

Article

Middle-Income Durability and Social Sustainability in China: Evidence from Household Panel Data

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Abstract

Social sustainability and inclusive development require attention not only to the size of the middle-income group but also to households' capacity to maintain middle-income status over time. This study examines which middle-income household-years in China face a higher probability of moving to low income at the next survey wave. Using household panel data from the China Family Panel Studies, the analysis follows middle-income origins at wave t to observed destinations at wave $t + 1$. It distinguishes the relative position within the middle-income interval, prior status switching, and maximum observed consecutive middle-income duration. The observed next-state transition sample contains 23,931 household-years, of which 28.2% move to low income. In joint models, a higher relative position and longer observed persistence are associated with lower subsequent downward-mobility risk, whereas prior switching is positively associated with risk but is less stable across waves. A descriptive three-item score shows a monotonic inverse-probability-weighted risk gradient, from 4.04% at score 0 to 50.79% at score 3. These findings describe longitudinal risk associations rather than causal effects. The study approaches social sustainability through one bounded empirical dimension, the durability of the household economic position, rather than as a comprehensive measure of social sustainability or household resilience. Middle-income expansion alone is therefore an incomplete indicator of social sustainability: assessments of middle-income consolidation should also distinguish current members' observed histories and destination-specific risks.

Keywords: middle-income durability; social sustainability; downward mobility; inclusive development; income mobility; household panel data; China; economic insecurity



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1. Introduction

Social sustainability concerns whether the gains from development can be sustained in ways that support social justice, well-being, security, and meaningful participation over time [1]. In the present article, this broad concern is linked most directly to Sustainable Development Goal 10, which addresses within-country inequality and social and economic inclusion [2]. This study addresses that agenda through a deliberately bounded empirical question: whether a currently middle-income household occupies a durable economic position across observed survey waves. In China, debates on inclusive development and common prosperity have heightened interest in how improvements in income and living standards are shared and sustained across households [3]. Yet aggregate income gains, or a larger number of households currently classified as middle income, do not by themselves show whether such positions are durable. Income inequality and its measurement remain

central to socioeconomic sustainability, but distributional monitoring commonly records the current location rather than whether that location persists or is followed by an adverse transition [4].

The middle-income group provides a particularly informative case. It is often treated as an indicator of economic security and social consolidation [5,6]. Yet a household may meet a middle-income threshold at one survey wave while remaining close to the lower boundary, moving repeatedly across income states, or having only a short observed attachment to the middle. Earlier research on China links income mobility to distributional and development concerns [7], while research on vulnerable middle classes cautions that a position above poverty may not be insulated from later deterioration [8,9]. Work on income instability likewise distinguishes current income from exposure to uncertain income paths and future risk [10,11].

This gap matters for social sustainability because a growing middle-income group can coexist with uneven durability among current members. When some households have a substantially higher observed probability of moving from middle to low income at the next survey wave, current membership is an incomplete indicator of consolidated inclusion. The issue is not whether a cross-sectional middle-income category is useful; it is whether the category can be interpreted as a sustainable social position without considering the location within it and the observed histories preceding the next destination.

Accordingly, this article adopts an origin–history–destination design. It conditions on the middle-income status at wave t and distinguishes three possible destinations at the next observed survey wave, $t + 1$: low income, middle income, and high income. The primary outcome is the middle-to-low transition, not an annual hazard or a continuous-time event-history rate. The explanatory framework uses only information measured at t or earlier: relative income position within the middle-income interval, the cumulative number of prior switches among low, middle, and high income states, and the maximum observed consecutive middle-income duration. This design retains a transparent category definition while making the prior history and destination-specific movement visible [12,13]. It does not treat observed persistence as causal state dependence or the descriptive score as a new social class.

China provides an informative setting because the distributional change and middle-income expansion have been central to debates on inclusive development, even as household trajectories remain heterogeneous. Existing research has examined mobility and middle-class vulnerability in China [14–17]. Using China Family Panel Studies data across the 2010–2022 observation window, the present analysis applies an origin–history–destination design to middle-income household-years and distinguishes their next observed low-, middle-, or high-income destination. The China case is not presented as a descriptive national endpoint or as a source of universal transition rates. Its broader contribution is analytical logic that can be adapted to other household panels: distinguish current category membership from observed durability, make prior histories explicit, and retain the social meaning of different subsequent destinations.

Accordingly, this study asks the following: among household-years observed as middle income at wave t , how do the relative position, prior status switching, and observed persistence relate to the probability of a subsequent move to low income? The article evaluates a three-dimensional pre-transition framework and treats low-, middle-, and high-income destinations as conceptually distinct. The following section positions this framework within social-sustainability and mobility scholarship; the empirical analysis then evaluates its descriptive longitudinal associations.

2. Literature Review and Theoretical Framework

2.1. Middle-Income Durability and Social Sustainability

Income categories provide a concise description of the distributional location. They translate a continuous distribution into socially interpretable positions, including low, middle, and high income. A static classification, however, cannot establish whether the position it records is reproduced over time. The same limitation appears throughout stratification research: class, income, and occupational positions may be observed at a single point, while the processes through which they are retained, interrupted, or transformed remain unobserved. Panel data introduce temporal ordering into the description of social position [18,19]. Cumulative approaches similarly show why earlier locations and histories can matter for later inequality without, by themselves, identifying a causal process [20].

The concept of durability is useful here because it does not presume that a current state mechanically produces later outcomes. It directs attention to the continuity of a position over an observed interval. For middle-income households, durability concerns whether current membership is accompanied by a record of continuity and followed by a non-downward destination. This differs from, although it is related to, economic insecurity. Economic insecurity concerns exposure to material uncertainty and adverse shocks [10,11,21]; durability concerns whether a socially meaningful income position appears to be retained. The conceptual link to social sustainability is therefore temporal and distributional: inclusion is more durable when households can maintain a socially meaningful economic position across observed periods, rather than repeatedly facing downward reclassification. This is relevant to SDG 10's concern with inequality and inclusion and to broader concerns about intertemporal security and social cohesion, but the present analysis does not directly measure welfare, cohesion, or intergenerational outcomes. Social sustainability remains the broader interpretive relevance of the analysis, not a separately estimated outcome.

