On the Nature of Entrepreneurship

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Disclaimer

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This Paper

- Informs theories of entrepreneurship
- How?
  - Assembles novel longitudinal database of business owners
  - Studies patterns of life-cycle income profiles
  - Analyzes determinants of entrepreneurial choice

Data

Sample

- Primary source: administrative IRS data
  - Balanced panel of living individuals with US SSN
  - Tax years 2000-2015
  - Birth cohorts 1950-1975
- Income Measures:
  - Self-employment (SE) income:
    - Schedule C net profits
    - Schedule K-1 ordinary business income
    - W-2 wages of S-corporation owners
  - Paid-employment (PE) income:
    - W-2 wages of non-owners

Employment Status

- Self-employed (SE) in a given year if:
  - |SE income| $>$ 5,000 in 2012\$ **and** at least one of:
    - |SE income| $>$ PE income or
    - Share of gross profits $>$ PE income or
    - Share in business $\times$ employees ≥ 1
- Paid-employed (PE) in a given year if:
  - Not SE
  - PE income $>$ 5,000 in 2012\$
- Non-employed (NE) in a given year if:
  - Not SE or PE

Skill and Education Measures

Skills:

- Individuals with occupation in e-filing
  - Map entry to SOC code
  - Map SOC to cognitive, interpersonal, and manual skills (as in Lise and Postel-Vinay 2020)

- Individuals with missing codes
  - Use AI tools and data for peers with codes

Education:

- Use CPS-based classifier

Life-Cycle Profile Estimation

Object of Interest

$$\text{Income}(\text{Age} \mid \text{Individual and aggregate factors})$$

Estimation Procedure

- Statistical model for income:

$$y_{it} = \alpha_i + \beta_{g(i),t} + \sum_{a=a_0}^{a(i,t)} \gamma^a_{c(i),g(i)} + \epsilon_{i,t}$$

  where

  - $i \in \mathcal{I}$ is set of individuals
  - $t \in \mathcal{T}$ is set of calendar dates
  - $c \in \mathcal{C}$ is set of birth years
  - $a \in \mathcal{A}$ is set of ages
  - $g \in \mathcal{G}$ is set of groups partitioning $\mathcal{I}$

Estimation Procedure

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fixed effects

where

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Estimation Procedure

- Statistical model for income:

$$y_{it} = \alpha_i + \beta_{g(i),t} + \sum_{a=a_0}^{a(i,t)} \gamma^a_{c(i),g(i)} + \epsilon_{i,t}$$

time effects

where

  - $i \in \mathcal{I}$ is set of individuals
  - $t \in \mathcal{T}$ is set of calendar dates
  - $c \in \mathcal{C}$ is set of birth years
  - $a \in \mathcal{A}$ is set of ages
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Estimation Procedure

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$$y_{it} = \alpha_i + \beta_{g(i),t} + \sum_{a=a_0}^{a(i,t)} \gamma^a_{c(i),g(i)} + \epsilon_{i,t}$$

age effects

where

  - $i \in \mathcal{I}$ is set of individuals
  - $t \in \mathcal{T}$ is set of calendar dates
  - $c \in \mathcal{C}$ is set of birth years
  - $a \in \mathcal{A}$ is set of ages
  - $g \in \mathcal{G}$ is set of groups partitioning $\mathcal{I}$

Estimation Procedure

- Estimation of time ($\Delta\beta$), age (γ) effects:

$$\Delta y_{i,t} = \underbrace{\Delta\beta_{g(i),t} + \gamma^{a(i,t)}_{c(i),g(i)}}_{\text{identification}} + \Delta\epsilon_{i,t}.$$

- Identification:
  - Assume that age effects are constant across binned cohorts
  - Normalize time effects to reflect group-specific growth

▸ More details on identification assumptions

Application: set $\mathcal{G}$ with 46,080 subgroups

- Time-invariant characteristics include usual ones:
  - Cohort, gender, educated, skilled (cognitively, interpersonally, manually), industry, married, children
- Plus partition sample based on *Employment attachment*
  - Attached SE, Attached PE, Switchers ▸ Definitions

Comparisons Central for Analysis

- Attached SE vs PE growth informs differences in:
  - Preferences for amenities, risk, etc.
  - Productivities in SE/PE
  - Investment opportunities
  - Non-compliance opportunities
- Switchers vs non-swithcers informs entrpreneurial choice

Main Empirical Results

Income and Growth Profiles

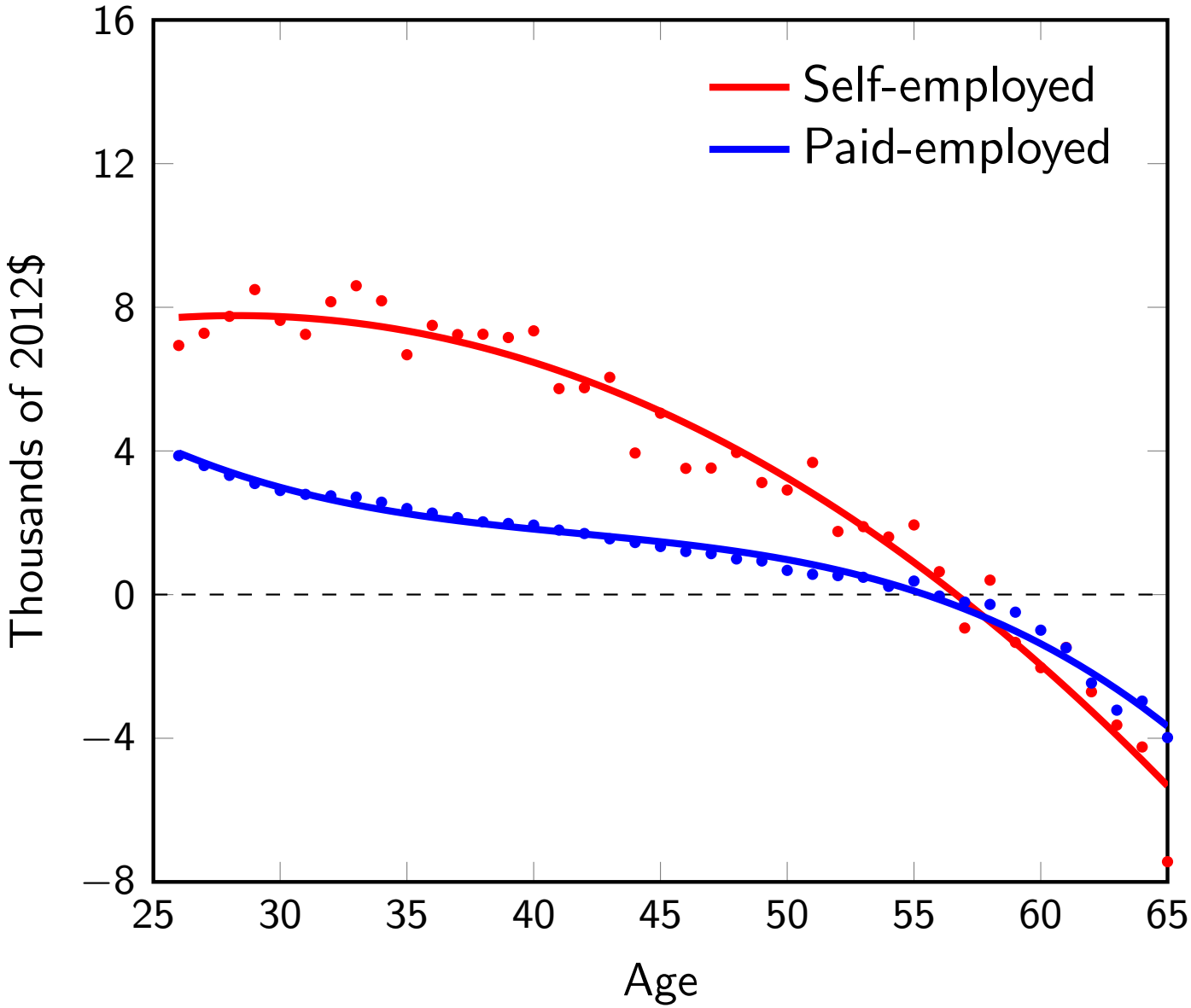
- Attached self-employed
  - Income similar on average to paid-employed when 25
  - Growth significantly higher and more persistent

