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Intergenerational Mobility of Earnings in South Korea

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Abstract

The purpose of this study is to estimate the extent of intergenerational mobility of earnings in the Republic of Korea (South Korea), using household microdata. The estimation result suggests that the elasticity of the son's earnings with respect to the father's earnings is 0.24 or less for sons around age thirty, using multiyear averages and the simulation extrapolation (SIMEX) method to treat the measurement error of father's earnings. Two-stage estimates using the predicted father's earnings suggest that the elasticity is about 0.25 when sons are in their thirties, and about 0.35 for sons aged 25–54. The estimates are slightly higher for daughters. Nonparametric regression of father-son log earnings illustrates a gentle convex curve for younger cohorts and a nearly linear relation for elder cohorts.

JEL classification: D31, J62

Keywords: intergenerational mobility, measurement error, simulation extrapolation

1. Introduction

This study aims to estimate the extent of intergenerational mobility of earnings in the Republic of Korea ("Korea," henceforth). Korea is well known for having achieved remarkable economic growth in the last half century. At the same time, it has witnessed a relatively low inequality: the GINI indicator for Korea was 31.6 in 1998, which was lower than 40.8 for the United States in 2000, but slightly higher than 24.9 for Japan in 1993 and 25.0 for Sweden in 2000.[1] Recent studies have paid more attention to economic inequality in addition to economic performance of Korea as a mature economy (e.g., Jung, 1992; You, 1998; Fields and Yoo, 2000).

The extent of intergenerational transmission of economic status from parents to their children is considered as one of the measures of inequality of economic opportunity. Individual economic status, such as lifetime earnings, may be affected by innate ability, ability acquired by education, family background, or preferences for occupation and life-style. In a society with a high correlation between parental and children's economic status, one's upbringing and family background are likely to affect one's economic success. When the intergenerational economic relation is weak, the inequalities of economic opportunity are likely to be small, and children's economic status may be relatively independent of parental economic status.

Following the seminal work of Solon (1992) and Zimmerman (1992), an increasing number of international studies contributed to the estimation of elasticity of offspring's earnings with respect to parental earnings, focusing on the measurement error problem. According to these studies, the estimated elasticity seems to vary across societies. The elasticity is estimated to be as high as 0.4–0.6 for the United States (Solon, 1992; Zimmerman, 1992), Britain (Dearden, Machin, and Reed, 1997), Italy (Mocetti, 2007; Piraino, 2007), and Brazil (Dunn, 2007). Meanwhile, relatively low estimates of 0.3 or less are found for the Scandinavian countries (Björklund and Jäntti, 1997; Bratberg, Nilsen, and Vaage, 2005; Bratsberg, Røed, Raaum, Naylor, Jäntti, Eriksson, and Österbacka, 2007), Canada (Corak and Heisz, 1999), and Australia (Leigh, 2007). Regarding the East Asian countries, the estimates are 0.41–0.46 in the case of Japan (Ueda, 2009) and at least 0.23–0.28 in the case of Singapore (Ng, 2007).

This paper estimates the intergenerational elasticity of earnings in the case of Korea, using two types of samples: One type consists of observed earnings of a father-son pair in the same household and is analyzed by the multiyear averages

[1] Source: World Development Indicators Online.

approach and the instrumental variables approach proposed by Solon (1992), and the simulation extrapolation method proposed by Cook and Stefanski (1994). The other type consists of observations that provide information on the father's characteristics and is analyzed using predicted father's earnings, applying the two-stage method proposed by Björklund and Jäntti (1997).

The estimation result from father-son pairs using multiyear earnings suggests that the elasticity is at most 0.24 with sons around age thirty. Two-stage estimates using predicted father's earnings suggest that the elasticity is about 0.25 when sons are in their thirties and about 0.35 for sons aged 25–54. The estimation results are slightly higher for daughters.

Recent studies have also considered nonlinear relations. Studies in some societies find a linear relation (Bratberg et al., 2005, in the United States and Britain), while others find S-shaped or convex curves (Corak and Heisz, 1999, in Canada; Bratsberg et al., 2007, in Norway; Ueda, 2009, in Japan). The latter case illustrates low elasticity for low-income families; that is, children from lowest-income families face similar economic opportunity as those from moderately low-income families, and this reduces the overall intergenerational elasticity. In the case of Korea, nonparametric regression shows a convex curve for younger cohorts, but an almost linear relation for elder cohorts.

Finally, quantile regression is applied to examine the intergenerational elasticity among the distribution of son's earnings conditional on father's earnings. Some studies find that the elasticity is higher in lower quantiles than in higher quantiles (Eide and Showalter, 1999; Fertig, 2003; Grawe, 2004b, in the United States and Canada), while others find no apparent relation between the elasticity and quantiles (Grawe, 2004b, in Germany and Britain; Ueda, 2009, in Japan). In the case of Korea, no apparent relation is found by quantile regression.

The remainder of this paper is structured as follows: Section 2 describes the empirical framework following the relevant literature. Section 3 explains the data sources and variables. Section 4 presents estimates of the intergenerational elasticity in Korea. Section 5 presents the nonlinear regression and quantile regression results. Section 6 provides a summary.

