Perceived Income Risks

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June 29, 2022
4th Behavioral Macro Workshop

Outline

1. Motivation
2. Empirical evidence
   - Cross-sectional patterns
   - Permanent versus transitory risks
   - Perceived risks and decisions
3. Model
4. Conclusion

Motivation

- Risks matter for individual decisions
  - precautionary saving
  - stock market participation
  - portfolio choice
- Risks matter for macroeconomic outcomes
  - since idiosyncratic risks are not perfectly insured
    - $\rightarrow$ income/wealth inequality
    - $\rightarrow$ heterogeneous MPCs
    - $\rightarrow$ distributional channel of macroeconomic policies
    - $\rightarrow$ business cycle fluctuations
- Income risks are central inputs of any incomplete-market model
  - Conventional approach: estimated using panel data
  - This paper: directly perceived risks from survey

Some macro facts

- Wealth inequality and heterogeneity in MPCs
  - a standard incomplete market model generates insufficient inequality seen in the data
  - unless additional features such as preference heterogeneity or costly adjustment are introduced
- Liquid assets holdings
  - too few in data compared to a standard one-asset incomplete market model
- "Excessive sensitivity" to unanticipated transitory shocks
  - high MPCs seen in the data than PIH model prediction

Preview of the findings

1. **Empirics:** subjective risk profiles from a density survey
   - Heterogeneity: sizable difference across/within groups
   - Superior information: on average lower than standard parameterizations used by economists
   - State-dependence: negative correlation with recent/past labor market conditions
   - Extrapolation: correlated with negative labor outcomes
   - History-dependence: positive correlation with experienced volatility/unemployment
   - Decisions: spending plans react to risk perceptions

Preview of the findings

1. **Empirics:** subjective risk profiles from a density survey
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   - History-dependence: positive correlation with experienced volatility/unemployment
   - Decisions: spending plans react to risk perceptions
2. **Model**:
   - survey-calibrated OLG / incomplete-market GE model
     - Lower PR $\rightarrow$ lower savings
     - Heterogeneity in PR $\rightarrow$ more wealth inequality

Literature

- income risks and partial insurance: Gottschalk et al. (1994), Carroll and Samwick (1997), Meghir and Pistaferri (2004), Storesletten et al. (2004), Blundell et al. (2008), Moffitt and Gottschalk (2002), Guvenen et al. (2014), Arellano et al. (2017), Bloom et al. (2018)
- subjective/probabilistic survey of beliefs: Manski (2004), Delavande et al. (2011), Manski (2018), Bertrand and Mullainathan (2001), Armantier et al. (2017)
- incomplete market macro: Bewley (1976), Aiyagari (1994), Huggett (1996), Krusell and Smith (1998), Heathcote et al. (2009), Carroll et al. (2017), Krueger et al. (2016), Bayer et al. (2019)
- consumption/saving under incomplete information/imperfect perception: Pischke (1995), Wang (2004), Rozsypal and Schlafmann (2017), Carroll et al. (2018), Lian (2019)

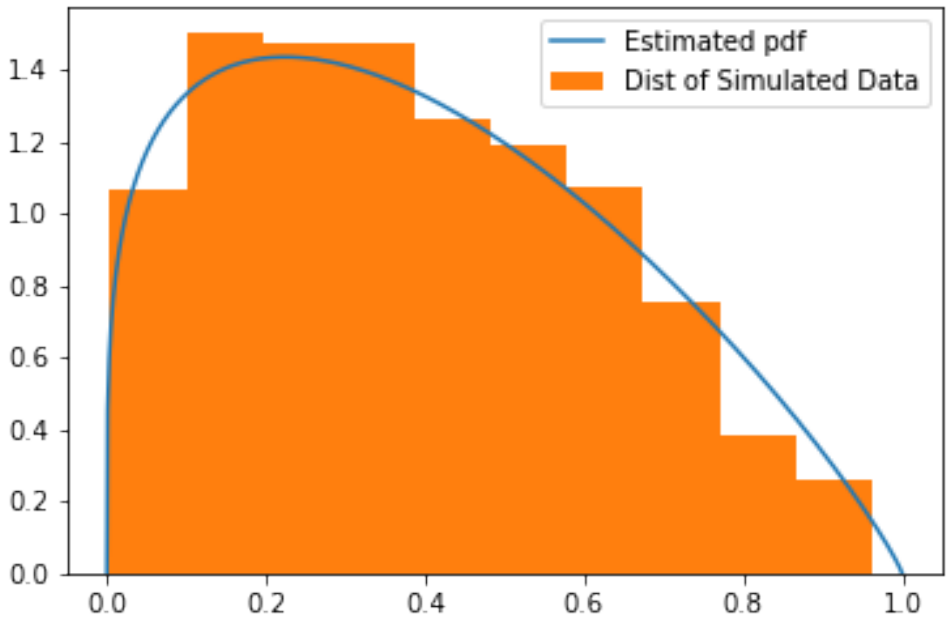
Data and sample

- Density survey: SCE
  - 2013M6-2020M4 (monthly)
  - 1300 households
  - 12-month panel
- Income panel: SIPP
  - 2014M1-2019M12 (monthly)
  - wage computed for the primary job
  - 900-2700 respondents
  - CPI adjusted
  - age 25-65
  - only job-stayers with the same employer for $\geq$2 years

Survey question

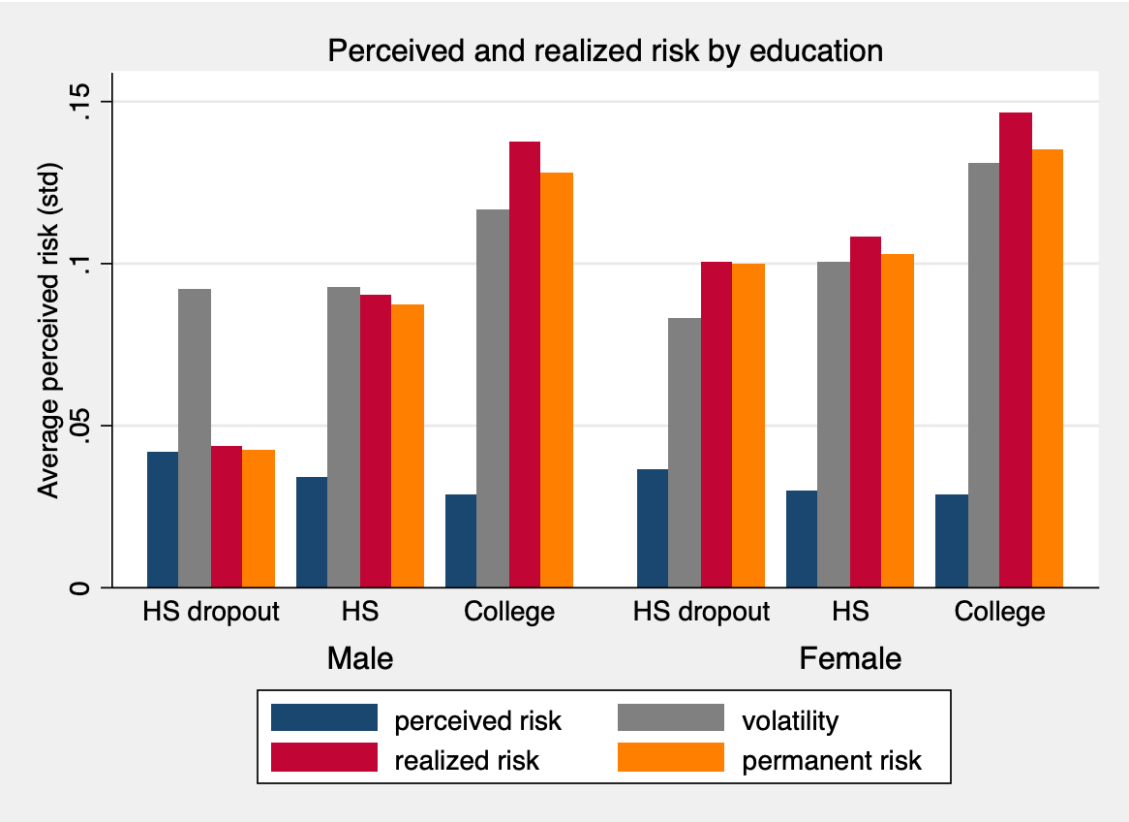
- Individual-specific bin-based forecast on $\Delta w_{i,t+1}$
  - wage growth of the same job/position/hours
  - exl. endogenous labor supply changes/promotion/demotion/separation
- Measurement of PR:
  - variance: $\overline{Var}_{i,t}(\Delta w_{i,t+1})$
  - computed from the density forecast
- density estimation following Engelberg et al. (2009)
- restricted to attentive/high numeracy score sample
- adjusted into real terms using inflation uncertainty