$\Rightarrow$ Entrepreneurial investment does pay

Income Profiles: Attached Subsamples

Add Switchers

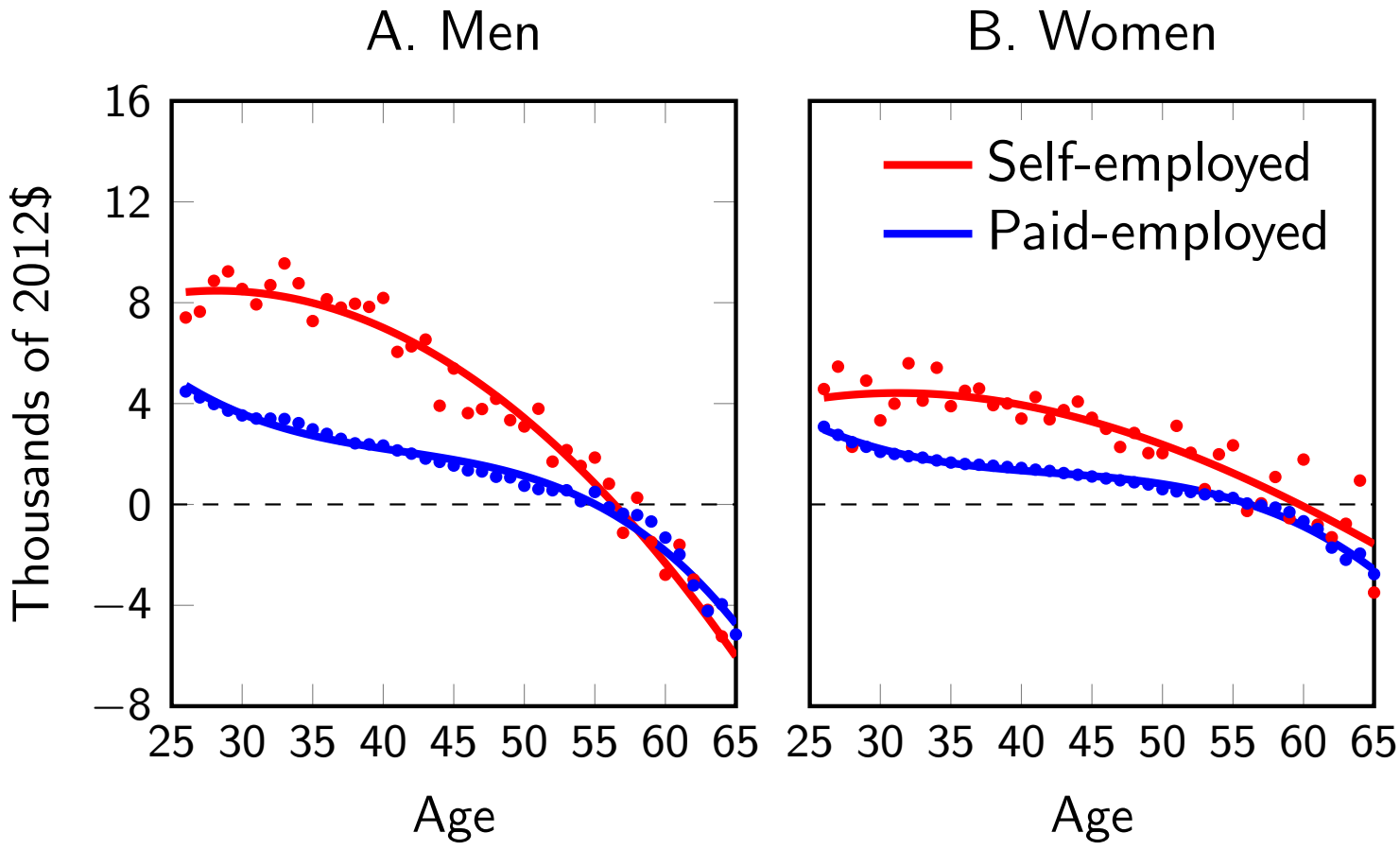
Growth Profiles: Attached Subsamples



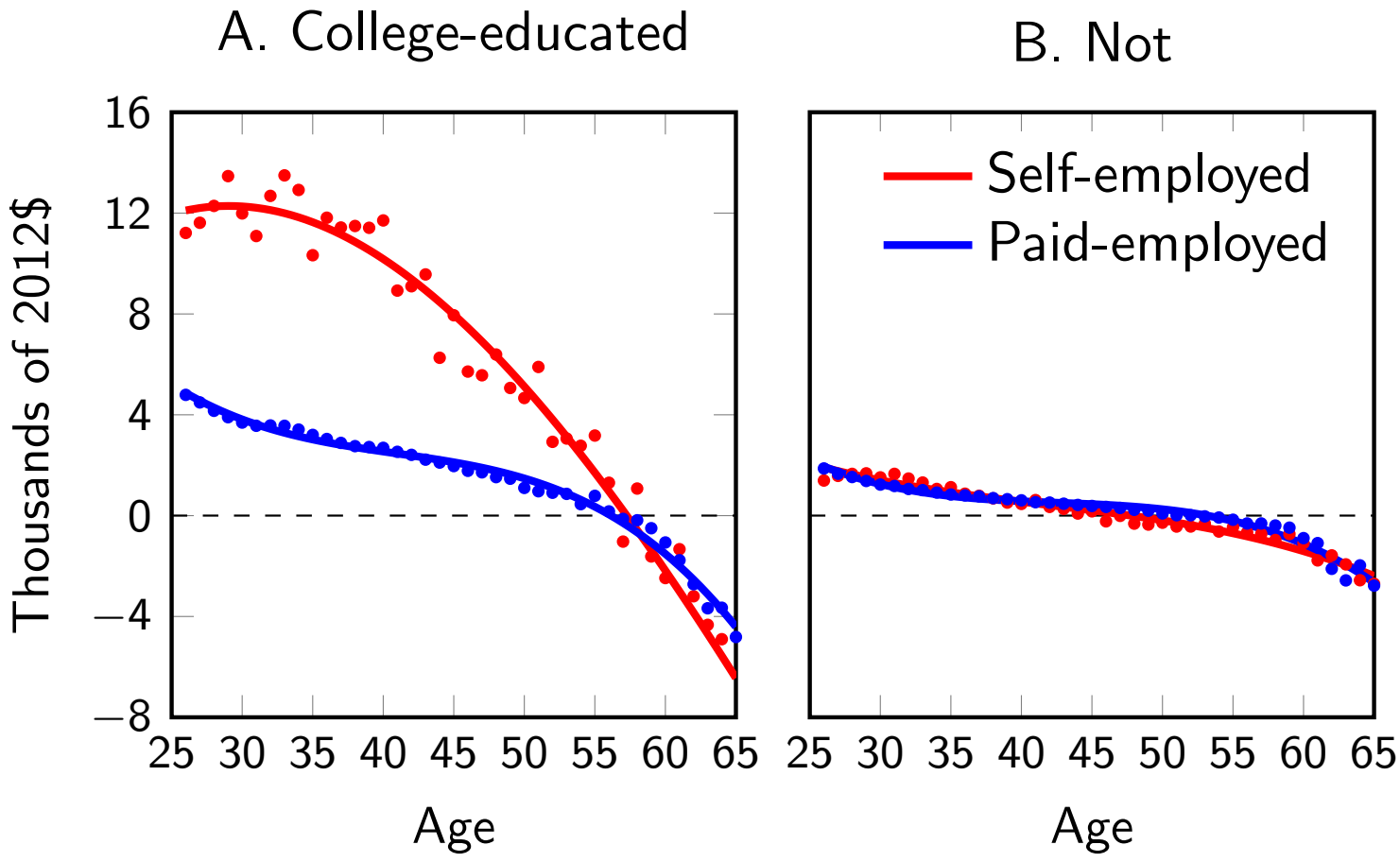
▸ Time Effects

Disaggregating the Main Results for Attached Subsamples

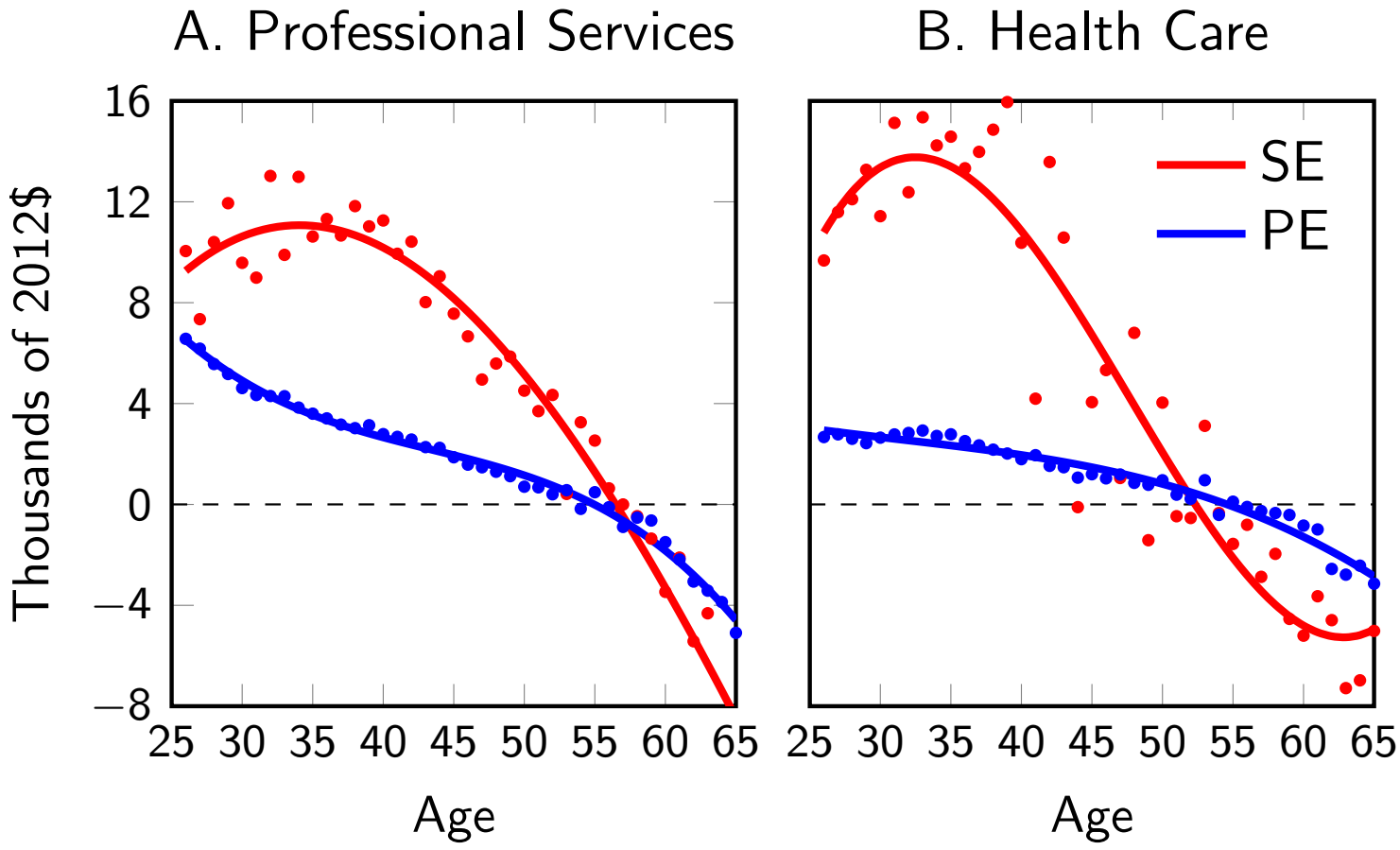
Growth Profiles: By Gender



