Hours Worked and Lifetime Earnings Inequality*

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*The views in this paper are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of St. Louis or the Federal Reserve System.

Motivation: The Sources of Lifetime Earnings Inequality

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  2. What are these attributes and shocks, and which are most important?
- Our focus: how important are hours worked for lifetime earn. inequality?
  - Static channel: more hours today, higher earnings today
  - Dynamic channel: more hours today, higher earnings in future

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  - *"There is no royal flower-strewn path to success. And if there is, I have not found it, for whatever success I have attained has been the result of much hard work and many sleepless nights."* — Madam C.J. Walker
- Little existing work on the role of hours for lifetime earnings
  - Cross-sectional hours variation $\neq$ lifetime hours variation
  - Social Security data do not have hours

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   - Heterogeneous preferences account for 16% of earnings variation
   - Dynamic human capital channel plays an important role

Some Related Literature

- Sources of life-cycle earnings inequality
  - Topel, Ward (1992)
  - Heckman, Lochner, Taber (1998)
  - Rubinstein and Weiss (2006)
  - Huggett, Ventura, Yaron (2006, 2011)
  - Kaplan (2012)
  - Hosseini, Kopecky, Zhao (2022)
  - Karahan, Ozkan, Song (2022)
- Life-cycle models with endogenous hours and learning
  - Imai, Keane (2004)
  - Wallenius (2011, 2013)
  - Kapicka (2015)
  - Stancheva (2015, 2017)
  - Keane, Wasi (2016)
  - Guvenen, Kuruscu, Ozkan (2014)
  - Badel, Huggett, Luo (2022)

Outline

Data Source: The NLSY79

- **Coverage: 1979 - 2020**
  - Annual through 1994, then biennial (hours for all years)
  - 1979: ages 14 - 22. 2020: ages 56 - 64.

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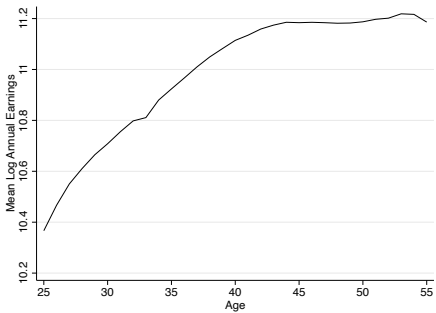
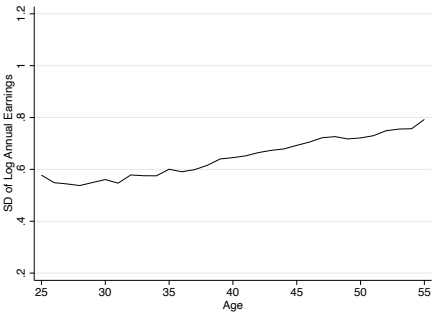
  - Today: focus on $1,418$ men who worked 520 hours each year
    - Closest papers impose similar hours criteria (Huggett et al. '11, Guvenen et al. '14)
    - Less hours variation than full sample $\implies$ lower bound for impact of hours

Cross-Sectional Earnings Moments over the Life-Cycle

Mean log Annual Earnings



SD of log Annual Earnings



- Most of previously-cited papers match these or related moments

Cross-Sectional Hours Moments ≈ Stable over Life-Cycle

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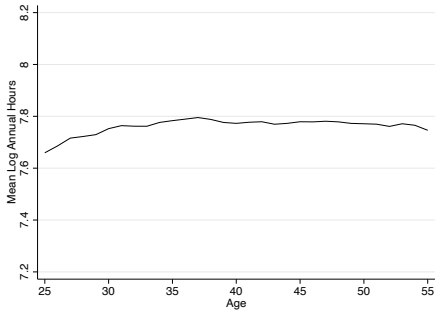

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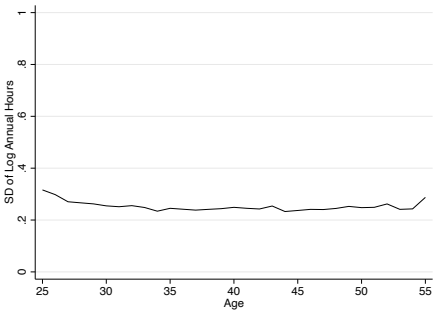

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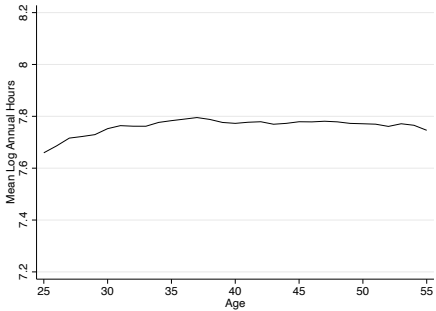

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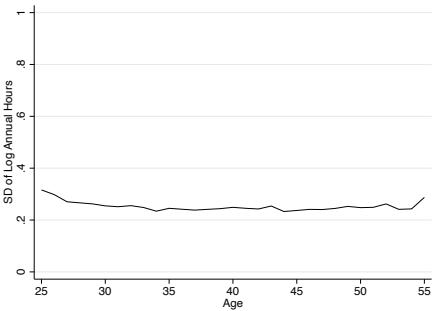

