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The Evolution of Income Risk and Consumption Insurance in South Korea over the Last Two Decades*

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Abstract

Using data from the Korea Labor Income Panel Study, we study the evolution of income risk and consumption insurance against transitory and permanent income shocks in South Korea over the last two decades. We find a decreasing trend in both income and consumption risks. Furthermore, we estimate that 47.6% of permanent income shocks and 9.8% of transitory income shocks pass through to consumption. We also provide evidence of substantial improvements in consumption insurance among the less educated and the older cohort nearing retirement. Our results suggest that recent developments of social safety net and welfare system may have played an important role in insuring income shocks in South Korea.

I. Introduction

Much attention has been paid to income and consumption inequalities among researchers and policymakers across many countries. Although the patterns of income inequality and income risks are extensively explored, most of the existing studies focus on the United States and European countries, mainly because of data availability and the size of their economies (Blundell and Preston, 1998; Blundell, Pistaferri and Preston, 2008; Piketty, 2014).

Using nationally representative household panel survey data on consumption and income, this study examines the trend of income and consumption inequalities in South Korea (hereafter, Korea) and investigates the extent of consumption insurance with respect to income shocks over the past two decades. We argue that exploring the case of Korea

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is interesting and meaningful. Korea is one of the few countries that experienced rapid economic growth since the 1960s. However, prior to the Asian financial crisis in 1997, the government did not invest sufficiently in social insurance and means-tested welfare benefits. In addition, due to the set of labour market reforms implemented after the financial crisis, temporary employment, including fixed-term contracts and temporary agency work, has become widespread (Grubb, Lee and Tergeist, 2007). Hence, to improve insurance against income shocks, the Korean government has gradually extended and adopted social insurance and means-tested programs over the past two decades (Jo, 2008; Kim, 2010).[1] To the best of our knowledge, this study is the first of its kind to investigate the degree of consumption insurance from developed countries other than the United States. We argue that Korea can be considered a representative example among several industrial countries in Asia that experienced unprecedented economic growth.

Recent research has documented that income inequality (typically measured by the variance of log income) or income risk (estimated from unexplained component growth of income) has been widening across developed countries (Attanasio, Hurst and Pistaferri, 2014; Attanasio and Pistaferri, 2014; Piketty, 2014). However, it is not clear whether the increased income risk will translate to a lower level of welfare because of the availability of consumption insurance. For example, several factors, such as intra-household transfers, social insurance and means-tested welfare programs, and intertemporal optimization, can affect how well protected an individual or a household is from the impact of adverse income shocks.

Empirical evidence on consumption insurance is relatively scant, compared with evidence on income risks or wealth inequality, because of the lack of high-quality consumption panel data. Most studies in the literature use data from the Panel Study of Income Dynamics (PSID) in the United States (Blundell *et al.*, 2008; Kaplan and Violante, 2010; Attanasio and Pistaferri, 2014; Blundell, Pistaferri and Saporta-Eksten, 2018). These studies have documented that, over the past decades, consumption inequality grows less rapidly compared with income inequality. Moreover, these studies have shown some evidence of partial insurance of permanent shocks. However, it is difficult to find studies outside the United States because of data limitations. The study of Santaeulàlia-Llopis and Zheng (2018) which utilized a Chinese data set is an exception. They studied the consumption insurance in China between 1989 and 2009 using data from the China Health and Nutrition Survey (CHNS), a panel survey of nine provinces in China. Hence, the findings of our study would contribute to the literature by expanding the understanding of consumption insurance in a different country setting other than the United States and China. In addition, this study has an advantage in terms of data quality over those existing studies because our survey data collect comprehensive information on consumption spending (comparable with the US Consumer Expenditure Survey) on an annual basis. The previous studies using the PSID or CHNS data used imputed measures of total household consumption spending.

We firstly document the evolution of income inequality and consumption inequality, which are measured by unconditional variances of log income and log consumption, respectively. Figure 1 indicates that both income and consumption inequalities have decreased

[1] Examples include a means-tested cash transfer program (the National Basic Livelihood Security System) for the needy introduced in 2000, non-contributory pension schemes for the poor and the elderly (the Basic Pension Program) implemented in 2008, and gradual expansions of unemployment insurance, first introduced in 1995.

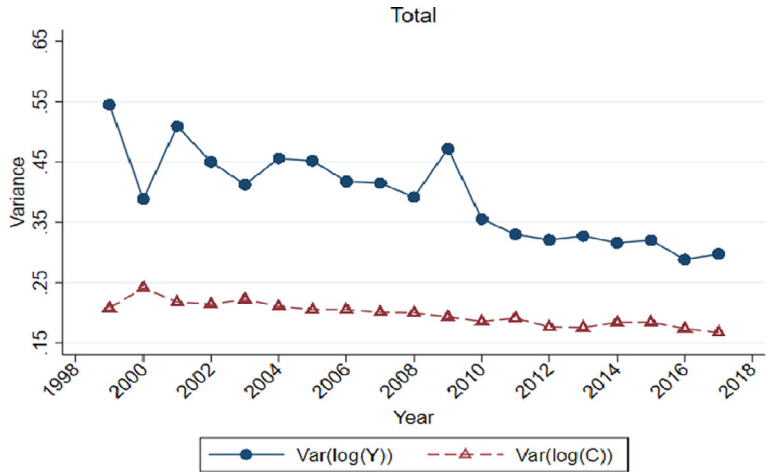


Figure 1. Consumption (C) and income (Y) variances in South Korea by year.
Source: Author's own calculation using the 1999–2017 KLIPS data.

over the last two decades.[2] In particular, the declining pattern in consumption inequality of Korea is quite different from that of the United States, which has risen in the last 30 years (see Appendix Figure A1). This finding suggests the importance of understanding consumption insurance under different economic environments.

Next, we document the evolution of income and consumption risks. We find that the variance of unexplained income growth in Korea has decreased more than half during the study period. More surprisingly, the variance of unexplained consumption growth has decreased almost by two-thirds. The decreasing income and consumption risks are similar to the declining patterns of income inequality and consumption inequality, respectively. However, we find that the estimated variances of permanent and transitory income shocks are moderately decreasing and relatively stable over the sample period, respectively.

Thirdly, using the framework of Blundell *et al.* (2008), we estimate how the degree of consumption insurance in Korea has evolved. By imposing a set of statistical assumptions about the income process and the covariance structure between income and consumption, we quantify how well a household can cope with permanent and transitory income shocks. We estimate that 47.6% of permanent income shocks and 9.8% of transitory income shocks pass through to consumption. We also find that taxes and transfers play a major role in providing consumption insurance against permanent income shocks. These estimates are consistent with the findings from the studies using the PSID data (Blundell *et al.*, 2008) in the sense that permanent income shocks are much less insured compared with transitory shocks. However, Korean households are less insured to the transitory income shocks than American households are.

Lastly, we provide evidence of improvement in consumption insurance among less educated and older cohorts nearing retirement over the past two decades. In particular, the degree of consumption insurance against permanent income shock increases by 53%

[2] Following the literature, we restrict our sample to continuously married households whose heads are male aged between 30 and 60 years. Hence, one needs to be cautious about extrapolating our findings to other population groups. Nevertheless, our sample populations account for the major type of Korean households.

among less educated households (headed by those without a college degree) and by 44% among older households (headed by those aged 45 years and above) over the sample period. These results suggest that improved access to the social safety net and welfare programs, as well as the extension of the national pension system, implemented in Korea over the two last decades may have played an important role in insuring household consumption against income shocks.

The rest of the paper is structured as follows. Section II introduces the data. Section III presents descriptive evidence on income and consumption inequalities in Korea between 1999 and 2017. Section IV describes the empirical methodology. Section V presents and discusses the estimation results. Section VI concludes the paper.

II. Data

The dataset must meet the following key requirements for our study: (i) a nationally representative household panel; (ii) long enough to keep track of changes over the last two decades; and (iii) contain information on both consumption spending and income, as well as other household characteristics. To our best knowledge, the Korea Labor Income Panel Study (KLIPS) is the only dataset that meets these requirements.