An illustration of the density forecast estimation



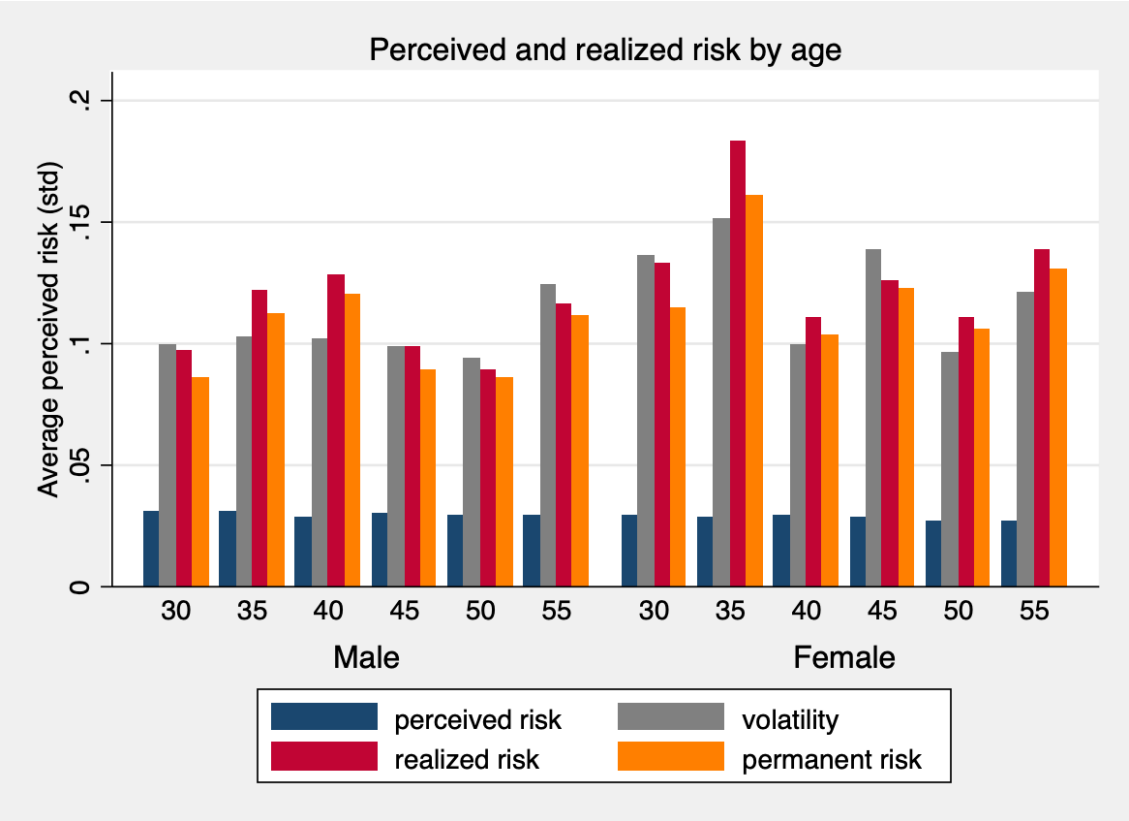
- case 1. 3+ intervals with positive probs, a generalized beta dist
- case 2. exactly 2 adjacent intervals with positive probs: a triangle dist
- case 3. one interval only: a uniform dist

Observable heterogeneity: by education and gender

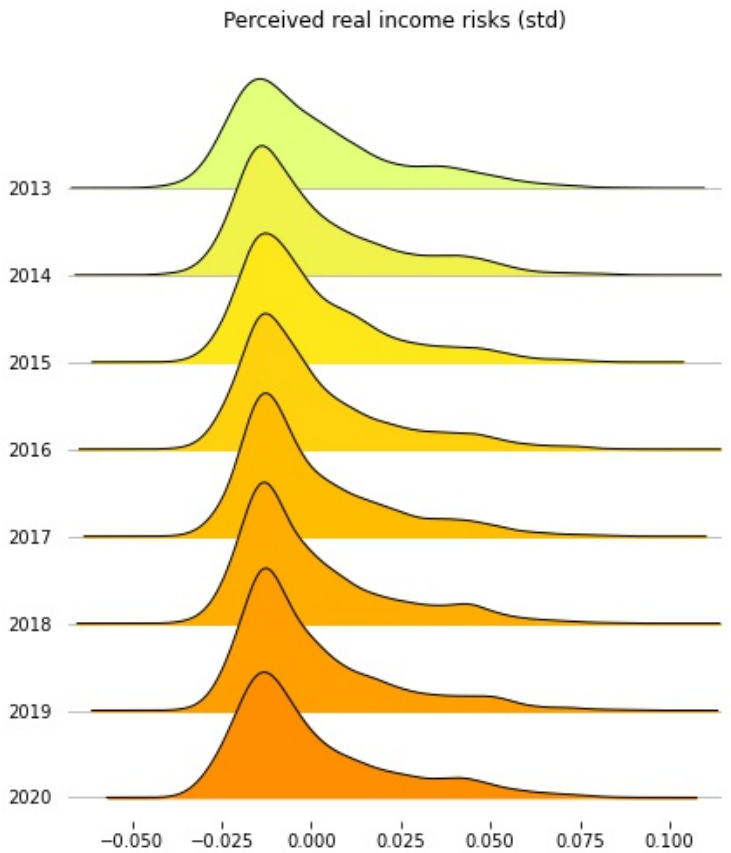


- consistent with Meghir and Pistaferri (2004)

Observable heterogeneity: by age and gender



Unobservable heterogeneity



- residuals controlling for observables + time FE ($R^2 = 0.10$)
- average PR: 3.5% in std; 10/90 IQR: 5.2% in std nominal

