Anatomy of Lifetime Earnings Inequality
Heterogeneity in Job Ladder Risk vs Human Capital

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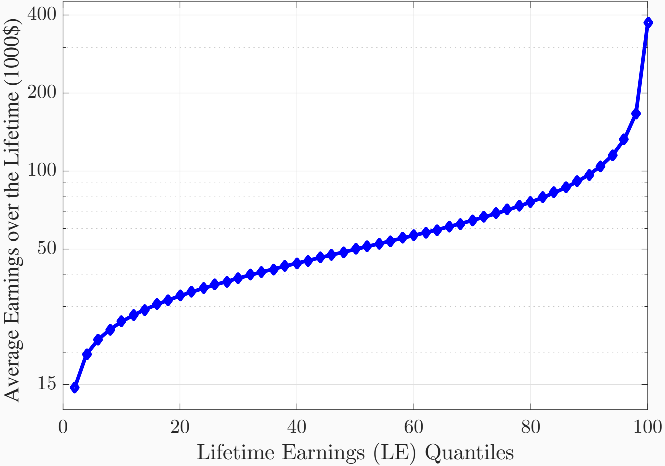
IZA Workshop: Heterogeneity and the Labor Market
November 22, 2019

Motivation: Lifetime Earnings Inequality

1. **Large differences in lifetime earnings (LE) of males**

- **LE**: Total **labor (wage/salary) income** between age 25 and 55.
- Rank into 50 equally sized LE quantiles.

Motivation: Lifetime Earnings Inequality



- P90/P10≃4;
- Larger differences at the top: P100/P10≃14.
- Pareto Tail of LE distribution:

$\frac{S(p/10)}{S(p)}$	ζ
0.29	2.2

Motivation: Lifetime Earnings Inequality

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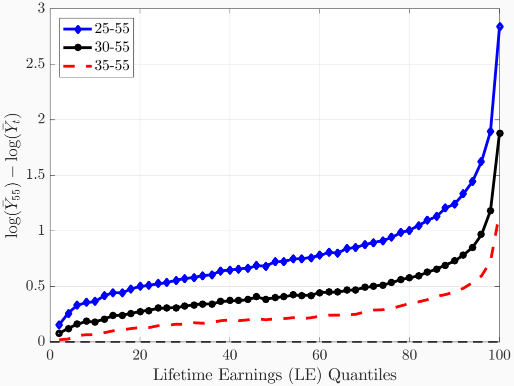
2. **Inequality starts early in life, but growth differences over the life time is key.**



Average earnings growth: 25 to 55

- Top $\simeq$ 2000%
- Median $\simeq$ 200%
- Bottom$\simeq$ 10%

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2. **Inequality starts early in life, but growth differences over the life time is key.**

3. **If there were no differences in earnings growth:**

- P90/P10 would have been halved.
- The effects are much larger at the top of the distribution: P100/P10≈2.5 (vs. 14).

Possible Explanations of Earnings Growth Differences

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- Ability to accumulate human capital (Huggett, Ventura, Yaron 2011 AER)?
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  - make more job-to-job transitions?
  - make larger jumps when they switch?
  - face lower unemployment risk and fall of the ladder (the slippery slope–Jarosch 2015)?

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  - make more job-to-job transitions?
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- Unexplained ex-post productivity shocks?

What We Do and Find?

1. **Empirically** investigate the career paths of different LEs.

- Twice more #employers at the bottom than above the median
- Switch jobs due to different reasons: Higher unemp. risk at the bottom, more job-to-job transitions at the top
- Little heterogeneity in earnings growth among stayers in the bottom 2/3 of the LE

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2. **Quantitatively** estimate a model with heterogeneity in job ladder risk and learning ability:

- Large ex-ante differences in unemp. risk, job finding and contact rate below-median LE$\Rightarrow$
- 80% of differences between the bottom and the median LE vanish if same ex-ante job ladder risk.
- Median and top LE differences are driven by Pareto-distributed learning ability.

Today

1. Facts
2. Job Ladder Model
3. Estimation Results
4. Conclusion

Facts

SSA Data

- We draw our sample from SSA: all individuals in the US with a SSN.
- Labor income data from W-2 forms for wage/salary workers.
- Employees are linked to their employers via EINs.
- Sample period covers 36 years between 1978 to 2013 for 1953–1960 cohorts.
- Drawback: Annual data.
  - It is typical that a worker has more than one EIN in a year.
  - Complicates the identification of job changes.
  - Cannot distinguish between E-U-E vs. E-E or U vs. N.

Sample of Workers with Labor Force Attachment

- Focus on males between ages 25–55.

- Exclude individuals that are full-year non-employed
  - for more than 1/4 of life time.
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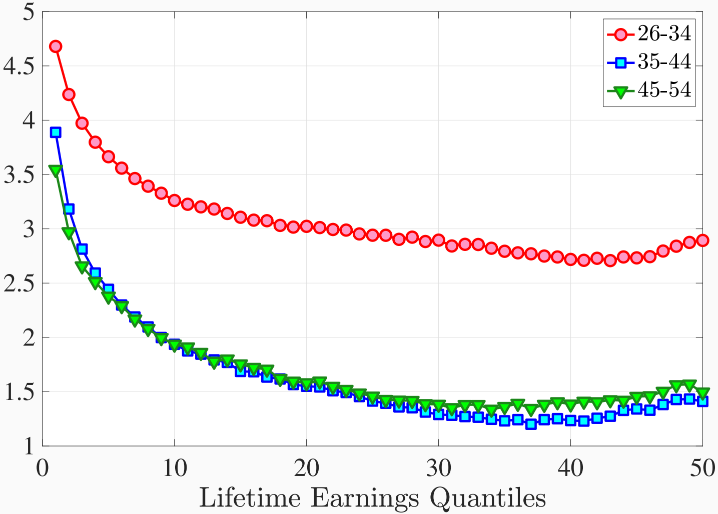
- Compute lifetime earnings (25–55) and rank into 50 equally-sized groups.
  - More than 12000 observations in each group.

Number of Employers Over the Career

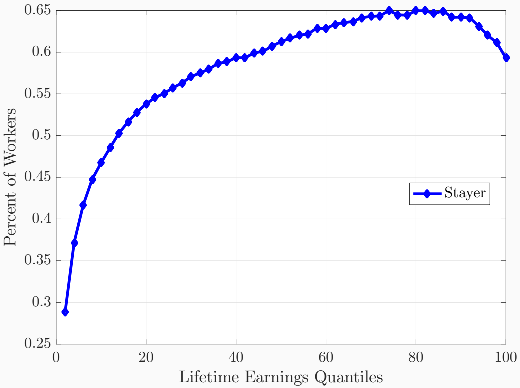


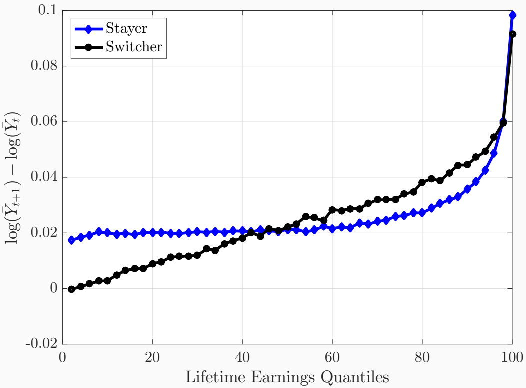
- Twice more #employers at the bottom than above median
- Bottom LE less likely to settle into stable jobs.
- Bottom LE: higher unemployment risk.