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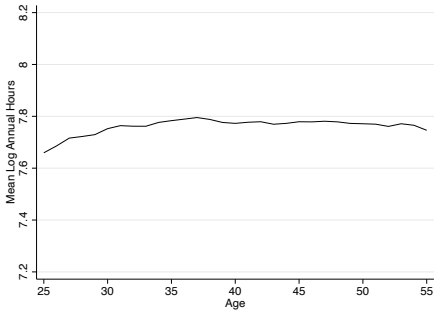

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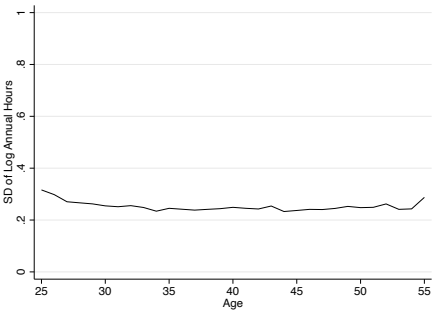

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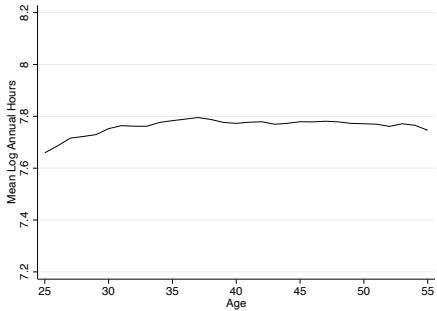

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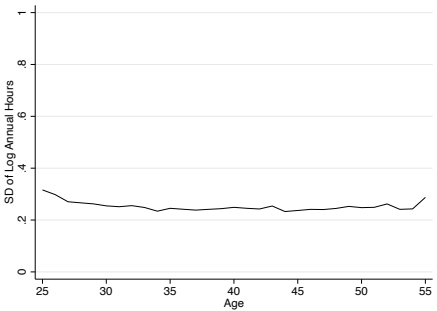

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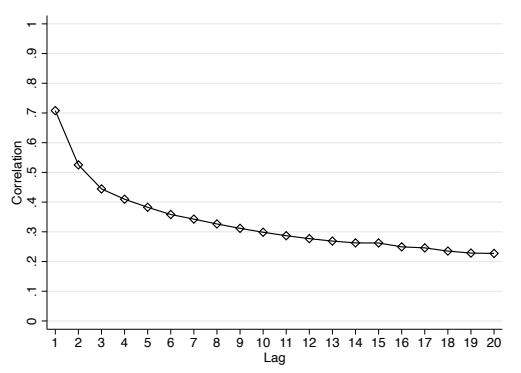
- A few target cross-sectional SD (Kaplan '12; Keane and Wasi '16)

Variation in Hours is Persistent Over the Life-Cycle



- Even 20 years apart, individual hours are positively correlated

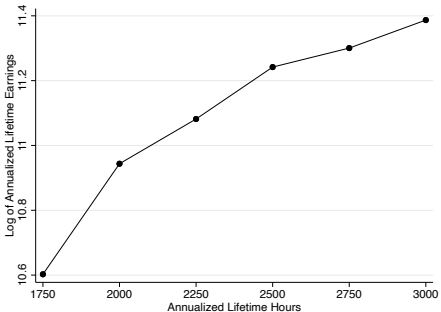
Distribution of Lifetime Hours and Components

Percentile	Annualized Lifetime Hours	Weeks per Year Worked	Hours per Week Worked
5	1982.7	49.2	40.4
10	2054.8	50.6	40.7
25	2155.1	50.8	42.4
50	2340.3	51.1	45.8
75	2588.4	51.0	50.8
90	2904.4	51.5	56.4
95	3141.6	50.7	62.0

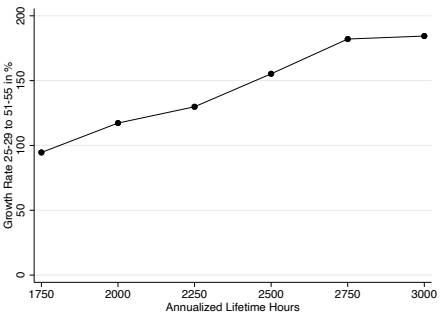
- Lifetime hours percentile ratios
  - $75/25 = 1.2$ ($\approx$ 430 hours/year)
  - $90/10 = 1.4$ ($\approx$ 850 hours/year)

Lifetime Earnings and Lifetime Hours Worked

Average Lifetime Earnings



Life-cycle Earnings Growth



- Elasticity of lifetime earnings w.r.t. lifetime hours ≈ 1.3
- Elasticity of life-cycle earnings growth w.r.t. lifetime hours ≈ 1.6

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  - Shocks to: human capital & persistent work disutility

Preferences, Human Capital, and Earnings

- **Preferences**: permanent & transitory heterogeneity in work disutility

$$u(c_{j,t}, n_{j,t} + i_{j,t}) = \frac{c_{j,t}^{1-\frac{1}{\sigma}} - 1}{1 - \frac{1}{\sigma}} - \psi_j \cdot \pi_{j,t} \cdot \frac{(n_{j,t} + i_{j,t})^{1+\frac{1}{\gamma}}}{1 + \frac{1}{\gamma}}$$

$$\log \pi_{j,t} = \rho_\pi \log \pi_{j,t-1} + \nu_{j,t} \text{ with } \nu_{j,t} \sim N(0, \sigma_\pi)$$