2. Framework of Empirical Analysis

2.1 Basic Framework to Estimate Intergenerational Mobility

Recent studies on intergenerational mobility mostly follow the empirical framework proposed by Solon (1992). Let y_{0i} denote the lifetime economic status of the parent, and y_{1i} denote that of the offspring in family i. The economic status is usually represented by log earnings or income. The intergenerational economic status relationship is expressed as

$$(1) \qquad y_{1i} = a_0 + \rho y_{0i} + \varepsilon_i ,$$

where a_0 is a constant, ε_i is an error term, and ρ indicates the intergenerational elasticity of offspring's earnings with respect to parental earnings. However the lifetime economic status is not usually observed by statisticians. They observe the short-term economic status (e.g., annual earnings) of the offspring y_{1it} at time t and that of the parent y_{0is} at time s for family i. When the age (or experience) effect is considered, the short-term economic status of the offspring is expressed as

$$(2) \qquad y_{1it} = y_{1i} + a_1 A_{1it} + a_2 A_{1it}^{\ 2} + u_{1it} ,$$

where A_{1it} is the age of the offspring i at time t, a_1 and a_2 are coefficients, and u_{1it} is an error term. The short-term economic status of the parent is similarly expressed as

$$(3) \qquad y_{0is} = y_{0i} + b_1 A_{0is} + b_2 A_{0is}^{\ 2} + u_{0is} ,$$

where A_{0is} is the age of the parent i at time s, b_1 and b_2 are coefficients, and u_{0is} is an error term. Substituting equations (2) and (3) into equation (1), the short-term economic status of the offspring is expressed as

$$(4) \qquad \begin{aligned} y_{1it} &= a_0 + \rho y_{0is} + a_1 A_{1it} + a_2 A_{1it}^{\ 2} - \rho b_1 A_{0is} - \rho b_2 A_{0is}^{\ 2} + \{\varepsilon_i + u_{1it} - \rho u_{0is}\} \\ &\equiv \ a_0 + \rho y_{0is} + a_1 A_{1it} + a_2 A_{1it}^{\ 2} + \tilde{b}_1 A_{0is} + \tilde{b}_2 A_{0is}^{\ 2} + \tilde{\varepsilon}_i . \end{aligned}$$

Then the elasticity ρ is estimated using short-term economic status and the ages of the offspring and the parent. However, an OLS estimate of ρ may be downward biased because of the measurement error caused by the correlation between y_{0is} and $\tilde{\varepsilon}_i$.

Solon (1992) proposes two approaches to eliminate the downward bias. One approach is to apply a several-period average to y_{0is} .Although the estimate is still downward biased, the bias can be reduced. Another approach is the instrumental variables (IV) estimation using education or social status of the parent as instruments. An IV estimate may be upward biased if the parental education (or social status) is positively correlated with ε_i. Therefore, it is considered that an estimate using a several-period average is a lower bound and that an IV estimate is an upper bound of the intergenerational elasticity. Mazumder (2005), however, suggests that estimates using fairly long-term averages, such as 15 years, are close to the IV estimates.

Furthermore, this paper introduces the simulation extrapolation (SIMEX) method proposed by Cook and Stefanski (1994), which is applicable when replicated measurements, such as multiyear earnings, are observed. SIMEX is a simulation-based estimation method that reduces the bias caused by measurement error; however, it adds an additional error to the data in a resampling-like stage, and extrapolates back to the case without measurement error (Carroll et al., 2006).

2.2 Two-Stage Approach using Predicted Economic Status of Parent

In order to estimate equation (4), both offspring's and parental earnings should be observed. In this case, the analysis requires a long-run survey that involves the earnings of two generations in a household.

Björklund and Jäntti (1997) propose a two-sample two-stage approach that applies predictive earnings from parental characteristics such as education and occupation, as an imperfect substitute for parental earnings. Assuming that the lifetime economic status of the parent y_{0i} is explained as a vector of the parental characteristics q_{0i} associated with a vector of coefficient α, y_{0i} is substituted by $q_{0i}\alpha'$. In the first stage, α is estimated using wage surveys that include earnings, age, and individual characteristics. In the second stage, the lifetime economic status of the parent y_{0i} is predicted by $q_{0i}\hat{\alpha}'$, where $\hat{\alpha}$ is an estimate of α. Then an estimated equation using prediction $\hat{y}_{0i}$ is

(5) $$y_{1it} = a_0 + \rho \cdot \hat{y}_{0i} + a_1 A_{1it} + a_2 A_{1it}^{\ 2} + \{\varepsilon_i + u_{1it}\}\ .$$

This approach enables an estimation using cross-sectional data without observing actual parental earnings, provided that the parental characteristics are observed. Furthermore, this approach is similar to the IV estimation in that it may lead to an upward bias (Solon, 2002). Therefore, an estimate of the two-stage approach is also considered as an upper bound of the elasticity.

3. Data used in the Analysis

Data are obtained from the 1998–2006 rounds of the Korean Labor & Income Panel

Study (KLIPS) conducted by the Korea Labor Institute. KLIPS is a longitudinal survey of the labor market and income activities of households and their members in urban areas. The 1998 survey includes 5000 households with 13,321 members aged 15 or older. Supplemental data are obtained from 1993–97 rounds of the Korean Household Panel Study (KHPS) undertaken by the Daewoo Economic Research Institute, for the purpose of comparison before and after the financial crisis of late 1997 to the early 1998.[2] For this reason, the final round of KHPS in 1998 is not used. The 1993 round of KHPS includes 4547 households with 10,460 members aged 18 or older from all over Korea. In both surveys, parental economic status is represented by father's earnings because in Korea mothers are often homemakers. Observations with positive earnings are selected, and non-working observations are excluded. The ages of the offspring at the point of observation are restricted to 25–54, which is the period when most men are working.

This paper analyzes two types of samples: The first one includes father-son pairs living together in the initial round of KLIPS and KHPS.[3] If a father lives with two or more sons, the eldest son is selected. The sample is analyzed using multiyear averages, SIMEX, and the IV approach.

An advantage of the father-son paired sample is that it observes the actual earnings of fathers. Meanwhile, the observations are restricted to pairs living together, at least in the first round. Moreover, earnings are measured at relatively late ages for fathers and early ages for sons. It is generally agreed, however, that the age at the point of observation affects the estimates of intergenerational elasticity (Solon, 2002; Mazumder, 2005; Grawe, 2006; Haider and Solon, 2006). The estimates tend to be lower when the short-time economic status of a son is measured at an early age, such as the early twenties. In order to reduce the life-cycle bias, Haider and Solon (2006) suggest using the early thirties to mid-forties for sons, and Grawe (2006) suggests approximately age forty for both sons and fathers at the point of observation. In the analysis, earnings are retrieved from the early rounds (e.g., 1998) for fathers, and from later rounds (e.g., 2006) for sons, as far as possible.

