Perceived Income Risks and Subjective Attribution

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April 28, 2020

Outline

1. Motivation
2. Model
   - Learning and attribution
   - Simulation
3. Empirical facts
   - Cross-sectional patterns
   - Perceived risks and decisions
   - Coutercylical perceived risks

Motivation

- Risks matter for individual decisions
  - precautionary saving
  - portfolio choice and stock market participation
- Risks matter for macroeconomic outcomes
  - Since idiosyncratic risks are not perfectly insured
  - Different wealth $\rightarrow$ different MPCs $\rightarrow$ distributional channel of macroeconomic policies
- Risks estimated from the inequality $\approx$ "the truth" $\approx$ perceptions?

This paper's agenda

1. **Theory**: a subjective heterogeneous-agent model
   - imperfect understanding of income risks
     - the size: experienced volatility → perceived risks, different across age and generation groups
     - the nature: subjective attribution, i.e. aggregate v.s. idiosyncratic → different perceptions
   - life-cycle agent with uninsured idioyncratic (and aggregate) risks)
2. **Empirics:** subjective risk profiles from density surveys
   - Cross-sectional profile, different across age, generation and income
   - Correlation structure with current labor market outcomes: countercylical perceived risks
   - Decision implications, i.e. higher perceived risk → higher precautionary saving

Literature

- experience-based learning, Malmendier and Nagel (2015)
- subjective survey, especially on probabilistic surveys. Manski (2004), Delavande et al. (2011), Manski (2018), Bertrand and Mullainathan (2001), Armantier et al. (2017)
- "insurance or information": Kaufmann and Pistaferri (2009), Meghir and Pistaferri (2011), Pistaferri (2001), New York Fed Blog (2019), Flavin (1988)
- consumption/saving and portfolio choice under imperfect perception/understanding. Rozsypal and Schlafmann (2017), Carroll et al. (2018), Lian (2019)
- macroeconomic expectation formation, Coibion and Gorodnichenko (2012), Fuhrer (2018), etc
- counter-cyclical labor income risks: Storesletten et al. (2004), Guvenen et al. (2014), Catherine (2019)

Preview of the theory

- Learning: learns about the parameters of income process from a small sample
- Experience: past experience of volatility $\rightarrow$ future risk perceptions
- Attribution: subjectively determine whether shocks are aggregate or idiosyncratic $\rightarrow$ different parameter uncertainty
- Attribution errors: positive (negative) shocks $\rightarrow$ internal (external) attribution $\rightarrow$ zero (positive) subjective correlation $\rightarrow$ low (high) perceived risks
- Countercylical perceived risks: positive (negative) news $\rightarrow$ low (high) aggregate uncertainty

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Income process

$$
\begin{aligned}
y_{i,c,t} &= \rho y_{i,c,t-1} + \epsilon_{i,c,t} \\
\epsilon_{i,c,t} &\sim N(0, \sigma^2)
\end{aligned}
\tag{1}
$$

- individual i at time t
- cohort c, year of entering the job market
- ρ: persistence parameter
- $\epsilon_{i,c,t}$, income shock
  - Identical: constant income risks across people and time
  - Independence: purely idiosyncratic risk
  - Both can be relaxed, i.e. cross-sectional correlation for aggregate shocks

Perceived risk

- Perfect understanding

$$
\begin{aligned}
Var^*_{i,t}(\Delta y_{i,t+1}) &= Var^*_{i,t}(\epsilon_{i,t+1}) \\
&= \sigma^2
\end{aligned} \tag{2}
$$

- Imperfect understanding

$$
\widehat{V}ar_{i,t}(\Delta y_{i,t+1}) = y^2_{i,t-1} \underbrace{\widehat{Var}^{\rho}_{i,t}}_{\text{Persistence uncertainty}} + \underbrace{\hat{\sigma}^2_{i,t}}_{\text{Shock uncertainty}} \tag{3}
$$