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$$x_{j,t+1} = \left[(1-\delta)x_{j,t} + \alpha_j (i_{j,t} x_{j,t})^\phi\right]$$

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- **Post-Tax Labor income**: $\tau_0 (w x_{j,t} n_{j,t})^{1-\tau_1}$

FOC of Investment Choice (interior, no shocks)

UMP

$$\underbrace{wx_t}_{\text{MC of investment}} = \underbrace{\alpha\phi x_t^{\phi} i_t^{\phi-1} \sum_{t'=t+1}^{T_R-1} \left[\frac{1}{1+R}\right]^{t'-t} w(n_{t'} + i_{t'})(1-\delta)^{t'-(t+1)}}_{\text{MB of investment}}$$

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- All else constant: Higher future hours $(n_{t'} + i_{t'})$: RHS $\uparrow \implies i_t \uparrow$

Outline

Mapping Data Measures into the Model

- **Assumption 1**: hours $h_{j,t} = n_{j,t} + i_{j,t}$
  - Implies all investment "on-the-job"
  - Mainly affects hours, hourly wages in first few years
  - Results robust to assuming half of investment "off-the-job"

- **Assumption 2**: classical measurement error in hours and earnings

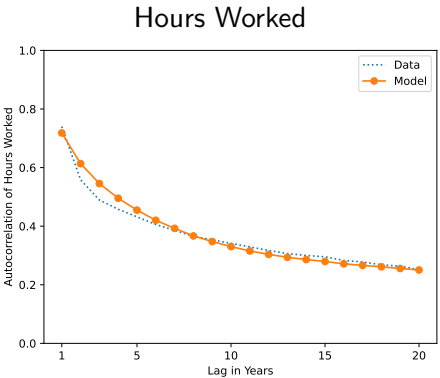
$$\tilde{h}_{j,t} = \exp(\epsilon^h_{j,t}) h_{j,t}, \quad \text{where } \epsilon^h_{j,t} \sim N(0, \sigma_h)$$
$$\tilde{e}_{j,t} = \exp(\epsilon^e_{j,t}) e_{j,t}, \quad \text{where } \epsilon^e_{j,t} \sim N(0, \sigma_e)$$

Calibration Summary

- Calibrate open economy stationary equilibrium
  - Government collects income taxes & proportional consumption tax
    $\rightarrow$ Redistributes lump sum transfer to balance budget
- One key parameter: $\rho_{\alpha,\psi} = -0.15$
  - Correlation of learning ability and permanent work disutility
  - Negative sign $\implies$ high ability tend to have lower work disutility
  - Small magnitude $\implies$ many high ability types with strong dislike of work
    $\implies$ many low ability types willing to work long hours

more

Fit: Persistence of Hours Worked and Earnings (Targeted)



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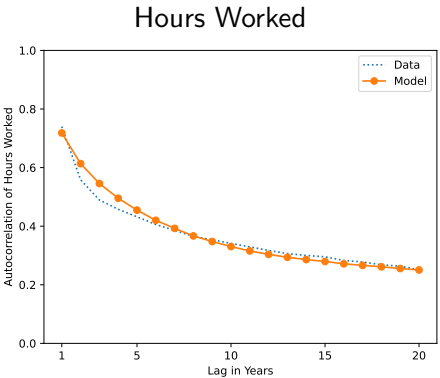
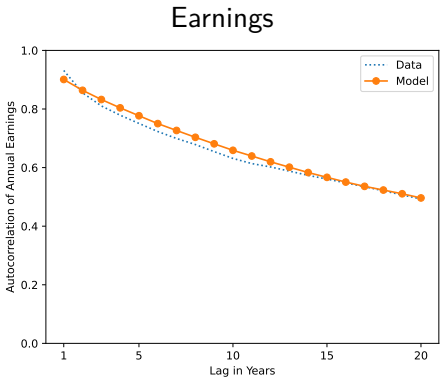
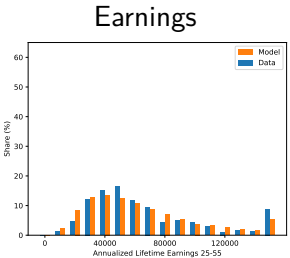




Fit: Lifetime Earnings and Lifetime Hours (Untargeted)



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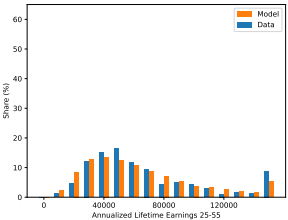

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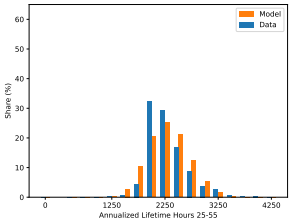

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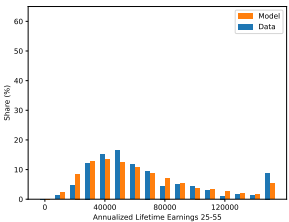

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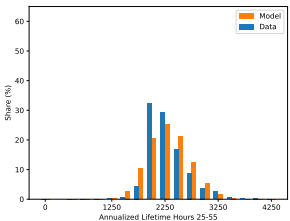
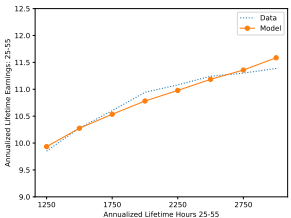


Earnings and Hours



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How Important are Hours Worked for Earnings Inequality?