Log wage process

$$\underbrace{w_{i,t}}_{\text{log wage}} = \underbrace{z_{i,t}}_{\text{predictable component}} + \underbrace{e_{i,t}}_{\text{stochastic component}}$$

- individual i at time t
- $e_{i,t}$: to be specified later

Perceived risks (PR)

- Wage growth

$$\Delta w_{i,t+1} = \Delta z_{i,t+1} + \Delta e_{i,t+1}$$

- To the agent: **conditional** variance under FIRE

$$Var^*_{i,t}(\Delta w_{i,t+1}) = \sigma^2_{i,t+1|t}$$

- To econometricians: **approximated unconditional** variance

$$Var^c(\Delta \hat{e}_{i,c,t+1}) = \hat{\sigma}^2_{c,t} + \hat{\sigma}^2_{c,t+1} - 2Cov^c(\hat{e}_{i,c,t}, \hat{e}_{i,c,t+1})$$

- $\hat{e}_{i,c,t+1}$: first step regression residual controlling observable vars
- group c: **assumed** to share income process/risks $\sigma^2_{c,t}$
  - i.e. education/year of birth/gender/age

Limitations with risk estimates from panel data

- Superior information/unobservable heterogeneity: $\hat{z}_{i,t} \neq z_{i,t}$
  - $\hat{z}_{i,t}$ unlikely capture all in the information set of i at t
    1. Intrinsic heterogeneity of individual i not observable by economists
    2. Foresight about individual circumstance not available to economists

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- Model misspecfication
  - Risks may differ within group c, but economists have to estimate it at group level.
- Surveyed PR can be a better alternative
  - Directly conditional on information set of each i at t
  - No need to restrict risk heterogeneity by group c
  - But need to be careful with measurement errors

Time series structure of wage shocks

$$e_{i,c,t} = \underbrace{p_{i,c,t}}_{\text{permanent}} + \underbrace{\theta_{i,c,t}}_{\text{transitory}}$$

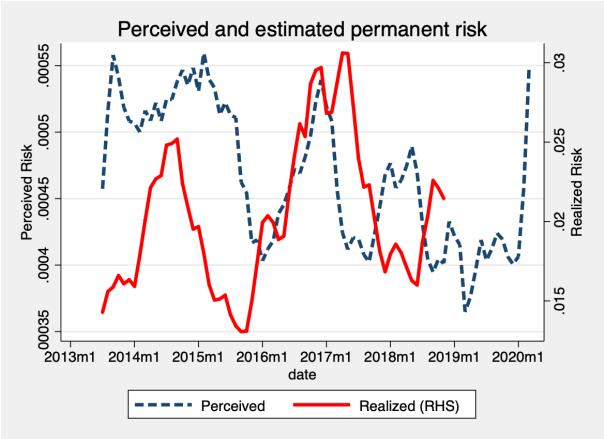
$$p_{i,c,t+1} = p_{i,c,t} + \psi_{i,c,t+1}$$

$$\psi_{i,c,t} \sim N(0, \sigma^2_{c,t,\psi})$$

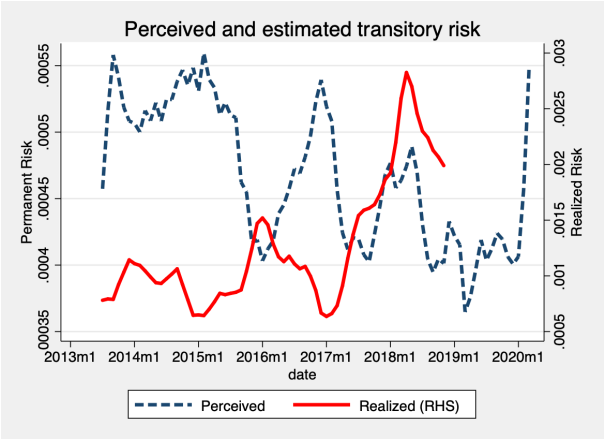
$$\theta_{i,c,t} \sim N(0, \sigma^2_{c,t,\theta})$$

Permanent versus transitory risks

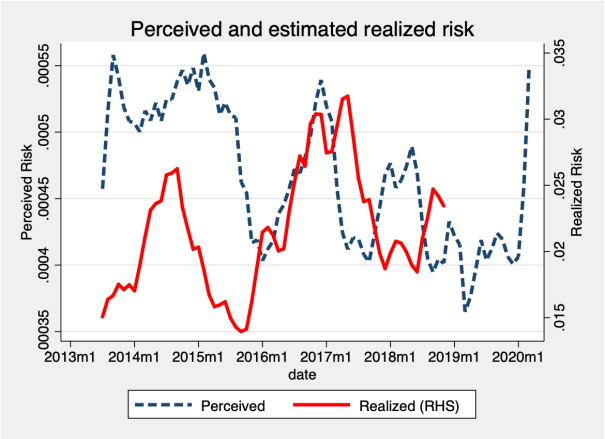
(a) permanent



(b) transitory



(c) volatility



- i.e. one-year-ahead perceived risk at 2014m1 v.s. realized risk over the same period
- wage rate for the same job/hours/position
- estimated monthly risks aggregated into annual frequency