The KLIPS is an annual panel survey that began in 1998.[3] It is designed after the US PSID. For example, similar to the PSID, the KLIPS surveys every household member aged 15 years and above and its spin-off family members through marriage, divorce and so on. In addition, the KLIPS collects rich information about the income, expenditure, household structure, wealth, education, and other individual and household characteristics. We use data from the 1999 to 2017 KLIPS for our study.

We use the following key variables for the empirical analysis. Firstly, we measure annual after-tax household income as the sum of earned income, financial income, income from real estates (e.g. rents), income from social insurance (pension, unemployment benefit, etc.), public and private transfer income, and other income. Secondly, we measure annual household consumption spending using a wide array of items available in the KLIPS, which include expenditures on food, dining out, public and private education, housing, medical care, recreational activities and durables. Data on average monthly spending for each item during the last calendar year were also obtained. To construct the aggregate annual household consumption spending measure, we sum them up and multiply by 12. To avoid the possibility of measurement error, we winsorized annual after-tax household income and annual household consumption spending at the 1st and 99th percentiles.[4] The missing observations for some spending items in the data are considered zero. Lastly, we use individual- and household-specific variables to remove predictable components of income and consumption processes. These variables include birth year, gender, number of children, household size, education, employment status, province of residence and calendar year. All monetary values used are converted to 2016 Korean won (KRW). In

[3] We do not use the first survey wave collected in 1998 because of a major change to improve the measurement of annual household income in 1999 (second wave).

[4] We conduct a set of robustness checks by employing four alternative definitions to handle zero values and outliers. The results repeating the baseline analysis with the alternative definitions are reported in Appendices F, G and H.

TABLE 1

Sample characteristics (selected years)

	1999	*2004*	*2009*	*2013*	*2017*
	Mean (SD)	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Age	44.12 (8.35)	44.53 (8.39)	45.45 (8.34)	46.09 (8.42)	46.91 (8.12)
Household size	4.05 (0.94)	3.87 (0.88)	3.74 (0.89)	3.70 (0.90)	3.70 (0.88)
High school education or below	0.71 (0.45)	0.63 (0.48)	0.58 (0.49)	0.53 (0.50)	0.46 (0.50)
Husband working	0.96 (0.36)	0.95 (0.30)	0.95 (0.28)	0.96 (0.24)	0.96 (0.23)
Wife working	0.52 (0.53)	0.52 (0.53)	0.52 (0.53)	0.56 (0.51)	0.60 (0.51)
Annual household income	34.07 (27.07)	49.01 (33.37)	51.19 (34.15)	56.48 (32.06)	63.33 (35.33)
Annual household expenditures	22.78 (10.90)	32.68 (14.49)	35.22 (14.48)	36.21 (14.47)	38.75 (14.69)
Annual nondurable expenditures	13.55 (5.98)	15.78 (6.40)	16.29 (5.98)	17.08 (5.81)	18.06 (5.85)
Household net worth	153.25 (213.7)	184.74 (257.90)	200.64 (262.56)	195.24 (226.58)	241.25 (250.26)
No. of households	2,615	2,449	2,768	2,607	2,497

Notes: Standard deviations are in parentheses. Monetary units are in 1,000,000 of CPI-adjusted Korean won (KRW), using 2016 as a base year. Nondurable goods include food at home, food away from home, vehicle maintenance (gasoline, automobile tax, and car insurance), housing-related bills (monthly rents, electricity, water, and gas), healthcare, public transport, necessities, clothing and shoes.

Appendix B, we provide evidence on the comparability between KLIPS and other national statistics.

We impose the following sample selection criteria. Firstly, we restrict the sample to households whose heads are male aged between 30 and 60 years. In our analysis, we choose 30 years as the youngest age to focus on the households who already entered the labour market and 60 years as the oldest age to avoid the potential influence of retirement. Secondly, we focus on continuously married households during the observed survey years to ensure that our analysis is not affected by the changes in marital status because consumption insurance critically depends on family structure. Changes in family structure or age structure, such as a rise in single households and population ageing, have important implications for consumption insurance, but the research topic is beyond the scope of this paper.

Table 1 presents the summary statistics of the study sample for the selected years. On average, our sample household heads are in their 40s, but the average age is increasing over time, reflecting the ageing trend in Korea.[5] The household size, measured by the number of household members living together, is decreasing from 4.05 in 1999 to 3.70 in 2017, reflecting the decreasing marriage and fertility rates. A notable positive change is the increasing trend in educational attainments. In 1999, 71% of the sample members reported that they have high school education or below. This proportion steadily goes down to 46% by 2017. During the sample period, 95%–96% of husbands are working, whereas only

[5] The proportion of individuals aged between 55 and 65 years is expected to increase from 19.7% in 2017 to 26.7% by 2050 (Lee and Lee, 2017).

52%–60% of wives are working. Female labour force participation is relatively low, but it has been increasing over the past decade. Moreover, the annual household income had continuously grown from about 34 million KRW in 1999 to 63.3 million KRW in 2017.[6] Meanwhile, household consumption expenditure and net worth exhibit similar patterns. To better understand how the distribution of key variables changes over time, we also report the quantile values in 2001 and 2017 in Appendix Table C1. We find that the percentage gaps between the 25th and 75th percentiles of key variables – in particular, consumption spending (from 42.6 % to 37.6%) – decrease over time.

III. Descriptive evidence on consumption and income inequality trends

We firstly start our empirical analysis by documenting the consumption and income inequality trends between 1999 and 2017 using the KLIPS data. Following the literature, we use the unconditional variances of log consumption spending and log income to capture consumption inequality and income inequality respectively.

Figure 1 shows that (after-tax) income variance has been steadily declining by almost 40% from 1999 to 2016. A sharp surge in income inequality in 2009 is likely due to the recent Great Recession. In contrast to the growing pattern of income inequality over several decades based on US or European data, income inequality in Korea has been declining over time. It is noteworthy that we are considering prime-aged working populations and continuously married households living in urban areas; hence, the overall pattern of inequality for society as a whole could be different. The declining income inequality is consistent with a decrease (albeit small) in Gini coefficient among households with prime-aged heads in Korea over the past decade (Yun, 2017). Not surprisingly, the level of consumption inequality is lower than that of income inequality, because of intertemporal optimization and public/private transfers, among others. In addition, the pattern of consumption inequality has been more stable than that of income inequality, although it decreased by about 20%, from 0.208 in 1999 to 0.167 in 2017. Appendix F presents the same figures using alternative winsorization rules or the inverse hyperbolic sine (IHS) transformation. The patterns are robust to how we handle zero and outliers.

Figure 2 provides graphical evidence on consumption and income inequalities by age. Although different birth cohorts are mixed in the figure, consumption and income inequalities are rising with age. This feature is consistent with the prediction of Deaton and Paxson (1994) and the US data (p. 1891, Blundell *et al.*, 2008).

To account for the differences in initial conditions, we also report income and consumption inequalities by age for different birth cohorts in Figure 3. We find that significant differences exist in inequality levels across different birth cohorts even at the same age. Panel A indicates that younger cohorts generally experience smaller income inequalities within the same age. Similarly, Panel B shows that younger cohorts are more likely to experience smaller consumption inequalities within the same age, implying stronger consumption insurance developed over the past decades.

The graphical evidence reported in this section is suggestive, but does not directly provide information on the size of income risks over time and the degree of consumption

[6] As of 2 January 2020, 1 US dollar is equivalent to 1,158.8 Korean won.

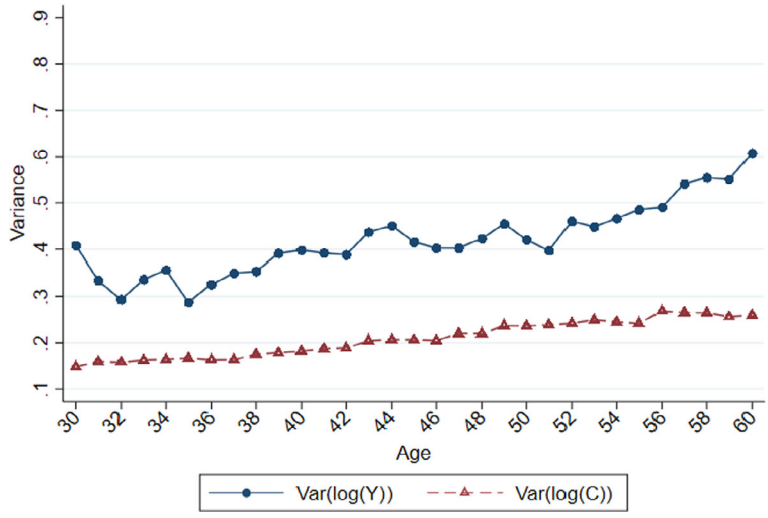


Figure 2. Consumption and income variances in South Korea by age.
Source: Author's own calculation using the 1999–2017 KLIPS data.

insurance against income risks. Thus, we move on to the next section to estimate the distribution of income risks and the degree of consumption insurance.

