The Life Cycle Dynamics of Wealth Mobility

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Disclaimer: The views below are those of the authors and do not necessarily reflect the position of the Federal Reserve Bank of New York, the Federal Reserve System, the European Central Bank or the Eurosystem.

Wealth mobility over the life cycle

- Individual wealth histories result from many decisions and shocks
  - Human capital accumulation, homeownership, portfolio choices, entrepreneurship, etc.
- Wealth mobility matters:
  - Key to contextualize inequality. What makes some people rich and some poor?
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Today: Document patterns of relative wealth mobility across life cycle

Made possible by **Norwegian administrative data** on wealth+income 1993–2017

This paper

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  - Measure intra- and inter-generational mobility
  - But: as many different histories as individuals
  - Use clustering techniques to find "typical" trajectories responsible for mobility
- Study how our clusters relate to other observable characteristics
  - Life cycle choices and events (Housing, civil status, portfolio composition, etc.)
  - To which extent do individual characteristics at age 30 predict future trajectories?

Main findings

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   - Risers drive intra- and inter-generational mobility patterns (20% of cohort)
3. Individual circumstances help to predict trajectories: Human capital is key
   - Parental background: key determinant of Wealthy/Poor
   - Education: key determinant of Risers/Fallers

Contributions

1. New evidence on wealth mobility and wealth accumulation: Full life cycle trajectories
   - Add to results for the super wealthy (Ozkan, Hubmer, Salgado, Halvorsen) and the role of individual factors like inheritances (Black, Devereux, Landaud, Salvanes).
2. New facts documenting the distribution of changes in wealth ranks
   - Extensive literature on income (Guvenen, Ozkan, Karahan, Song; Guvenen, Pistaferri, Violante; Arellano, Blundell, Bonhomme; De Nardi, Fella, Paz-Pardo)
3. Inter-generational links to full life cycle wealth dynamics
   - Complements "snapshot" links in income (Solon; Aaronson, Mazumder; Chetty, Hendren, Kline, Saez, Turner; Chetty, Grusky, Hendren, Hell, Manduca, Narang) & wealth (Charles, Hurst; Boserup, Kopczuk, Kreiner; Fagereng, Guiso, Malacrino, Pistaferri; Fagereng, Mogstad, Rønning)
4. Dimension reduction methods in economics & applications to labour markets
   - K-Means (Bonhome, Lamadon, Manresa; Gregory, Menzio, Wiczer), Sequence Analysis (Humphries), Hidden Markov (Ahn, Hobijn, Şahin), Finite Mixture

Norwegian Wealth Data

Data: Norwegian Tax Registry 1993 – 2017 ▸ Context ▸ Details

- No top-coding + Limited misreporting or measurement error (third-party reporting)
  - Focus on wealth (e.g., don't include public pensions)
  - No transaction data (e.g., changing houses or selling stocks)
- We adjust the tax value to reflect market values (Fagereng, Holm, Torstensen, 2023)
- We link to administrative records (Education, Family, Civil Status, Income)
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Sample selection: Norwegian residents 1993–2017 (no immigrants after 25/2011, no emigrants)

- Focus on birth cohort born between 1960 and 1965 (first observed in early 30s)
  - 292,222 individuals in this sample (279,002 after balancing)

Ranks and Histories

- Compute within cohort ranks as

$$y_{i,t} = 100 \times F_w \left(w_{i,t} | t, i \in BC(i) \right)$$

  - Computed separately for each year and each cohort

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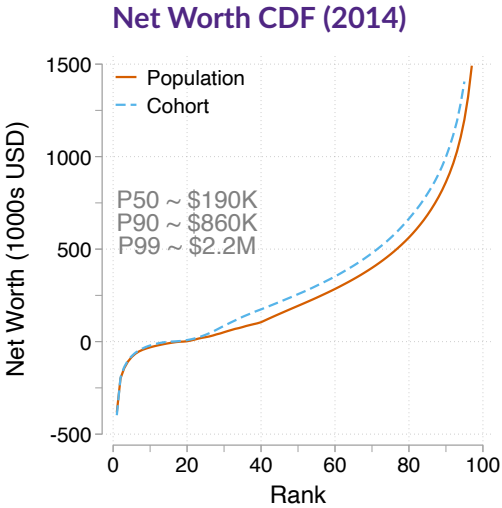
- Trajectories: Histories of ranks

$$\mathbf{Y}_i = (y_{i,1993}, y_{i,1994}, \ldots, y_{i,2016}, y_{i,2017}) \in [0, 100]^{25}$$

We are interested in the distribution of the trajectories $\mathbf{Y}_i$

Ranks vs Wealth Levels



- Substantial wealth inequality in Norway
- Meaningful differences in wealth levels across ranks
- e.g. at the median, 10 ranks ≈ 60k USD

▸ BC vs Pop Ranks

- US: p90≈$620K, p99≈$3.5M (SZZ, 2022)

Intra- and Inter-Generational Wealth Mobility

Linear rank-rank persistence:

Shorrocks

$$y^k_{i,t} = \alpha_t + \rho_t y^j_{i,0} + u_{i,t} \qquad \text{where} \qquad j \in \{\text{k,p}\}$$

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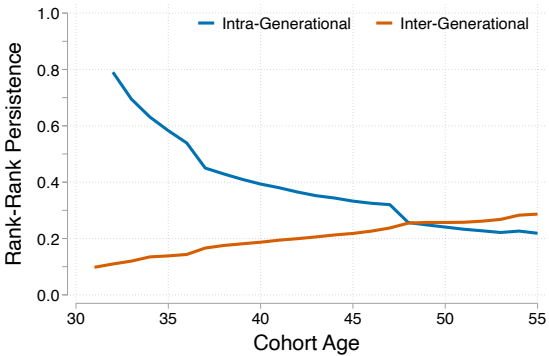

- Declining intra-generational persistence $\longrightarrow$ Increased mobility
- Increasing inter-generational persistence $\longrightarrow$ Decreased mobility

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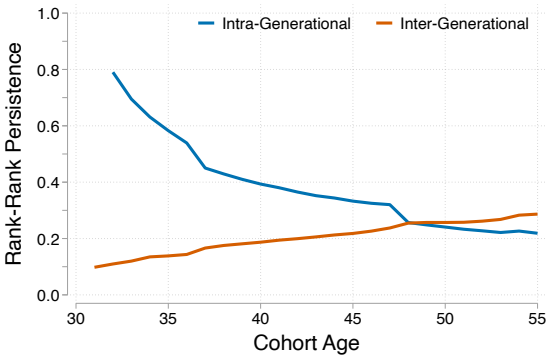

- Declining intra-generational persistence $\longrightarrow$ Increased mobility
- Increasing inter-generational persistence $\longrightarrow$ Decreased mobility
- How broad-based is mobility? What (who) drives patterns?
- Persistence collapses heterogeneous trajectories

Clustering Wealth Histories

Grouping Individuals Into Typical Histories

Goal: Identify patterns in (ex-post) life cycle paths without restricting to a single statistic

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Method: Agglomerative Hierarchical Clustering to group rank histories

- Start with $G = N$ groups (one for each individual)
- Recursively merge groups by selecting *similar* pairs: $\underset{g,g' \in G,\, g \neq g'}{\operatorname{argmin}} \; d(g, g')$.

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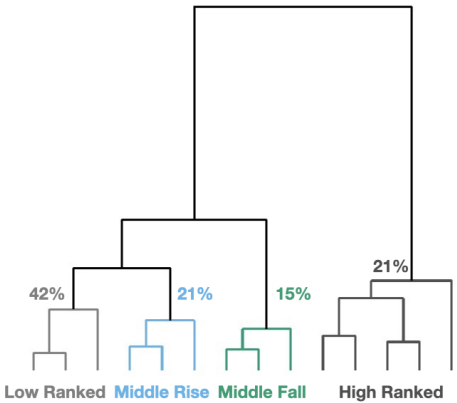
Result: Hierarchy of partitions ranging from $G = N$ to $G = 1$.

- Global result with nested clusters
- Similar results for alternative clustering (HH ranks, log-assets, "Lorenz" position, K means)

Two Levels of Clustering

Clustering Tree



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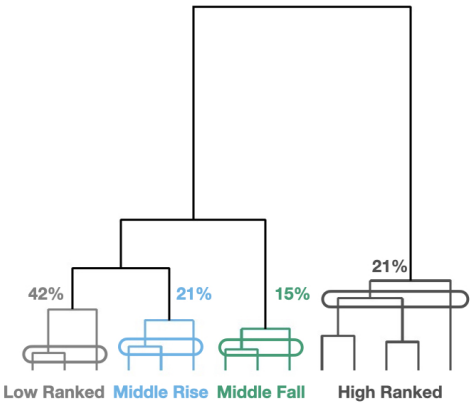
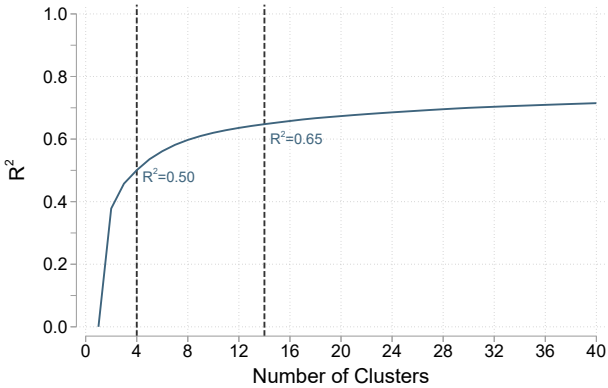
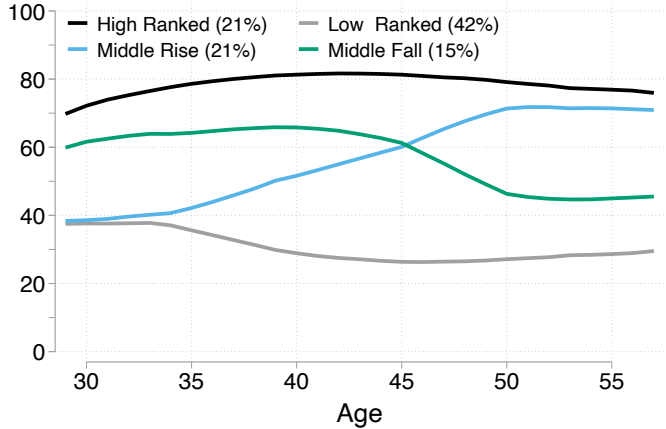


Variation Explained



Typical Rank Histories

Cohort Ranks



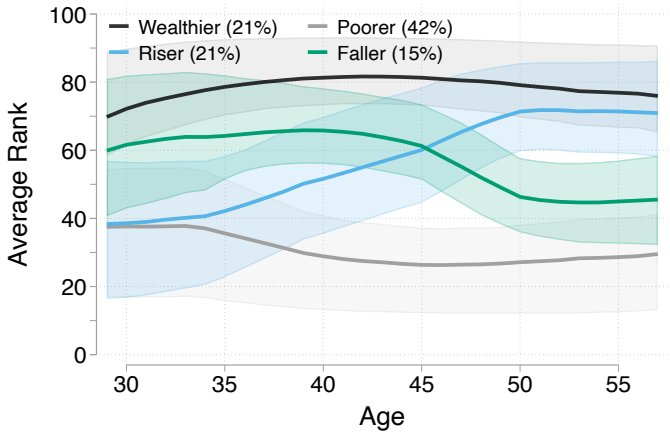
▸ Alt. Clustering ▸ Rnd Clustering

Four largest groups

- Wealthy/High Ranked: always at top of the distribution
- Poor/Low Ranked: always at the bottom of the distribution
- Middle class: one group of Risers and one group of Fallers

