

# The Life-Cycle Dynamics of Wealth Mobility

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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

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  - But: as many wealth 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?



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- Mobility driven by two groups experiencing a *reversal of fortune* in middle of distribution
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## 3. Individual circumstances help to predict trajectories:

Parental Background → Wealthy/Poor    &    Education → Risers/Fallers

# 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., no public pensions)
  - No transaction data (e.g., changing houses or selling stocks)
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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

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

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- Computed separately for each year and each cohort
- Trajectories: Histories of ranks

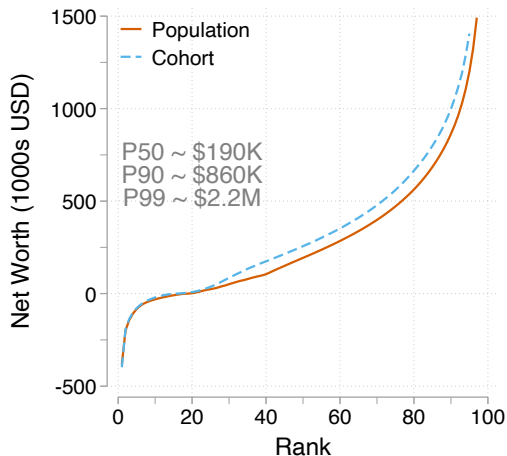
$$\mathbf{Y}_i = (y_{i,1993}, y_{i,1994}, \dots, y_{i,2016}, y_{i,2017}) \in [0, 100]^{25}$$

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



# Ranks vs Wealth Levels

## Net Worth CDF (2014)



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

► BC vs Pop Ranks

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

# Intra-Generational Wealth Mobility

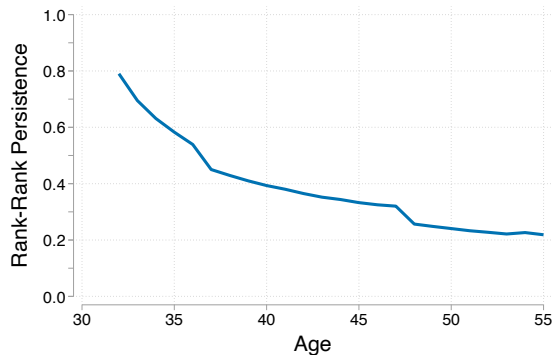
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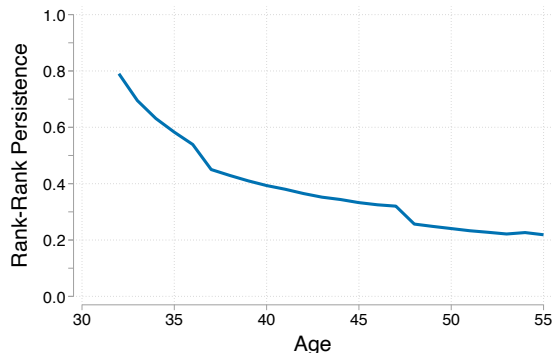


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→ Increased (cumulative) mobility
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- By age 55 only 25% of individuals remain in age 30 quintile (13% in decile)
- How broad-based is mobility?  
What (who) drives patterns?
- Persistence collapses heterogeneous trajectories

# Clustering Wealth Histories

# Grouping Individuals Into Typical Histories

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- Start with  $G = N$  groups (one for each individual)
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**Result:** Hierarchy of (nested) partitions ranging from  $G = N$  to  $G = 1$ .

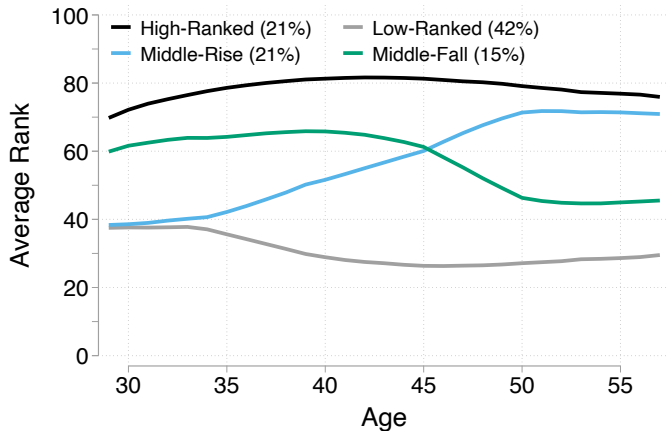
- Choose  $G^*$  explaining over 50% variation in histories
- Asymptotically consistent as we observe longer trajectories, even for fixed  $N$   
(Borysov, Hannig, Marron, 2014; Egashira, Yata, Aoshima, 2024)

► Dendrogram



# Typical Rank Histories

## Cohort Ranks

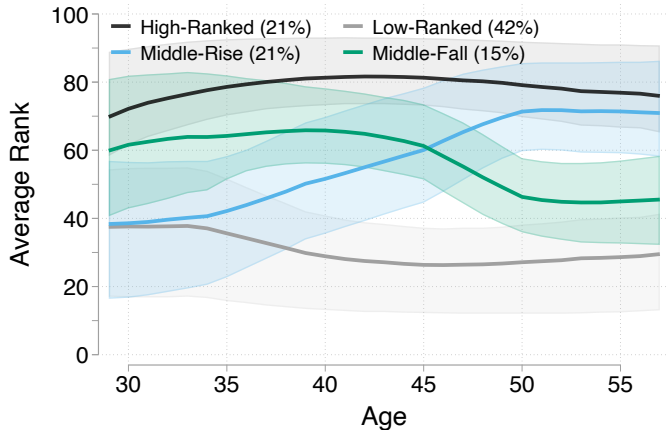


## Four largest groups

- 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

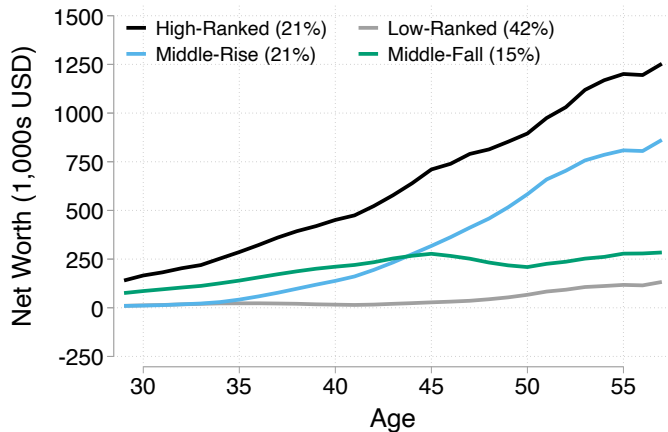


## Segmented mobility

- 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)

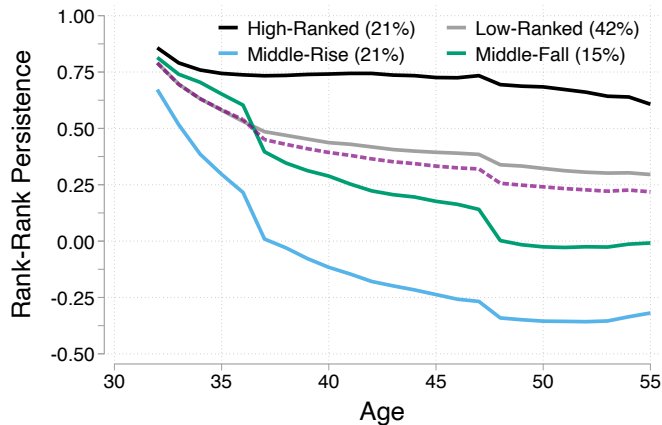


Significant diff. in wealth profiles

- **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

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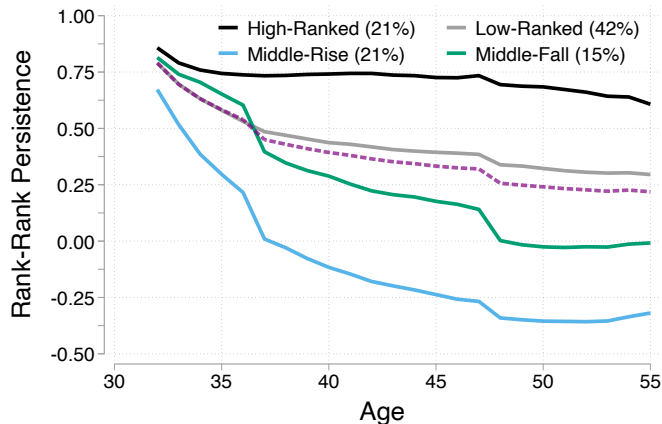


- **Top:** Immobile over 25y
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- Mobility in the middle drives population mobility patterns. Risers are key.

# Heterogeneity Across and Within Groups

## Link Tax Registry to Income and Demographic Data

► Group Characteristics

- Both income levels and composition of portfolio play a role.
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## Use Hierarchy of Clusters for Subgroups

► Subgroup Trajectories

- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)
- High- and Low-Ranked differ in levels within segments

# Towards Determinants of Trajectories



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► Levels

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

► Results

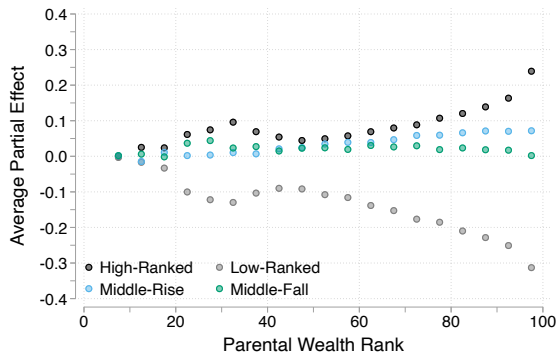
# Non-Linear Effects of Parental Wealth and Education

PW CIs

ED CIs

ED Field

## Parental Wealth



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

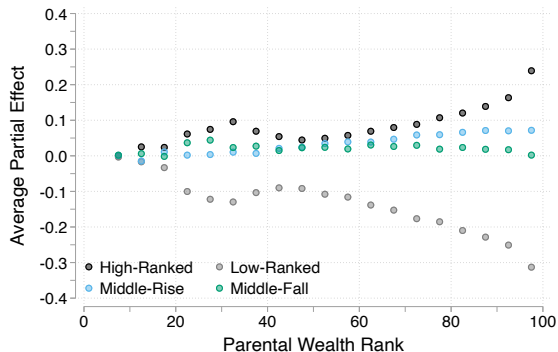
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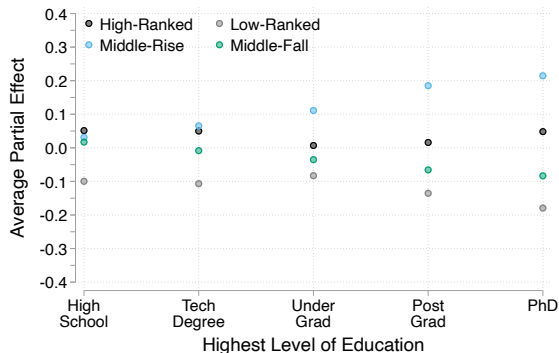
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- Parental wealth's explanatory power: High for top/bottom, limited for middle groups
- Education tells risers/fallers apart: Equalizing effect but doesn't overcome initial cond.