Earnings Growth: Stayers vs Switchers

- Classify workers in a given year as **stayers** vs **switchers**.
  - Several plausible definitions.
- A worker is a **stayer** between year t and $t+1$ if
  - income from the same employer 4 years in a row, $t-1$ to $t+2$.
  - that employer pays at least 90% of his wage/salary income in t and $t+1$.
- **Switchers** are very heterogenous:
  - UE, EU, EUE, or EE.

Stayers vs. Switchers





- Higher-LE are more likely to **stay**.
- Pronounced heterogeneity among **switchers** (below 75th LE percentile).

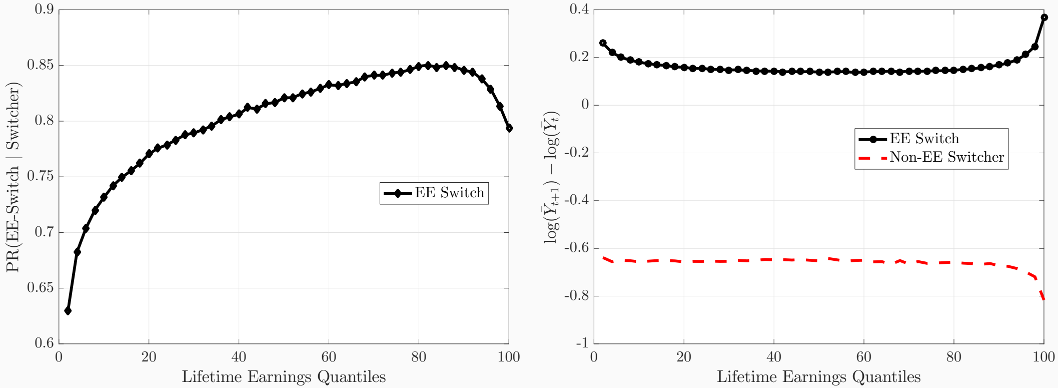
Switchers: E vs U

- What drives the differences among **switchers?**

- **Switchers** are very heterogenous.
  - UE, EU, EUE, or EE
  - The annual nature of the data makes it hard to separate these.

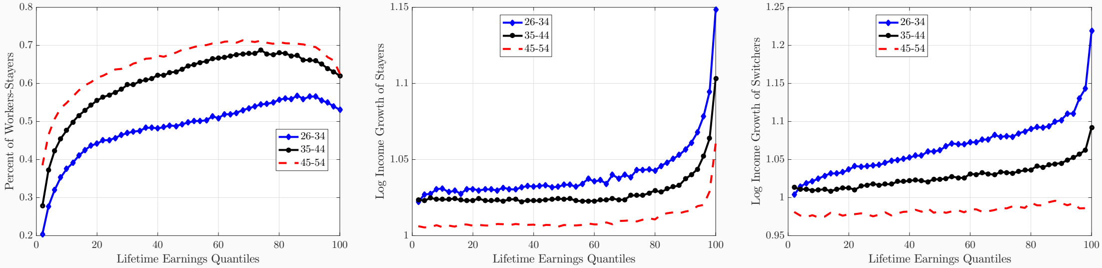
- Different parts of the earnings growth distribution is more informative about different types of switches:
  - **U-switcher**: Workers experience $Y_{t+1} < 0.75 * Y_t$ more likely to go through nonemployment
  - **E-switchers** those that experience $Y_{t+1} > 0.75 * Y_t$
    - includes EE and UE workers.

E vs. U Switchers



- Small differences among **E** and **U** (except top groups).
- Heterogeneity is mainly due to composition: Higher LEs are more likely to be **E.**

Life-Cycle Variation



- Workers are more likely to **stay** as they age.
- **Stayer** and **Switcher** income growth declines over the life cycle.

Taking stock: What do we learn?

* These empirical findings guide us when developing the structural model.

* The model has to capture the heterogeneity in income growth due to:

- Bottom vs median LE: differences in switcher income growth.
  - Large heterogeneity in switcher growth and
  - More likely to be switchers.

- Median vs top LE: differences in stayer income growth.
  - Large heterogeneity in stayer income growth and
  - More likely to be stayer.

- Large heterogeneity in worker flows, also confirmed using high-frequency SIPP data

Job Ladder Model

Model Overview

- A life-cycle job ladder model with two-sided heterogeneity à la Bagger, Postel-Vinay and Robin (2014) that features:
  - on the job search and employer competition (à la Bertrand)
  - Perpetual youth (Blanchard-Yaari)

- Allow for lots of worker heterogeneity:
  - unemployment risk,
  - job finding rate, the contact rate for employed workers,
  - on-the-job training ability (returns to experience),

- Recalls for unemployed workers (à la Fujita and Moscarini 2016).

Worker Productivity

Worker productivity is given by

$$h_t^i = \alpha_i + \beta_i \tau_{i,t} + \gamma \tau_{i,t}^2 + \epsilon_{i,t}$$

- Ex-ante heterogeneity in permanent productivity α_i and learning ability (returns to experience) β_i.
  - $\tau_{i,t}$ actual experience
  - $\alpha_i \sim \mathcal{N}\left(\mu_\alpha, \sigma_\alpha^2\right)$, $\beta_i \sim$ *Pareto*(ψ_W, ς_W).
  - α_i and β_i are correlated.

- AR(1) idiosyncratic shocks, $\epsilon_{i,t} = \rho \epsilon_{i,t-1} + \varepsilon_{i,t}$
  - with probability π, $\varepsilon_{it} \sim \mathcal{N}\left(0, \sigma_\varepsilon^2\right)$ and with probability $1 - \pi$, $\varepsilon_{it} = 0$.

Production Technology

- Workers draw firm productivity from $p_t^j \sim \mathit{Pareto}(\psi_F, \varsigma_F)$.
  - experimented with other distributions.
- Once in a match, produce a single divisible good sold in a competitive market.
- The log-output per period of a match, $y_t^{ij} = p_t^j + h_t^i$
- Unemployment risk and meeting probabilities are functions of worker fixed effect α_i and vary over the life-cycle.

Wage Setting

- Bargain over the piece rate, $R \in [0,1]$, $W_t^{ij} = Re^{p_t^j + h_t^i}$.
- This setup generates
  - job-to-job changes with wage cuts (for better future earnings growth)
  - endogenous large wage increases on the job due to employer competition.
- Recalls also help us generate large wage cuts for stayers, very prevalent in the data.

Estimation Results

Estimation Methodology

- Estimate using Simulated Method of Moments.
  - Create an employer-employee panel mimicking the SSA sample.

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Targeted moments

1. Higher-order moments (skewness and kurtosis) of 1-year earnings growth.

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  - Create an employer-employee panel mimicking the SSA sample.

