Household characteristics at the bottom, the typical, and the top of the 2016 income distribution in South Korea: A quantile regression analysis

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Abstract
This paper seeks understanding how demographic characteristics affect the different quantiles of the South Korean income distribution. Findings from the 2016 Household Income and Expenditure Survey data suggest that, at the bottom of the distribution, households relied heavily on cash transfers from institutions and other households, while those at the top relied more on wages, suggesting that high-income households in South Korea were not members of the “propertied class.” We then develop simple empirical models to measure the effect of demographic covariates on household income conditional on a number of variables commonly used in inequality studies, including lifecycle, education, gender, marital status, urban residence, job security, industry and occupation type. Quantile regression results demonstrate how a particular quantile of the conditional distribution changes with demographic characteristics. Specifically, we found an increase in gender and unemployment effects as we go from high to low quantiles. Programmes aimed at combating gender discrimination and persistent unemployment therefore are expected to be inequality reducing. This is in contrast to policies to promote higher education or to expand public sector employment that quantile regression models indicate to be inequality enhancing.

KEYWORDS
income distribution, quantile regressions, South Korea
Spectacular economic growth has transformed South Korea from a basket case in the aftermath of Japanese occupation and Korean War into a maturing OECD economy. Welfare has improved from a below subsistence living standard in the 1950s to an export-oriented powerhouse with per capita income of over US$27,000 in 2016. It is thus only natural that early discussions on Korean economic performance tend to revolve around the phenomenal increase in the average living standards. During the period of rapid take-off from 1962 to the mid-1990s in particular, when growth rate averaged 8% annually, the lack of concern for those at the bottom of the distribution was bolstered by the argument that the poor would gain more from economic growth than from redistribution. In the meanwhile, the lingering inequality was thought of as the impetus that would not only motivate individuals to work harder, but would also allow rich individuals’ higher savings propensity to generate more investments and thereby sustain long-run growth (Kaldor, 1957).

Sustained economic growth is an important indicator of economic development but does not guarantee welfare improvement for the masses. If growth has led to rising inequality, it likely has both positive and negative effects. On the positive side, rewarded performance provides incentives for individuals not only to work hard but also to innovate. On the negative side, differential rewards that are uncorrelated with performance—for example, those due to sexual discrimination—undermine civil society and cause misallocation of resources. It is because of this ambiguity that, more recently, distributional concerns have spurred a vigorous debate about whether the gap between the poor and the rich has widened and if so, whether anything could be or should be done about it.

Income inequality in South Korea surged right after the 1997 financial crisis, which appears to have pushed the Korean economy out of its previous steady state characterized by relatively low income inequality into a new trajectory marked by widening disparities. The extent to which income inequality has risen in South Korea probably took most economists by surprise. Throughout the early high-growth episodes until the mid-1990s, income distribution in Korea remained relatively stable as the strong gains accruing to those at the top of the distribution were accompanied by even stronger gains for the rest of the population.

It appears that the recent trend has not quite worked out that way. Figure 1 shows the evolution of income distribution in South Korea between 1990 and 2016 using Gini coefficient as the inequality measure.

Numerous empirical studies have examined the distribution of income in South Korea. In general, the literature in this area can be broken down into two strands; namely those that seek to explain income disparities using covariate analysis (see, e.g., Fields & Yoo, 2000), and those that examine inequality trend using aggregate measures (e.g., Yoo & Kwon, 1987). That inequality in Korea has exacerbated significantly is also the subject of some of these studies. Among studies that we are aware of, Sato and Fukushige (2009) conclude that achieving per capita income of US$9,200 in South Korea was the turning point where subsequent increases in income has led to widening disparities. Also consistent with our calculations are Kwack and Lee (2007) and Shin and Kong (2014), all of which highlight the sharp deterioration in household income distribution since 1998. By 2009, the top quintile earned six times the wage income of the bottom quintile (Jones & Urasawa, 2014), and by 2013, the income share of the top decile has risen to almost 50%, a level comparable to that prevailing in the United States and highest among Asian countries (Byeon, Choi, Choi, & Kim, 2017).

The present study examines the cross section of Korean households in 2016, and compares the demographic characteristics of a typical household representing the entire population to those at the bottom and the top of the income distribution. The analysis is primarily descriptive: we wish to understand whether there are systematic
differences between the poor and the rich households. In addition, the analyses reported below aimed at measuring the effects of demographic characteristics, such as lifecycle, education, gender, marital status, place of residence, and job status, on different quantiles of the income distribution.

Other studies have used cross-sectional dataset to make inferences about the degree of inequality among Korean households. Notably and using Occupational Wage Survey Data, Fields and Yoo (2000) compare covariates of wage differentials in 1986 with those in 1993. Unlike the present study, however, Fields and Yoo focus only on labour income, and do not take into considerations other sources of income or the contributions of other household members. Thus, we employ here household income as the main welfare indicator because an examination of wages alone often misses large disparities in non-labour income, and because an individual's welfare depends in large part on the family's economic performance.

The present study also focuses on income distribution as the source of disparities rather than wealth distribution because income remains the primary indicator of well-being for the overwhelming majority of individuals and households in any society (Chaudhuri & Ravallion, 1994). Although both income and consumption data are available, income is a more appropriate indicator as it captures more fully the degree to which labour market structure (industries or occupations), capital ownership, and household demographics are associated with welfare. Nonetheless, we also estimated all models using log household expenditures as the dependent variable. The central results reported here are robust to alternative measures of household welfare.

For the parametric part of the empirical analysis, we employ quantile regressions to determine whether the effects of the covariates vary over quantiles of the conditional distribution. Other studies that examine household income distribution in South Korea typically employ a variant of least-square methods to estimate the degree to which demographic characteristics affect mean income (see, e.g., Lee, Kim, & Cin, 2013; Nam, 2018; Suh, 2011). As Hao and Naiman (2007) point out, the mean effects estimated through such methods cannot capture significant departures from the mean that exist in either tail of the conditional distribution due to non-normality or heteroscedasticity.

To the best of our knowledge, the present study is among the first that applies quantile regressions to Korea household income data. As introduced by Koenker and Bassett (1978, 1982), quantile regressions are more sensitive than OLS to observations in both tails of the distribution, and thus are suitable for the present study, which compares the effects of income covariates at the bottom (i.e., lower tail) with those at the top (i.e., upper tail) of the conditional distribution.

