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Byung-Goo Kang
Myeong-Su Yun

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Byung-Goo Kang
Inha University

Myeong-Su Yun
Tulane University
and IZA

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

Changes in Korean Wage Inequality, 1980−2005*

Korea is known not only for rapid economic growth but also relatively low wage inequality. It is one of the few countries in which wage inequality decreased during the 1980s, though in recent years wage inequality has increased. This paper studies what factors contributed to the changes in wage inequality during the last two decades. This paper implements a recently developed Oaxaca-type inequality decomposition method to decompose "U" shaped changes in inequality into characteristics (quantity), coefficients (price) and residuals effects at both overall and detailed levels. The results of decomposition analysis show that changes in the wage structure significantly contribute to the changes in wage inequality in Korea. The coefficients effect of human capital factors has played a major role not only in increasing wage inequality from mid-1990s, but also decreasing wage inequality in 1980s and early 1990s.

JEL Classification: D30, J30

Keywords: decomposition analysis of inequality, earnings equation, coefficients (price) effect, characteristics (quantity) effect, residuals effect

Corresponding author:

Myeong-Su Yun
Department of Economics
Tulane University
206 Tilton Hall
New Orleans, LA 70118
USA
E-mail: msyun@tualne.edu

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I. Introduction

South Korea (Republic of Korea, below denoted simply as Korea) has shown a rare combination of high growth and low inequality. Especially during the 1980s and the first half of 1990s wage inequality persistently decreased in Korea. The decrease in wage inequality until mid-1990s caught the interest of researchers (e.g., Fields and Yoo, 2000, Kim and Topel, 1995, Yoo, 1998). It is not surprising that the decreasing wage inequality was a topic of intense interest because quite a few countries experienced a surge in wage and income inequality in the 1980s. However, the trend reversed in the mid-1990s and wage inequality has since increased. This reversal has alarmed most Koreans and raised questions about what caused this change in the trend of wage inequality in Korea (e.g., Chung and Choi, 2001, Nam, 2005, and Park, 2000).

This paper examines wage inequality in Korea from 1980 to 2005 using a sample from the "Occupational Wage Survey". We study the factors that have contributed to the "U" shaped changes in wage inequality, decreasing during the 1980s and first half of the 1990s, and increasing the rest of the 1990s and a few years in the 21st century. To be specific, we investigate how much of the changes in the dispersion of wages can be explained by the changes in the distribution of worker's characteristics (characteristics effect), by the changes in returns to worker's characteristics (coefficients effect), and by changes in the distribution of unobserved factors (residuals effect).

Decomposing changes in wage inequality into overall characteristics, coefficients, and residuals effects using earnings equations has been widely applied since the publication of the very influential paper by Juhn, Murphy and Pierce (1993, denoted below as JMP). However, their decomposition method does not allow us to study the factors responsible for the changes at the individual variable level. On the other hand, Fields (2003) also uses earnings equations in his

decomposition method, but computes the contribution of each factor to the changes in wage inequality without further decomposing the contribution to characteristics and coefficients effects. These two methods have been already applied in studying Korean inequality. Park (2000) applies JMP method and finds that the surge of wage inequality in late 1990s was due to rapid increases in returns to observed skills. Fields and Yoo (2000), and Yoo (1998) employing Fields' method find the decrease in wage inequality until the mid-1990s was caused by the decrease in the return to education, rather than by institutional reasons, e.g., spread of unionization.

This paper employs an inequality decomposition method by Yun (2006) which overcomes the shortcomings of both JMP and Fields methods. His method unifies the two methods in order to explain the changes in wage inequality in terms of characteristics and coefficients effects for both overall and detailed decompositions. In addition, we develop another decomposition method similar to the unified method of Yun (2006) in order to check robustness of our results. From our decomposition analyses, we find that changes in wage structure substantially explain both the decreasing and increasing of wage inequality even without including the residuals effect. If we follow interpretations of Blau and Kahn (1996) and consider not only the coefficients effect but also the residuals effect as an outcome of changes in wage structure, then almost all of the changes in wage inequality can be explained by the changes in wage structure. Detailed decomposition shows that factors related to human capital play an important role in molding the U shaped changes in wage inequality in Korea.

2. Data and Trends in Wage Inequality

We employ the 26 waves of the Korean Occupational Wage Survey, 1980–2005.[1] This survey is excellent for studying changes in wage inequality in Korea.[2] This survey selects companies from a list of companies with 10 or more employees from all industries and regions except for government offices, army and police, and educational institutions. The sampling scheme depends on the size of company, and it has changed over time.[3] Due to the sampling design based on establishment, the survey excludes not only workers in small companies, but also temporary workers, the self-employed and unemployed. This drawback of survey will lead to underestimation of wage inequality.

Though the survey covers companies with 5 or more employees since 1999, we restrict our samples to workers in companies with 10 or more employees from samples since 1999 to be consistent with previous years. We further restrict our sample to individuals between 20 and 60 years old and exclude workers in the agricultural sector. We also exclude those who do not report

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[1] The Occupational Wage Survey has been collected from 1968 by the Department of Labor, and has been widely used in studying wage inequality in Korea, e.g., Fields and Yoo (2000) and Kim and Topel (1995). Further information on the Occupational Wage Survey, currently called the Basic Statistical Study on Wage Structure, can be found at http://laborstat.molab.go.kr.

[2] The Urban Household Income and Expenditure Survey has been also used frequently for studying trends in inequality in Korea. This household survey enables researchers to study all sources of income, labor and non-labor income, of all households, e.g., Park (2000), and Chung and Choi (2001). These papers using this survey also find a similar trend in inequality, whether inequality in wages or income, that is, decreasing until 1993 or 1994 and increasing afterward.

[3] For example, in year 2005, the survey covers all workers in the selected companies with less than 100 workers, 80% of those in companies with 100-299 employees, 67% of those in companies with 300-499 employees, 50% of those in companies with 500-999 employees, 33% of those in companies with 1000-4999 employees, and 10% of those in companies with 5000 employees or more. This survey covers 6495 establishments and all information in the survey is related to activities in June, 2005.

wages and whose potential experience (age - years of education - 6) is negative.