- Common hours counterfactual: at each age t assign everyone $\overline{n}_t$ and $\overline{i}_t$

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  $\Longrightarrow$ Total hours account for 90% of overall impact
  - Huggett et al. ('11) do not feature any variation in total hours
  - Guvenen et al. ('14) have hours choice, but minimal variation

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$\Rightarrow$ Together, preference heterogeneity drives 16% of lifetime inequality

Policy Implications: An Illustrative Example

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  - Reduced standard workweek from 39 to 35 hours (OT pay above this)
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  - Exceptions for managers and executive "cadres"
- Motivated by the Aubry reforms, we run the following counterfactual
  - Cap production time, n, at 48 hours/week

The Impact of a 48-Hours/Week Cap

more

- Impact on lifetime earnings
  - Mean declines 13%
  - Variance declines 17%
- Mean decline in lifetime utility is 3% (CEV)
- Impact larger for workers with low ψ
  - $\approx 4\%$ earnings loss for highest ψ quintile
  - $\approx 20\%$ earnings loss for lowest ψ quintile
  - $corr(\psi, \alpha) = -0.15 \implies$ many low earners experience large losses

Outline

Conclusion

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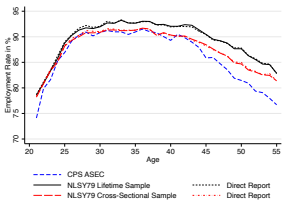
  - Substantial variation in lifetime hours
- Use data to discipline life-cycle human capital model of hours & earnings
  - Model requires preference heterogeneity to match hours patterns
- Find: Hours worked are a key source of lifetime earnings inequality
  - Hours variation accounts for 30% of variation
  - Heterogeneous preferences account for 16% of variation
  - Dynamic human capital channel plays an important role

Thank you!

Sample Validation: Employment

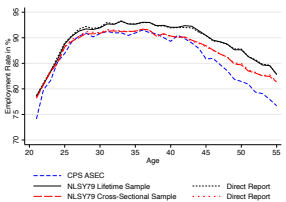
Annual Hours $\geq$ 520



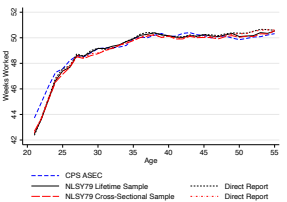
Back

Sample Validation: Employment

Annual Hours $\geq$ 520



Weeks Worked



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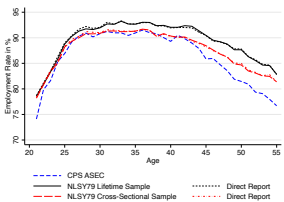

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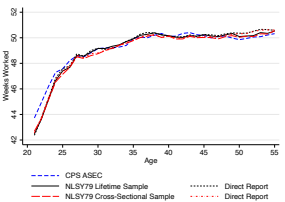
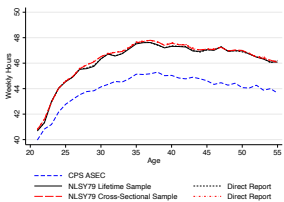


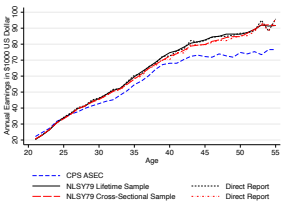
Weekly Hours



Back

Sample Validation: Life-Cycle Earnings

Mean Earnings



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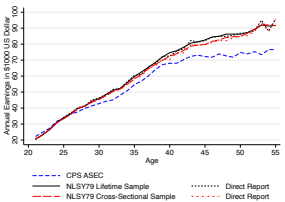
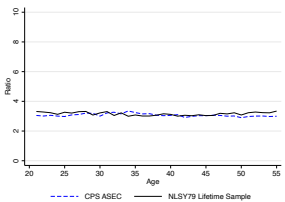


P90/P50 Ratio



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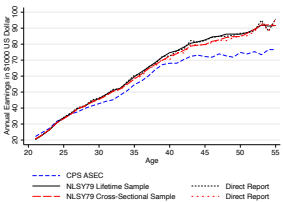
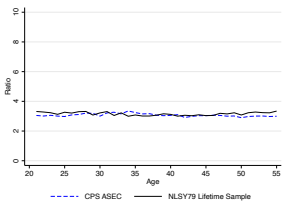
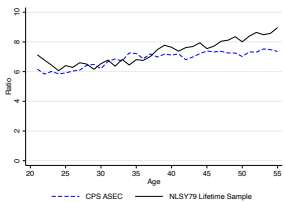