This distinction guards against a common interpretive shortcut. A larger middle-income group may reflect broad-based advancement, but it may also include households whose membership is recent or intermittent. Treating all members as equally secure makes the category appear more homogeneous than the underlying histories warrant. The analytical task is not to replace income categories with trajectories; it is to read a current category historically by asking how the location within the category and observed prior movement shape the meaning of membership. This is a question of within-category stratification, not simply of the size of the middle.

2.2. Downward Mobility and Inclusive Development

Mobility research distinguishes movements by origin and destination because the social meaning of a transition cannot be inferred from movement alone. A household that leaves the middle for high income differs substantively from one that leaves the middle for low income. The first reaches an upward destination; the second loses its current middle-income position. A broad exit indicator combines these outcomes and is therefore a useful descriptive complement, but an imprecise measure of fragility. The primary outcome is consequently the transition from middle at t to low at $t + 1$.

Focusing on a middle-income origin has two advantages. First, it makes the relevant comparison internal to the middle rather than a comparison between households already located at different points in the distribution. Second, it makes competing destinations visible. A household can remain middle income, move downward, or move upward. These three destinations describe different transition pathways, and the adverse pathway cannot be reduced to the overall rate of exit. This destination-specific framing follows the broader

mobility insight that aggregate movement can conceal asymmetric processes across states and groups [13,22–25].

Downward mobility is not identical to poverty dynamics. The outcome indicates a transition into the low-income category under the study's relative threshold; it does not claim to identify long-term poverty, deprivation, or a specific shock, nor does it imply that every downward transition has the same material consequences. Its analytical value is narrower: it allows the study to examine whether a current middle-income location is followed by an adverse categorical destination and whether that risk is distributed unevenly among households with the same observed origin state.

2.3. Three Pre-Transition Dimensions of Within-Middle Durability

The first dimension is position vulnerability. Middle-income membership spans an interval rather than a single point, so households occupy relatively high or low positions within it. A household closer to the lower boundary has a lower relative-income distance from classification as low income at the next wave. This pattern may partly arise from threshold mechanics and regression toward the middle of the distribution and should not be treated as a complete account of fragility. The relative position nevertheless remains substantively relevant because category membership is heterogeneous even before observed histories are considered. A location near the lower edge of the middle represents a thinner form of membership than a location closer to the center or upper segment of the interval. Evidence from China likewise motivates attention to vulnerability within the middle-income category, while using a measurement approach distinct from the one adopted here [15].

H1. *Higher relative income position within the middle-income interval is associated with lower subsequent downward mobility risk.*

The second dimension is historical instability. The prior status-switch count captures how often a household has crossed among the three income states (low, middle, and high) in the observed history through wave t . It is not an income-variance measure and does not identify the causes of movement. Instead, it records whether current middle-income membership follows a settled or unsettled sequence of categorical positions. A household that has crossed status boundaries several times may have a more contingent relationship to the middle than one with a comparatively stable observed history. Because switches can include upward, as well as downward, movement, the expected association is empirical rather than deterministic; the measure is best understood as a marker of historical instability.

H2. *A greater prior status-switch count is associated with a higher subsequent downward mobility risk.*

The third dimension is observed persistence: maximum observed consecutive middle-income duration through wave t . A longer observed spell indicates that a household's current membership has been maintained across consecutive survey observations. It therefore distinguishes recent or interrupted membership from a longer observed attachment to the middle. The measure is deliberately termed maximum observed consecutive duration because the panel does not recover complete lifetime income histories. Households first observed after the beginning of the panel may have earlier unobserved spells, and short durations may partly reflect left censoring or limited observation windows.

H3. *A longer maximum observed consecutive middle-income duration is associated with lower subsequent downward mobility risk.*

2.4. Integrated Analytical Framework and Score Gradient

The position, switching, and observed persistence capture distinct temporal aspects of a middle-income location. The position describes where a household stands within the current interval. Switching records whether membership follows movement across categorical boundaries. Observed persistence summarizes continuity in the middle over the panel window. No single dimension fully represents fragility. A household near the lower boundary may still have a long observed middle-income spell, a household with a relatively high current position may have an unsettled history, and a long spell does not eliminate exposure to a future downward transition. Their joint consideration is therefore more informative than static membership alone.

The integrated framework also limits an overly mechanistic reading of any single dimension. The position near a lower boundary may matter, but proximity alone cannot distinguish a recent, unsettled membership from a long observed spell. Conversely, a long spell is not equivalent to security when a household occupies a relatively low current position. The joint model preserves these distinctions, while the score makes the accumulation of markers legible. Neither device turns the three measures into interchangeable proxies for a single unmeasured mechanism.

The framework is not a mechanism model. It does not imply that changing a score component would, by itself, change a household's future destination. Instead, it describes a pre-transition profile. For interpretive purposes, the three dimensions are combined into a rule-based score ranging from 0 to 3. One point is assigned for a relatively low position, above-median prior switching, and relatively short observed persistence, using cutoffs established before the next-state outcome is examined. The score is not a validated latent scale, an official class boundary, or a permanent household type. It is a descriptive summary of accumulated markers that can reveal whether the observed next-wave transition probability is graded within the middle.

H4. *The subsequent downward mobility risk rises monotonically as the three-item fragility score increases.*

This framework makes three contributions to the literature. First, it treats middle-income durability as a bounded social-sustainability monitoring issue: membership counts are interpreted alongside the observed continuity and destination-specific transition risk. Second, it develops a transparent three-dimensional pre-transition framework for within-middle stratification. Third, it separates downward mobility from upward exit, avoiding the treatment of all movement out of the middle as insecurity. These are longitudinal descriptive contributions; they do not identify the interventions or mechanisms that would change subsequent destinations.