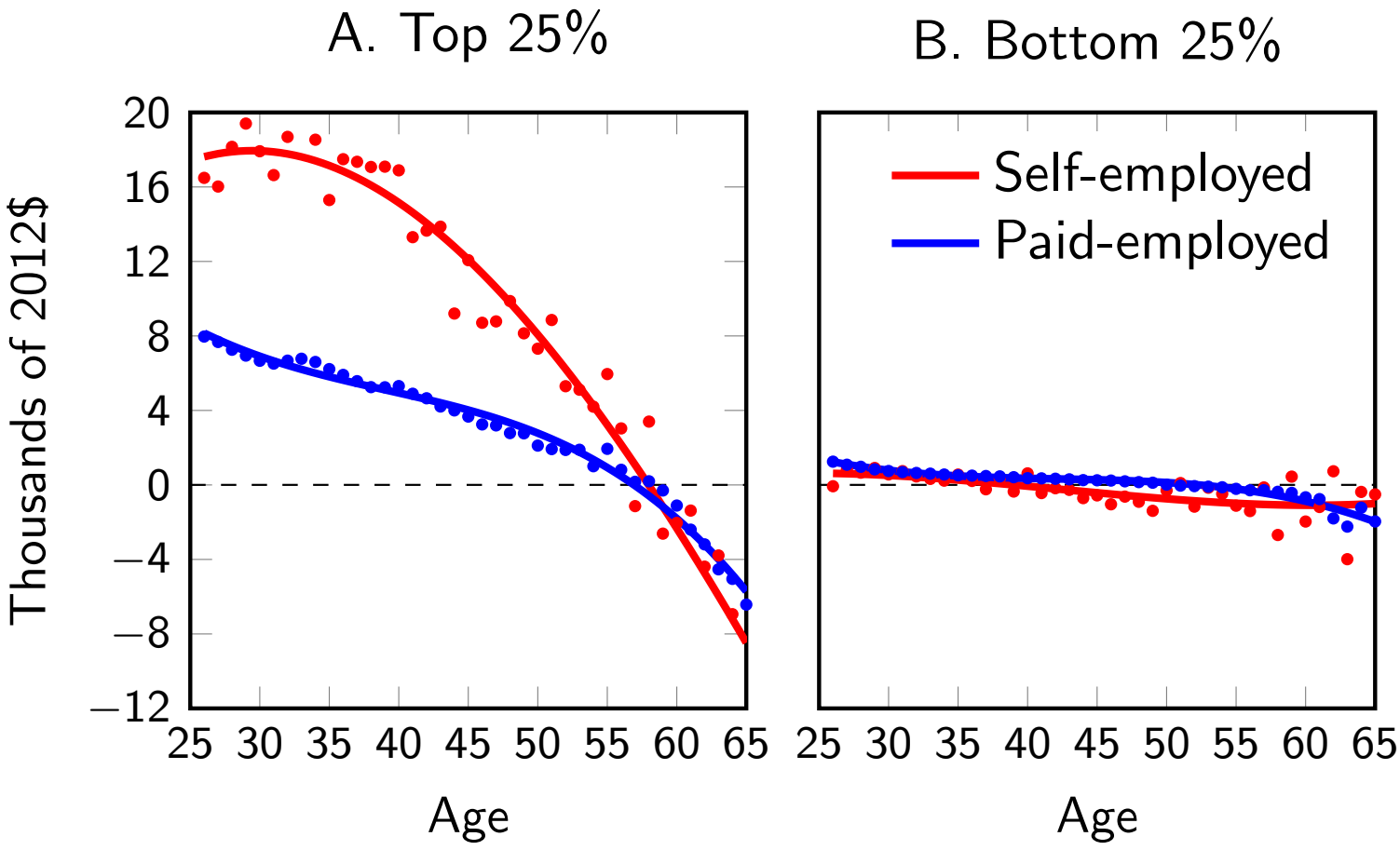
Growth Profiles: By Education



Growth Profiles: By Industry



Growth Profiles: By Income Ranks



Down to the Subgroup Level: An Example

Down to the Subgroup Level: An Example

- Consider

Down to the Subgroup Level: An Example

- Consider
  - Men

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated
  - Not cognitively skilled