Typical Rank Histories

Cohort Ranks, interquartile range

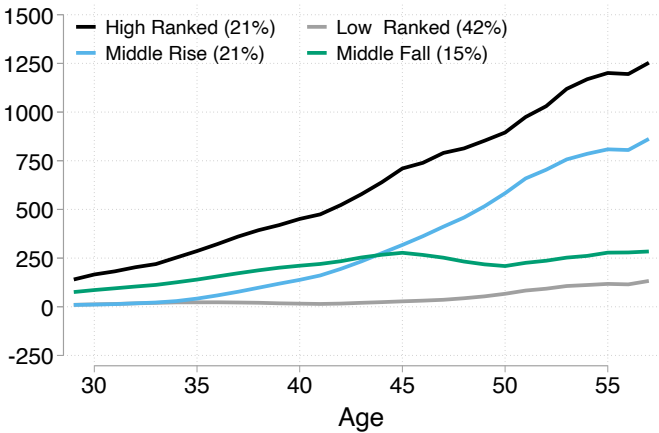


Segmented mobility

- Individuals move within segments of the distribution
- The mean trajectory of a group hides rank swaps within
  - Subclusters reveal patterns
- Segments overlap:
  Middle 60% Top & Bottom 40%

Wealth Histories Across Segments of the Distribution

Net Worth ($1000s)

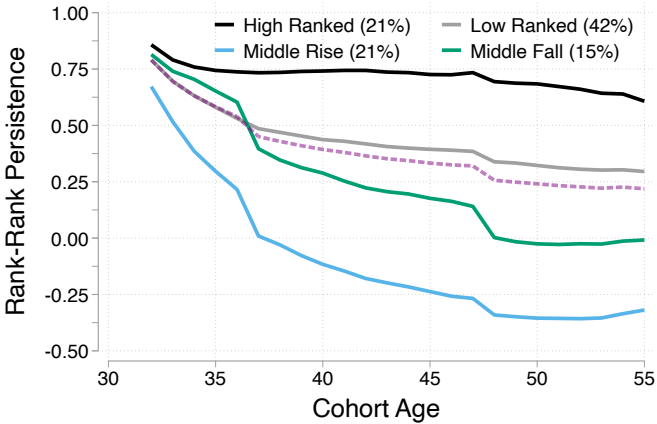


Significant diff. in wealth profiles

- Top: Maintaining rank means level growth (8-10%)
- Bottom: Stay very low
- Risers: Grow on avg. 18%/y
- Fallers: ahead in 30s + low growth (5%) + Great Recession

Intra-Generational Mobility

$$y_{i,t}^{k} = \alpha_t + \rho_t^{g(i)} y_{i,0}^{k} + u_{i,t}$$



- Top: Immobile over 25y
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- Risers: Reversal of fortune within 1 decade
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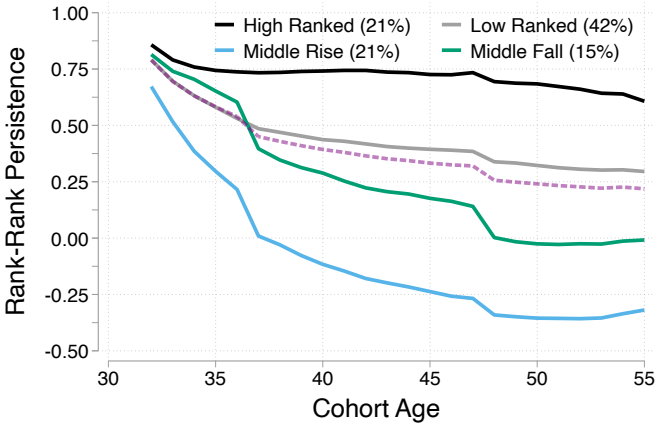

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- Mobility in the middle drives population mobility patterns. Risers are key.

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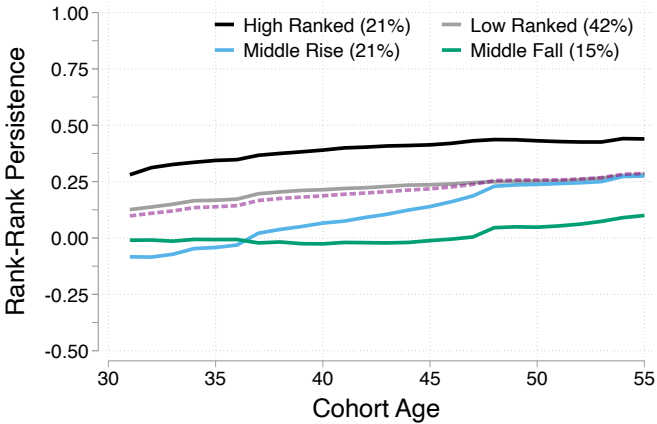

- Persistence rises for all groups
- Level differences are parallel

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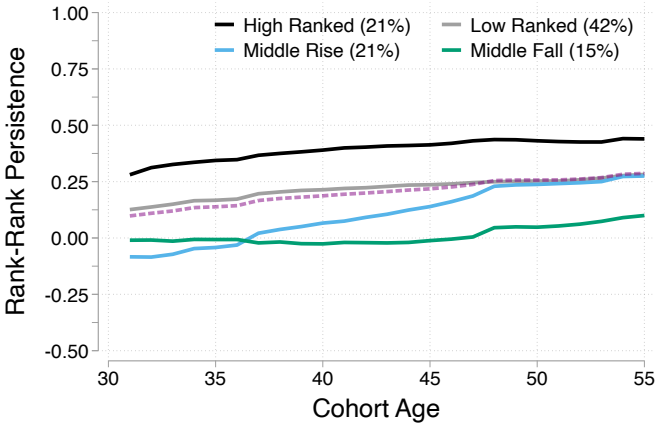

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  Except for risers!
- Risers' mobility trends from get-go
- Reversal of fortune increases inter-generational persistence

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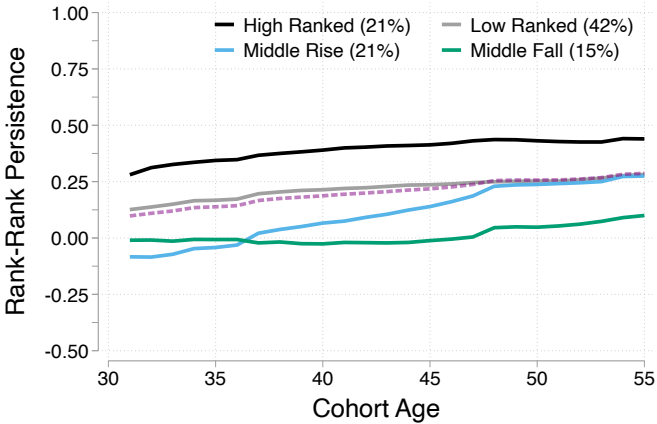

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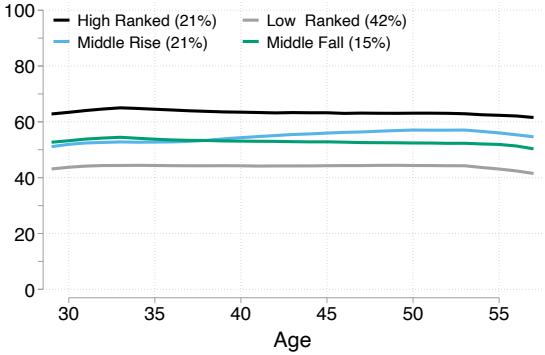
- Clustering of trajectories captures persistent differences in mobility

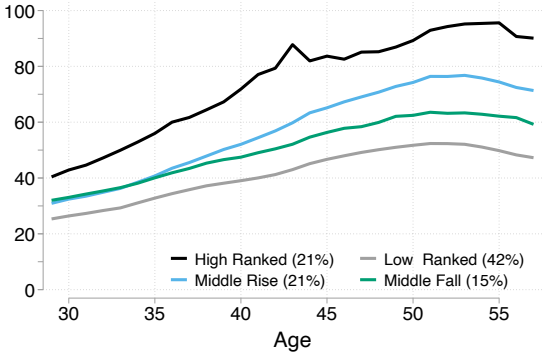
Heterogeneity Across and Within Groups

Income Histories Across Segments of the Distribution

Income Cohort Ranks

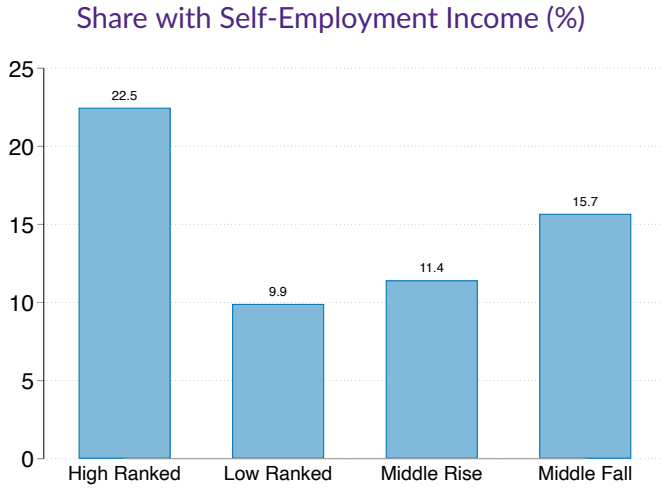


Income ($1000s)



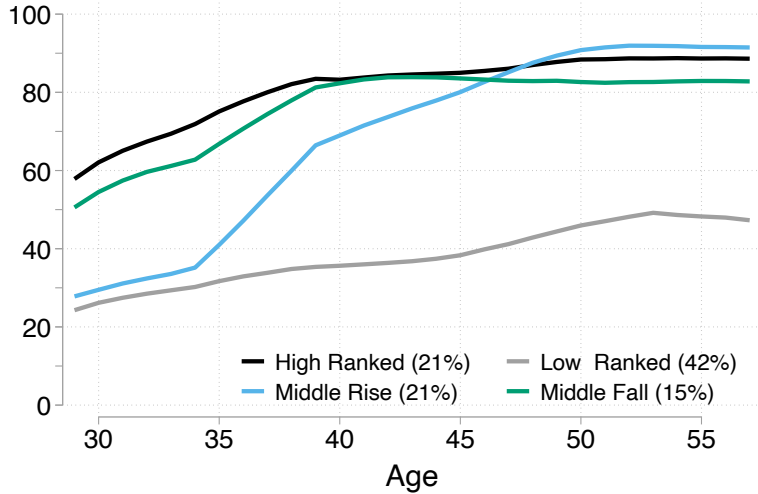
- Distribution of income across clusters compressed relative to wealth ▸ Median Income
- Similar patterns for HH income; Risers same inc. as high ranked on average ▸ HH Inc. CS

Self-Employment Rates, Age 45



▸ Income shares

Homeownership Rates by Cluster



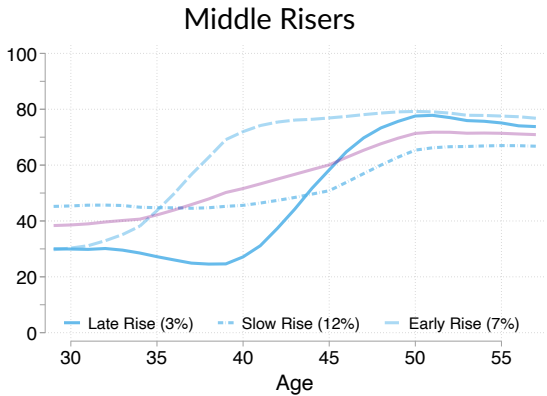
Asset Portfolios

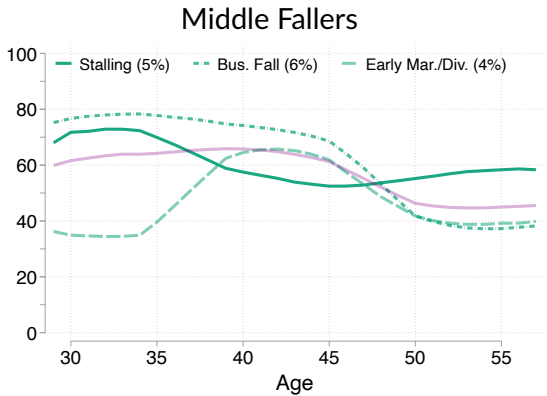
Taking stock: four largest clusters

- Wealthy - High Ranked
  - Stable at the top
  - Accumulate wealth fast
  - Homeowners, likely to own businesses
  - Largest labour market income
- Risers
  - Start out low
  - Accumulate wealth fast
  - Income similar to Wealthy
  - Become homeowners along the way
- Fallers
  - Start out relatively well off
  - Relatively lower labour market income
  - Likely to be self-employed
  - Usually own assets
- Poor - Low Ranked
  - Stuck at the bottom
  - Little rise at the end
  - Lowest incomes
  - Non-homeowners

Heterogeneity in Trajectories

Wealth | Portfolio | Homeownership | Inc. | SE | Edu.





- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)

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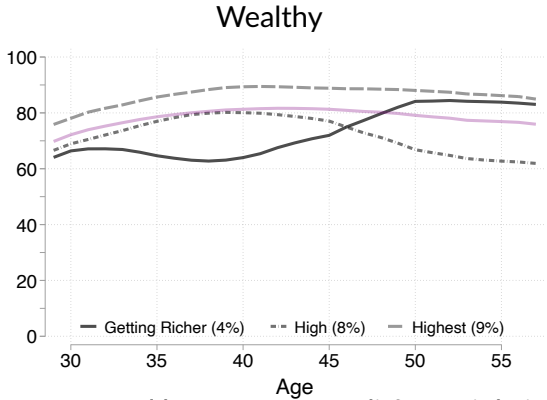

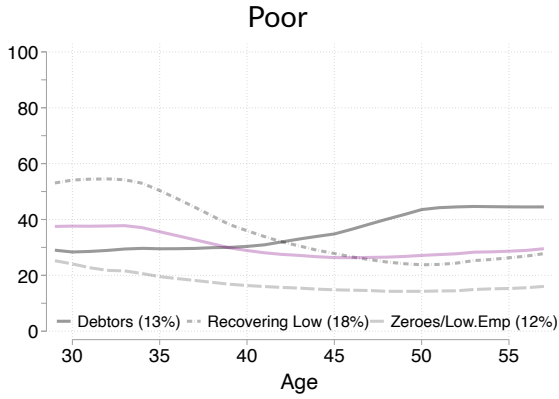

- Top and bottom groups differ mainly in avg. levels
- Zeros are quite different from debtors

Next Step: Relate differences in timing/level to individual circumstances

Towards Determinants of Trajectories

Hereditary Advantage vs Human Capital

Goal: Understand role of different circumstances/characteristics in determining trajectories

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$$Pr\left(g = j\right) = F\left(\alpha_0^j + \beta_{q(i)}^j + \gamma_{educ(i)}^j + \delta_{subj(i)}^j + \lambda_{male(i)}^j + \mu_{bcounty(i)}^j\right)$$

- $\beta_{q(i)}^j$: Indicators for 1993 parental wealth (cohort rank by ventile)

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- $\lambda_{male(i)}^j$: Indicator for sex ▸ Sex APE
- $\mu_{bcounty(i)}^j$: Indicator for birth location ▸ Location APE

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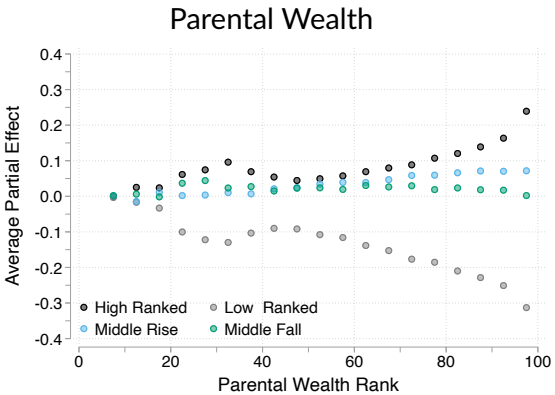
Predictors explain at most 6% of cross-group variation (same as rank-rank inter-gen reg) ▸ Results

Non-Linear Effects of Parental Wealth and Education

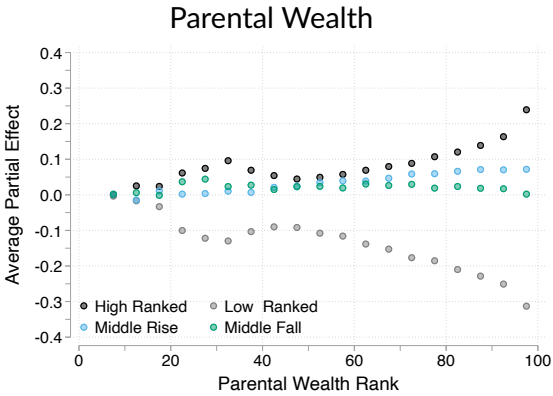
PW CIs | ED CIs | ED Field

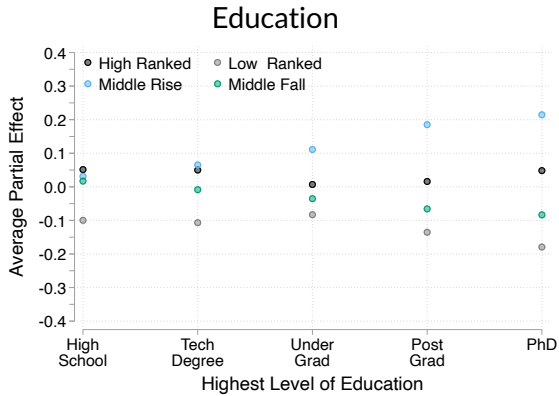


- Parental wealth's explanatory power: High for top/bottom, limited for middle groups

Non-Linear Effects of Parental Wealth and Education

PW CIs | ED CIs | ED Field





- Parental wealth's explanatory power: High for top/bottom, limited for middle groups
- Education tells risers/fallers apart: Equalizing effect but doesn't overcome initial cond.

Heterogeneity and Robustness

- Robust to controlling for individuals' initial wealth rank + parent portfolio (1993)
  - $\downarrow$ Effect sizes by 25-40% (+ explained variation)
  - $\uparrow$ Overall variation explained ($\times 4$)
  - Driven by own initial wealth $\Rightarrow$ consistent w/ segmentation!

▸ APE ▸ Shapley-Owen

Heterogeneity and Robustness

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▸ APE ▸ Shapley-Owen

- Patterns across sub-clusters:
  - Education and Parental Wealth explain risers and fallers within segments

▸ High Ranked ▸ Low Ranked ▸ Middle Rise ▸ Middle Fall

Conclusions

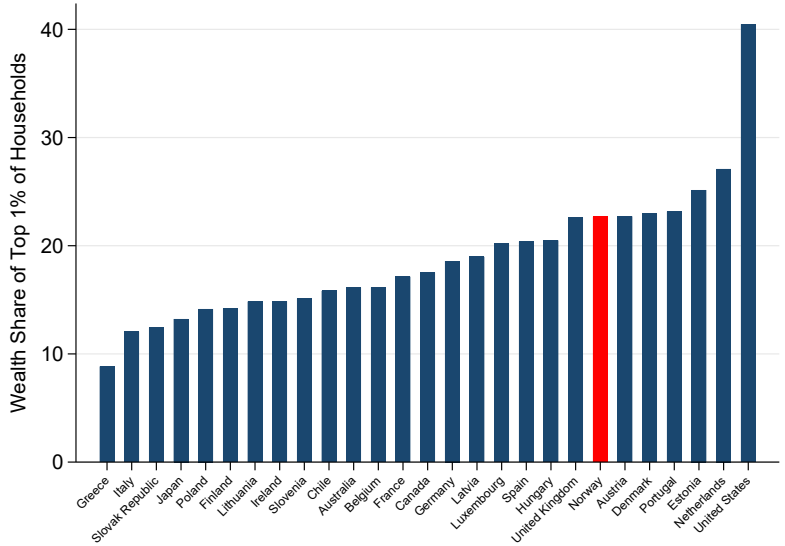
Conclusions

- Document intra- and inter-generational wealth mobility over the life cycle
- Uncover typical trajectories of individuals through the wealth distribution
  - Find important evidence of reversals in fortune over a quarter century
- Mobility driven my reversal of fortune for selected groups in the middle of the distribution
- Intergenerational background an important predictor of whole history
- Education is key for movements through the wealth distribution

Extra

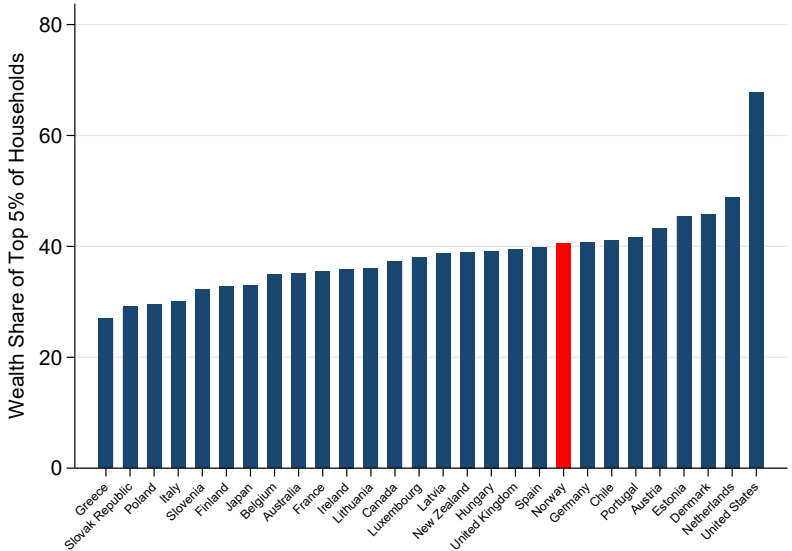
Norway in Context

Back



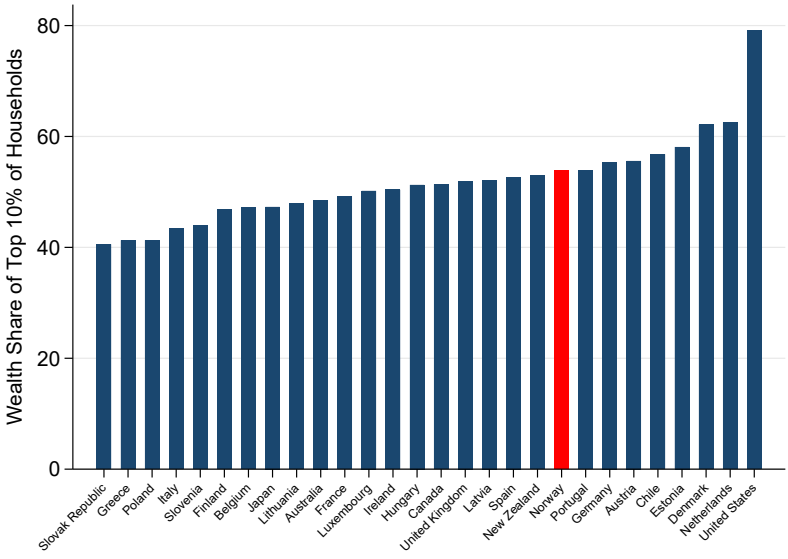
Norway in Context: Top 5% Share

Back



Norway in Context: Top 10% Share

Back

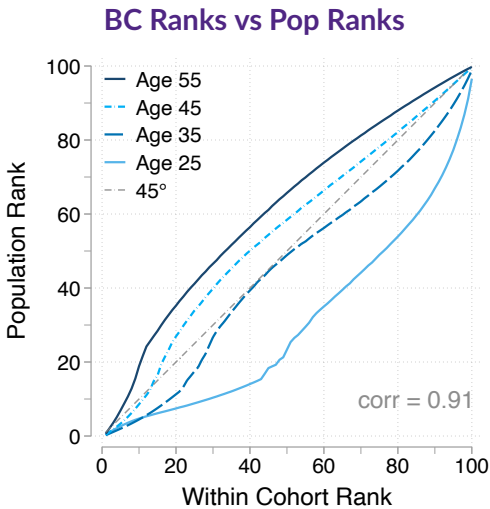


Key Variables back

- **Wealth:** Net worth = assets-debt $\longrightarrow$ **Primary Variable**
- **Assets & Debt:** Total assets and debt, and major asset categories
  - Domestic, foreign, property, vehicles, "safe," publicly and privately traded
  - Leverage, some assets are net positions
- **Income:** Including gifts/bequests, transfers, asset income, & earnings
- **Demographics:** Age, sex, education, civil status, place-of-birth
- **Lineage:** Match individuals to their parents and siblings