Another type of sample consists of observations of information from KLIPS on fathers' characteristics, in which individual respondents report their father's education and occupation when respondents were at the age of 14. The sample is analyzed using

[2] The financial crisis is considered to have had an influence on business and employment practice in Korea, and possibly also on economic opportunity.

[3] It is a tradition in East Asian countries that never-married sons and daughters often continue to live with their parents after graduating from school. Also, the eldest son often lives with his parents after his marriage, in order to take care of them.

the two-stage approach. An advantage of this type is that it obtains a large number of observations, including a wide range of sons' ages. A disadvantage of this approach is that the actual earnings of fathers are not observed.

In addition to the father-son relation, the father-daughter relation is also analyzed using prediction. The sample consists of married daughters in the initial round. The economic status of a daughter is measured by the earnings of her husband, because the labor force participation rates of married women are much lower than those of men, and in Korea the majority of women get married in the course of their life.[4]

Earnings are obtained from "average monthly earnings from main job" and "total annual earned income," as reported in KLIPS. The former is reported as monthly average salary after taxes for the employed, and monthly average net income for those who are self-employed. The latter is reported as earned income in total during the previous year after taxes.[5] As an earnings measure, the latter may be preferable as actual earnings received, but it was surveyed only in the 2003–2006 rounds, whereas the monthly main-job earnings are surveyed throughout the survey. Similarly, the average monthly earnings are retrieved from KHPS; they include total monthly salary with allowances and overtime payment for wage-earners, net income for non-wage earners, and revenue excluding costs for farmers and fishermen. Earnings are converted in real terms using the Consumer Price Index.

The father's characteristics include education and occupation. The education of the father is captured by dummy variables from junior high school, senior high school, junior college, and university, using elementary school as the base. The occupational characteristics are captured by dummy variables for managers, professionals, technicians, sales workers, service workers, craft and trade workers, plant workers, and elementary occupations for the regularly employed, as well as primary industrial workers, the temporary-employed, and the self-employed, using regularly employed clerks as the base.

Table 1 reports the summary statistics of age at the point of observation for father-son pairs. Regarding the sample from KLIPS, the average age of sons is approximately 31 and that of fathers is approximately 54 in the case of monthly main-job earnings in 1998 and 58 in the case of annual total earnings in 2003. The sample from KHPS shows similar characteristics.

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4 Labor force participation rate is 50.2 for women (74.0 for men) in 2007, and the percentage of women aged 40–44 that never married was 2.6% in 2000 in Korea (National Institute of Population and Social Security Research, Japan).

5 Annual earned income before taxes is also analyzed, but the result is similar to using income after taxes.

4. Estimation Results of Intergenerational Elasticity

4.1 Estimation Result of Father-Son Pairs

Table 2 presents estimates of the elasticity using the sample of father-son pairs from KLIPS. Case (A) applies the latest earnings of sons, in order to measure earnings at upper ages as far as possible. Case (B) applies the average earnings of sons when they are positive, so as to reduce the measurement error of the dependent variable; applied age is also an averaged age. The instruments are educational dummy variables for IV estimation.[6]

The estimates with single-year earnings are less than 0.1, whereas estimates using multiyear earnings are at most 0.24. The SIMEX estimates are close to the estimates using multiyear averages. The estimates using annual total earnings are around 0.2, which is slightly higher than those using monthly main-job earnings, which are around 0.15.

IV estimates using monthly main-job earnings are around 0.19, which is close to the multiyear estimation. In contrast, IV estimates using annual total earnings are around 0.39–0.46, which is the highest.

Table 3 reports the estimation result using father-son pairs from KHPS before the financial crisis. Regarding the sons, the latest earnings are applied. The estimate is at most 0.12. Compared to the result from KLIPS in Case (A) in Table 2, the estimates from KHPS are closer to those using single-year or two-year averages.

4.2 Estimation Result of Sons by using Prediction

Table 4 reports the estimates of elasticity using the two-stage approach with the predicted earnings of the father. In the first stage, the earnings equations are estimated using the pooled data of working men aged 25–54, from KLIPS.[7] Subsamples according to the son's age group are also used to confirm the age effect at the point of observation.

The estimates vary across the age groups of sons. When the earnings of sons are measured at an early age, the estimates are fairly low: the estimates for sons aged 25–34

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6 Occupational characteristics are not used because of considerable number of missing cases.

7 R^2 of the OLS estimate is 0.22–0.24.

are 0.13–0.20 and 0.22–0.25 for sons aged 30–39. These estimates are similar to those using the multiyear earnings in Table 2 when the sons' average age is 31–32. On the other hand, the estimates for sons aged 45–54 exceed 0.4. On comparing cases (A) and (B), averaging son's earnings seem to reduce variation among age groups and standard errors, whereas estimates using annual total earnings look similar except for upper age groups.

Regarding the sample of ages 25–54, the estimates are 0.28–0.30 using monthly main-job earnings and 0.36–0.39 using annual total earnings. The difference seems to be caused by different estimates in the upper age groups. Table 5 reports the estimates using a sample in which both the types of earnings are observed. The result confirms that the estimates using annual total earnings are higher than those using monthly main-job earnings for sons aged around fifty, but not for those aged in their thirties or early forties. One possible explanation is that sons in the upper age groups are more likely to be engaged in jobs such as self-employment, in which earnings fluctuate over time, or are engaged in a side business in addition to their main job. If we select annual total earnings in Case (B), the suggested elasticity is likely to be around 0.25 for sons in their thirties and 0.35 for the entire sample aged 25–54.