More details

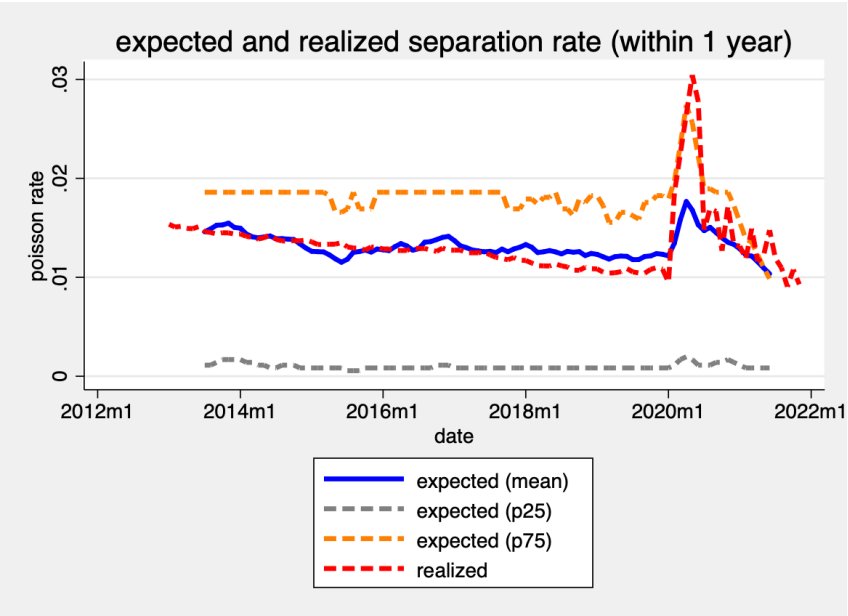
Perceived risks and household spending

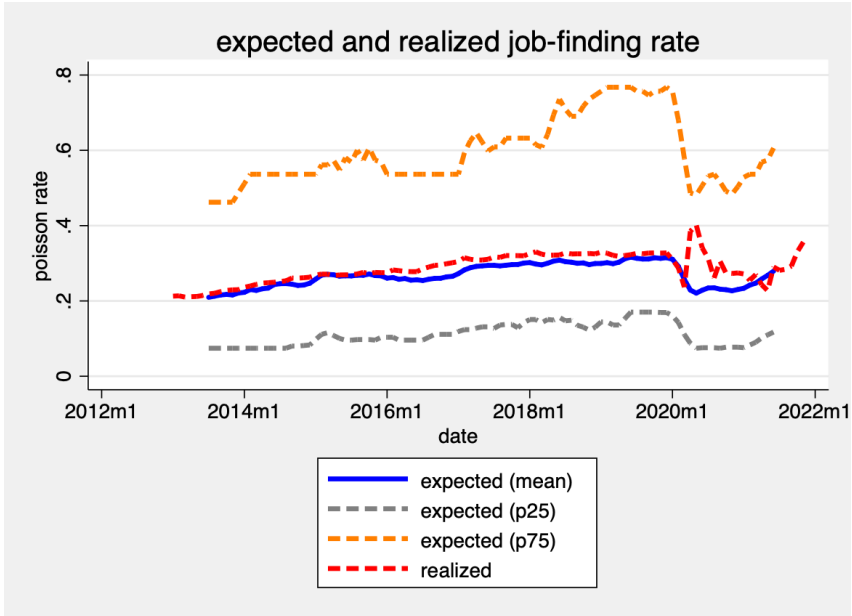
$$E_{i,t}(\Delta c_{i,t+1}) = u_0 + u_1 \overline{\text{risks}}_{i,t}(\Delta y_{i,t+1}) + \xi_{i,t}$$

	(1)	(2)	(3)	(4)	(5)	(6)
perceived earning risk	8.394***	8.399***	3.642***	3.243***		
	(1.175)	(1.176)	(0.533)	(0.537)		
perceived earning risk (nominal)					3.656***	
					(0.990)	
perceived ue risk						0.353***
						(0.0553)
R-squared	0.0010	0.00282	0.928	0.928	0.941	0.633
Sample Size	53178	53178	53178	53178	54584	6269
Time FE	No	Yes	No	Yes	Yes	No
Individual FE	No	No	Yes	Yes	Yes	Yes

- Higher perceived risks → higher expected spending growth.

Perceived UE risks and realization





- realization computed from CPS panel of individuals

Implications for consumption/saving

- On level of savings
  1. $\downarrow$ lower PR: lower precautionary saving motives $\rightarrow$ less liquid holding $\rightarrow$ higher MPC

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- On level of savings
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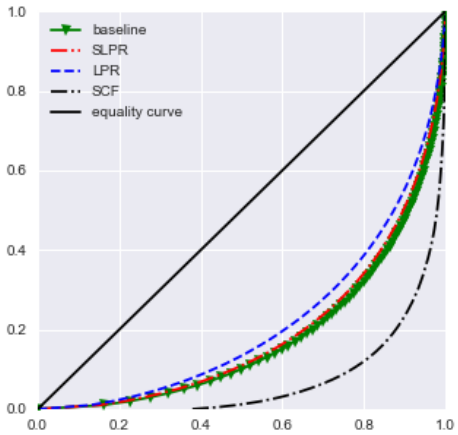
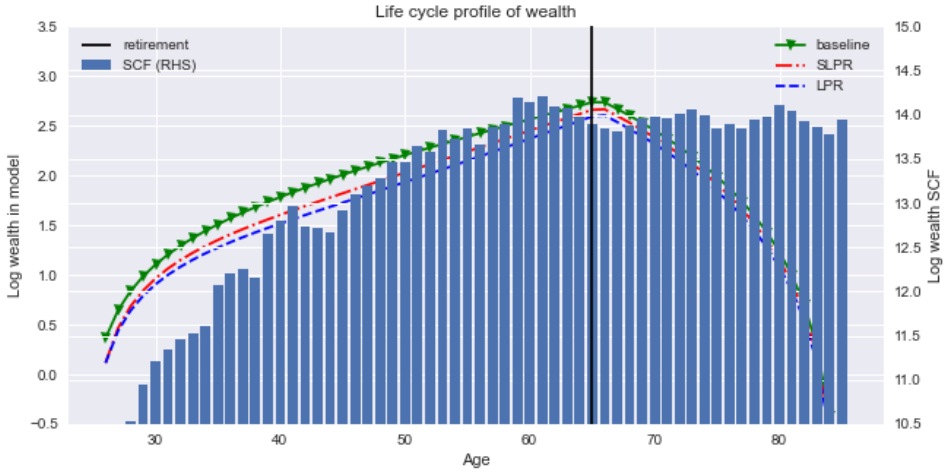
- On wealth inequality
  - $\uparrow$ heterogeneous PR $\rightarrow$ heterogeneity in saving/wealth

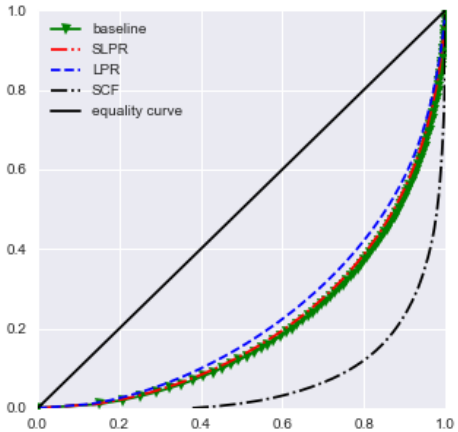
Model overview

- Overlapping generation
- General equilibrium
- Uninsured idiosyncratic income risks
  - Permanent+ transitory productivity shock
  - Persistent unemployment spells
- No aggregate risk a la Krusell and Smith (1998)
- A blend of Huggett (1996) and Carroll (1997)
- Single one risk-free asset
- Calibrating income risks using survey versus estimates from panel
- Extension: subjective risk perceptions
  - Individuals swing between low/high risk perceptions

StE Distribution model with lower PR (LPR)







Calibration | Partial equilibrium

Calibration of survey-based PR in the model

$$\underbrace{\tilde{\Gamma}^{s}_{i,t}}_{\text{reported PR}} = \underbrace{\tilde{\Gamma}_l + \mathbb{1}(\overbrace{J_{i,t}}^{\text{Hidden state}} = 1)(\tilde{\Gamma}_h - \tilde{\Gamma}_l)}_{\tilde{\Gamma}_{i,t}} + \xi_t + \eta_i + \epsilon_{i,t}$$