IV. Methodology

We use the seminal methodology developed by Blundell *et al.* (2008; hereafter, BPP) to identify the degree of consumption insurance. Thus, our methodology description below is a brief recap of BPP's (2008) methods. We use the same notational convention for comparability. See section II of BPP (2008) for the full details of the methodology.

Model assumptions

Assuming that an income shock to household net income is the only source of risks to a household and that consumption and labour disutility are separable in a normative preference, we can write an income process for household i in year t as

$$\log Y_{i,t} = Z_{i,t}\varphi_t + P_{i,t} + v_{i,t} \tag{1}$$

where Y represents household income, Z denotes observable household (or household head) characteristics such as age, education and gender. P denotes a permanent unobservable component, and v is a transitory unobservable component.

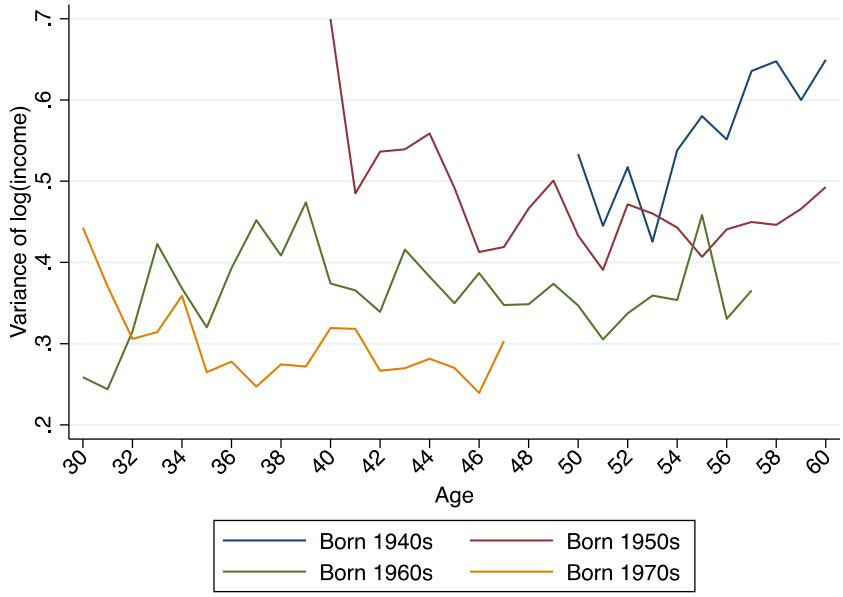
We also define that the permanent component (P) has the random walk process as follows:

$$P_{i,t} = P_{i,t-1} + \zeta_{i,t} \tag{2}$$

where ζ is an $i.i.d.$ shock drawn from a normal distribution $N(0, \sigma_\zeta^2)$.

Lastly, we assume that the transitory component (v) follows an MA (q) process:

Panel (a) : Household Income



Panel (b) : Household Consumption

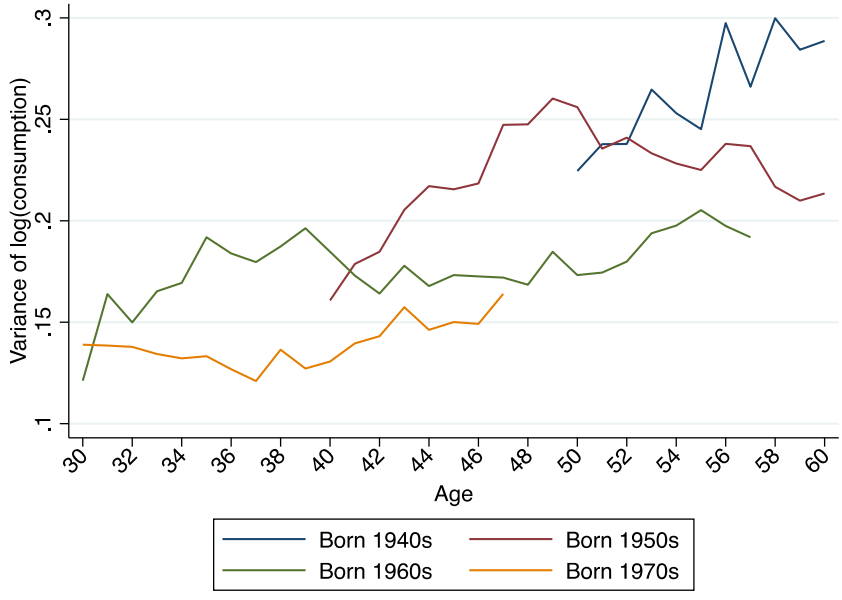


Figure 3. Income and consumption variances by age and cohort.
Panel A: Household Income.
Panel B: Household Consumption
Source: Author's own calculation using the 1999–2017 KLIPS data.

$$v_{i,t} = \sum_{j=0}^{q} \theta_j \varepsilon_{i,t-j} \tag{3}$$

with $\theta_0 \equiv 1$.

According to the above-stated assumptions, the unexplained income innovation can be described as

$$\Delta y_{i,t} = \zeta_{i,t} + \Delta v_{i,t} \tag{4}$$

where $y_{i,t}$ is log $Y_{i,t} - Z_{i,t}\phi_t$, that is, the log of unexplained income.

Measurements of consumption insurance parameters

The model assumptions imply that the change in unexplained log consumption can be expressed as follows:

$$\Delta c_{i,t} = \phi_{i,t}\zeta_{i,t} + \psi_{i,t}\varepsilon_{i,t} + \xi_{i,t}, \tag{5}$$

where c is the unexplained component of log consumption. The specification in equation (5) implies that a unit increase in the permanent income shock (ζ) and temporary income shock (ε) affects the first difference in residual log consumption by φ and ψ respectively. ξ is an $i.i.d.$ error term that can be interpreted as classical measurement error, preference shocks and so on. Under the BPP framework, φ and ψ are parameters of interest that capture the degree of consumption insurance against permanent and transitory shocks respectively. For example, φ equals 0 indicates full insurance against permanent income shocks, and φ equals 1 means no insurance against permanent income shocks.

To identify the consumption insurance parameters φ and ψ, we impose covariance structures on the bivariate processes (4) and (5). We base our identification of the insurance parameters on BPP (2008). Thus, we describe moments to be used for the minimum distance estimation of the consumption insurance parameters in Appendix D.

Lastly, as discussed in BPP (2008), we reiterate the advantages of using panel data on both income and consumption over those studies using repeated cross-sectional data. With the cross-sectional data, we cannot observe the variance–covariance structure of income and consumption changes. One can still estimate the degree of consumption insurance to some extent with cross-sectional data assuming zero serial correlation of transitory shocks. However, such a strong assumption is difficult to justify with the observed data.

V. Results

We present empirical evidence on (i) auto-covariance structure of income and consumption, (ii) consumption insurance parameters and variances of permanent and transitory income shocks and (iii) how these parameters change over time and across groups.