Table 1 reports the mean hourly wage rates, and various standard measures of inequality (the variance of log-wage, a version of the Theil index, the Gini coefficient, the coefficient of variation and log-wage differentials between the top tenth and bottom tenth percentiles) for 26 years.[4] Figure 1 shows changes in wage inequality using standardized measures (1980 = 1 for comparison purposes, see Karoly, 1992). The wage inequality persistently decreased until 1994 - except for an aberration in 1989 - and then started to increase. The timing of the turning point in 1994 indicates that it is not the economic crisis in 1997-8 in Korea, as popularly believed which triggered the reversal of the decreasing trend in wage inequality.[5] Wage inequality decreased to approximately 20-47% of the level in 1980 until 1994, then it increased, and the wage inequality in 2005 is about 79-92% of the level in 1980.

The trend in income inequality studied using Urban Household Income and Expenditure Survey confirms what we find using Korean Occupational Wage Survey. Chung and Choi (2001) study trends in household income inequality in 1990s and find that household income inequality decreased until 1993, increased from 1994, and accelerated its increase after economic crisis in 1997. They also study wage inequality of head of household and find a similar trend.

For the rest of the paper we restrict our attention to the variance of log-wages as our measure of inequality in order to utilize the decomposition method proposed by Yun (2006). The variance of log-wages has been widely used in studying wage inequality and serves quite well for our

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[4] Population weights provided in the survey are applied to calculations of measures and estimation of earnings equations.

[5] Though economic crisis in 1997-98 was not the turning point, it made us acutely aware of increasing inequality not only in wages but also household income and wealth.

decomposition analysis. The variance of log-wages also shows similar pattern to other measures from 1980 to 2005. The variance of log-wages decreased until 1994 at 59.32% of the level it was in 1980 then increased until 2005 at 84.57% of the level it was in 1980. Of course, as the Table 1 shows, the wage level itself does not follow the wage inequality pattern: the wage level has increased continuously except for the economic crisis in 1997-1998.

Our main interest is what happened between 1980 and 1994 and between 1994 and 2005 which correspond to the two periods where decreasing and increasing of wage inequality occurred. Table 3 presents the sample means for the variables we use in our analysis for samples in 1980, 1994 and 2005. Variable definitions are summarized at Table 2. We restrict ourselves to basic variables for our wage analysis: experience, education, occupation, establishment size, industry, tenure, and region. When we compare the mean characteristics between 1980 and 2005, we see that potential experience, tenure, and education increased. The marriage rate also increased. There are a few compositional changes; the share of the first occupational category substantially increased while the share of the fourth occupational category significantly decreased; very large size firms (500 plus workers) lost their share, while firms with workers of 300-499, and small firms with less than 30 workers gained their share; manufacturing (industry 2) and mining (industry 1) shrank while sales (industry 5) and service industries (industry 7, 8) grew substantially; regional concentration in Seoul (region 1) has weakened.

Table 1 and Table 3 show dramatic movements of wage inequality in Korea between 1980 and 2005. What stands out is the substantial decrease in wage inequality at first, then persistent increase since 1994. The remainder of this paper studies the sources of the changes in wage inequality: Have the changes in the distribution of workers' characteristics caused the changes?;

Have the changes in returns to workers' characteristics caused the decreasing and increasing of wage inequality?.

3. Explaining Changes in Inequality using the Earnings Equation

Yun (2006) develops a new decomposition method for the changes in wage inequality measured in terms of the variance of log-wages utilizing the information contained in the earnings equation suitable for examining the changes in wage inequality in Korea since 1980. This decomposition method explains changes in the wage inequality in terms of differences in the distribution of characteristics (characteristics effect), differences in coefficients (coefficients effect) and differences in the distribution of the residuals (residuals effect) at aggregate and detailed levels by combining two decomposition methods of JMP (1993) and Fields (2003).[6]

Let wages (Y_t) be generated from the following regression equations (earnings equations)

$$y_A = \beta_{0A} + \sum_{k=1}^{k=K-1} \beta_{kA} x_{kA} + e_A \text{ and}$$

$$y_B = \beta_{0B} + \sum_{k=1}^{k=K-1} \beta_{kB} x_{kB} + e_B, \quad (1)$$

where $y_t = \log(Y_t)$, and x_{kt} and e_t are the kth exogenous variable and residuals, respectively, and $t = A, B$. In order to decompose the changes in the variance of log-wages, we construct two auxiliary equations, by switching coefficients, and observed characteristics;

$$y^* = \beta_{0B} + \sum_{k=1}^{k=K-1} \beta_{kB} x_{kA} + e_A, \text{ and}$$

[6] Decomposing the changes in variance of log-wages into the three effects is similar to decomposing changes or differentials in mean wage level into the three effects which is well-established since the publication by Oaxaca (1973).

$$y^{**} = \beta_{0B} + \sum_{k=1}^{k=K-1} \beta_{kB} x_{kB} + e_A.$$

By using earnings generated from the four earnings equations, y_A, y^*, y^{**} and y_B, we may measure earnings inequality corresponding to each earnings equation, denoted as $I_{y_A}, I_{y^*}, I_{y^{**}}$ and I_{y_B}, respectively.[7]

Following the usual strategy of decomposition methodology, JMP (1993) decompose the differences in earnings inequality between time periods *A* and *B* as follows;

$$I_{y_A} - I_{y_B} = (I_{y_A} - I_{y^*}) + (I_{y^*} - I_{y^{**}}) + (I_{y^{**}} - I_{y_B}),$$

where the first, second and last components of right hand side represent, respectively, the effects of differences in coefficients (coefficients or price effect), the effects of differences in the distribution of individual characteristics (characteristics or quantity effect), and the effects of differences in the distribution of unobservables (residuals effect).[8]

Once we restrict our measure of inequality to the variance of log-wages, we can derive JMP decomposition equation as below. From the equation (1), we can find following identity (Fields, 2003);

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[7] Of course, we can construct another decomposition equation. Starting from group *B*'s earnings equation, we can construct a counter-factual distribution when returns to group *B*'s characteristics are same as group *A*'s, and later changing stochastic terms. Some may also consider using average of the results from the two decomposition equations. This is well-known index problem in Oaxaca decomposition equation (Neumark 1988, and Oaxaca and Ransom, 1994).