$$\text{Prob}(J_{i,t+1}|J_{i,t}) = \Omega$$

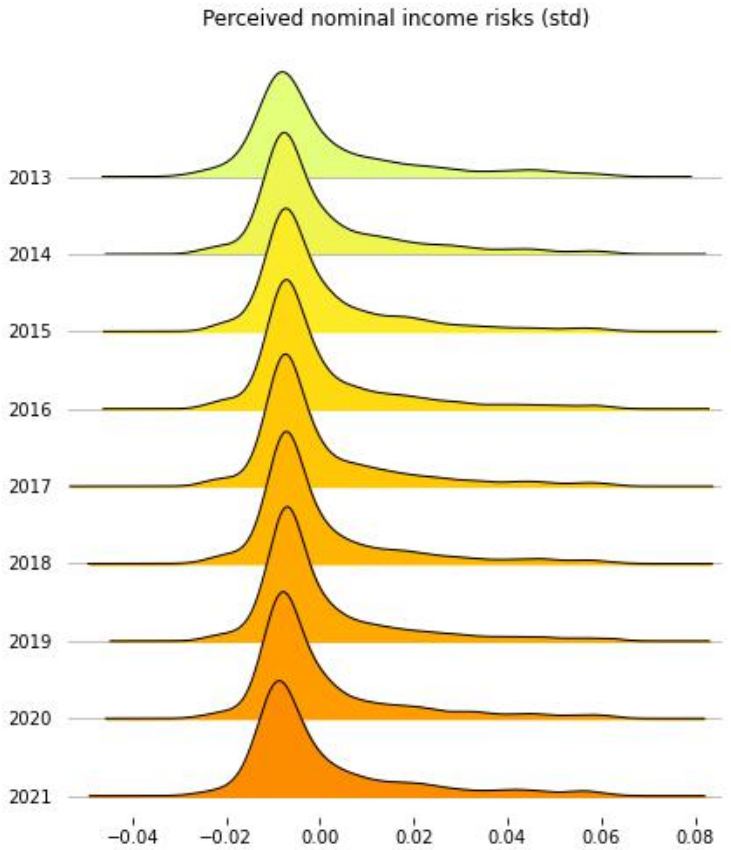
- $J_{i,t} = 0$ for low and $= 1$ for high PR state
- a short time series of $\tilde{\Gamma}_{i,t}$ for many is observed in the survey
- $\{\tilde{\Gamma}_l\, \tilde{\Gamma}_h, \Omega\}$ can be estimated by MLE
- a modified Hamilton (1989) 2-regime-switching model
- $J_{i.t}$ can be also dependent upon business cycles

More details

Summary

- Survey data can inform incomplete-market macro models
  - Direct evidence for heterogeneity in perceptions that *matter*
  - Closer to agents' information set that truly affects their decisions
  - No need to make stringent assumptions on expectation formation
- More work needed on
  - heterogeneous beliefs in HM models
  - understanding risk perception formation

Within-group dispersion in nominal PR



- residuals controlling for observables /time fixed effects
- average PR: 2.1% in std; 10/90 IQR: 3.2% in std

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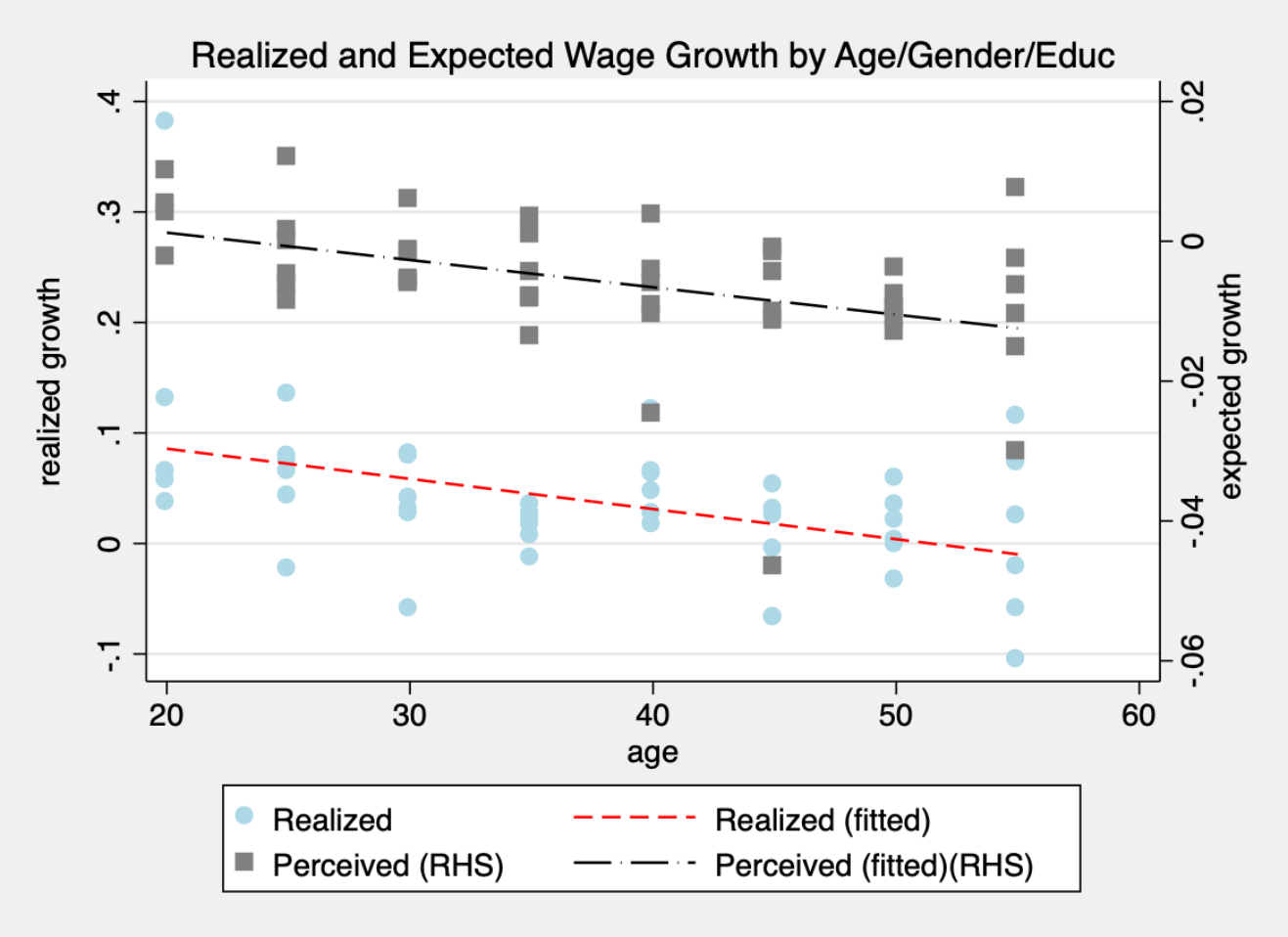
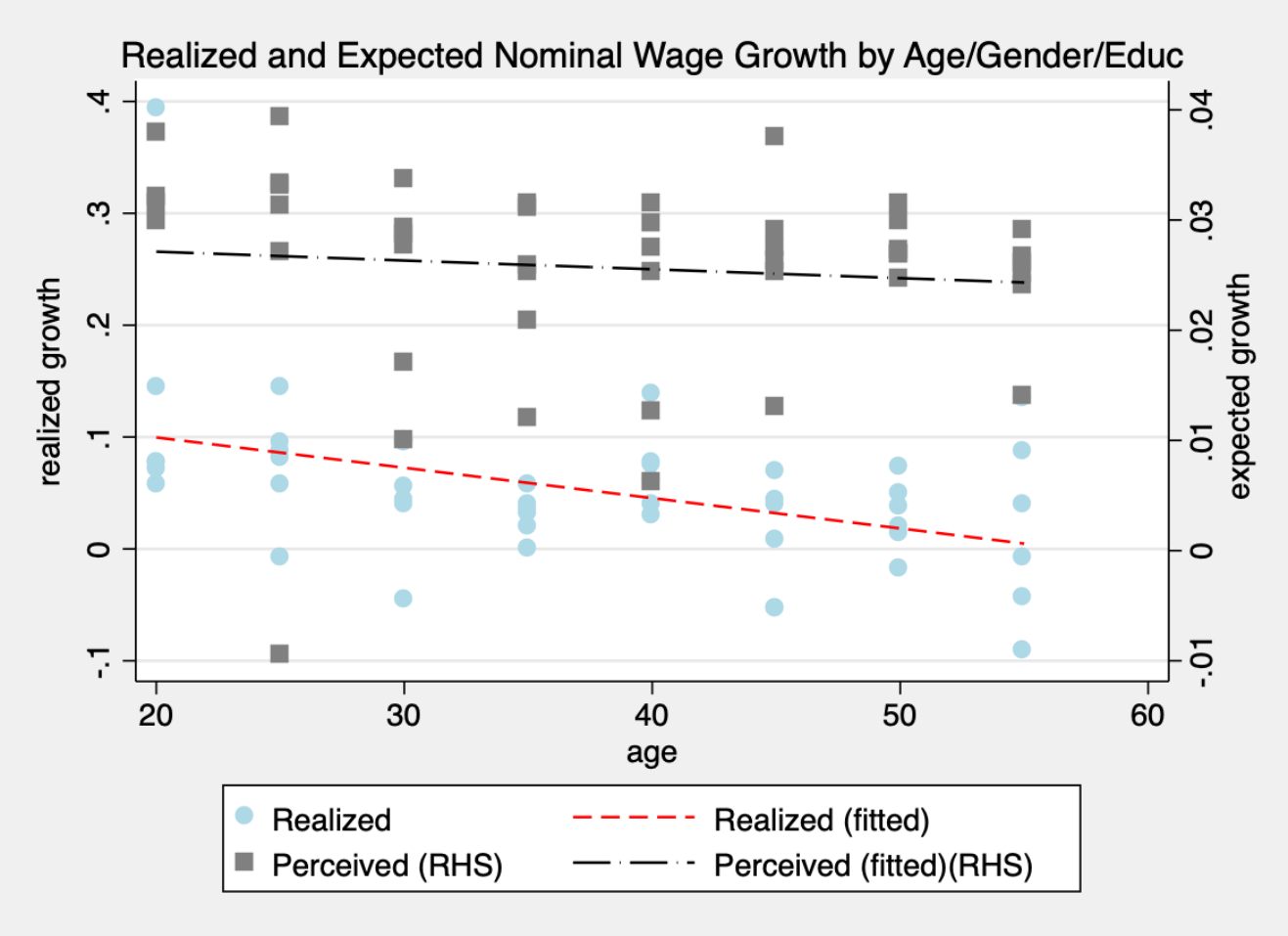
Appendix: expected growth by age