Learning

$$\underbrace{\hat{\rho}_{i,t}}_{\text{estimated parameter}} = (\sum_{k=0}^{t-c}\sum_{j=1}^{n} y^2_{j,t-k-1})^{-1}(\sum_{k=0}^{t-c}\sum_{j=1}^{n} y_{j,t-k-1}y_{j,t-k}) \tag{4}$$

- sample: past experience of both i's own and others' income
- size: $N_{i,t} = n(t-c)$
  - n, an arbitrarily small n is sufficient
  - $t-c$, the duration of career (approximate for age)
- least-square learning rule (see, for instance, Evans and Honkapohja (2012))

Shock uncertainty

$$\underbrace{\widehat{\sigma}^2_{i,t}}_{\text{estimated shock uncertainty}} = \underbrace{\frac{1}{N_{i,t}-1}\sum_{j=1}^{N_{i,t}}\sum_{k=0}^{t-c}\hat{e}^2_{j,t-k}}_{\text{experienced volatility}} \tag{5}$$

- $N_{i,t} = n(t-c)$, sample size
- $\hat{e}_{i,t}$: unexpected income shocks (learning residuals)

Persistence uncertainty

$$\tilde{Var}^{\rho}_{i,t} = (\sum_{k=0}^{t-c}\sum_{j=1}^{n} y^2_{j,t-k-1})^{-1}(\sum_{k=0}^{t-c}\tilde{\Omega}_{t-k})(\sum_{k=0}^{t-c}\sum_{j=1}^{n} y^2_{j,t-k-1})^{-1} \tag{6}$$

$$\begin{aligned}\tilde{\Omega}_t &= \tilde{E}_{i,t}(Y'_{t-1}\epsilon'_t\epsilon_t Y_{t-1}) \\ Y'_{t-1} &= [y_{1,t-1}, y_{2,t-1}...y_{n,t-1}]'\end{aligned} \tag{7}$$

- **Attribution**: how i thinks about the correlation between her own income and others
- $\tilde{\Omega}_t$, perceived variance-covariance at time t

Internal attribution

- "my income has nothing to do with others"

$$\tilde{\Omega}_t = \widehat{\Omega}_t = (\sum_{k=0}^{t-c}\sum_{j=1}^{n} y^2_{j,t-k-1})\widehat{\sigma}^2_{i,t} \tag{8}$$

- $\widehat{\Omega}_t$ assumes cross-sectional independence

External attribution

- "something common affects me as well as others"
- A special case

$$\tilde{\Omega}_t \approx \tilde{\sigma}^2_t(1+\underbrace{\tilde{\delta}_{y,i,t}\tilde{\delta}_{\epsilon,i,t}}_{\equiv\tilde{\delta}_{i,t}}(n-1))\sum_{j=1}^{n} y^2_{j,t} \tag{9}$$

- fixed sample size n and time-invariant risk σ^2
- $\tilde{\delta}_{\epsilon,i,t}$: subjective correlation in income shocks
- $\tilde{\delta}_{y,i,t}$: subjective correlation in income
- $\tilde{\delta}_{i,t} \in [0,1]$: attribution parameter, the subjective correlation of individual outcome with others.
  - internal: $\tilde{\delta}_{i,t} = 0$
  - external: $\tilde{\delta}_{i,t} > 0$

Perceived risk under internal v.s. external attribution

- Incorrect: $\tilde{\delta}_{i,t} > 0$

$$\tilde{Var}_{i,t}(\Delta y_{i,t+1}) = y^2_{i,t-1}\tilde{Var}^{\rho}_{i,t} + \tilde{\sigma}^2_{i,t}$$
$$= [(\sum_{k=0}^{t-c}\sum_{j=1}^{n} y^2_{j,t-k-1})^{-1}(1+\tilde{\delta}_{i,t}(n-1))y^2_{i,t}+1]\tilde{\sigma}^2_{i,t} \tag{10}$$