Moments

We report the moments required to estimate the consumption insurance parameters. The estimation of the auto-covariance structure of consumption and income starts with

TABLE 2

Auto-covariance of income growth

Year	$var(\Delta y_t)$		$cov(\Delta y_{t+1}, \Delta y_t)$		$cov(\Delta y_{t+2}, \Delta y_t)$	
	(1)		*(2)*		*(3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
2001	0.353	(0.025)	−0.199	(0.021)	−0.006	(0.009)
2002	0.394	(0.026)	−0.123	(0.014)	−0.004	(0.007)
2003	0.295	(0.026)	−0.092	(0.009)	−0.020	(0.007)
2004	0.254	(0.016)	−0.099	(0.013)	−0.001	(0.006)
2005	0.270	(0.021)	−0.010	(0.014)	−0.002	(0.008)
2006	0.253	(0.020)	−0.092	(0.012)	−0.005	(0.007)
2007	0.249	(0.021)	−0.103	(0.019)	0.009	(0.007)
2008	0.211	(0.015)	−0.070	(0.008)	−0.002	(0.007)
2009	0.302	(0.033)	−0.150	(0.025)	−0.007	(0.006)
2010	0.281	(0.023)	−0.084	(0.013)	−0.001	(0.005)
2011	0.189	(0.014)	−0.061	(0.007)	0.002	(0.004)
2012	0.189	(0.015)	−0.057	(0.007)	−0.008	(0.006)
2013	0.171	(0.017)	−0.076	(0.015)	−0.005	(0.003)
2014	0.177	(0.017)	−0.059	(0.007)	−0.008	(0.005)
2015	0.153	(0.011)	−0.059	(0.008)	0.001	(0.004)
2016	0.135	(0.009)	−0.041	(0.005)	NA	NA
2017	0.136	(0.010)	NA	NA	NA	NA

removing the influences of the observables, which include year-, birth cohort- and province-fixed effects and time-varying characteristics – educational attainment, number of children, household size and employment status. We allow the effects of these characteristics to vary over time. We isolate the unexplained component of income (y_{it}) by estimating equation (1). In the same manner, we also isolate the unexplained component of consumption (c_{it}).

Table 2 reports the auto-covariance matrix of income innovation in Korea from 2001 to 2017. We observe that the variance of the first difference in unexplained income is steadily going down from 0.353 in 2001 to 0.136 in 2017. In other words, the size of income risks has decreased by more than half over the 16-year period. The second-order and third-order auto-covariances shown in columns (2) and (3) of Table 2, respectively, suggest that the income process follows an MA(1) process.

We then proceed to the consumption process. Table 3 reports the auto-covariance matrix of consumption innovation from 2001 to 2017. Column (1) shows that the variance of the first difference in the unexplained component of consumption spending steadily and almost monotonically goes down from 0.167 in 2001 to 0.056 in 2017. The reduction in this variation has declined by about two-thirds, even more striking than that of income. This information is useful in inferring the degree of consumption insurance and the extent of measurement error. Meanwhile, column (2) shows that first-order autocovariance of consumption growth is decreasing over time. This is likely to reflect improved consumption insurance and reduced variances of unexplained income as documented in Table 2. The second-order autocovariance of consumption growth reported in column (3) is generally small in magnitude and statistically insignificant. As a robustness check, we also conduct the

TABLE 3

Auto-covariance of consumption growth

Year	$var(\Delta c_t)$		$cov(\Delta c_{t+1}, \Delta c_t)$		$cov(\Delta c_{t+2}, \Delta c_t)$	
	(1)		*(2)*		*(3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
2001	0.167	(0.0065)	−0.061	(0.0045)	0.0003	(0.0038)
2002	0.132	(0.0050)	−0.050	(0.0037)	−0.0016	(0.0029)
2003	0.119	(0.0050)	−0.043	(0.0032)	−0.0057	(0.0027)
2004	0.105	(0.0040)	−0.033	(0.0026)	−0.0029	(0.0023)
2005	0.092	(0.0035)	−0.029	(0.0024)	−0.0031	(0.0022)
2006	0.082	(0.0035)	−0.033	(0.0027)	−0.0058	(0.0023)
2007	0.081	(0.0032)	−0.030	(0.0022)	−0.0014	(0.0022)
2008	0.087	(0.0034)	−0.034	(0.0025)	−0.0014	(0.0022)
2009	0.083	(0.0031)	−0.033	(0.0023)	−0.0001	(0.0020)
2010	0.084	(0.0031)	−0.031	(0.0022)	−0.0038	(0.0022)
2011	0.075	(0.0027)	−0.028	(0.0020)	−0.0001	(0.0018)
2012	0.075	(0.0031)	−0.028	(0.0021)	−0.0038	(0.0018)
2013	0.069	(0.0026)	−0.026	(0.0018)	−0.0036	(0.0015)
2014	0.065	(0.0028)	−0.024	(0.0020)	−0.0021	(0.0021)
2015	0.060	(0.0026)	−0.023	(0.0021)	−0.0016	(0.0014)
2016	0.061	(0.0027)	−0.025	(0.0017)	NA	NA
2017	0.056	(0.0023)	NA	NA	NA	NA

same exercise using non-durable consumption expenditures as a measure of consumption, and the results are robust, as reported in Appendix E.

Table 4 reports the auto-covariance matrix of consumption and income innovations. It investigates the relationship between unexplained components of income and consumption innovations. We observe that the covariance between income and consumption growth becomes smaller steadily (column 1). The p-value of joint significance for all years reported at the foot of the table is less than 0.001. In addition, we check whether the future income difference would covary with the current consumption difference (column 2). The covariance should be zero unless information about future income shock is available to consumers in advance and only partial insurance exists for transitory shocks. Magnitudes of individual estimates are generally small, and the p-value for the joint test of significance is 0.561, implying that to some extent, households are insured to the transitory income shocks and future income shock information is not available to consumers in advance.[7] Column (3) of Table 4 shows that the current income growth negatively covaries with future consumption growth. However, the magnitudes are economically insignificant in general, and the p-value for the joint test of significance is 0.437. In sum, we present evidence that the variances of unexplained components of income and consumption decrease simultaneously and monotonically in Korea.

[7] We also conducted the same exercise using non-durable consumption expenditures as a measure of consumption. The results, reported in Appendix F, remain robust.

TABLE 4

Covariance of consumption–income growth

Year	$cov(\Delta y_t, \Delta c_t)$		$cov(\Delta y_{t+1}, \Delta c_t)$		$cov(\Delta y_t, \Delta c_{t+1})$	
	(1)		*(2)*		*(3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
2001	0.063	(0.0068)	−0.011	(0.0065)	−0.0069	(0.0056)
2002	0.041	(0.0057)	−0.013	(0.0047)	−0.0089	(0.0061)
2003	0.047	(0.0052)	−0.0083	(0.0041)	−0.0044	(0.0048)
2004	0.039	(0.0045)	−0.013	(0.0041)	−0.0079	(0.0042)
2005	0.042	(0.0046)	−0.014	(0.0036)	−0.015	(0.0039)
2006	0.047	(0.0041)	−0.012	(0.0036)	−0.013	(0.0034)
2007	0.046	(0.0038)	−0.0092	(0.0034)	−0.018	(0.0037)
2008	0.041	(0.0038)	−0.0109	(0.0038)	−0.015	(0.0035)
2009	0.037	(0.0043)	−0.0097	(0.0038)	−0.012	(0.0038)
2010	0.034	(0.0040)	−0.0089	(0.0030)	−0.014	(0.0036)
2011	0.029	(0.0026)	−0.0048	(0.0025)	−0.0089	(0.0025)
2012	0.032	(0.0034)	−0.0056	(0.0027)	−0.012	(0.0026)
2013	0.029	(0.0030)	−0.0056	(0.0026)	−0.0078	(0.0025)
2014	0.026	(0.0024)	−0.0052	(0.0022)	−0.0077	(0.0024)
2015	0.026	(0.0030)	−0.0041	(0.0026)	−0.011	(0.0032)
2016	0.024	(0.0029)	−0.0038	(0.0021)	−0.0089	(0.0020)
2017	0.023	(0.0024)	NA	NA	NA	NA
p-value for the joint significance test for all t	<0.001		0.561		0.437	

Consumption insurance and changes in consumption insurance over time

In this subsection, we report our estimates of income risks and consumption insurance parameters described in section IV. In column (1) of Table 5, we find that the estimated variances of permanent income shocks have been slowly decreasing over time. However, the size of the decrease is modest, and the pattern is not monotonic. Compared with the US data in the early 1990s, the magnitude of the Korean data is somewhat larger or similar depending on the sample period. In column (2) of Table 5, we report the estimated variances of transitory income shocks. The size of transitory income risks is much larger than that of permanent income risks. Figure 4 illustrates how the distribution of income shocks change over time.[8]

We present our parameter estimates of interest, φ and ψ, in Table 6. The degree of consumption insurance against permanent income shocks, captured by φ, is 0.476 – meaning that about 48% of permanent income shocks pass through to consumption. In other words, about half of the shocks to permanent income are insured. Meanwhile, the degree of consumption insurance against temporary income shocks, captured by ψ, is 0.098 – meaning that only about 10% of transitory income shocks pass through to consumption, which is much smaller than the impact of permanent income shocks. In other words, about

[8]The results of the same analysis using alternative winsorization rules and the IHS transformation are reported in Appendix G.