# Heterogeneity + Robustness + Intergenerational Mobility

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

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[▶ High Ranked](#) [▶ Low Ranked](#) [▶ Middle Rise](#) [▶ Middle Fall](#)
- Decreasing intergenerational mobility:
  - Correlation between parents' and own wealth ranks increases over age
  - Reversal of fortune increases inter-generational persistence [▶ details](#)

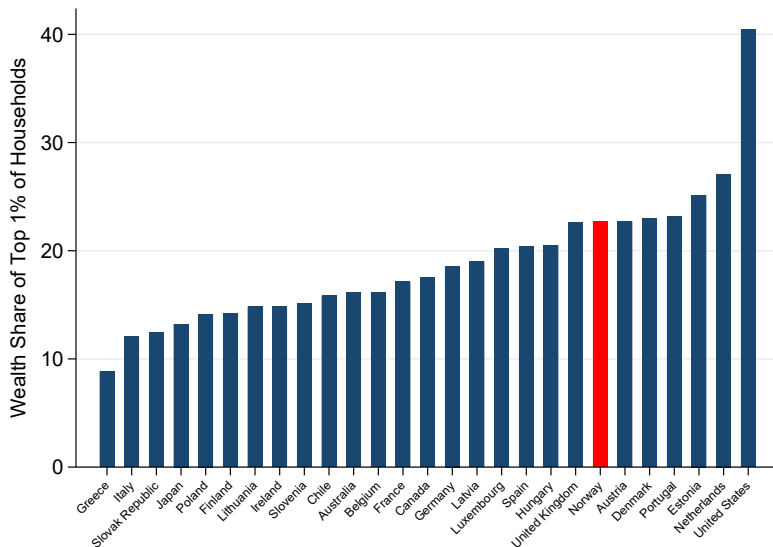
# Conclusions

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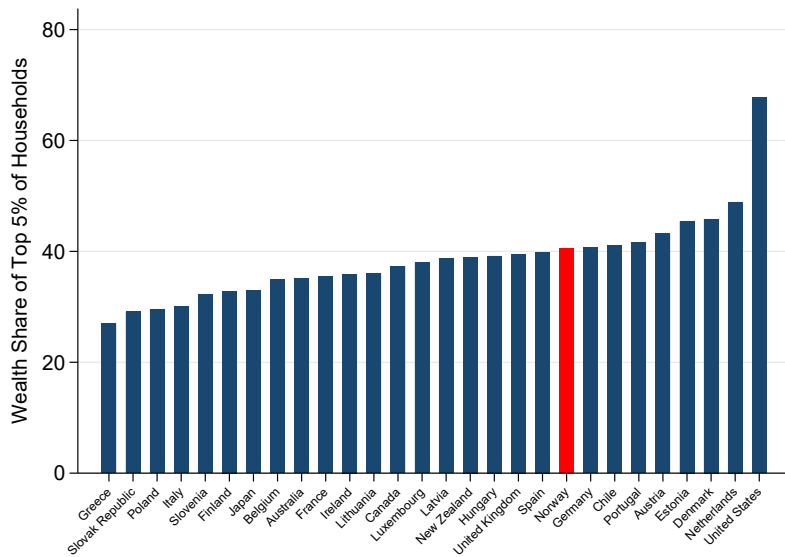
- Document intra- and inter-generational wealth mobility over the life cycle
- Uncover typical trajectories of individuals through the wealth distribution
  - Find important evidence of reversals in fortune over a quarter century
- Mobility driven by reversal of fortune for selected groups in the middle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

Extra

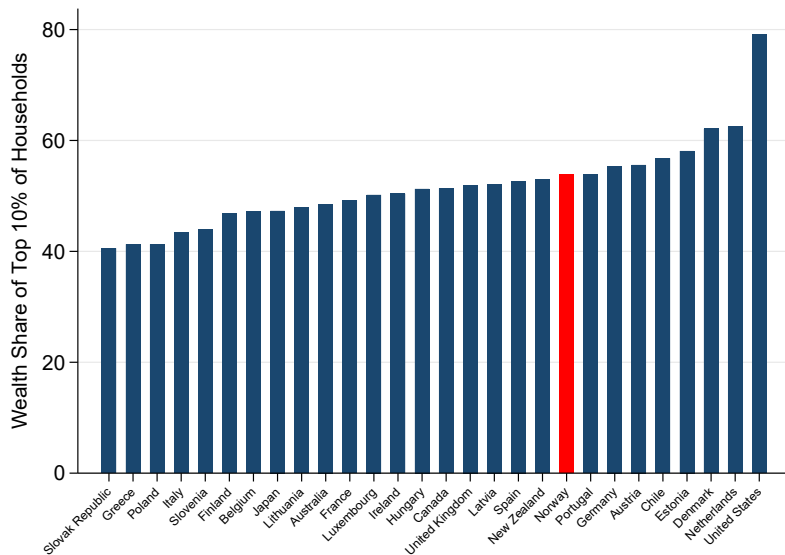
# Norway in Context

[◀ Back](#)

## Norway in Context: Top 5% Share [◀ Back](#)



## Norway in Context: Top 10% Share [◀ Back](#)



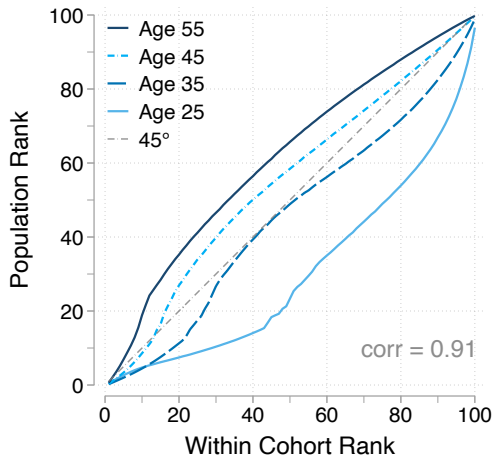


# Key Variables [◀ back](#)

- **Wealth:** Net worth = assets-debt → **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](#)

## BC Ranks vs Pop Ranks

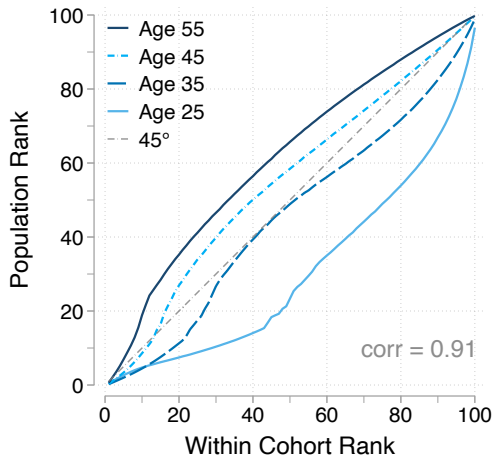


- Changes in wealth levels at each rank as the cohort ages
- 75 percent of age 25 individuals are below the median
- 35 percent of age 55 individuals are below the median

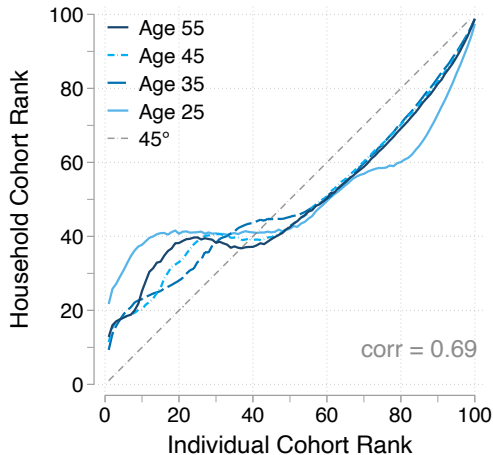
[▶ Household Ranks](#)

# Birth Cohort Individual Ranks vs Household Ranks [◀ back](#)

## BC Ranks vs Pop Ranks



## BC Individual Ranks vs Household Ranks

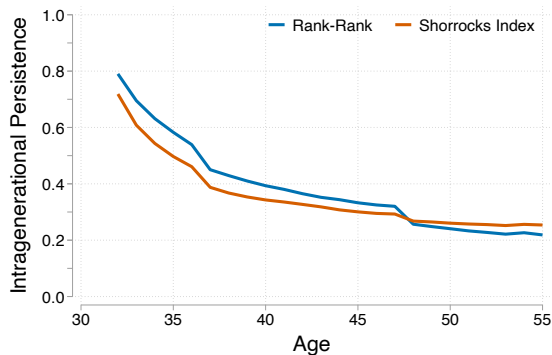


## Shorrocks Mobility Index [◀ back](#)

- Linear rank-rank persistence:  $y_{i,t} = \alpha_t + \rho_t y_{i,0} + u_{i,t}$
- Shorrocks Index: Share that remains in initial quintile of dist. (trace of transition matrix)

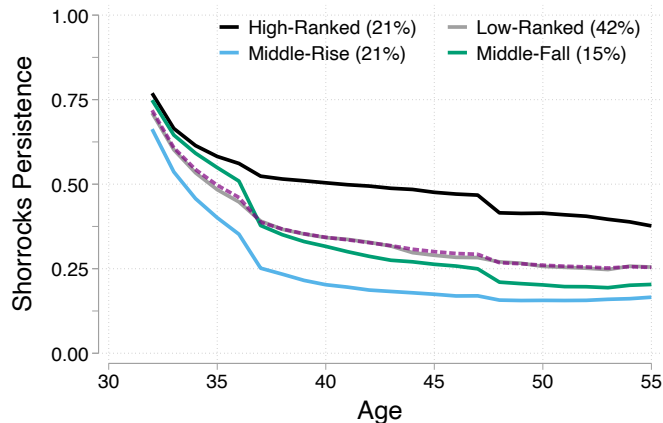
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- Declining intra-generational persistence  
→ Increased (cumulative) mobility
- By age 55 only 25% of individuals remain in age 30 quintile (13% in decile)
- Same patterns as rank persistence

# Intra-Generational Shorrocks Mobility Index [◀ back](#)

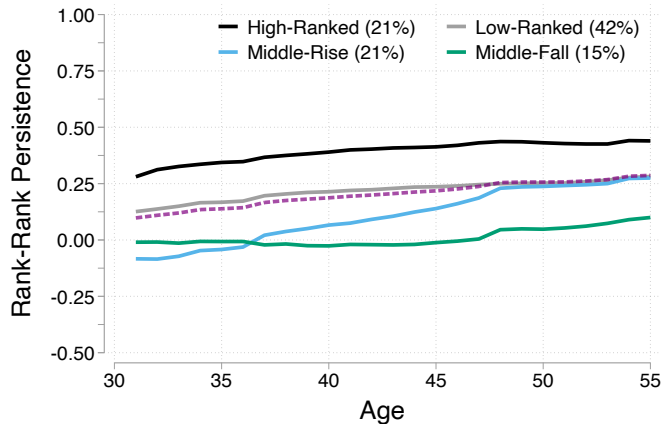


- **Top:** Higher persistence than population
- **Fallers:** Lower persistence than population

# Decreasing Inter-Generational Mobility

[< back](#)