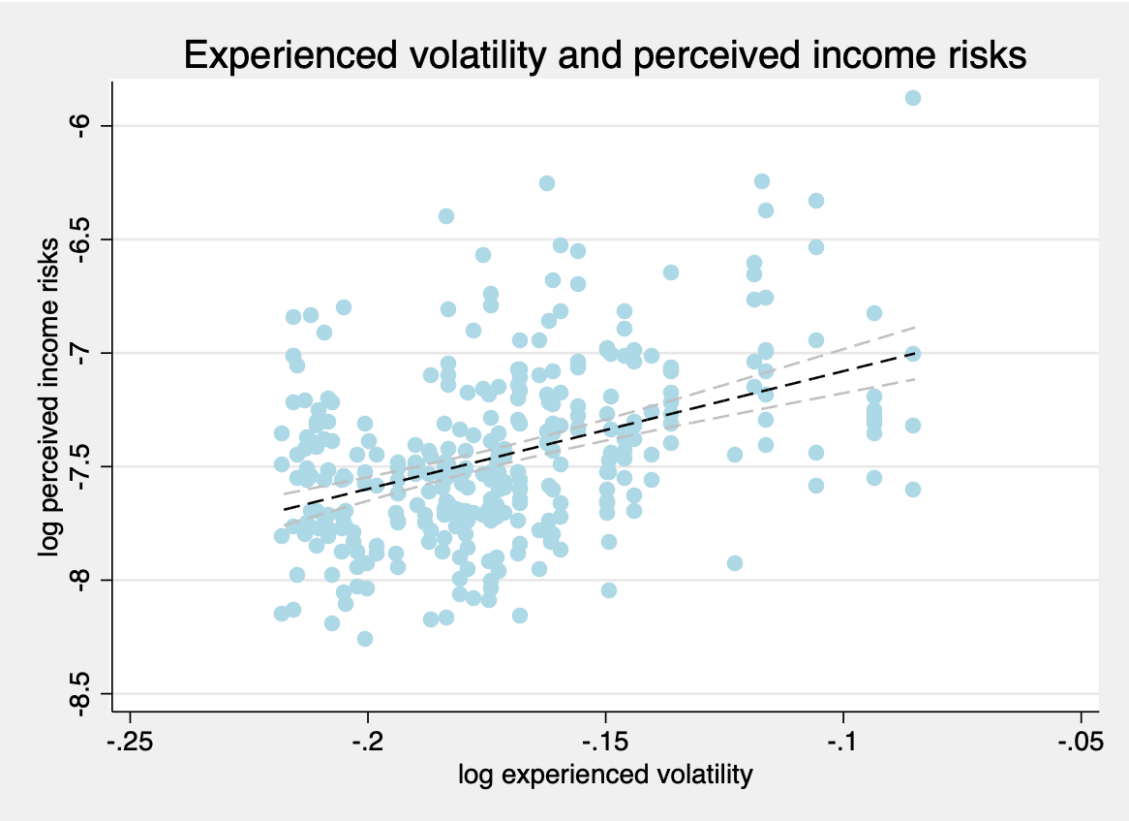
- e.g. a male high school graduate aged 30