Targeted moments

1. Higher order moments (skewness and kurtosis) of 1-year earnings growth.
   - conditional on LE and age,
   - Separately for stayers and switchers.
2. fraction of stayers and non-stayers conditional on LE income and age, their average income growth.

How to Identify the Different Sources of Earnings Growth?

Earnings growth among people differs for several reasons

1. Heterogeneity in returns to experience: β
2. Speed of climbing the ladder: $\lambda_0, \lambda_1, \delta$
3. Productivity shocks/unexplained variation: ϵ

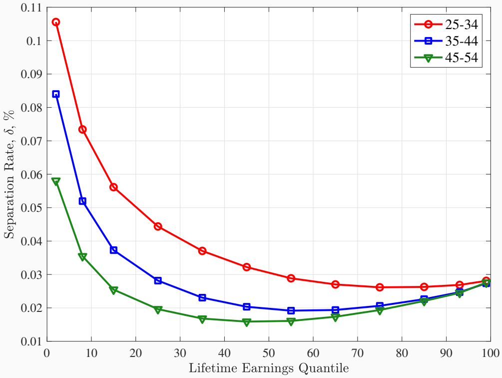
Key insight: exploit differences earnings growth between stayers and switchers.

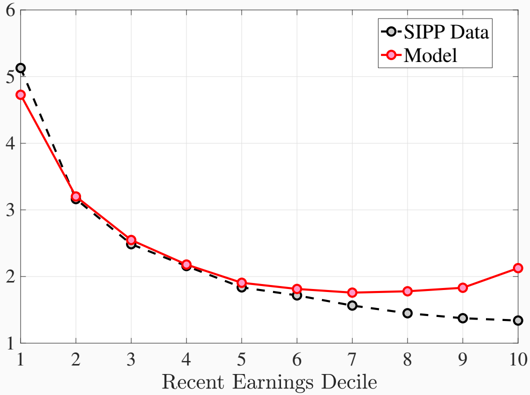
- If job ladder is not important, they should experience similar growth, driven by β.
- Differences in the distribution of earnings growth between stayers and switchers over the LE are informative about the nature of the job ladder risk.

Estimation Results

Parameter Estimates

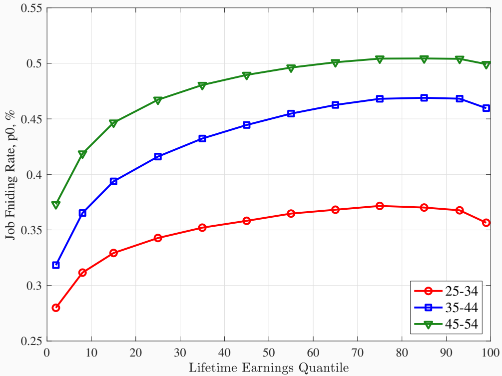
Heterogeneity in Unemployment Risk

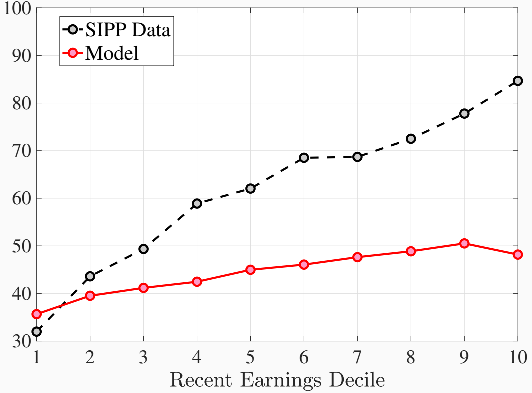




- Large heterogeneity in EU by income and age, overall consistent with the data.

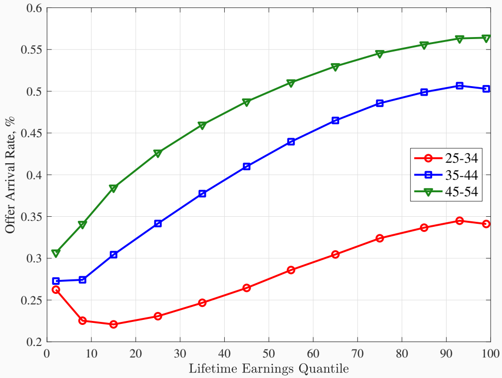
Heterogeneity in Job Finding Rate

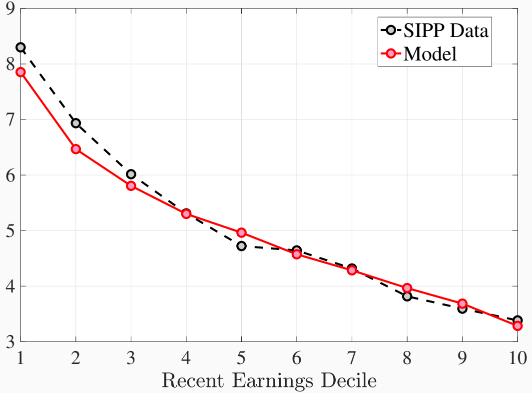




- The model generates an increasing pattern of UE w.r.t. RE
- The variation is much less pronounced compared to the data.

Heterogeneity in the Contact Rate





- λ_1 is increasing by LE, whereas EE is declining (matches the SIPP).
- Higher offer arrival rate by income in the NY Fed SCE data.

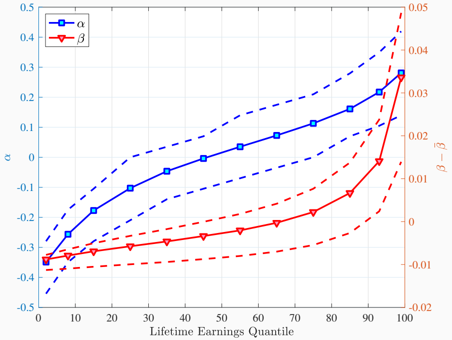
Heterogeneity in the Contact Rate

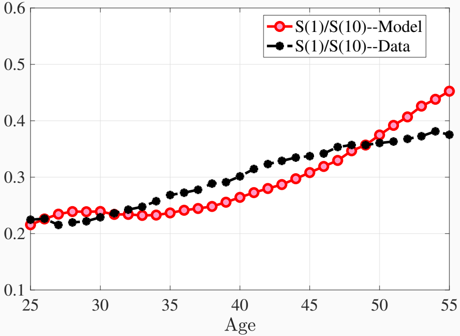
Recent earnings groups	1-25%	26-50%	51-75%	76-94%	95+%
Total Number of Contacts	0.18	0.18	0.13	0.26	0.43
Unsolicited Contacts	0.09	0.02	0.04	0.11	0.43

Note: Respondents age 25-55. Individuals who report 25 or more contacts in the last 4 weeks are dropped from the sample. We assign zero contacts for those reporting a positive number of contacts but none corresponding with either (i) an employer directly online or through email, (ii) an employer directly through other means, including in-person, or (iii) an employment agency or career center (including a career center at a school or university).

- Higher offer arrival rate by income in the NY Fed SCE data.