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated
  - Not cognitively skilled
  - Interpersonally skilled

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated
  - Not cognitively skilled
  - Interpersonally skilled
  - Not manually skilled

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated
  - Not cognitively skilled
  - Interpersonally skilled
  - Not manually skilled
  - Working in professional services

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated
  - Not cognitively skilled
  - Interpersonally skilled
  - Not manually skilled
  - Working in professional services
  - Attached to paid- or self-employment

Down to the Subgroup Level: An Example

- Consider
  - Men
  - Married
  - With kids
  - Educated
  - Not cognitively skilled
  - Interpersonally skilled
  - Not manually skilled
  - Working in professional services
  - Attached to paid- or self-employment

$\Rightarrow$ Just 2 of the 46,080 groups

Growth Profiles: Example subgroups

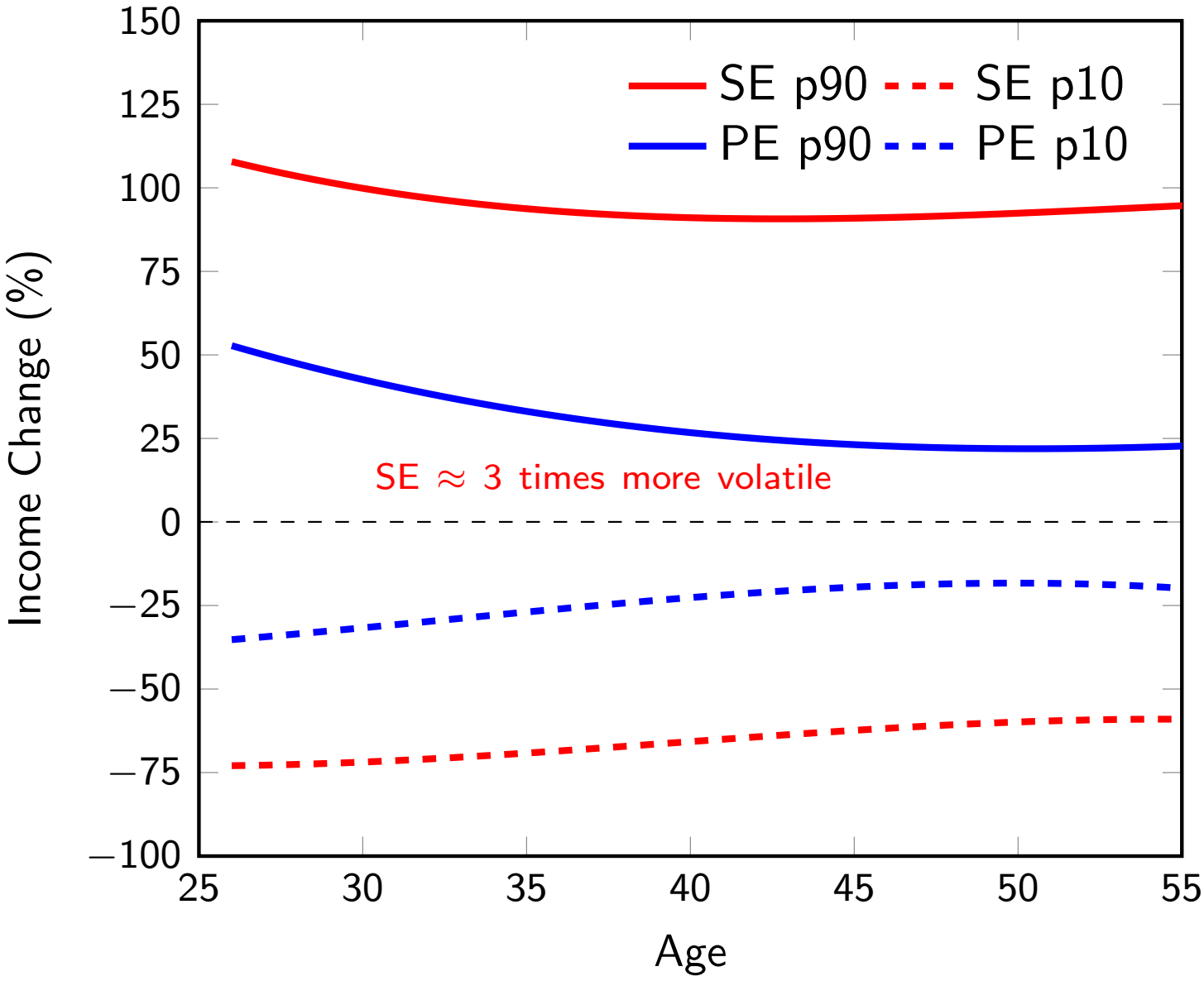
Volatility Patterns

- Large literature on risk in entreprenurship
  - Is SE more risky than PE? By how much?
  - Are differences in growth driven by increasing risk over age?
- Compute distribution of residuals (net of time-age effects)