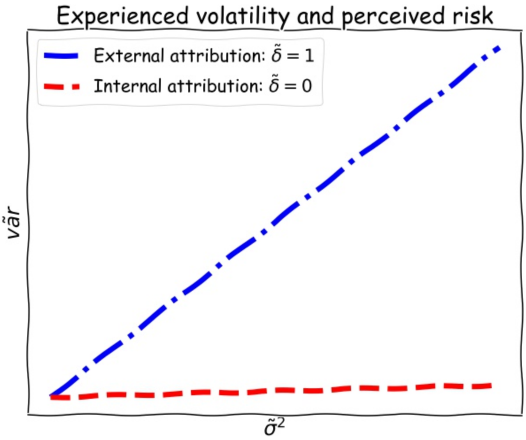
- Correct: $\tilde{\delta}_{i,t} = 0$

$$\widehat{Var}_{i,t}(\Delta y_{i,t+1}) =$$
$$[(\sum_{k=0}^{t-c}\sum_{j=1}^{n} y^2_{j,t-k-1})^{-1}y^2_{i,t}+1]\hat{\sigma}^2_{i,t} \quad \forall\tilde{\delta}_{i,t} > 0 \tag{11}$$

- Comparison

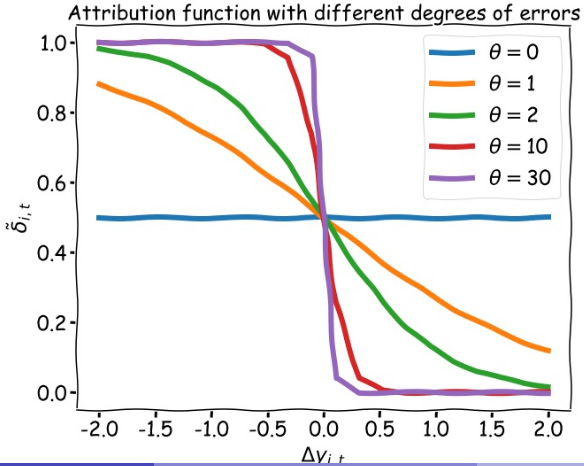
$$\tilde{Var}_{i,t}(\Delta y_{i,t+1}) \geq \widehat{Var}_{i,t}(\Delta y_{i,t+1}) \tag{12}$$

Prediction 1. experienced volatility extrapolated into perceived risks

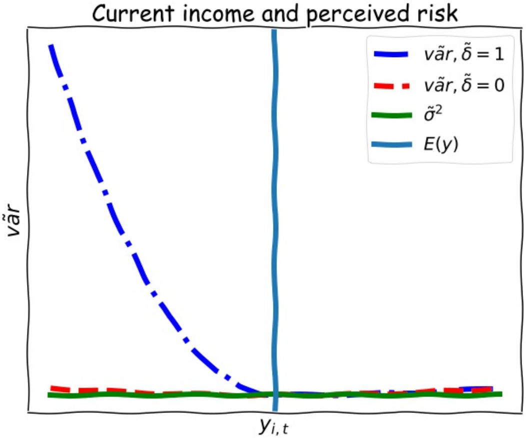


Attribution errors

- positive (negative) shock induces internal (external) attribution
- reminicent of the self-serving bias in the social psycology literature



Prediction 2. skewned U-shaped income profile



Prediction 3. perceived risks declines over age

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Data

Table: Survey of Consumer Expectations

Time period	2013M6-2019M6
Frequency	monthly
Sample size	1,300
Density variable	1-yr-ahead earning growth (same position/hours)
Pannel structure	12 months
Demographics	educ, income, age, gender, state

- density estimation following Engelberg et al. (2009)
- exclude top and bottom 1% values of each moment

