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Rising earnings inequality and the role of education revisited

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Abstract Numerous studies have found a strong positive association between the level of education and economic returns (i.e., earnings). This relationship, however, has received less examination in the context of institutional or temporal variability. Drawing on the experience of South Korea in the decade after the 1997 Asian financial crisis, this study examines the role of education in rising earnings inequality under a radically changing institutional environment. Based on data from the Korean Labor Income Panel Study and Theil index decomposition, this study finds that despite the robust association between education and earnings inequality in post-crisis South Korea, a substantial amount of the rise in overall inequality is primarily attributable to rapid increase in within-education-group inequality rather than between-group inequality. This demands renewed attention to the role of education in earnings inequality to fully account for the changing dynamics of inequality in the twenty first century.

Keywords Earnings inequality · Education · Rising inequality · Asian financial crisis · South Korea

Introduction

The effect of education on one's welfare is critical in contemporary society. Not only does it virtually secure a higher socioeconomic status within a stratification system, but it also enhances various social and biological functionalities of individuals throughout their lifetime (Angrist and Kreuger 1991; Cutler and Lleras-Muney 2008; Herd et al. 2007). In particular, the effect of educational attainment on earnings potential is well documented both in sociology and economics, and numerous studies have found a strong positive correlation between

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level of education and economic returns (i.e., earnings), net of potential confounding factors such as individual talent and family background (Becker 1993; Blundell et al. 2000; Card 1999; Xie and Hannum 1996).

The robust relationship between education and earnings and the persistent earnings inequality across education groups, however, have been tested less against temporal and contextual variability. For instance, is the earnings gap and inequality across different educational categories stable over time? If it varies, under what circumstances does it converge or diverge? Does the pattern of convergence or divergence interact with existing structural and institutional arrangements? Moreover, what is the relationship between level of education and rising inequality? Although it sounds reasonable to directly associate education with rising earnings inequality, the extent to which one's level of education contributes to rising inequality over time is less obvious than it seems, let alone its implications for the study of inequality and stratification.

In order to address these issues on empirical grounds, this study investigates the potential variability of earnings inequality by education under radically changing institutional settings. Beginning with the assumptions that (1) the relationship between education and earnings inequality is not constant over time and (2) the changing relationship interacts with external institutional factors, I examine the role of education in rising earnings inequality, drawing on the experience of South Korea in the decade after the 1997 Asian financial crisis. South Korea, once known for its rapid economic development with relatively equal income distribution, has experienced an unprecedented increase in income inequality since the mid-1990s, particularly after the 1997 crisis. Although many factors have contributed to this rising inequality, I focus on its association with education, analyzing the proportion of the increase in overall inequality due to the changing inequalities between education groups. Based on the results of this exploratory analysis, I also discuss two competing hypotheses, one market-based and the other institution-based, regarding the effect of education on rising inequality.

In testing the empirical foundation of the hypotheses, data extracted from the Korean Labor and Income Panel Study (KLIPS) and other national statistics have been utilized along with Theil index decomposition. Theil index decomposition is a particularly useful statistical tool in this regard, not only because it is a widely used measure of distributive inequality, but also because it possesses all the desirable properties for a measure of earnings inequality, including additive decomposability (decomposability of the overall inequality into between- and within-group inequalities). Since the primary goals of this study are to document the rising inequality of post-crisis South Korea and to account for the increase in overall earnings inequality in terms of education, the Theil index and its decomposed values for between- and within-education-group inequalities are crucial.

The following sections present the theories, hypotheses, and analysis of this study. First, two competing explanations of the role of education on rising inequality are discussed to set up the hypotheses. Second, South Korea's experience following the 1997 Asian financial crisis is briefly discussed as the context of the study. In the analysis section, data, measurements, and the Theil index are explained in detail, followed by results. Lastly, based on these empirical analyses, I discuss the implications of rising earnings inequality and the role of education for the broader study of inequality and stratification.

Rising earnings inequality and the role of education: theories and hypotheses

The significance of education for one's general welfare is almost universal, affecting various socioeconomic parameters throughout an individual's life course (for example,

occupation, income, and health). Of the multiple socioeconomic functionalities of education, one of the most salient features in the current capitalist system is its strong positive association with earnings: in general, the higher the one's educational attainment, the higher the one's earnings potential, net of individual talent or family background (Angrist and Kreuger 1991; Becker 1993; Blundell et al. 2000; Card 1999; Tsai and Xie 2008). Although theories about what exactly renders education so valuable and financially rewarding in contemporary society vary across perspectives (e.g., human capital, credentialism, screening hypothesis, and cultural capital), there is no objection to the existence of earnings inequality by education, which is regarded as more than a proxy of one's innate talent or economic potential in the current socioeconomic system.

What is less known, however, is the variability of the association over time and space: does earnings inequality by education remain constant regardless of temporal or contextual changes? In other words, how does the association between the two variables interact with external circumstances such as economic crisis and institutional reform? Even if the association between education and earnings inequality has been proven robust, this does not necessarily imply invariability over time and space, demanding a separate set of questions. Moreover, since it is well known that the association is defined not only by market forces (such as demand and supply) but also by institutional factors (such as minimum wage, unionization, and governmental policies), investigating how earnings inequality by education is shaped and structured by power and inequality that originate outside the marketplace is also essential to further our sociological understanding of these dynamics (Morris and Western 1999).

