

Perceived versus Calibrated Income Risks in Heterogeneous-agent Consumption Models

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Roadmap

Motivation

Empirical Evidence

- Framework

- Perceived v.s. calibrated risks

- Unemployment risks

- Perceived risks and decisions

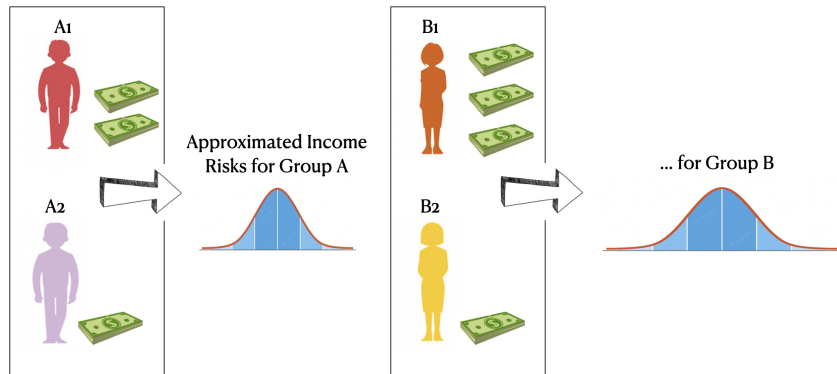
Model

- Objective model

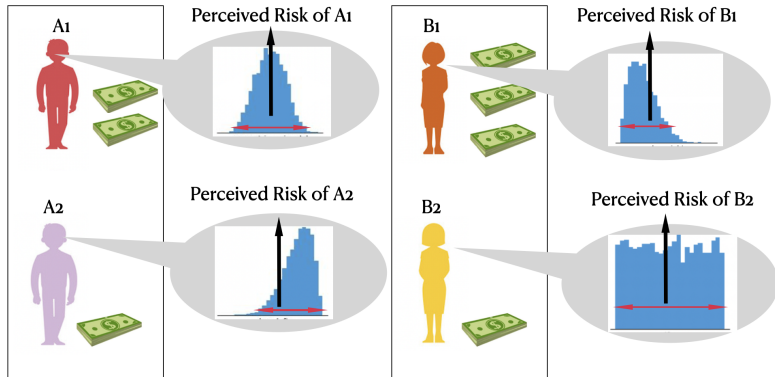
- Subjective model

Conclusion

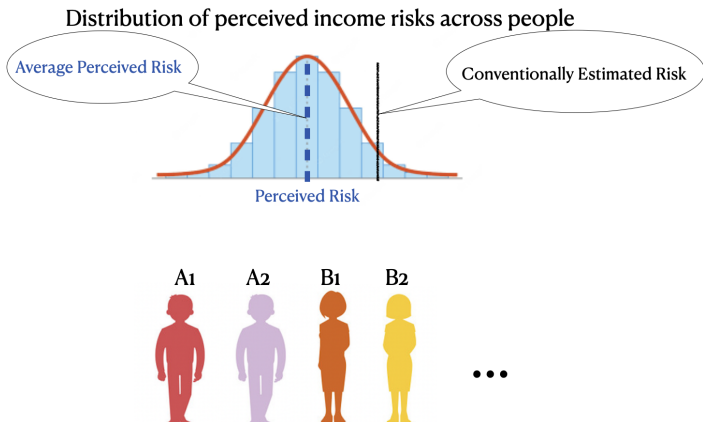
Conventional calibration: estimated from panel data



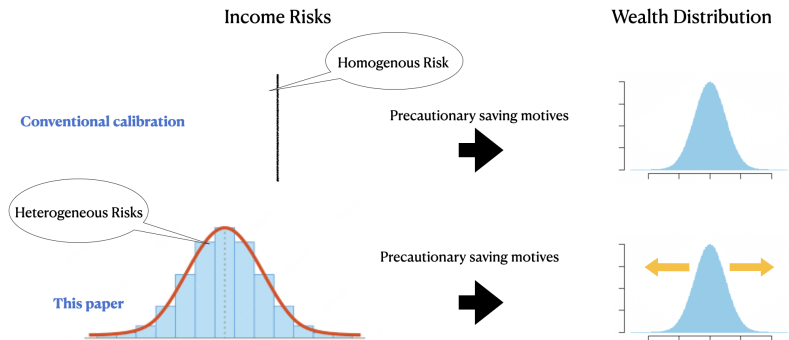
This paper: reported perceived risks in a survey