Birth Cohort Ranks vs Population Ranks

back



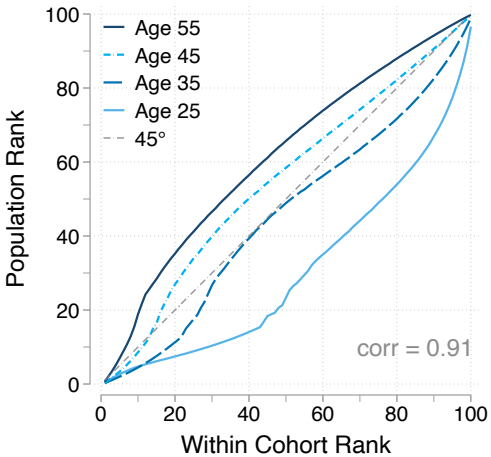
- Changes in wealth levels at each rank as the cohort ages
- 75 percent of age 25 individuals are below the median
- 35 percent of age 55 individuals are below the median

Household Ranks

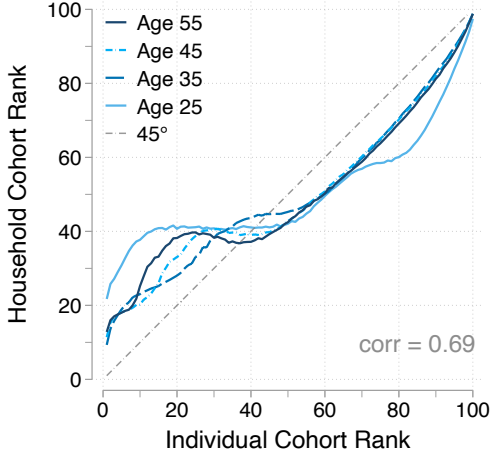
Birth Cohort Individual Ranks vs Household Ranks

back

BC Ranks vs Pop Ranks



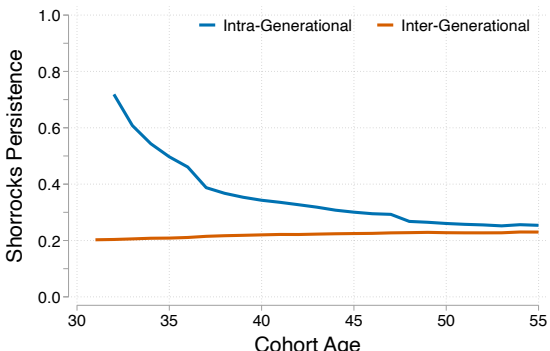
BC Individual Ranks vs Household Ranks



Shorrocks Mobility Index

back

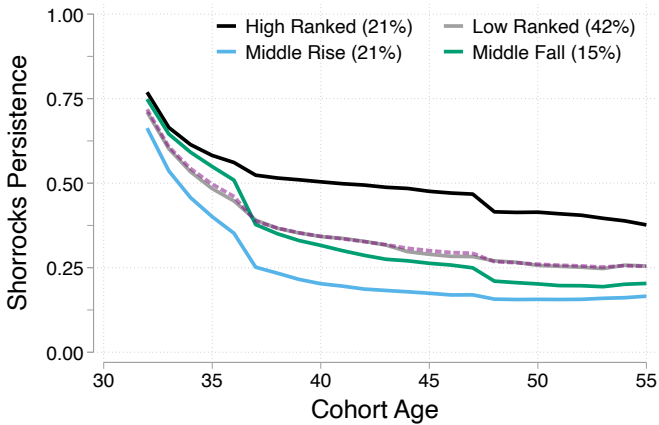
Trace of transition matrix: Divide individuals by quintiles.



- Declining intra-generational persistence $\longrightarrow$ Increased mobility
- Increasing inter-generational persistence $\longrightarrow$ Decreased mobility

Intra-Generational Shorrocks Mobility Index

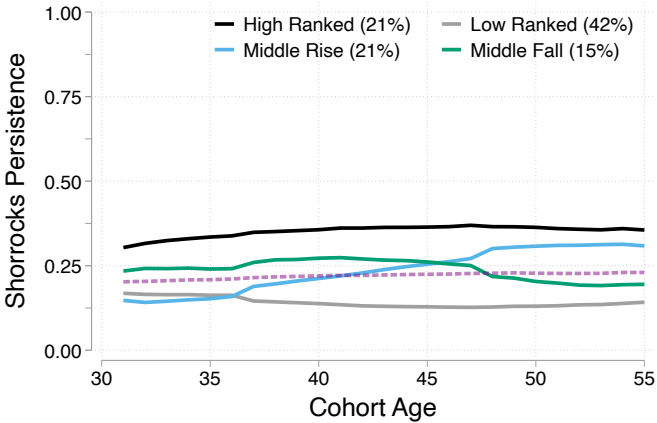
back



- Top: Higher persistence than population
- Fallers: Lower persistence than population

Inter-Generational Shorrocks Mobility Index

back



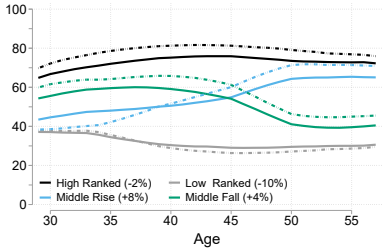
- Risers have clear upwards persistence trend
- Flat patterns for other groups

Characteristics of Main Clusters

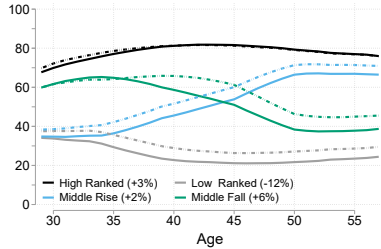
Alternative Clustering

Back

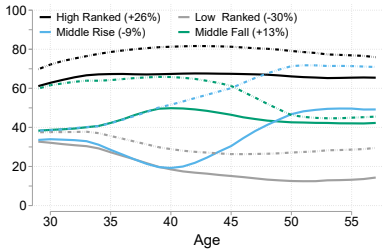
Household Cohort Ranks



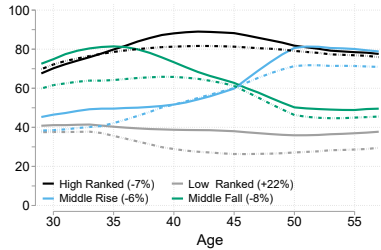
K Means on Ind. Cohort Ranks



Log Net Worth



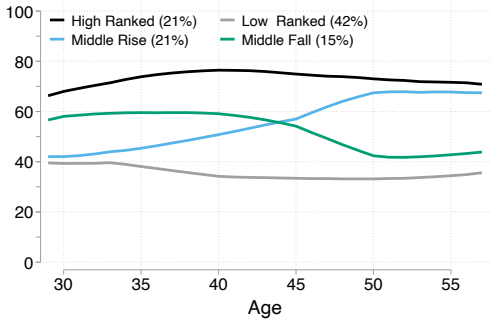
"Lorenz" Ordinates



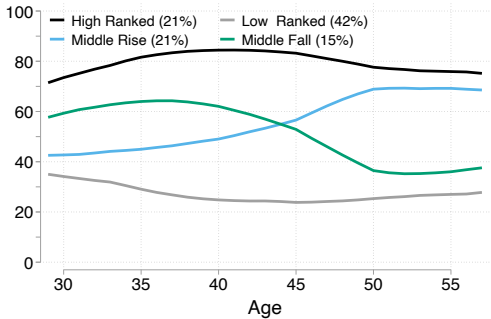
Household Wealth Ranks

Back

Household Cohort Ranks (Ind. Cl)

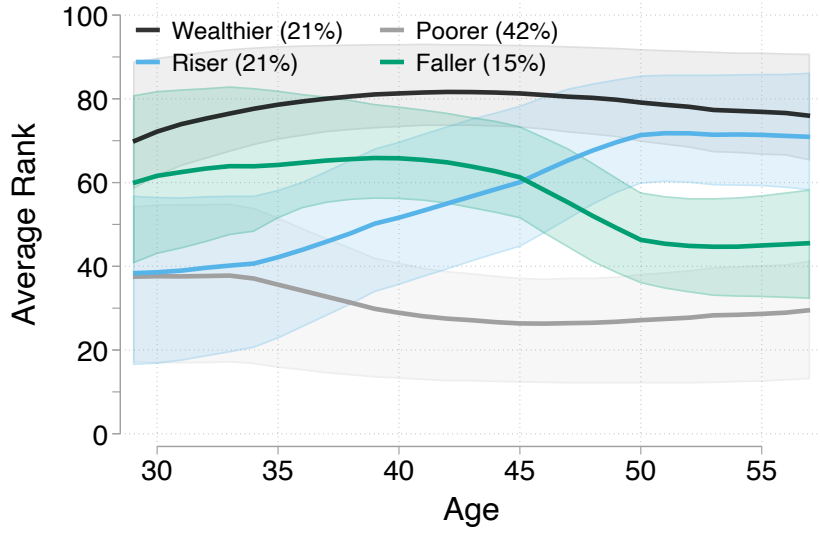


Household Cohort Ranks (HH. Cl)



Distribution of Trajectories by Cluster

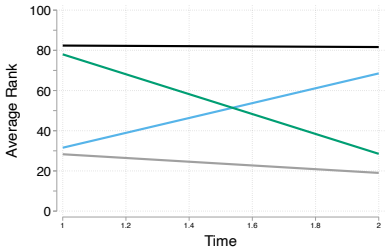
Back



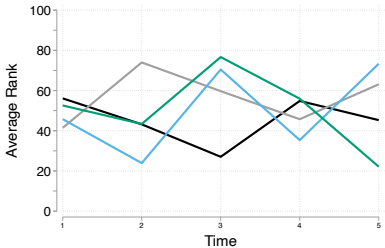
Clustering Random Ranks

Back

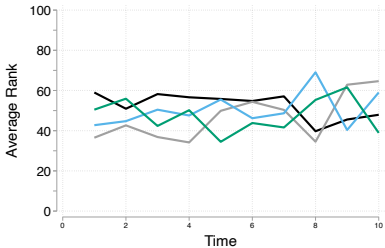
2 Periods



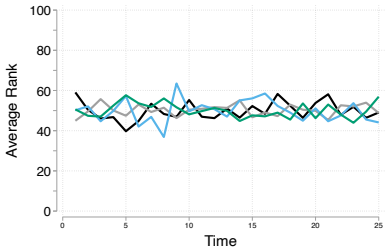
5 Periods



10 Periods



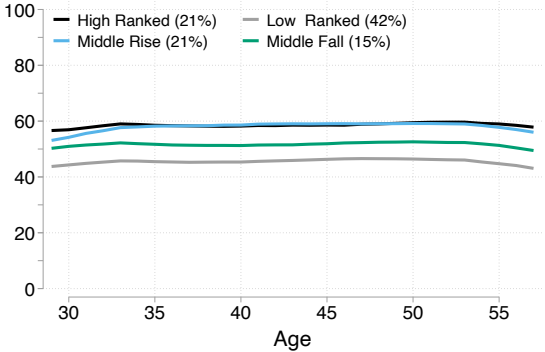
25 Periods



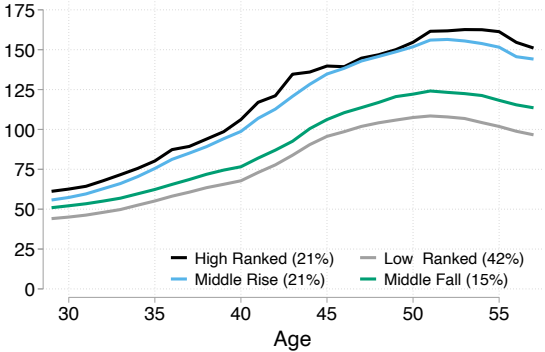
Household Income

Back

Household Income Cohort Ranks



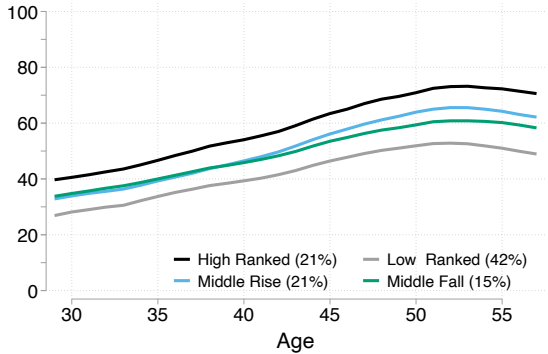
Household Income ($1000s)