TABLE 5

Variance estimates of permanent and transitory income shocks

Year	σ_{ζ}^2 *(Variance of permanent income shocks) (1)*	σ_{ε}^2 *(Variance of transitory income shocks) (2)*
2001	NA	0.0105
		(0.0011)
2002	0.0022	0.0067
	(0.0005)	(0.0008)
2003	0.0020	0.0052
	(0.0005)	(0.0005)
2004	0.0030	0.0058
	(0.0005)	(0.0008)
2005	0.0023	0.0061
	(0.0005)	(0.0009)
2006	0.0020	0.0056
	(0.0006)	(0.0007)
2007	0.0021	0.0063
	(0.0005)	(0.0012)
2008	0.0015	0.0041
	(0.0005)	(0.0005)
2009	0.0021	0.0087
	(0.0005)	(0.0014)
2010	0.0017	0.0056
	(0.0004)	(0.0009)
2011	0.0017	0.0042
	(0.0004)	(0.0005)
2012	0.0028	0.0040
	(0.0006)	(0.0005)
2013	0.0019	0.0053
	(0.0005)	(0.0011)
2014	0.0019	0.0039
	(0.0004)	(0.0005)
2015	0.0019	0.0039
	(0.0004)	(0.0005)
2016	0.0020	0.0028
	(0.0004)	(0.0003)

Note: Standard errors are in parentheses.

90% of shocks to transitory income are insured, although we reject the null hypothesis that temporary income shocks are fully insured. This finding suggests that the government efforts to protect workers should be more focused on structural changes in the economy.[9]

To assess how consumption insurance changed before and after the financial crisis in 2008 and understand the source of consumption insurance, we separately estimate the consumption insurance parameters before and after 2008 and consider other income

[9] The results of the same analysis using alternative winsorization rules and the IHS transformation are reported in Appendix H.

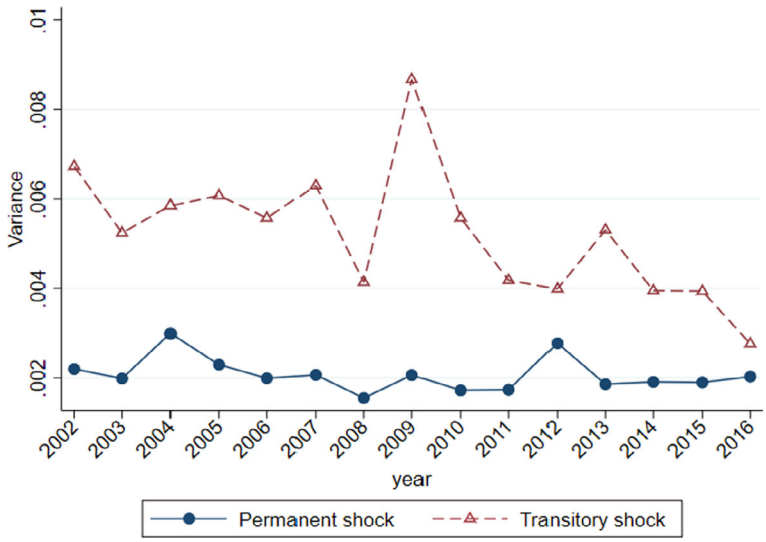


Figure 4. The evolution of variances of permanent and transitory income shocks.
Source: Author's own calculation using the 1999–2017 KLIPS data.

TABLE 6

Consumption insurance parameter estimates

	(1)
φ (Consumption insurance parameter for permanent income shocks)	0.476
	(0.038)
ψ (Consumption insurance parameter for transitory income shocks)	0.098
	(0.010)

Notes: Standard errors are in parentheses.

definitions. In addition to the baseline household income that takes account of both tax and transfers, we use pretax household income with and without transfers and post-tax household income without transfers. The results are reported in Table 7.

Firstly, in column (1), we find that the degree of consumption insurance becomes stronger after 2008. Compared with the United States evidence in the 1990s in which the value of φ was 0.642, as reported by Blundell *et al.* (2008), the degree of consumption insurance against permanent shocks is higher in Korea in 2001–08 by 30% than that in the United States $((1 - 0.532)/(1 - 0.642))$. However, we acknowledge that the direct comparison requires some caution because of the differences in the sample periods and the economic environments between the United States and Korea.

Secondly, column (2) indicates that the coefficient estimates of φ are smaller than those in column (1) by 24.5% (in 2001–08) and by 24.8% (in 2009–17) without subtracting taxes and transfers. This result implies that taxes and transfers play a significant role in providing consumption insurance against permanent income shocks in Korea. Blundell *et al.* (2008) estimate that taxes and transfers jointly explain the 50% consumption insurance to permanent income shocks in the United States. The difference is likely to stem from the fact that Korea's income tax rates are rather low due to the presence of various deductions.

TABLE 7

Consumption insurance parameter estimates using alternative income definitions

Household income	Year	*(1)*	*(2)*	*(3)*	*(4)*
		Post-tax income with transfers (baseline)	*Pre-tax income without transfers*	*Pre-tax income with transfers*	*Post-tax income without transfers*
φ *(Consumption insurance parameter for permanent income shocks)*	2001–08	0.532	0.402	0.458	0.512
		(0.060)	(0.049)	(0.048)	(0.053)
	2009–17	0.420	0.316	0.331	0.404
		(0.047)	(0.034)	(0.034)	(0.044)
ψ *(Consumption insurance parameter for transitory income shocks)*	2000–08	0.111	0.123	0.128	0.111
		(0.014)	(0.015)	(0.016)	(0.015)
	2009–17	0.082	0.065	0.089	0.079
		(0.013)	(0.014)	(0.014)	(0.014)

Note: Standard errors are in parentheses.

To illustrate, a net average tax rate for a single worker in Korea is 14.9%, which is about 10% points lower than the OECD average of 25.5% (OECD, 2019).[10] In addition, we do not find evidence that taxation affects the degree of insurance to transitory income shocks as in Blundell *et al.* (2008).

Thirdly, the results reported in columns (3) and (4) show the extent of consumption insurance attributed by taxes and by transfers respectively. We find that taxes and deductions play a much bigger role than transfers do. The coefficient estimates of φ decrease by 13.9% (in 2001–08) and by 21.2% (in 2009–17), when we do not subtract taxes (column 3). By contrast, the corresponding coefficient estimates decrease only by about 4% in both periods when we subtract transfers (column 4).

To investigate the potential role of social safety net and welfare programs in consumption insurance, we estimate consumption insurance parameters separately by population groups with different likelihoods of receiving the benefits of social programs in Table 8. We divide the sample by education attainments (college and above vs. high school and below) and by a household head's age (below 45 years vs. 45 years and above).[11]

In columns (1) and (2), we find that the level of consumption insurance was lower for the less educated than that for the more educated group before 2009, especially against permanent income shocks. However, consumption insurance among the less educated dramatically improved by 53% during the last decades. In particular, the parameter estimates regarding the impact of permanent income shocks on consumption markedly decrease for the less educated and become smaller (0.33) than that for the more educated (0.53) in 2009–17. In addition, columns (3) and (4) show a similar pattern for older households. Consumption insurance against permanent shocks for older households in 2009–17 im-

[10] In our sample, individuals pay, on average, 11.6% of their pre-tax earnings as taxes.

[11] We employ 45 years as the cut-off age for older households because workers in Korea tend to retire at younger ages compared with those in Western countries. Mandatory retirement ages set by firms in Korea have often been as low as 55 years until the recent implementation of the Aged Employment Promotion Act in 2016 that mandates firms to set their retirement ages to 60 years or above. According to the recent statistic, the average age of retirement from a life-time main job is only 49.1 years (Statistics Korea, 2020).