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**FIGURE 1** Inequality Trend, South Korea, 1990–2016 (Gini Coefficients)

*Note: Data from South Korean Household Income and Expenditure Survey (HIES)*
Unlike least-squares methods, which assume distributional invariance, quantile regressions are appropriate when covariates influence income differently at different segments of the distribution. This is the case, for example, when higher educational attainment increases not only the mean but also the spread of the conditional income distribution. Quantile regression is appropriate in cases that do not lend themselves to least-squares methods because certain covariates affect different income quantiles differently. The distributionally-sensitive method facilitates comparisons of the contribution of covariates to income differences across all segments of interest and, in doing so, offers more insight into the conditional distribution of household income.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 presents the exploratory analyses. Section 4 reports the results of the formal empirical estimations. We close in Section 5 with concluding remarks.

2 | DATA

Our data come from the 2016 Household Income and Expenditure Survey, which has been administered by the Korea National Statistical Office (NSO) since 1963. The 2016 data were collected quarterly and the variables are available in three main categories, namely household demographic characteristics, income sources, and expenditure breakdown.

The demographic indicators track variables such as householder’s lifecycle (measured by age), gender, place of residence (urban or rural), educational attainment, marital status (married with spouse present, married without spouse present, or single), job status, industry of employment, occupation, as well as demographic characteristics of the spouse and up to seven other household members. Education is divided into five categories of the householder’s maximum attainment; namely elementary school dropouts, completed elementary school, middle school, high school, and college graduates. Job status distinguishes eight types, which include regular and temporary employee, business owner, and unemployed. Rounding up, the original dataset recognizes 22 industries of employment and 11 occupation categories.

The income data is organized in a hierarchical format as follows. At the first level of disaggregation, household total income is sub-divided into income flows and wealth adjustments arising from changes in assets and liabilities. In turn, income flows can be broken down into regular income and irregular income, the latter of which includes cash gifts and proceeds from used-good sales, while wealth adjustments into changes in asset and debt positions and asset transfers. The next level classifies regular income sources into four categories, namely wage earnings, business incomes, capital incomes, and transfers. Finally, wage earnings are decomposed into household members’ contributions (head, spouse, and other members), while capital incomes into those drawn from interest-bearing assets, dividends, real-estate, and other properties.

The original 2016 data contains the quarterly survey of more than 7,000 households, from which we subsequently select those that reported for at least three out of four quarters in order to minimize seasonal bias. Note that many households reported changes in characteristics during the sampling period. Some of these changes doubtlessly are legitimate. For example, place of residence would change upon relocation from a rural to an urban area. Other changes may be due to reporting inaccuracies. In order to minimize measurement errors, we select the indicator value that appeared most frequently (i.e., the maximum mode). For example, if a household claimed to be an urban resident in three out of four quarters of observation, then for the analyses this household is recognized as an urban resident for the entire year. The final result is a sample of 6,678 households that we use for all subsequent analyses.

3 | EXPLORATORY ANALYSES

The demographic characteristics of households for the entire sample, at the bottom 10% and the top 10%, and the propertied class are summarized in Table 1. Consistent with Piketty (2014), we define the “propertied class” to be
## TABLE 1  Characteristics of households in the entire sample, at the bottom, and at the top of the household income distribution, 2016

| Residence          | Entire sample | Bottom 10% | Top 10% | Difference (top 10% - bottom 10%) | Propertied Class<sup>a</sup> |
|--------------------|---------------|------------|---------|----------------------------------|-----------------------------|
| % urban            | 89.6          | 83.1       | 94.2    | 11.1                             | 90.7                        |
| Head's gender      |               |            |         |                                  |                             |
| % Male             | 64.0          | 35.1       | 79.3    | 44.2                             | 69.9                        |
| Head's age (years) |               |            |         |                                  |                             |
| Median             | 55            | 62         | 51      | -11                              | 56                          |
| Head's marital status |             |            |         |                                  |                             |
| % Married          | 63.9          | 27.9       | 81.7    | 53.8                             | 63.7                        |
| No. of children    |               |            |         |                                  |                             |
| Median             | 1             | 0          | 1       | 1                                | 1                           |
| Mean age of children |             |            |         |                                  |                             |
| Median             | 7.0           | 3.0        | 10.0    | 7.0                              | 7.8                         |
| Head's education (max. Attainment, %) | | | | | |
| Less than primary  | 0.8           | 4.5        | -4.5    | 0.3                              |                             |
| Primary school     | 6.3           | 21.1       | 2.6     | -18.5                            | 6.4                         |
| Middle school      | 5.4           | 10.9       | 1.9     | -9.0                             | 6.2                         |
| High school        | 31.7          | 32.6       | 25.9    | -6.7                             | 28.8                        |
| College/beyond     | 55.8          | 30.9       | 69.6    | 38.7                             | 58.3                        |
| Head's employment status (% |           |            |         |                                  |                             |
| Unemployed         | 21.0          | 58.6       | 8.1     | -50.5                            | 26.8                        |
| Regular employee   | 44.1          | 8.6        | 67.3    | 58.7                             | 41.7                        |
| Temporary employee | 7.8           | 13.9       | 3.5     | -10.4                            | 7.8                         |
| Daily employee     | 2.6           | 3.3        | 1.9     | -1.4                             | 2.4                         |
| Employer           | 2.5           | 1.1        | 2.7     | 1.6                              | 1.6                         |
| Managing owner     | 19.7          | 12.1       | 15.4    | 3.3                              | 17.4                        |
| Other              | 2.3           | 2.4        | 1.1     | -1.3                             | 2.3                         |
| Head's industry of employment (%)<sup>b</sup> |           |            |         |                                  |                             |
| Manuf. (22.4)      | Trade (23.8)  | Manuf. (22.4) | - | Manuf. (23.6)                    |
| Oth. Svc. (11.8)   | Health (13.7) | Educ. (11.4) | - | Educ. (11.1)                     |
| Trade (10.1)       | Oth. Svc. (10.0) | Pub. Ad. (11.4) | - | Health (11.1)                    |
| Head's occupation (%)<sup>c</sup> |           |            |         |                                  |                             |
| Manual (29.4)      | Manual (62.4) | Production (25.1) | - | Manual (23.6)                    |
| Production (23.0)  | Service (9.4) | Manual (21.6) | - | Production (22.7)                |
| Professional (13.9)| Sales (8.6)   | Professional (20.4) | - | Professional (16.9)              |
| No. Obs.           | 6,678         | 667        | 667     | -                                | 667                         |

<sup>a</sup>90th percentile of household capital income.