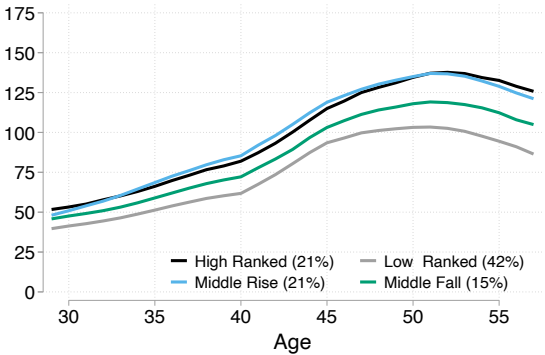
Median Income Histories

Back

Median Income

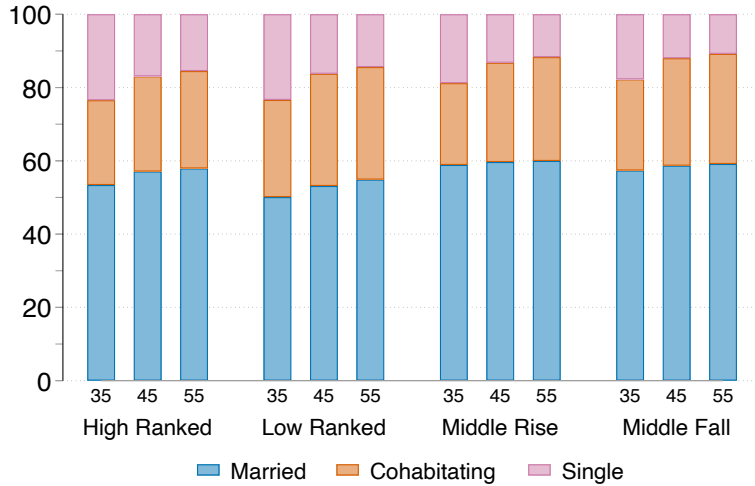


Household Median Income ($1000s)



Civil Status

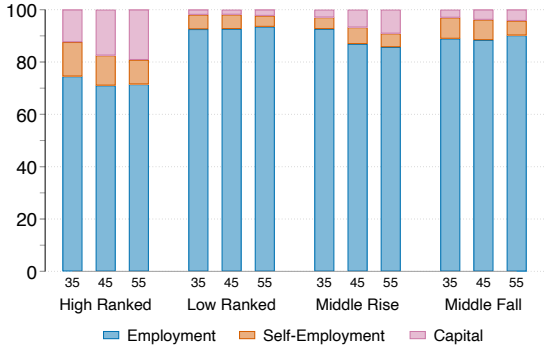
Back



Portfolio and Income Composition

Back

Income Sources



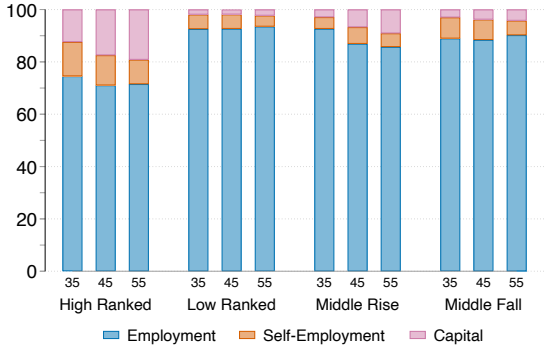
- Income differences in Self-Employment and Capital

SE Transfers Gifts

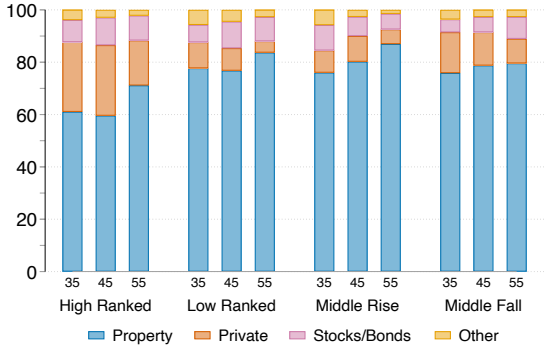
Portfolio and Income Composition

Back

Income Sources



Asset Portfolio



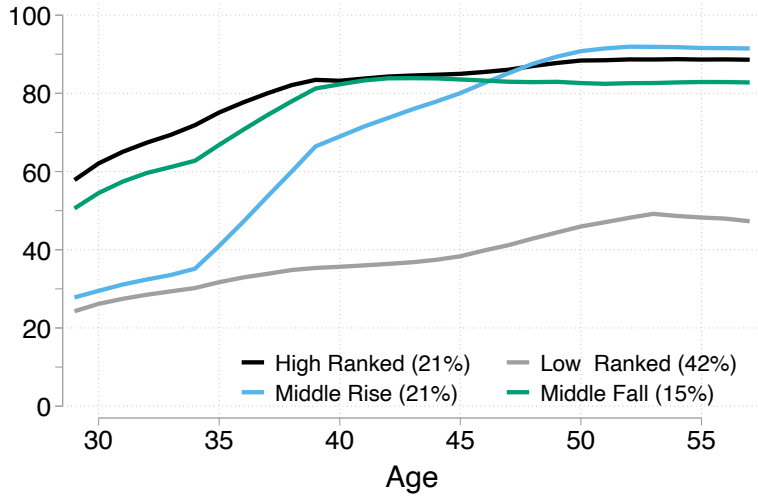
- Income differences in Self-Employment and Capital

SE Transfers Gifts

- Asset differences across clusters in Private Equity and Property

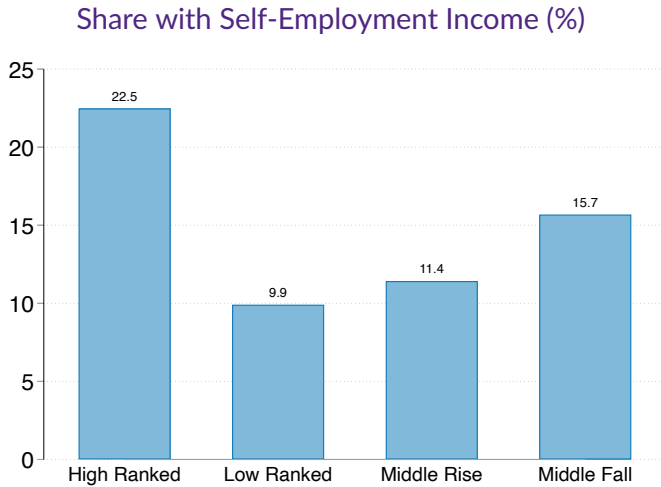
Home-ownership Rates by Cluster

Back



Self-Employment Rates, Age 45

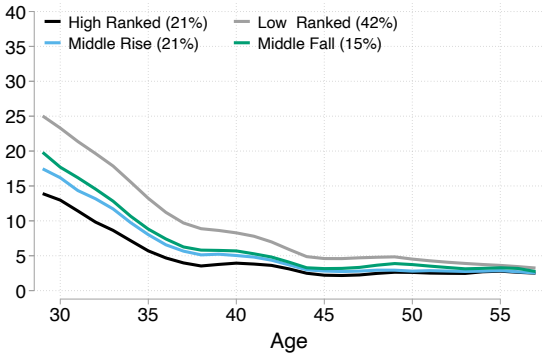
Back



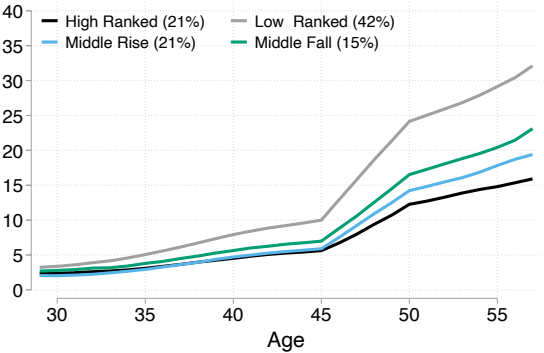
Transfers: Unemployment, Disability, Sick Leave, Nursing

Back

Share with Unemployment Benefits (%)

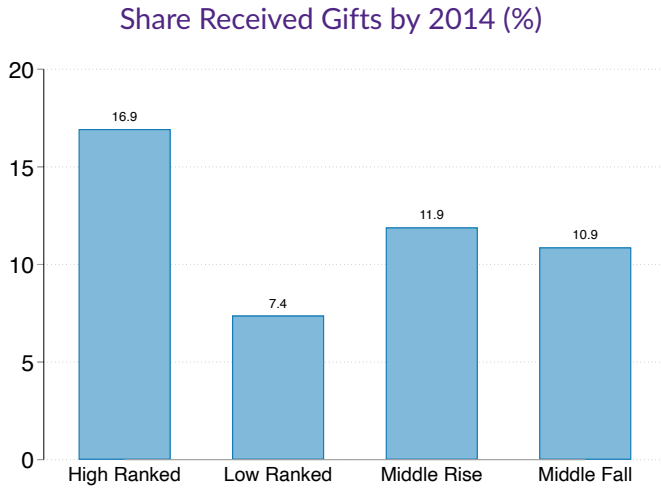


Share with Health-Related Transfers (%)



Lifetime Inheritances and Gifts

Back

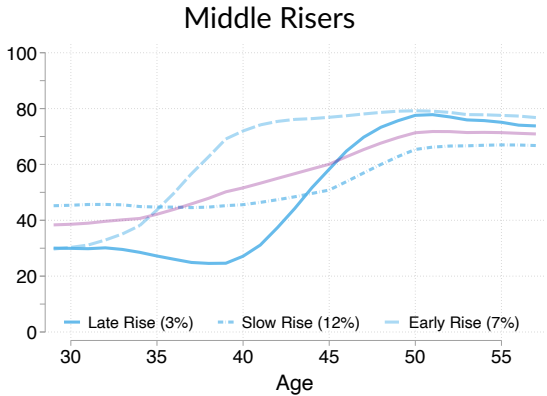


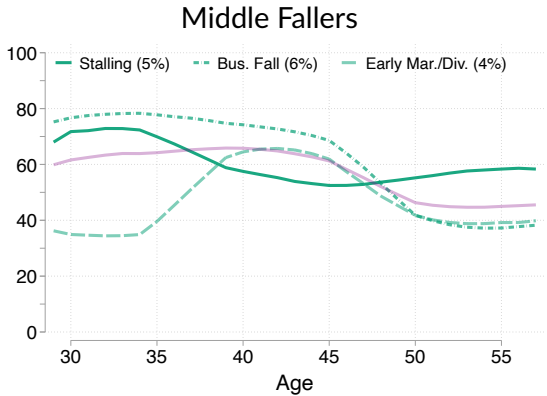
Notes: Total received $>$ NOK 470K ($\approx$ \$47K) before 2014

Characteristics of Sub-Clusters

Heterogeneity in Trajectories: Levels vs Timing

Back



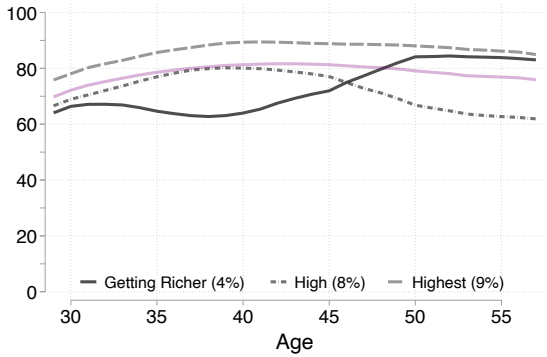


- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)