TABLE 8

Consumption insurance parameter estimates

	Year	*(1)*	*(2)*	*(3)*	*(4)*
		College and above	*High school and below*	*Household head's age < 45*	*Household head's age ⩾ 45*
φ (Permanent shock)	2001–08	0.468	0.562	0.499	0.567
		(0.099)	(0.075)	(0.079)	(0.091)
	2009–17	0.533	0.330	0.483	0.375
		(0.070)	(0.064)	(0.078)	(0.059)
ψ (Transitory shock)	2000–08	0.114	0.110	0.096	0.125
		(0.024)	(0.018)	(0.020)	(0.020)
	2009–17	0.060	0.094	0.062	0.100
		(0.022)	(0.017)	(0.018)	(0.019)

Notes: Standard errors are in parentheses.

proves by 44%. Before 2009, older households (whose household heads are aged 45 years and above) are more vulnerable to permanent income shocks than younger ones. However, after 2009, older households are better protected against permanent income shocks than younger households. The consistent patterns found from the less-educated and the older households suggest that access to the social safety net and welfare programs may play an important role in insuring income shocks for the disadvantaged groups.[12]

VI. Conclusion

We document the evolution of income and consumption inequalities and income risks and assess the degree of consumption insurance in Korea over the last two decades, using rich household-level panel data. The case of Korea is useful in studying consumption insurance, not only because it is considered a representative example among several industrial countries in Asia that experienced unprecedented economic growth, but also because Korea has significantly expanded social safety nets over the last two decades.

We report that both income and consumption inequalities are declining steadily between 1999 and 2017, which is quite different from those of the United States in which income inequality has risen for the last 30 years. Concurrently, we find that the estimated variances of permanent and transitory income shocks, respectively, are moderately decreasing and relatively stable. In addition, we estimate that about 48% of permanent income shocks and about 10% of transitory income shocks pass through to consumption, suggesting the greater importance of providing consumption insurance for permanent income shocks such as structural changes in the economy. Lastly, we provide some evidence of improvements in consumption insurance among the less educated and among older households, suggesting that access to the social safety net and welfare programs, as well as the extension of the national pension system, may have played an important role in insuring income shocks.

[12] We also conducted the analysis by the number of children in a household but found little differences between households with one child and households with more than one child. The results are available upon request.

We acknowledge several limitations of our analysis that can translate into avenues for future research. Firstly, our analysis does not consider changes in family structure. Family structure is an important source of consumption insurance; therefore, it would be interesting to assess the role of changing family structure in explaining the evolution of income risks and consumption insurance in Korea. Secondly, we estimate the insurance and risk-related parameters in a parsimonious partial insurance model. It would be meaningful to extend our model to incorporate a richer feature of life-cycle models as in Kaplan and Violante (2010) and conduct counterfactual analysis to evaluate the effects of increased permanent income risks to the economy on behavioural and welfare impacts.

Appendix A.
Consumption inequality in the United States

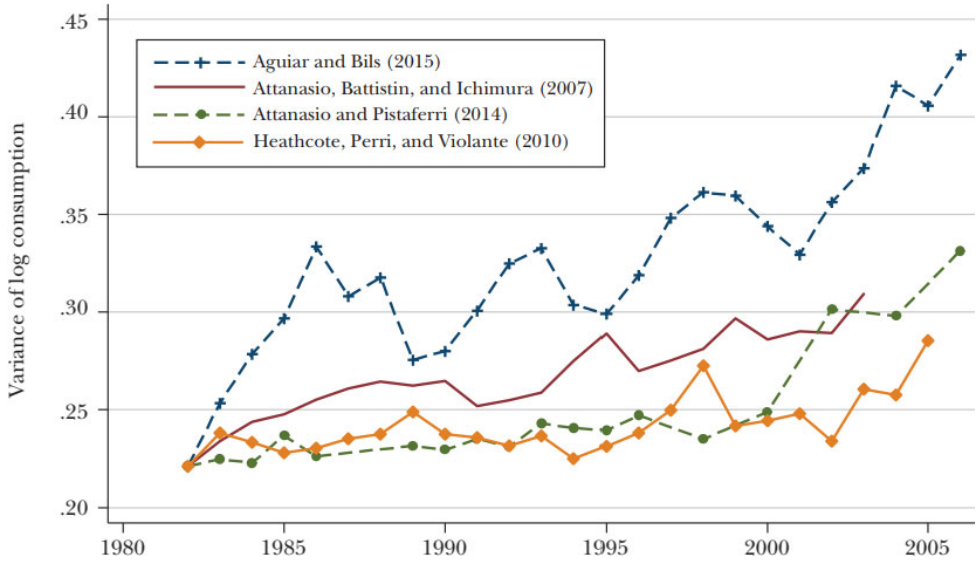


Figure A1. Consumption inequality in the United States.
Source: Figure 1 in Attanasio and Pistaferri (2016).

Appendix B.
Comparability between the KLIPS and other national statistics

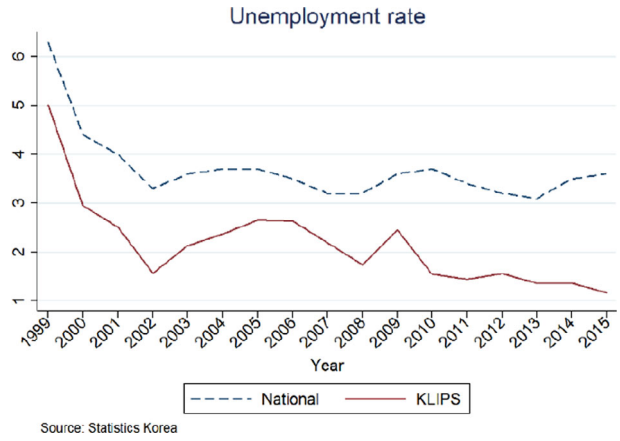


Figure B1. Unemployment rate.
Note: National statistics is obtained from the Korea Economic Activity and Population Survey.

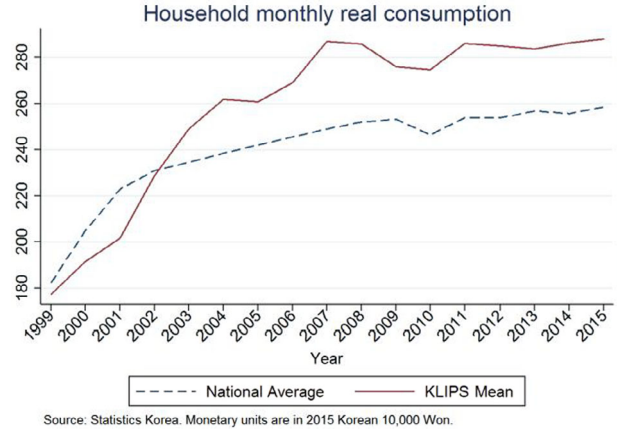


Figure B2. Household monthly consumption expenditure.
Note: National statistics is obtained from the Korea Household Income and Expenditure Survey.

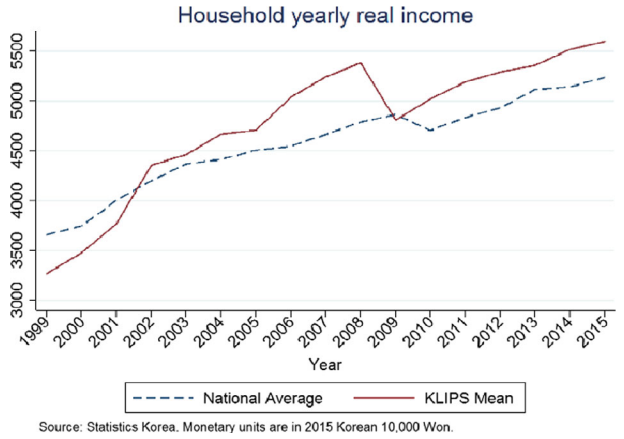


Figure B3. Income.
Note: National statistics is obtained from the Korea Household Income and Expenditure Survey.