2.5. Analytical Boundaries

Observed persistence should also be distinguished from state dependence. State dependence is a structural or causal proposition about how a prior state changes a later outcome after accounting for unobserved heterogeneity. The duration measure used here does not establish that proposition. It summarizes a history observed before the subsequent destination. Its theoretical role is therefore descriptive and stratificational: continuity in the observed middle-income position may signal a more durable attachment to the category, even though the mechanisms underlying that continuity are not identified.

The observed-history qualification is consequential. Duration and switching partly depend on the number of waves in which a household can be observed: a longer window permits both a longer recorded spell and more opportunities to record status changes.

These measures should therefore be treated as informative yet incomplete observed histories. History-length and entry-cohort diagnostics assess this concern, while the primary interpretation remains tied to the observed panel window. This limitation specifies what the duration measure can describe without making its association with subsequent risk uninformative.

Figure 1 summarizes the temporal framework and the distinction between the three pre-transition dimensions and the three possible subsequent destinations.

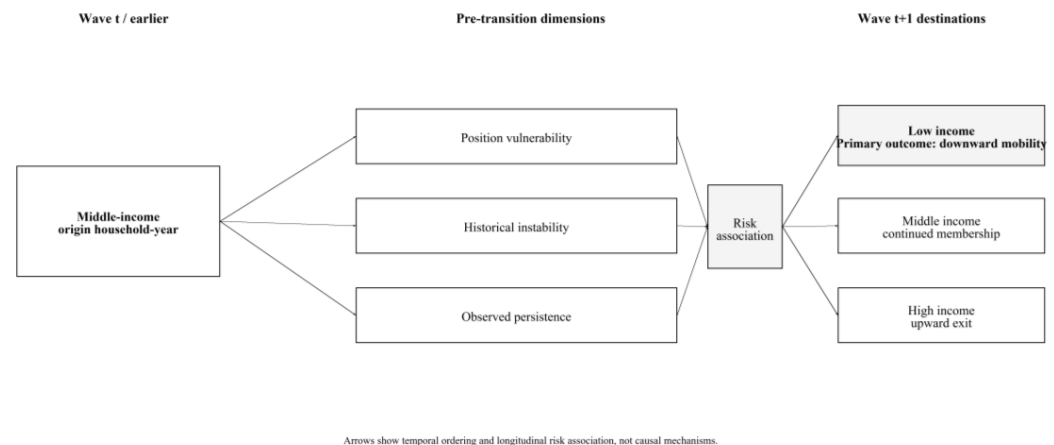


Figure 1. Analytical framework linking middle-income durability and subsequent mobility.

The framework begins with a middle-income household at wave t . Position vulnerability, historical instability, and observed persistence are measured at t or earlier and are associated with differential destinations at $t + 1$: low income, middle income, and high income. Downward mobility is the primary outcome. Arrows indicate temporal ordering and risk association, not causal mechanisms.

3. Materials and Methods

3.1. Data Source and Sample Construction

The analysis uses the household panel component of the China Family Panel Studies, a nationally oriented longitudinal survey that follows Chinese individuals and households across repeated waves [26,27]. It draws on observations from 2010, 2012, 2014, 2016, 2018, 2020, and 2022. Household-year records are linked through the baseline household-chain identifier, allowing a household to contribute more than one transition while clustering repeated observations within the same chain. China is treated as the empirical setting for a question about within-middle stratification; the analysis does not assume that the resulting transition pattern is universal across welfare regimes or labor markets.

Income status is constructed from real per-capita household income. Following a widely used OECD relative-income convention [5], the national median of real per-capita income within each survey wave defines a middle-income interval from 75% to 200% of that median. Household-years below the lower threshold are coded low income, those inside the interval are middle income, and those above the upper threshold are high income. This is an analytical relative-income definition rather than an official Chinese administrative classification. It provides a transparent common national reference while allowing comparisons across changing price levels and income distributions. Research on middle-class vulnerability in China further motivates attention to heterogeneity within a relative middle-income category, while using a distinct measurement approach [15]. Alternative 67–200% and P20–P80 definitions reconstruct the states and histories in pre-specified sensitivity analyses. Household consumption, debt, assets, and insurance are substantively important resources, but they are not treated as substitute income thresholds.

because they measure different constructs and are not comparably available in the frozen household-year transition file. Because no single official, price- and region-comparable absolute middle-income standard is available across the full 2010–2022 panel, the study does not introduce a post hoc absolute cutoff. The reported alternative relative definitions therefore test definitional sensitivity, while absolute classification remains a limitation of the relative-income design.

Sample construction proceeds in stages. The income construction uses the public-use CFPS family-economic files released for 2010 (202008), 2012 (201906), 2014 (201906), 2016 (201807), 2018 (202101), 2020 (202306), and 2022 (202410). File-level release identifiers and the harmonization sequence are reported in Supplementary S1-L. The full middle-income origin pool contains 30,285 household-years observed as middle income at wave t across 2010–2022. Of these, 3399 observations occur in 2022 and are administratively right censored because no later survey wave is available by design. Removing them yields the eligible transition-origin pool of 26,886 middle-income household-years in 2010–2020. Among eligible origins, 2955 lack a valid next-state classification because of a noninterview, mapping gaps, or missing income status. The observed next-state transition sample therefore contains 23,931 household-years from 10,009 household chains with a low-, middle-, or high-income destination at the next wave.

The main regression requires complete information on the three focal predictors, household size, urban residence, province, year, and the household-chain identifier. The covariate-complete primary analysis sample includes 23,803 household-years from 9996 household chains. Thus, the difference between the observed transition sample and the primary analysis sample is 128 household-years with incomplete model covariates. Thus, the sample flow is 30,285 middle-income origins, 26,886 eligible transition origins after administrative right censoring, 23,931 origins with an observed next state, and 23,803 covariate-complete observations for the primary models. Supplementary S1-A presents detailed variable definitions, and Supplementary S1-B documents the complete sample flow and wave-specific counts.