Ex-ante Heterogeneity (α, β)



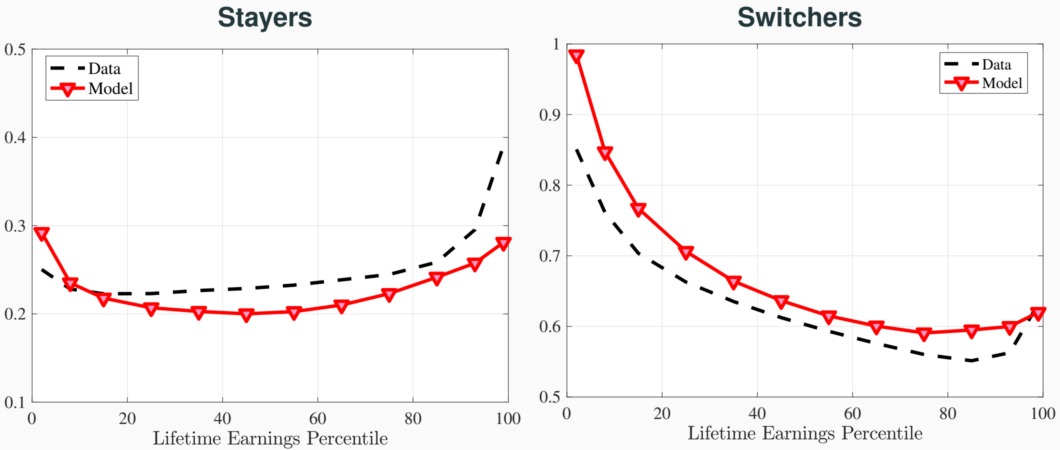


- Higher LE workers have higher α and β, $corr(\alpha, \beta) \sim 0.40$.
- Pareto tails of β distribution needed to capture the large growth at the top.
- Along with Pareto firm distribution, Pareto β generates fractal top inequality:
  $\frac{S(p/10)}{S(p)} = \frac{S(p'/10)}{S(p')}$

Estimation Results

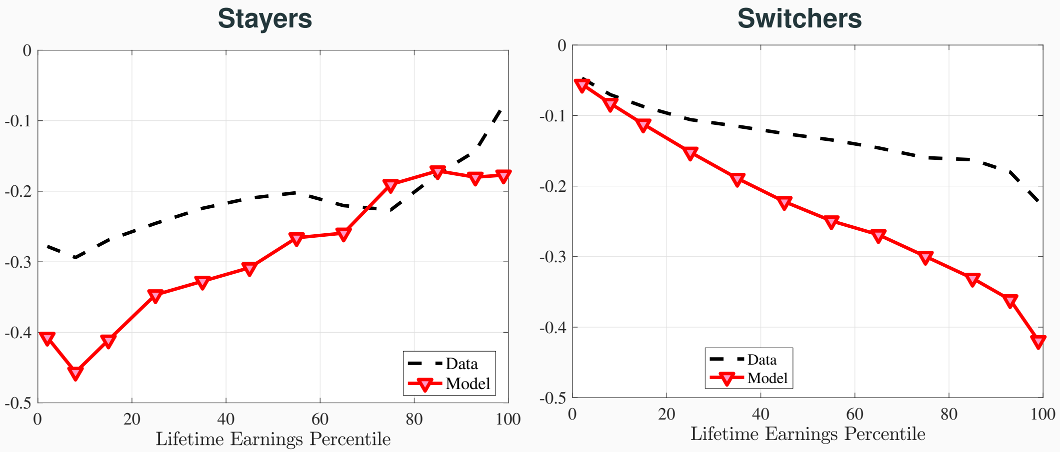
Model Fit

Standard Deviation of Arc Percent Growth, $2\frac{Y_{t+1}-Y_t}{Y_{t+1}+Y_t}$



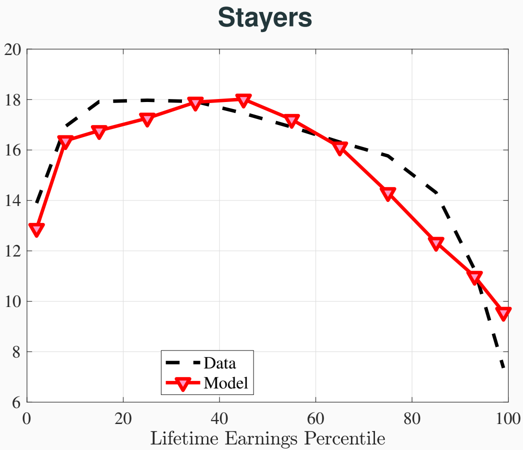
- Captures the variation over the LE and between stayers and switchers.

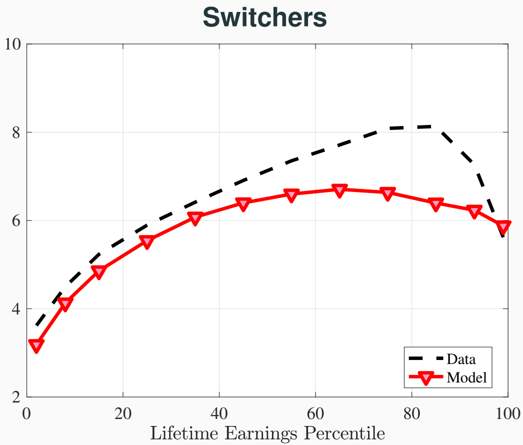
Skewness of Arc Percent Growth, $2\frac{Y_{t+1}-Y_t}{Y_{t+1}+Y_t}$



- Captures the variation over the LE and between stayers and switchers.

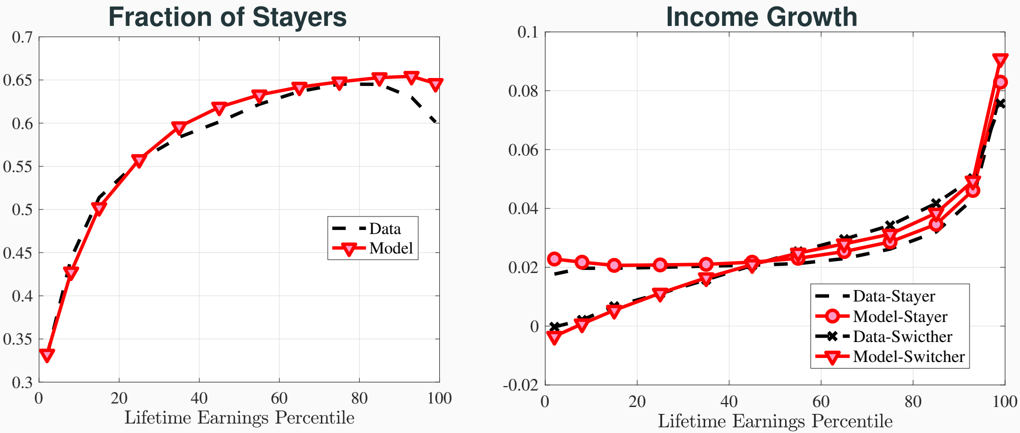
Kurtosis of Arc Percent Growth, $2\frac{Y_{t+1}-Y_t}{Y_{t+1}+Y_t}$