Appendix: expected **nominal** growth by age



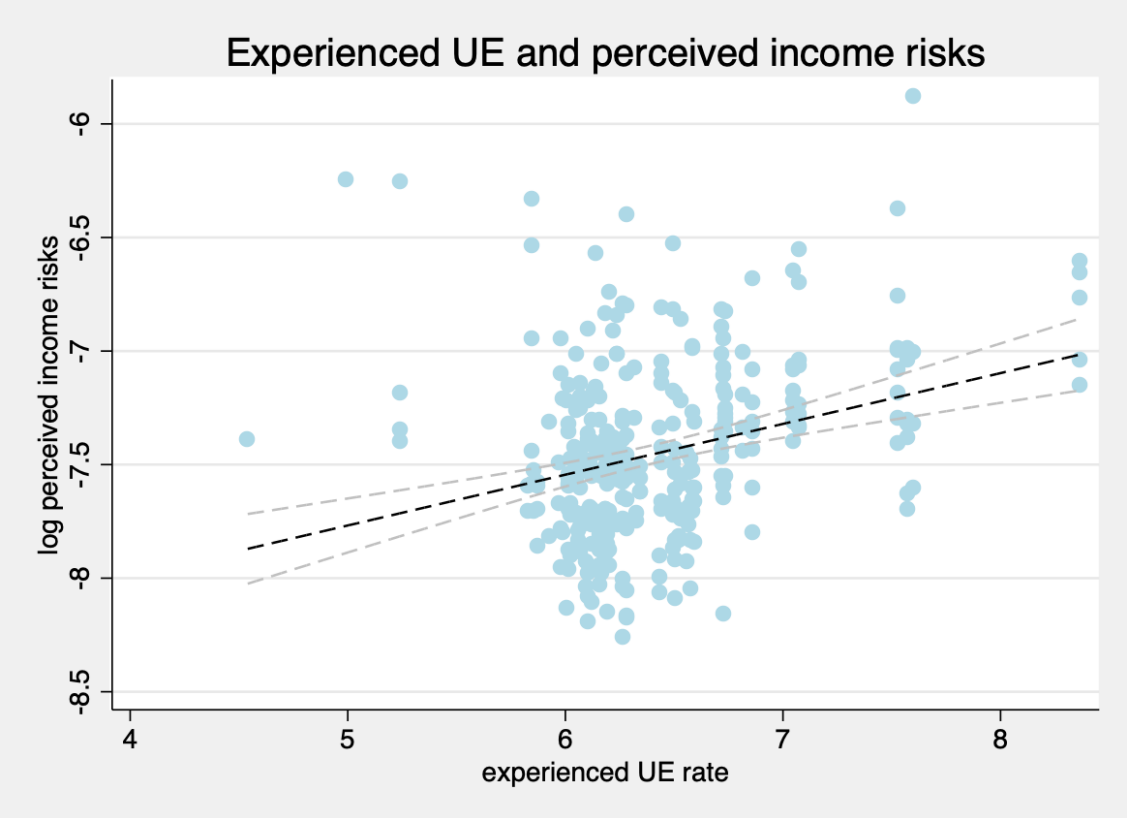
- e.g. a male high school graduate aged 30

Appendix: Experienced volatility and PR



- income volatility conditional on macroeconomic history Storesletten et al. (2004)
- e.g. the experience by a 25-year old till 2015 is between 1990-2015

Experienced labor market and perceived risks



- e.g. experienced UE by a 25-year old in 2015 is between UE over 1990-2015

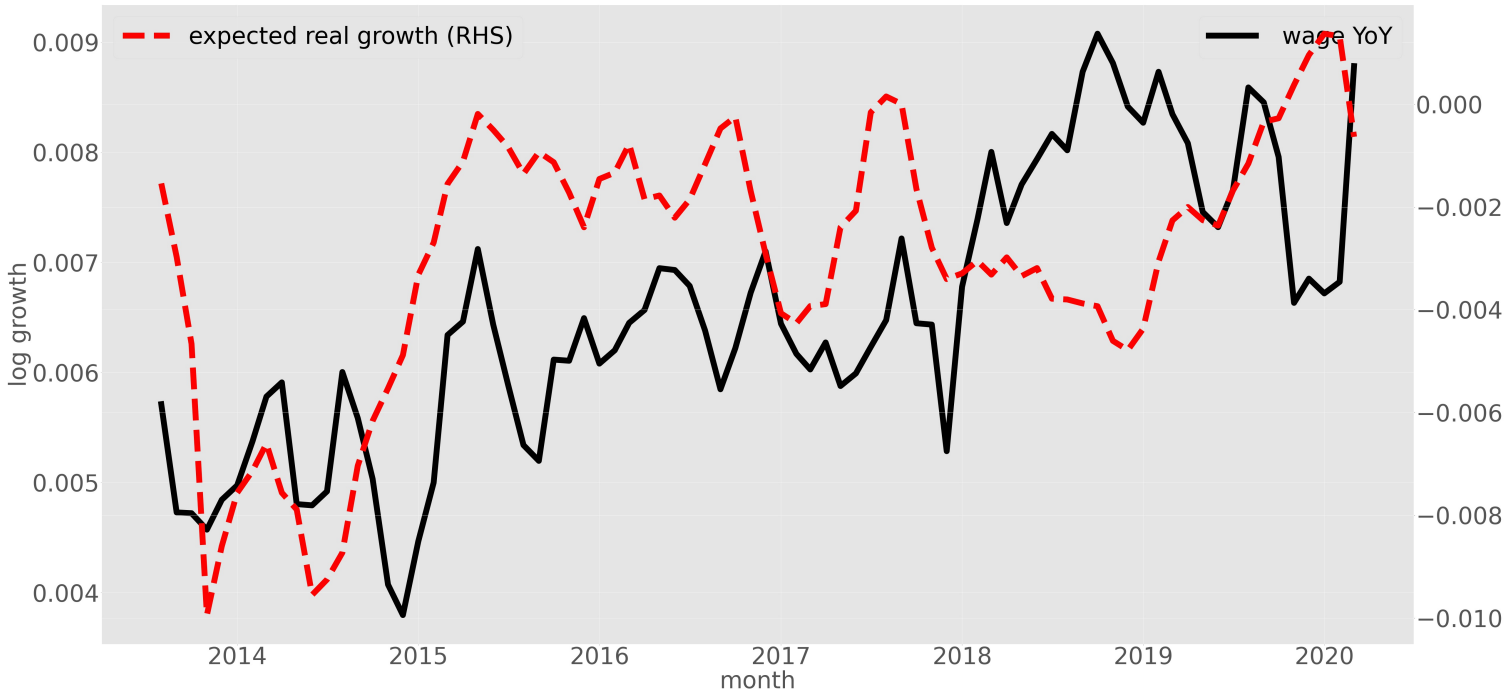
Appendix: Extrapolation from individual experiences

- higher experienced volatility → higher PR
- recent unemployment experience → higher PR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
income shock squared	0.0225***	0.0222***	0.0217***	0.0207***	0.000773	0.00205***	0.000566	0.00183***	0.000614	0.00184***
	(0.00562)	(0.00570)	(0.00562)	(0.00564)	(0.000743)	(0.000516)	(0.000744)	(0.000515)	(0.000745)	(0.000516)
recently unemployed				0.511*	0.228***	0.0895***				
				(0.260)	(0.0330)	(0.0200)				
unemployed since m-8							0.161***	0.0783***		
							(0.0207)	(0.0121)		
unemployed since y-1									0.138***	0.0701***
									(0.0193)	(0.0113)
Observations	3662	3662	3662	3662	3701	1871	3701	1871	3701	1871
R-squared	0.004	0.013	0.016	0.017	0.015	0.030	0.019	0.041	0.016	0.039

Appendix: expected income growth and recent (past) wage growth

- $\overline{\exp_t}$: average expected growth across individuals
- quarterly growth in average hourly wage



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Appendix: PR and current labor market condition

$$\underbrace{\overline{\text{risk}_t}}_{\text{average perceived risk}} = \alpha + \beta \underbrace{(log(\text{wage}_{t-k/12}) - log(\text{wage}_{t-(k-3)/12}))}_{\text{wage growth}} + \epsilon_{i,t}$$

$$\forall k = 0...4$$

	mean:var	mean:iqr	mean:rvar	mean:skew
0	-0.28**	-0.42***	-0.48***	-0.02
1	-0.42***	-0.53***	-0.51***	0.12
2	-0.43***	-0.48***	-0.44***	-0.01
3	-0.43***	-0.48***	-0.42***	-0.1
4	-0.31***	-0.41***	-0.32***	-0.21*