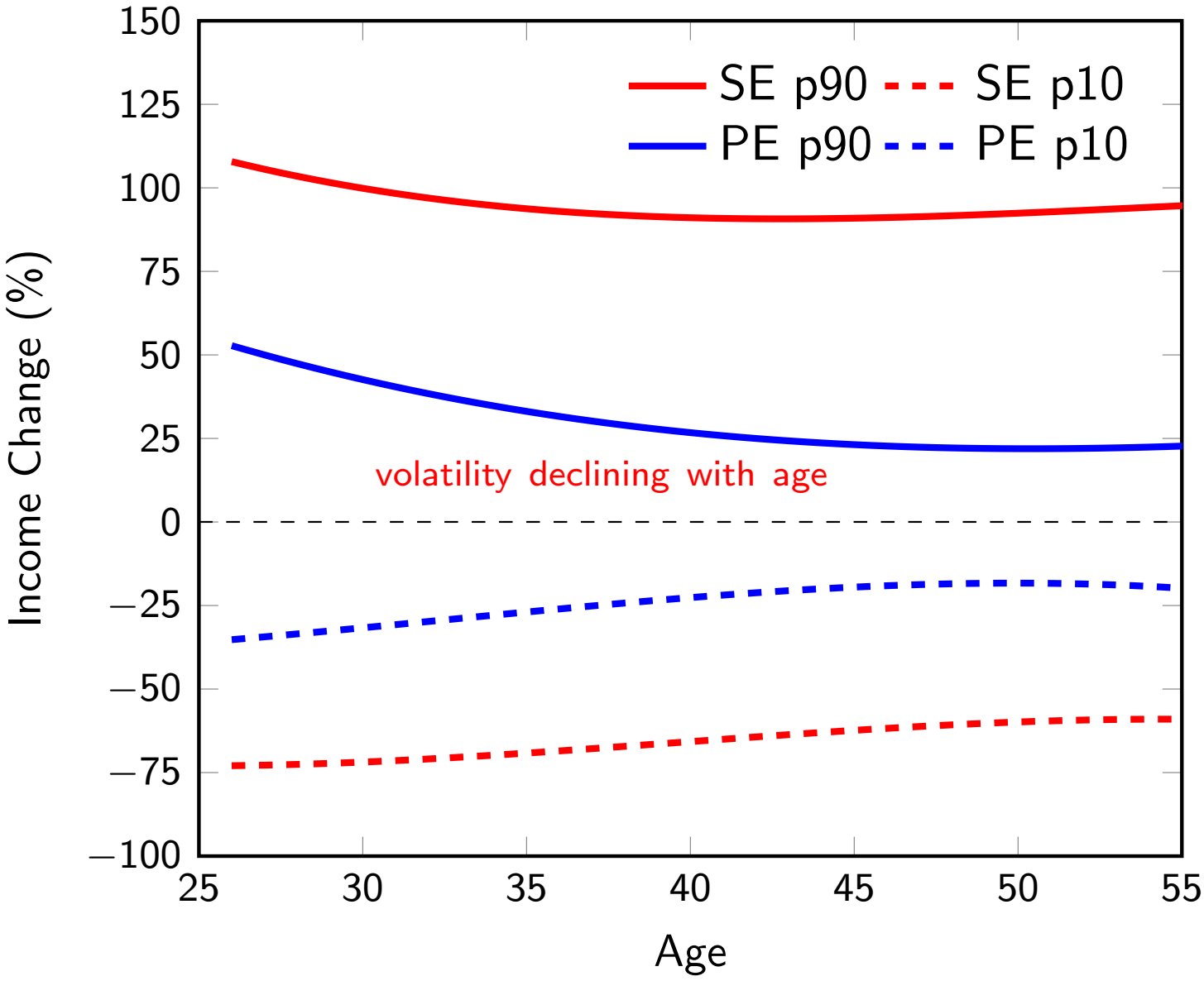
$$\Delta \epsilon_{i,a} / |y_{i,a-1}|$$

- Compare SE and PE
  - Plot 10^{th} and 90^{th} percentiles by age and employment status

Income More Volatile for Attached SE



Income More Volatile for Attached SE



Back of the Envelope Welfare Calculation

- With assumptions on
  - Preferences, eg, Epstein-Zin with $\rho \to 0$

$$V_t(\{c_j\}_{j=t}^{\infty}) = \left[(1-\beta)c_t^{\rho} + \beta(E_t V_{t+1}^{\alpha})^{\rho/\alpha}\right]^{\frac{1}{\rho}}$$

  - Income processes, eg, random walk r_t plus temporary z_t

- Can match moments for income growth:
  - 90-10 difference in growth, $Q = 2.56\sqrt{\sigma_r^2 + 2\sigma_z^2}$
  - Autocorrelation, $A = -\sigma_z^2/(\sigma_r^2 + 2\sigma_z^2)$

- To infer fraction of wealth λ sacrificed to fully insure $c = y$

$$\lambda = -0.5\alpha\beta\sigma_r^2$$

Back of the Envelope Welfare Calculation (SE/PE Ratio)

- With assumptions on
  - Preferences, eg, Epstein-Zin with $\rho \to 0$

$$V_t(\{c_j\}_{j=t}^{\infty}) = \left[(1-\beta)c_t^{\rho} + \beta(E_t V_{t+1}^{\alpha})^{\rho/\alpha}\right]^{\frac{1}{\rho}}$$

  - Income processes, eg, random walk r_t plus temporary z_t

- Can match moments for income growth:
  - 90-10 difference in growth, $Q = 2.56\sqrt{\sigma_r^2 + 2\sigma_z^2}$ (≈ 3)
  - Autocorrelation, $A = -\sigma_z^2/(\sigma_r^2 + 2\sigma_z^2)$ (≈ 1)

- To infer fraction of wealth λ sacrificed to fully insure $c = y$

$$\lambda = -0.5\alpha\beta\sigma_r^2 \qquad (\approx Q^2 = 9)$$

Analysis of Entrpreneurial Choice with Full Sample

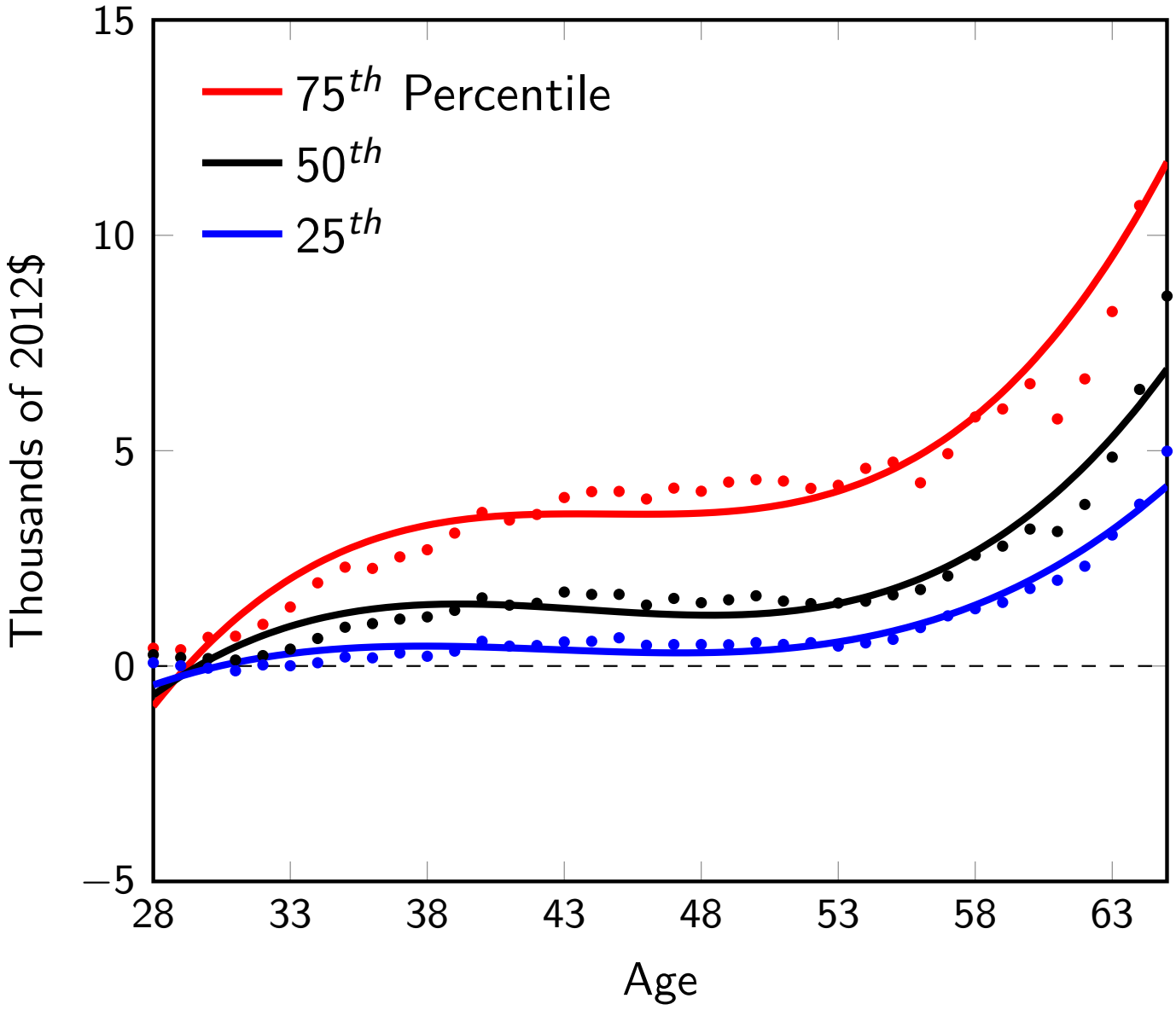
Entrepreneurial Choice

- Entry and exit rates
  - Results similar to surveys
- Use switchers to study
  - Key determinants of choosing self-employment