Of the potentially many patterns of the changing association between education and earnings inequality over time and space, this study pays particular attention to the role of education on rising earnings inequality—that is, the amount of contribution that level of education makes to the increase in overall earnings inequality over time. This is because, although it is feasible that educational attainment can be associated with decreasing earnings inequality under particular temporal or contextual settings, what has been more commonly observed in recent decades is rising earnings inequality within several countries (Firebaugh 2003), and the increase in overall inequality is often attributed to diverging earnings returns to education. Considering the robust association between education and earnings inequality in the existing literature, this claim regarding the effect of education on rising earnings inequality sounds reasonable enough, but its empirical validity has yet to be tested. Thus, I aim to examine the association in a specific temporal and spatial context to critically evaluate the statement.

Two major theoretical accounts of rising earnings inequality, market-based and institution-based, implicitly or explicitly address the role of education in the process. The market-based approach argues that the primary cause of observed rising earnings inequality is the combined consequence of (1) rising demand for highly educated workers due to technological changes; and (2) downward wage pressure for low-skilled and less-educated workers due to globalization (Card and DiNardo 2002; Katz and Autor 1999). On the one hand, constant changes and upgrades in modern technologies require workers to be equipped with comparable skills and education, and this trend of skill-biased technical change (SBTC) under contemporary capitalism naturally incurs higher demand and wages for highly skilled workers, widening earnings inequalities in favor of the highly educated. On the other hand, the increasing force of globalization—notably, free trade and immigration—put extra competitive pressure on low-skilled workers, resulting in deteriorating wages for the less educated. As a result, the earnings gaps and inequalities between education groups increase over time, and, as long as SBTC and globalization work in favor

of highly educated workers, earnings inequality by education is expected to continue to rise as a natural consequence of the logic of the market mechanism.

In contrast, the institution-based stance argues that rising earnings inequality is caused, not by indifferent market forces of technological change or globalization, but by changes to institutional factors such as labor unions, social norms, and political power (DiPrete 2007; Levy and Temin 2007; Piketty and Saez 2003; Pontusson et al. 2002). This perspective acknowledges the positive and significant association between education and earnings inequality, but it differentiates itself from the market-based approach by emphasizing the role of education on rising (or changing) earnings inequality. It argues that regardless of the robust association between education and earnings, the variability of this association over time and space is primarily defined by changes in institutional factors. The rationale is as follows: The recent trend in rising earnings inequality is not caused by SBTC or globalization but by changes in institutions and social forces that allow those in power to effectively take larger economic shares than before. If rising earnings inequality is, indeed, the result of SBTC and globalization, then proponents of this perspective ask, why don't we observe the same pattern of growing inequality across countries that are equally affected by the same market forces (DiPrete 2007)?

In addition, proponents argue that SBTC and globalization have, to a certain extent, been present and had an effect throughout the history of human development, and they ask why, in that case, the association between education and earnings inequality has varied. Moreover, if rising inequality is primarily due to the college premium, as the marketists argue, why do we observe more of the growing earnings inequality within the college-educated group than between education groups?

Since it is not possible to explain a variable (differential across countries in rising earnings inequality by education) with a constant (the force of SBTC and globalization), the institutionalists argue that the market-based explanation cannot fully explain the dynamics of rising earnings inequality by education, and that we must thus look to alternative explanations based on institutional factors, such as the rise and fall of organized labor (Western and Rosenfeld 2011). In sum, from the institutional perspective, the role of education on rising earnings inequality is not as clear as in market-based explanations, and despite the robust relationship between the two, the issue demands a separate set of empirical investigations that would examine the relationship's potential interaction with existing institutional frameworks.

In an attempt to test these two competing explanations of the role of education in rising earnings inequality, this study tests the following hypotheses:

Hypothesis 1 The association between education and earnings inequality is not constant over time and space, and the nature of the association is open to empirical investigation.

Hypothesis 2 If rising earnings inequality is due to the college premium driven by SBTC and globalization, we will see widening earnings inequality between education groups when we decompose the increase in overall earnings inequality into between-education-group and within-education-group inequalities. If, however, the rising earnings inequality is due to factors other than the college premium, we will see the reverse trend: an increase in overall earnings inequality that is primarily driven by rising within-education-group inequality.

Although the empirical evidence and tests of these hypotheses are exploratory at best and do not provide a definitive evaluation of market-based versus institution-based arguments, they do provide an empirical foundation for further study of the role of education in rising earnings inequality.

The next section briefly introduces the temporal and spatial context of this study—South Korea in the decade after the 1997 Asian financial crisis. During this period, South Korea experienced not only a rapid and unprecedented increase in income inequality but also substantial institutional reforms. Although this concomitance was not unique to South Korea and has occurred in other industrial countries undergoing similar socioeconomic restructuring since the 1980s, the context of South Korea provides an interesting case with which to test the hypotheses given its unique history of development and inequality.

Background of the study: South Korea after the 1997 Asian financial crisis

South Korea, once known for its rapid economic growth with relatively equal income distribution, began to experience a rapid increase in income inequality in the early 1990s, continuing and intensifying after the 1997 Asian financial crisis (see Fig. 1).

Contrary to the prediction of the Kuznets curve,[1] the level of inequality in South Korea substantially decreased during the initial period of rapid industrialization and economic development (1960s–1980s) and only started to rise as the economy moved toward a post-industrialization era with a globalization drive beginning in the early 1990s. This rise in inequality has accelerated since the 1997 crisis and, as can be seen in the trend of the quintile share ratios in Fig. 1, has been led primarily by substantial gains for the top income group.

Who exactly comprises this top income group that disproportionately gained from the post-crisis economic recovery in the midst of rapidly rising income inequality? Does it include the highly educated workers who the marketists predict will enjoy the college premium driven by SBTC and globalization? Or is it those who were able to take advantage of the post-crisis institutional reforms, which has less to do with the level of education? Moreover, why did the trend suddenly accelerate after the 1997 crisis? In order to answer these questions and test the hypotheses stated in the previous section, we first need to understand more about the context of South Korea in the wake of the 1997 Asian financial crisis.