3.2. Measures

The primary outcome, subsequent downward mobility, is coded one when a household is middle income at wave t and low income at the next observed survey wave, $t + 1$. It is a binary observed next-wave transition, not an annual hazard, a continuous-time event-history rate, or a direct measure of welfare loss. The key secondary outcome is an exit from middle-income status, which equals one when a household moves from middle income to either low or high income. Remaining middle income and moving to high income are descriptive competing destinations. The secondary outcome is not interpreted as a pure measure of fragility because it includes upward exit.

Relative income position is defined as the ratio of household real per-capita income to national median real per-capita income in the current wave. Within the middle-income origin state, a lower value indicates proximity to the lower threshold. The prior status-switch count is the cumulative number of observed changes among the three income states (low, middle, and high) through wave t . It uses only current and prior observations and is sensitive to the length of observed history; the appendix reports history-length and entry-cohort diagnostics. The maximum observed consecutive middle-income duration is the longest consecutive middle-income spell observed through wave t . It is an observed panel-history measure, not a lifetime duration measure.

For the score analysis, position vulnerability is coded when the relative position is at or below the pre-specified median cutoff, historical instability is coded when the prior switch count is above its cutoff, and weak persistence is coded when the maximum observed consecutive duration is at or below its cutoff. These three indicators are summed to form a

0–3 score. Scores of 0 or 1 define the secure-middle profile, while scores of 2 or 3 define the fragile-middle profile. These labels describe household-year profiles rather than stable identities. All score components are determined before the subsequent destination is measured. To assess whether the descriptive gradient depends on dichotomization and equal point allocation, Supplementary S1-N also reports a continuous principal-component sensitivity score constructed from the three direction-coded standardized measures. It is a sensitivity analysis and does not replace the pre-specified 0–3 score.

The models adjust for household size and urban residence, together with survey-wave and province fixed effects. These controls remain deliberately parsimonious. They account for basic compositional and spatial differences without conditioning on a broad set of variables that may lie on the pathway between a household's position and later transition. To examine descriptive heterogeneity without changing the primary estimand, the study also estimates rural/urban and four macro-region stratified joint LPMs; full specifications and estimates are reported in Supplementary S1-K.

The adjustment set is intended to describe longitudinal risk differences rather than to maximize prediction. It excludes the subsequent income, future family composition, and later assets, which occur after the origin state or may lie on pathways associated with later mobility. Potential mechanisms are not entered as ordinary controls, preserving the temporal distinction between the pre-transition profile and the subsequent destination. Their measurement coverage is documented in Supplementary S1-M.

3.3. Empirical Strategy

The primary specification is specified as the following joint linear probability model for subsequent downward mobility:

$$Y_{i,t+1} = \alpha + \beta_1 \text{Position}_{it} + \beta_2 \text{Switching}_{it} + \beta_3 \text{Persistence}_{it} + \gamma' X_{it} + \lambda_t + \delta_p + \varepsilon_{it} \quad (1)$$

Here, i denotes the household chain and t denotes the origin wave; $Y_{i,t+1}$ equals one when a household is middle income at t and low income at $t+1$. $X(i,t)$ contains the household size and urban residence, while $\lambda(t)$ and $\delta(p)$ denote wave and province fixed effects. The three focal predictors are standardized within the primary analysis sample, so each coefficient is an adjusted percentage-point difference in the probability of subsequent downward mobility associated with a one-standard-deviation difference in that predictor. Standard errors are clustered by household chain. The primary specification is estimated in the covariate-complete analysis sample; inverse-probability weighting is used only as a sensitivity analysis for observed next-state availability. As an additional sensitivity to time-invariant household characteristics not represented in the parsimonious primary adjustment set, Supplementary S1-N estimates a household-chain fixed-effects LPM with year fixed effects. This specification uses within-chain variation and is not a replacement for the primary between- and within-household association model; history-based measures may have insufficient within-chain variation to be separately estimated.

The analysis first estimates single-dimension models to describe each association separately and then estimates the joint three-dimensional model. A paired logit model reports average marginal effects using the same outcome, focal predictors, adjustment structure, and primary analysis sample. These effects express sample-average changes in predicted probability on the same probability scale as the linear probability model. They serve as a functional-form check rather than a competing primary specification. The corresponding estimates are presented in the Section 4.

The score analysis is descriptive. It reports score-specific raw transition risks and inverse-probability-weighted risks, as well as raw and weighted contrasts between secure- and fragile-profile household-years. The score is not estimated as a treatment and the group

contrast is not interpreted as a causal effect of classification. A companion competing-state analysis, reported in Supplementary S1-H, evaluates low, middle, and high destinations jointly to clarify why the primary outcome should not be replaced by broad exit.

3.4. Missingness and Sensitivity Analyses

Next-state observation is not guaranteed in a household panel. Administrative right censoring is distinct from non-administrative missingness: the 3399 middle-income origins observed in 2022 have no scheduled next wave, whereas 2955 eligible origins in earlier waves lack a valid next-state classification. The observed transition sample is therefore an outcome-observed subset of the eligible transition-origin pool. The primary estimates preserve this distinction rather than treating all unavailable next states as the same form of attrition. Supplementary S1-B and S1-J provide the detailed sample-flow and missingness diagnostics.

As a sensitivity analysis for observed next-state availability, a propensity model is estimated in a 30,049-row complete propensity-model sample. The model predicts the observation of the next income state using the three pre-transition dimensions and the primary design covariates. Stabilized inverse-probability weights are applied to the covariate-complete primary analysis sample of 23,803 household-years; a second sensitivity analysis trims weights at the first and ninety-ninth percentiles. Diagnostics for the overlap, weight distribution, and effective sample size are reported in Supplementary S1-D. The weights reweight observed next-state availability under observed covariates; they do not correct the selection caused by unobserved income shocks or unobserved attrition processes, and they do not turn the reported associations into causal effects.