<sup>b</sup>Construct. = Construction, Educ. = Education, Health = Health and social services, Manuf. = Manufacturing, Oth. Svc. = Other services, Pub. Ad. = Public administration, national defense, and social security administration, Trade = Wholesale and retail trade.

<sup>c</sup>Manual = Manual labour, Production = Production workers, Service = Service workers.
households that are at the 90th percentile or above in terms of capital income. Among all households in the sample, 90% are urban dwellers, while the rest live in rural areas. The median age of householders (i.e., heads of households) is 55, and about two-thirds are male. About 64% of householders are married, and more than 87% completed at least 12 years of schooling, of which about two-thirds had college degrees or higher.

Over one fifth of householders were unemployed, while about 8% were temporarily employed during the survey. Another one-fifth belongs to the category that includes employers and managing owners. The modal industry of employed householders was manufacturing, while the modal occupation is a blue collar operator in a production line. Employment composition thus has retained the structure that was recognized more than 10 years ago (Economist Intelligence Unit, May 2006), where manufacturing generated over a quarter of aggregate income. Manufacturing therefore has continued its dominance in today's Korean economy as a source of both employment and income.

Households at the bottom 10% differ in important respects from the rest of the sample. First, the lowest-income households were somewhat less likely to be urban residents, while significantly more likely to be female headed (65% vs. 36% for the whole sample). On average, a bottom-decile householder is seven years older than the median head of a household. Compared to the entire sample, there is a considerably greater likelihood at the bottom decile (72% vs. 36%) to be led by a single person without a spouse. It may come as no surprise that the lowest-income householders, on average, attain significantly less education than the typical Korean householder. Specifically, one quarter of the bottom householders had at most six years of elementary school education, while about two thirds completed high school.

Unemployment rate among lowest-income households was almost three times that in the full sample. Specifically, about 60% of the lower-tail householders claimed to be unemployed, while at the same time 14% were employed temporarily during the survey. The modal industry of employment for the poor was retail trade, suggesting many at the bottom were small traders toiling in the informal sector (see also OECD, 2008). The vast majority (62%) of the bottom-decile householders worked as manual labour. Other notable occupations were service work and sales person.

There are also important distinctions between households at the top 10% and the rest. Male-led householders in the upper tail were even more dominant than in the rest of the sample, making up 80% of the top-decile households, and four fifths were married. The highest-income householders are, without question, well educated. Among the top-decile householders, about 70% completed at least high school, of which two thirds are college educated and beyond.

Sixty-seven per cent of the top income householders were employed on a regular (non-fixed term) basis, while about 18% identified themselves as either an employer or a managing business owner. Only 8% of upper-tail householders claimed to be unemployed, and only 3% were temporarily employed. The preponderance of manufacturing is also evident among the top-decile householders, employing over one fifth of the employed heads. Other key industries of employment were education and public administration, each making up 11% of the top-decile householders. The modal occupation for the top household heads was production work, followed in the second and third place by manual labour and professional work.

### 3.1 Household Incomes

#### 3.1.1 All Households

The total income breakdown of households in the entire sample, at the bottom 10% and top 10%, as well as the propertyed class are summarized in Table 2.

Median household income for the full sample is about 3.5 million Korean Won (KRW) per month, which is roughly equal to US$3,000 at the 2016 average exchange rate, while the mean is four million KRW. At the first level of disaggregation, we found that 88% of mean total income was accounted for by income flows, while the rest by wealth adjustments.
Well over 95% of the former was accounted for by regular incomes, which include wage earnings (65%), business income (20%), and transfers (14.5%). Virtually every household earned at least part of their income from salary or wages, while four fifths drew income from own-businesses, and only a quarter drew income from capital. The typical household therefore relied on wages, at least to some extent, as the source of regular income. Furthermore, capital income—the hallmark of the propertied class—with zero median does not appear to be an important source of supplementary income for the typical Korean household. It is also noteworthy that changes in asset holding, for example, the proceeds from asset liquidations, accounted for about two thirds of wealth adjustments. This suggests that the typical Korean household relied heavily on either savings or the sale of existing assets to supplement their main income.

The intra-household distribution of wage income is as follows. The head of a household on average contributes 70% of the household’s total wage earnings, while spouse about 16%, and other family members the rest. Virtually every householder contributes through salary or wage earnings. About two thirds of householders have a spouse that contributes to the household’s wage earnings, with the spouse’s median monthly wage income of 242,500 KRW (about US$210), while slightly less than half of all surveyed households have other family members that contribute through wage earnings. The median wage income of the latter is zero, however, indicating that most of the other family members did not contribute to the household’s wage earnings.

### 3.1.2 Bottom 10%

The lowest-decile households in 2016 earned a maximum total income of two million KRW per month (about US$1,800). By construction, there are 667 households that belonged to this category, with a mean income that is less than one-half of the median household’s mean income. Income flows accounted for almost all of total income, indicating that the poor relied more on income flows, and less on the distribution of assets, than the typical Korean household. The composition of their income flows, however, differs from that for a typical household in the full sample.

Specifically, wage earnings on average accounted for less than half of the bottom-decile’s regular incomes, with a median monthly wage that was less than a third of the median wage for the typical Korean household. The lowest-income households therefore relied to a lesser extent on wage income than most Korean households. Instead, transfer incomes played a much larger role. Defined as cash disbursements from the government, non-profit organizations,
or other households, transfers accounted for one-third of the bottom decile's regular incomes, more than double the mean share for the entire sample.

Among the poor, the intra-household distribution of wage income is as follows. Heads of households, on average, contribute 72% of the total wage earnings, spouse (when living together) 14%, and other members the rest. Despite a 59% unemployment rate, nine out of every 10 of the lowest-income householders drew income from salaries or wages. Further, only about a third were married with a spouse who contributes through paid work, and only a fifth have other wage-earning family members. This is reflected in the median wage contribution of family members other than the heads of bottom-decile households that was equal to zero.