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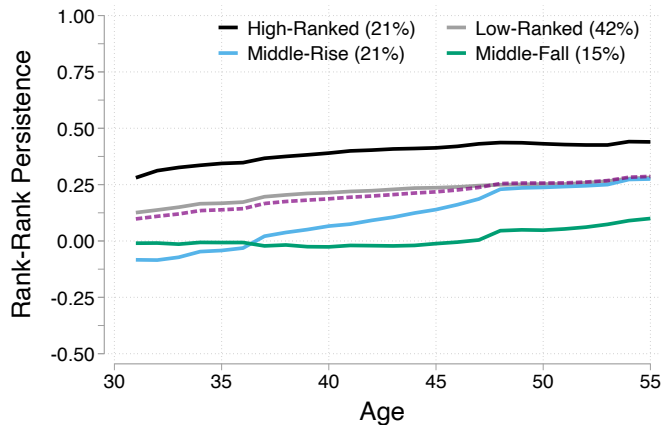


- Persistence rises for all groups
- Level differences are parallel

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

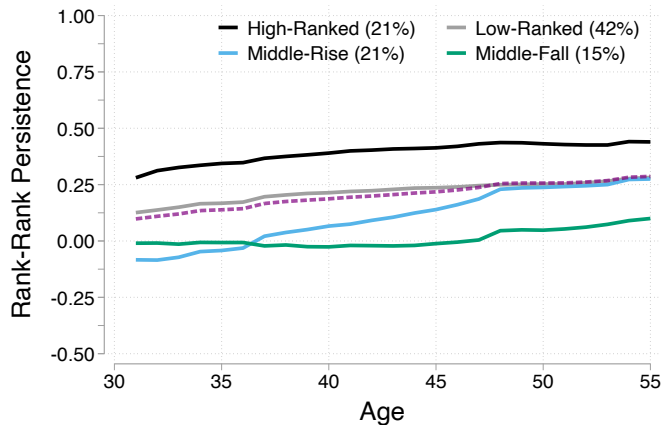
▶ Shorrocks



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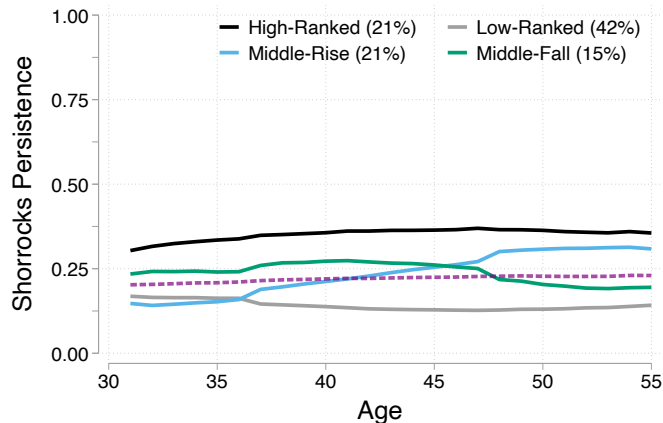


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► Shorrocks

- Clustering of trajectories captures persistent differences in mobility

# Inter-Generational Shorrocks Mobility Index [◀ back](#)

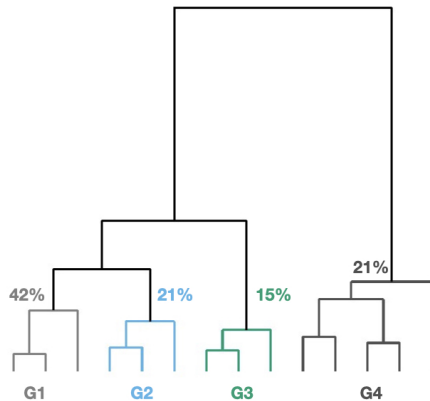


- Risers have clear upwards persistence trend
- Flat patterns for other groups

# Two Levels of Clustering

[◀ back](#)

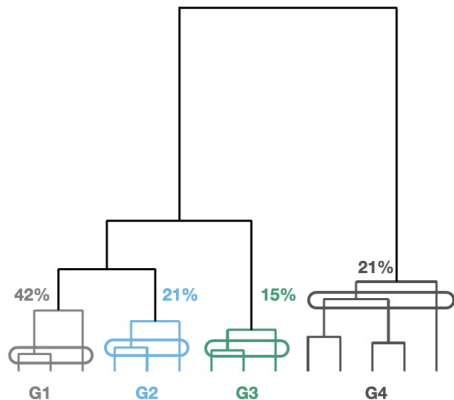
## Clustering Tree



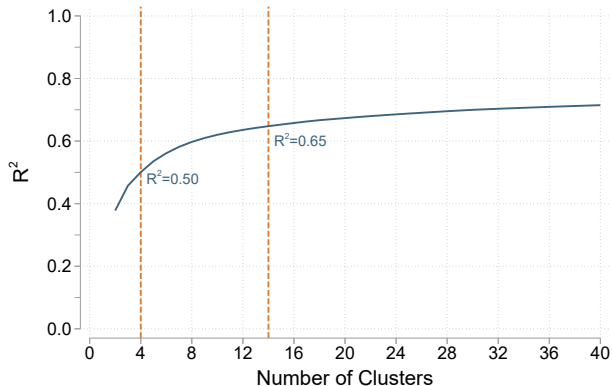
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[◀ back](#)

## Clustering Tree



## Variation Explained

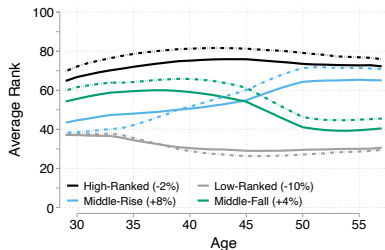


# Characteristics of Main Clusters

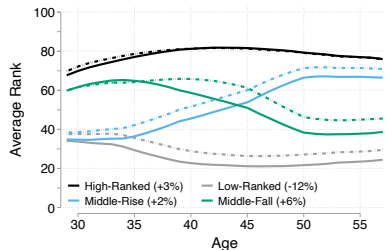
# Alternative Clustering

[◀ Back](#)

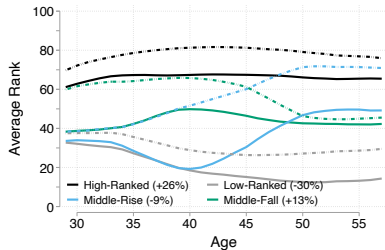
## Household Cohort Ranks



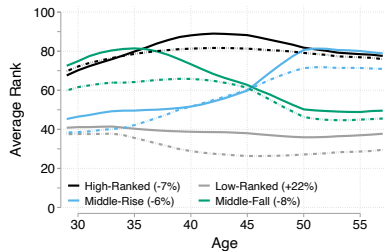
## K Means on Ind. Cohort Ranks



## Log Net Worth



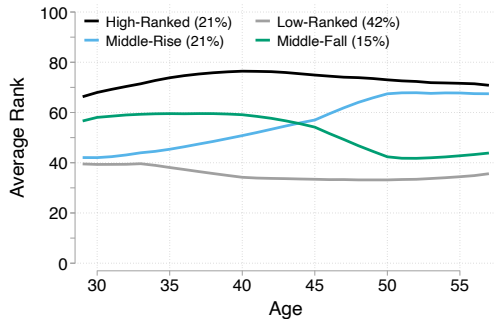
## “Lorenz” Ordinates



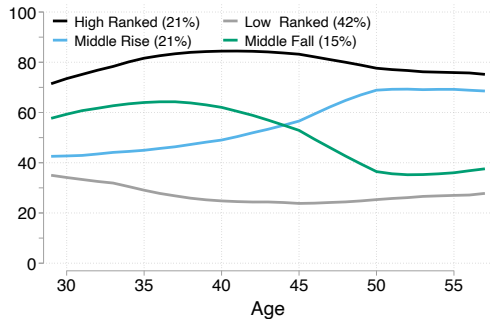
# Household Wealth Ranks

[◀ Back](#)

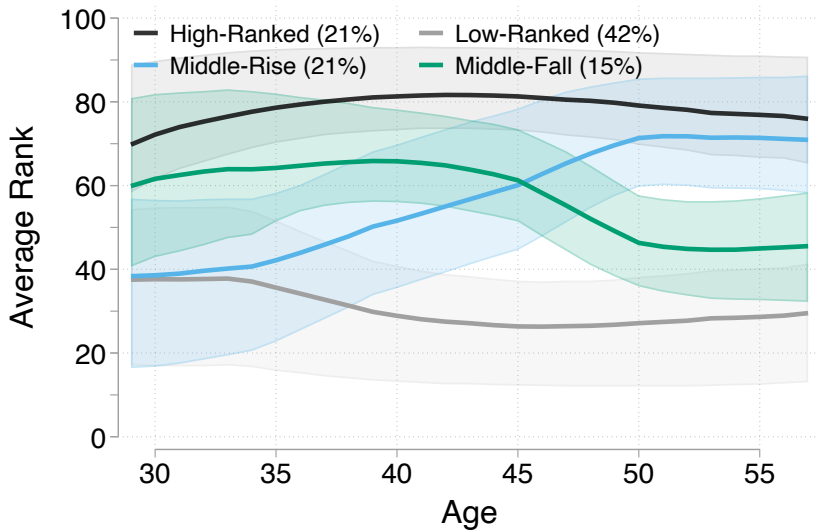
## Household Cohort Ranks (Ind. CI)



## Household Cohort Ranks (HH. CI)



## Distribution of Trajectories by Cluster

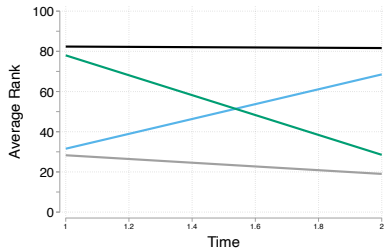
[◀ Back](#)



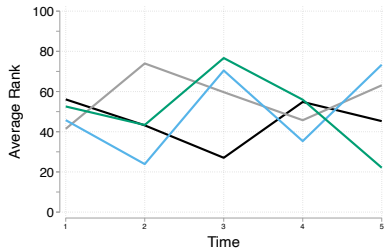
# Clustering Random Ranks

[◀ Back](#)

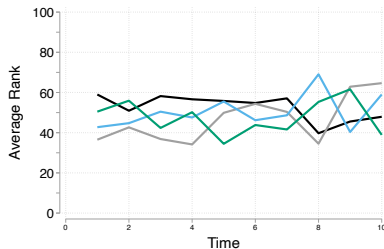
## 2 Periods



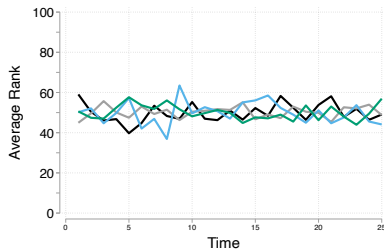
## 5 Periods



## 10 Periods



## 25 Periods

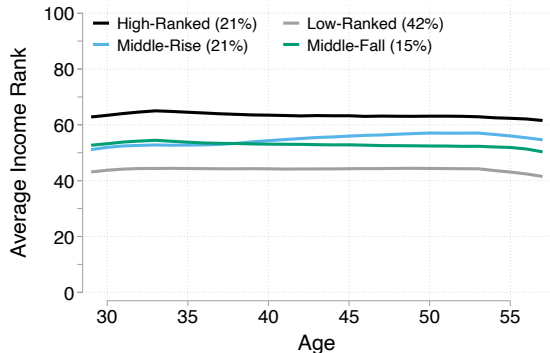


# Heterogeneity Across and Within Groups

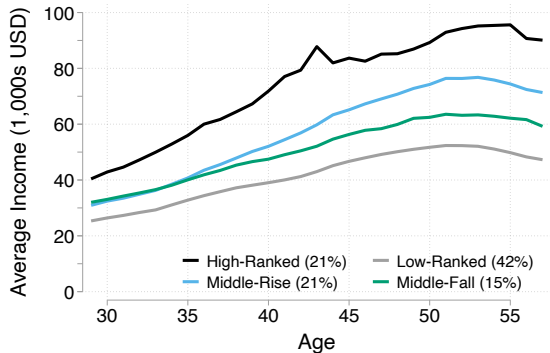
# Income Histories Across Segments of the Distribution