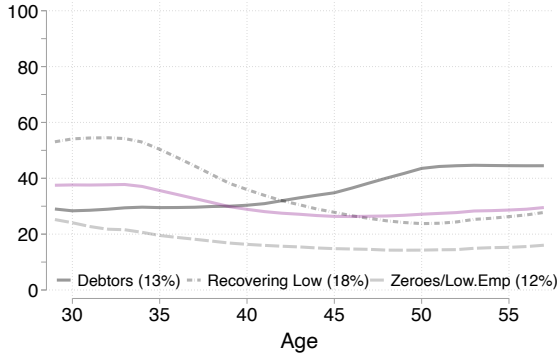
Heterogeneity in Trajectories: Levels vs Timing

Back

Top of the Distribution



Bottom of the Distribution

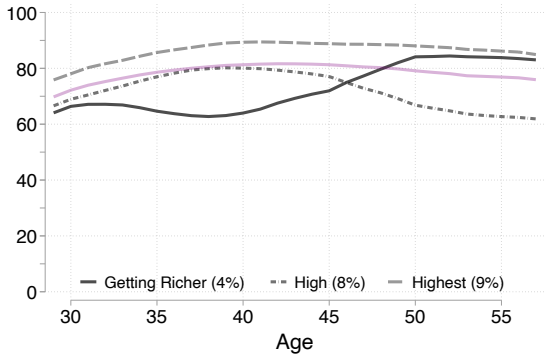


- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)
- Top and bottom groups differ mainly in avg. levels (with a rising sub-group in each)

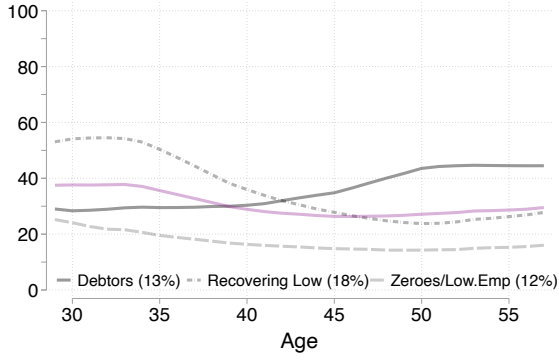
Heterogeneity in Trajectories: Levels vs Timing

Back

Top of the Distribution



Bottom of the Distribution

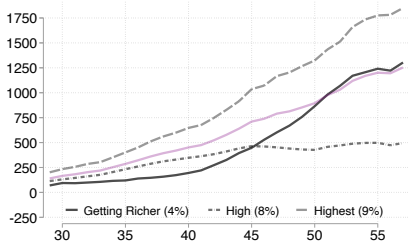


- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)
- Top and bottom groups differ mainly in avg. levels (with a rising sub-group in each)

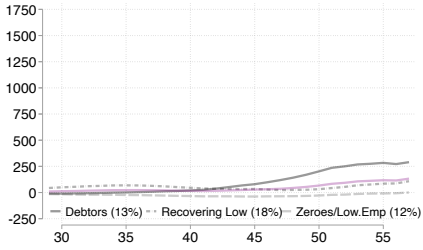
Sub-Clusters: Wealth Levels

Back

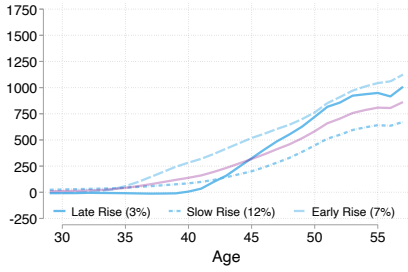
High Ranked



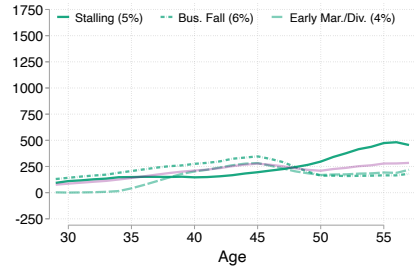
Low Ranked



Middle Risers



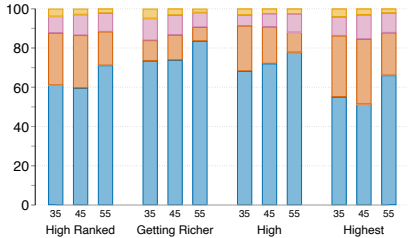
Middle Fallers



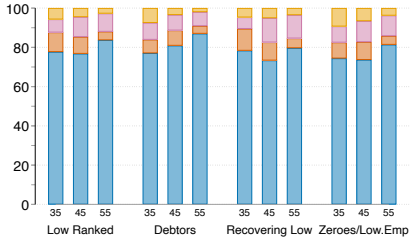
Sub-Clusters: Portfolio

Back

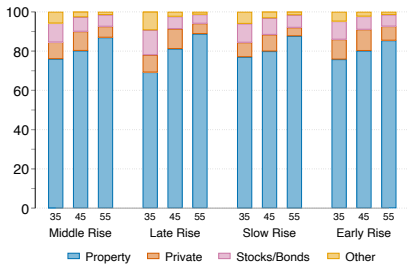
High Ranked



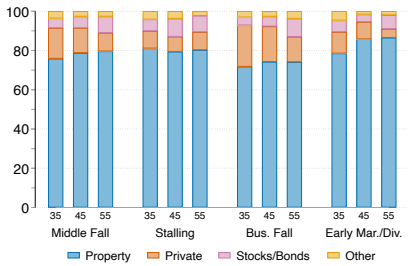
Low Ranked



Middle Risers



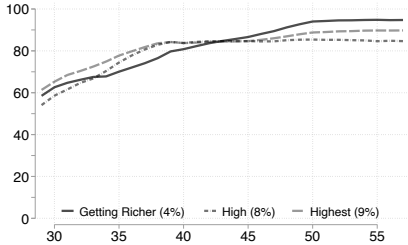
Middle Fallers



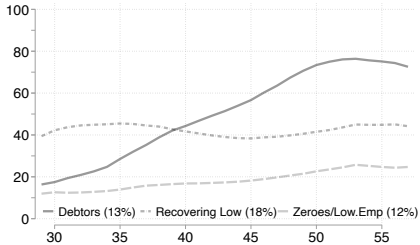
Sub-Clusters: Homeownership

Back

High Ranked



Low Ranked



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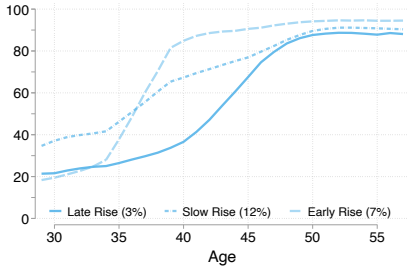
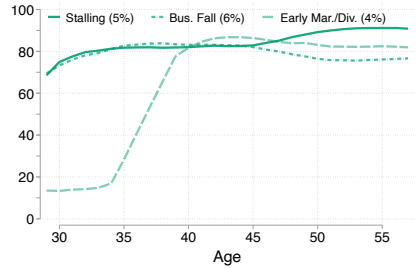


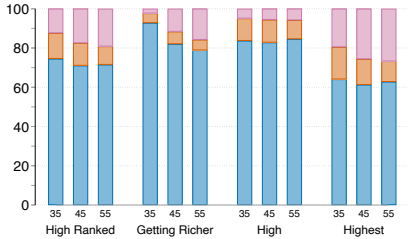
Middle Fallers



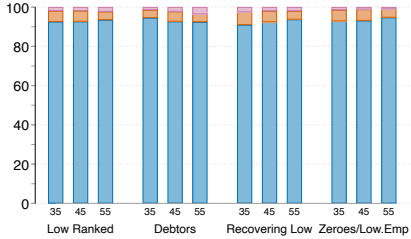
Sub-Clusters: Income Composition

Back

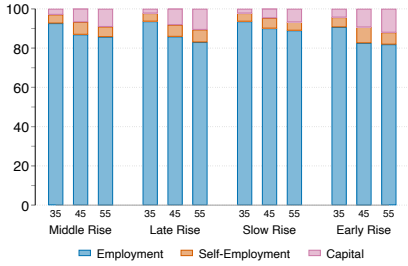
High Ranked



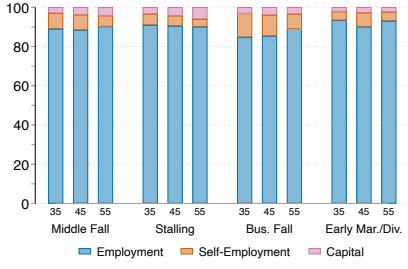
Low Ranked



Middle Risers



Middle Fallers

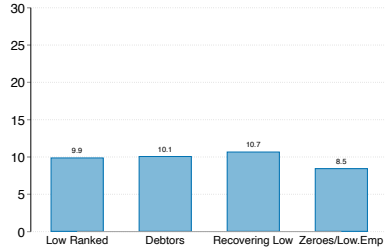


Sub-Clusters: Self-Employment

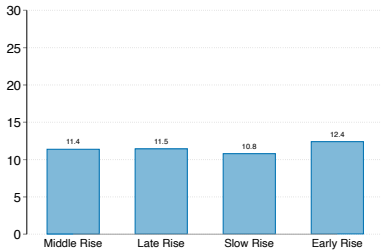
Back

High Ranked

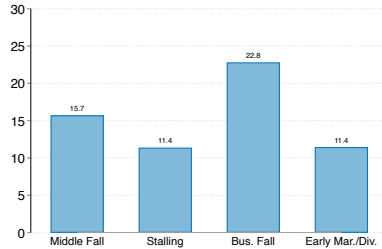
Low Ranked



Middle Risers



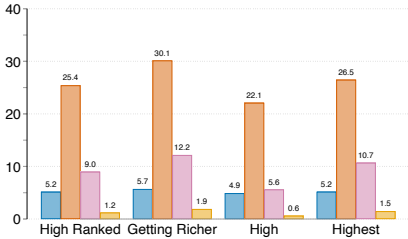
Middle Fallers



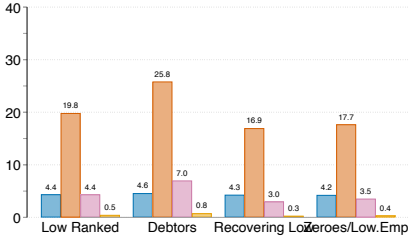
Sub-Clusters: Education

Back

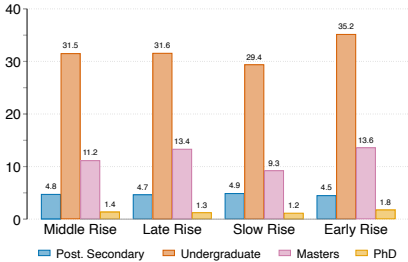
High Ranked



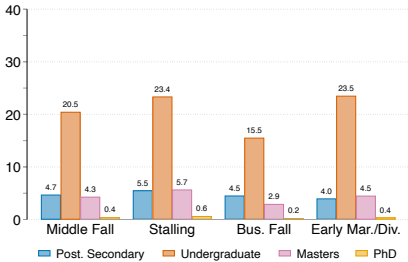
Low Ranked



Middle Risers



Middle Fallers



Shapley-Owen Decomposition

How Important Are Ex-Ante Explanations? Back

Two measures:

1. Distance Weighted Classification Rate $\in [0, 1]$

$$1 - \frac{\sum_{i=1}^{N} \sum_{k=1}^{G} \widehat{Pr}(g = k|X_i) D(g(i), k)}{\sum_{i=1}^{N} \sum_{k=1}^{G} \widehat{Pr}(g = k) D(g(i), k)} \qquad \left(\text{in spirit of } \frac{ESS}{TSS} \right)$$

How Important Are Ex-Ante Explanations? Back

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2. Correct Classification Rate $\in [0, 1]$

$$\frac{1}{N} \sum_{i=1}^{N} \sum_{k=1}^{G} \widehat{Pr}\left(g = k \mid X_i\right) \mathbb{1}[g(i) = k]$$

How Important Are Ex-Ante Explanations? Back

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- Report Shapley-Owen decomposition of covariates
  - Order invariant & sums to statistic + Single value per covariate category

How Important Are Ex-Ante Explanations? Back

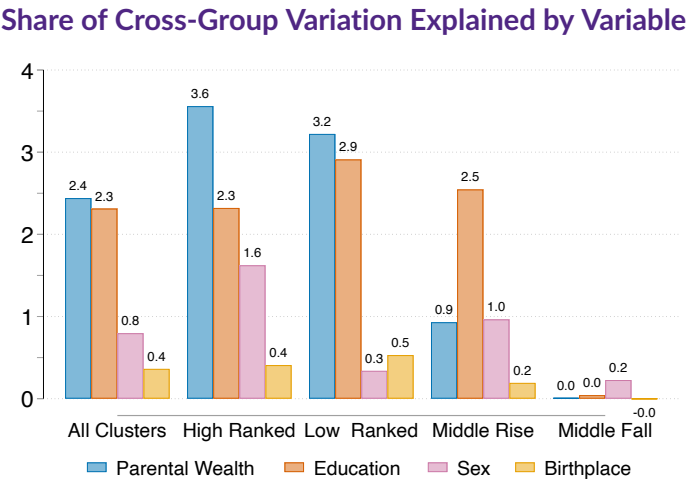
Total Contribution*	Partial Contribution			
	Parent	Education	Sex	Birth Place
Share of Distance Variation Explained by Variable (pp)				
5.9	2.4	2.3	0.8	0.4
Share of Individuals Correctly Classified (pp)				
3.1	1.1	1.3	0.6	1.2

*Contribution relative to random classification using population shares.