P90/P50 Ratio



P50/P10 Ratio



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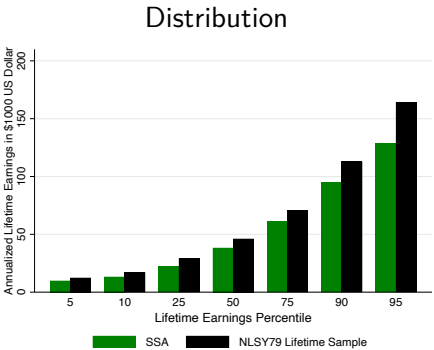
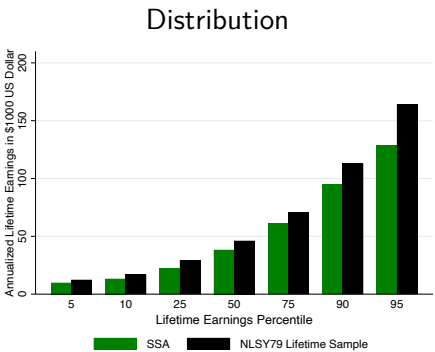
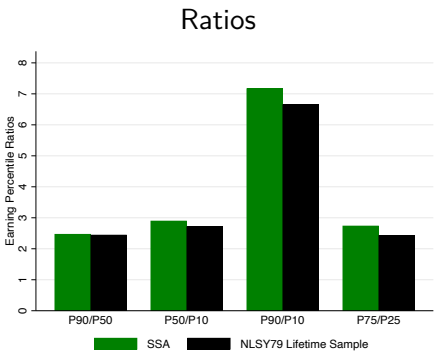
Sample Validation: Lifetime Earnings



- Guvenen et al (2022): Social Security Earnings for the cohort born in 1957
- NLSY79: Self-reported earnings for the cohorts born 1957-64 Back

Sample Validation: Lifetime Earnings





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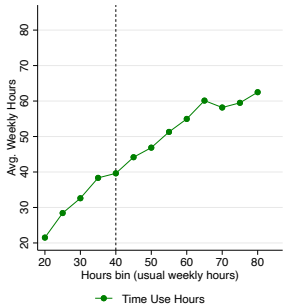
Validation Check of Usual Hours in the CPS

- American Time Use Survey (ATUS): Hours worked at the main job
- Conducted for subset of CPS ORG: Usual weekly hours worked

$\Rightarrow$ Construct avg. weekly time use hours by usual weekly hours bin

Back

Usual Hours Predict ATUS Hours Well



- Avgerage weekly time use hours increasing in usual weekly hours Days

Back

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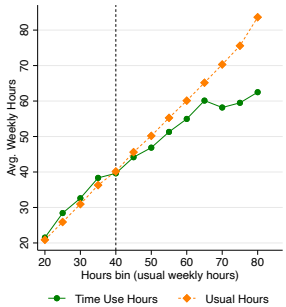
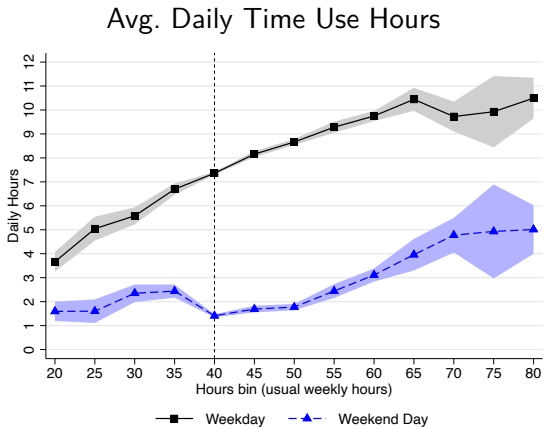


- Avgerage weekly time use hours increasing in usual weekly hours Days
- Diff. b/w avg. weekly time use & usual hours small (below 70 hours) SH

Back

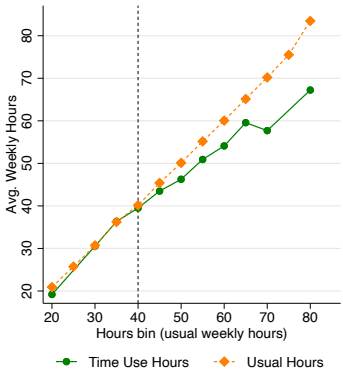
Avg. Time Use Hours Increase in Usual Weekly Hours



