



Household Composition Change and Structural Distortion in Poverty Statistics: Evidence from Korea, 2014–2024

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Abstract

We examine how demographic shifts—population aging, declining fertility, and the rise of one-person households—reshape household composition and distort relative-poverty statistics in Korea (2014–2024). Using Household Finance and Living Conditions Survey (SHFLCS) microdata, we classify households into nine types, apply counterfactual reweighting to impose the 2014 composition on 2024 incomes, and implement a Das Gupta variant of Kitagawa decomposition. Within-type poverty fell across all categories, yet the aggregate poverty rate rose by 2.46% points (pp). Composition accounts for +3.55 pp, partly offset by a poverty-line shift (−1.02 pp) and a residual/interaction term (−0.07 pp). This contribution amounts to about 144% of the overall increase, showing that demographic shifts in household structure can mechanically inflate poverty rates even without any deterioration in income distribution. Accordingly, our findings highlight the importance of distinguishing between statistical illusions and substantive poverty. We also document a contraction in private inter-household transfers consistent with household downsizing, implying real (non-statistical) losses among vulnerable groups. Importantly, a rising headcount in projections can reflect a poverty-rate illusion: as average household size shrinks, the relative poverty line moves up mechanically, so measured poverty can increase even when real resources or social spending do not deteriorate. These findings argue for composition-sensitive indicator series and targeted support to one- and two-person vulnerable households.

Keywords Relative poverty · Household composition · Equivalization · Demographic change · Korea · Private transfers

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1 Introduction

Population aging, low fertility, and the rapid rise of one-person households have fundamentally reshaped Korea's demographics. These are not merely societal changes; they carry direct statistical consequences for how poverty is measured and interpreted. Despite an ongoing policy focus, Korea repeatedly records the highest older adult poverty rate among OECD nations. Beyond media reports, official sources such as the OECD Income Distribution Database (OECD, 2023) and the Korea Institute for Health and Social Affairs (KIHASA, 2022) similarly emphasize Korea's exceptionally high old-age poverty rates. The persistence of such figures leads to a crucial question: to what degree are these measures a reflection of material deprivation, and to what degree are they a result of compositional changes in the household? This distinction matters significantly for current public debates. An increase in the elderly poverty rate does not automatically mean seniors are materially worse off. When household sizes shrink, the relative poverty threshold (50% of the median equivalized income) rises mechanically; thus, the indicator can move upward even as benefits or expenditures grow. In short, part of the observed or projected increase can be a poverty-rate illusion driven by composition rather than a deterioration in living standards.

The relative poverty rate is conventionally specified as the share of the population living on less than 50% of the median equivalized disposable income, making it highly sensitive to household size. Prior studies have strongly highlighted labor markets, pension scheme formulations, and fiscal redistribution as central poverty determinants (Ku & Kim, 2020; OECD, 2021). While these factors remain critical—particularly in ongoing discussions regarding the reform and governance of the national pension system—fewer studies analyze how changes in family formation systematically alter the yardstick against which poverty is measured. Increases in single-person families diminish household-level economies of scale in the calculation of equivalized income, which may spuriously raise the relative poverty line (Kim et al., 2006). We advance the literature by explicitly quantifying this “statistical illusion” generated by household downsizing. We offer a distinct methodological and conceptual contribution by demonstrating that demographic shifts alone can mechanically inflate aggregate poverty rates, completely independent of actual economic deterioration.

This gap has been a core issue in estimating the reliability of poverty statistics for aging nations like Korea. There is a prevailing concern that fading intrahousehold resource transfers and private intergenerational transfers will aggravate substantive poverty among older adults. Additionally, demographic shifts can suppress the median income in the long term, leading to a lower level of registered poverty without any genuine improvement in standards of living. These interacting factors highlight methodological shortcomings in poverty estimation and the inherent danger of statistical illusions.

We address these gaps in three phases. First, we clarify whether structural changes in household composition mechanically raise the relative poverty line and exaggerate old-age poverty, even if within-household welfare improves. Second, we assess whether the decline of private intergenerational transfers—historically characteristic of multi-person residences—exacerbates material deprivation for the older population. Finally, we inquire whether population aging might ultimately depress median income, thereby reducing registered poverty without substantive well-being changes. Altogether, these questions bridge concerns regarding the validity of poverty estimation, substantive well-being, and long-term statistical dynamics.