Share of individuals correctly classified by random classification 29.3% vs 32.5% with full model.

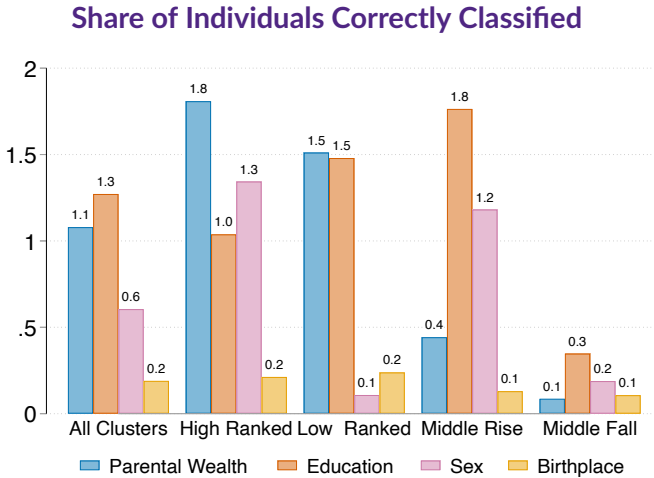
D by Cluster C by Cluster

How Important Are Ex-Ante Explanations? back



How Important Are Ex-Ante Explanations?

back



*Contribution relative to random classification using population shares.

How Important Are Ex-Ante Explanations? Extra controls

Back

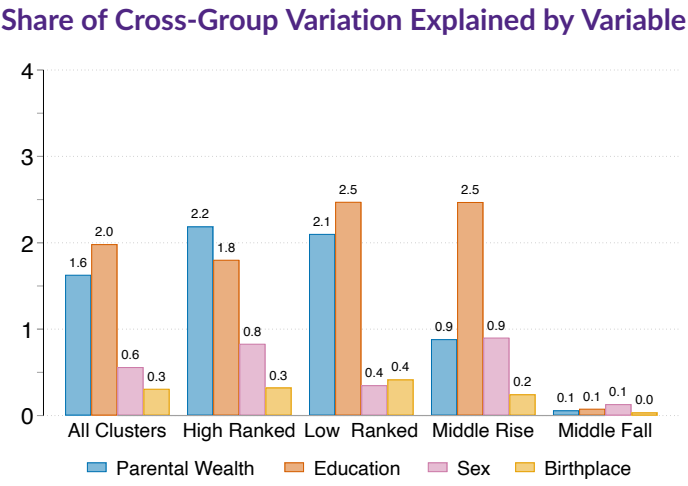
Total Contribution*	Partial Contribution					
	Parent	Education	Sex	Birth Place	Par. Bus.	Own State
Share of Distance Variation Explained by Variable (pp)						
20.0	1.6	2.0	0.6	0.3	0.6	15.0
Share of Individuals Correctly Classified (pp)						
10.6	0.8	1.1	0.4	0.2	0.3	7.9

*Contribution relative to random classification using population shares.

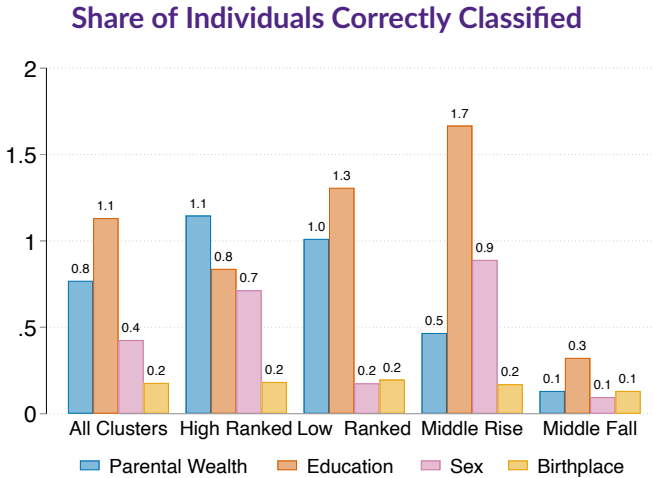
Share of individuals correctly classified by random classification 29.3% vs 40.0% with full model.

D by Cluster C by Cluster

How Important Are Ex-Ante Explanations? back



How Important Are Ex-Ante Explanations? back

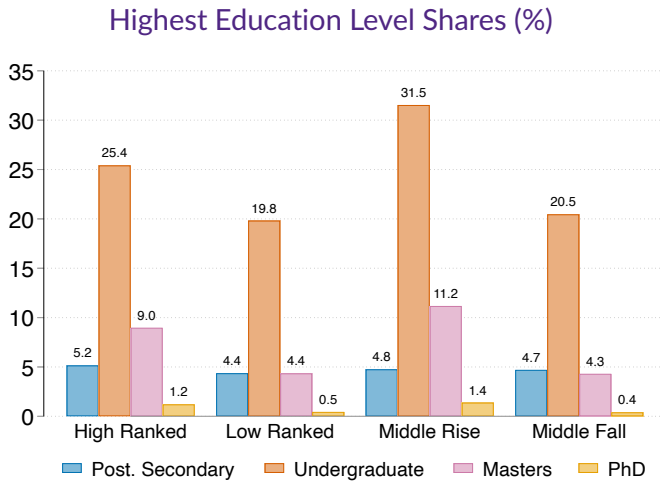


*Contribution relative to random classification using population shares.

Classification Results for Main Clusters

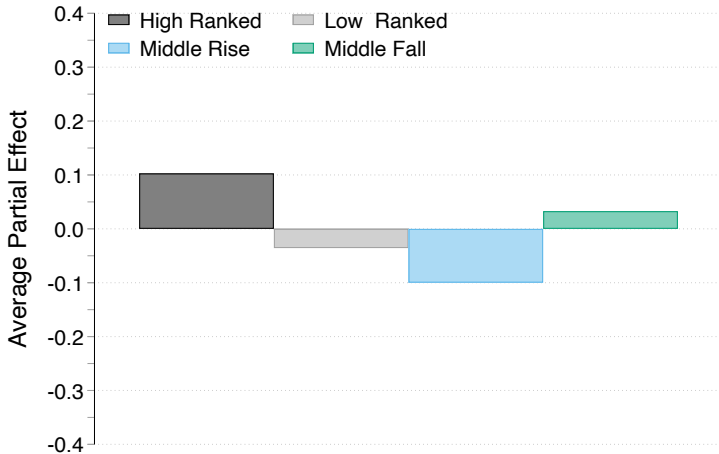
Education: Highest among risers

back



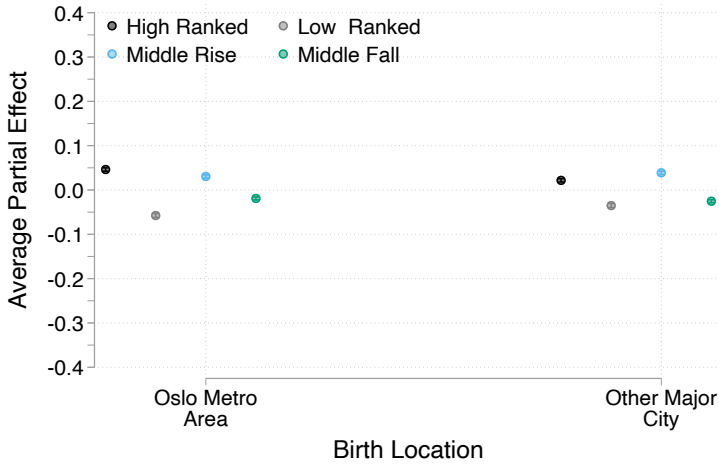
Sex Average Partial Effect

back



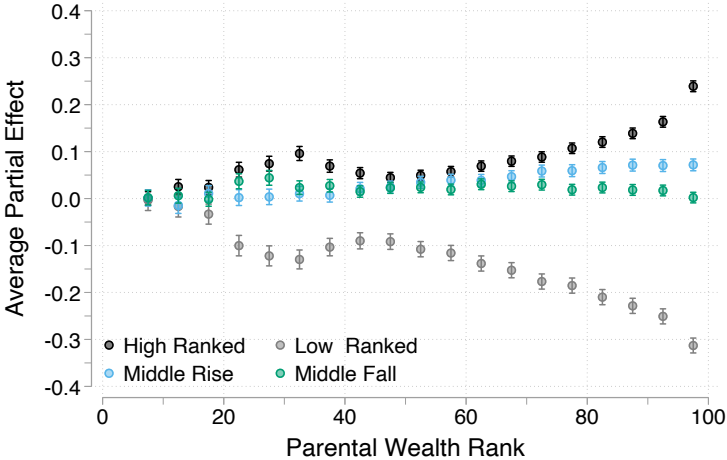
Where Is The Land of Opportunity? Norway

back



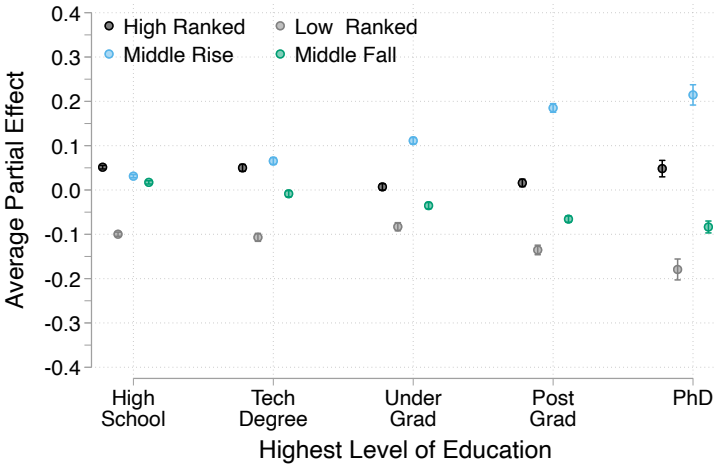
The Non-Linear Effect of Parental Wealth: CI