[8] The residuals effect is usually interpreted as the effect of differences in unmeasured characteristics and returns. However, it should be borne in mind that, as in all regression-based models, the residuals pick up all of the omitted variables, mismeasured ones, and the like. It is not surprising that one of the main issues in the debate on causes of increases in wage inequality in America since 1980s is how to interpret the residuals effect, e.g., Lemieux (2006).

$$\sigma_y^2 = \sum_{k=1}^{K-1} \sigma_{\beta_k x_k, y} + \sigma_{e,y} = \tilde{\sigma}_y^2 + \sigma_e^2, \quad (2)$$

where σ_y^2, $\sigma_{\beta_k x_k, y}$, and $\sigma_{e,y}$ are, respectively, the variance of log-earnings, the covariance of $\beta_k x_k$ and *y*, and the covariance of the residuals (e) and *y*. Note that $\sigma_{e,y} = \sigma_e^2$ since $\sigma_{e,x_k} = 0$ by the construction of OLS, where $k = 1, \cdots, K-1$. Obviously, constructing y^{**} is not necessary to isolate the residuals effect. Therefore, the JMP decomposition can be shown as

$$\sigma_{y_A}^2 - \sigma_{y_B}^2 = (\tilde{\sigma}_{y^*}^2 - \tilde{\sigma}_{y_B}^2) + (\tilde{\sigma}_{y_A}^2 - \tilde{\sigma}_{y^*}^2) + (\sigma_{e_A}^2 - \sigma_{e_B}^2), \quad (3)$$

where $\tilde{\sigma}_{y^*}^2 = \sigma_{y^*}^2 - \sigma_{e_A}^2$ since $\sigma_{e_A, y^*} = \sigma_{e_A}^2$. The first, second and last components of the right hand side of the decomposition equation are, respectively, characteristics, coefficients and residuals effects. However, the decomposition method by JMP studies only at overall effect, hence it cannot directly answer a few interesting questions related to detailed decomposition, e.g., do the returns to education contribute to the changes in wage inequality?

Another decomposition method developed by Fields (2003) is handy in answering questions related to detailed decomposition. The identity in (2) is a foundation for decomposition analysis by Fields (2003). Fields (2003) defines a relative factor inequality weight for a factor *k* (s_k) using the OLS estimate of the coefficient of the earnings equation. The relative factor inequality weight for a factor *k* is

$$s_k = \sigma_{\beta_k x_k, y} / \sigma_y^2 = \beta_k \sigma_{x_k} \rho_{x_k, y} / \sigma_y,$$

where σ_{x_k} is the standard deviation of x_k and $\rho_{x_k,y} = \sigma_{x_k,y} / (\sigma_{x_k} \sigma_y)$, therefore,

$\sigma_y^2 = \sum_{k=1}^{K-1} s_k \sigma_y^2 + \sigma_e^2$.[9]

Fields (2003) argues that the relative contribution of a factor to overall inequality is invariant to the choice of inequality measure under six axioms proposed by Shorrocks (1982). Hence, the contribution of an individual factor to earnings inequality is simply $s_k \cdot I$. After computing the share of contribution of each factor to the overall inequality, Fields (2003) computes the share of the contribution of a factor *k* to the difference in inequality between time periods *A* and *B*. This is defined as:

$$\Pi_k = (s_{kA} \cdot I_A - s_{kB} \cdot I_B) / (I_A - I_B),$$

where s_{kt} is, for $t = A$ and B, the relative factor inequality weight of factor *k*.

In short, JMP (1993) explain the changes in wage inequality in terms of characteristics, coefficients and residuals effects and study the changes only at aggregate level without identifying the role of each variable. On the other hand, Fields (2003) does not decompose the changes in wage inequality in terms of characteristics, coefficients and residuals effects. It is obvious that the two methods by JMP (1993) and Fields (2003) can complement each other as Yun (2006) points out.

Yun (2006) synthesizes the two decomposition methods to decompose the changes in the variance of log-wages as follows;[10]

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[9] Fields' decomposition can be succinctly written as $\sigma_y^2 = \sum_{k=1}^{K} s_k \sigma_y^2$, where e is considered as the *K* th variable, and $\beta_K = 1$.

[10] As noted in footnote 7, we can construct another decomposition equation using a different parameterization. Though not reported in this paper, those results with different parameterization and average of the two decomposition results are available from authors. Though numerical values change under different parameterization, the empirical findings in the next section do not change substantially. We feel the current parameterization is appropriate for our purposes since periods *A* and *B* are ending and starting periods, that is, *A*=2005 and *B*=1994 when we study changes in wage inequality between 1994 and 2005. We are asking what would be the counter-factual inequality when the previous wage structure has not changed.

$$\sigma^2_{y_A} - \sigma^2_{y_B} = \sum_{k=1}^{K-1} (s_{ky^*}\sigma^2_{y^*} - s_{ky_B}\sigma^2_{y_B}) + \sum_{k=1}^{K-1} (s_{ky_A}\sigma^2_{y_A} - s_{ky^*}\sigma^2_{y^*}) + (\sigma^2_{e_A} - \sigma^2_{e_B}), \quad (4)$$

where, the first, second and last terms of the equation (4), respectively, represent the characteristics effect, coefficients effect and residuals effect.[11] This unified decomposition method will be applied for studying changes in wage inequality in Korea.[12]

4. Empirical Results from Decomposition Analysis

In this section we present our decomposition results. We apply the unified inequality decomposition equation (3) to analyze the characteristics and coefficients effects that lie behind the overall changes in wage inequality using the variance of log-wage as our inequality measure. Our primary emphasis is on what happened before and after 1994. In order to perform wage inequality decompositions, we estimate earnings equations for 1980, 1994 and 2005 using OLS.

Table 4 reports the estimates of earnings equations for 1980, 1994 and 2005. We find that education raises wages, but the returns to education in 1994 and 2005 are smaller than in 1980;[13] potential experience and tenure follow an inverted U shaped pattern; being a female decreases wages, but the magnitude has decreased; being married increases wages; professionals, technicians

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[11] See Gang and Yun (2003) and Gindling and Trejos (2005) for applying the unified method, equation (4).