One limitation of the analysis is that the estimated earnings equation using KLIPS survey for 1998–2006 may not accurately predict the earnings of fathers in earlier periods, particularly in a rapidly growing economy like Korea. Table 6 reports an estimation result using the average annual earnings of men aged 40–44, according to education and occupation in 1982 from a national survey, as predicted father's earnings.[8] The table also reports estimates applying OLS prediction using average earnings according to a 5-year age group, education, and occupation, also from the 1982 national survey. Monthly main-job earnings are used for the earnings of son, because father's earnings are occupational earnings. The estimation results are mostly similar to those in Table 4. The estimate is also calculated using various years from 1975–1985: the estimation results vary across the survey years, but the estimates are closer to or lower than the estimates in Table 4.

4.3 Estimation Result of Daughters by using Prediction

[8] *Report on Occupational Wages Survey* 1983, Ministry of Labor, Government of Korea. The data are restricted to regular employees; self-employed, temporary employed, and primary sector workers are assumed to have the same wage level as clerical workers, elementary workers, and service workers, respectively. Also, professionals and technicians are one category, and craftsmen, tradesmen, and plant workers are in another category.

Recent studies have investigated the intergenerational relation of parent-daughter pairs, in addition to father-son pairs. Chadwick and Solon (2002) report lower elasticity for daughters than for sons in the case of the United States, while Dearden et al. (1997) report the opposite result in the case of Britain. In the case of East Asia, Ueda (2009) finds lower elasticity for daughters than for sons.

Table 7 reports the estimates in the case of married daughters, using predicted father's earnings. The earnings and ages of offspring are those of the husband. The results indicate that the elasticity is slightly higher for daughters than for sons. For ages 25–54, the estimates are 0.39–0.46 for daughters, whereas the estimates for sons are 0.28–0.39 as shown in Table 4. Focusing on those in their thirties, the estimates are 0.26–0.37 for daughters and 0.22–0.25 for sons.[9]

4.4 A Discussion Arising from an International Comparison

The estimates of intergenerational elasticity vary among studies even for the same country, depending on data sources, estimation methods, or age at the point of observation. Nonetheless, an increasing number of international studies help to show an outline of mobility.

Focusing on the father-son relation with sons in the thirties at the point of observation, the estimation result suggests that Korea is a relatively mobile society among advanced countries. Regarding the father-son relation using the multiyear approach, the estimate of 0.24 in Korea seems to be almost equivalent to the estimates in the cases of Canada, Sweden, and Finland (Table 1 in Solon, 2002), and lower than the estimate of 0.4 for sons aged 25–33 in the case of the United States (Solon, 1992). Using the two-stage approach, the estimate of 0.22–0.25 for sons aged 30–39 seems to be almost comparable to the estimate in the case of Sweden by Björklund and Jäntti (1997) who report an elasticity of 0.28 for sons aged 29–38. Meanwhile, this estimate seems to be lower than the estimates of 0.39–0.44 for sons aged 33 in the case of Britain by Dearden et al. (1997), and the estimate of 0.5 for sons in their thirties in the case of Italy by Mocetti (2007). Among East Asian countries, the estimate for Korea is lower than those of 0.41–0.46 in the case of Japan by Ueda (2009). In the case of Singapore (Ng (2007)), the estimates of 0.23–0.28 may have been underestimated due to the data limitations of young sons aged 23–29.

However, the estimation result also suggests that such a view may be somewhat

9 One possible reason may be related to the role of matchmaking: in Korea, daughters and their parents may regard the husband's economic status as important.

misleading. First, it should be noted that, in the case of Korea, estimates for daughters are higher than those for sons; mobility in Korea is reduced when daughters are included in the sample. Second, estimates measured for upper age groups are considerably higher than those measured in the thirties or younger. In the case of Korea, further investigation is necessary to establish whether the estimated elasticity in the thirties represents the intergenerational relation of lifetime economic status. This problem is partly investigated in the next section.

5. Variation in Mobility

It has been presumed that there is a common elasticity for all intergenerational pairs. However, it is possible that offspring under different circumstances are influenced by parental economic status to different extents. In other words, offspring from different families may face a different intergenerational elasticity. This section examines intergenerational elasticity, focusing on variation in mobility.

5.1 Nonlinearity in Mobility

It has been assumed that the intergenerational relation of log earnings is linear. Recent studies, however, suggest that a nonlinear relation exists in some societies.[10] This implies that intergenerational mobility may differ among low, middle, and high-income families. Now, the relation equation (1) is rewritten as

(6) $$y_{1i} = f(y_{0i}) + \varepsilon_i \,.$$

A limitation of nonlinear estimation is that the measurement error of covariates is in the nonlinear function. In that case, IV approach may not be used.[11] Carroll et al. (2006) introduced various estimation methods for a nonparametric regression model with measurement error in covariates. This study applies the SIMEX method with splines and the Bayesian MCMC (Markov Chain Monte Carlo) method, also with splines, to the father-son paired sample from KLIPS.[12] These methods require

[10] Corak and Heisz (1999) use local regression (locfit), Grawe (2004a) applies a spline method, and Raaum et al. (2007) apply a polynomial function.

[11] Y. Amemiya (1985) points out that the estimator for nonlinear simultaneous equations model proposed by T. Amemiya (1974) is inconsistent in the case of the error-in-variables model.

[12] This paper is indebted to MATLAB programs offered by Raymond J. Carroll's Webpage (http://www.stat.tamu.edu/~carroll/) accessed on Sep. 19, 2000. SIMEX estimate is iterated 100 times, and MCMC estimate is the mean of 5000 iterations after 5000 burn-in iterations. The degree of spline is

replicated data for covariates, but the number of replicates may vary among individuals. Therefore, the sample consists of father-son pairs in which the earnings of fathers are observed for at least two years.