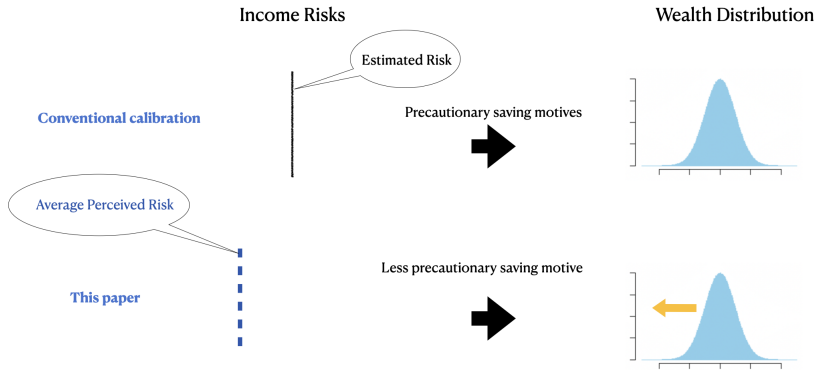
Perceived versus Calibrated Risk



Heterogeneous risks \rightarrow differential savings



Smaller risks \rightarrow lower level of savings



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Log wage process

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

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- Wage growth

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

- individual i at time t
- the time-series nature of $e_{i,t}$ to be specified later

Perceived risks (PR)

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

$$Var_{i,t}^*(\Delta w_{i,t+1}) = Var_{i,t}^*(\Delta e_{i,t+1})$$

Perceived risks (PR)

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

$$Var_{i,t}^*(\Delta w_{i,t+1}) = Var_{i,t}^*(\Delta e_{i,t+1})$$

- To econometricians: **approximated unconditional** variance

$$Var_c(\Delta \hat{e}_{i,c,t+1}) = Var_c(\Delta w_{i,t+1} - \Delta \hat{z}_{i,t+1})$$

- $\hat{e}_{i,c,t+1}$: the first-step regression residual controlling observable vars
- group c : **assumed** to share income process/risks
 - e.g. 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
 2. Foresight about individual circumstances

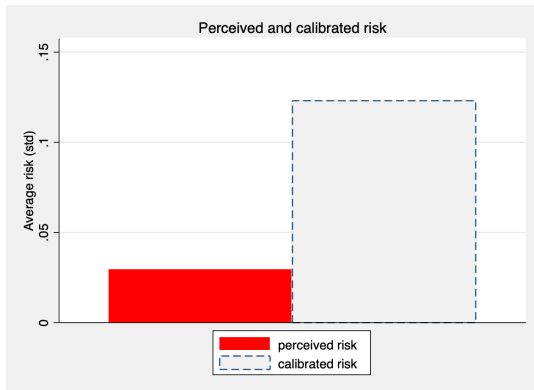
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- Model misspecification
 - Risks may differ within group c

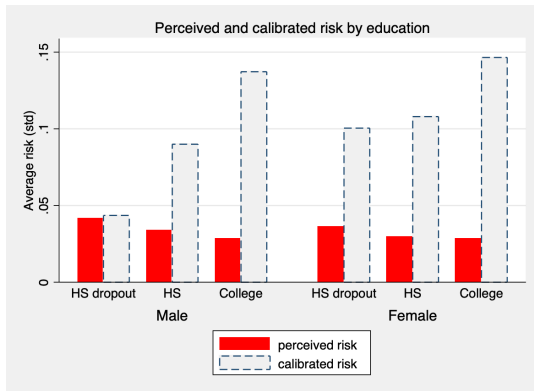
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 1. Intrinsic heterogeneity of individual i
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- Model misspecification
 - Risks may differ within group c
- Surveyed PR can be a useful alternative
 - Directly conditional on information set of each i at t
 - No need to restrict risk heterogeneity by group c
 - But need to be careful with measurement errors