For the descriptive weighted score gradient, uncertainty is quantified using household-chain cluster bootstrap percentile intervals. The bootstrap resamples baseline household chains, holds the pre-specified score definition and observation weights fixed, and uses 2000 replications. Score-specific labels report unweighted observed counts, whereas weighted risks use household-years with nonmissing stabilized weights. This procedure quantifies uncertainty around the descriptive weighted gradient and does not alter the score definition.

Robustness checks also reconstruct the income states and observed histories under the 67–200% relative-median interval and the P20–P80 definition. These alternatives change the composition of the middle-income origin state and therefore generate different transition samples; they are not common-sample substitutions. Full threshold details and supporting diagnostics are reported in Supplementary S1-E through S1-N.

4. Results

4.1. Transition Patterns Among Middle-Income Household-Years

Observed subsequent destinations show that current middle-income membership is neither uniformly durable nor uniformly fragile. In the observed next-state transition sample, of 23,931 household-years from 10,009 household chains, 28.2% move from middle to low income at the next observed survey wave, 54.8% remain middle income, and 17.0% move to high income. The downward share makes the durability question substantively meaningful, while the upward share shows why exit from the middle cannot be used as a synonym for downward mobility. The 45.2% overall exit rate combines an adverse categorical destination with upward advancement and is therefore treated as a secondary outcome rather than the primary measure of fragility. The competing-state model in Supplementary S1-H reports separate associations for high- versus middle-income and low- versus middle-income destinations; it is used to clarify destination asymmetry, not to attribute the high-income destination to a distinct causal mechanism.

Table 1 situates these transitions alongside the focal dimensions. The relative income position has a mean of 1.266 within the middle-income origin state, the prior status-switch count has a mean of 2.203, and the maximum observed consecutive middle-income duration has a mean of 2.904 observed waves. These descriptive measures do not establish a causal process, but they show that the middle category contains variation in the current location and observed history before the next destination is known. The empirical question is whether this variation is systematically associated with the subsequent downward transition.

Table 1. Sample and descriptive statistics.

Variable	Mean/Rate	SD	P25	Median	P75	N
A. Transition outcomes						
Subsequent downward mobility	28.18%	0.450	-	-	-	23,931
Remain middle income	54.78%	0.498	-	-	-	23,931
Move to high income	17.04%	0.376	-	-	-	23,931
B. Core fragility dimensions						
Relative income position	1.266	0.349	0.965	1.212	1.539	23,931
Prior status-switch count	2.203	1.342	1.000	2.000	3.000	23,931
Maximum observed consecutive middle-income duration	2.904	1.575	2.000	3.000	4.000	23,931
C. Primary-model covariates						
Household size	4.453	2.108	3.000	4.000	5.000	23,803
Urban residence	51.28%	0.500	-	-	-	23,803

Note. Observed next-state transition sample = 23,931 household-years from 10,009 household chains. Covariate-complete primary analysis sample = 23,803 household-years from 9996 household chains. Binary variables report mean/rate, SD, and N only.

The three destinations also clarify the paper’s conceptual focus. Staying middle income is a useful descriptive complement because it indicates continuity in the current category. Moving to high income is an upward exit. Moving to low income, by contrast, is the destination that directly challenges the assumption that a current middle-income classification denotes a durable position. The following models therefore keep the origin state fixed and examine variation in the risk of the low-income destination.

These proportions apply only to household-years with an observed next state. They do not describe every middle-income origin in the broader panel, because some otherwise eligible observations lack a valid later income status and the final survey wave has no scheduled successor. The sample construction reported in the Methods separates these sources of non-observation. Table 1 is accordingly centered on the observed destinations that define the primary transition outcome rather than presenting the transition rates as population-wide persistence estimates. The competing-state diagnostic in Supplementary S1-H further distinguishes low, middle, and high destinations and confirms why the adverse low-income destination should not be conflated with upward exit.

4.2. Three Pre-Transition Dimensions of Downward Mobility Risk

The results show that the three dimensions are associated differently with subsequent downward-mobility risk. Table 2 first presents separate linear probability models and then the joint three-dimensional specification. In the separate models, a one-standard-deviation higher relative position is associated with an 8.1-percentage-point lower probability of downward mobility, a one-standard-deviation higher prior switch count is associated with

a 10.2-percentage-point higher probability, and a one-standard-deviation longer maximum observed middle-income duration is associated with a 17.8-percentage-point lower probability. These estimates provide the orientation but do not establish whether the dimensions retain distinct information when considered jointly.

Table 2. Three dimensions of subsequent downward mobility risk.

	(1) Position Only LPM	(2) Switching Only LPM	(3) Persistence Only LPM	(4) Joint LPM	(5) Joint Logit AME
Relative income position	−0.081			−0.073	−0.069
	(0.003)			(0.003)	(0.003)
Prior status-switch count		0.102		0.012	0.019
		(0.003)		(0.003)	(0.003)
Maximum observed consecutive middle-income duration			−0.178	−0.168	−0.206
			(0.003)	(0.003)	(0.004)
Controls	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	23,803	23,803	23,803	23,803	23,803
Household chains	9996	9996	9996	9996	9996
R-squared	0.219	0.222	0.230	0.232	

Note. Predictors are standardized to one sample SD. LPM entries are percentage-point changes; Logit AMEs are sample-average predicted-probability changes. Standard errors clustered by household chain are in parentheses.

In the joint linear probability model, a higher relative position remains associated with a lower subsequent downward risk. A one-standard-deviation difference in the relative position corresponds to a 7.3-percentage-point lower probability of moving to low income (95% CI: −7.8 to −6.8 percentage points). The corresponding logit average marginal effect is similar in direction and scale (−6.9 percentage points). This consistency across specifications indicates that the position association is not solely a by-product of the other two observed dimensions. It is nevertheless interpreted as a position-vulnerability association, not as evidence that a marginal income change would causally prevent a future downward transition.

