums. For example, in the United States, the government of each state autonomously decides upon and sets the minimum wage. Likewise, Japan has 47 different regional minimum wages. In Germany, Australia, and Canada, minimum wages vary among regions as well. This minimum wages adjusted to the cost of living could be also necessary in Korea as well. Therefore, this study provides important policy implications for the Korean government.

Appendix

Descriptive Statistics Ⅰ

Table A1 provides the summary statistics of the variables used in the regression from section 3.3., 3.4.

[Table A1] Summary Statistics (for section 3.3., 3.4.)

(Data: KLIPS, Ministry of Employment and Labor, Statistic Korea, N=3743)

Variable	Mean	Standard Deviation	Min	Max
lnincome	4.97	0.57	2.08	6.20
workdur	5.23	6.44	0.00	47.00
edu	12.65	3.26	6.00	23.00
exp	14.80	12.19	0.00	58.00
gender	0.61	0.49	0.00	1.00
marriage	0.67	0.47	0.00	1.00
jtype	0.79	0.41	0.00	1.00
union	0.22	0.41	0.00	1.00
region	6.14	4.55	1.00	15.00
lngrdp	10.58	0.23	10.17	11.39
lnnfirm	12.14	0.88	10.09	13.07
lnndeath	9.03	0.72	6.99	10.06

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Descriptive Statistics Ⅱ

Table A2 shows the summary statistics of these variables used in the regression from section 3.5.. The sample contains 207 pairs of fathers and sons.

[Table A2] Summary Statistics (for section 3.5.)

(Data: KLIPS, N=207)

Variable	Mean	Standard Deviation	Min	Max
Son's age in 2012	35.89	4.78	29	51
Son's log monthly earnings in 2012	5.54	0.41	4.50	6.62
Father's age in 1998	51.27	6.48	41	75
Father's average log monthly earnings in 1998-2000	4.65	0.51	3.34	5.61

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국문초록

한국의 지역별 물가와 명목임금의 관련성과 실질소득 불평등도 분석

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본 연구에서는 한국의 지역별 물가와 명목임금의 상관성을 분석한다. 또한, 이 연구는 지역별 물가와 명목임금의 상관성을 분석하면서 명목소득 불평등도를 실질소득 불평등도와 횡단면 분석과 종단면 분석을 통해 비교한다. 종단면 분석은 다시 단기간 분석과 장기간 분석으로 나뉘는데, 단기간 분석은 기간을 한 세대 내로 제한하고, 장기간 분석은 기간을 세대 간으로까지 확대시켜 분석한다.

주요어: 명목임금, 지역별 물가, 실질소득 불평등도, 보상임금격차, 임시소득
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