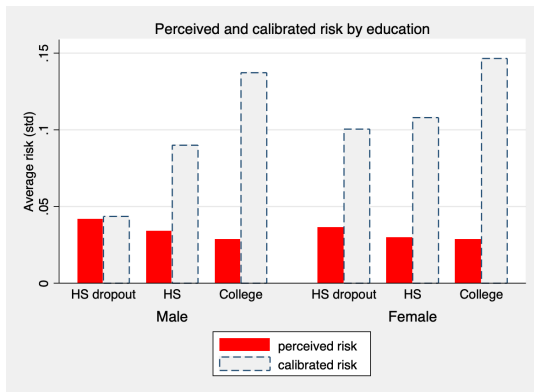
Average PR < calibrated risk



PRs < calibrated risks **within groups**



PRs < calibrated risks **within groups**

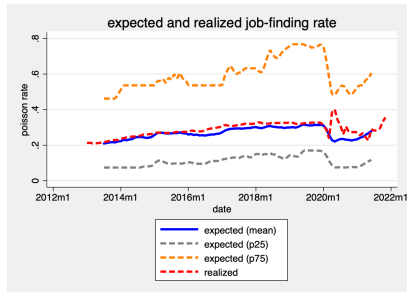
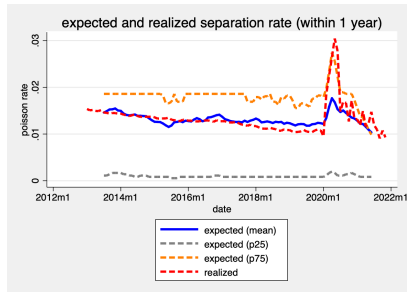


- The wage risk estimates by [Low, Meghir, and Pistaferri, 2010](#):
 - low education: permanent risk = 0.09, transitory risk = 0.08
 - high education: permanent risk = 0.106, transitory risk = 0.08

What explains the PR heterogeneity?

- Observables + time FE: $R^2 = 0.10$
- Individual fixed-effects only: $R^2 = 0.60$

Perceived UE risks and realization



- realizations are computed from CPS panel data of workers following Fujita and Ramey, 2009

Individual PRs explain **their own** spending decisions

$$E_{i,t}(\Delta c_{i,t+1}) = u_0 + u_1 E_{i,t}(\Delta w_{i,t}) + u_2 \text{Var}_{i,t}(\Delta w_{i,t+1}) + \xi_{i,t}$$

	(1)	(2)	(3)	(4)	(5)
expected wage growth	0.324*** (0.0825)	0.306*** (0.0828)	0.254*** (0.0334)	0.243*** (0.0334)	
perceived wage risk	6.127*** (1.163)	6.185*** (1.165)	2.096*** (0.439)	1.711*** (0.442)	
perceived UE risk next 4m					0.353*** (0.0553)
R-squared	0.000939	0.00318	0.953	0.953	0.633
Sample Size	56046	56046	56046	56046	6269
Time FE	No	Yes	No	Yes	Yes
Individual FE	No	No	Yes	Yes	Yes

- Higher perceived risks → higher expected spending growth.

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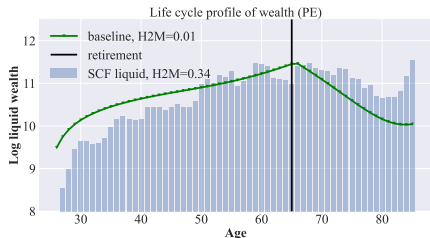
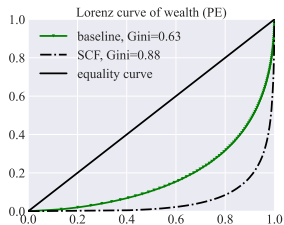
Conclusion

Model overview

- Overlapping generation
- Uninsured idiosyncratic income risks
 - Permanent+ transitory idiosyncratic wage shock
 - Persistent unemployment spells
- Partial/general equilibrium
- No aggregate risk a la Krusell and Smith, 1998
- A blend of Huggett, 1996 and C. D. Carroll, 1997
- Only one risk-free asset
- Calibrating income risks using survey versus estimates from panel
- Extension: subjective model
 - subjective PR \neq objective income risks

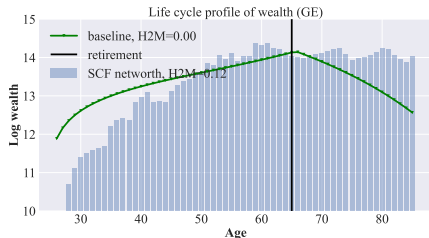
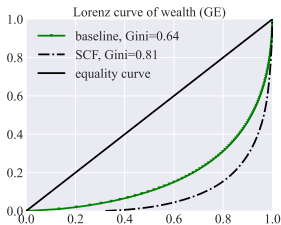
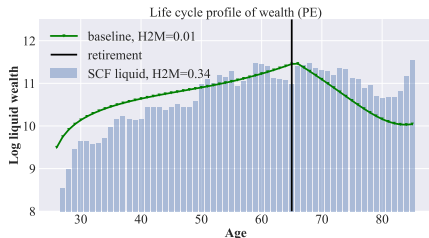
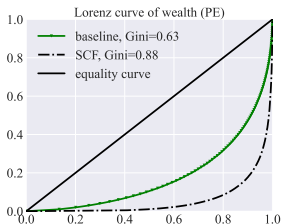
StE distribution in the baseline model