Observed persistence remains the largest protective association in the joint model. A one-standard-deviation longer maximum observed consecutive middle-income duration corresponds to a 16.8-percentage-point lower probability of subsequent downward mobility (95% CI: −17.4 to −16.1 percentage points). The paired logit average marginal effect is also negative (−20.6 percentage points). This magnitude should be interpreted on the standardized scale used in Table 2, rather than as a comparison of raw-duration units with the other predictors. Substantively, the result is consistent with the idea that a current middle-income position has different implications when supported by a longer observed spell rather than a shorter or interrupted one.

Prior switching contributes a more qualified historical dimension. In the pooled joint linear probability model, a one-standard-deviation higher switch count corresponds to a 1.2-percentage-point higher probability of downward mobility (95% CI: 0.6 to 1.8 percentage points), and the paired logit average marginal effect is 1.9 percentage points. Thus, a more unsettled observed status history retains information beyond the current position and observed persistence. The association is smaller than in the separate model because

the histories and duration are related, and it is not interpreted as equally stable across all empirical slices. Wave-specific results in Supplementary S1-F show partial sensitivity in the switching dimension, a boundary considered below rather than concealed by the pooled estimate.

Taken together, the joint evidence supports a three-dimensional description of within-middle stratification. The position identifies a household's location within the current interval, observed persistence summarizes prior continuity in the middle, and prior switching captures an additional, though less uniformly stable, history of movement across status boundaries. The evidence does not imply that every dimension has identical empirical strength. Rather, current membership contains distinguishable forms of location and history associated with different subsequent risks.

4.3. Fragility Score and Risk Stratification

The score analysis translates the three dimensions into a transparent description of accumulated pre-transition markers. One point is assigned for a lower relative position, above-cutoff prior switching, and weaker observed persistence, producing a score from 0 to 3. Because each component is measured at the origin wave or earlier, the score does not define a household as fragile on the basis of whether it later moves downward. It summarizes the configuration of the position and observed history that precedes the next destination.

Figure 2 shows a pronounced monotonic gradient in stabilized inverse-probability-weighted downward risk. Weighted risk is 4.04% for score 0 (95% CI: 3.44–4.65%), 17.00% for score 1 (95% CI: 16.15–17.92%), 37.26% for score 2 (95% CI: 36.13–38.37%), and 50.79% for score 3 (95% CI: 49.39–52.28%). The central finding is the gradient itself: middle-income household-years sharing the same origin category have different observed next-wave transition risk profiles. Accumulating more of the three descriptive markers corresponds to a higher observed probability of a subsequent move to low income.

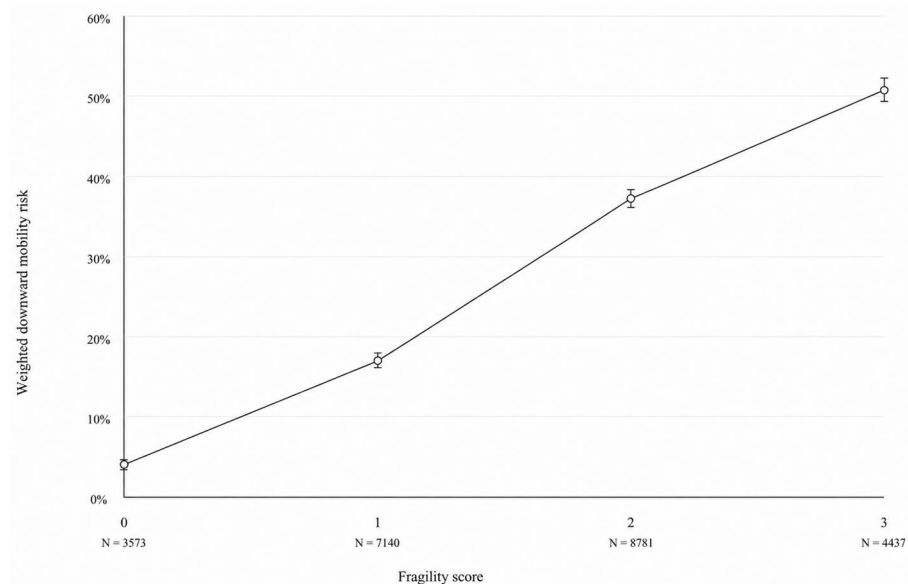


Figure 2. IPW-weighted subsequent downward-mobility risk by fragility score.

Points show household-chain cluster-bootstrap percentile 95% confidence intervals (2000 replications); labels report unweighted observed household-year counts. Score components are measured at wave t or earlier.

Table 3 records both raw and weighted score-specific risks. The raw rates follow the same ordering, ranging from 4.1% at score 0 to 50.6% at score 3. The weighted risks are

presented as a sensitivity-based description for observed next-state availability, not as proof that all selection processes have been resolved. The alignment between raw and weighted gradients is therefore informative, while the remaining uncertainty about unobserved selection remains part of the interpretation.

Table 3. Fragility score and within-middle stratification.

Group	N	Household Chains	Raw Risk	IPW Risk	IPW 95% CI
Panel A. Score gradient					
Score 0	3573	1393	4.06%	4.04%	[3.44%, 4.65%]
Score 1	7140	4310	16.55%	17.00%	[16.15%, 17.92%]
Score 2	8781	5812	36.12%	37.26%	[36.13%, 38.37%]
Score 3	4437	2602	50.57%	50.79%	[49.39%, 52.28%]
Panel B. Secure versus fragile profiles					
Secure profile (Score 0–1)	10,713	4521	12.39%	13.00%	[12.36%, 13.66%]
Fragile profile (Score 2–3)	13,218	6807	40.97%	41.49%	[40.53%, 42.43%]
Fragile minus Secure	-	-	28.59 pp	28.50 pp	[27.33%, 29.70%]

Note. IPW = stabilized inverse-probability weighted risk for observed next-state availability. CIs are household-chain cluster bootstrap percentile intervals. Score components are measured at wave *t* or earlier. Secure and fragile profiles are descriptive household-year profiles, not causal treatment groups.