The analysis applies age-adjusted log earnings using estimates of the earnings equation.[13] In the case of son's earnings, averages are applied. The average of observation years is 6.3 using the monthly main-job earnings during 1998–2006 and 3.5 using the annual total earnings during 2003–06.

Figure 1 illustrates the naïve fit of splines without considering measurement error, SIMEX fit, and Bayesian MCMC fit for the father-son paired sample. Both naïve fit and SIMEX fit illustrate a gentle S-shaped curve in the case of monthly main-job earnings and gentle convex curves in the case of annual total earnings, although the SIMEX fit is steeper than the naïve fit. The figure suggests that middle-income families face higher elasticity than low-income families. Using monthly main-job earnings, the MCMC fit is even steeper than the SIMEX fit for middle-income families, but it shows a different relation for low and highest income families.[14]

Figure 2 illustrates naïve fits using the prediction sample according to the sons' age group. Regarding the sons in their late twenties and thirties, the nonlinear fits illustrate convex curves, similar to the naïve and SIMEX fits with the paired sample. Meanwhile, regarding the sons in their forties or older, the fits look nearly linear or show very gentle concave curves, which is rather similar to the MCMC fit with the paired sample. Focusing on high-income families, the relation looks nearly linear and the slopes of the fits look similar, regardless of the son's age.

Table 8 lists the linear estimation results for the upper half and lower half of fathers' predicted earnings, with the cutting point as the median of the entire sample. The table confirms the nonlinear relation illustrated in the figures. The estimates using upper-half subsamples are similar across age groups, but those using lower-half subsamples vary with large standard errors.

One question is whether the difference among sons' age groups arises from an age effect or a cohort effect. To investigate the changes over time for the same cohort, the selected sample includes sons for whom monthly main-job earnings in both 1998 and 2006 are observed. The number of observations is 626 for younger cohorts aged 36 (44) or younger, and 560 for upper cohorts aged 37 (45) or older in 1998 (2006). The estimated elasticity of linear analysis rises from 0.118 to 0.229 for younger cohorts and

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[13] Nonparametric method is applied to obtain smooth and stable estimation of the function $f(\cdot)$, although the semiparametric method by Carroll et al. [6] is also available.

[14] MCMC fit does not appear in the figure in the case of annual total earnings due to undersmoothing.

from 0.269 to 0.476 for elder cohorts in eight years.

Figure 3 compares the naïve fits by cohort. The nonlinear relation looks similar between 1998 and 2006, although the slope becomes steeper. High-income families face higher elasticity than low-income families in younger cohorts, whereas low-income families in elder cohorts face higher elasticity. The difference in nonlinear relation seems to arise from a cohort effect rather than an age effect, although the comparison is limited to the transformation in eight years.

If the cohort effect exists, one possible explanation of the cohort difference may be sought in the structural changes in the Korean economy under rapid economic growth.[15] Economic growth may have created better opportunities for the younger generation of lowest-income families.

An additional implication is that the elasticity in Korea may fall over time. If the relation has shifted from a linear one to a convex one, then it is possible that Korea has shifted to a more mobile society, especially by providing better opportunity for the sons of lower-income families.

5.2 Quantile Regression

Classical regression estimates conditional mean models. Meanwhile, quantile regression estimates conditional quantile functions (e.g., Koenker, 2005; Koenker and Hallock, 2005; Hao and Naiman, 2007). Quantile regression is useful for examining possible variations among conditional distributions. The least-squares method minimizes

$$\sum_{i=1}^{N}\{y_{1i}-f(y_{0i})\}^2,$$

while the p-th quantile regression minimizes

$$p\sum_{y_{1i}\geq f(y_{0i})}|y_{1i}-f(y_{0i})|+(1-p)\sum_{y_{1i}<f(y_{0i})}|y_{1i}-f(y_{0i})|.$$

Quantile regression is applied to estimate linear equation (5) with the prediction of father's earnings. However, nonlinear analysis suggests that for low-income families, the elasticity varies depending on the son's age. Therefore, quantile regression is also applied to subsamples restricted to fathers with upper-half earnings.

Table 9 presents the quantile regression estimates of the elasticity at 10%, 25%, 50%, 75%, and 90%. Using the monthly main-job earnings, elasticity in the upper

[15] Labor income inequality in Korea is reported to have declined in the 1970s and 80s using national firm surveys (Kim and Topel, 1995; Fields and Yoo, 2000), although the trend is inconclusive using household income surveys (Jung, 1992).

quantiles tends to be higher than in the lower quantiles, particularly for the upper-half earnings subsample. However, using annual total earnings, the relation between the elasticity and quantiles seems to be the opposite. The result seems to be inconclusive regarding the relation between quantiles and elasticity.

6. A Summary

This paper has investigated the intergenerational mobility of earnings in Korea. Intergenerational elasticity can be a measure of economic opportunity and can indicate the extent to which a society offers equal economic opportunity. The estimation result using multiyear earnings suggests an elasticity of 0.24 or less for sons around age thirty, and two-stage estimates suggest an elasticity of around 0.25 for sons in their thirties. The estimates seem to be moderately low in comparison with Western and East Asian advanced economies. In this respect, Korea is likely to be a society that offers moderately equal opportunity.

However, the estimation result also suggests other considerations. Higher estimates for daughters than for sons are likely to reduce the overall mobility of Korea. Moreover, the higher estimates of 0.4–0.6 for those in their forties or older result in overall estimates of 0.35 for sons and 0.45 for married daughters aged 25–54.

Nonparametric regression shows convex curves for the younger generation, but an almost linear relation for the older generation. An eight-year transformation suggests that the difference may be caused by a cohort effect, rather than an age effect. If this is the case, the shift from a linear relation to a convex relation leads to an improvement in equalized opportunity for sons from lowest-income families.