- $\sigma_\psi = 0.15, \sigma_\theta = 0.15, U2U = 0.18, E2E = 0.96$ other parameters
- H2M: net liquid asset < half-month income Kaplan, Moll, and Violante, 2018



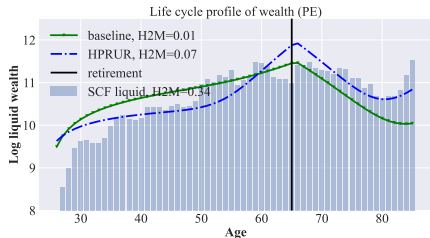
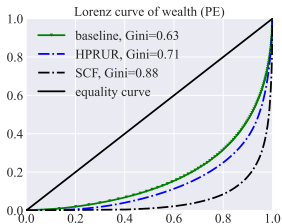
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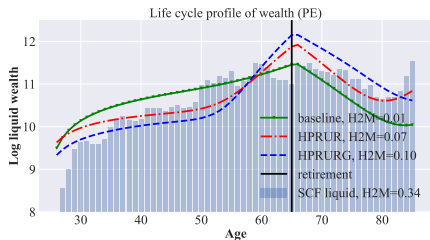
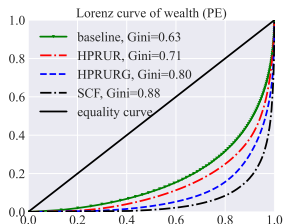
Heterogeneous perceived wage /UE risks (HPRUR)

$$\sigma_{\psi} = \sigma_{\theta} = [0.01, 0.02, 0.04], U2U = [0, 0.02, 0.24], E2E = [0.96, 0.99, 1.0]$$



Hetero perceived wage /UE risks/ growth rates (HPRURG)

$$\sigma_{\psi} = \sigma_{\theta} = [0.01, 0.02, 0.04], U2U = [0.1, 0.5, 0.8], E2E = [0.85, 0.97, 0.99], \text{std}(G) = 0.03$$



Taking stock

Model/Data	Gini	Top 0.05	Top 0.1	Top 0.5	Mean wealth/income ratio	H2M share
SCF (liquid)	0.88	0.72	0.82	0.99	0.67	0.34
baseline (PE)	0.63	0.40	0.53	0.89	1.17	0.01
HPR (PE)	0.64	0.43	0.57	0.89	0.84	0.01
HPRUR (PE)	0.71	0.48	0.62	0.93	0.51	0.07
HPRURG (PE)	0.80	0.56	0.70	0.97	0.63	0.10
SCF (net worth)	0.81	0.57	0.71	0.98	6.72	0.12
baseline (GE)	0.64	0.40	0.53	0.90	1.65	0.00
HPR (GE)	0.65	0.43	0.57	0.89	1.23	0.01
HPRUR (GE)	0.70	0.47	0.61	0.92	1.12	0.02
HPRURG (GE)	0.76	0.52	0.65	0.95	0.99	0.04

Extension: subjective PR

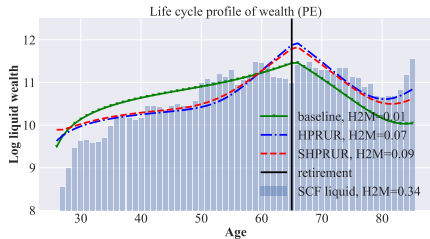
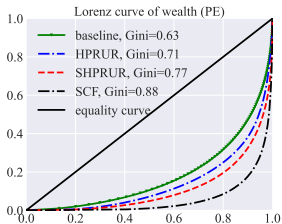
Key assumption:

- Ex-ante: saving decisions \leftarrow subjective PRs
- Ex-post: realized income inequality \leftarrow objective size of income risks

Two purposes:

- A robustness check: what if PRs are incorrect?
 - but we did find people behave according to their PRs
- A model breakdown into ex-ante and ex-post channels

Subjective (SHPRUR) v.s. Objective (HPRUR)



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- People's saving behaviors better explained by their **perceptions** ... than **what economists assume** to be their perceptions
- 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
- More work needed on
 - heterogeneous beliefs in HM models
 - understanding risk perception formation