Appendix C.
Quantiles of key variables (in 2001 and 2017)

TABLE C1

Quantiles of key variables

Variable	*Year*	*5th*	*10th*	*25th*	*50th*	*75th*	*90th*	*95th*
Annual income	2001	7.41	13.6	21.9	33.1	46.4	71.0	90.3
	2017	23.8	29.0	39.7	55.6	78. 3	107.0	202.1
Annual consumption spending	2001	11.0	12.8	17.6	22.9	30.7	39.8	49.7
	2017	17.9	23.7	29.7	35.7	47.6	59.4	71.2
Changes in residual log income (Δy_t)	2001	−0.882	−0.533	−0.223	0.012	0.290	0.613	0.823
	2017	−0.512	−0.329	−0.135	−0.005	0.148	0.363	0.550
Changes in residual log consumption spending (Δc_t)	2001	−0.647	−0.501	−0.255	0.007	0.287	0.512	0.686
	2017	−0.381	−0.280	−0.126	−0.002	0.146	0.298	0.385

Notes: Monetary units are CPI-adjusted and in 1,000,000 KRW.

Appendix D.
Identification of consumption insurance parameters

We briefly describe the various moments to be used for the minimum distance estimation of the consumption insurance parameters. As stated in section IV, the following description is based on BPP (2008). Please see their paper for the full details. From equations (1)–(5), one can derive the following:

$$\operatorname{cov}(\Delta y_t, \Delta y_{t+s}) = \begin{cases} \operatorname{var}(\zeta_t) + \operatorname{var}(\Delta v_t) & s = 0 \\ \operatorname{cov}(\Delta v_t, \Delta v_{t+s}) & s \neq 0 \end{cases} \quad (A1)$$

where var(.) and cov(.) represent cross-sectional variances and covariances respectively.

In addition, based on equation (5), we can derive the formula for consumption growth inequality as follows:

$$\operatorname{cov}(\Delta c_t, \Delta c_{t+s}) = \phi_t^2 \operatorname{var}(\zeta_t) + \psi_t^2 \operatorname{var}(\varepsilon_t) + \operatorname{var}(\xi_t) \quad (A2)$$

for s = 0, and zero otherwise.

This equation shows that consumption growth inequality is a function of (i) consumption insurances parameters, (ii) variance of permanent income shocks, (iii) variance of temporary income shocks and (iv) variance of the $i.i.d.$ consumption shocks.

Using equation (A2), one can also derive an additional moment as follows:

$$\Delta \operatorname{var}(\Delta c_t) = \operatorname{var}(\zeta_t)\Delta\phi_t^2 + \phi_{t-1}^2 \Delta \operatorname{var}(\zeta_t) + \operatorname{var}(\varepsilon_t)\Delta\psi_t^2 + \psi_{t-1}^2 \Delta \operatorname{var}(\varepsilon_t). \quad (A3)$$

This equation shows how the variance of consumption innovation changes over time. The covariance between consumption innovation and income innovation can be written as follows:

$$\operatorname{cov}(\Delta c_t, \Delta y_{t+s}) = \begin{cases} \phi_t \operatorname{var}(\zeta_t) + \psi_t \operatorname{var}(\varepsilon_t) & \text{if } s = 0 \\ \psi_t \operatorname{cov}(\varepsilon_t, \Delta v_{\mathrm{t+s}}) & \text{if } s > 0 \end{cases} \quad (A4)$$

Appendix E.
Variance and auto-covariance matrices of consumption growth using non-durable expenditures

TABLE E1

Auto-covariance matrix of consumption growth using non-durable expenditures

$var(\Delta c_t)$	$cov(\Delta c_{t+1}, \Delta c_t)$		$cov(\Delta c_{t+2}, \Delta c_t)$		$var(\Delta c_t)$	
	(1)		*(2)*		*(3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
2002	0.1486	(0.0057)	−0.0599	(0.0041)	−0.0035	(0.0037)
2003	0.1418	(0.0053)	−0.0561	(0.0041)	−0.0086	(0.0033)
2004	0.1254	(0.0053)	−0.0476	(0.0034)	0.0004	(0.0029)
2005	0.1118	(0.0040)	−0.0425	(0.0029)	−0.0019	(0.0026)
2006	0.0982	(0.0037)	−0.0386	(0.0026)	0.0002	(0.0025)
2007	0.0919	(0.0034)	−0.0389	(0.0026)	0.0012	(0.0024)

(*continued*)

TABLE E1

(Continued)

$var(\Delta c_t)$	$cov(\Delta c_{t+1}, \Delta c_t)$		$cov(\Delta c_{t+2}, \Delta c_t)$		$var(\Delta c_t)$	
	(1)		*(2)*		*(3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
2008	0.0940	(0.0038)	−0.0413	(0.0030)	0.0001	(0.0022)
2009	0.0971	(0.0039)	−0.0385	(0.0025)	−0.0020	(0.0023)
2010	0.0877	(0.0033)	−0.0328	(0.0023)	−0.0022	(0.0022)
2011	0.0810	(0.0030)	−0.0336	(0.0023)	0.0004	(0.0017)
2012	0.0797	(0.0033)	−0.0276	(0.0021)	−0.0052	(0.0017)
2013	0.0662	(0.0025)	−0.0259	(0.0018)	−0.0003	(0.0016)
2014	0.0624	(0.0026)	−0.0259	(0.0018)	0.0008	(0.0015)
2015	0.0621	(0.0026)	−0.0235	(0.0018)	−0.0032	(0.0017)
2016	0.0690	(0.0035)	−0.0242	(0.0018)	−0.0035	(0.0037)
2017	0.0655	(0.0032)	NA	NA	NA	NA

Notes: Nondurable goods include food at home, food away from home, vehicle maintenance (gasoline, automobile tax and car insurance), housing-related bills (monthly rents, electricity, water and gas), healthcare, public transport, necessities, clothing and shoes. Values for 2001 are missing because non-durable expenditures were not separately surveyed in 2000.

TABLE E2

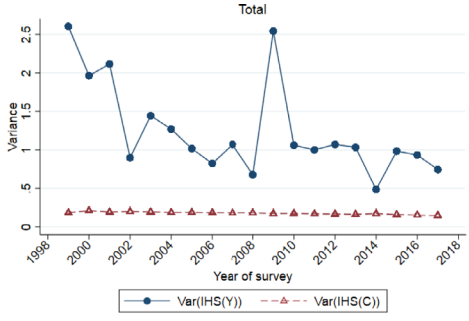
Consumption–income growth covariance matrix using non-durable expenditure

Year	$cov(\Delta y_t, \Delta c_t)$		$cov(\Delta y_{t+1}, \Delta c_t)$		$cov(\Delta y_t, \Delta c_{t+1})$	
	(1)		*(2)*		*(3)*	
	Coef.	*Std. Err.*	*Coef.*	*Std. Err.*	*Coef.*	*Std. Err.*
2001	NA	NA	NA	NA	−0.0081	(0.0067)
2002	0.0295	(0.0063)	−0.0103	(0.0046)	−0.0065	(0.0062)
2003	0.0367	(0.0050)	−0.0081	(0.0044)	−0.0110	(0.0049)
2004	0.0323	(0.0045)	−0.0106	(0.0048)	−0.0053	(0.0040)
2005	0.0410	(0.0048)	−0.0179	(0.0047)	−0.0124	(0.0039)
2006	0.0391	(0.0043)	−0.0151	(0.0043)	−0.0085	(0.0039)
2007	0.0386	(0.0045)	−0.0109	(0.0043)	−0.0157	(0.0035)
2008	0.0324	(0.0038)	−0.0107	(0.0039)	−0.0097	(0.0033)
2009	0.0266	(0.0042)	−0.0066	(0.0038)	−0.0071	(0.0043)
2010	0.0266	(0.0035)	−0.0057	(0.0031)	−0.0111	(0.0033)
2011	0.0219	(0.0028)	−0.0032	(0.0028)	−0.0061	(0.0025)
2012	0.0245	(0.0032)	−0.0040	(0.0024)	−0.0077	(0.0024)
2013	0.0167	(0.0025)	−0.0026	(0.0025)	−0.0067	(0.0022)
2014	0.0155	(0.0022)	−0.0009	(0.0025)	−0.0069	(0.0023)
2015	0.0134	(0.0025)	0.0002	(0.0020)	−0.0047	(0.0025)
2016	0.0179	(0.0025)	−0.0035	(0.0021)	−0.0076	(0.0022)
2017	0.0200	(0.0023)	NA	NA	NA	NA

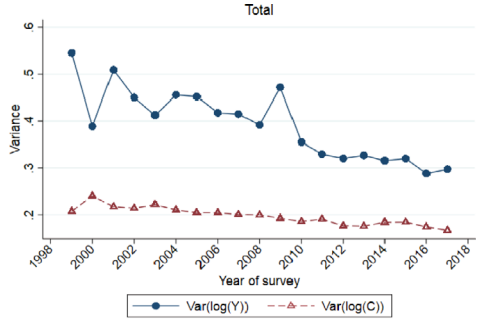
Notes: Nondurable goods include food at home, food away from home, vehicle maintenance (gasoline, automobile tax and car insurance), housing-related bills (monthly rents, electricity, water and gas), healthcare, public transport, necessities, clothing and shoes. Values for 2001 are missing because non-durable expenditures were not separately surveyed in 2000.