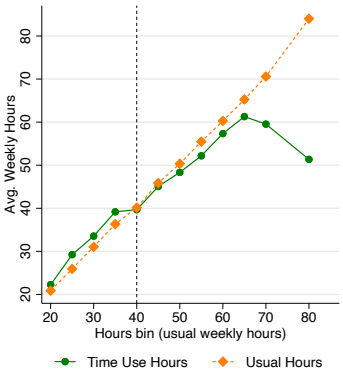
Back

Avg. Time Use Hours Increase in Usual Weekly Hours

Salaried Workers

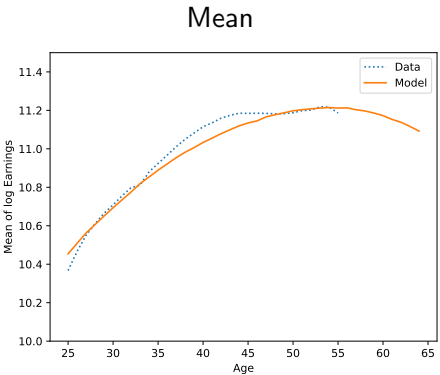


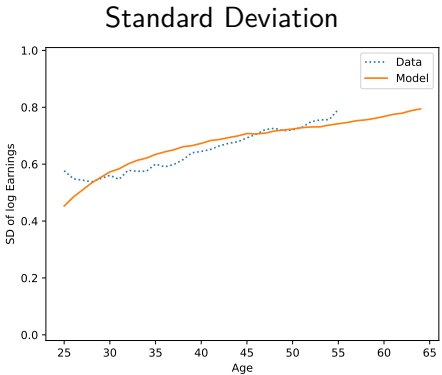
Hourly Workers



Back

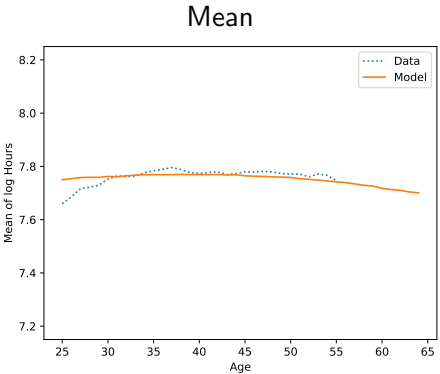
Earnings Over the Life-cycle (Targets: Ages 30 & 50)

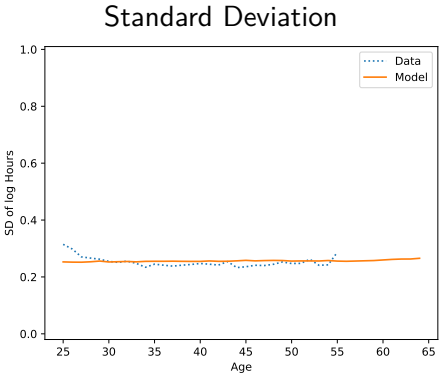




back

Hours Worked Over the Life-cycle (Targets: cross-section 25-52)





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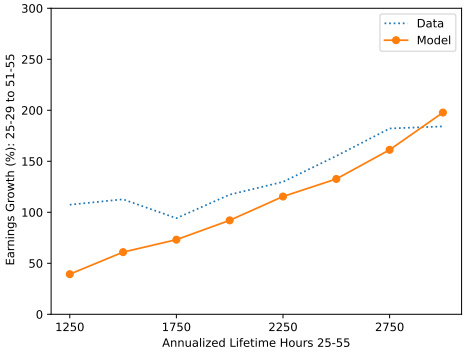
Lifetime Hours and Earnings Growth (Targets: $2750 - 1500$ hour bins)

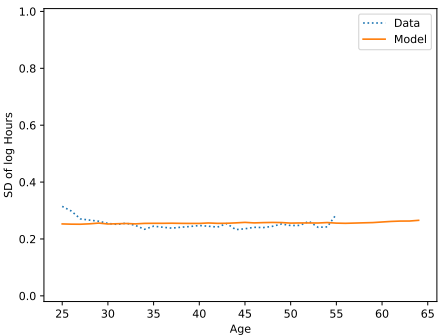


back

Hours Variation & Persistence: Benchmark Model

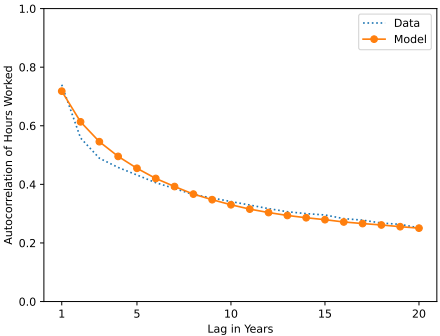
Standard Deviation

(Targeted in calibration)



Persistence

(Targeted in calibration)



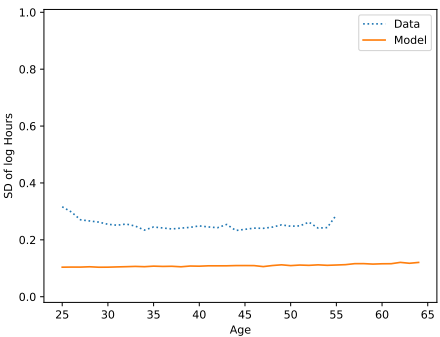
back

Hours Variation & Persistence: "Homogeneous" Model

back

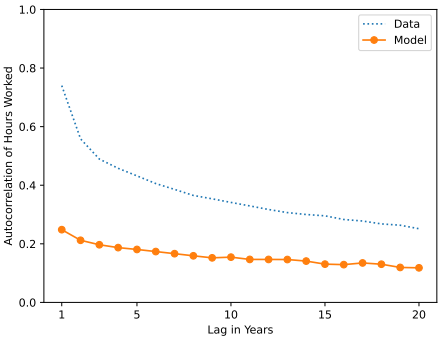
Standard Deviation

(Not targeted)