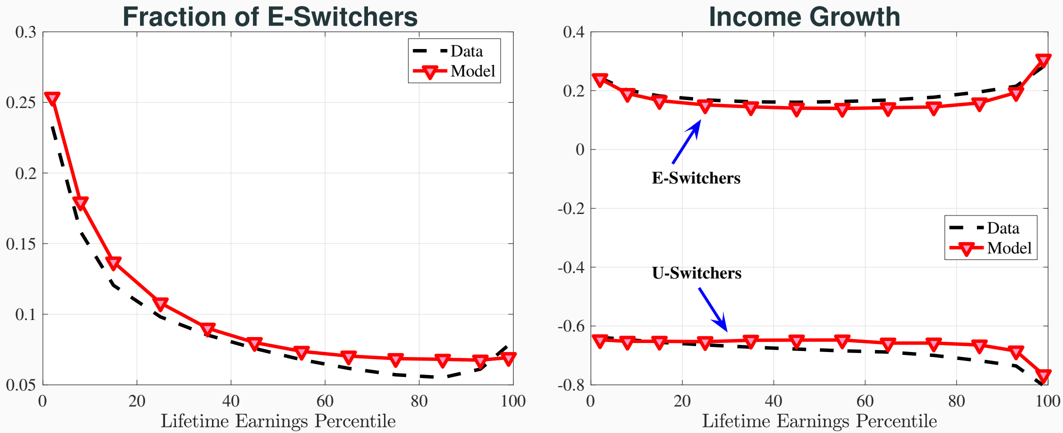
- Captures the levels and patterns of kurtosis between stayers and switchers fairly well.

Fraction of Stayers and Income Growth



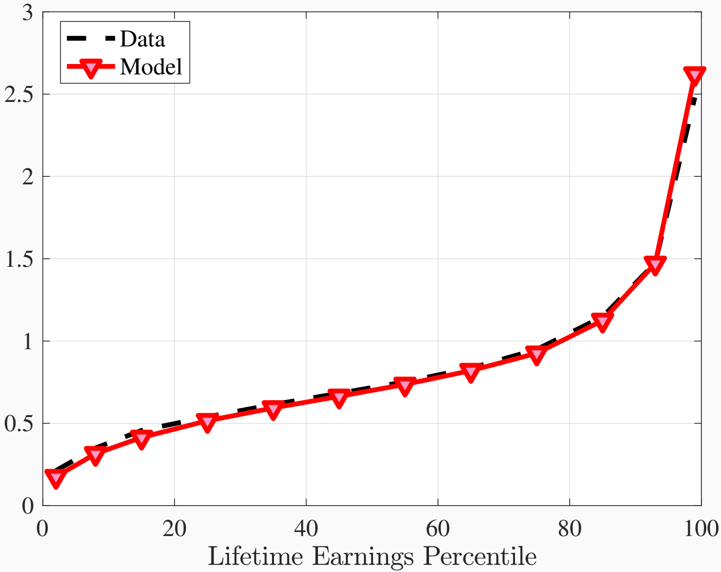
- Matches the share of stayers and captures stayer and switcher income growth.

Fraction of E-Switchers and Income Growth



- Matches the fraction of E-switchers and their income growth remarkably well.

Earnings Growth Between 25 and 55—Not Targeted

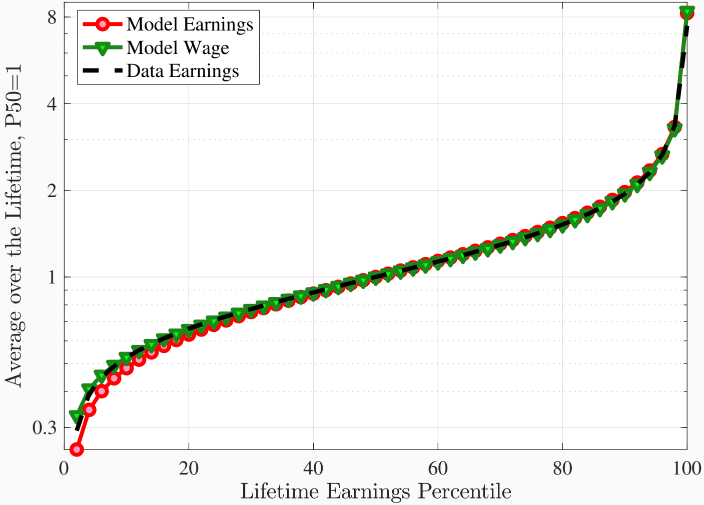


- The model captures earnings growth differences well throughout the LE distribution.

Estimation Results

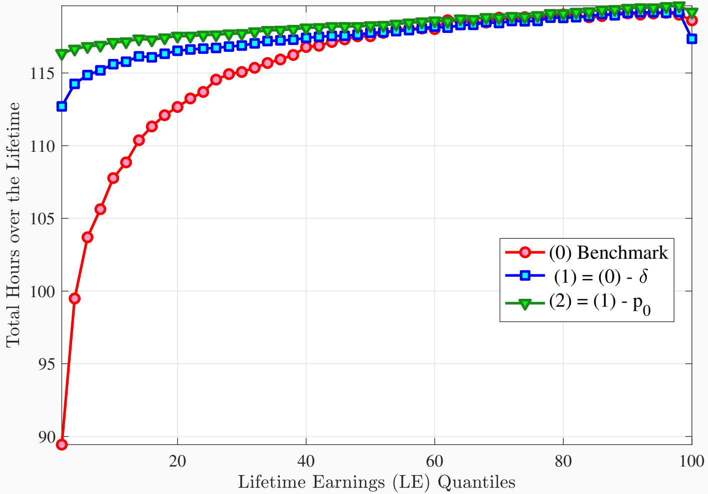
Decomposition of Lifetime Earnings

Lifetime Earnings and Wages



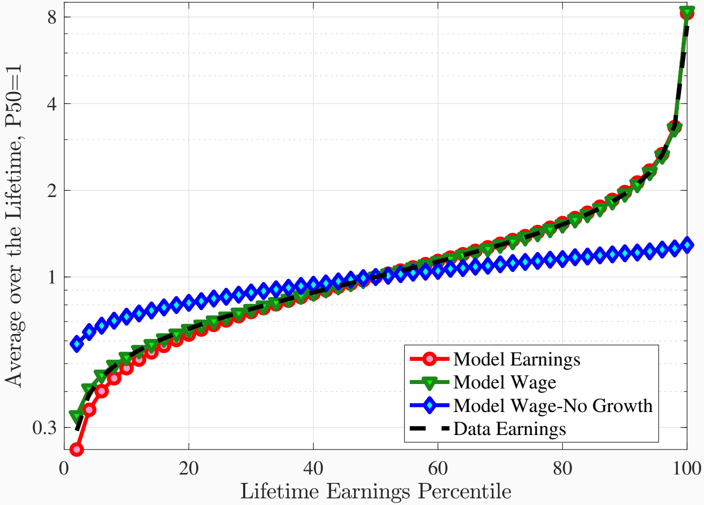
- matches lifetime earnings inequality.
- most inequality due to wages.
- except at the bottom: lifetime employment is lower.