At the same time, 68% of bottom-decile householders and 15% of the spouses drew income from self-employment. Note that across other income categories, proceeds from asset sales accounted for about 64% of total wealth adjustments, while new debts only about 35%. It appears that lower-tail households faced significant barriers to credit access, indicating the increasing reluctance of financial institutions to lend to low-income households following the collapse of South Korea's credit bubble in the early 2000s (Jones & Urasawa, 2014).

### 3.1.3 Top 10%

The highest-income households in the 2016 sample earned a minimum monthly income of six million KRW (about US$ 5,200) and a maximum of over 97 million KRW (about US$84,000). The median monthly income of the top decile was 7.3 million KRW (US$6,300); more than twice the median income for the entire sample. Income flows accounted for 60% of the top decile's total income, while asset adjustments made up the rest. The rich in 2016 therefore relied much more on the drawing down of assets—savings, proceeds from asset liquidations, or new loans—and less so on salaries or wages, than most Korean households.

Like in the typical case, over 90% of income flows were accounted for by regular incomes, which in turn can be subdivided further into wage earnings (70.5% of regular income), business income (20%), capital income (0.5%), and transfers (9%). Thus, capital is a trivial source of income among the top-decile Korean households in 2016. At the same time, about 73% of householders were paid employees, while about 18% drew income from own businesses as either an employer or a managing owner.

### 3.1.4 The propertied class

It has been argued that the distribution of property income is significantly less egalitarian than the distribution of labour income (Yoo & Kwon, 1987). In today's Korea, a potential source of income disparities was the highly unequal distribution of real estate assets. Thus, given the booming real-estate market, particularly in the capital city of Seoul, we expect households at the top of the distribution to draw significant portions of their income from property ownerships. We examine next whether upper-tail households in 2016 indeed belonged to the "propertied class."

In 2016, the 667 households that belong to the 90th percentile or above of the capital income distribution took home a total monthly income that ranged from about 840,000 KRW (US$728) to over 69 million KRW (about US$60,000). The propertied class thus includes members of both the lowest-income and highest-income households in Korea. The median income was about 3.9 million KRW per month, about half of the highest decile's median income, suggesting that a typical member of the propertied class did not have the purchasing power of the highest-income households. As in the United States (Piketty & Saez, 2003), members of the propertied class in Korea were not the "working rich" or the well-compensated executives.

Nine out of every 10 of propertied householders were urban residents, on a par with the entire sample. Over a quarter claimed to be unemployed in 2016, while about a fifth were either self-employed or managing business owners. Slightly less than 8% of the propertied householders were temporarily employed, about the same level as among the rest of the households.
Over 55% of propertied householders were married males, and about the same proportion were college educated; both were significantly lower than those in the upper-tail of the income distribution. Just like for the entire sample, however, the median age of the propertied householder was 56, thus on average six years younger than lower-tail householders but five years older than those at the upper tail. Manufacturing was the propertied class’ modal industry of employment, while manual work primarily in that sector was the modal occupation. Unemployment, however, appears to be voluntary, as the median monthly income was a considerable three million KRW (US $2,670) among those unemployed. The substantial unemployment income suggest that many propertied householders received at least a portion of their income through asset ownership.

Indeed, wealth adjustments accounted for about a quarter of the total income for propertied households. Nevertheless, virtually all of propertied households drew part of their income from salaries or wages, while the majority also earned additional income from own-businesses. Thus, the propertied class has a diversified portfolio of income sources, with every household in the group receiving some amount of labour income as either an employee or a business owner. Unlike in the richest group, however, wages represented less than two-thirds of regular income, while business income less than one-fifth. The prevalence of unemployment indicates that the members of the propertied class exhibit characteristics that are very similar to the “coupon-clipping rentiers” in the United States (Piketty & Saez, 2003). Nevertheless, on average capital income accounted for less than 5% of regular income (Table 2), and this suggests the diminishing role of capital even among the 90th percentile households of the capital income distribution in 2016 South Korea.

4 | QUANTILE REGRESSION ANALYSIS

The previous analyses reveal the income sources and demographic characteristics of households at different segments of the income distribution. The analysis is only exploratory, however, because it does not control for various changes that might simultaneously affect household income. Further, such exploration cannot determine the importance of a particular covariate relative to others. This section accordingly employs regression models to examine why income is so much higher among households at the top decile than among those at the bottom of the conditional distribution.

Previous covariate analyses of household incomes in South Korea employ conventional least-squares methods. Our exploratory analysis, however, suggests that the contribution of various covariates to income differences is not uniform across different segments of the income strata. Thus, and in addition to standard ordinary least squares, we perform quantile regressions to reveal the effects of demographic covariates on the median, bottom 10%, and top 10% of the conditional income distribution:

\[
y_i = \beta(p) X_i + \varepsilon_{pi},
\]

where the dependent variable \(y_i\) is log income, \(\beta(p)\) the \(1 \times k\) vector of the parameters specific to the \(p\)th quantile, \(X_i\) the \(k \times 1\) vector of covariates, \(\varepsilon_{pi}\) a residual term, and \(0 < p < 1\) the proportion of households with the dependent variable below the quantile at \(p = 0.1\) (bottom decile), 0.5 (median), and 0.9 (top decile), respectively.

As Bedi and Edwards (2002) summarize, quantile regressions have several advantages over OLS, particularly for distributional analysis. First, quantile regressions can easily detect the presence of scale-dependent dispersion (i.e., heteroscedasticity). Perhaps more importantly for the purpose of the present study, quantile regressions allow the entire conditional income distribution to be explored by expressing any quantile of interests as a function of demographic characteristics. In addition, quantile regressions are more resistant to outliers because it is based on minimization of the sum of absolute deviations rather than minimization of the sum of squares. Formally:

\[\text{For a gentle introduction to quantile regressions, see Koenker and Hallock (2001).}\]
\[ \beta^{(p)} = \arg \min_{\beta \in \mathbb{R}^p} \sum_{y_i \geq \hat{y}_i} |y_i - \hat{y}_i| + (1 - p) \sum_{y_i < \hat{y}_i} |y_i - \hat{y}_i|, \]  

where \( \hat{y}_i = \beta^{(p)} X_i \) is the \( p \)th conditional quantile of the dependent variable given the vector of covariates \( X_i \). It is because quantile regression results are robust to unusual deviations in the tails of the distribution (i.e., outliers) that the approach can also be used to evaluate the appropriateness of least squares estimates.