In response, we codify the statistical illusion in poverty measures arising from compositional and demographic change. Empirically, we leverage nationally representative microdata from the 2014–2024 Korean Household Finance and Living Conditions Survey (SHFLC). Using counterfactual reweighting and a Kitagawa decomposition, we isolate household composition changes from within-type income changes. Theoretically, we situate the Korean experience within broader cross-country discussions on the viability of poverty indicators for aging societies.

From a practical policy perspective, the analytical framework presented here can be directly operationalized by national statistical offices. Given that relative poverty measures are hyper-sensitive to household formation, our findings highlight the necessity of thinking beyond standard low-income thresholds. The rising share of one-person households and the decline in intergenerational transfers make targeted interventions—such as housing support and cash benefit schemes for aged one-person households (OECD, 2022)—a critical necessity.

This proposal resonates with Alkire and Foster's (2011) multidimensional poverty measurement approach. By integrating income-based relative poverty with non-income dimensions such as housing, health, and social connectedness, we recommend the adoption of a Dual Poverty Index. Such an index would allow policymakers to clearly separate statistical artifacts from substantive deprivation.

Lastly, this study emphasizes that poverty statistics in aging societies carry profound implications beyond mere figures. Appreciating the gap between statistical thresholds and material deprivation enables policymakers to make better data-informed decisions to alleviate social inequality. Furthermore, while our empirical analysis focuses on the Korean experience, this framework is highly generalizable. Future research should extend this analytical lens to other rapidly aging OECD and non-OECD nations undergoing similar transitions—such as Japan or Germany—to investigate the broad cross-national correspondence between demographic restructuring and poverty measurement.

2 Theoretical Framework & Literature Review

2.1 Relative Poverty Concept and Worldwide Criticisms

The relative poverty rate (RPR) is computed as the proportion of inhabitants living at or below 50% median equivalized disposable income and has been usable for cross-country comparisons and policy evaluation. Whilst useful for raising awareness about inequality and relative positions within distribution, three central shortcomings have been presented in the literature: sensitivity to median shifts, potential divergence from material deprivation, and vulnerability to compositional change in household size and structure.

- (1) Sensitivity to changes in median: Atkinson (2015) cautions that poverty lines based on median are prone to being easily shifted by changes in the structure of income distribution or economic cycles. Poverty rates would thereby increase or decrease without a simultaneous rise or fall in welfare, hence creating room for confusing poverty and inequality dynamics.

- (2) Divergent from material deprivation: Nolan and Whelan (1996, 2011) and Smeeding (2006) argue that RPR often gets misaligned with material deprivation indicators. One could be just short of the income threshold and yet be meeting minimally required standards of living, and one just above the threshold could experience exclusion or resource inadequacy. Recent methodological discussions in Social Indicators Research reinforce this concern, demonstrating that relying solely on income poverty indicators can confound poverty evaluations, as income and material deprivation indicators frequently disagree on an individual's actual poverty status (Notten, 2016).
- (3) Now a turning point for household size and equivalence scales: Bradbury and Jäntti (2001) and Förster (1994) both make a similar argument that changes in household size and composition shift the statistical benchmark and produce artificial changes in rates of poverty. As rapid structural change would render equivalence scales misleading, they cannot necessarily compensate for economies of scale in sharing resources.

These arguments suggest that measures of relative poverty should be framed relative to material deprivation and thresholds of need in order to exclude statistical anomalies. The concept of “statistical illusion” adopted here builds on earlier debates by Townsend (1979) and Sen (1983) on the relativity of poverty but extends the notion by identifying household restructuring and demographic transitions as a novel source of distortion. This resonates with Ravallion's (2016) caution regarding the interpretive limits of poverty indicators and situates our work within the broader poverty-measurement literature.

Household reorganization represents an exogenous relative poverty measure. Single-person households, low fertility rates, and marriage postponement directly impact equivalized income. As equivalence scales for economies of scale for household resource sharing, smaller household sizes increase individual equivalized income estimates. As a result, the median may be inflated and thus lift the poverty line appreciably (Bradbury & Jäntti, 2001).

Moreover, one-child or childless couple increases would raise median equivalized income and force older families with unchanged incomes into poverty. The effect is “statistical illusions” of increases in poverty without actual worsening of welfare. Förster (1994) warns that such kinds of biases are acute in fast-aging societies and jeopardize the reliability of indicators.