[12] An alternative detailed decomposition which synthesizes the JMP method with another formulation of decomposition equation by Fields (2003) is discussed in the appendix as a robustness check. As shown in the appendix, the decomposition results are not substantially different whether we use the decomposition of Yun (2006) or the one in the appendix.

[13] The decrease in the wage premium of education between 1980 and 1994 may be explained by the increased supply of more educated workers. However, the supply factor, increases in highly educated workers, cannot explain the increase in the wage premium of education between 1994 and 2005.

and managers receive highest among occupations; manufacturing (construction) is the lowest paying industry in 1980 (2005); Seoul is the highest paying region.

Based on these estimates, decomposition analysis is performed. Table 5 shows our inequality decomposition results from 1980 to 1994 (equalizing period) and 1994 to 2005 (disequalizing period). The first part of Table 5 shows us how much each factor contributes to inequality in that year ("levels question" in Fields' terminology), while the second part decomposes the changes in inequality ("differences question" in Fields' terminology).

From 1980 to 1994 wage inequality measured by the variance of log-wages has decreased roughly 40% (from 0.446 to 0.265). In total, the characteristics, coefficients and residuals effects are, respectively, 7.5%, 71.5% and 21.0%. This means that wage inequality in 1994 was lower than in 1980 due to changes in the coefficients of the earnings equation by 71.5% and due to changes in the distribution of residuals by 21.0%. However, the effect of changes in the distribution of characteristics of wage/salary earners on decreasing wage inequality was very small (7.5%). In other words, the changes in individual characteristics, such as education, age, and industrial and occupational composition, contributed to decreasing wage inequality by 7.5%; the changes in wage structure (changes in coefficients) between 1980 and 1994 contributed to decreasing wage inequality by 71.5%; the remaining 21.0% of the inequality change between the two time periods is the residuals effect.

On the other hand, during the disequalizing period between 1994 and 2005, wage inequality measured by the variance of log-wages in 2005 is roughly 42% higher relative to that in 1994 (from 0.265 to 0.377). What is outstanding compared to the equalizing period is that changes in the distribution of residuals account for the increasing about 54%. Changes in returns to characteristics

explain 50% of increase in wage inequality in this period. On the other hand, changes in the distribution of characteristics of wage/salary earners contribute to lowering inequality, though the effect is small (-3.9%). Blau and Kahn (1996) argue that changes in the wage structure may be reflected in both the coefficients and residuals effects. Virtually all of both the decreasing and increasing of wage inequality are, then, explained by the changes in wage structure.

From Table 5, it is also easy to see the sources of the changes in wage inequality at the detailed level. The factors (variables) used in the decomposition may be grouped as human capital (potential labor market experience, tenure, and education), occupation, establishment size, industry and region in addition to two demographic variables, female and married.[14] We have already seen that the residuals played a major role during both in equalizing (1980-1994) and disequalizing (1994-2005) periods. Judging from the gross effects of factors (that is, the sum of the coefficients and characteristics effects), factors related to human capital, occupation, establishment size (during the disequalizing period) and the gender wage gap have played major roles in both decreasing and increasing wage inequality. Particularly, the shrinkage of gender wage gap contributed persistently to decreasing wage inequality even during the disequalizing period. On the other hand, tenure played the reverse role; it contributed to increasing wage inequality even during the equalizing period. However, education may be a trend setter since its share is large and its direction of impact on wage inequality is the same as the overall changes in wage inequality. To a smaller degree, potential labor market experience plays a similar role to education.

When the gross effects are further decomposed into characteristics and coefficients effects,

[14] The effects of categorical variables (e.g., industry) or very closely related variables (e.g., experience and experience squared in hundreds) are computed by aggregating the effects of each variable.

overall, the magnitude of coefficients effect is larger than that of characteristics effect. However, during the equalizing period, some variables related to human capital have larger characteristics effect. Education is interesting in this decomposition too. During the equalizing period both characteristics and coefficients effects contributed substantially to lowering wage inequality; however, during the disequalizing period, the characteristics effect of education, though quite small, still contributed to decreasing wage inequality while the coefficients effect more strongly contributed to increasing wage inequality.[15]

Occupational wage differentials are another important factor, which also moved along with the overall trend of wage inequality in similar fashion to the education variable. Occupational composition does not play much of a role in changing inequality. The wage premium of large establishments contributed to increasing wage inequality, especially during the disequalizing period between 1994 and 2005.

One interesting omission in the analysis above is the effect of surge of unionization since 1987. Though not reported here, we study the role of unions from 1987, the year when information on union status is available. As Fields and Yoo (2000, p. 152) put it, strong labor unions emerged after major democratization in Korea around 1987. However, as Fields and Yoo (2000) also find, unions did not contribute to lowering wage inequality even during the equalizing period from1987 to 1994. If we simply add the additional variable 'union' to our regression specification and do the

[15] The coefficients effects of education, experience and tenure during the disequalizing period may be interpreted from the viewpoints of skill-biased technical change theory of increasing wage inequality. In addition, as noted in footnote 8, some view increasing residual inequality as another evidence of skill-biased technical change theory. See JMP (1993), Card and DiNardo (2002), Lemieux (2006), and Autor, Katz and Kearney (2008) for discussion on skill-biased technical change theory.

decomposition again, then unions in fact contributed to increasing wage inequality, that is, 0.001 (-1.0%) and 0.001 (-0.9%) for characteristics and coefficients effects, respectively. During the disequalizing period between 1994 and 2005, unions contributed again to increasing wage inequality, that is, 0.0002 (0.2%) and 0.004 (3.7%) for characteristics and coefficients effects, respectively.[16]

Of course, this paper has the limitation that it is not able to explain why the wage structure changed from reducing wage inequality to increasing wage inequality around the mid-1990s, when most other countries showed surge in wage inequality from 1980s. There is no satisfactory explanation for this anomaly. It seems that there is a consensus that the increase in inequality from the mid-1990s is not an temporary phenomenon considering the persistent increase in inequality even after the worst of economic crisis was over.