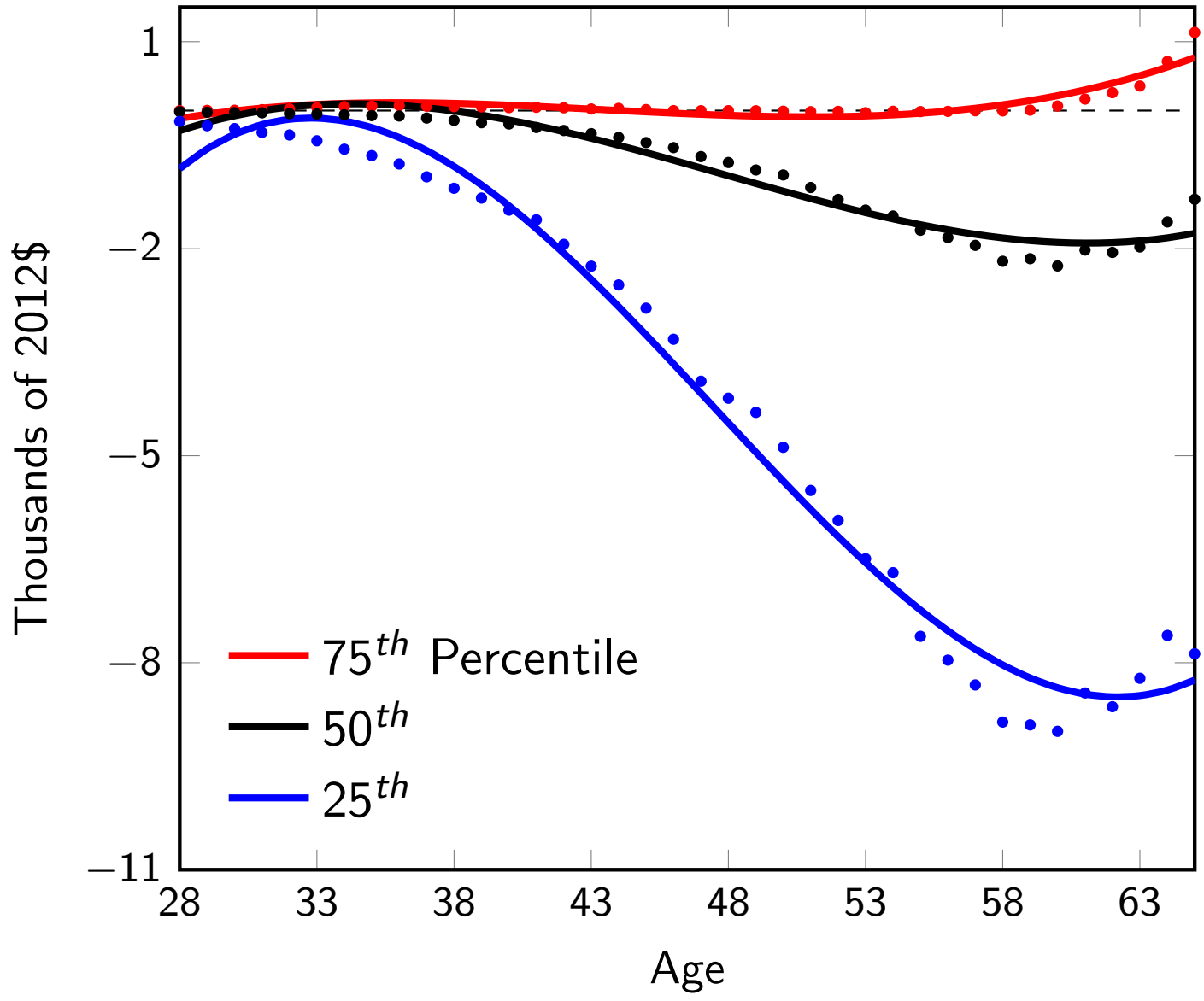
Determinants of Self-Employment

- Compare SE entrants to "similar" peers
  - One-time entrants into SE ("Treatment")
  - Future switchers with same characteristics ("Control")
- Assess "misfit" hypothesis for SE
  - Compare wage income before entry
- Assess "financial-friction" hypothesis for SE
  - Compare asset income before entry

Past Wage Incomes Higher for Switchers



Past Asset Incomes Lower for Switchers



Start-ups: Income in Initial Years

- Consider S-corp/partnership founders in 1970-75 cohort
  - First Schedule K-1 in year business starts
  - Eight years of consecutive tax filings

- Year: business/owner has negative income (%)

  1: 45 / 10
  2: 35 / 9
  3: 32 / 8

- Year: business/owner income first positive (%)

  1: 53 / 90
  2: 19 / 5
  3: 8 / 2

Relation to Survey-based Findings

Most Previous Work

- Uses surveys with
  - Top-coding
  - Short panels
- Concludes that self-employed (relative to peers)
  - Have flatter life-cycle profiles
  - Enter self-employment with lower past labor income
  - Enter with higher past asset income
- Motivates theories where entrepreneurs
  - Earn large non-pecuniary benefits
  - Are misfits
  - Face liquidity constraints

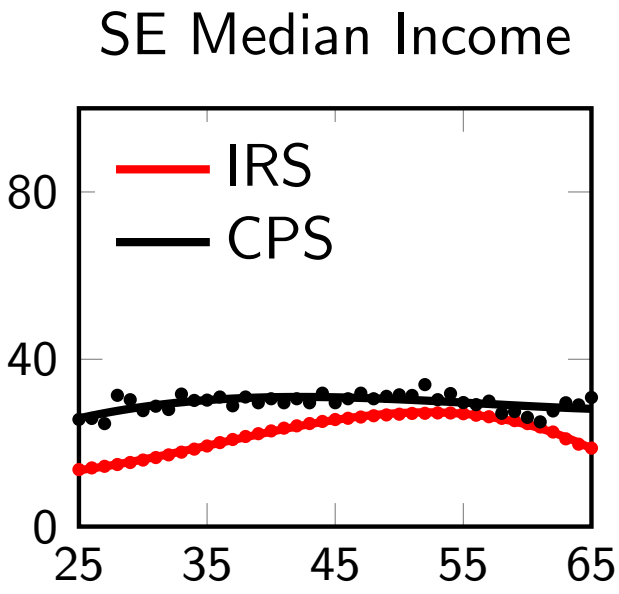
In Contrast to Literature

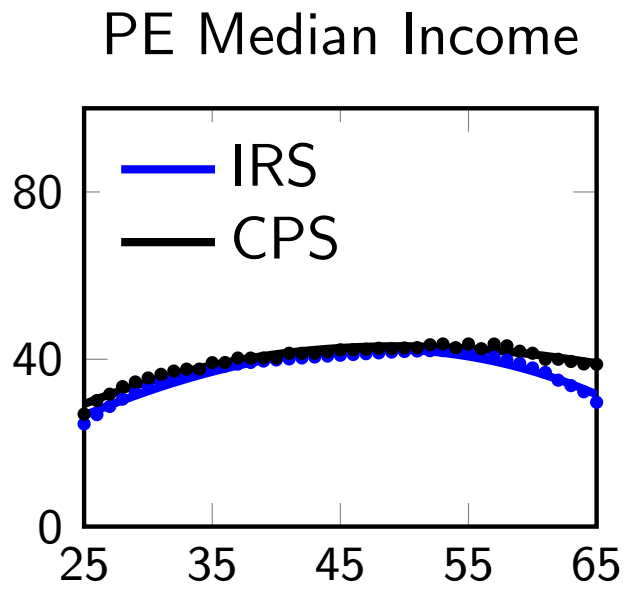
- Use administrative data with
  - No Top-coding
  - Long panels
- Conclude that self-employed (relative to peers)
  - Have significantly steeper life-cycle profiles
  - Enter self-employment with higher past labor income
  - Enter with lower past asset income
- Motivate theories where entrepreneurs
  - Make significant investments in business
  - Are not misfits using SE as fallback
  - Face few liquidity constraints