Persistence

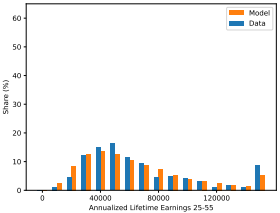
(Not targeted)



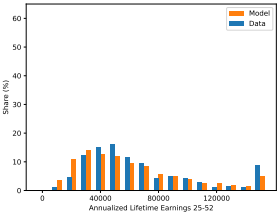
Lifetime Earnings & Hours: Comparing Models

back

Benchmark: Earnings



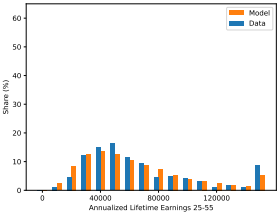
"Homog.": Earnings



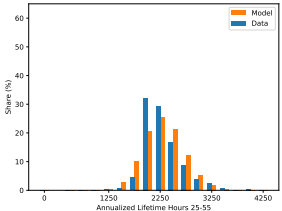
Lifetime Earnings & Hours: Comparing Models

back

Benchmark: Earnings



Hours



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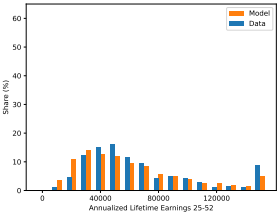
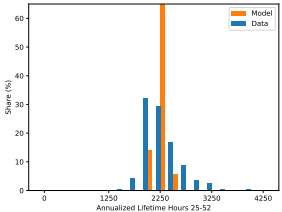


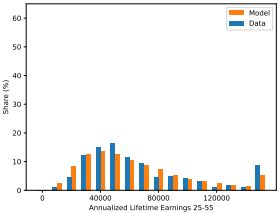
Hours



Lifetime Earnings & Hours: Comparing Models

back

Benchmark: Earnings



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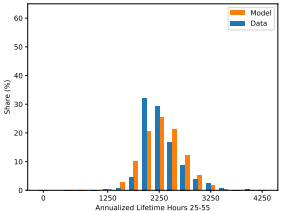
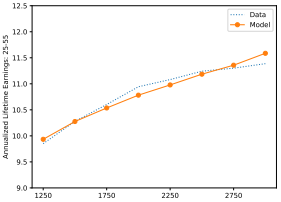


Earnings by Hours



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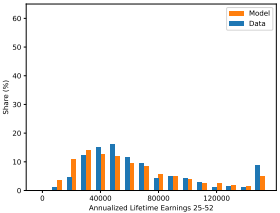
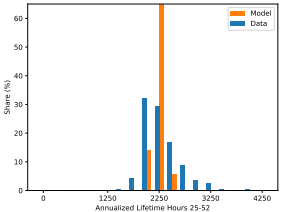
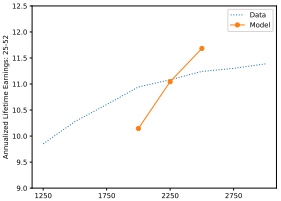