The Asian financial crisis

The crisis, which began in Thailand in summer 1997 and spread to the rest of East Asia by the end of the same year, significantly debilitated most East and South East Asian economies. Thailand, Malaysia, Indonesia, and South Korea were hit particularly hard. Although the crisis was relatively short-lived and was followed by a steady economic recovery across the region, the speed and magnitude of Asia's collective stumble, the erosion of wealth, and the increases in poverty and social insecurity during the crisis were massive enough to be referred to as the regional equivalent of the Great Depression of the 1930s (Wade 1998).

South Korea, which prior to the crisis had been praised as the exemplar of the developmental state (Woo-Cumings 1999), was among the hardest hit, suffering the worst economic recession since the Korean War. With Korea facing massive capital flight and rapid depletion of its foreign reserves, banks and *chaebols*[2] were unable to repay

[1] Kuznets (1955) speculated that industrialization has a nonlinear effect on income inequality, with inequality increasing as nations begin to industrialize and then declining at later stages of industrialization.

[2] *Chaebols* are large, diversified, family-controlled conglomerates that have played a key role in the industrial development of South Korea, particularly after the 1960s.

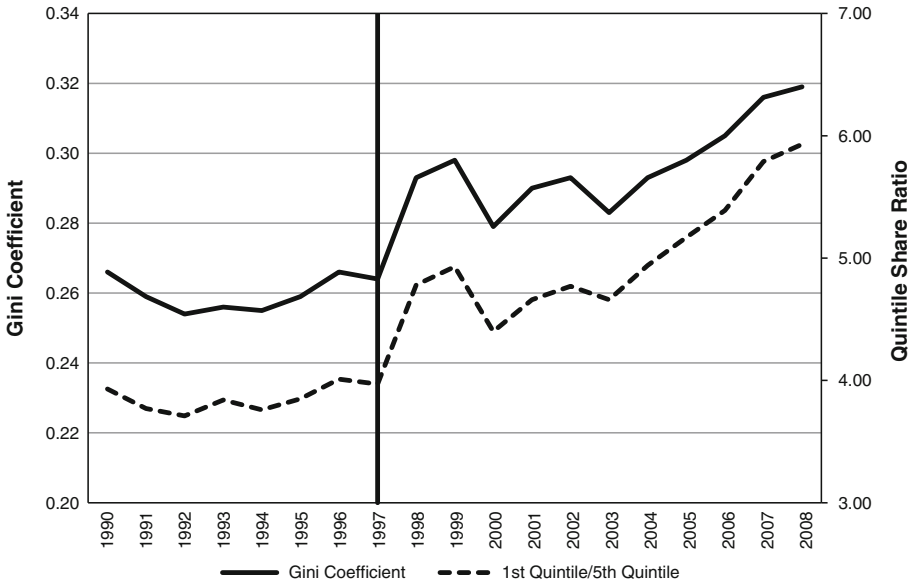

Fig. 1 Trends in income inequality in South Korea, 1990–2008. *Note* The *vertical line* represents the year when the Asian financial crisis occurred

international loans on time, and in the end, the government had to ask the International Monetary Fund (IMF) for an emergency bailout so as not to confront the worst-case scenario of national bankruptcy.

In exchange for the then record-high $57 billions in loans from the IMF and other international financial institutions, however, the South Korean government had to accept and implement the IMF's structural adjustment program, based on the neoliberal economic policies of deregulation, privatization, and liberalization (see IMF 1997 for the details of the agreement). The program recommended by the IMF consisted of two sets of policy measures. First, as an immediate measure to recover investors' confidence, the program called on crisis-struck nations to cut back on government spending to reduce deficits, allow insolvent banks and financial institutions to fail, and aggressively raise interest rates, based on the reasoning that these steps would restore confidence in the nations' fiscal solvency, penalize insolvent companies, and protect currency values. Second, to promote long-term economic restructuring aligned with the logic of neoliberalism, the borrowing nations were pressured to follow a set of socioeconomic policies favoring free-market mechanisms over state intervention in the distribution of goods and services.

Although efforts to liberalize the Korean market had been gradually implemented since the early 1980s when South Korea was still a dirigiste state (Pirie 2008; Woo 1991), the wholesale implementation of neoliberal economic restructuring in the midst of the deep recession provoked by the Asian financial crisis was critical and abrupt enough to substantially transform Korean society within a short time.[3] The economic "miracle" of South Korea during the pre-crisis era was the product of strong governmental interventions and

[3] Economic liberalization was actually initiated in the mid-1990s under the slogan *seigyehwa* (globalization), but actual implementation of specific policies started in earnest following and in response to the 1997 crisis.

market controls (Amsden 1989; Evans 1995; World Bank 1993), and so the measures jointly decided upon by the government and the IMF in response to the crisis essentially constituted the abandonment of the developmental system that South Korea had effectively utilized for the prior three decades (Shin and Chang 2003).

The Korean economy began to recover as early as 1999, but the crisis and subsequent economic restructuring premised on the new ideology left an indelible mark on the Korean political economy, substantially transforming the Korean developmental state into a neoliberal state (Gray 2007; Pirie 2008; Woo 2007a, b).[4] Among the many changes associated with this transformation, those affecting the general public the most have been the emergence of inequality, insecurity, and poverty despite the country's otherwise steady economic comeback (Lim and Jang 2006; Shin 2011). In particular, although overall macroeconomic indicators, such as annual economic growth rates and household consumption levels, began to recuperate as early as late 1998 and continuously improved until the 2008 global financial crisis, the distributional inequality measures, such as the Gini coefficient and quintile share ratio,[5] have become the worst in Korea's recent history (see Table 1 for principal economic indicators and Fig. 1 for trends in the Gini coefficient and the quintile share ratio). With its conventional developmental strategies of strong state interventions and coordination of the market gradually removed from most policy domains, South Korea has become a neoliberal economy that is extensively integrated into the global market, within which individual competition and merit-based reward systems are stronger than ever.