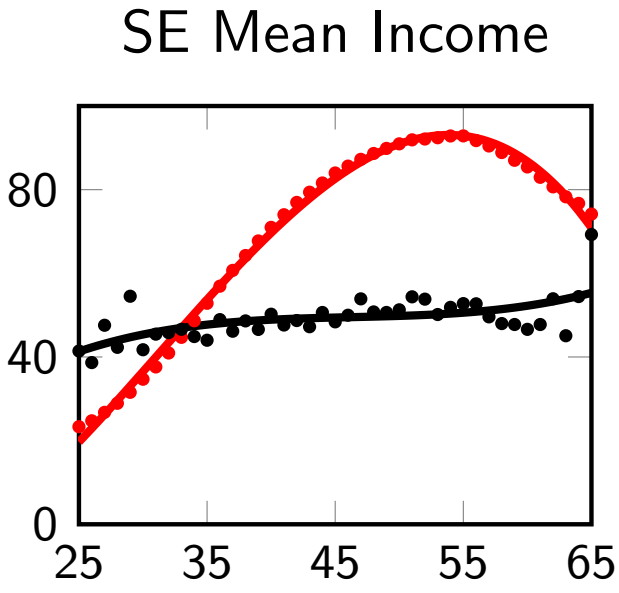
Problems Even with Larger Surveys

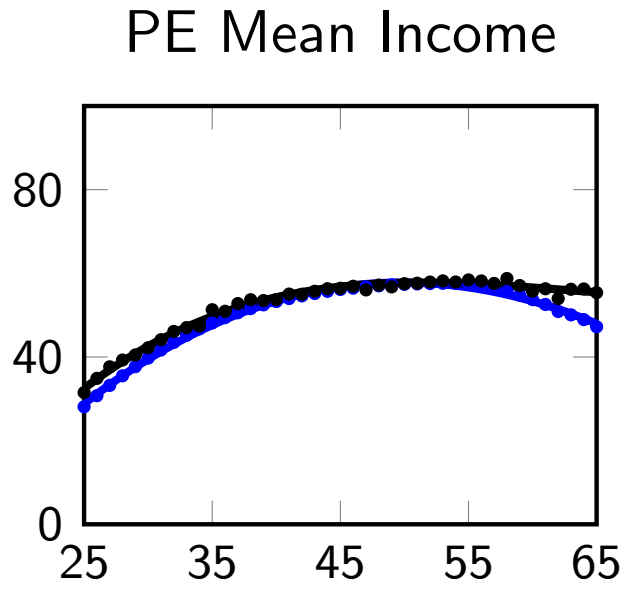
- Compare cross-sectional moments:
  - IRS full population
  - Current population household survey
- Use comparable employment-status categorization:
  - SE if |SE income| $>$ 5,000 and |SE income| $>$PE income
  - PE if not SE and PE income $>$ 5,000 in 2012\$
  - NE if not SE or PE

Empirical Moments: IRS vs CPS (Th. 2012$)









Informing Theory: Details

Empirically-Motivated Features

- Patterns in the data
  - Hump-shaped and persistent income growth
  - Declining exit rates
  - Volatility decreasing with age
- Empirical results suggest three model features
  - Investment in self-created intangible assets ▸ Evidence
  - Incomplete information about entrepreneurial productivity
  - Slow adjustment in achieving optimal size

Modeling Intangibles

- State vector $s = [a, \kappa, j, \epsilon, z, \mu]$
- Dynamic program for entrepreneur

$$
\begin{aligned}
V_k(s) &= \max\{U(c, \ell) + \beta EV(s')\} \\
a' &= (1 + r)a + pe^z f_y(\kappa, h_y, k, n) - (r + \delta_k)k - wn - e - c \geq 0 \\
\kappa' &= (1 - \delta_\kappa)\kappa + f_\kappa(h_\kappa, e) \\
\ell &= 1 - h_y - h_\kappa
\end{aligned}
$$

- Two production technologies:
  - $f_y(\kappa, h_y, k, n)$: goods and services
  - $f_\kappa(h_\kappa, e)$: new intangible assets

Modeling Intangibles

- State vector $s = [a, \kappa, j, \epsilon, z, \mu]$

  financial assets

- Dynamic program for entrepreneur

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\ell &= 1 - h_y - h_\kappa
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$$

- Two production technologies:
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Modeling Intangibles

- State vector $s = [a, \kappa, j, \epsilon, z, \mu]$

  intangible assets

- Dynamic program for entrepreneur

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\ell &= 1 - h_y - h_\kappa
\end{aligned}
$$

- Two production technologies:
  - $f_y(\kappa, h_y, k, n)$: goods and services
  - $f_\kappa(h_\kappa, e)$: new intangible assets

Modeling Intangibles

- State vector $s = [a, \kappa, j, \epsilon, z, \mu]$ (age)
- Dynamic program for entrepreneur

$$
\begin{aligned}
V_k(s) &= \max\{U(c, \ell) + \beta EV(s')\} \\
a' &= (1 + r)a + pe^z f_y(\kappa, h_y, k, n) - (r + \delta_k)k - wn - e - c \geq 0 \\
\kappa' &= (1 - \delta_\kappa)\kappa + f_\kappa(h_\kappa, e) \\
\ell &= 1 - h_y - h_\kappa
\end{aligned}
$$

- Two production technologies:
  - $f_y(\kappa, h_y, k, n)$: goods and services
  - $f_\kappa(h_\kappa, e)$: new intangible assets

Modeling Intangibles

- State vector $s = [a, \kappa, j, \epsilon, z, \mu]$

  true and predicted skills

- Dynamic program for entrepreneur

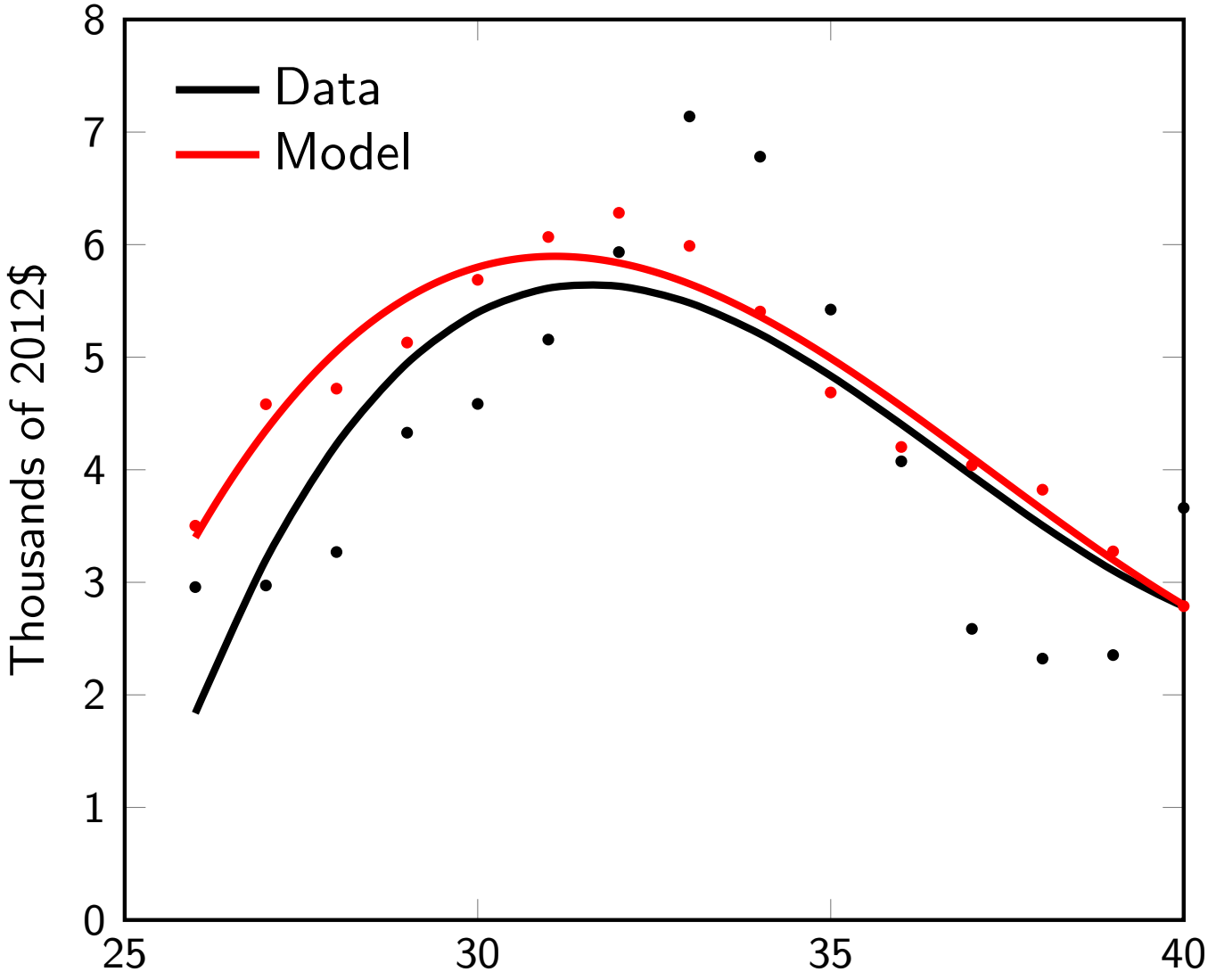
$$
\begin{aligned}
V_k(s) &= \max\{U(c, \ell) + \beta EV(s')\} \\
a' &= (1 + r)a + pe^z f_y(\kappa, h_y, k, n) - (r + \delta_k)k - wn - e - c \geq 0 \\
\kappa' &= (1 - \delta_\kappa)\kappa + f_\kappa(h_\kappa, e) \\
\ell &= 1 - h_y - h_\kappa
\end{aligned}
$$