Lifetime Employment



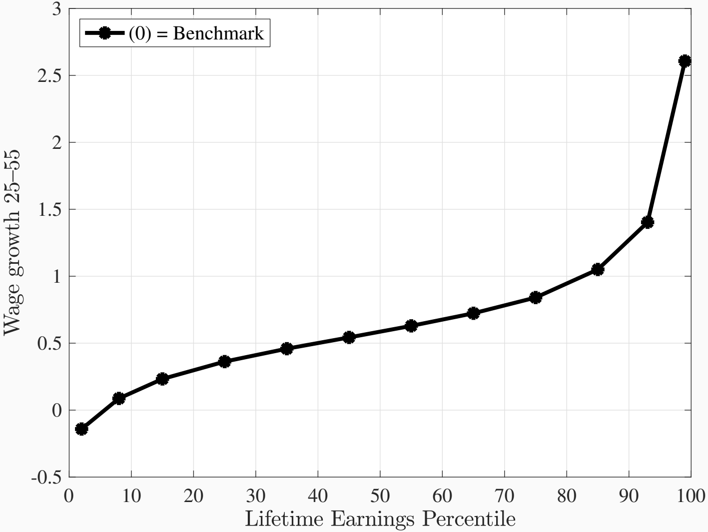
- 25% lower employment at the bottom.
- mostly due to higher unemployment risk and (somewhat) lower job finding rate.
- Little role to ex-post luck.

Lifetime Earnings and Wages



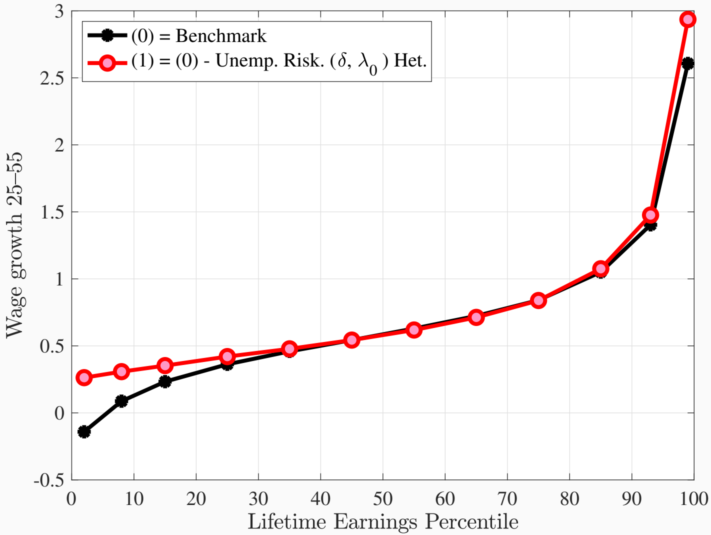
- Most of the wage inequality is due to differences in wage growth.
- What explains the differences in wage growth?

Decomposing Differences in Wage Growth



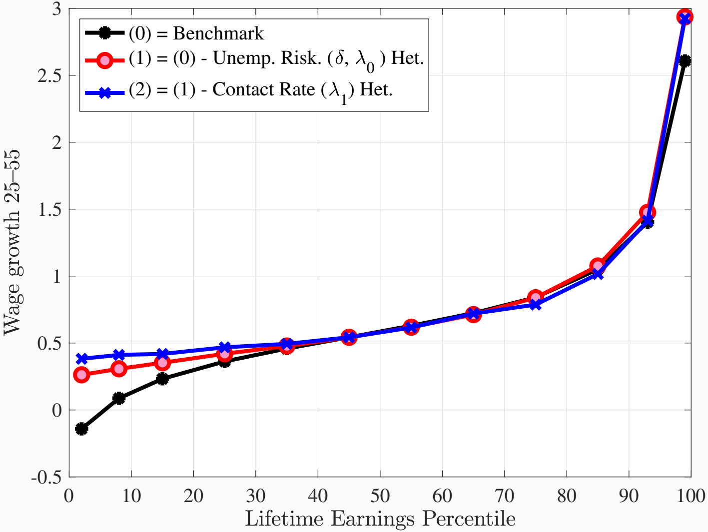
- We shut down each heterogeneity one after another, until we eliminate all differences.
- We keep the rankings of workers the same (i.e., not sorting again under new parameters).

Decomposing Differences in Wage Growth



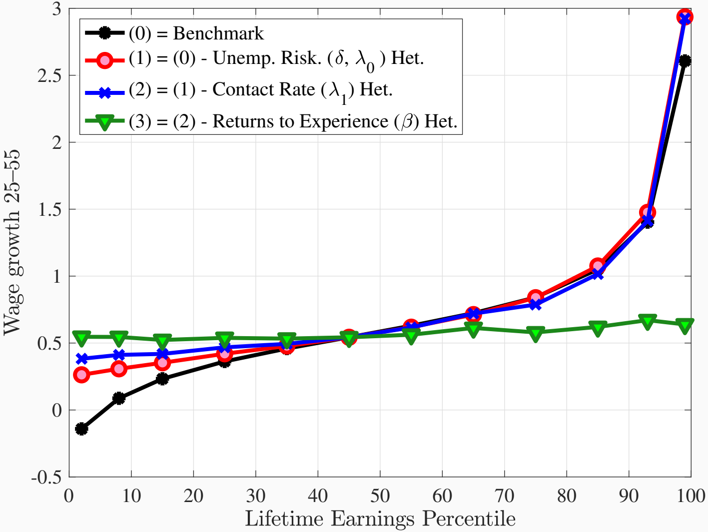
- Suppose all workers face the same unemployment risk, δ and job finding rate λ_0 as the $\alpha = 0$.
- Large effect at bottom.
- Also significant effect at the top.

Decomposing Differences in Wage Growth



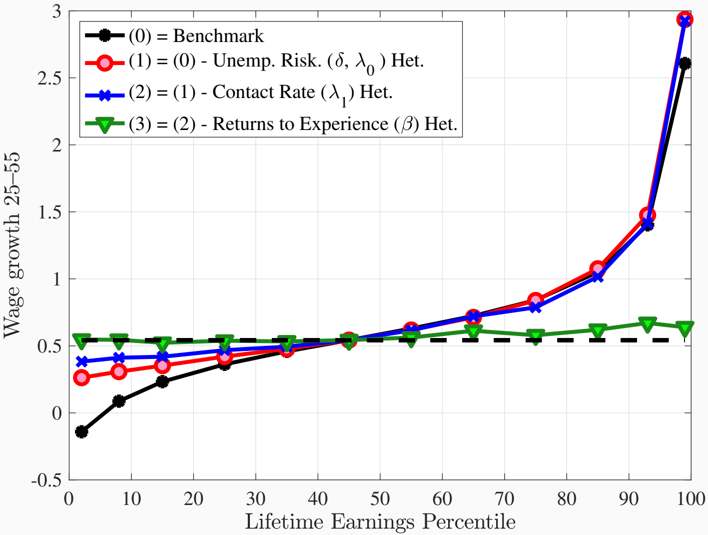
- Suppose now all workers also receive same number of outside offers λ_1 as $\alpha = 0$.
- 80% of differences between the bottom and median vanish.

Decomposing Differences in Wage Growth



- Suppose now all workers also face the same returns to experience β.
- Above the median growth differences vanish.
- Sizable effect at the bottom.