In East Asian nations—including Korea—welfare systems have historically relied on familialistic arrangements, where private intergenerational transfers functioned as implicit insurance and helped stabilize incomes in old age (Goodman et al., 1998; Lee & Mason, 2011). These arrangements, however, have been increasingly undermined by rapid household restructuring and individualization. Increased one-person households and lower intergenerational co-residence reduce the size and prevalence of private transfers, hence lowering substantive deprivation mitigation among older adults. Furthermore, recent empirical work published in Social Indicators Research emphasizes that in the context of limited public welfare, private asset accumulation—particularly illiquid assets like real estate—has become entrenched as a functional equivalent to public welfare in South Korea, acting as a crucial private safety net (Yang, 2024). Ku and Kim (2020) and Weon and Rothwell (2020) indicate that a high proportion of old-age income in Korea consists of transfers from adult children, and a declining frequency in those transfers increases poverty risks considerably.

Debate in Korea has similarly emphasized the inadequacies of relative poverty measures. Recently, KIHASA (2018; 2022) reports have emphasized the application of multidimen-

sional poverty indicators—namely subjective poverty and deprivation measures—to offset how strictly income-based thresholds overlook crucial shortcomings in actual welfare. This is particularly relevant for older adults, for whom poverty exposure significantly hinges on shelter, health, and social relationships. Furthermore, the OECD (2021, 2022) documents modest redistribution relative to OECD averages. This contends that observed movements in estimated poverty are often shaped more by statistical systems and demographic mechanics than by changes prompted by policy initiatives.

2.2 Analytical Framework

Let P denote the relative-poverty headcount rate and h index household types (nine categories by size, vulnerability, and age). Define S_h as the population share of type h and P_h as the within-type poverty rate. Then

$$P = \sum_h s_h p_h$$

Comparing two years, $t=0$ and $t=1$, following Das Gupta's (1993) first-order expansion of the Kitagawa (1955) method, the change in poverty can be written as

$$\Delta P \approx \sum_h (\Delta s_h) p_h^* + \sum_h s_h^* (\Delta p_h) + \sum_h (\Delta s_h) (\Delta p_h)$$

Where $\Delta s_h = s_{1,h} - s_{0,h}$, $\Delta p_h = p_{1,h} - p_{0,h}$, and $(\cdot)^*$ denotes the midpoint (average of endpoints).

We label the first term the composition effect: $\sum_h (\Delta s_h) p_h^*$, the second the within-type effect (inclusive of poverty-line shifts transmitted via medians): $\sum_h s_h^* (\Delta p_h)$, and the third the interaction term is $\sum_h (\Delta s_h) (\Delta p_h)$, typically small in magnitude.

The poverty-line shift arises because the threshold is Poverty line = $0.5 \times \text{median}(y_{eq})$. If the median changes due to economy-wide conditions or composition, all P_h may move mechanically. We therefore further apportion the within-type term into a component due to the median shift and a residual net-of-line shift.

Equivalentized income $y_{eq} = \frac{y}{\sqrt{n}}$ exceeds per-capita income for $n > 1$ and is relatively more favorable to larger households. When households downsize (e.g., splits of multi-person households), the equivalentized income of the remaining units can decline, mechanically pushing multiple individuals below the poverty threshold even in the absence of any change in aggregate resources.

2.3 Hypotheses

- H1 (Statistical/Composition): Growth in high-poverty types—especially one- and two-person vulnerable households—raises P via $\Delta S_h > 0$.
- H2 (Threshold/Median): Movement of the median (through overall conditions and composition) partially offsets or amplifies H1.

- H3 (Transfers/Substantive): Shrinking multi-person households reduces private transfers, worsening effective income for vulnerable types.

2.4 Identification Strategy

We implement a DiNardo-Fortin-Lemieux (DFL)-style reweighting procedure to estimate counterfactual distributions by applying factors,

$$w'_i = w_i \times \frac{s_{2014,h}}{s_{2024,h}} \times \kappa$$

to each observation i in household type h , where κ rescales totals to observed aggregates. Using these counterfactual weights, we then compute medians, relative poverty rates, and poverty gaps under the 2014 composition applied to 2024 incomes.

While the Kitagawa (1955) decomposition has the advantage of clearly partitioning aggregate poverty changes into components, it cannot capture distributional shifts across the income spectrum. Conversely, DFL reweighting is designed to estimate counterfactual distributions conditional on composition. The Kitagawa decomposition was specifically selected for this analysis because it directly and comprehensively partitions aggregate rate changes into distinct composition and within-type effects. While other decomposition methods might be better suited for continuous variables, the Kitagawa method is optimally designed to handle the binary nature of poverty headcounts, providing unambiguous aggregate clarity on how demographic shifts mechanically alter statistics. Using both methods in tandem therefore enables complementary insights: Kitagawa for aggregate clarity and DFL for distributional nuance.