Hours

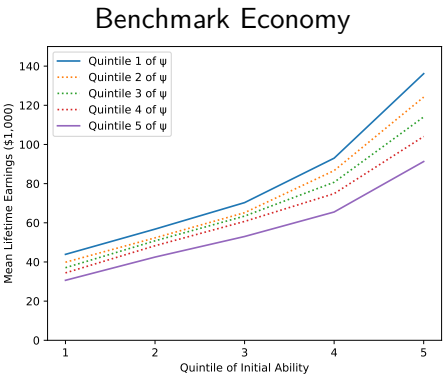


Earnings by Hours



The Impact of a 48-Hour/Week Cap

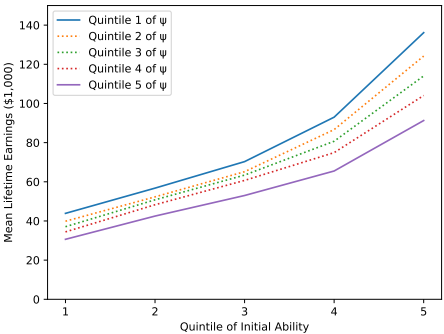
back



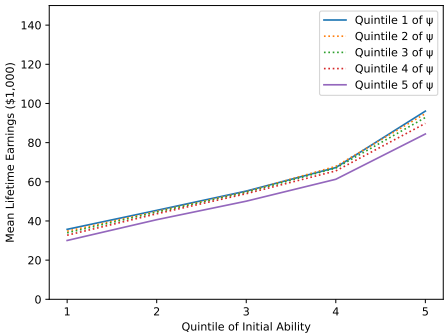
The Impact of a 48-Hour/Week Cap

back

Benchmark Economy



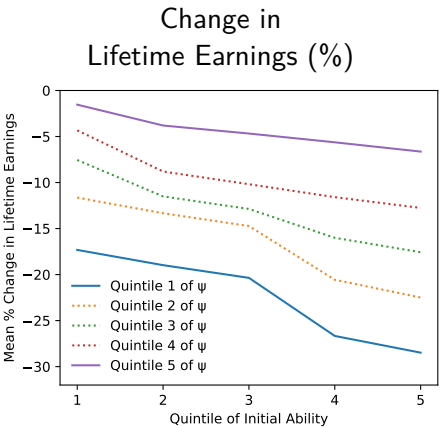
48 Hour/Week Cap



- Hours cap eliminates most additional earnings of low-ψ types

The Impact of a 48-Hours/Week Cap

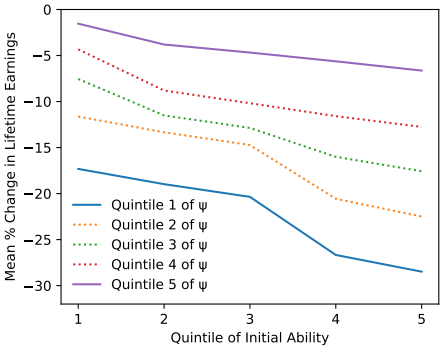
back



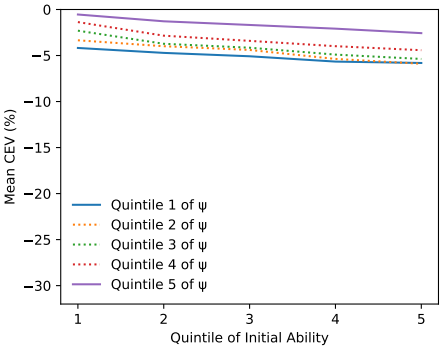
The Impact of a 48-Hours/Week Cap

back

Change in
Lifetime Earnings (%)



Change in
Lifetime Utility (% CEV)



French Hours Worked

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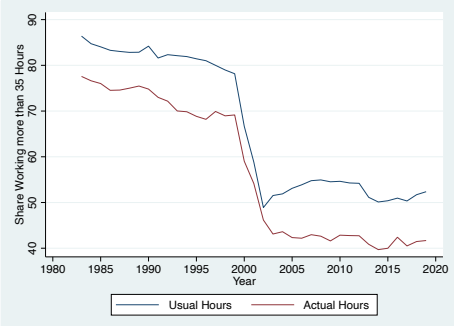
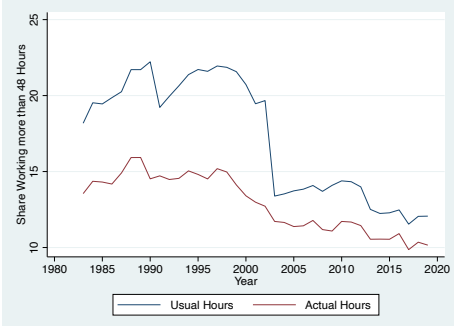
Share Working More Than 35 Hours



Share Working More Than 48 Hours



An Individual's Utility Maximization Problem

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- **A worker's problem** $(t < T_r)$

$$V_t(k, x; \pi, \psi, \alpha) = \max_{c,k',i,n} \quad u(c, i+n; \pi, \psi) + \beta \mathbb{E}_{z',\pi'} V_{t+1}(k', z'\tilde{x}'; \pi', \psi, a)$$

$$s.t. \quad (1+\tau_c)c + k' = Rk + \tau_0 (wxn)^{1-\tau_1} + G$$

$$\tilde{x}' = (1-\delta)x + \alpha(ix)^{\phi}$$

An Individual's Utility Maximization Problem

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$$\tilde{x}' = (1-\delta)x + \alpha(ix)^{\phi}$$

- **A retiree's problem** $(t \geq T_r)$
  - Identical except with added constraint $n = i = 0$

Calibration: Exogenously-Set Parameters

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Parameter	Interpretation	Value	Source
R	Gross interest rate	1.02	$1/\beta$
β	Patience	0.9804	Huggett et al. (2011)
σ	CRRA	1.0	—
γ	Frisch elasticity	0.3	—
δ	Human capital depreciation	0.02	Huggett et al. (2011)
τ_0	Tax Rate	0.81	Heathcote et al. (2014)
τ_1	Tax Progressivity	0.181	Heathcote et al. (2014)
τ_c	Consumption tax	0.08	Heathcote et al. (2014)
μ_x	Mean of $\log x_0$	0.0	Normalization

- Calibrate stationary eq. of open economy with balanced gov't budget

Calibration: Endogenously-Set Parameters

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Parameter	Interpretation	Value	Moment
σ_x	SD of $\log x_0$	0.3625	SD earnings, age 30
μ_α	Mean of $\log \alpha$	-2.2459	Mean earnings, age 50
σ_α	SD of $\log \alpha$	0.2109	SD earnings, age 50
μ_ψ	Mean of $\log \psi$	3.5993	Mean annual hours, age 25-52
σ_ψ	SD of $\log \psi$	0.45	SD annual hours, age 25-52
$\rho_{\alpha,\psi}$	Corr. of $(\log \alpha, \log \psi)$	-0.15	Correlation of hours and earnings, age 30
σ_π	SD of $\log \pi$	0.4	Hours autocorrelation profile
ρ_π	Autocorrelation of $\log \pi$	0.88	Hours autocorrelation profile
σ_{mh}	SD measurement error	0.1	Hours autocorrelation profile
σ_{me}	SD measurement error	0.17	Earnings autocorrelation profile
σ_z	SD human capital shock	0.085	Earnings autocorrelation profile
ϕ	HC elasticity wrt investment	0.57	Lifetime hours, earnings growth