Before proceeding further, we note the important distinction between, say, the bottom households identified in section III, and the bottom households implied by quantile regressions. In Section 3, households are segmented according to their income levels. In quantile regressions the dependent variable is household income, which means the sample must be segmented according to the conditioning covariates (Koenker & Hallock, 2001). Thus, in the extreme case where none of the poorest householders was college educated, there should still be households in the bottom 10% conditional on whether the heads were college graduates. Nonetheless, it is reasonable to expect significant overlaps, in that households at the bottom of the unconditional income distribution are also likely to be those at the lower tail of the conditional distribution.

Figure 2(a) reveals that the unconditional distribution of income is unimodal and peaks around the median monthly total income of 3.5 million KRW. The skewed shape of the distribution indicates the appropriateness of log-income as the dependent variable and the use of quantile models to yield more insight into the distribution. The distribution of log-income is shown in Figure 2(b), which indeed exhibits a more symmetric shape, albeit with a skewness measure of 0.52 that exceeds the threshold for a normally-distributed variable.

In all the estimates reported here, the common set of explanatory variables composes head’s age, age-squared, average age of children, family size, number of children, and indicator variables for educational attainment (four dummy variables), gender, urban residence, and married with spouse present. Extended models also control for job status (six dummy variables), industry of employment (eight dummy variables), and occupational type (five dummy variables).

Table 3 compares results from the conditional mean (OLS) models with those from the conditional median (50th percentile) models. To guard against the possibility of arbitrary heteroscedasticity (Wooldridge, 2002), for ordinary least squares (OLS) we report the results from robust standard-error estimations. For both OLS and median regressions, we estimate two models: the first does not control for industry and occupational characteristics (OLS (1) and quantile regression (QR) (1) models), while the second includes them (OLS (2) and QR (2) models).

**FIGURE 2**  Distribution of gross household income, South Korea, 2016

Note: Data from the 2016 South Korean Household Income and Expenditure Survey (HIES). Figure (b) overlays the density function of a Normal distribution.
### TABLE 3  Results from OLS and median (50th percentile) regressions$^{a,b}$

| Dependent variable: log of gross household income | OLS (1) | OLS (2) | QR (1) | QR (2) |
|-----------------------------------------------|---------|---------|--------|--------|
| **Explanatory variable**                      |         |         |        |        |
| Age                                           | 0.0325*** (0.0073) | 0.0370*** (0.0073) | 0.0341*** (0.0069) | 0.0333*** (0.0058) |
| Age$^2$                                        | −0.0004*** (0.0001) | −0.0004*** (0.0001) | −0.0004*** (0.0001) | −0.0004*** (0.0001) |
| Average age of children                       | 0.0142*** (0.0010) | 0.0146*** (0.0010) | 0.0154*** (0.0010) | 0.0153*** (0.0010) |
| Family size                                    | 0.0329*** (0.0048) | 0.0287*** (0.0047) | 0.0282*** (0.0044) | 0.0289*** (0.0039) |
| Number of children                             | 0.0278*** (0.0116) | 0.0243*** (0.0114) | 0.0391*** (0.0110) | 0.0289*** (0.0105) |
| Head's gender (base level is "Male")          | −0.1163*** (0.0109) | −0.0981*** (0.0109) | −0.1177*** (0.0101) | −0.0945*** (0.0107) |
| Urban (base level is "Rural")                 | 0.0405*** (0.0151) | 0.0328*** (0.0147) | 0.0149 (0.0160) | 0.0263* (0.0147) |
| Spousal status (base level is "Spouse absent") | 0.2025*** (0.0196) | 0.1876*** (0.0193) | 0.1785*** (0.0181) | 0.1683*** (0.0173) |
| Education (base level is "Less than primary") |         |         |        |        |
| Primary school                                 | 0.0850** (0.0498) | 0.0858* (0.0489) | 0.0304 (0.0643) | 0.0410 (0.0502) |
| Middle school                                  | 0.1033*** (0.0496) | 0.1207** (0.0487) | 0.0377 (0.0634) | 0.0709 (0.0504) |
| High school                                    | 0.1690*** (0.0470) | 0.1832*** (0.0461) | 0.1194** (0.0629) | 0.1424*** (0.0476) |
| College                                        | 0.2461*** (0.0471) | 0.2326*** (0.0461) | 0.1997*** (0.0638) | 0.1987*** (0.0480) |
| Head's unemployment status (base level is "Employed") | −0.1625*** (0.0136) | −0.1525*** (0.0122) |         |        |
| Head's job status (base level is "Regular employee") |         |         |        |        |
| Unemployed                                     | −0.2067*** (0.0176) | −0.1859*** (0.0151) |         |        |
| Temporary worker                               | −0.2029*** (0.0185) | −0.1948*** (0.0173) |         |        |
| Daily worker                                   | −0.1194*** (0.0332) | −0.1099*** (0.0290) |         |        |
| Employer                                       | 0.0101 (0.0328) | 0.0114 (0.0273) |         |        |
| Managing owner                                 | −0.1178*** (0.0129) | −0.1095*** (0.0138) |         |        |
| Unpaid family worker                           | −0.1520*** (0.0308) | −0.0717* (0.0432) |         |        |
| Industry (base level is "transportation")      |         |         |        |        |
| Manufacturing                                  | 0.0381 (0.0358) | 0.0445 (0.0296) |         |        |
| Construction                                   | 0.0024 (0.0398) | 0.0161 (0.0398) |         |        |
| Trade                                          | 0.0132 (0.0413) | 0.0276 (0.0339) |         |        |
| Tourism                                        | 0.0081 (0.0526) | −0.0041 (0.0422) |         |        |
| Business services                              | 0.0845 (0.0376) | 0.0681* (0.0306) |         |        |
| Public services                                | 0.1042** (0.0433) | 0.1195*** (0.0369) |         |        |
| Social services                                | 0.0572 (0.0382) | 0.0681* (0.0304) |         |        |
| Others                                         | 0.0444 (0.0359) | 0.0565* (0.0298) |         |        |
| Occupation (base level is "service workers")   |         |         |        |        |
| Professionals                                  | 0.0382 (0.0381) | −0.0262 (0.0319) |         |        |
| Office workers                                 | 0.0225 (0.0387) | −0.0083 (0.0348) |         |        |
| Sales                                          | −0.0882** (0.0444) | −0.1012** (0.0409) |         |        |
| Skilled operators                              | −0.0275 (0.0344) | −0.0659* (0.0289) |         |        |
| Others                                         | −0.0708* (0.0340) | −0.1112** (0.0282) |         |        |
| Number of observations                         | 6,678 | 6,678 | 6,678 | 6,678 |
| Intercept                                      | 13.936*** (0.1964) | 13.8318*** (0.2020) | 13.9447*** (0.1839) | 13.9759*** (0.1620) |
| Goodness of fit$^c$                             | 0.3015 | 0.3314 | 0.2035 | 0.2256 |

Notes: ***$p < 0.001$, **$p < 0.05$, *$p < 0.1$.