To decompose overall poverty, we define

$$P_t = \sum_h s_{t,h} p_{t,h}$$

Where $P_{t,h}$ is the poverty rate within type h . The Kitagawa decomposition expresses the change in poverty between two periods as

$$\Delta P = \sum_h (s_{2024,h} - s_{2014,h}) \bar{p}_h + \sum_h (p_{2024,h} - p_{2014,h}) \bar{s}_h$$

With \bar{p}_h , \bar{s}_h denoting midpoint averages across the two periods.

3 Data and Methods

3.1 Data Sources

The analysis utilized microdata from Statistics Korea's Household Finances and Living Conditions Survey (public-use version), specifically from the 2014 dataset (survey year 2013) and the 2024 dataset (survey year 2023). A nationally representative survey jointly

conducted by Statistics Korea and the Bank of Korea, covering 18,200 households annually with detailed information on income, expenditures, assets, debts, and welfare indicators (Statistics Korea, 2025). Household type shares observed in 2014 were applied to the 2024 sample through reweighting procedures. Weighted to represent the national population, it is well-suited for analyzing long-run changes in household structure and income distribution. This adjustment enabled an assessment of how poverty rate, poverty gap, and quintile share ratio would have evolved if the household composition of 2014 had been maintained through 2024.

3.2 Household Typology

Households were initially classified into 32 categories according to three primary criteria: (1) household size (one-person, two-person, three-person, four-person or more), (2) vulnerability status (vulnerable vs. non-vulnerable), and (3) age of the household head (50 years and older vs. under 50 years). For categories with fewer than 1,000 valid observations, reclassification was conducted within each household size group to ensure sufficient sample size for statistical reliability. As a result, the 32 categories were consolidated into nine analytically valid household types:

- One-person, non-vulnerable, under 50.
- One-person, non-vulnerable, 50 and over.
- One-person, vulnerable.
- Two-person, non-vulnerable.
- Two-person, vulnerable.
- Three-person, under 50.
- Three-person, 50 and over.
- Four-person or more, under 50.
- Four-person or more, 50 and over.

Here, vulnerable households were defined as those that fall into at least one of the following categories: elderly households, grandparent-grandchild households, single-parent households, multicultural households, or households including persons with disabilities.

3.3 Validity of the Household Classification

Excessive stratification of household types risks inflating standard errors due to insufficient sample size per group. To mitigate this, three criteria strongly associated with income were selected as the primary classification bases, while other potential criteria were excluded after validation tests. Specifically, metropolitan area residence, gender of household head, educational attainment of household head, marital status of household head, and housing tenure status were omitted. Chi-square tests confirmed that these five variables did not exhibit statistically significant differences across the nine household types (p-values ranging from 0.112 to 0.456). The p-values for each variable were as follows: metropolitan area residence (0.251), gender of household head (0.364), educational attainment (0.122), marital status (0.269), and housing tenure (0.456). Accordingly, their exclusion was deemed statistically valid.

3.4 Variables

- Equivalized disposable income: Based on the OECD-modified scale (square root of household size).
- Relative poverty: Indicator=1 if equivalized income < 50% of median.
- Poverty gap: Mean shortfall relative to poverty line.
- Quintile ratio (P80/P20): Inequality measure.
- Private transfers: Cash/gift transfers paid/received, adjusted to 2023 KRW.
- Absolute/material poverty: Based on minimum living standard or deprivation index.
- Controls: Macro-level controls include GDP growth, female employment, pension coverage, and CPI inflation.

3.5 Analytical Methods

- Counterfactual reweighting: Applies 2014 household composition shares to 2024 data to estimate counterfactual medians and poverty rates.
- Kitagawa decomposition: Separates overall poverty change (ΔP) into composition and within-type effects. Sensitivity checked with Das Gupta and Shorrocks variants.
- Econometric strategy: Time-series OLS with Newey-West SEs, plus household-level pseudo-panels. Instruments include marriage rates, housing costs, and age-specific singlehood rates.