It must be noted that, in the analysis, fathers are the generation experiencing rapid economic growth in Korea. It is possible that the extent of economic opportunity will change in a mature economy after achieving economic growth. Focusing on upper-income families, the estimated elasticity is around 0.4 even for sons in their thirties; it is not impossible that an increase in middle-income families in a mature economy will result in an upturn in intergenerational elasticity.

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Table 1: Summary Statistics of Age in the Paired Sample

	Father		Son		Sample size
Father-son pairs from KLIPS					
Monthly main-job earnings (1998-2006)	54.2	(6.3)	31.8	(4.9)	446
Annual total earnings (2003-2006)	58.3	(6.3)	31.4	(4.4)	366
Father-son pairs from KHPS					
Monthly main-job earnings (1993-1997)	56.6	(5.1)	29.5	(3.9)	184

Note: Standard deviations are in parentheses. Age of son is at the point of the latest observation.

Table 2: Estimation result using father-son pairs from KLIPS

N = Sample size

Earnings type	Method and father's earnings	Case (A)			Case (B)		
		Estimate		N	Estimate		N
Monthly main-job earnings (1998–2006)	Single-year (1998)	0.088	(0.034)	446	0.099	(0.029)	415
	Multi-year averages						
	Two-year (1998–1999)	0.067	(0.045)	335	0.083	(0.039)	312
	Three-year (1998–2000)	0.129	(0.050)	276	0.120	(0.044)	256
	Four-year (1998–2001)	0.187	(0.051)	228	0.162	(0.047)	210
	Five-year (1998–2002)	0.146	(0.054)	201	0.132	(0.050)	186
	SIMEX						
	Two-year (1998–99)	0.081	(0.057)	335	0.112	(0.045)	312
	Three-year (1998–2000)	0.142	(0.054)	276	0.124	(0.045)	256
	Four-year (1998–2001)	0.183	(0.053)	228	0.147	(0.050)	210
	Five-year (1998–2002)	0.141	(0.053)	201	0.133	(0.050)	186
	IV for single-year (1998)	0.189	(0.086)	435	0.188	(0.073)	405
Annual total earnings (2003–2006)	Single-year (2003)	0.077	(0.045)	366	0.099	(0.041)	347
	Multi-year averages						
	Two-year (2003–2004)	0.178	(0.056)	321	0.190	(0.051)	304
	Three-year (2003–2005)	0.200	(0.061)	286	0.209	(0.055)	269
	Four-year (2003–2006)	0.209	(0.070)	255	0.227	(0.064)	239
	SIMEX						
	Two-year (2003–2004)	0.195	(0.065)	321	0.203	(0.064)	304
	Three-year (2003–2005)	0.215	(0.071)	286	0.213	(0.067)	269
	Four-year (2003–2006)	0.215	(0.082)	255	0.236	(0.085)	239
	IV for single-year (2003)	0.385	(0.119)	358	0.459	(0.109)	340

Notes: Case (A) employs the latest earnings, and Case (B) employs averages for sons. Standard errors are in parentheses. For SIMEX, bootstrap standard errors are reported.

Table 3: Estimation result using father-son pairs from KHPS

N = Sample size

Measure of father's earnings	Estimate		N
Single-year (1993)	0.087	(0.038)	184
Two-year average (1993–1994)	0.122	(0.051)	140
Three-year average (1993–1995)	0.077	(0.063)	103
Four-year average (1993–1996)	0.053	(0.076)	79
Five-year average (1993–1997)	0.062	(0.090)	65

Note: Standard errors are in parentheses.

Table 4: Estimates for sons using predicted earnings of fathers

N = Sample size

Earnings type	Age of son	Case (A)			Case (B)		
		Estimate		N	Estimate		N
Monthly	Ages 25–54	0.298	(0.037)	2521	0.277	(0.030)	2587
main job	Ages 25–34	0.132	(0.052)	822	0.155	(0.037)	1092
Earnings	Ages 30–39	0.230	(0.050)	988	0.250	(0.044)	1035
(1998–2006)	Ages 35–44	0.338	(0.059)	957	0.352	(0.052)	892
	Ages 40–49	0.366	(0.073)	866	0.339	(0.061)	788
	Ages 45–54	0.413	(0.080)	742	0.407	(0.080)	603
Annual	Ages 25–54	0.394	(0.054)	2082	0.356	(0.046)	2099
Total	Ages 25–34	0.161	(0.094)	667	0.199	(0.076)	735
Earnings	Ages 30–39	0.223	(0.072)	809	0.237	(0.061)	852
(2003–2006)	Ages 35–44	0.390	(0.078)	786	0.381	(0.069)	790
	Ages 40–49	0.521	(0.090)	728	0.415	(0.078)	711
	Ages 45–54	0.595	(0.101)	629	0.510	(0.090)	574

Notes: Case (A) employs the latest earnings, and Case (B) employs averages for sons. Standard errors in parentheses are corrected following Murphy and Topel (1985).

Table 5: Estimates with prediction using the common sample for two earnings measures

	Monthly main-job earnings		Annual total earnings		Sample size
Ages 25–54	0.316	(0.044)	0.378	(0.052)	1827
Ages 25–34	0.141	(0.062)	0.224	(0.092)	555
Ages 30–39	0.218	(0.057)	0.213	(0.066)	723
Ages 35–44	0.338	(0.070)	0.347	(0.073)	706
Ages 40–49	0.404	(0.082)	0.496	(0.091)	660
Ages 45–54	0.423	(0.088)	0.544	(0.099)	566

Notes: Earnings of sons are the latest during 2003–2006. Standard errors in parentheses are corrected following Murphy and Topel (1985).