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References VII

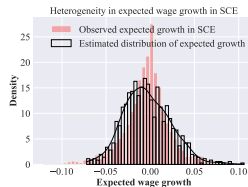
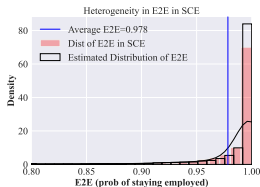
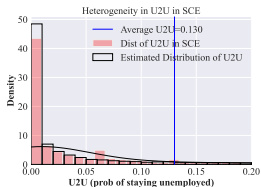
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 - “heterogeneity or risk”: Cunha, Heckman, and Navarro, 2005, Primiceri and Van Rens, 2009, Guvenen and Smith, 2014
 - “insurance or information”: Pistaferri, 2001, Kaufmann and Pistaferri, 2009, Meghir and Pistaferri, 2011, Kaplan and Violante, 2010
- subjective/probabilistic survey of beliefs: Manski, 2004, Delavande, Giné, and McKenzie, 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, Storesletten, and Violante, 2009, C. Carroll et al., 2017, Krueger, Mitman, and Perri, 2016, Bayer et al., 2019
- consumption/saving under incomplete information/imperfect perception: Pischke, 1995, Wang, 2004, Rozsypal and Schlafmann, 2017, C. D. Carroll,

Calibrating heterogeneous PRs

- Fit a truncated log-normal dist over the cross-section of PRs



Appendix: PR and current labor market conditions

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

$\forall k = 0 \dots 4$

	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*

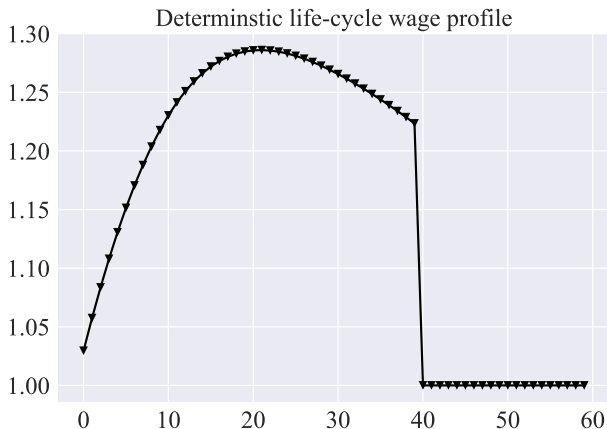
- Counter-cyclical income risks: Storesletten, Telmer, and Yaron, 2004, Guvenen, Ozkan, and Song, 2014, Bayer et al., 2019

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*** (0.01)		-0.03*** (0.01)	
unemp rate		0.04* (0.02)		0.04*** (0.01)
Observations	3529	3529	3546	3546
R-squared	0.023	0.020	0.025	0.028

Deterministic wage profile over life cycle



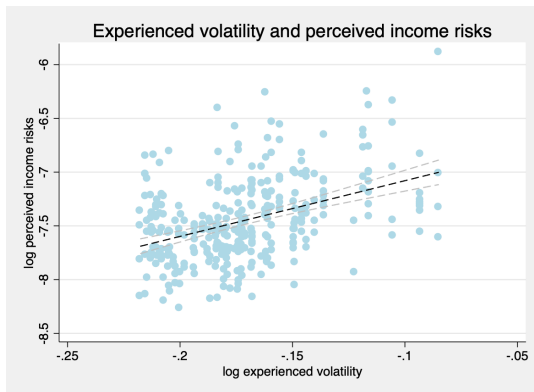
- Estimated from SIPP with a fourth-order age polynomial regression

Appendix: Extrapolation from individual experiences

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

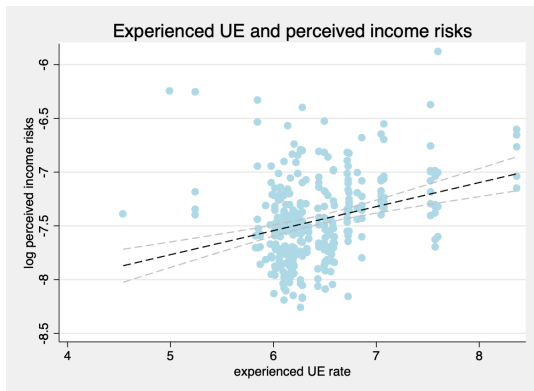
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
income shock squared	0.0225*** (0.00562)	0.0222*** (0.00570)	0.0217*** (0.00562)	0.0207*** (0.00564)	0.000773 (0.000743)	0.00205*** (0.000516)	0.000566 (0.000744)	0.00183*** (0.000515)	0.000614 (0.000745)	0.00184*** (0.000516)
recently unemployed				0.511* (0.260)	0.228*** (0.0330)	0.0895*** (0.0200)				
unemployed since m-8							0.161*** (0.0207)	0.0783*** (0.0121)		
unemployed since y-1									0.138*** (0.0193)	0.0701*** (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: Experienced volatility and PR



- income volatility conditional on macroeconomic history Storesletten, Telmer, and Yaron, 2004
- e.g. the experience by a 25-year old till 2015 is between 1990-2015

Appendix: Experienced UE rates and PR



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