4 Results

4.1 Descriptive Trends in Household Composition, 2014–2024

To establish the demographic context for our hypotheses, we first examine the overarching shifts in household formation. From 2014 to 2024, Korea's household structure changed considerably. The most salient shifts are the rise of single-person households and the decline of 4-person-or-larger households. Among single-person households, 'under-50, general' increased by +6.42% points (pp), while '50+general' and 'vulnerable singles' increased by +3.14pp and +3.31pp, respectively. In contrast, '4+persons, under 50' declined by -12.83pp, the largest drop. These shifts reflect structural change—low fertility, population aging, and individualization. Rising non-marriage among the young and falling births expanded one-person households, while growth of the older population and reduced inter-generational co-residence raised the share of older single-person households. Because the poverty threshold is defined in terms of equivalized income, changes in household size alone can alter measured poverty even when total resources are unchanged—a statistical composition effect (Table 1).

Table 1 Demographic trends in household composition, 2014–2024 (# of households, %, pp)

Household size	Subtype	2014 composition (count, %)	2024 composition (count, %)	Change (pp)
1-person	Under 50, General	1,023,198 (5.56)	2,650,704 (11.98)	1,627,506 (6.42)
	50+, General	646,562 (3.52)	1,473,266 (6.66)	826,704 (3.14)
	Vulnerable	1,481,795 (8.06)	2,518,652 (11.38)	1,036,857 (3.31)
2-person	General	2,567,428 (13.96)	3,667,940 (16.58)	1,110,512 (2.62)
	Vulnerable	1,747,785 (9.50)	2,569,821 (11.61)	822,036 (2.11)
3-person	Under 50	1,999,967 (10.87)	1,782,487 (8.06)	−217,480 (−2.81)
	50+	1,857,024 (10.10)	2,809,063 (12.69)	952,039 (2.59)
4+ persons	Under 50	4,347,217 (23.63)	2,389,314 (10.80)	−1,957,905 (−12.83)
	50+	2,722,740 (14.80)	2,277,162 (10.29)	−445,578 (−4.51)
Total		18,393,716 (100)	22,127,321 (100)	3,733,605 (—)

Notes: SHFLC estimates use survey weights. '2024' refers to the publication year (fieldwork conducted in 2023). The 2024 microdata are reweighted to the 2014 distribution of household types, with weight ratios computed from composition shares

4.2 Income and Poverty after Composition Adjustment

If the aggregate poverty rate were purely a reflection of worsening economic conditions, we would expect to see median incomes falling and poverty rising across all household types. However, our counterfactual analysis reveals a different mechanism. Panel A of Table 2 shows that the median equalized disposable income declined within every type; the all-households median fell by 174 (10,000 KRW; ≈ 1.74 \$ million KRW). Crucially, Panel B shows that within-type poverty fell everywhere, yet aggregate poverty rose by 2.46 pp because high-poverty types grew in share.

4.3 Decomposition: Quantifying Channels

To directly address Hypothesis 1 (Composition effect) and Hypothesis 2 (Median shift effect), we decomposed the aggregate poverty changes. Table 3 attributes +3.55pp of ΔP to composition, partly offset by a -1.02 pp poverty-line shift and a -0.07 pp residual (interaction/rounding), summing to +2.46pp. To interpret the sheer magnitude of this structural distortion: composition explains about 144% of the total change; the line shift offsets $\sim 41\%$ and the residual $\sim 3\%$ (percent of total). Under constant composition (holding S_h at 2014 levels), the headcount would be 11.47% (12.56 $-$ 1.19), implying that within-type conditions and the threshold effect would have reduced poverty absent compositional change (rounding explains minor discrepancies).

Which specific groups drive this massive composition effect? Appendix Table 9 shows that one- and two-person vulnerable categories account for about +2.68 pp ($\approx 75\%$) of the +3.55 pp, while 4+under-50 offsets -1.00 pp ($\sim 28\%$). This confirms H1, demonstrating

Table 2 Income and poverty by household type after weight adjustment

Panel A. Median equivalized disposable income (Unit: 10,000 KRW)				
Household size	Subtype	2014	2024	Change
1-person	Under 50, General	3,704	3,512	-189
	50+, General	2,674	2,473	-201
	Vulnerable	1,630	1,337	-293
2-person	General	3,885	3,825	-60
	Vulnerable	2,736	2,344	-392
3-person	Under 50	4,126	4,080	-46
	50+	4,515	4,262	-253
4+ persons	Under 50	4,153	3,957	-196
	50+	4,735	4,646	-89
All households	—	3,929	3,755	-174
Panel B. Poverty rates by household type (% and percentage-point change)				
Household size	Subtype	2014 pov-erty rate	2024 pov-erty rate	Δ (pp)
1-person	Under 50, General	16.92	15.67	-1.25
	50+, General	38.18	35.01	-3.17
	Vulnerable	72.05	70.26	-1.79
2-person	General	14.01	12.52	-1.49
	Vulnerable	40.15	38.26	-1.89
3-person	Under 50	8.33	6.76	-1.57
	50+	9.43	8.51	-0.92
4+ persons	Under 50	6.87	6.29	-0.58
	50+	6.01	5.31	-0.70
Total	—	12.56	15.02	+2.46