Earning trends by education

As Figs. 2 and 3 show, average monthly earnings diverge between education categories, and gaps between education groups have widened since 1997. The increase is greater for those with 4 years of college education and above, and the relative gains from the economic recovery are smaller among those with less than 4 years of college.

However, since the trends reflect only the changes in the mean level of earnings by education, it is not clear if the post-crisis increase in earnings inequality can be fully explained by the differential earnings returns to education. In other words, the total level of inequality is the sum of between- and within-group inequalities in general, but the two figures and trends show only the former source of the rise in post-crisis earnings inequality—diverging earnings returns between education groups. In order to have a complete understanding of post-crisis earnings inequality and the rise in the earnings inequality by education, it is, therefore, essential to also examine the other half of the story—changes in within-education-group inequality. The following section discusses ways to examine both forms of inequality and explains the data, analytic sample, and measurement used in this study.

[4] The neoliberal state is the mode of governance in which free-market mechanisms are prioritized in the distribution of goods and services, as opposed to the Keynesian welfare state that was prominent in the global economy during the golden age of capitalism, roughly 1945–1973.

[5] The Gini coefficient, developed by the Italian statistician Corrado Gini, is the most widely used statistical measure of inequality of income or wealth distribution. The coefficient varies between 0, which reflects complete equality (everyone has the same income or wealth), and 1, which indicates complete inequality (one person has all the income or wealth, all others have none). The quintile share ratio represents the ratio of the average income of the richest 20 % of the population divided by the average income of the poorest 20 %.

Table 1 Principal economic indicators in South Korea, 1990–2008

Years	Real GDP (annual % change)	GNI per capita (dollars)	Stock price index (annual average)	Exchange rate (won/dollars)	Unemployment rate (%)
1990	9.2	6,147	746.0	716.7	2.4
1991	9.4	7,105	658.0	759.5	2.4
1992	5.9	7,527	585.7	786.9	2.5
1993	6.1	8,177	728.4	807.2	2.9
1994	8.5	9,459	965.3	788.5	2.5
1995	9.2	11,432	934.9	775.7	2.1
1996	7.0	12,197	833.4	844.9	2.0
1997[a]	4.7	11,176	654.5	1,695.0	2.6
1998[a]	−6.9	7,355	406.1	1,204.0	7.0
1999	9.5	9,438	806.8	1,138.0	6.3
2000	8.5	11,292	734.2	1,264.5	4.1
2001	4.0	10,631	572.8	1,313.5	3.8
2002	7.2	12,100	757.0	1,186.2	3.1
2003	2.8	13,460	679.8	1,192.6	3.4
2004	4.6	15,082	832.9	1,035.1	3.5
2005	4.0	17,531	1,073.6	1,011.6	3.5
2006	5.2	19,722	1,352.2	929.8	3.3
2007	5.1	21,695	1,712.5	936.1	3.0
2008	2.2	19,231	1,529.5	1,259.5	3.0

Source Bank of Korea (2013)

GDP gross domestic product, *GNI* gross national income

[a] Indicates the years of the Asian financial crisis

Methods

Data and analytic sample

The KLIPS is a comprehensive longitudinal survey that contains information on the Korean labor market and related socioeconomic activities of households and individuals residing in the urban areas of South Korea (Korea Labor Institute 2009). Benchmarking the success of other nationally representative panel surveys, such as the Panel Study of Income Dynamics in the United States, the Korea Labor Institute launched the first wave of KLIPS in 1998 with a sample of 5,000 households and their 13,321 household members aged 15 years or above, and has continuously tracked the initial samples and branched households on an annual basis.[6] The original sample of households was selected by two-stage stratified cluster sampling (random choice of urban households within the Korean Census enumeration districts), and the data are principally collected through a direct face-to-face interview comprised of separate questionnaires for the household and all of its individual members aged 15 and above. As of 2013, the household and individual datasets from waves 1 through 11 are available on the Korea Labor Institute website for public use.

[6] The rate of retention of original households was 75.5 % by wave 10, which is comparable to other highly regarded national panel studies such as the U.S. PSID, the British BHPS, and the German GSOEP.

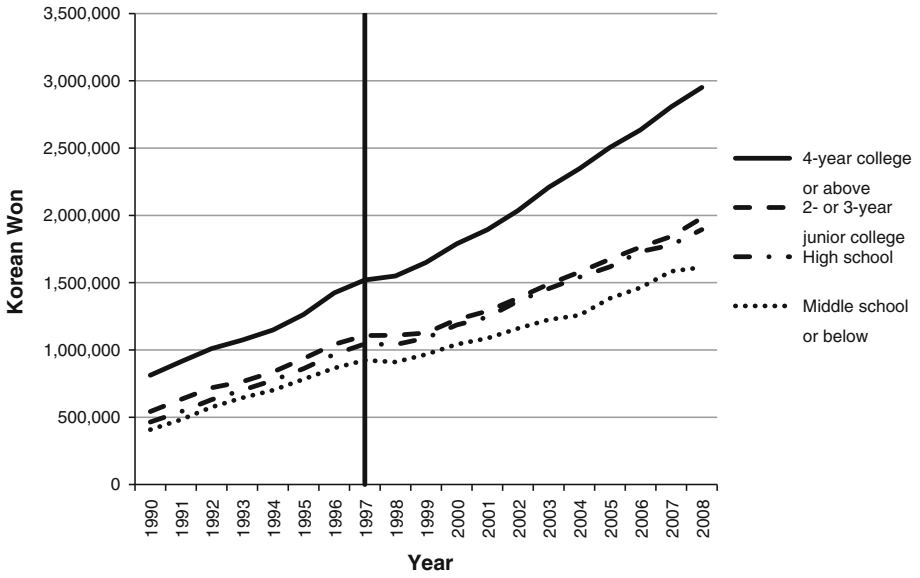

Fig. 2 Earnings trends by education level, 1990–2008. *Source* Statistics Korea (2013). *Note* The *vertical line* represents the year when the Asian financial crisis occurred