The secure- and fragile-middle profiles provide a concise summary of this within-category contrast. Secure-profile household-years, defined by scores of 0 or 1, have a raw downward risk of 12.4% and a weighted risk of 13.0%. Fragile-profile household-years, defined by scores of 2 or 3, have a raw downward risk of 41.0% and a weighted risk of 41.5%. The raw fragile–secure difference is 28.6 percentage points; the weighted difference is 28.5 percentage points (95% CI: 27.3–29.7 percentage points). These are descriptive and weighted contrasts, not an adjusted treatment effect. They show that the middle-income category contains household-years with sharply different subsequent risk profiles.

The score should not replace the separate dimensions in the main model. Its value is primarily communicative and descriptive. The relative position, historical instability, and observed persistence have different units and different degrees of stability across waves. The score makes their accumulation visible without claiming that the components have equal causal importance or that the resulting profiles are permanent household types. Figure 2 and Table 3 therefore complement Table 2: the model separates the dimensions, while the score shows how their joint configuration stratifies risk within the same middle-income origin category.

4.4. Robustness and Sensitivity Checks

The specifications summarized in Table 4 assess whether the joint three-dimensional pattern depends on the treatment of observed next-state availability or on the primary middle-income definition. The paired logit average marginal effects in Table 2 preserve the directions observed in the joint linear probability model. With stabilized observation weights, a higher relative position and longer observed persistence remain negatively associated with downward mobility, whereas prior switching remains positively associated with it. The same directions are retained when weights are trimmed at the first and ninety-ninth percentiles. These are sensitivity analyses for observed next-state availability; they do not establish that weighting removes all selection related to unobserved characteristics.

Table 4. Sensitivity analyses for the joint three-dimensional model.

Specification	Relative Income Position	Prior Status-Switch Count	Maximum Observed Consecutive Middle-Income Duration	N	Household Chains
IPW LPM	−0.075 (0.003)	0.016 (0.003)	−0.169 (0.003)	23,803	9996
Trimmed IPW LPM	−0.075 (0.003)	0.014 (0.003)	−0.170 (0.003)	23,803	9996
67–200% threshold	−0.074 (0.002)	0.023 (0.003)	−0.159 (0.003)	26,268	10,402
P20–P80 threshold	−0.064 (0.002)	0.042 (0.003)	−0.108 (0.002)	36,842	11,822

Note. Entries are LPM coefficients per one sample SD, with household-chain clustered standard errors in parentheses. The unweighted joint LPM is reported in Table 2; IPW and trimmed IPW rows are sensitivity estimates. Alternative definitions reconstruct state histories and observed transition samples.

The two alternative middle-income definitions also preserve this broad directional pattern. Under both the 67–200% relative-median interval and the P20–P80 definition, a higher relative position and longer observed persistence are negatively associated with the low-income destination, whereas prior switching is positively associated with it. The alternative definitions reconstruct the income states, histories, and observed transition samples rather than merely changing a current-wave indicator. Their sample sizes therefore differ from the primary analysis sample. The substantive conclusion is not that coefficients are invariant to the threshold choice, but that the central direction of the three associations is retained across the pre-specified definitions.

Additional diagnostics are reported in Supplementary S1. Wave-specific estimates in Supplementary S1-F show that the relative position and observed persistence retain their expected directions, whereas prior switching has partial wave sensitivity. Identifier diagnostics in Supplementary S1-G clarify the limits of the alternative economic-chain identifier, and competing-state models in Supplementary S1-H distinguish downward mobility from upward exit. The residence and macro-region models in Supplementary S1-K retain negative associations for the relative position and observed persistence across the reported strata; switching is more heterogeneous. Supplementary S1-N adds three bounded sensitivities. In household-chain fixed-effects models, the relative position remains negatively associated with downward mobility (−2.34 percentage points per full-sample SD, 95% CI: −3.07 to −1.60), whereas switching and observed persistence are not separately estimable because they have insufficient within-chain variation after fixed effects. A continuous PCA fragility score is positively associated with downward mobility (16.46 percentage points per SD, 95% CI: 15.95 to 16.97). Excluding the 2018 and 2020 origin windows retains the negative position and persistence associations and the positive switching association. These checks are descriptive sensitivities, not estimates of a pandemic, regional, or household-fixed causal effect.

5. Discussion

5.1. Middle-Income Durability as a Social Sustainability Issue

The central implication of the analysis is that middle-income membership should not be equated with a durable middle-income position. A static category identifies where a household is observed at a particular time, but not whether the position follows a settled history, has been continuously observed, or is followed by a downward destination. By treating middle income as an origin state rather than a final destination, the study makes these distinctions empirically visible. The social-sustainability relevance is accordingly specific: durability of the household economic position is one informative dimension of whether apparent inclusion is sustained, not a comprehensive assessment of social sustainability or resilience.

This contribution also speaks to a broader issue in stratification research. Categorical measures remain valuable because they identify socially legible positions, but their interpretation changes when longitudinal histories are available. A category can be treated as a container, or it can be treated as a position whose continuity and transitions are part of its social meaning. The latter approach does not deny the importance of cross-sectional distributional measures. It asks what those measures leave unresolved when households are followed over time. For the middle-income group, the unresolved issue is durability.

5.2. Within-Middle Risk Stratification and Inclusive Development

The three-dimensional framework shows why current membership alone is incomplete. The relative position identifies a household's location inside the middle interval, prior switching records a history of boundary crossing, and observed persistence records the continuity of a middle-income spell within the available panel. These dimensions organize different temporal objects. Their joint consideration avoids treating a household's current location, its prior movement, and its duration in the middle as a single undifferentiated form of stability.