[◀ back](#)

## Income Cohort Ranks



## Income (\$1000s)



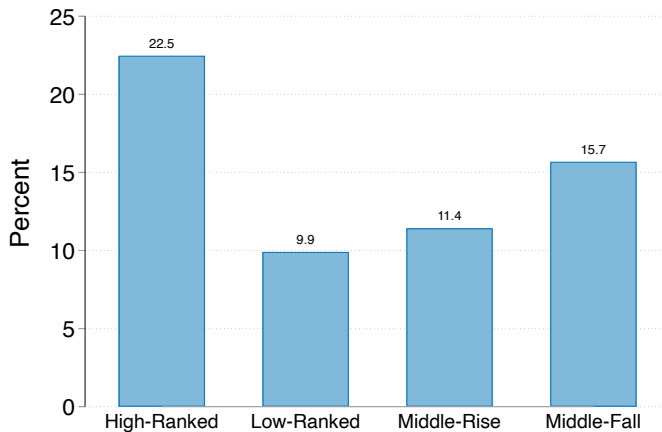
- Distribution of income across clusters compressed relative to wealth

[▶ Median Income](#)

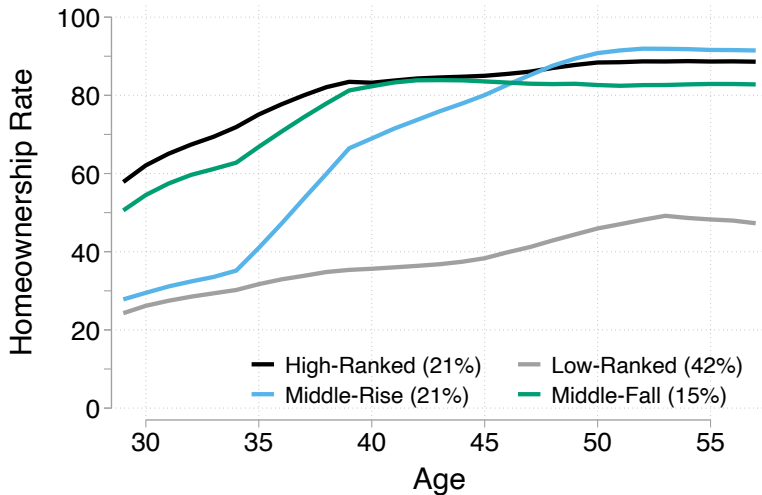
- Similar patterns for HH income; Risers same inc. as high ranked on average

[▶ HH Inc.](#)[CS](#)

## Share with Self-Employment Income (%)



# Homeownership Rates by Cluster

[◀ back](#)

# Taking stock: four largest clusters

[< back](#)

## - High-Ranked

- Stable at the top
- Accumulate wealth fast
- Homeowners, likely to own businesses
- Largest labour market income

## - Middle-Risers

- Start out low
- Accumulate wealth fast
- Income similar to Wealthy
- Become homeowners along the way

## - Middle-Fallers

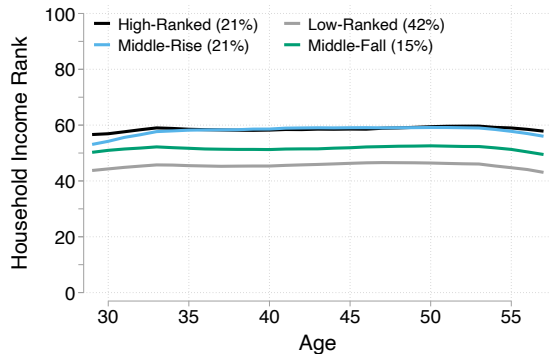
- Start out relatively well off
- Relatively lower labour market income
- Likely to be self-employed
- Usually own assets

## - Low-Ranked

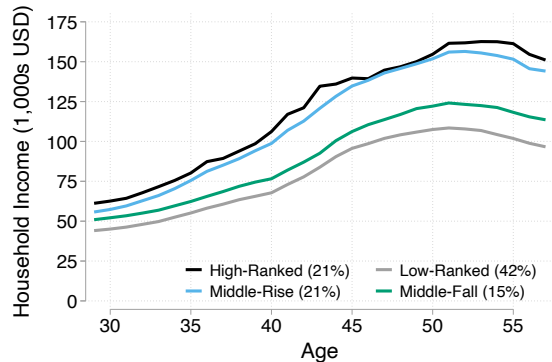
- Stuck at the bottom
- Little rise at the end
- Lowest incomes
- Non-homeowners

# Household Income [◀ Back](#)

## Household Income Cohort Ranks



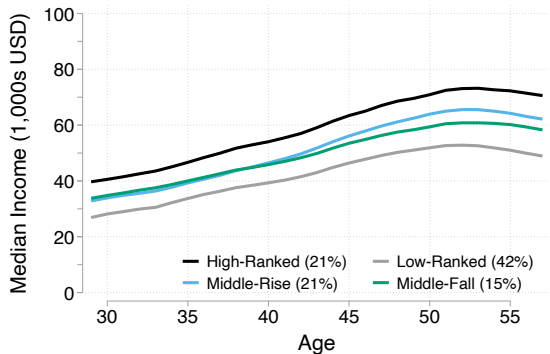
## Household Income (\$1000s)



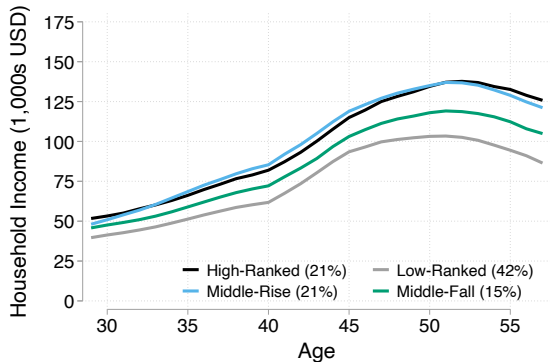
# Median Income Histories

[◀ Back](#)

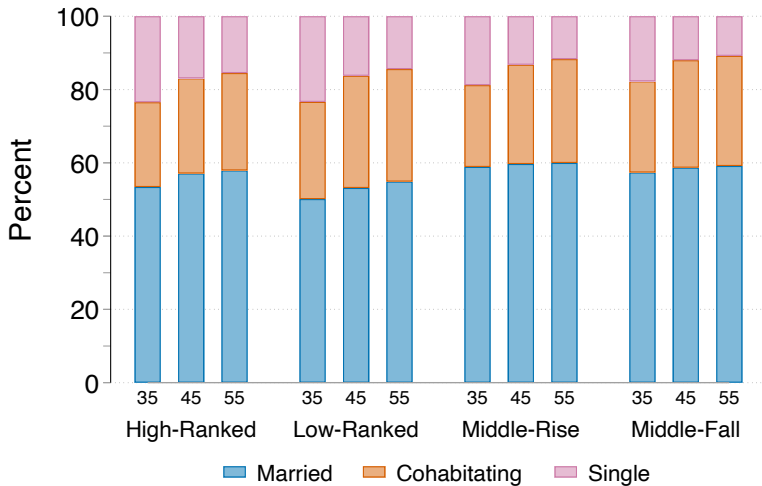
## Median Income



## Household Median Income (\$1000s)

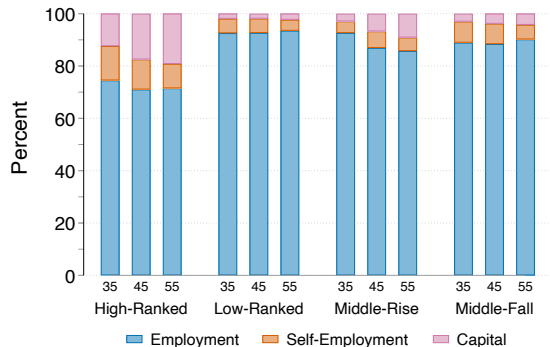






# Portfolio and Income Composition [◀ Back](#)

## Income Sources



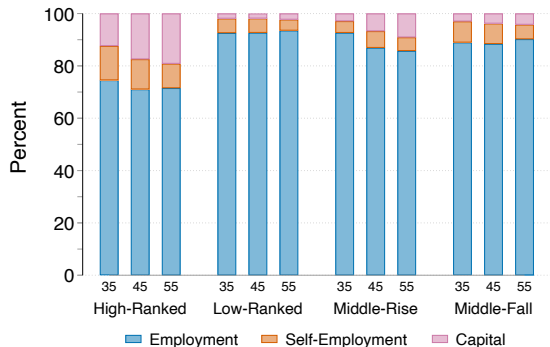
- Income differences in Self-Employment and Capital

[▶ SE](#)[▶ Transfers](#)[▶ Gifts](#)

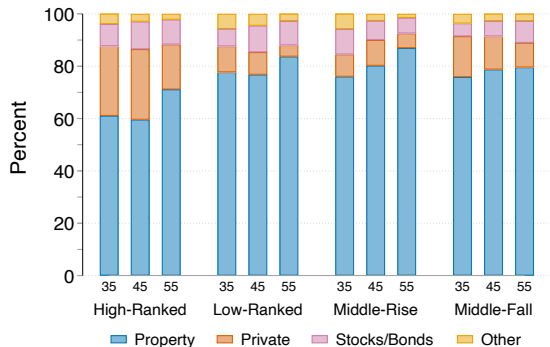
# Portfolio and Income Composition

[◀ Back](#)

## Income Sources



## Asset Portfolio

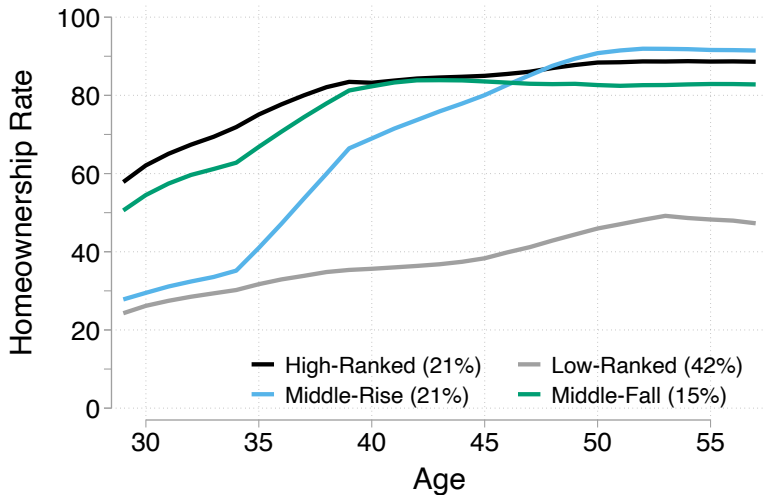


- Income differences in **Self-Employment** and **Capital**

[▶ SE](#)[▶ Transfers](#)[▶ Gifts](#)