One hypothesis based on skill-biased technical change theory is that Korean economy was transformed into more knowledge intensive, high tech industry centered economy around mid-1990s from more traditional manufacturing industry based economy. Indeed, information and telecommunication industry became major industry during 1990s. This transformation might have increased relative demand for highly educated workers. It might be also related to de-industrialization by relocating manufacturing plants to China or other countries where labor costs are low, and increasing import of consumer goods substantially from China and other countries. This de-industrialization reduces demand for less educated workers.

Some may seek explanation of changing inequality from socio-political reasons beyond

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[16] The contributions of other factors slightly change when the union variable is added into the decomposition analysis.

narrowly defined economic reasons. It is possible that the globalization movement has influenced Korea to accept fully a market-oriented economic system and price fundamentalism, particularly after economic crisis in late 1997 under the guidance of IMF. Though the globalization was talked since early 1990s, it is the economic crisis in late 1997 that finally made government policy makers and more or less general population accept the theme of globalization, particularly allowing greater flexibility in hiring, firing and wage setting practices.[17] Quite a few researchers have criticized the government policies creating flexible labor market in 1990s as one of major reasons of increases in wage inequality in Korea.

It is likely that the "true" cause of the surge in wage inequality lies between the two explorations. Understanding the relative role of changes in technology and socio-economic institutions will be the next task.

5. Concluding Discussion

In this paper we examine the quite interesting U shaped pattern of changes in wage inequality in Korea between 1980 and 2005. Korea has achieved a remarkably high output growth and

[17] It is well-known that Korean firms have increased so-called numerical flexibility by hiring non-standard workers such as part-time workers, fixed term contract workers, and temporary workers hired through employment agency. It is desirable to examine the role of increased numerical flexibility on increasing wage inequality, but unfortunately, the OWS is not well equipped for this task since OWS does not explicitly record the employee's contractual status. Only information on status of full- or part-time workers is available since 1984. Since the information on part-time status is not available from 1980, we generate two dummy variables for part-time workers using working hours (whether total or usual working less than 36 hours per week). The share of part-time workers increases from 1.4% (3.6%) to 3.1% (4.7%) if total (usual) working hours are used from 1980 to 2005. Though not reported, when either dummy variable of part-time worker status is included for decomposition analysis, the contribution of part-time status is negligible. The results are available from the authors upon request.

reducing of wage inequality during the 1980s and early 1990s. However, since 1994 the trend has reversed and wage inequality is rising. We have examined the factors that can explain the changes in the wage inequality trend using a decomposition method proposed by Yun (2006) in the fashion of the Oaxaca decomposition for wage differentials. Using the decomposition, we are able to break down the changes in wage inequality into characteristics, coefficients and residuals effects.

We found that changes in wage structure substantially explain both the decreasing and increasing of wage inequality even without including the residuals effect. If the residuals effect can be also interpreted as the results of changes in wage structure, then virtually all of the changes in wage inequality can be explained by the changes in wage structure. This may not be earth-shattering since many studies have made similar conclusions on various countries and over various periods. However, it is still amazing that the substantial changes in the distribution of worker's characteristics and changes in occupational or industrial composition explain almost nothing.

The majority of public opinion in Korea is very critical of the recent increases in wage inequality. This may be because the surge in wage inequality in Korea has been accompanied by economic hardship and lost job security, particularly after 1997 economic crisis. The current trend of increasing wage inequality has strained Korean society, long known for its homogeneity and unity. Though seldom or never voiced in current debate on inequality in Korea, it is interesting that there is an argument that some degree of inequality may be productive for the economy (e.g., Rosen, 1997).

Though it is highly unlikely that Koreans will embrace rising inequality with open arms, it is quite likely that wage inequality will continue to increase. It is necessary to study causes of the surge in wage inequality, e.g., the role of rapidly changing technology and institutions, and devise

policies to provide better social safety net for those who might get hurt in the disequalizing economy.

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Appendix: An Alternative Decomposition

One may expand the equation (4) using the definition of the relative factor inequality weight (s_k) as follows;

$$\begin{aligned}\sigma^2_{y_A} - \sigma^2_{y_B} &= \sum_{k=1}^{K-1} (s_{ky^*}\sigma^2_{y^*} - s_{ky_B}\sigma^2_{y_B}) + \sum_{k=1}^{K-1} (s_{ky_A}\sigma^2_{y_A} - s_{ky^*}\sigma^2_{y^*}) + (\sigma^2_{e_A} - \sigma^2_{e_B}) \\ &= \sum_{k=1}^{K-1} (\beta_{kB}\sigma_{x_{kA}}\rho_{x_{kA},y^*}\sigma_{y^*} - \beta_{kB}\sigma_{x_{kB}}\rho_{x_{kB},y_B}\sigma_{y_B}) \\ &+ \sum_{k=1}^{K-1} (\beta_{kA}\sigma_{x_{kA}}\rho_{x_{kA},y_A}\sigma_{y_A} - \beta_{kB}\sigma_{x_{kA}}\rho_{x_{kA},y^*}\sigma_{y^*}) \\ &+ (\sigma^2_{e_A} - \sigma^2_{e_B}).\end{aligned} \tag{4'}$$

Some may feel it is awkward that both sides of the equation contain σ_y.[18] To address this kind reservations, Fields (2003) proposes another version of the decomposition equation, $\sigma^2_y \approx \sum_{k=1}^{K-1} \beta^2_k \sigma^2_{x_k} + \sigma^2_e$, and the corresponding version of relative factor inequality weight for a factor *k*, $s'_k = (\beta^2_k \sigma^2_{x_k}) / \sigma^2_y$. Fields (2003, p. 14) develops this version of the decomposition equation and relative factor inequality weight for a factor *k* by assuming that *k* th factor is

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[18] The authors thank Jaques Silber for pointing this out. This should not be a critical drawback of the unified decomposition since even the standard Oaxaca decomposition for wage differentials can be derived in a similar fashion used for deriving the unified method (Yun, 2004). That is,

$$\bar{Y}_A - \bar{Y}_B = \sum_{k=1}^{k=K-1} P^k_{\Delta X}(\bar{Y}^* - \bar{Y}_B) + \sum_{k=1}^{k=K-1} P^k_{\Delta\beta}(\bar{Y}_A - \bar{Y}^*),$$

where $P^k_{\Delta X} = \dfrac{(\bar{X}_{kA} - \bar{X}_{kB})\ \beta_{kB}}{\sum_{k=1}^{k=K-1} (\bar{X}_{kA} - \bar{X}_{kB})\ \beta_{kB}}$, $P^k_{\Delta\beta} = \dfrac{\bar{X}_{kA}\ (\beta_{kA} - \beta_{kB})}{\sum_{k=1}^{k=K-1} \bar{X}_{kA}\ (\beta_{kA} - \beta_{kB})}$,

$\sum_{k=1}^{k=K-1} P^k_{\Delta X} = \sum_{k=1}^{k=K-1} P^k_{\Delta\beta} = 1$, and $\bar{Y} = \sum_{k=1}^{k=K-1} \bar{X}_k \beta_k$ since $\bar{e} = 0$.

orthogonal to the other income-determining factors.