back



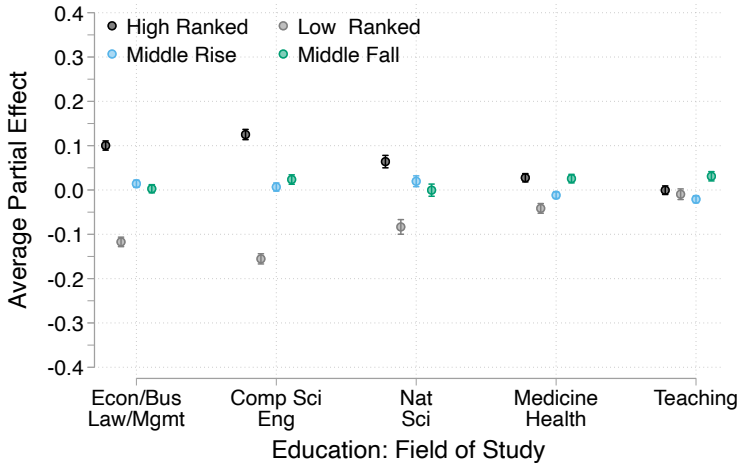
Learn & Rise?: CI

back



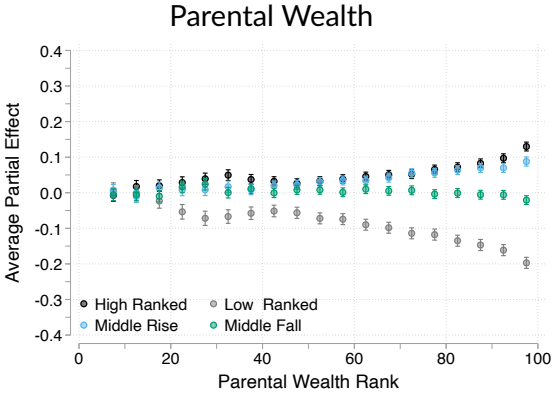
Education: Fields

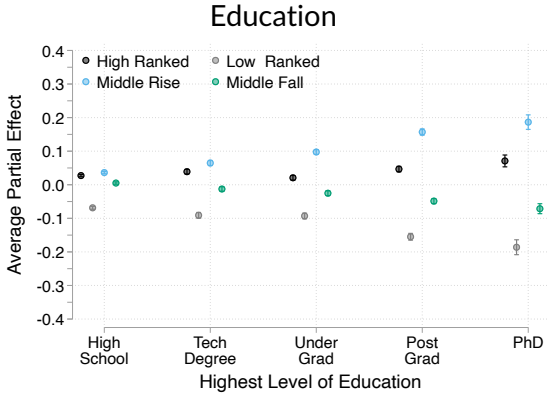
Back



Patterns still present after conditioning on own initial wealth

Back



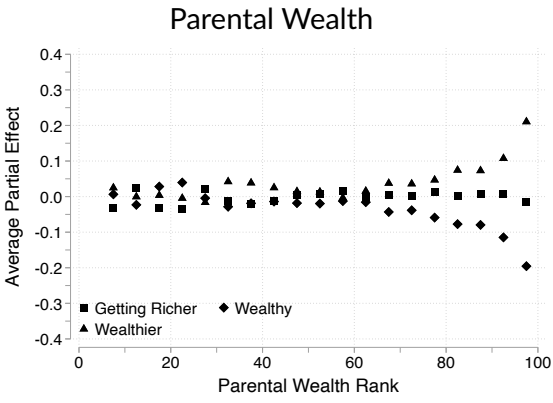


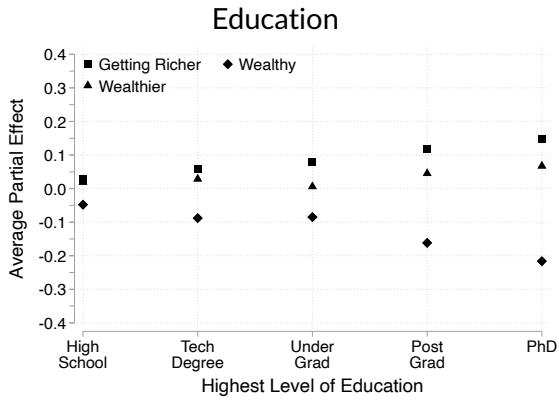
- Robust to controlling for individuals' initial wealth rank + parent portfolio (1993)
  - ↓ Effect sizes by 25-40% (+ explained variation)
  - ↑ Overall variation explained ($\times 4$)

Classification Results for Sub-Clusters

What about heterogeneity within clusters? Top Group

Back

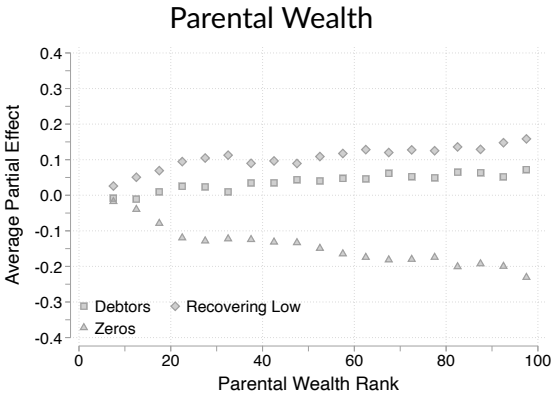


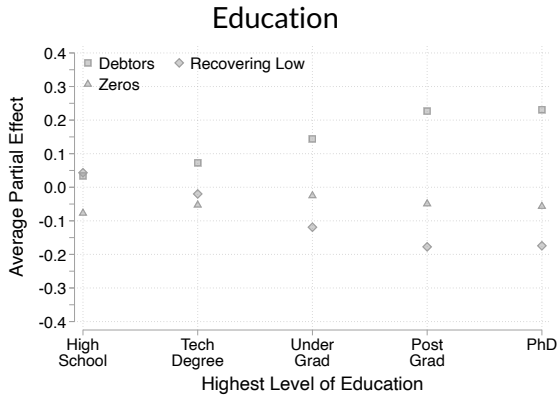


- Even within the groups, movers are hard to predict with parental wealth PW CI
- Education predicts dynamics within groups (e.g., getting richer vs already wealthy) ED CI

What about heterogeneity within clusters? Bottom Group

Back



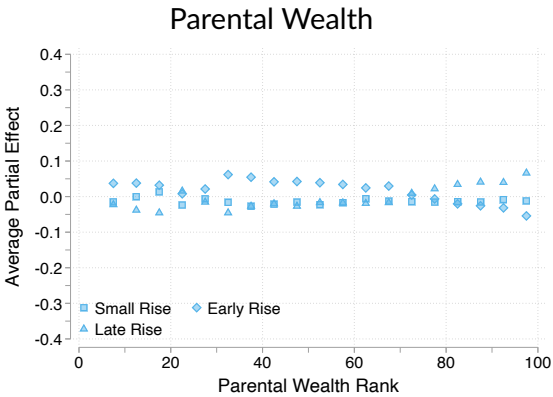


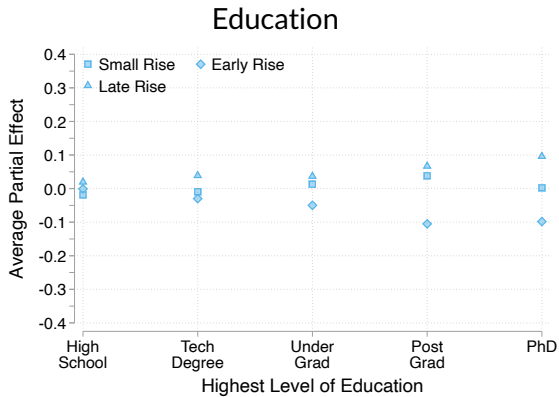
- Among poor, parental wealth does not predict movements
- Education predicts recovery

Middle Rise Middle Fall

What about heterogeneity within clusters? Middle Risers

Back

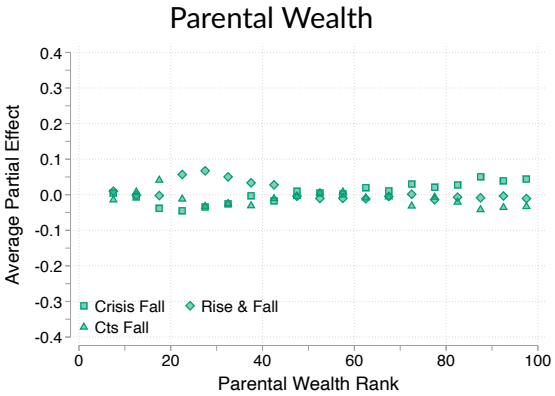


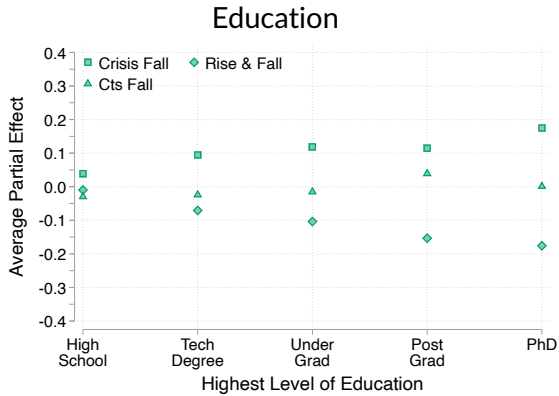


- Within Risers, movers not predicted by parental wealth
- Education predicts timing

What about heterogeneity within clusters? Middle Fallers

Back





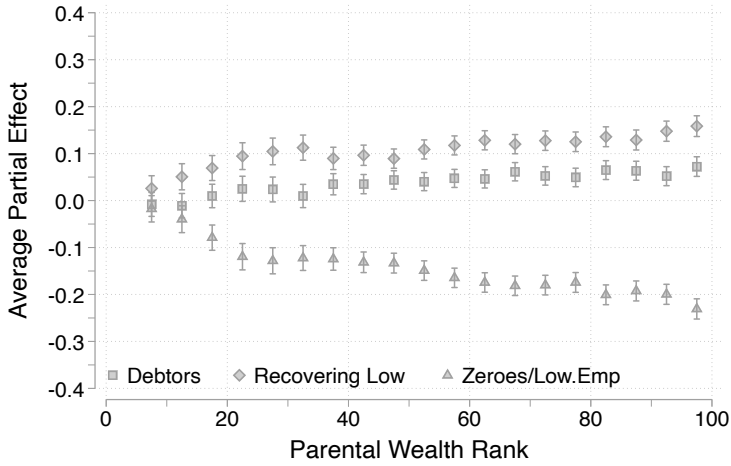
- Similar to Risers, little role for parental wealth
- But Education predicts dynamics

The Non-Linear Effect of Parental Wealth: CI

back

The Non-Linear Effect of Parental Wealth: CI

back



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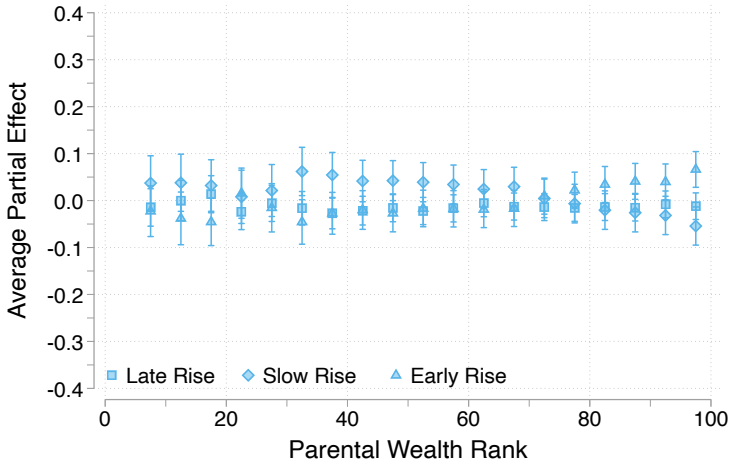

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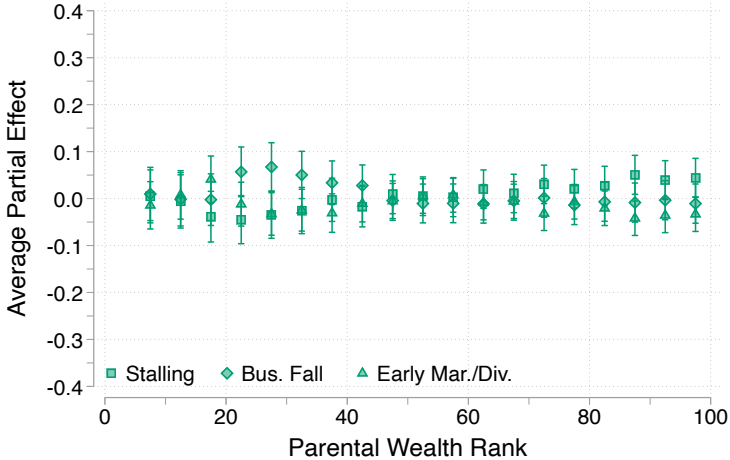

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