Notes: A common within-type weight factor was applied; medians may shift because baseline survey weights differ across the income distribution. Δ is 2024–2014 in percentage points

Table 3 Decomposition of the change in the poverty rate (Das Gupta variant of Kitagawa; percentage points)

Component	Contribution (pp)
Composition effect (household-type shares)	+3.55
Poverty-line shift effect	-1.02
Interaction	-0.07
Total change	+2.46

Notes. Decomposition based on Das Gupta variant of Kitagawa. The residual reflects rounding error. Under constant composition (holding S_{it} at 2014 levels), the counterfactual poverty headcount is 11.37%

Table 4 Decomposition of the change in the poverty gap (all households)

Component	Contribution (pp)	Share of total (%)
Composition effect (household-type shares)	+1.45	148.94
Within-type change (income/poverty-gap shift)	-0.38	-38.74
Interaction	-0.10	-10.20
Total change	+0.97	100

Table 5 Change in private inter-household transfers, 2014→2024

Measure	2014	2024	Change (rate)
Median (KRW)	600,000	500,000	-100,000 (-16.7%)
Mean (KRW)	1,737,127	1,624,848	-112,279 (-6.5%)

that the growth in small, vulnerable households artificially inflates the aggregate poverty rate.

4.4 Distributional Indicators and Poverty Gap

The poverty gap among the poor increased by 0.97 pp, and decomposition (Table 4) indicates this deterioration is also composition-driven (+1.45 pp), while within-type shifts would have reduced it (-0.38 pp).

4.5 Real Effects: Private Transfers

Finally, to address Hypothesis 3 and clearly separate statistical artifacts from substantive material deprivation, we analyzed the flow of private inter-household transfers. Transfer incidence is lower and zero-spending shares are higher for small households. Consistent with the downsizing of household size, median transfers fell by 16.7% and mean transfers by 6.5% from 2014 to 2024 (Table 5), reinforcing H3 that weakened informal insurance mechanically tightens budgets among vulnerable small households. Unlike the statistical illusions generated by equalization, these patterns demonstrate an actual contraction of household resources. In other words, while composition effects generate statistical illusions, the decline of private transfers signals a substantive deterioration of material well-being among vulnerable groups.

4.6 Robustness and Sensitivity

- **Threshold sensitivity.** The qualitative results are invariant to reasonable alternative poverty lines (e.g., 40% or 60% of the median). Because the composition effect operates through the population shares (S_n), headcount differences across cutoffs change in absolute level but not in sign or overall ranking.
- **Equivalence-scale sensitivity:** Replacing \sqrt{n} with n^θ (where $\theta \in [0.5, 0.7]$) does not overturn the pattern that household downsizing mathematically elevates measured poverty via composition; a larger θ simply strengthens the assumed scale economies and hence amplifies composition effects.

- **Weighting diagnostics.** As reported in Appendices Table 6, 7, 8, intermediate factors and totals confirm that our results are driven by broad structural shifts, rather than being artifacts of outlier cells or small-cell instability.

5 Discussion

The empirical data verifies that the documented increase in Korea's poverty rate between 2014 and 2024 was not primarily due to deteriorating income distribution, but rather emerged as a structural byproduct of demographic and household composition changes. The boom in vulnerable small-householder and single-householder units mechanically boosted median equivalized income, thus lifting the relative poverty line and creating a statistical illusion of growing poverty. The statistical illusion on its own would account for the 3.56% point rise, balanced to some extent by drops in within-type poverty, bringing a net rise of 2.46% points. In parallel, the contraction of private transfers represents an actual rise in substantive deprivation. The descriptive statistics demonstrate that more than one-third of one-person families, and nearly two-fifths of vulnerable one-person families, experience zero private transfers. Multi-person families that traditionally brokered intergenerational transfers diminished. As a result, even where equivalized incomes increased within forms, deprivation resulting from the loss of informal support networks was exacerbated, particularly for older and vulnerable families.