- Counter-cyclical income risks: Storesletten et al. (2004), Guvenen et al. (2014), Bayer et al. (2019)

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Appendix: PR and current labor market condition

$$\underbrace{\overline{\text{risk}_{s,t}}}_{\text{median perceived risk in state } s} = r + \psi \underbrace{LM_{s,t}}_{\text{state labor market condition}} + \eta_{s,t}$$

	(1)	(2)	(3)	(4)
	log(var)	log(risk)	log(iqr)	log(iqr)
wage growth	-0.05***		-0.03***	
	(0.01)		(0.01)	
unemp rate		0.04*		0.04***
		(0.02)		(0.01)
Observations	3529	3529	3546	3546
R-squared	0.023	0.020	0.025	0.028

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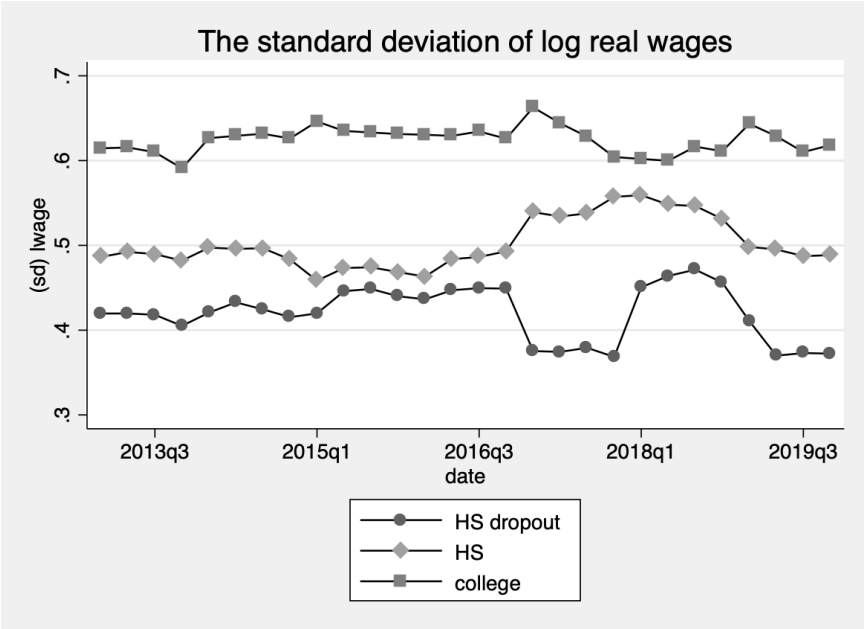
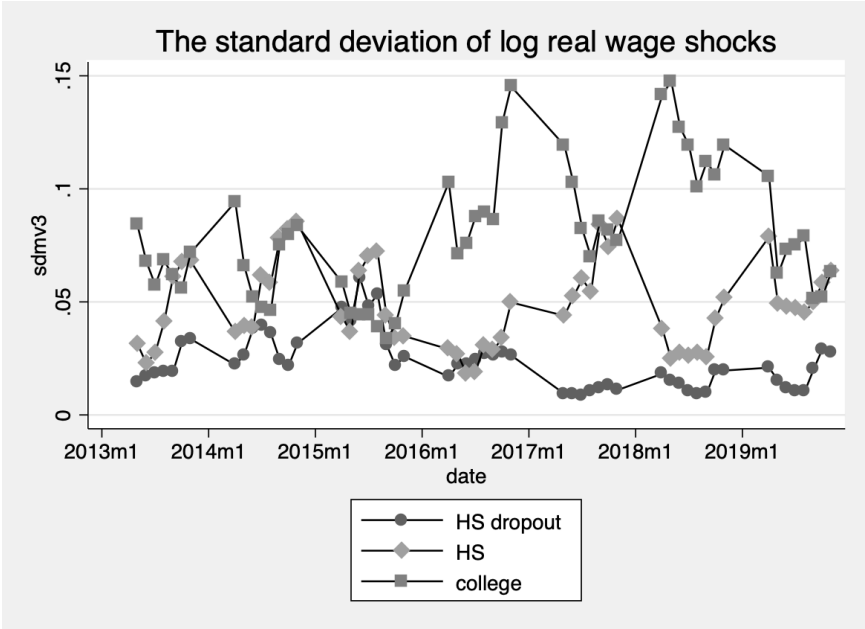
Appendix: monthly earning inequality and volatility

(a) Inequality



(b) Volatility



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Appendix: estimation of subjective risk profile

$$\log(\tilde{\text{var}}_{i,t}) = (12 + \frac{1}{12\kappa^2})\tilde{\sigma}^2_{i,t,\psi} + \xi_t + \eta_i + \epsilon_{i,t}$$

- κ: externally assumed ratio of permanent and transitory risks $\frac{\tilde{\sigma}_{i,t,\psi}}{\tilde{\sigma}_{i,t,\theta}}$

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Appendix: calibration of the objective model

Table: Model parameters

block	parameter name	values	source
risk	σ_ψ	0.15	Median estimates from the literature
risk	σ_θ	0.1	Median estimates from the literature
risk	$U2U$	0.18	Median estimates from the literature
risk	$E2E$	0.96	Median estimates from the literature
initial condition	$\sigma_\psi^{\text{init}}$	0.629	Estimated for age 25 in the 2016 SCF
initial condition	bequest ratio	0	assumption
life cycle	T	40	standard assumption
life cycle	L	60	standard assumption
life cycle	$1-D$	0.994	standard assumption
preference	ρ	1	standard assumption
preference	β	0.98	standard assumption
policy	$\mathbb{S}$	0.65	U.S. average
policy	λ	0	endogenously determined
policy	λ_{SS}	0	endogenously determined
policy	μ	0.15	U.S. average
production	W	1	target values in steady state
production	K2Y ratio	3	target values in steady state
production	α	0.33	standard assumption
production	δ	0.025	standard assumption

Extensions: additional heterogeneity in MPC

- Heterogeneous time preferences
  - Ex-ante differences in β, a la Krusell and Smith (1998); Carroll et al. (2017); Krueger et al. (2016).
- Costly adjustments

$$V_{i,\tau}(c_{i,\tau-1}, x_{i,\tau}) = \max \quad \{V_\tau^A(x_{i,\tau}) - \chi, V_\tau^N(c_{i,\tau-1}, x_{i,\tau})\}$$
$$V_\tau^A(x_{i,\tau}) = \max_{\{c_{i,\tau}\}} \quad u(c_{i,\tau}) + (1-D)\beta\mathbb{E}_\tau\left[V_{\tau+1}(x_{i,\tau+1})\right]$$
$$V_\tau^N(c_{i,\tau-1}, x_{i,\tau}) = u(c_{i,\tau-1}) + (1-D)\beta\mathbb{E}_\tau\left[V_{\tau+1}(c_{i,\tau}, x_{i,\tau+1})\right]$$

  - Utility cost from adjusting consumption in each period
  - To introduce extensive margin of consumption change and match high MPC from data

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