- Asset differences across clusters in **Private Equity** and **Property**

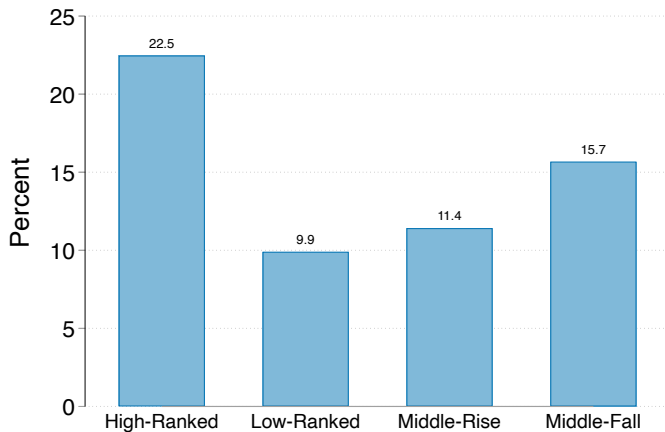
# Home-ownership Rates by Cluster

[◀ Back](#)

# Self-Employment Rates, Age 45

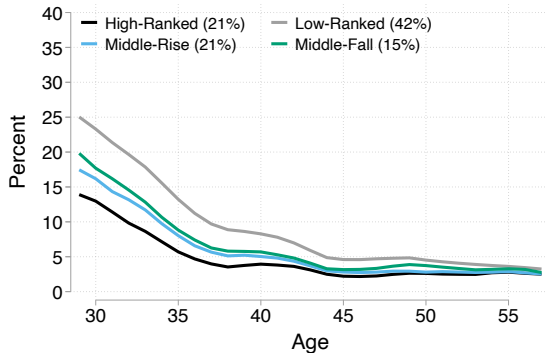
[◀ Back](#)

## Share with Self-Employment Income (%)

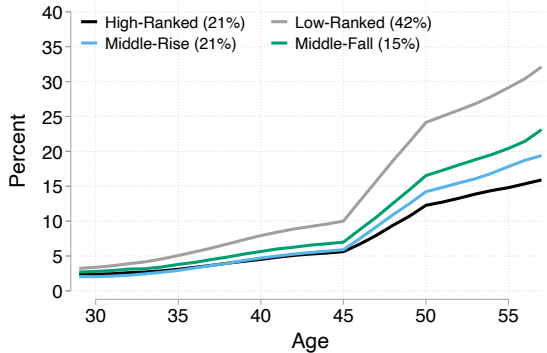


# Transfers: Unemployment, Disability, Sick Leave, Nursing [◀ Back](#)

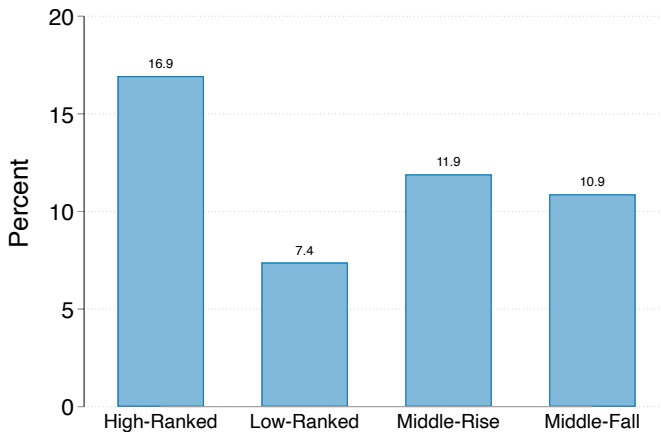
## Share with Unemployment Benefits (%)



## Share with Health-Related Transfers (%)



Share Received Gifts by 2014 (%)



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

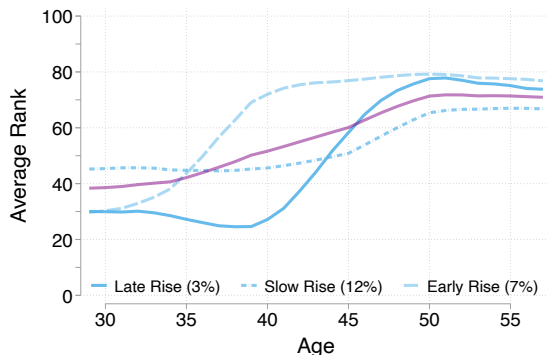
# Characteristics of Sub-Clusters



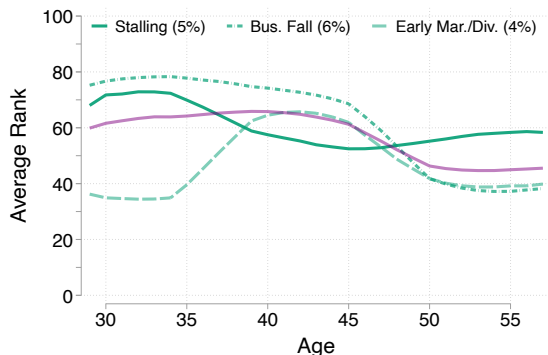
# Heterogeneity in Trajectories

[▶ Wealth](#)[▶ Portfolio](#)[▶ Homeownership](#)[▶ Inc.](#)[▶ SE](#)[▶ Edu.](#)

## Middle-Risers



## Middle Fallers



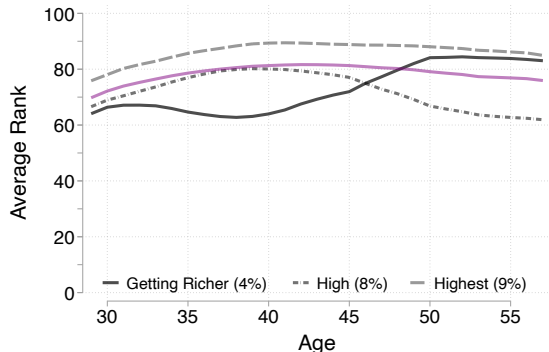
- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)

[◀ back](#)

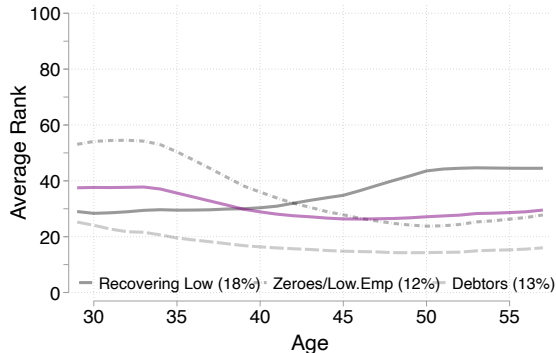
# Heterogeneity in Trajectories

[▶ Wealth](#)[▶ Portfolio](#)[▶ Homeownership](#)[▶ Inc.](#)[▶ SE](#)[▶ Edu.](#)

## High-Ranked



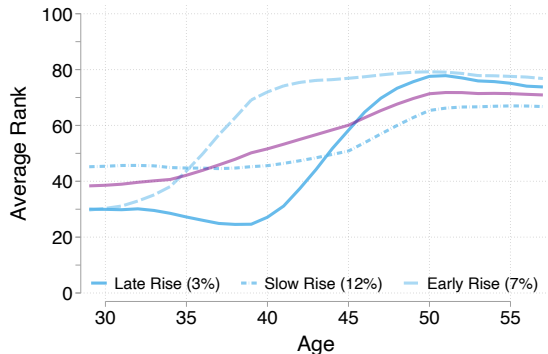
## Low-Ranked



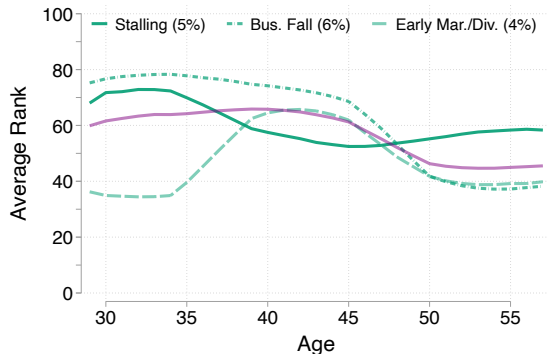
- Top and bottom groups differ mainly in avg. levels
- Zeros are quite different from debtors

# Heterogeneity in Trajectories: Levels vs Timing [◀ Back](#)

## Middle-Risers



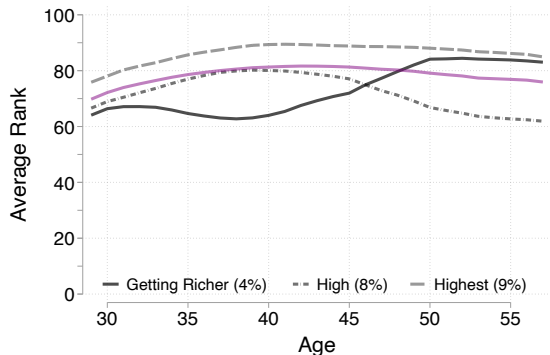
## Middle-Fallers



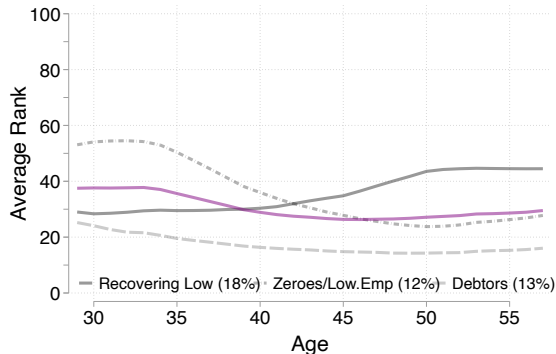
- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)

# Heterogeneity in Trajectories: Levels vs Timing [◀ Back](#)

## High-Ranked



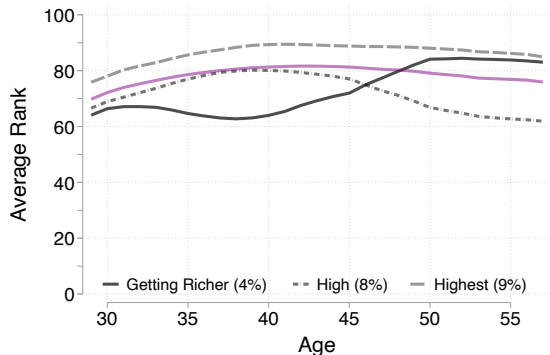
## Low-Ranked



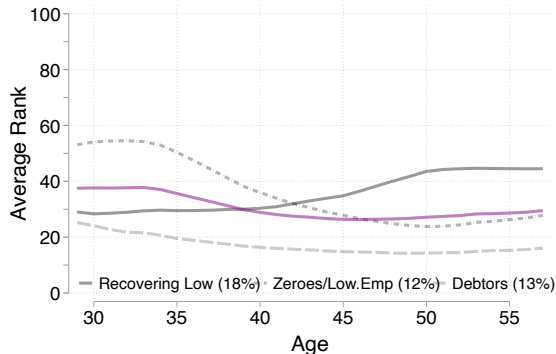
- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)
- Top and bottom groups differ mainly in avg. levels (with a rising sub-group in each)