This two-phased mechanism—statistical illusion arising from compositional variations, and substantive loss of well-being arising from transfer deterioration—demonstrates how population restructuring can concurrently bias poverty indices and worsen real standards of living. Unlike prior research on labor markets or pension plans, these results highlight the overlooked demographic origin of poverty statistics (Ku & Kim, 2020; Hwang & Nam, 2022).

Importantly, these mechanisms are highly generalizable and are not limited to Korea. In fast-aging nations like Japan, Germany, and Southern Europe, household downsizing has similar interactions with the relative poverty line. Early in a demographic transition, declining household size expands poverty rates while welfare is unchanged or improving. Late on, falls in median incomes paradoxically decrease observed poverty without actual benefit—a phenomenon we label inverse statistical illusion. International studies similarly show this pattern. For example, shrinking intergenerational transfers and growing elderly single-person households have inflated statistical poverty while increasing deprivation in many countries (Zaidi et al., 2012). In addition, OECD comparative studies highlight household downsizing as a driver of poverty dynamics and as a challenge for indicator reliability in aging societies (Verbist et al., 2012). Therefore, the compositional bias observed in Korea has strong parallels elsewhere, meaning the analytic framework developed here can serve as a standard template for comparative research across other aging OECD societies.

From a practical policy perspective, our findings demand a shift in the methodology of measuring poverty and evaluating welfare programs. As demonstrated by Notten (2016) in the context of European transfer programs, relying solely on single income poverty indicators often confounds the evaluation of a program's true poverty-reduction effects, necessitating the use of multiple indicators to separate measurement issues from actual welfare outcomes. In alignment with this, we strongly recommend that national statistical offices publish composition-sensitive indicator series alongside base poverty rates, providing sen-

sitivity tests over alternative equivalence scales and thresholds. This would make the data more transparent and allow policymakers to differentiate between statistical artifacts and meaningful changes in welfare.

Furthermore, these findings support the operationalization of a Dual Poverty Index. By combining relative income poverty with deprivation indexes and minimum living standards, policymakers can accurately target structural vulnerabilities. Policy responses should be directed at small vulnerable families—specifically old-age singles—by supplementing cash transfers, accommodation support, and service delivery to offset reduced familial transfers. Public safety-net programs become absolutely crucial where population movement dismantles informal intergenerational transfers.

6 Conclusion

This research demonstrates that Korea's aggregate poverty rate increased by 2.46% points from 2014 to 2024, paradoxically occurring alongside income improvements within individual household types. Through the combined application of counterfactual reweighting and Kitagawa decomposition, we confirm that this aggregate rise was primarily driven by compositional changes—specifically, the rapid growth of high-poverty, small-household units. Meanwhile, the concurrent decline in private transfers aggravated substantive deprivation, particularly for old-age, single-householder units.

By placing household composition at the center of poverty measurement, this study provides a novel conceptual framework for interpreting poverty dynamics in rapidly aging nations. Separating statistical illusions from substantive welfare mechanisms sheds light on the critical shortcomings of standard relative poverty measures and highlights the importance of demographically sensitive indices. Methodologically, our approach offers a highly reproducible template that effectively unites aggregate decompositions with microdata nuance. Substantively, we illustrate how demographic reorganization simultaneously distorts static measures of poverty while exacerbating real experiential deprivation (Brady & Parolin, 2020).

From a practical policy standpoint, our analysis underscores the danger of relying on singular, unadjusted income poverty metrics to evaluate social welfare. We strongly advocate for the adoption of composition-adjusted poverty series and multidimensional metrics, such as a Dual Poverty Index, to ensure that public resources are accurately targeted toward those facing genuine material hardship, rather than statistical artifacts. Specifically, the real loss of informal private transfers necessitates immediate, targeted policy interventions—such as enhanced housing and cash benefits—for vulnerable, one- and two-person elderly households.

To build upon these findings, there are three key directions for future research. Firstly, cross-country comparative research is essential to corroborate if similar statistical and substantive mechanisms are at work elsewhere in aging societies, allowing us to test this framework in broader institutional contexts. Secondly, the incorporation of wealth inequality alongside income dynamics would provide a fuller measure of material well-being. Finally, panel data techniques might better establish causal relationships between restructuring at the household level, private transfers, and deprivation. All these extensions would deepen our understanding of how demographic transitions reshape poverty measurement and inform the design of more effective indicators and social protection systems (Whelan & Maître, 2012).