Appendix F.
Consumption (C) and income (Y) variances in Korea by year using alternative definitions

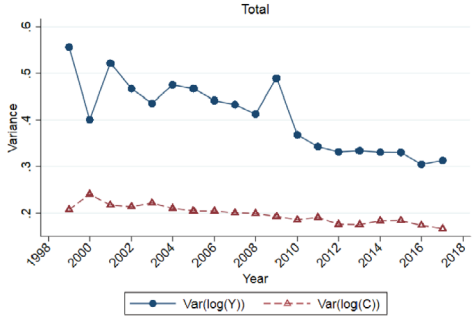
(a) IHS transformation



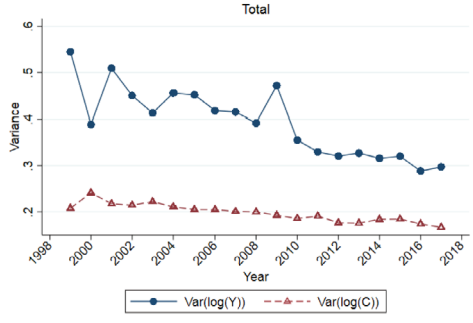
(b) No winsorization



(c) Winsorization at the bottom 1%

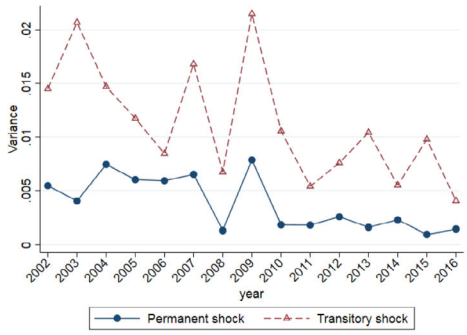


(d) Winsorization at the top 1%

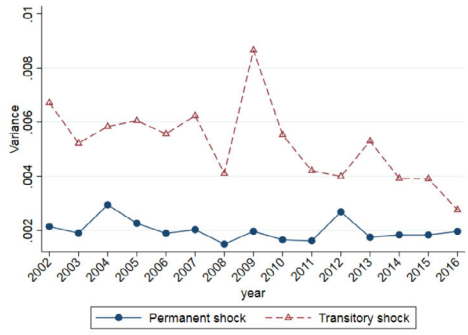


Appendix G.
The evolution of variances of permanent and transitory income shocks using alternative definitions

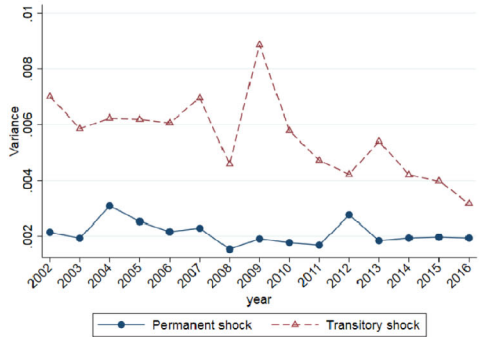
(a) IHS transformation



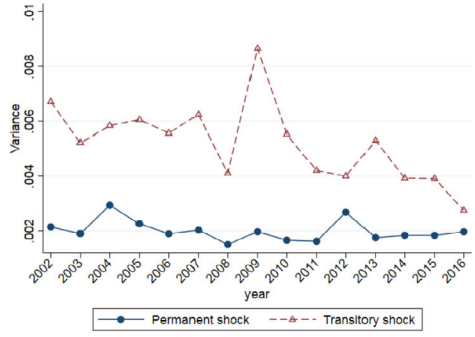
(b) No winsorization



(c) Winsorization at the bottom 1%



(d) Winsorization at the top 1%



Appendix H.
Consumption insurance parameter estimates using alternative measures

TABLE H1

Consumption insurance parameter estimates

	IHS-transformation	*No winsorization*	*Winsorization at the bottom 1%*	*Winsorization at the top 1%*
	(1)	*(2)*	*(3)*	*(4)*
ϕ (Consumption insurance parameter for permanent income shocks)	0.195 (0.045)	0.458 (0.038)	0.442 (0.037)	0.458 (0.038)
ψ (Consumption insurance parameter for transitory income shocks)	0.066 (0.009)	0.102 (0.011)	0.091 (0.010)	0.101 (0.011)

Note: Standard errors are in parentheses.

References

Attanasio, O., Hurst, E. and Pistaferri, L. (2014). 'The evolution of income, consumption, and leisure inequality in the US, 1980–2010', *Improving the Measurement of Consumer Expenditures*. , Chicago, IL: University of Chicago Press, pp. 100–140.

Attanasio, O. and Pistaferri, L. (2014). 'Consumption inequality over the last half century: some evidence using the new PSID consumption measure', *American Economic Review*, Vol. 104, pp. 122–126.

Attanasio, O. and Pistaferri, L. (2016). 'Consumption inequality', *Journal of Economic Perspectives*, Vol. 30, pp. 1–27.

Blundell, R. and Preston, I. (1998). Consumption inequality and income uncertainty. *The Quarterly Journal of Economics*, Vol. 113, pp. 603–640.

Blundell, R., Pistaferri, L. and Preston, I. (2008). 'Consumption inequality and partial insurance', *American Economic Review*, Vol. 98, pp. 1887–1921.

Blundell, R., Pistaferri, L. and Saporta-Eksten, I. (2018). 'Children, time allocation, and consumption insurance', *Journal of Political Economy*, Vol. 126, pp. S73–S115.

Deaton, A. and Paxson, C. (1994). 'Intertemporal choice and inequality', *Journal of Political Economy*, Vol. 102, pp. 437–467.

Grubb, D., Lee, J. and Tergeist, P. (2007). *Addressing Labour Market Duality in Korea*. OECD Publishing, Paris, France.

Jo, J. Y. (2008). 'Korea: economic development, social security and productive welfare', in Midgley J. and Tang K. (eds), *Social Security, the Economy and Development*, London: Palgrave Macmillan.

Kaplan, G. and Violante, G. L. (2010). 'How much consumption insurance beyond self-insurance?', *American Economic Journal: Macroeconomics*, Vol. 2, pp. 53–87.

Kim, S. T. (2010). '*Korea's Unemployment Insurance in the 1998 Asian Financial Crisis and Adjustments in the 2008 Global Financial Crisis*.', Working Paper, Asian Development Bank Institute.

Lee, C. and Lee, J. (2017). '*The Outlook and Challenges of Population Aging and Labor Market*', Working Paper No. 2017-30, The Bank of Korea Economic Research.

OECD (2019). *Taxing Wages 2019*, OECD Publishing, Paris, https://doi.org/10.1787/tax_wages-2019-en.

Piketty, T. (2014). *Capital in the Twenty-First Century*, The Belknap Press of Harvard University Press, Cambridge, MA.

Santaeulàlia-Llopis, R. and Zheng, Y. (2018). 'The price of growth: consumption insurance in China 1989–2009', *American Economic Journal: Macroeconomics*, Vol. 10, pp. 1–35.

Statistics Korea (2020). *The 2017 Supplement for Old Population, Economically Active Population*, Available at http://kosis.kr/

Yun, H. S. (2017). 'Income inequality in Korea: interpretation and implication for preparing the future', *Korean Review of Applied Economics*, Vol. 19, pp. 5–40 (in Korean).