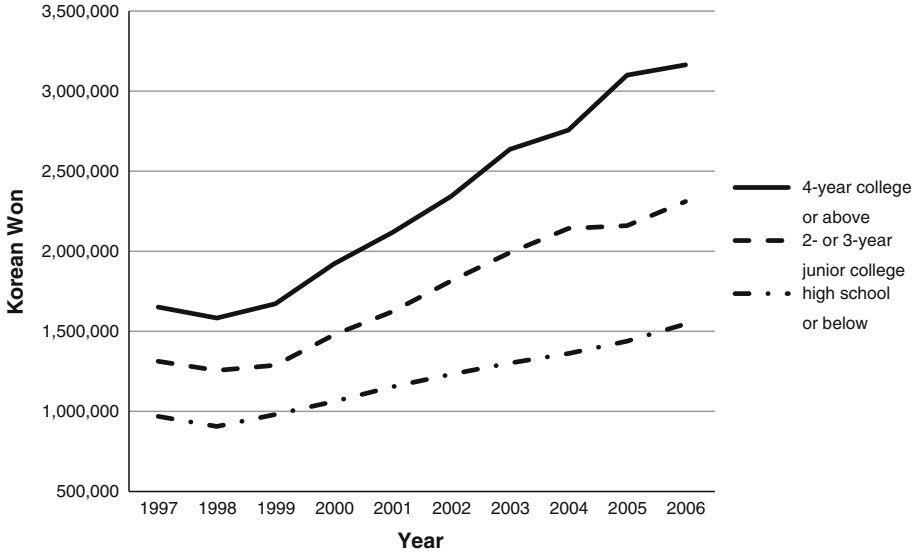

Fig. 3 Earnings trends by education level, 1997–2006. *Source* Korean Labor and Income Panel Study

The major topics of the KLIPS cover both household characteristics (such as household composition, housing information, and financial condition) and individual socioeconomic activities particularly related to the labor market (such as employment, education, income, job training, working conditions, and welfare) with occasional supplemental surveys for

Table 2 Variables and descriptive statistics by year, 1997–2006

Years	Average monthly earnings (10,000 Korean won)		Education (%)			Sample size
	Mean	SD	High school or below	2- or 3-year junior college	4-year college or above	
1997	117.48	67.33	66.08	8.01	25.91	3,370
1998	109.26	64.20	68.35	7.65	24.00	3,188
1999	116.13	65.51	69.67	7.68	22.65	2,892
2000	128.94	82.33	69.15	7.96	22.89	2,840
2001	140.13	85.96	69.80	7.71	22.50	2,907
2002	154.61	98.62	67.64	8.05	24.31	2,933
2003	169.37	111.63	67.06	7.80	25.14	2,872
2004	177.47	116.88	66.19	8.81	25.01	2,703
2005	188.96	149.52	66.84	8.84	24.32	2,738
2006	200.94	214.55	66.74	8.67	24.59	2,712
Overall	148.71	116.66	67.75	8.10	24.15	29,155

specific demographic groups. Since the primary goal of this study is to analyze earnings inequality by education, the analytic sample is limited to wage earners aged 26 and above, resulting in 6,020 individuals with 29,155 person-year observations between 1997 and 2006.

Measurement

The dependent variable of this study is average monthly wages in Korean won, and the primary independent variable is level of education, categorized into three different groups—high school or below, 2- or 3-year junior college, and 4-year college or above—reflecting clear divisions between the categories in the Korean education system.[7] The descriptive statistics of these variables for 1997–2006 are summarized in Table 2.

As expected, there was a substantial drop in average monthly earnings in 1998 when Korean workers suffered most from the 1997 Asian financial crisis, but earnings soon recuperated from the crisis and constantly increased between 1999 and 2006. What was less expected from the process of wage recovery, however, was the substantial increase in the variation around the mean earnings, as noted in the changes in the standard deviations over the years. While the mean level of earnings approximately doubled between 1997 and 2006, the level of variation around the means more than tripled for the same period. In other words, although average post-crisis wage levels substantially increased, the increase in the average was not equally shared by all Korean workers, indicating a rise in distributional earnings inequality between 1998 and 2006. This is the focus of this study, which analyzes the post-crisis rise in earning inequality by education, decomposing the sources of the rise into both between- and within-education-group inequalities.

[7] In this article, "high school" refers to secondary education and "college" refers to post-secondary education. As of 2008, over 99 % of middle school graduates advanced to high school and over 80 % of high school graduates advanced to some type of college in South Korea; thus, the qualitative distinction between the three categories is much more crucial than the quantitative difference within each group when it comes to its effect on various socioeconomic outcomes.

Analytic method: Theil index decomposition as a measure of inequality

Inequality indicates the absence of equality in which a certain item of interest is not equally distributed across individual units. Various indexes have been suggested to measure the degree of inequality (for example, the Gini index, variance-based measures, and the generalized entropy measures); each captures different aspects of distributional inequality, and each has advantages and disadvantages. This study utilizes the Theil index, not only because it is the best suited to address these specific research questions, but also because it possesses more desirable properties than other popular measures of inequality.