Evidence is strongest for the position and observed persistence. Both retain their expected directions in the pooled joint model and across the reported sensitivity structure. Historical instability contributes additional information in the pooled model, but shows partial wave sensitivity. This mixed evidence is substantively important: prior switching is best understood as a marker of unsettled observed history rather than a universally stable predictor. A framework for within-middle stratification does not require every component to be equally strong; it requires clarity about what each component represents and transparency about the limits of its empirical regularity. This interpretation is consistent with vulnerability research showing that income above a threshold need not imply protection from later deterioration [8–11,15]. Recent household-level studies in China further document associations of job stability and intergenerational educational mobility with household financial or economic vulnerability [28,29]. It also extends China-focused mobility research [14–17] by conditioning on a common middle-income origin and distinguishing the subsequent low-income destination from upward exit. Rather than treating mobility as a single favorable or unfavorable process, the results show why the meaning of movement depends on both the observed origin history and the destination considered.

The score gradient extends this point without replacing the component-level evidence. It shows that the configuration of pre-transition markers is associated with a clear ordering of the observed next-wave transition probability. The score is intentionally simple and descriptive. It does not identify a new social class, rank households by immutable vulnerability, or establish the mechanisms that generate a transition. Its value lies in showing that a category that appears unified at wave t contains profiles with different observed relations to the next destination.

5.3. Monitoring Downward Mobility Without Confusing It with Upward Exit

The study also contributes to mobility research by distinguishing the meanings of destinations. Broad exit from the middle combines downward and upward movement. That aggregate outcome can describe turnover in a category, but it cannot by itself answer a question about fragility. The low-income destination is adverse relative to the current middle-income origin; the high-income destination is not. The descriptive transition structure and competing-state analyses therefore support a destination-specific interpretation rather than a general theory of movement out of the middle.

This distinction has implications for how middle-income expansion is interpreted. A rise in middle-income membership may coexist with substantial churn if house-

holds enter and leave the interval through different pathways. A count of middle-income households alone cannot distinguish durable membership from temporary occupation, nor can an overall exit rate distinguish downward movement from advancement. Origin–history–destination designs offer one way to make these differences visible without treating all categorical movement as equivalent.

5.4. Limitations

Several limitations delimit the findings. First, the duration measure is based on observed panel histories rather than complete lifetime trajectories. The maximum observed consecutive middle-income duration can be affected by late entry into the panel and cannot be interpreted as lifetime persistence. Second, status switching is based on observed categorical states and may summarize different forms of movement, including upward, as well as downward, transitions. Its partial wave sensitivity reinforces the need for a cautious interpretation. Third, next-state observation is selective. The analysis distinguishes administrative right censoring from non-administrative missing next states and uses inverse-probability weighting as a sensitivity analysis, but this cannot address the selection related to unobserved shocks or attrition. Fourth, the classification of middle income is threshold dependent. The reported relative-threshold alternatives are informative, but the study does not supply a single official absolute middle-income definition applicable across the full panel. Fifth, the pandemic-window exclusion is a descriptive sensitivity rather than a design for estimating the effect of COVID-19 or other macroeconomic shocks. Finally, the design establishes longitudinal ordering and risk association, not causal effects of the income position, switching, or observed duration.

China provides an informative case because it allows the analysis of a large and changing middle-income origin state over repeated survey waves. The substantive processes that organize durability may differ elsewhere with labor-market institutions, social protection systems, household structures, and survey designs. China's common-prosperity agenda, pension reforms, and rural–urban migration institutions may also shape the resources and constraints surrounding household trajectories, but they are not policy treatments identified by this design. Province fixed effects and the supplementary residence/region strata describe spatial patterning; they do not estimate institutional effects. The results should therefore not be read as universal transition rates. What may travel more readily than the specific estimates is the analytical logic: define an origin category, make prior histories explicit, distinguish destinations, and ask whether apparently similar current members occupy positions of unequal durability.

The implication for monitoring is limited yet clear. Aggregate counts of middle-income households are incomplete indicators of security when detached from transition histories and destinations. The analysis does not identify an intervention that would prevent downward movement or establish which mechanism should be targeted. Instead, it shows why assessments of middle-income consolidation should distinguish membership prevalence from membership durability. This distinction provides a starting point for later work on the conditions that buffer, or fail to buffer, households against adverse transitions.

6. Conclusions

The evidence indicates that current middle-income membership is not, on its own, evidence of a durable middle-income position. In the observed next-state transition sample, middle-income household-years differ substantially in their subsequent probability of moving to low income at the next survey wave. H1 and H3 receive consistent support: a higher relative position and longer maximum observed consecutive middle-income duration are associated with a lower downward risk. H2 receives qualified support in the

pooled model, but prior switching is more wave- and stratum-sensitive. H4 is supported as a descriptive score gradient, and the continuous PCA sensitivity reaches the same directional conclusion without binary score cutoffs.

The descriptive score makes this internal differentiation particularly visible: stabilized inverse-probability-weighted downward risk rises from 4.04% at score 0 to 50.79% at score 3. This gradient is not a causal effect and does not define new social classes. It shows that households sharing the same current middle-income origin can have very different observed risk profiles when the pre-transition location and history are considered jointly.

For monitoring middle-income consolidation, the implication is straightforward. Counts of middle-income households should be complemented by indicators of observed durability and destination-specific transitions. Treating downward mobility separately from upward exit is essential because the two movements have different meanings for the durability of the household economic position. The evidence presented here is a panel-based account of longitudinal association within a Chinese household panel, not a causal evaluation of policy or household interventions. These findings should be read with the stated limits on threshold choice, next-state observation, and causal interpretation. Future work should connect the origin–history–destination framework to harmonized measures of social protection, employment security, assets, debt, health shocks, and macroeconomic disruptions, using research designs capable of identifying those mechanisms.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su18157827/s1>, Supplementary S1: Additional Definitions, Diagnostics, and Robustness Checks.

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