Table 6: Estimates for sons using predicted earnings of fathers in 1982

N = Sample size

Prediction for father	Age of son	Case (A)			Case (B)		
		Estimate		N	Estimate		N
Predicted earnings of fathers from averages of ages 40-44 in 1982	Ages 25–54	0.281	(0.038)	2521	0.273	(0.032)	2587
	Ages 25–34	0.119	(0.052)	822	0.160	(0.038)	1092
	Ages 30–39	0.230	(0.051)	988	0.256	(0.046)	1035
	Ages 35–44	0.345	(0.062)	957	0.344	(0.056)	892
	Ages 40–49	0.324	(0.080)	866	0.327	(0.065)	788
	Ages 45–54	0.386	(0.088)	742	0.426	(0.089)	603
Predicted earnings of fathers from OLS estimates in 1982	Ages 25–54	0.287	(0.043)	2521	0.291	(0.035)	2587
	Ages 25–34	0.124	(0.052)	822	0.177	(0.040)	1092
	Ages 30–39	0.254	(0.054)	988	0.320	(0.050)	1035
	Ages 35–44	0.399	(0.070)	957	0.413	(0.065)	892
	Ages 40–49	0.396	(0.096)	866	0.354	(0.080)	788
	Ages 45–54	0.417	(0.108)	742	0.462	(0.111)	603

Notes: Measures for sons are monthly main-job earnings (1998–-2006). Case (A) employs the latest, and Case (B) employs averages for sons. Standard errors are in parentheses.

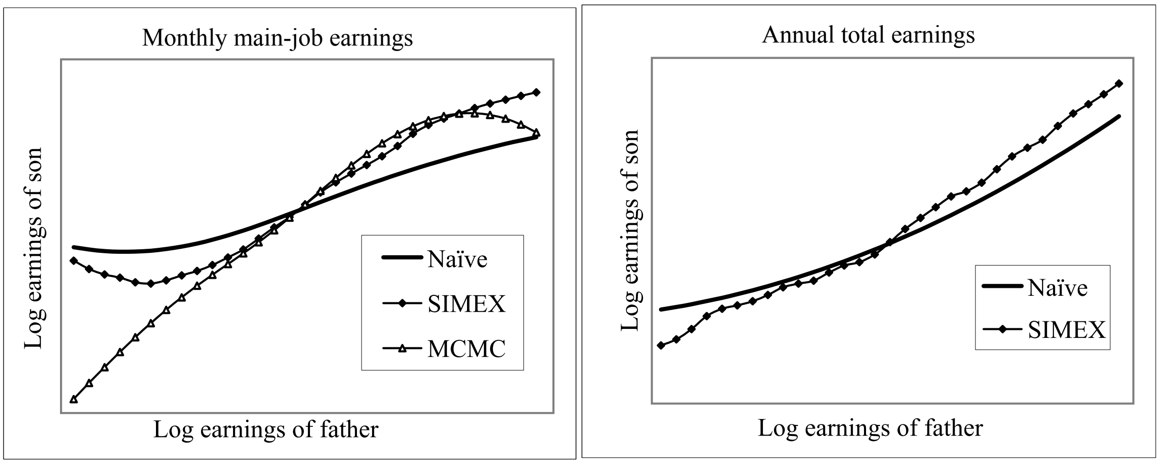
Table 7: Estimates for married daughters using predicted earnings of fathers

N = Sample size

Earnings type	Age of husband	Case (A) Estimate		N	Case (B) Estimate		N
Monthly main-job earnings (1998–2006)	Ages 25–54	0.387	(0.054)	1488	0.421	(0.042)	1647
	Ages 25–34	0.169	(0.155)	90	0.300	(0.084)	235
	Ages 30–39	0.304	(0.091)	347	0.369	(0.057)	602
	Ages 35–44	0.315	(0.071)	671	0.372	(0.052)	832
	Ages 40–49	0.315	(0.071)	841	0.459	(0.063)	774
	Ages 45–54	0.483	(0.085)	727	0.554	(0.085)	580
Annual total earnings (2003–2006)	Ages 25–54	0.457	(0.076)	1184	0.461	(0.063)	1249
	Ages 25–34	-0.012	(0.659)	30	0.284	(0.298)	58
	Ages 30–39	0.257	(0.163)	220	0.344	(0.098)	329
	Ages 35–44	0.368	(0.098)	523	0.383	(0.076)	624
	Ages 40–49	0.482	(0.091)	707	0.421	(0.080)	694
	Ages 45–54	0.540	(0.110)	631	0.556	(0.100)	567

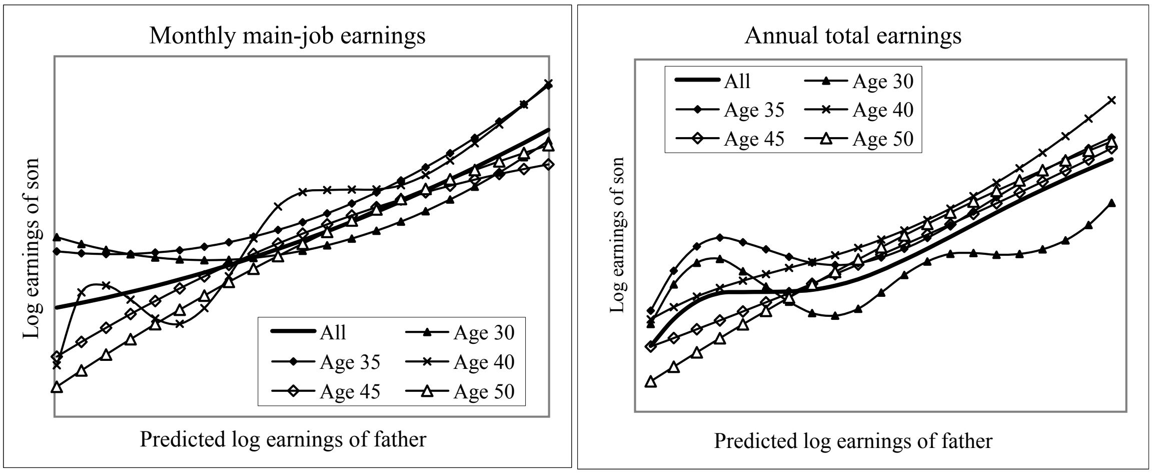
Notes: Case (A) employs the latest earnings, and Case (B) employs averages for daughter's husband. Standard errors in parentheses are corrected following Murphy and Topel (1985).