$^a$OLS (1) and OLS (2) report least-squares regression results, while QR (1) and QR (2) report median (50th percentile) quantile regression results.

$^b$Robust standard errors for OLS, and bootstrap standard errors based on 1,000 bootstrap replications for the median (50th percentile) regressions, are reported in parentheses.

$^c$The goodness of fit measures are $R^2$ for OLS and pseudo-$R^2$ for quantile regressions.
In general, the covariates appear with the anticipated signs. With a few, notable exceptions, the magnitude of the estimated coefficients from OLS and median regressions are very similar, indicating that the OLS estimates of the conditional mean are not driven by extreme outliers. We discuss select covariates of interest next. The association between householder’s lifecycle and income appears to be quadratic. Specifically and consistently across all models, the estimated coefficients for age and age squared suggest a non-linear relationship where household income increases with the head’s age up to the early 40s before declining when householder is 42 or over. Older children tend to increase household income – possibly reflecting the parents’ lifecycle effects not already captured by age, or older children’s ability to contribute to family income.

Householder’s gender has a statistically-significant contribution to the difference between female and male-headed household incomes, calculated as \( \exp(b_G) - 1 \), where \( b_G \) is the estimated coefficient for gender. Both OLS (1) and QR (1) results suggest that male-headed households earned 11% higher income than female-headed households. Controlling for industries and occupations reduces the income differential to 9% in favour of male-headed households, suggesting that part of the difference exists due to entry barriers against women in certain industries or occupations. It appears that gender income differentials in Korea remain highest among OECD countries, and indeed studies have attributed them to persistent sexual discrimination in favor of males (e.g., Monk-Turner & Turner, 2004).

The OLS results indicate that, on average, any education levels higher than some primary schooling contributed to higher income. Quantile regression models, however, suggest that only high-school and college education yield statistically-significant premium for household’s conditional median income. College premium has remained significant in magnitude. OLS (2) for example, suggest that, other things equal, the conditional mean income of college-educated householders is about 5% higher than that for high-school-educated householders, which in turn earned 20% more than householders who are elementary school dropouts.

Thus far, we have limited the analyses to the relationship between covariates and income at the centre (mean or median) of the distribution. The Breusch-Pagan test for heteroskedasticity (Breusch & Pagan, 1979), however, rejects the null hypothesis of homoscedasticity at the 1% level of significance. Quantile regressions allow us to explore the implications of heteroscedasticity for both tails of the distribution. Table 4 reports results from quantile regressions for the lower-tail (10th percentile) and upper-tail (90th percentile) households. For comparison purposes, results from the fitted median model are reproduced in the middle column. All regressions reported in Table 4 control for industry and occupational characteristics.

As in least squares, the estimated coefficients can be interpreted as the contribution of a one-unit change of the covariate to the variation in the dependent variable. At any quantile \( p \), we can ask how much lower (or higher) household income is expected to be, conditional on the explanatory variables. The following discussion probes the effects of select covariates.

The positive effect of householder’s age diminished most rapidly for the conditional-median households. Among households at both the lower and upper tails of the conditional distribution, income increases with householder’s age up to 45 years, at which point income begins to decline. The turning point occurs somewhat earlier, however, at age 42 for median income households at the centre of the conditional distribution.

The effects of gender, public-sector employment, education, and unemployment are of substantial policy interests, and will be discussed next. Figure 3 displays the variation in the estimated coefficients of these variables over the conditional quintiles of the log income distribution. For comparison, overlaid in each sub-plot are the corresponding OLS estimate and the 90% confidence intervals.

First, Table 4 shows the “male premium” is about 11% at the bottom decile, higher than that for the median and the top-decile regression models, suggesting the contribution of gender to income disparity. This is consistent with Figure 3(a), which shows that the coefficient for female falls at the lower bound of the OLS confidence interval. The gender effect is even stronger at the 0.05th quantile while less palpable at the 0.15th quantile, indicating that female-led households experience wider gender pay gap as we go from high to low quantiles. The policy implication is straightforward. To the extent that income gaps reflect employers’ preferences for males (see Cho & Cho, 2011; Grubb, Lee, & Tergist, 2007; Lim, Choi, & Lee, 2015), female-headed households at the lower tail of the conditional
### TABLE 4  Results from quantile regressions using the full set of explanatory variables\(^a\) \(^b\)