We can derive a simpler decomposition equation based on $s_k^{/}$ as follows,

$$\sigma_{y_A}^2 - \sigma_{y_B}^2 = \sum_{k=1}^{K-1} W_{\Delta X}^{k/} (\tilde{\sigma}_{y^*}^2 - \tilde{\sigma}_{y_B}^2) + \sum_{k=1}^{K-1} W_{\Delta\beta}^{k/} (\tilde{\sigma}_{y_A}^2 - \tilde{\sigma}_{y^*}^2) + (\sigma_{e_A}^2 - \sigma_{e_B}^2), \qquad (5)$$

where $W_{\Delta X}^{k/} = \dfrac{\beta_{kB}^2 (\sigma_{x_{kA}}^2 - \sigma_{x_{kB}}^2)}{\sum_{k=1}^{K-1} \beta_{kB}^2 (\sigma_{x_{kA}}^2 - \sigma_{x_{kB}}^2)}$, $\quad W_{\Delta\beta}^{k/} = \dfrac{(\beta_{kA}^2 - \beta_{kB}^2)\sigma_{x_{kA}}^2}{\sum_{k=1}^{K-1} (\beta_{kA}^2 - \beta_{kB}^2)\sigma_{x_{kA}}^2}$,

and $\sum_{k=1}^{K-1} W_{\Delta X}^{k/} = \sum_{k=1}^{K-1} W_{\Delta\beta}^{k/} = 1$. This decomposition equation does not contain σ_y on the right hand side. The key question in deriving the decomposition equation (5) is how to properly weight the contribution of each variable to the characteristics and coefficients effects. Based on the approximation, $\sigma_y^2 \approx \sum_{k=1}^{K-1} \beta_k^2 \sigma_{x_k}^2 + \sigma_e^2$, weights in the equation (5) are derived.[19]

The results of using decomposition equation (5) are shown in Table A. Obviously, by design, the overall effects are not changed from Table 5. For the detailed decomposition, there are

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[19] Indeed, the equation (4) can be rewritten in this fashion as

$$\sigma_{y_A}^2 - \sigma_{y_B}^2 = \sum_{k=1}^{K-1} W_{\Delta X}^{k} (\tilde{\sigma}_{y^*}^2 - \tilde{\sigma}_{y_B}^2) + \sum_{k=1}^{K-1} W_{\Delta\beta}^{k} (\tilde{\sigma}_{y_A}^2 - \tilde{\sigma}_{y^*}^2) + (\sigma_{e_A}^2 - \sigma_{e_B}^2), \qquad (4')$$

where the weights are defined as

$$W_{\Delta X}^{k} = \frac{s_{ky^*}\sigma_{y^*}^2 - s_{ky_B}\sigma_{y_B}^2}{\tilde{\sigma}_{y^*}^2 - \tilde{\sigma}_{y_B}^2}, \quad W_{\Delta\beta}^{k} = \frac{s_{ky_A}\sigma_{y_A}^2 - s_{ky^*}\sigma_{y^*}^2}{\tilde{\sigma}_{y_A}^2 - \tilde{\sigma}_{y^*}^2},$$

and $\sum_{k=1}^{K-1} W_{\Delta X}^{k} = \sum_{k=1}^{K-1} W_{\Delta\beta}^{k} = 1$.

a few changes from Table 5. For example, the coefficients effect of human capital variables is larger than reported in Table 5.

Table 1. Mean Wages and Inequality Measures

	Mean	VLOG	Theil	Gini	CV	Log-Diff.
1980	3.025	0.446	0.266	0.389	0.867	1.721
1981	3.051	0.457	0.269	0.392	0.872	1.739
1982	3.279	0.442	0.263	0.385	0.877	1.706
1983	3.455	0.433	0.248	0.379	0.818	1.709
1984	3.678	0.411	0.240	0.372	0.810	1.654
1985	3.899	0.404	0.241	0.371	0.814	1.632
1986	4.137	0.393	0.231	0.365	0.790	1.611
1987	4.345	0.377	0.228	0.361	0.793	1.571
1988	4.817	0.352	0.210	0.348	0.754	1.526
1989	5.436	0.439	0.247	0.379	0.815	1.721
1990	5.927	0.314	0.181	0.325	0.686	1.445
1991	6.739	0.301	0.171	0.317	0.660	1.427
1992	7.202	0.275	0.153	0.301	0.619	1.359
1993	7.374	0.276	0.149	0.298	0.601	1.364
1994	7.675	0.265	0.139	0.290	0.573	1.345
1995	8.398	0.274	0.143	0.294	0.582	1.360
1996	9.490	0.298	0.156	0.307	0.609	1.408
1997	9.912	0.293	0.150	0.301	0.596	1.396
1998	9.330	0.304	0.153	0.305	0.596	1.431
1999	9.205	0.312	0.163	0.312	0.632	1.444
2000	10.065	0.328	0.179	0.323	0.691	1.470
2001	10.544	0.340	0.183	0.327	0.694	1.499
2002	11.545	0.371	0.196	0.340	0.709	1.569
2003	12.009	0.373	0.204	0.345	0.744	1.580
2004	11.837	0.369	0.198	0.343	0.710	1.588
2005	12.498	0.377	0.210	0.351	0.752	1.592

Note: 1. Both hourly and monthly wage rates in terms of 2005 constant Korean thousand won.