# Heterogeneity in Trajectories: Levels vs Timing [◀ Back](#)

## High-Ranked



## Low-Ranked

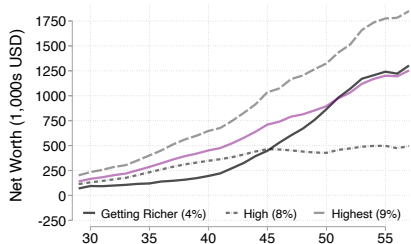


- Risers differ mainly in timing of changes (similar initial conditions)
- Fallers differ in initial conditions and timing of changes (similar final conditions)
- Top and bottom groups differ mainly in avg. levels (with a rising sub-group in each)

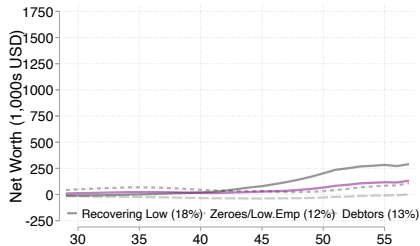
# Sub-Clusters: Wealth Levels

[◀ Back](#)

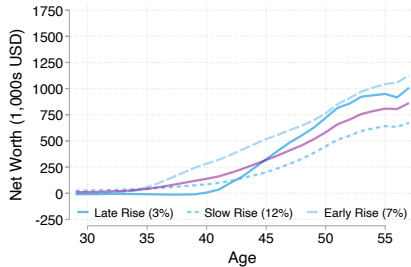
## High Ranked



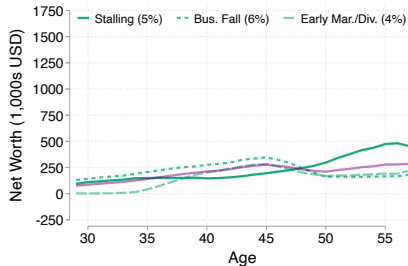
## Low Ranked



## Middle Risers



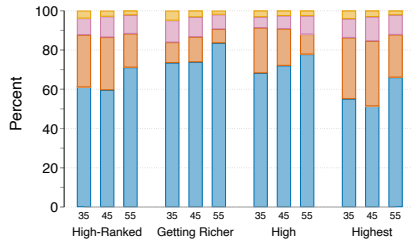
## Middle Fallers



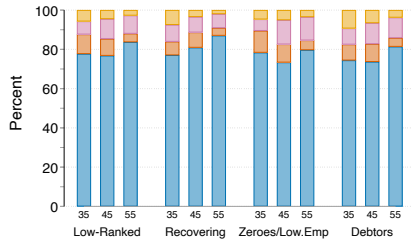
# Sub-Clusters: Portfolio

[◀ Back](#)

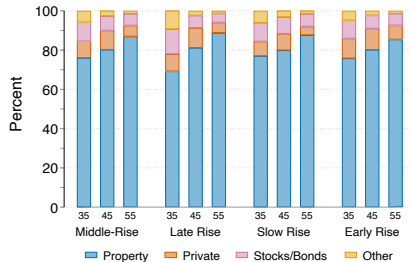
## High Ranked



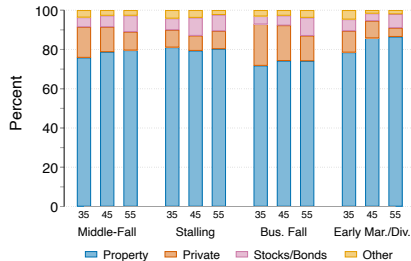
## Low Ranked



## Middle Risers



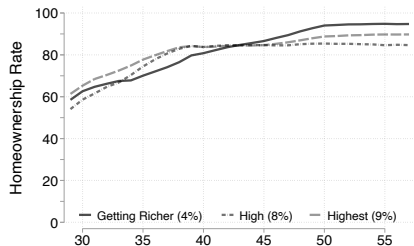
## Middle Fallers



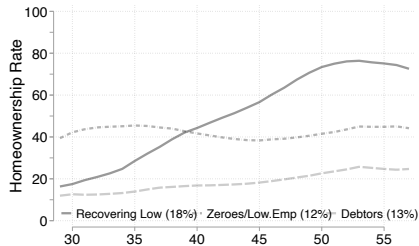
# Sub-Clusters: Homeownership

[◀ Back](#)

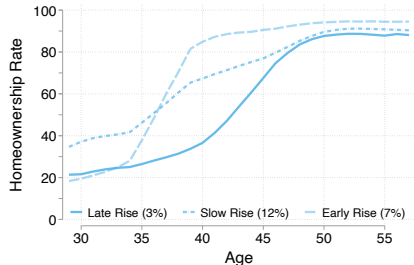
## High Ranked



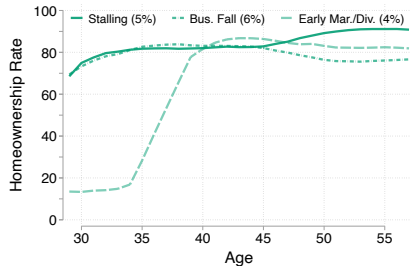
## Low Ranked



## Middle Risers



## Middle Fallers

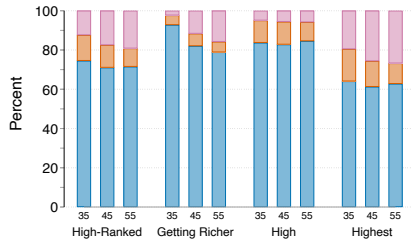




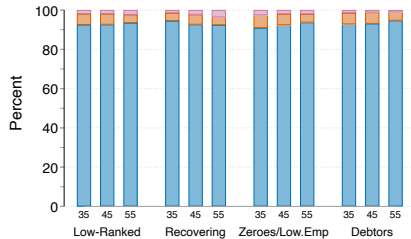
# Sub-Clusters: Income Composition

[◀ Back](#)

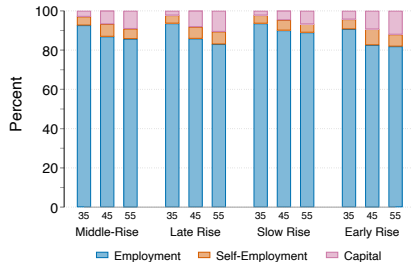
## High Ranked



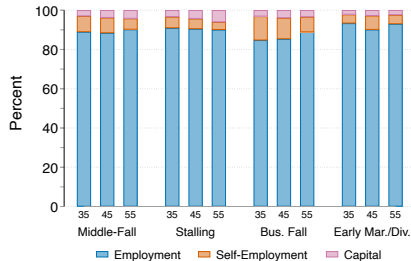
## Low Ranked



## Middle Risers

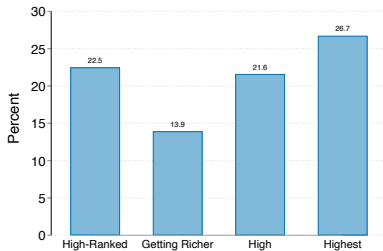


## Middle Fallers

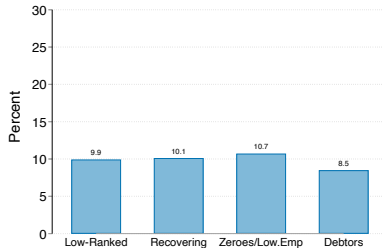


# Sub-Clusters: Self-Employment [◀ Back](#)

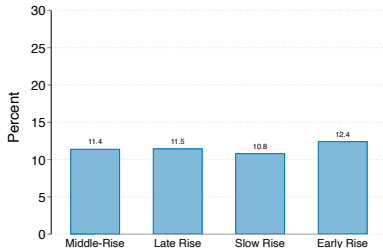
## High Ranked



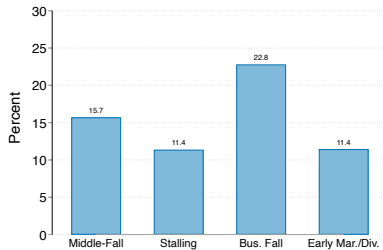
## Low Ranked



## Middle Risers



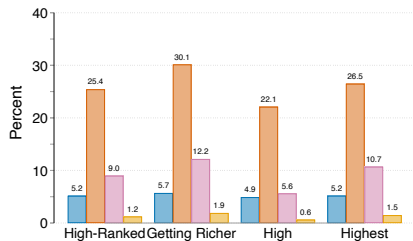
## Middle Fallers



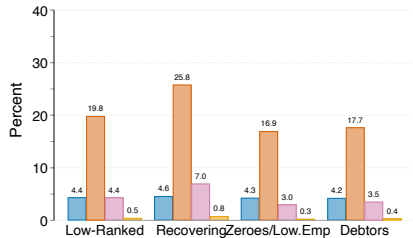
# Sub-Clusters: Education

[◀ Back](#)

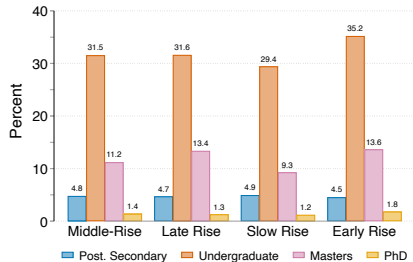
## High Ranked



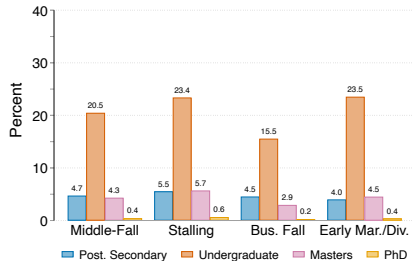
## Low Ranked



## Middle Risers



## Middle Fallers



# Shapley-Owen Decomposition

# How Important Are Ex-Ante Explanations? [◀ Back](#)

## Two measures:

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

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

# How Important Are Ex-Ante Explanations? [◀ Back](#)

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

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

# How Important Are Ex-Ante Explanations? [◀ Back](#)

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

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

- 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
<b>Share of Distance Variation Explained by Variable (pp)</b>				
5.9	2.4	2.3	0.8	0.4
<b>Share of Individuals Correctly Classified (pp)</b>				
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.