| Dependent variable: log of gross household income | 10% | 50% | 90% |
|-------------------------------------------------|-----|-----|-----|
| Age                                             | 0.0450*** (0.0121) | 0.0333*** (0.0058) | 0.0356** (0.0149) |
| Age\(^2\)                                       | -0.0005*** (0.0001) | -0.0004*** (0.0001) | -0.0004*** (0.0001) |
| Average age of children                         | 0.0143*** (0.0015) | 0.0153*** (0.0010) | 0.0139*** (0.0020) |
| Family size                                     | 0.0316*** (0.0063) | 0.0289*** (0.0039) | 0.0156 (0.0099) |
| Number of children                              | 0.0620*** (0.0151) | 0.0289** (0.0105) | -0.0070 (0.0243) |
| Head's gender (base level is "Male")           | -0.1167*** (0.0167) | -0.0945*** (0.0107) | -0.1050*** (0.0208) |
| Urban (base level is "rural")                  | -0.0036 (0.0255) | 0.0263* (0.0147) | 0.0696** (0.0301) |
| Spousal status (base level is "spouse absent") | 0.2081*** (0.0279) | 0.1683*** (0.0173) | 0.1666*** (0.0336) |
| Education (base level is "Less than primary")  |                                             |                                             |                                             |
| Primary school                                  | 0.0155 (0.0815) | 0.0410 (0.0502) | 0.1174 (0.1004) |
| Middle school                                   | 0.1375* (0.0877) | 0.0709 (0.0504) | 0.1320 (0.0955) |
| High school                                     | 0.1503* (0.0803) | 0.1424** (0.0476) | 0.1986** (0.0887) |
| College                                         | 0.2041** (0.0802) | 0.1987*** (0.0480) | 0.2440** (0.0879) |
| Head's job status (base level is "Regular employee") |                                             |                                             |                                             |
| Unemployed                                      | -0.2484*** (0.0279) | -0.1859*** (0.0151) | -0.1438*** (0.0335) |
| Temporary worker                                | -0.1637*** (0.0259) | -0.1948*** (0.0173) | -0.1798*** (0.0387) |
| Daily worker                                    | -0.1258** (0.0487) | -0.1099*** (0.0290) | -0.0961** (0.0436) |
| Employer                                        | -0.0057 (0.0451) | 0.0114 (0.0273) | 0.0579 (0.1014) |
| Managing owner                                  | -0.1124*** (0.0193) | -0.1095*** (0.0138) | -0.1128*** (0.0273) |
| Unpaid family worker                            | -0.1769*** (0.0351) | -0.0717* (0.0432) | -0.1846*** (0.0462) |
| Industry (base level is "transportation")      |                                             |                                             |                                             |
| Manufacturing                                   | -0.0104 (0.0445) | 0.0445 (0.0296) | 0.1422 (0.0913) |
| Construction                                    | -0.0322 (0.0496) | 0.0161 (0.0398) | 0.0823 (0.0953) |
| Trade                                           | -0.0168 (0.0525) | 0.0276 (0.0339) | 0.1295 (0.0956) |
| Tourism                                         | -0.0281 (0.0665) | -0.0041 (0.0422) | 0.0265 (0.1005) |
| Business services                                | 0.0427 (0.0476) | 0.0681** (0.0306) | 0.1907** (0.0974) |
| Public services                                  | 0.0342 (0.0608) | 0.1195*** (0.0369) | 0.1849* (0.0988) |
| Social services                                  | 0.0143 (0.0530) | 0.0681** (0.0304) | 0.1312 (0.0920) |
| Others                                          | -0.0013 (0.0478) | 0.0565* (0.0298) | 0.0973 (0.0908) |
| Occupation (base level is "service workers")    |                                             |                                             |                                             |
| Professionals                                   | -0.0591 (0.0528) | -0.0262 (0.0319) | 0.1553* (0.0698) |
| Office workers                                   | -0.0283 (0.0518) | -0.0083 (0.0348) | 0.0767 (0.0640) |
| Sales                                           | -0.1125 (0.0732) | -0.1012** (0.0409) | -0.0904 (0.0684) |
| Skilled operators                                | -0.0824* (0.0481) | -0.0659** (0.0289) | 0.0336 (0.0553) |
| Others                                          | -0.1456** (0.0471) | -0.1112*** (0.0282) | -0.0093 (0.0548) |
| Number of observations                          | 6,678 | 6,678 | 6,678 |
| Intercept                                       | 13.3331*** (0.3330) | 13.9759*** (0.1620) | 14.1804*** (0.4331) |
| Goodness of fit\(^c\)                           | 0.3097 | 0.2256 | 0.1192 |

Notes: \(*\, p < 0.001, \, **\, p < 0.05, \, *\, p < 0.1.\)

\(^a\)Reported below are quantile regression results for the bottom decile (10th percentile), median (50th percentile), and top decile (90th percentile).

\(^b\)Robust standard errors for OLS, and bootstrap standard errors based on 1,000 bootstrap replications for the quantile regressions, are reported in parentheses.

\(^c\)The goodness of fit measures are \(R^2\) for OLS and pseudo-\(R^2\) for quantile regressions.
income distribution are expected to benefit the most from anti-discrimination measures. That is, policies aimed at combating gender discrimination are expected to be *inequality reducing*.

Four out of every five of male-led households were classified as "married, living together," which means the wife was present as a member of the household, while only 28% of female-led households had a live-in husband. At the same time, almost 70% of female-headed households were led by a single woman, but less than one fifth of male-headed households were led by a single man. Householder's gender is therefore closely related to whether a spouse is present. Table 4 indicates that the coefficient for spouse presence has the largest estimated value in the lower tail of the conditional income distribution, raising household income by 23%. Figure 3(b) shows that while spouse presence is statistically significant for the upper tail households, the estimated coefficient is considerably smaller and falls closer to the lower bound of the OLS confidence interval. The growing number of South Korean households led by single females are therefore expected to contribute to growing disparities.
Among householders employed in the public sector, the coefficient on public services is largest at the top decile of the conditional income distribution. The corresponding coefficient is not statistically significant at the bottom decile as well as for the 0.05th and 0.15th quantile models, indicating that left-tail households whose heads were civil servants earned as much income as households in the same quantiles whose heads were transportation workers (the baseline occupation). In contrast and relative to transportation workers, publicly-employed heads of conditional median households earned 13% more, while publicly-employed heads of top decile households 20% more. Thus, the recent proposal by the South Korean government to expand public-sector employment is expected to be inequality enhancing if it is not sufficiently broad based.

Turning now to the effects of schooling, we have seen that college education (and beyond) is associated with substantial increase in household income. Across the three income quantiles, both Table 4 and Figure 3(c) indicate that college education has the strongest effect at the right tail of the conditional distribution. Specifically, top-decile households led by college graduates earned 28% higher income than those led by elementary school dropouts and 5% more than those led by high school graduates. By contrast, conditional median and bottom-decile households whose heads were college educated made about 22% more than those led by elementary school dropouts. Promoting higher education therefore is expected to benefit all households, albeit potentially benefiting the upper-tail households the most. Thus, higher education is expected to be inequality enhancing.

Finally, unemployment also has an inequality-enhancing effect, which can be seen most easily from the estimated coefficient at the bottom decile that suggests a 23% lower income for households whose heads were unemployed than households whose heads had the privilege of being a regular employee. Figure 3(d) shows that the effect of unemployment is even stronger at lower quantiles. By contrast, conditional median households whose heads had regular jobs earned over 15% more than those whose heads were unemployed. At the same time, relative to households whose heads were unemployed, upper-tail households with regular employment earned roughly 13% higher income. Thus, a slowdown in economic activities leading to higher unemployment is expected to exacerbate the existing inequality.