Figure 1: Nonlinear relation of log earnings for father-son pairs



Note: Average earnings are used for sons.

Figure 2: Nonlinear relation for sons using prediction



Notes: Averages are applied for sons. Subsamples of age 30, 35, 40, 45, and 50 include observations ages 25—34, 30—39, 35—44, 40—49, and 44—54, respectively.

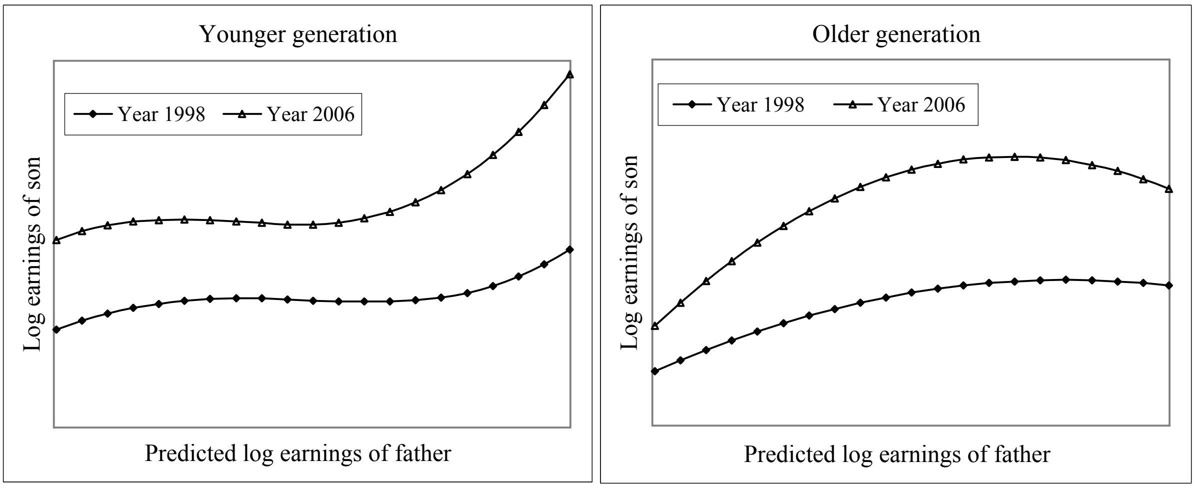
Table 8: Estimates by high and low earnings of fathers

N = Sample size

Earnings type	Ages of sons	Upper half			Lower half		
		Estimate		N	Estimate		N
Monthly	Ages 25–54	0.317	(0.063)	1289	0.054	(0.147)	1326
main-job	Ages 25–34	0.269	(0.078)	638	-0.113	(0.164)	464
earnings	Ages 30–39	0.378	(0.094)	523	-0.180	(0.216)	522
(1998–2006)	Ages 35–44	0.328	(0.118)	399	-0.028	(0.253)	505
	Ages 40–49	0.238	(0.135)	349	0.335	(0.324)	446
	Ages 45–54	0.375	(0.173)	252	0.822	(0.459)	357
Annual	Ages 25–54	0.359	(0.097)	929	0.218	(0.148)	1191
total	Ages 25–34	0.206	(0.152)	426	-0.091	(0.259)	315
earnings	Ages 30–39	0.364	(0.129)	410	0.028	(0.213)	451
(2003–2006)	Ages 35–44	0.517	(0.150)	304	0.282	(0.221)	497
	Ages 40–49	0.353	(0.184)	250	0.191	(0.251)	468
	Ages 45–54	0.340	(0.206)	199	0.532	(0.300)	379

Notes: Predicted earnings of fathers are applied. Earnings of sons are averaged. Standard errors in parentheses are corrected following Murphy and Topel (1985).

Figure 3: Change in nonlinear relation during 1998—2006



Notes: Monthly mian-job earnings are used. Averages are applied for sons.

Table 9: Quantile regression result for sons using prediction

N = Sample size

	10%		25%		50%		75%		90%		N
Monthly main-job earnings											
Ages 25—54	0.179	(0.067)	0.194	(0.039)	0.259	(0.033)	0.299	(0.035)	0.331	(0.057)	2615
Ages 30—39	0.102	(0.092)	0.256	(0.052)	0.252	(0.048)	0.228	(0.055)	0.275	(0.094)	1045
Upper-half											
Ages 25—54	0.257	(0.126)	0.363	(0.096)	0.362	(0.073)	0.434	(0.060)	0.389	(0.120)	1289
Ages 30—39	0.222	(0.203)	0.410	(0.122)	0.426	(0.091)	0.464	(0.118)	0.579	(0.188)	523
Annual total earnings											
Ages 25—54	0.346	(0.112)	0.333	(0.055)	0.353	(0.045)	0.326	(0.048)	0.232	(0.055)	2120
Ages 30—39	0.128	(0.185)	0.293	(0.084)	0.231	(0.068)	0.141	(0.054)	0.170	(0.090)	861
Upper-half											
Ages 25—54	0.353	(0.204)	0.487	(0.127)	0.388	(0.091)	0.403	(0.087)	0.187	(0.133)	929
Ages 30—39	0.432	(0.442)	0.482	(0.179)	0.419	(0.111)	0.406	(0.126)	0.188	(0.217)	410

Notes: Predicted earnings of fathers are applied. Earnings of sons are averaged. Bootstrap standard errors are in parentheses.