2. VLOG, Theil, Gini, CV and Log-Diff. are variance of log-wages, a version of Theil index, the Gini coefficient, coefficient of variation and log-wage differentials between top 10% and bottom 10%, respectively. Theil's index uses the equation $1/n\sum_{i=1}^{n}(Y_i/\mu_Y)\log(Y_i/\mu_Y)$, where Y, μ_Y, and n are, respectively, wages (level), mean wages, and number of observations.

Table 2. Variable Used in the Analysis

Variables	Definition
HWAGE	hourly wages in thousand constant 2005 won, calculated as monthly wages / monthly working hours, where monthly wages include regular, overtime, and annual bonus divided by 12.
HOURS	monthly working hours include both regular and overtime hours.
EXP	potential experience = age - years of schooling - 6
EXP_SQ	potential experience squared / 100
TENURE	years of tenure in current job
TENURE_SQ	tenure squared / 10
EDUCATION	years of schooling
FEMALE	1 if female, 0 otherwise
MARRIED	1 if married, 0 otherwise
UNION	1 if working place is covered by a union, 0 otherwise
Occupation	
OCC1*	Professionals, Technicians and Associated Professionals Legislators, Senior Officials and Managers
OCC2	Clerks
OCC3	Shop and Market Sales Workers, Service Workers
OCC4	Production: Craft and Related Trade Workers, Plant and Machine Operators and Assemblers, Elementary Occupations
Establishment Size	
SIZE1 *	10-29
SIZE2	30-99
SIZE3	100-299
SIZE4	300-499
SIZE5	500 or more
Industry	
IND1*	Mining and Quarrying
IND2	Manufacturing
IND3	Electricity, Gas and Water
IND4	Construction
IND5	Wholesale and Retail Trade, Restaurants and Hotels
IND6	Transport, Storage and Communication
IND7	Financing, Insurance, Real Estate and Business Services
IND8	Community, Social and Personal Services
Regions	
REG1*	Seoul
REG2	Pusan
REG3	Inchon and Gyunggi

REG4	Gangwon
REG5	Chungchong
REG6	Jeju and Junra
REG7	Daegu and Gyungsang

Note: * indicates a reference group in the regression analysis.

Table 3. Sample Means

	1980		1994		2005	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
HWAGE	3.025	2.623	7.675	4.401	12.498	9.397
HOURS	229.720	42.462	214.987	38.900	199.888	42.244
EXP	14.256	9.512	16.955	11.103	19.765	10.722
TENURE	3.114	3.409	5.399	5.349	5.851	6.411
EDUCATION	10.340	3.060	11.971	2.730	10.996	2.746
FEMALE	0.325	0.469	0.271	0.445	0.314	0.464
MARRIED	0.532	0.499	0.686	0.464	0.669	0.471
UNION			0.484	0.500	0.343	0.475
OCC1*	0.110	0.313	0.211	0.408	0.305	0.460
OCC2	0.233	0.423	0.249	0.433	0.272	0.445
OCC3	0.054	0.225	0.041	0.199	0.066	0.248
OCC4	0.603	0.489	0.498	0.500	0.357	0.479
SIZE1*	0.116	0.321	0.215	0.411	0.155	0.362
SIZE2	0.233	0.423	0.284	0.451	0.242	0.428
SIZE3	0.215	0.411	0.208	0.406	0.232	0.422
SIZE4	0.090	0.286	0.070	0.255	0.162	0.369
SIZE5	0.345	0.475	0.224	0.417	0.208	0.406
INDUSTRY1*	0.027	0.163	0.006	0.076	0.002	0.046
INDUSTRY2	0.647	0.478	0.508	0.500	0.405	0.491
INDUSTRY3	0.009	0.093	0.008	0.086	0.008	0.086
INDUSTRY4	0.038	0.191	0.057	0.232	0.059	0.235
INDUSTRY5	0.045	0.206	0.089	0.285	0.117	0.322
INDUSTRY6	0.103	0.303	0.106	0.308	0.078	0.267
INDUSTRY7	0.061	0.239	0.148	0.355	0.179	0.383
INDUSTRY8	0.071	0.257	0.078	0.268	0.153	0.360
REGION1*	0.326	0.469	0.217	0.412	0.295	0.456
REGION2	0.143	0.350	0.074	0.261	0.063	0.242
REGION3	0.173	0.379	0.195	0.396	0.280	0.449
REGION4	0.031	0.174	0.068	0.251	0.021	0.144
REGION5	0.061	0.240	0.096	0.294	0.078	0.268
REGION6	0.066	0.248	0.117	0.322	0.081	0.274
REGION7	0.199	0.399	0.234	0.424	0.182	0.386
Sample Size	336921		403887		471130	

Note: * indicates a reference group in the regression analysis.

Table 4. Regression Results of Hourly Wage Equations

	1980		1994		2005	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
CONSTANT	0.467	0.008	1.476	0.008	1.477	0.014
EXP	0.035	0.000	0.023	0.000	0.029	0.000
EXP_SQ	-0.063	0.001	-0.049	0.000	-0.061	0.001
TENURE	0.061	0.000	0.057	0.000	0.061	0.000
TENURE_SQ	-0.017	0.000	-0.011	0.000	-0.010	0.000
EDUCATION	0.065	0.000	0.039	0.000	0.056	0.000
FEMALE	-0.388	0.002	-0.285	0.001	-0.215	0.001
MARRIED	0.086	0.002	0.058	0.002	0.054	0.002
OCC 2	-0.261	0.003	-0.111	0.002	-0.070	0.002
OCC 3	-0.717	0.004	-0.203	0.003	-0.266	0.003
OCC 4	-0.483	0.003	-0.276	0.002	-0.298	0.002
SIZE 2	0.042	0.002	-0.010	0.001	0.088	0.002
SIZE 3	0.088	0.002	0.006	0.002	0.118	0.002
SIZE 4	0.081	0.003	0.027	0.002	0.159	0.002
SIZE 5	0.129	0.002	0.109	0.002	0.306	0.002
INDUSTRY 2	-0.329	0.005	-0.269	0.007	-0.224	0.013
INDUSTRY 3	-0.167	0.008	-0.212	0.009	-0.075	0.014
INDUSTRY 4	-0.246	0.006	-0.142	0.007	-0.299	0.013
INDUSTRY 5	-0.166	0.006	-0.239	0.007	-0.171	0.013
INDUSTRY 6	-0.190	0.005	-0.276	0.007	-0.259	0.013
INDUSTRY 7	-0.088	0.006	-0.190	0.007	-0.202	0.013
INDUSTRY 8	-0.159	0.005	-0.172	0.007	-0.238	0.013
REGION 2	-0.153	0.002	-0.081	0.002	-0.156	0.003
REGION 3	-0.099	0.002	-0.034	0.002	-0.037	0.002
REGION 4	-0.078	0.005	-0.113	0.002	-0.051	0.004
REGION 5	-0.145	0.003	-0.070	0.002	-0.064	0.002
REGION 6	-0.200	0.003	-0.110	0.002	-0.119	0.002
REGION 7	-0.093	0.002	-0.031	0.002	-0.142	0.002
Adjusted R^2	0.694		0.628		0.578	
F Value	28239.7		25199.1		23877.6	
Sample Size	336921		403887		4771130	