Decomposing Differences in Wage Growth



- The rest due to ex-post productivity and job ladder shocks.
- Luck plays a very limited role.

Conclusion

Conclusions

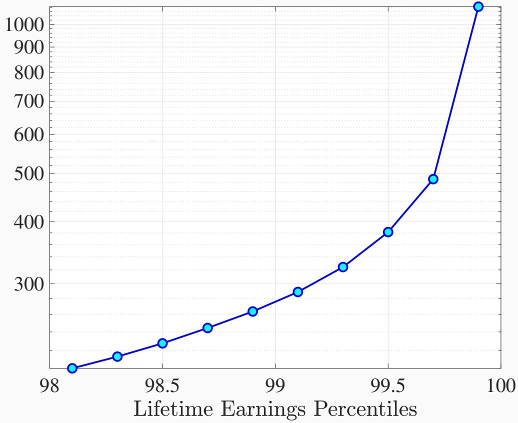
- We studied the reasons behind the vast heterogeneity in lifetime earnings.
- 2 different mechanisms for different parts of the LE: “Jobs” vs “Careers”
  - Below median LE: mainly heterogeneity in job ladder risk.
  - Above median LE: mostly heterogeneity in returns to experience.
- Ex-ante vs. ex-post debate: Ex-ante differences are more important than we think.

Appendix

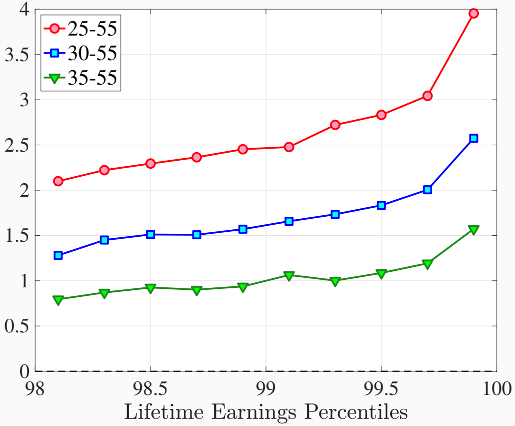
Appendix

Top Earnings Inequality

Lifetime Earnings Inequality in top 1%



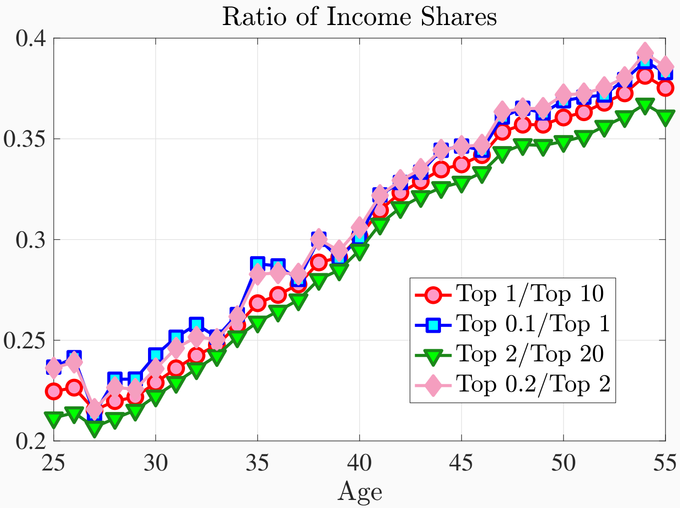
(g) Average earnings over the lifetime, $1,000



(h) Lifetime earnings growth, $\log \overline{Y}_{55} - \log \overline{Y}_h$

Note: The left panel shows the average annual earnings over the life cycle for each LE group. The right panel

Top Income Shares over the Life Cycle



- The earnings distribution has Pareto tails at each age with a declining pareto tail index (growing inequality).

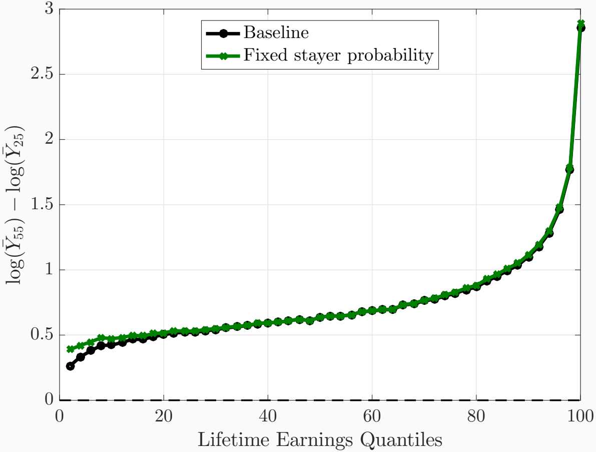
Appendix

Decomposition from the Data

A simple decomposition of earnings growth

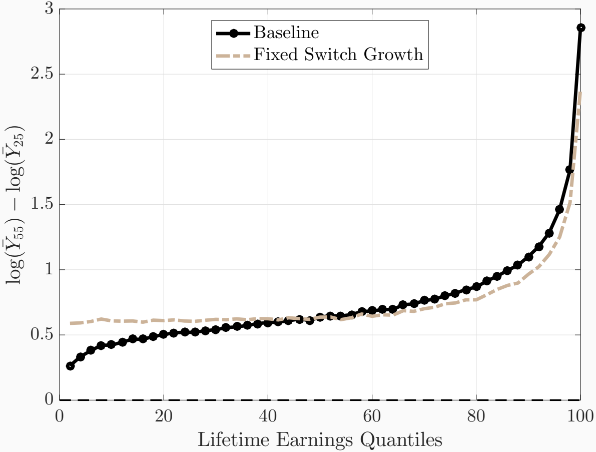
- Differences in lifetime income growth can be due to heterogeneity in:
  1. Probability of being a stayer,
  2. Switcher income growth,
  3. Stayer income growth.
- Shut down heterogeneity one at a time by assigning the level corresponding to median LE workers
- Compute the resulting income growth profile.

Stayer Probability Heterogeneity



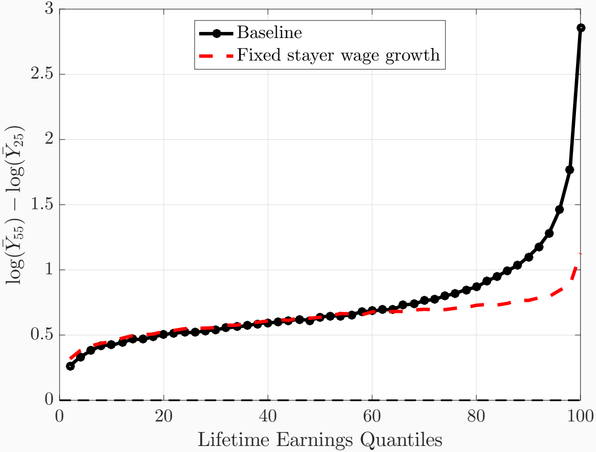
- Heterogeneity in stayer probability plays a very small role.
  - Above median no heterogeneity in stayer probability.
  - Below median stay and switch growth are similar.

Switcher Income Growth Heterogeneity



- Heterogeneity in switcher income growth is important below median, less so above median.