Appendix

Table 6 Reweighting factors to match 2014 composition

Household size	Subtype	Baseline (count, %)	Adjusted (count, %)	Weight factor
1-person	Under 50, General	2,650,704 (11.98%)	1,230,025 (5.56%)	÷ 2.155
	50+, General	1,473,266 (6.66%)	778,682 (3.52%)	÷ 1.892
	Vulnerable	2,518,652 (11.38%)	1,775,895 (8.03%)	÷ 1.412
2-person	General	3,667,940 (16.58%)	3,087,492 (13.96%)	÷ 1.188
	Vulnerable	2,569,821 (11.61%)	2,102,963 (9.51%)	÷ 1.222
3-person	Under 50	1,782,487 (8.06%)	2,404,574 (10.87%)	× 1.349
	50+	2,809,063 (12.69%)	2,236,515 (10.11%)	÷ 1.256
4+ persons	Under 50	2,389,314 (10.80%)	5,227,820 (23.64%)	× 2.188
	50+	2,277,162 (10.29%)	3,274,559 (14.80%)	× 1.438
Total	—	22,127,321 (100%)	22,118,525 (100%)	—

(Household counts in absolute numbers; units=households)

Table 7 Rescaling to household/ population totals

Household size	Subtype	Adjusted (count, %)	Rescaled (count, %)	Weight factor
1-person	Under 50, General	1,230,025 (5.56%)	998,746 (5.56%)	÷ 1.231
	50+, General	778,682 (3.52%)	632,272 (3.52%)	÷ 1.231
	Vulnerable	1,775,895 (8.03%)	1,556,066 (8.03%)	÷ 1.141
2-person	General	3,087,492 (13.96%)	2,964,708 (13.96%)	÷ 1.041
	Vulnerable	2,102,963 (9.51%)	2,053,625 (9.51%)	÷ 1.024
3-person	Under 50	2,404,574 (10.87%)	1,966,842 (10.87%)	÷ 1.223
	50+	2,236,515 (10.11%)	1,820,015 (10.11%)	÷ 1.229
4+ persons	Under 50	5,227,820 (23.64%)	4,353,183 (23.64%)	÷ 1.201
	50+	3,274,559 (14.80%)	2,448,259 (14.80%)	÷ 1.337
Total	—	22,118,525 (100%)	18,393,716 (100%)	—

(All totals are post-weight household counts aligned to SHFLC population controls of year t. Units=households)

Table 8 Final sample by household type

Household size	Subtype	2014 composition (count, %)	2024 composition (count, %)
1-person	Under 50, General	998,746 (5.56%)	2,650,704 (11.98%)
	50+, General	632,272 (3.52%)	1,473,266 (6.66%)
	Vulnerable	1,556,066 (8.03%)	2,518,652 (11.38%)
2-person	General	2,964,708 (13.96%)	3,667,940 (16.58%)
	Vulnerable	2,053,625 (9.51%)	2,569,821 (11.61%)
3-person	Under 50	1,966,842 (10.87%)	1,782,487 (8.06%)
	50+	1,820,015 (10.11%)	2,809,063 (12.69%)
4+ persons	Under 50	4,353,183 (23.64%)	2,389,314 (10.80%)
	50+	2,048,259 (14.80%)	2,277,162 (10.29%)
Total	—	18,393,716 (100%)	22,127,321 (100%)

(Household counts; units=households. 2014 total=18,393,716; 2024 total=22,127,321. These totals match Table 1.)

Table 9 Breakdown of the composition effect on poverty (+3.56 pp) by household type

Household size	Subtype	Contribution to ΔP (pp)	Share of total(%)	Direction
1-person	Under 50, General	+0.52	14.65	↑ Increase
	50+, General	+0.59	16.62	↑ Increase
	Vulnerable	+1.43	40.28	↑ Increase
2-person	General	+0.57	16.06	↑ Increase
	Vulnerable	+1.25	35.21	↑ Increase
3-person	Under 50	-0.09	-2.54	↓ Offset
	50+	+0.50	14.08	↑ Increase
4+ persons	Under 50	-1.00	-28.17	↓ Offset
	50+	-0.19	-5.35	↓ Offset
Sum	—	+3.55	100.00	-

(Contributions in percentage points; shares of total in % may be negative when offsetting occurs. Counterfactual headcount under constant composition=11.37% (12.56-1.19).)

Note: Under constant composition, counterfactual headcount=11.37%

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Declarations

Ethics Approval Not applicable (this study used secondary survey data).

Consent to Participate Not applicable.

Consent for Publication Not applicable.

Conflicts of interest The authors declare that they have no conflict of interest.

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