- Two production technologies:
  - $f_y(\kappa, h_y, k, n)$: goods and services
  - $f_\kappa(h_\kappa, e)$: new intangible assets

Comparing Growth Profiles

- Choose income shocks consistent with IRS micro data
- Simulate time series over the life cycle
- Aggregate simulations using IRS counts and entry ages
- Construct growth differential for self-employed:
  - Stayers: attached to self-employment past age 35
  - Switchers: ran a business at least 5 years but exited by 35

Growth Differentials for Young Entrepreneurs



Conclusion

- Assembled novel longitudinal database for business owners
- Estimated life-cycle income profiles for many groups
- Developed prototype model of entrepreneurs
- Studied model predictions for IRS data

Appendix

Identification

- Two identifying assumptions
  - Age effects are same across binned cohorts (≥ 2)
  - Average time effect satisfies (where $\overline{y}_{g,t_0}$ is avg income for g):

$$\frac{\overline{\Delta\beta_g}}{\overline{y}_{g,t_0}} = \frac{\mu_g}{T}\sum_t (1+\mu_g)^t$$

- Allows flexibility when set $\mathcal{G}$ large

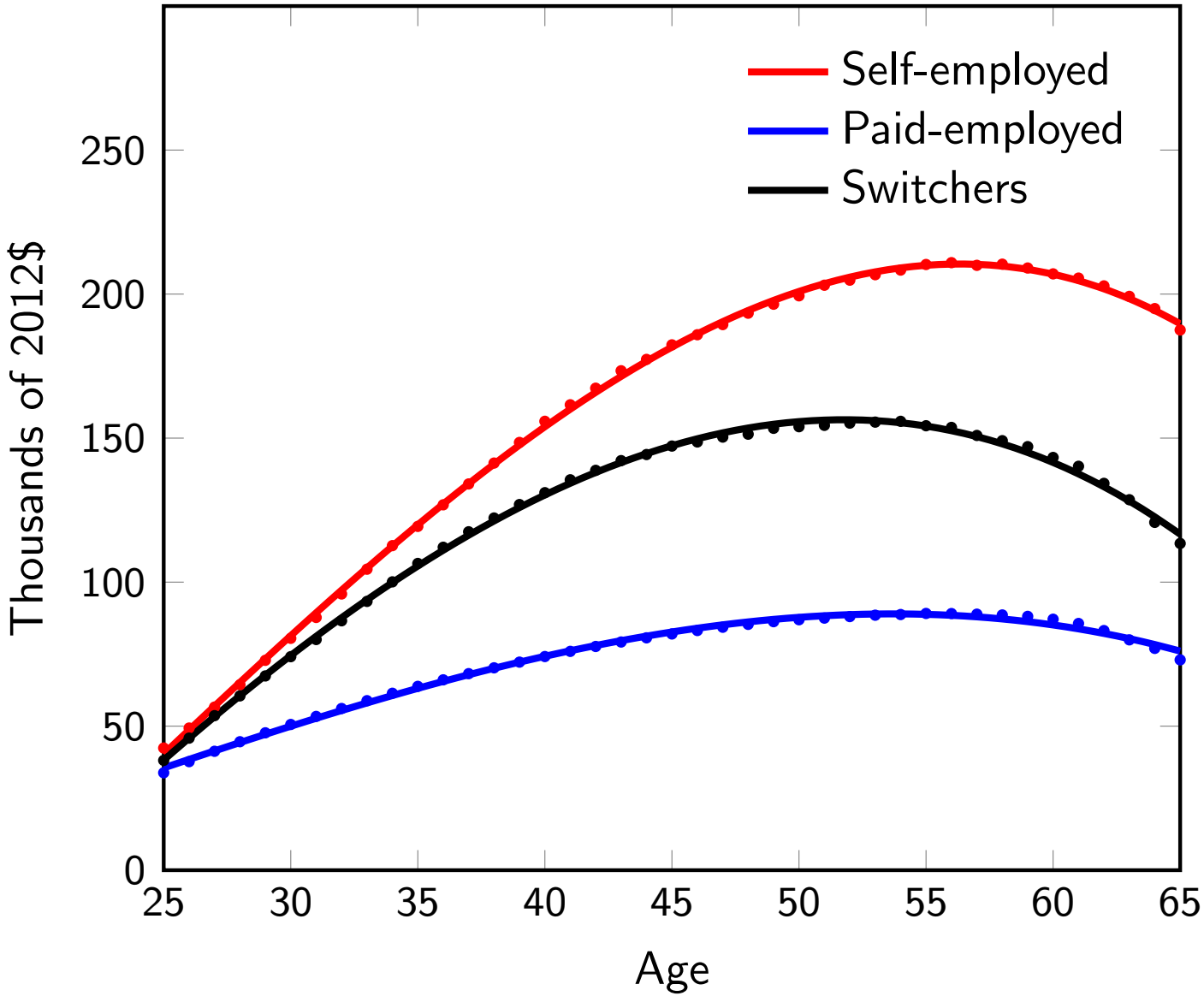
◂ Back

Employment Attachment

- *Attached* (SE or PE) if:
  - Fewer than 2 switches in status during sample
  - No itermediate spells of non-employment
- *Mostly switchers* if:
  - In SE or PE for 12+ years
  - No intermediate spells of non-employment
- *Any non-employment* if:
  - Switched in/out of NE from SE or PE at least once
  - Or, 5 years of NE during sample

Back

Income Profiles: Add Switchers



Back

Evidence of Business Intangibles

- Business sale is taxable event for buyer and seller
- Forms 8594, 8883 show assets primarily intangible, eg
  - Customer bases, client lists, non-compete covenants
  - Licenses, permits, trademarks, tradenames
  - Workforce in place
  - Goodwill and on-going concern value

◂ Back

Time Effects Relative to Income

Back