Note: 1. Every estimate and F value are statistically significant at 1%. 2. Reference group is the first category of occupation, establishment size, industry, and region.

Table 5. Decomposition of Changes in Hourly Wage Inequality (1980-1994 and 1994-2005)

	Wage Inequality [1]				Decomposition [2]			
	1980 - 1994							
	1980		1994		Char.Effect		Coeff. Effect	
	Estimate	Share	Estimate	Share	Estimate	Share	Estimate	Share
Total	0.446	100.0	0.265	100.0	-0.014	7.5	-0.130	71.5
Human Capital	0.139	31.1	0.095	35.7	-0.008	4.6	-0.036	19.6
Experience	0.026	5.9	0.013	4.9	-0.003	1.5	-0.011	6.0
Tenure	0.037	8.3	0.059	22.2	0.013	-7.3	0.008	-4.6
EDUCATION	0.075	16.8	0.023	8.6	-0.019	10.4	-0.033	18.3
FEMALE	0.065	14.5	0.029	10.9	-0.010	5.2	-0.026	14.5
MARRIED	0.013	2.9	0.004	1.5	-0.005	2.5	-0.004	2.3
Occupation	0.065	14.5	0.025	9.5	0.009	-4.8	-0.048	26.7
Establishment Size	0.001	0.2	0.005	2.0	0.004	-2.4	0.000	-0.1
Industry	0.021	4.6	0.005	1.9	-0.005	2.6	-0.011	5.9
Region	0.007	1.7	0.003	1.2	0.000	-0.2	-0.005	2.6
Residuals	0.137	30.6	0.099	37.2	-0.038	21.0		
	1994 - 2005							
	1994		2005		Char.Effect		Coeff. Effect	
	Estimate	Share	Estimate	Share	Estimate	Share	Estimate	Share
Total	0.265	100.0	0.377	100.0	-0.004	-3.9	0.056	50.0
Human Capital	0.095	35.7	0.141	37.3	0.003	2.2	0.043	38.6
Experience	0.013	4.9	0.014	3.7	-0.003	-2.5	0.004	3.4
Tenure	0.059	22.2	0.087	23.1	0.006	5.5	0.022	19.8
EDUCATION	0.023	8.6	0.039	10.4	-0.001	-0.8	0.017	15.4
FEMALE	0.029	10.9	0.019	4.9	-0.002	-2.0	-0.008	-7.0
MARRIED	0.004	1.5	0.003	0.8	-0.001	-0.7	0.000	-0.1
Occupation	0.025	9.5	0.033	8.6	-0.001	-0.6	0.008	7.3
Establishment Size	0.005	2.0	0.018	4.8	0.000	-0.2	0.013	11.6
Industry	0.005	1.9	0.001	0.3	-0.001	-1.2	-0.003	-2.2
Region	0.003	1.2	0.004	1.0	-0.002	-1.4	0.002	1.9
Residuals	0.099	37.2	0.159	42.2	0.061	53.9		

Note: 1. Shares of variance of log-wages in 1980 (0.446), 1994 (0.265) and 2005 (0.377) are reported. 2. Share of differences in variance of log-wages between 1980 and 1994 (-0.181=0.265-0.446), and between 1994 and 2005 (0.112=0.377-0.265) are reported. 3. Experience (tenure) shows the sum of the contributions of EXP and EXP_SQ (TENURE and TENURE_SQ).

Table A. Decomposition of Changes in Wage Inequality (1980-1994 and 1994-2005)

	1980-1994				1994-2005			
	Char.Effect		Coeff. Effect		Char.Effect		Coeff. Effect	
	Estimate	Share	Estimate	Share	Estimate	Share	Estimate	Share
Total	-0.014	7.5	-0.130	71.5	-0.004	-3.9	0.056	50.0
Human Capital	-0.014	7.5	-0.084	46.3	-0.004	-3.8	0.047	41.6
Experience	-0.006	3.6	-0.057	31.5	0.000	0.0	0.034	30.3
Tenure	-0.008	4.3	-0.017	9.4	-0.004	-3.7	0.006	5.8
EDUCATION	0.001	-0.4	-0.010	5.4	0.000	0.0	0.006	5.5
FEMALE	0.000	-0.2	-0.007	3.7	0.000	-0.1	-0.004	-3.3
MARRIED	0.000	0.0	0.000	0.2	0.000	0.0	0.000	0.0
Occupation	0.000	-0.1	-0.033	18.3	0.000	0.0	0.002	1.4
Establishment Size	0.000	0.0	-0.001	0.8	0.000	0.0	0.010	9.2
Industry	0.000	0.2	0.000	0.2	0.000	-0.1	-0.001	-0.5
Region	0.000	0.1	-0.004	2.1	0.000	0.1	0.002	1.7
Residuals	-0.038	21.0			0.061	53.9		

Note: Share of differences in variance of log-wages between 1980 and 1994 (-0.181=0.265-0.446), and between 1994 and 2005 (0.112=0.377-0.265) are reported.

Figure 1. Trends in Wage Inequality (Hourly Wages)