What income inequality indexes measure

Standard measures of inequality such as the Gini and Theil indexes use different metrics but are based on the same theoretical concept: inequality as an average disproportionality (Firebaugh 1999, 2003; Reardon and Firebaugh 2002). According to this concept, inequality occurs when units of interest (such as individuals or households) possess disproportionate shares of the item of interest (for example, income or consumption) in comparison to the mean of the entire unit values. Thus, it is uneven income growth, not income growth per se, that leads to growing income inequality. Because income growth per se results in bigger gaps but not greater inequality, it is a logical fallacy to infer growing income inequality from growing income gaps.

For instance, the ratio of individual income to mean income $(X/\bar{X})$ represents the degree of individual deviation from the mean. Unless all individuals share the same level of income, the individual ratios vary around the ratio of equality, which is 1.0, and the average distance of the individual deviations from the mean represents the degree of inequality. Based on this principle of average proportionality, the standard inequality measures aggregate all individual unit deviations into a single summary value with its own distinctive metrics depending on the definition of the individual unit ratio function.

Four desirable properties for a measure of income inequality

Despite the conceptual similarities among the standard measures of inequality, not all of them possess the same measure of desirable properties. An ideal inequality index should be (1) invariant to unit or scale changes in the unit values ("scale invariance"), (2) responsive to transfers between individual units at all points of the distribution ("principle of transfers"), and (3) consistent with the principle that income transfers among the poor are more consequential than income transfers among the rich ("the welfare principle"). In addition, like this study, most social studies are interested in the decomposition of overall income inequality by sociodemographic groups; thus, it is also useful if the inequality measure can be (4) additively decomposed into between- and within-group inequalities ("additive decomposability").

Since the Theil index satisfies all four of these criteria, which are essential to testing the primary hypotheses of this study, I use the Theil index to analyze the inequality trend of post-crisis South Korea as well as its decomposed components by the three education categories.

The Theil index and its decomposition by education categories

Like the Gini index and the variance of logged incomes, the Theil index (Theil 1967) is a single summary measure of distributional inequality widely used in the study of income

inequality (Allison 1978). As with other standard measures, the Theil index represents the degree of income inequality in terms of the average disproportionality computed from individual income ratios, but unlike other inequality measures, it possesses all four of the desirable properties discussed in the previous section, including additive decomposability. In particular, the Theil index, T, is defined as the arithmetic mean of the individual income ratios weighted by its logged value:

$$T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i}{\bar{x}}\right)\ln\left(\frac{x_i}{\bar{x}}\right) \tag{1}$$

where x_i denotes individual income, $\bar{x}$ mean income, and $\ln\left(\frac{x_i}{\bar{x}}\right)$the natural logarithm of the individual income ratio. According to this definition, the minimum value of the Theil index is 0, where everyone in the population has the same level of income, and the maximum value $\ln N$, where one individual possesses the entire income in the population. (If everyone's earnings are the same in the population, then $x_i = \bar{x}$, so that the natural logarithm of $x_i = \bar{x}$ becomes 0 for all individuals in the population.)

As can be seen in the technical details of Eq. 1, the Theil index satisfies the four basic criteria for a desirable inequality index. Not only does its value remain the same with proportional income changes across individuals in the population ("scale invariance"), but it also changes if income transfers are made from the rich to the poor and vice versa ("principle of transfers"). In addition, because the change in T depends on the ratio of the incomes weighted by its natural logarithm, the lower the level of income, the more sensitive T is to transfers, so that if it is assumed that income has diminishing marginal utility (that is, an income transfer at higher income levels is less significant than the same transfer at lower income levels), the T well represents "the welfare principle" in its formulation.

The most relevant feature of the Theil index for this study, however, is the fourth criterion for an ideal inequality measure, additive decomposability. As seen in Eq. 2, the Theil index has a sort of fractal structure in which the total inequality can be additively decomposed into two independent parts—between-group and within-group inequalities—however the group is defined. Specifically, T as defined in Eq. 1 is a weighted sum of the between-group index value and the within-group index value:

$$T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i}{\bar{x}}\right)\ln\left(\frac{x_i}{\bar{x}}\right) = \sum_{j=1}^{J} p_j\left(\frac{\bar{x}_j}{\bar{x}}\right)\ln\left(\frac{\bar{x}_j}{\bar{x}}\right) + \sum_{j=1}^{J} p_j\left(\frac{\bar{x}_j}{\bar{x}}\right)T_j \tag{2}$$

where p_j is the population share of group j, $\bar{x}_j$ the group-specific mean, and T_j is the Theil index for group j. Since the primary goal of this study is to analyze the rising earnings inequality of post-crisis South Korea in terms of the amount of inequality attributable to one's level of education, the Theil index and its decomposed values by the three education groups will provide empirical evidence to test the hypotheses.

Results

As can be seen in Fig. 4 and Table 3, the total earnings inequality of South Korea measured by the Theil index continuously increased between 1997 and 2006 from 0.151 to 0.280 (an almost 85 % increase over the decade). While the increase in the early period of recovery from the crisis (1999–2002) is rather modest, the changes are considerable for the rest of the post-crisis decade, particularly after 2004.