5 | CONCLUDING REMARKS

Our analyses found that, not surprisingly, the lowest-income households in 2016 South Korea were disproportionately led by a single individual who is female, less educated than households at higher quantiles, and employed chiefly as a simple, manual worker. They were also more likely to be rural residents than the typical household in the entire sample, and headed by older empty nesters whose children have grown up and left home. Unemployment was pervasive at the lower tail, and this means lowest-income households rely much less on wage earnings, drawing instead a significant portion of their income from transfers from the government, non-profit organizations, and other households.

Not anticipated in post-industrial South Korea is the continuing role of manufacturing as the main source of employment for upper-tail householders. Unlike in most other advanced economies, it appears that the high-end services (which include finance, insurance, and real-estate) were not yet the main industry of occupation for high-income households in South Korea. It is also surprising that capital income accounted for less than 1% of total household income at the right tail of the distribution, while the share of labour earnings was even larger than for most households.

Our findings thus do not support the hypothesis that capital was an important source of income for highest-income households, let alone the primary one. In fact, the median capital income for the top decile households in 2016 was zero. It thus appears that Korean households at the upper tail of the income distribution in 2016 typically did not belong to the propertied class, suggesting that the inequality of total income is much closer to the inequality of labour income than to the inequality of capital income. The preponderance of very high labour incomes among the

2Manufacturing accounted for less than 40% of South Korea’s output in 2016.
highest-income households is also found in the US (Raffalovich, Monnat, & Tsao, 2009). Piketty and Saez (2003) attribute rising labour income at the top to managerial compensation that has increased rapidly in recent years.

Yet another unanticipated finding is the role of age and location as key factors that distinguish households at the upper tail of the income distribution from the propertied class. On average, a propertied householder is five years older and more likely to be a rural resident than a high-income householder. Nevertheless, it is consistent with the lifecycle hypothesis where high-performing, mobile executives pursued well-paid urban employment during prime age, and then retired in the countryside while living off accumulated savings.

We have employed quantile regressions to describe more fully the effects of select covariates at the lower tail, median, and upper tail of the conditional household income distribution. The results suggest that an equal-opportunity policy ensuring that equally-qualified men and women have access to the same opportunities and programs aimed at combating unemployment are inequality reducing. By contrast, we found that policies and programmes meant to promote higher education or to expand public sector workforce are expected to be inequality enhancing.

We hasten to add that, while quantile regressions describe the entire distribution more completely than OLS, the present approach does not allow us to pin down the causal mechanisms that are responsible for the unevenly distributed effects of college education, gender, public employment, and unemployment. We may speculate, for example, that male premium is highest (and sexual discrimination most intense) at the bottom decile because the current legal system fails to provide adequate protection to the most vulnerable households. Testing such hypothesis, as well as exploring potential endogeneity problems, requires panel data and instrumental variables that are beyond the scope of the present study.

Finally, it is important to recognize the limitations of the data set. It is well known that household survey data significantly underestimate the share of income accruing to the highest-income households. In the US case, Krueger (2003) argues that there is substantial underreporting of the incomes of top households in household survey data. In the Korean case, Kwack and Lee (2007) point out that the Household Income and Expenditure Survey often excludes very rich households headed by, for example, medical doctors and lawyers. Further limiting the degree to which the sample is representative of the high-income population is the top coding of income sources, which effectively censors the distribution at the upper tail. In addition, the available geographic information (urban vs. rural) is too aggregated to explore in a more meaningful way the spatial aspects of economic development (e.g., the distinction between high-income and low-income regions). These and other limitations of the data set must be borne in mind when interpreting the results reported here.

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Grubb, D., Lee, J., & Tergist, P. (2007). *Addressing labour market duality in Korea*. OECD Publishing, OECD Social, Employment and Migration Working Papers, No. 61. Paris: OECD.
**Resumen.** El objetivo de este artículo es entender cómo afectan las características demográficas a los diferentes cuantiles de la distribución de ingresos en Corea del Sur. Los resultados de la Encuesta de Ingresos y Gastos de los Hogares de 2016 sugieren que, en la parte inferior de la distribución, los hogares dependen en gran medida de las transferencias en efectivo de instituciones o de otros hogares, mientras que los de la parte superior dependen más de los salarios, lo que sugiere que los hogares con altos ingresos en Corea del Sur no pertenecen al “propietariado”. A continuación, se desarrollaron modelos empíricos simples para medir el efecto de las covariables demográficas sobre los ingresos de los hogares, condicionadas a una serie de variables comúnmente utilizadas en los estudios de desigualdad, como el ciclo de vida, educación, género, estado civil, residencia urbana, seguridad laboral, y tipo de ocupación y sector laboral. Los resultados de la regresión cuantílica demuestran cómo cambia un determinado cuantil de la distribución condicional con las características demográficas. Especificamente, se encontró un aumento en los efectos de género y desempleo a medida que se pasa de los cuantiles altos a los bajos. Por lo tanto, se espera que los programas destinados a combatir la discriminación de género y el desempleo persistente reduzcan la desigualdad. Esto contrasta con la existencia de políticas de promoción de la educación superior o de expansión del empleo en el sector público, las cuales aumentan la desigualdad de acuerdo con los modelos de regresión cuantílica.

抄録：本稿では、韓国の所得分配の分位数に対して人口統計学的特性がどのように影響するかの解明を試みる。2016年の世帯収支調査( Household Income and Expenditure Survey )により得られた知見から、所得分配のボトムの世帯は、公共機関および他の世帯からの現金給付に大きく依存し、その一方で所得分配のトップの世帯は賃金にかなり依存していることが示され、そこから韓国の高所得世帯は「有産階級」ではないことが示唆される。次に、不平等の研究で多く用いられる様々な変数に依存的な世帯収入に対する人口統計学的共変量（ライフサイクル、学歴、性別、婚姻歴、都心居住、職の安定、業種、職種など）の影響を測定する簡単な実証モデルを作成する。分位点回帰分析の結果から、ある条件付分布の分位数が人口統計学的特性によりどのように変化するかがわかる。具体的には、大きい分位数から小さい分位数になるにつれて、性別と失業の影響が大きくなることが分かった。性別による差別と持続的な失業の対策を目的としたプログラムは、不平等を減少させることで期待される。これは、分位点回帰分析により不平等を拡大することが指摘される、高等教育の促進または公共セクターの雇用を拡充する政策と対照的である。