Stayer Income Growth Heterogeneity



- Heterogeneity in stayer income growth is the main determinant of above median.
- Little heterogeneity in stayer income growth below median.

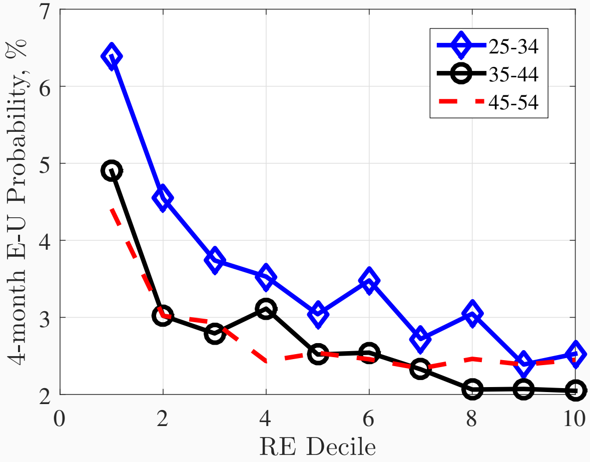
Appendix

Evidence From SIPP

SIPP Data

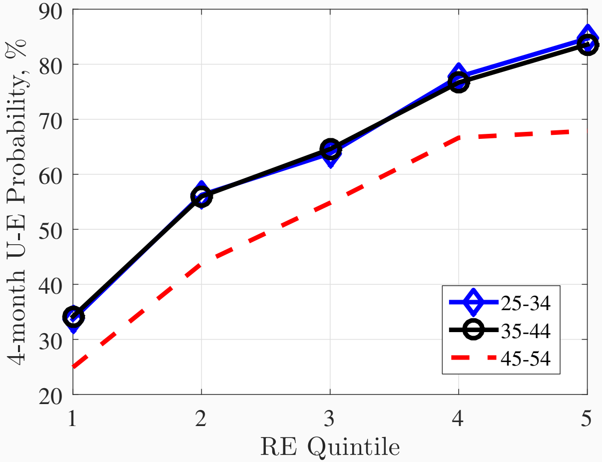
- SSA does not allow us to distinguish between E-U-E, vs. E-E as well as E-N vs. E-U.
- SIPP allows computation of flow probabilities.
- Cannot compute lifetime earnings. Rank people by past income (over 2 years instead).
- Rankings within age groups.

4-Month E-U Probabilities



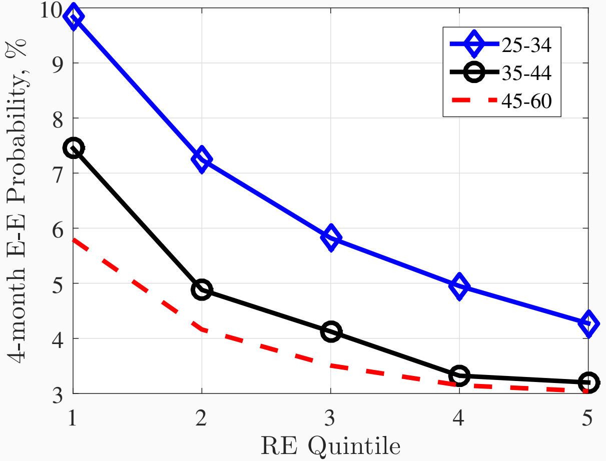
- Unemployment risk is lower for people with higher wages.

4-Month U-E Probabilities



- Job finding rates are higher at the top of the income distribution.

4-Month E-E Probabilities



- Job-to-job switches are more common at the bottom.

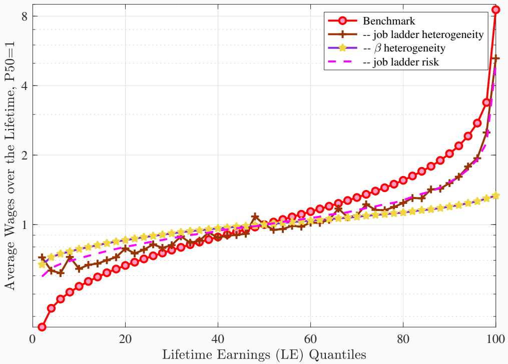
Appendix

Model Decomposition

Identification

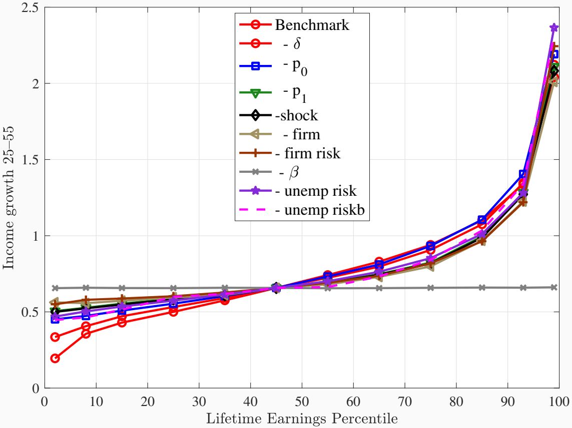
- Inequality at the beginning of life informs us on α.
- Wage growth of job stayers most informative about β.
- The left tail of the earnings change distribution of job switchers is due to long nonemployment spells (δ, λ_0).
- Fraction of EE-switchers informative about λ_1.
- Wage growth of (EE-)switchers informative about the firm distribution.
- Wage growth of stayers informative about the distribution of ϵ_{it}.

Decomposition of Lifetime Wages



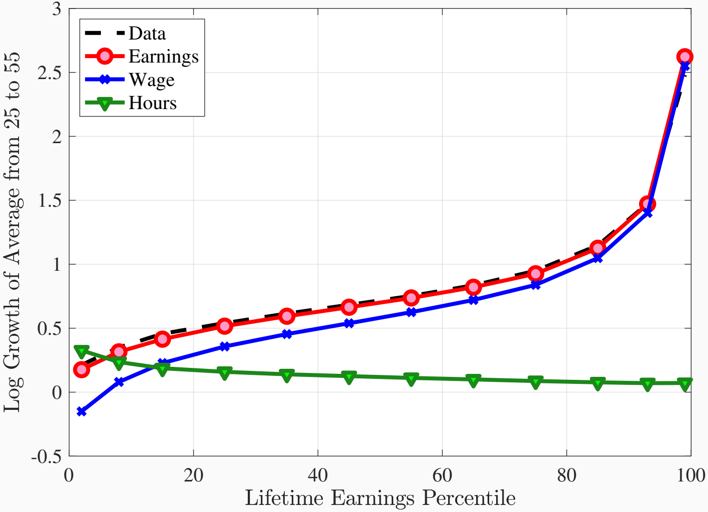
- Heterogeneity in job ladder risk and its ex-post idiosyncratic risk as well as alpha heterogeneity are important below median.
- Beta heterogeneity explains most of the income growth heterogeneity above median.

Decomposition of Earnings Growth



- Job ladder heterogeneity/risk is important below median.
- Beta heterogeneity explains most of the income growth heterogeneity above median.

Decomposition of Earnings Growth



- Over the life cycle hours grow as workers settle into stable jobs (especially bottom LE).
- Wage growth is lower than earnings growth.