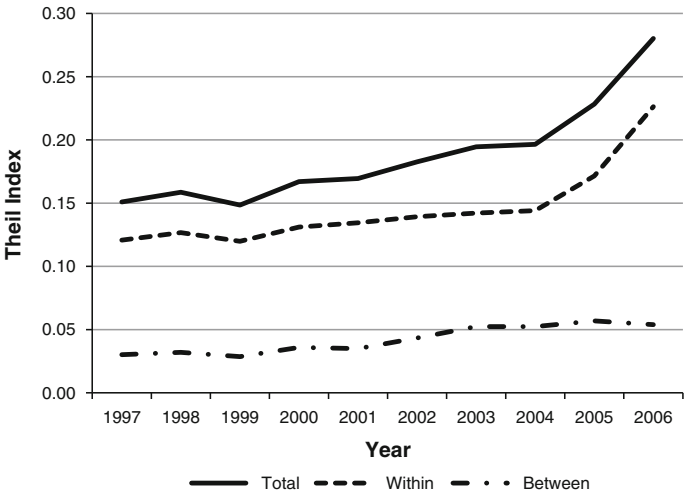

Fig. 4 Theil index decomposition by education level, 1997–2006

What is notable about the change, however, is the amount of the increased inequality attributable to the rising within-group inequality. Although between-group inequality also substantially contributed to the increase in total inequality (18.6 %), most of the increase (81.4 %) was due to the rising inequality within each education group.[8] In other words, contrary to the expectations of the SBTC argument, what has primarily driven the increasing earnings inequality in South Korea is not the increase in between-education-group inequality but the rising earnings inequality within each group.

This leads to another question: which education category contributed most to the rising within-group inequality? Based on the Theil index decomposition equation discussed above, the contribution made by each education group to the rising total within-group inequality during the period is presented in Fig. 5.

Although the inequality of all three education groups increased during the defined period, earnings inequality within the least educated group (high school or below) was the largest, followed by the most educated group (4-year college or above) and the middle group (2- or 3-year junior college).[9] Once again, contrary to the expectations of the SBTC argument, which implies a consolidation of earnings levels within each education category, both the most educated and the least educated groups have experienced a substantial rise in earnings inequality, and the amount of the increase over the defined period is larger for the least educated group. The details of the rising earnings inequality for each education group are presented in Table 4.

In sum, despite the robust association between earnings and level of education during the decade after the financial crisis in South Korea, most of the increase in overall inequality is due to the increase in within-education-group inequality, and the facts and analysis results do not seem to support the idea that SBTC was the main driver of rising

[8] Between-group contribution = (0.054 − 0.030)/(0.280 − 0.151) = 0.186; within-group contribution = (0.226 − 0.121)/(0.280 − 0.151) = 0.814.

[9] The sum of the three within-group inequalities weighted by its income share in the distribution is the total within-inequality presented in Table 4. For example, for 2006, the total within-group inequality (0.226) = (0.284 × 0.514) + (0.128 × 0.100) + (0.175 × 0.386).

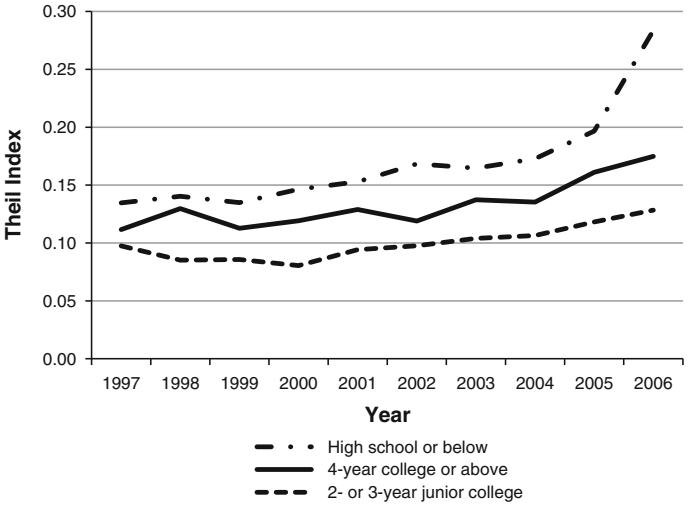

Fig. 5 Inequality trends by education level, 1997–2006

Table 3 Theil index decomposition by education level, 1997–2006

Years	Total	Within	Between
1997	0.151	0.121	0.030
1998	0.159	0.127	0.032
1999	0.148	0.120	0.029
2000	0.167	0.131	0.036
2001	0.169	0.135	0.035
2002	0.183	0.139	0.043
2003	0.195	0.142	0.052
2004	0.196	0.144	0.052
2005	0.228	0.171	0.057
2006	0.280	0.226	0.054

Table 4 Inequality trends by education level (Theil index), 1997–2006

Years	High school or below	2- or 3-year junior college	4-year college or above
1997	0.135	0.097	0.106
1998	0.140	0.085	0.115
1999	0.135	0.086	0.102
2000	0.146	0.081	0.119
2001	0.153	0.094	0.114
2002	0.168	0.098	0.107
2003	0.165	0.104	0.121
2004	0.173	0.106	0.117
2005	0.197	0.118	0.152
2006	0.284	0.128	0.175

inequality during this decade in South Korea. This demands not only renewed attention to the role of education in earnings inequality, but also additional study of rising earnings inequality in general, if we are to fully account for the changing dynamics of inequality in post-crisis Korea.

Conclusion and discussion

Since the 1980s, most countries, both industrial and industrializing, have experienced a substantial rise in within-nation income inequality (Firebaugh 1999, 2003; Goesling 2001). Some argue that this trend is primarily due to the diverging earnings returns to education in favor of highly educated workers—which is, in turn, driven by SBTC and globalization—while others argue that changes in institutions, norms, and political power have altered the association between education and earnings inequality to the advantage of those in power. Both perspectives acknowledge the strong positive association between education and earnings inequality at the cross-sectional level. What has been contentious is whether this association is invariable over time and space, and to what extent the observed rising earnings inequality, or changing earnings inequality in general, is associated with level of education. Given the well-established positive association between education and earnings inequality, it may seem safe to assume that education must have played a significant role in rising earnings inequality as well. But it is often the case that assumptions do not stand up to empirical scrutiny.