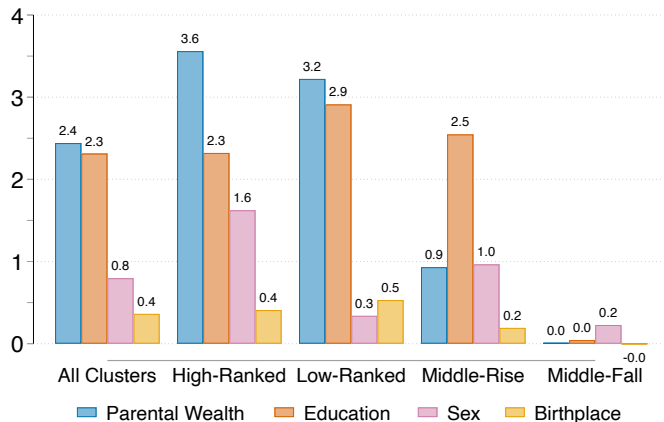
[▶ D by Cluster](#)

[▶ C by Cluster](#)



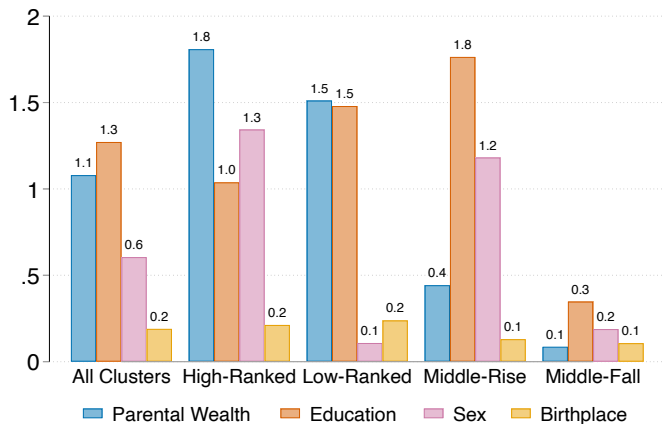
# How Important Are Ex-Ante Explanations? [◀ back](#)

## Share of Cross-Group Variation Explained by Variable



# How Important Are Ex-Ante Explanations? [◀ back](#)

## Share of Individuals Correctly Classified



\* 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
<b>Share of Distance Variation Explained by Variable (pp)</b>						
20.0	1.6	2.0	0.6	0.3	0.6	15.0
<b>Share of Individuals Correctly Classified (pp)</b>						
10.6	0.8	1.1	0.4	0.2	0.3	7.9

\* Contribution relative to random classification using population shares.

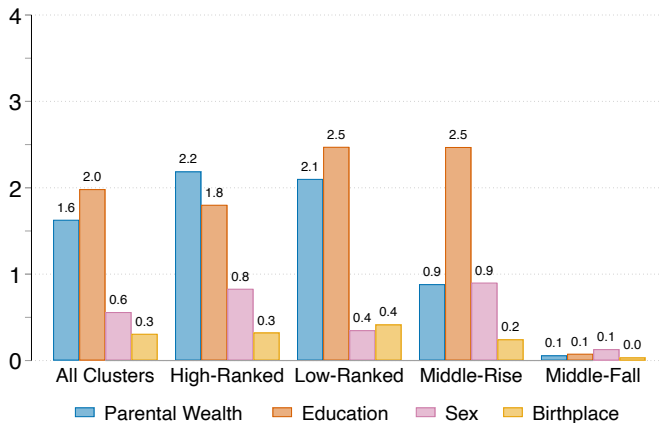
Share of individuals correctly classified by random classification 29.3% vs 40.0% with full model.

[▶ D by Cluster](#)

[▶ C by Cluster](#)

# How Important Are Ex-Ante Explanations? [◀ back](#)

## Share of Cross-Group Variation Explained by Variable



# How Important Are Ex-Ante Explanations? [◀ back](#)

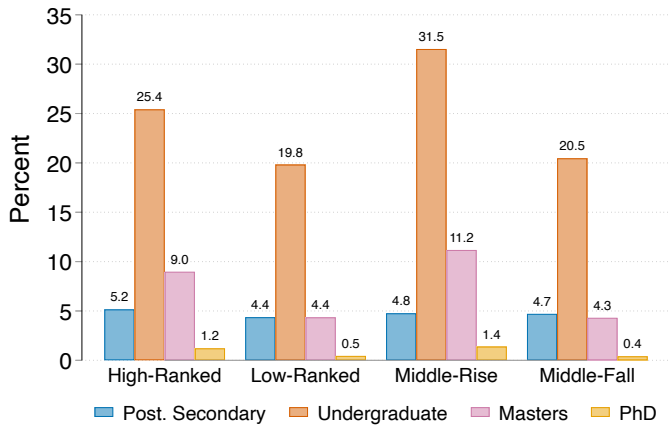
## Share of Individuals Correctly Classified



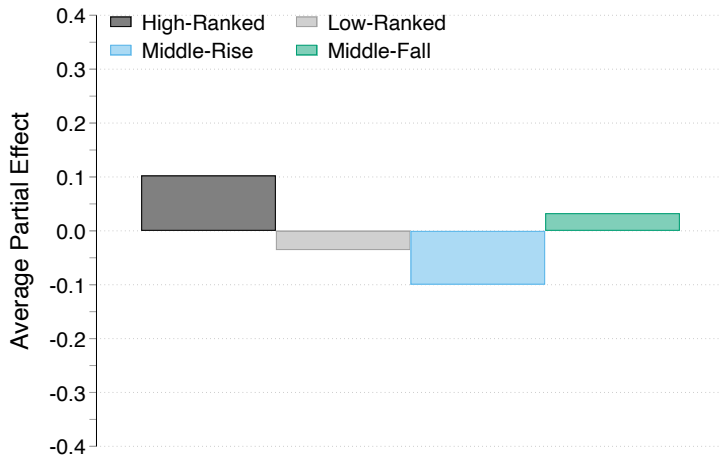
\* Contribution relative to random classification using population shares.

# Classification Results for Main Clusters

### Highest Education Level Shares (%)

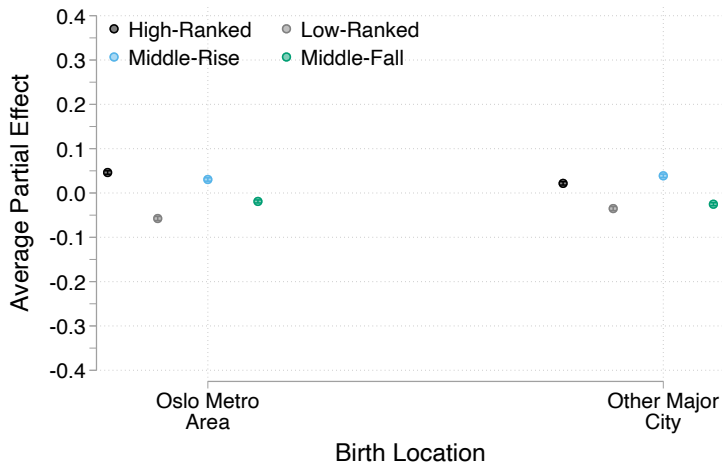


# Sex Average Partial Effect

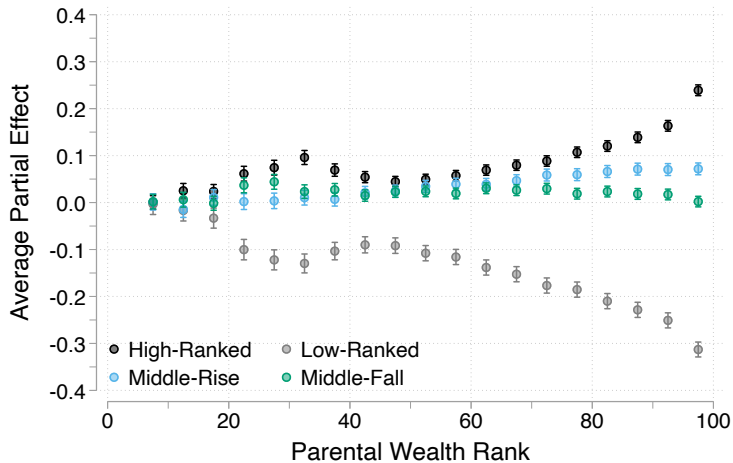
[◀ back](#)



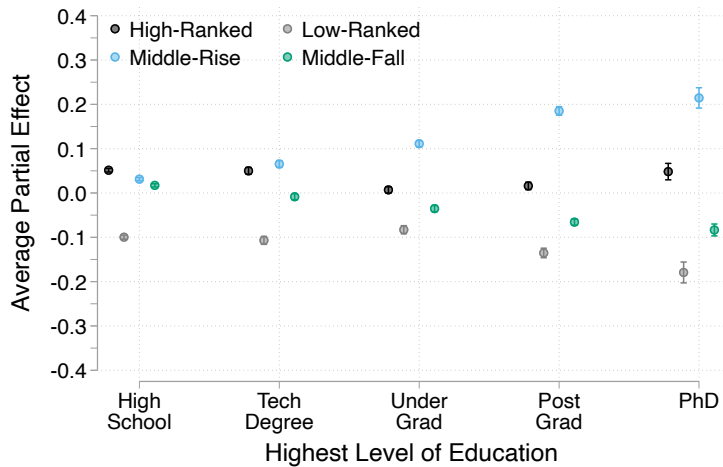
# Where Is The Land of Opportunity? Norway

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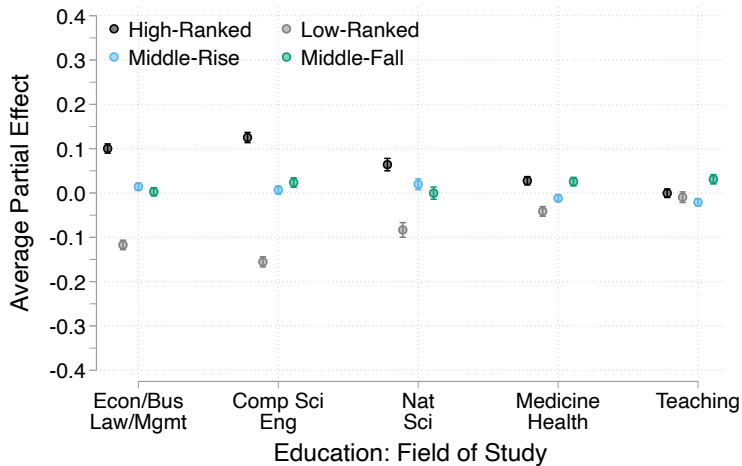
# The Non-Linear Effect of Parental Wealth: CI

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# Learn & Rise?: CI

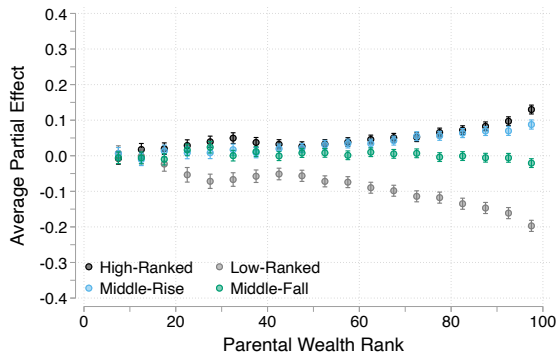
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## Education: Fields

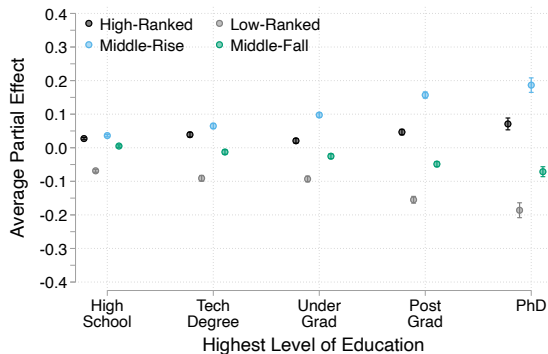
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# Patterns still present after conditioning on own initial wealth [◀ Back](#)

## Parental Wealth



## Education



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

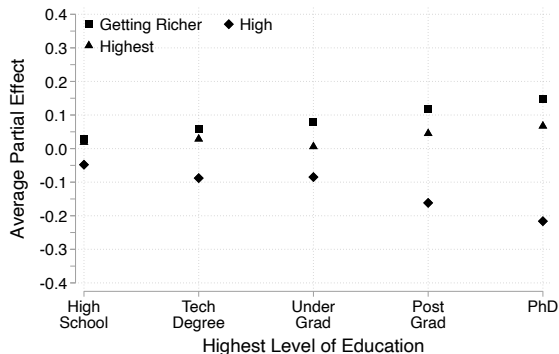
# Classification Results for Sub-Clusters