This study has examined the experience of South Korea in the decade after the 1997 Asian financial crisis as an empirical case we can use to judge between two competing explanations of education's relationship to rising earnings inequality. South Korea has experienced a rapid increase in income inequality since the mid-1990s, and this trend accelerated after the 1997 crisis, when the country underwent a series of radical institutional reforms, becoming a more globally integrated liberal economy. Under this new institutional arrangement, wherein marketable skills are supposed to yield higher economic returns than before, individuals with more socioeconomic resources are better positioned to take advantage of various opportunities; thus, it is expected that the highly educated, who possess one of the most crucial socioeconomic resources in the capitalist economy, may have gained more from the post-crisis economic recovery, contributing to the increase in inequality. In other words, if the rising earnings inequality of post-crisis South Korea is indeed due to SBTC and globalization favoring highly educated workers, as argued by marketists, the observed increase in earnings inequality ought to be significantly associated with level of education in the environment created by the post-crisis socioeconomic restructuring (Blau and Kahn 2002).

Against this particular temporal and spatial context, this study has analyzed the dynamics between education and rising earnings inequality and documented that, despite the robust relationship between the two, the greatest portion of the increase in earnings inequality in post-crisis South Korea is primarily attributable to the rise in within-education-group inequalities. Over 80 % of the increase in the overall level of earnings inequality between 1997 and 2006 is due to the sharp rise in within-group inequalities for all three education categories. Thus, the role of education in the rising earnings inequality of post-crisis South Korea was insubstantial at best, and if we want to properly understand the processes and mechanisms of post-crisis earnings inequality, it is necessary to investigate institutional factors other than education that have contributed to the rising within-group inequality.

What institutional factors, then, are potential candidates that merit further investigation in this respect? Given the nature of earnings inequality, they can be classified into two groups that are not mutually exclusive, both of which contribute to rising inequality with different dynamics: (1) factors that favor employers and capital at the expense of labor (for example, the casualization of labor and a regressive tax system), and (2) factors that further disadvantage labor at the bottom of the income strata (for example, weak social safety nets and conditional welfare provisioning). To be more specific, according to the experience of western countries that underwent a similar set of neoliberal reforms before South Korea (for example, the United States after Reagan and the United Kingdom after Thatcher), the decline of organized labor, stagnation of the minimum wage, casualization of labor, and shrinking welfare benefits—the consequences of the ongoing neoliberal restructuring effort for labor market "flexibility"—have been pointed out as prominent factors that have contributed to rising earnings inequality since the 1980s (Card and DiNardo 2002; Card et al. 2004; DiNardo et al. 1996; Kenworthy 2004; Lee 1999; Morris and Western 1999). In particular, the decline of organized labor has been singled out as a critical institutional factor having had as much impact on rising earnings inequality as differential earnings returns to education in the United States (Card 2001; Western and Rosenfeld 2011).

Three institutional and structural factors are particularly significant to the rising earnings inequality in post-crisis South Korea: (1) casualization of labor (increasing use of temporary and nonregular workers over regular workers on permanent contracts), (2) differences in employment quality and stability by firm size, and (3) a historically underdeveloped social safety net and welfare system. First, over 90 % of all new jobs created between 1998 and 2002 were nonpermanent, and wages for nonregular workers have remained stagnant, while regular workers saw their wages grow at close to double-digit rates over the same period (IMF 2004, pp. 34–36). The proportion of temporary and nonregular workers (46 %) was already high in South Korea compared to other OECD countries before the crisis (OECD 2000), and the acceleration in the casualization of labor after the crisis has worsened the earnings inequality between regular and nonregular workers.

Second, differential employment quality and stability by firm size has further contributed to the widening inequality among wage workers. Regular workers employed by large firms in South Korea have been traditionally well protected compared to their counterparts in small and medium-size firms, and the gaps in earnings and employment security between the two groups widened in the wake of the 1997 crisis (Koo 2001). Lastly, unlike in the United Kingdom or the United States, the neoliberal restructuring of post-crisis South Korea occurred in the virtual absence of the welfare state. While the implementation of neoliberal policy measures in the United States and the United Kingdom was reactionary to the expansion of the Keynesian welfare state in each context prior to the 1970s, the introduction of neoliberalism in South Korea was rather exogenous, having been implemented as a response to the problems of the former dirigiste state, which was devoid of any collective welfare system. Accordingly, the initial level of welfare benefits was substantially lower in South Korea, and it has remained low throughout the restructuring period due to the very logic of the neoliberal state (Cumings 1979; Gills 2000; Goodman et al. 1998). This has exposed a substantial portion of the Korean population to the double jeopardy of under-protection and diminishing institutional supports, which further disadvantages workers on the bottom income strata.

Unless the institutional and structural changes listed above are taken into account—keeping in mind that this list is by no means exhaustive—it is not possible to fully understand the dynamics of the rising earnings inequality in post-crisis South Korea in

particular, and the changing contours of earnings inequality across the globe observed under the current mode of capitalist development in general. While an analysis premised on the supply and demand of educated workers provides critical insights for the understanding of earnings inequality at the cross-sectional level, its explanatory power regarding variation in this relationship over time and space is limited. This is because what actually varies with changing earnings distribution is not so much the diverging earnings returns to education, but the institutions, social norms, and political power that ultimately define the association between education and earnings.[10] It is clear that education is a significant determinant of earnings inequality. What requires further investigation is how the association is embedded in an institutional and organizational context, and the extent to which the robust relationship between education and earnings inequality is moderated or modified by differential wage-setting institutional arrangements and social policies.

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[10] If we are interested in the changing dynamics of household income, it would also be critical to consider changes in total household income, household members' employment conditions, and family composition (Kenworthy 2007).

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