# What about heterogeneity within clusters? High-Ranked [◀ Back](#)

## Parental Wealth



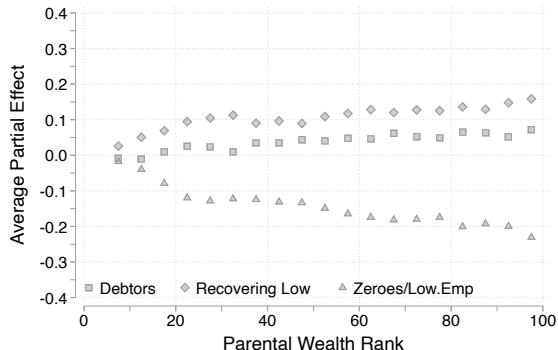
## Education



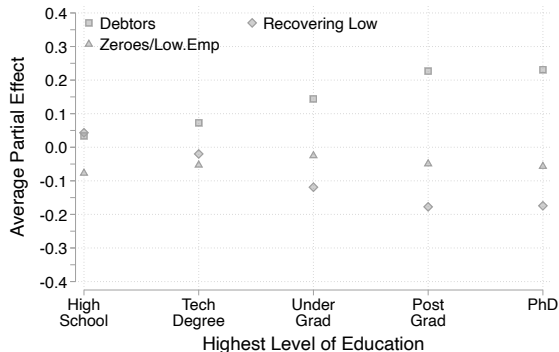
- Even within the groups, movers are hard to predict with parental wealth [▶ PW CI](#)
- Education predicts dynamics within groups (e.g., getting richer vs already wealthy) [▶ ED CI](#)

# What about heterogeneity within clusters? Low-Ranked [◀ Back](#)

## Parental Wealth



## Education

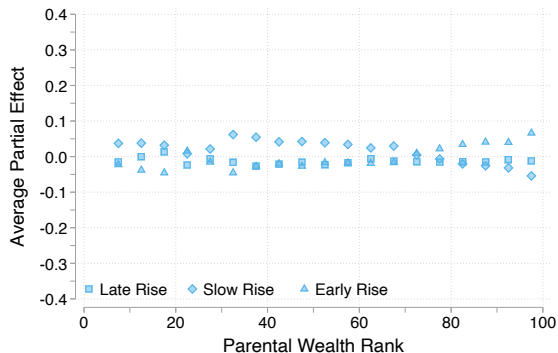


- Among poor, parental wealth does not predict movements
- Education predicts recovery

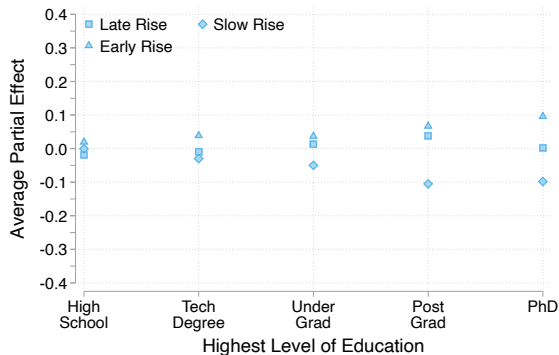


# What about heterogeneity within clusters? Middle-Risers [◀ Back](#)

## Parental Wealth



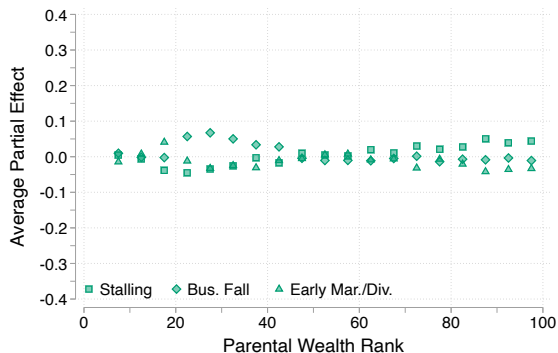
## Education



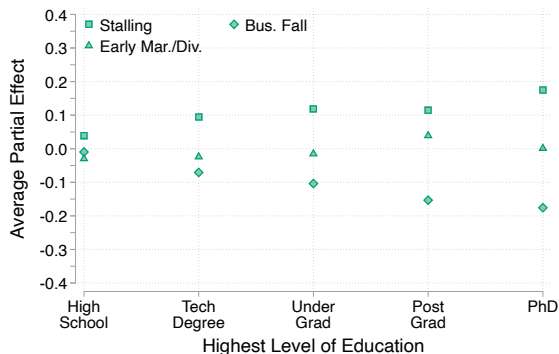
- Within Risers, movers not predicted by parental wealth
- Education predicts timing

# What about heterogeneity within clusters? Middle-Fallers [◀ Back](#)

## Parental Wealth

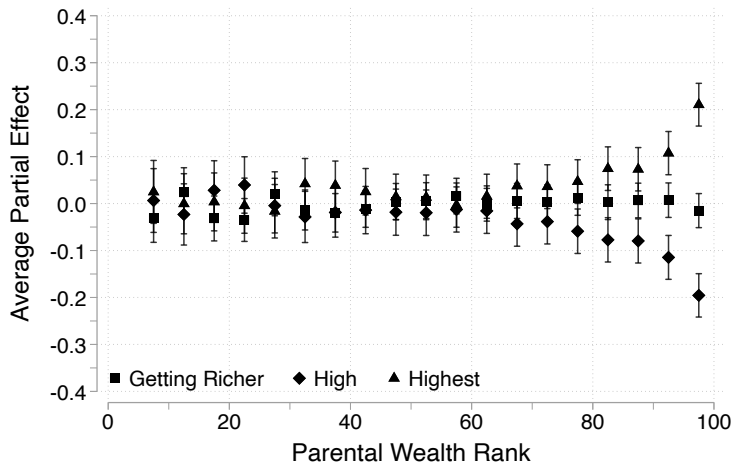


## Education

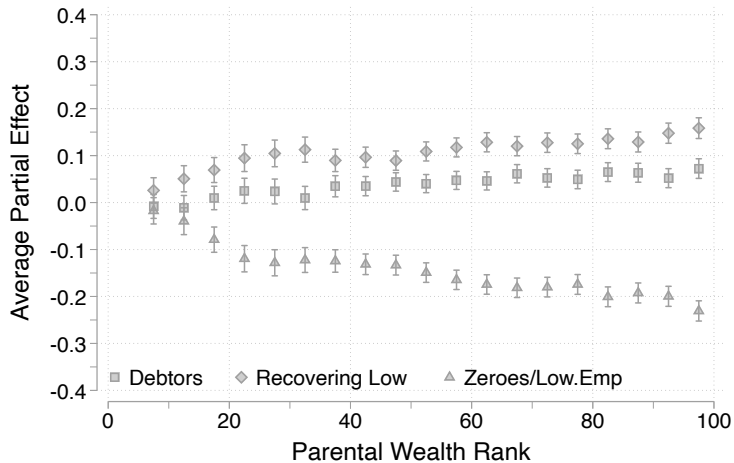


- Similar to Risers, little role for parental wealth
- But Education predicts dynamics

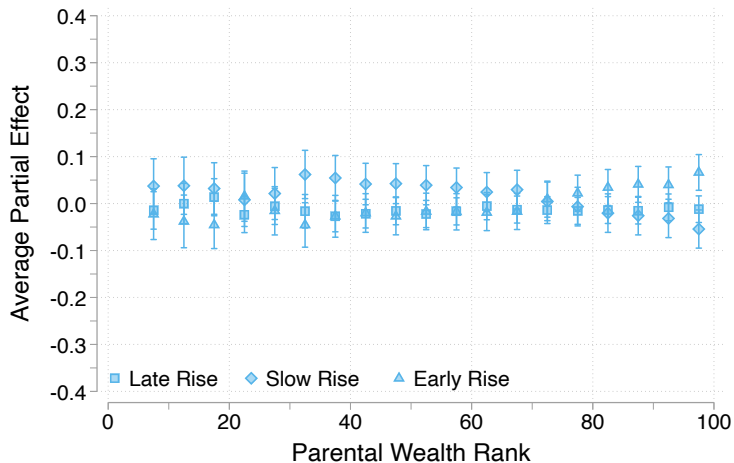
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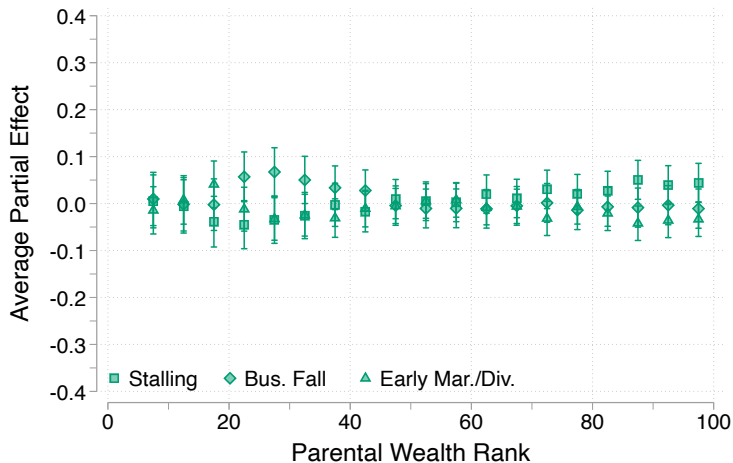
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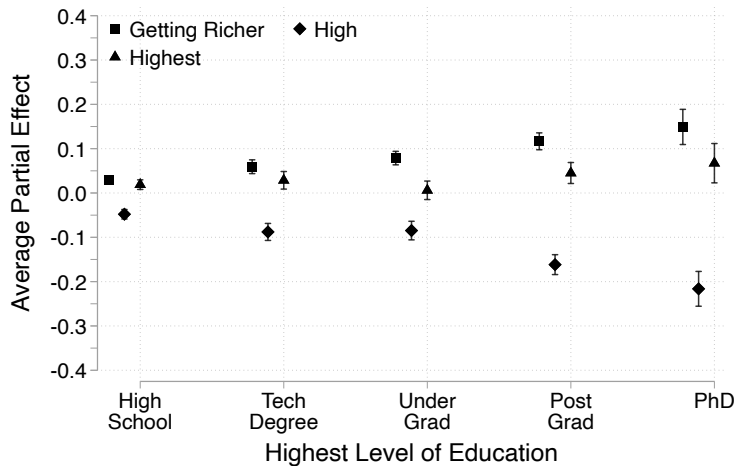
# The Non-Linear Effect of Parental Wealth: CI

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# The Non-Linear Effect of Parental Wealth: CI

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# Learn & Rise for Wealthy: CI

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1. New evidence on wealth mobility and wealth accumulation: Full life cycle trajectories
  - Add to results for the super wealthy (Gomez; Ozkan, Hubmer, Salgado, Halvorsen), the role of individual factors (Hugget, Ventura, Yaron; Black, Devereux, Landaud, Salvanes), and short-run mobility and race (Hurst, Luoh, Stafford, Gale).
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