Definition

- $\Delta Y_{i,t+12}$: the next-year income growth of the same job/position/hours, seperate from unemployement risk
- Moments of interest
  - expected growth, $\exp_{i,t} = E_{i,t}(\Delta Y_{i,t+12})$
  - variance: $\overline{var}_{i,t}(\Delta Y_{i,t+12})$
  - iqr: $\overline{iqr}_{i,t}(\Delta Y_{i,t+12})$
  - skewness: $\overline{skew}_{i,t}(\Delta Y_{i,t+12})$
- Nominal and real income growth
  - $\text{rexp}_{i,t} = E_{i,t}(\Delta Y^r_{i,t+12}) = E_i(\Delta Y^n_{i,t+12}) - E_{i,t+12}(\pi_{t+12})$
  - $\overline{rvar}_{i,t} = \overline{var}_{i,t}(\Delta Y^n_{i,t+12}) + \overline{var}_{i,t}(\pi_{t+12})$

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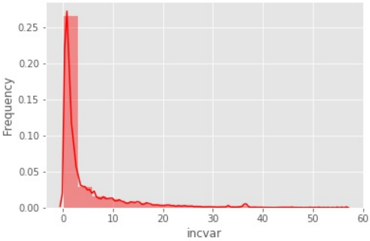
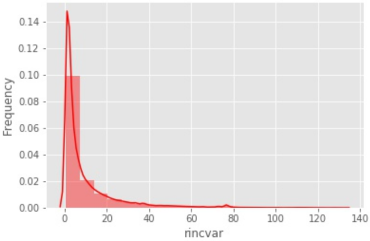
Cross-section of income risks

(a) nominal income risk

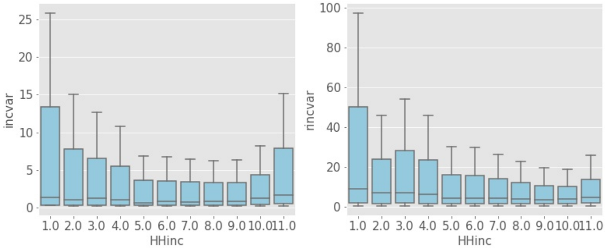


(b) real income risk



- average: 2.5% standard deviation for nominal and 3.5% standard deviation for real income

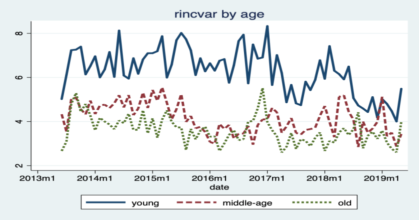
Perceived risks by household income



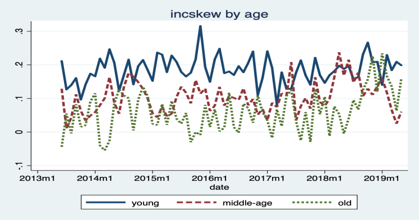
- Similar to the pattern of earning growth dispersion conditional on income in Bloom et al. (2018).

Perceived risks by age

(a) risks



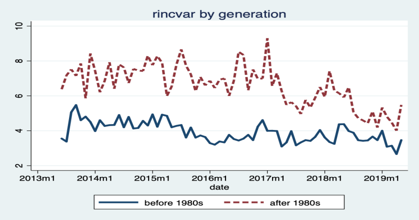
(b) skewness



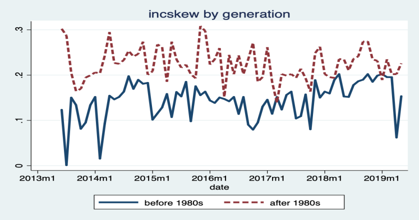
- in line with existing findings, for instance Bloom et al. (2018).

Perceived risks by generation

(a) risks



(b) skewness



Covariants of perceived risks

Table: Perceived income risks and individual characteristics

	incvar I	incvar II	incvar III	incvar IIII	rincvar I	rincvar II	rincvar III	rincvar IIII
HHinc_gr=low inc			1.56***				7.01***	
			(0.10)				(0.19)	
educ_gr=low educ				0.40***				3.82***
				(0.11)				(0.21)
gender=male				-0.80***				2.76***
				(0.10)				(0.19)
parttime=yes	0.05	0.24*	-0.12		1.41***	1.81***	0.19	
	(0.12)	(0.13)	(0.13)		(0.23)	(0.26)	(0.26)	
selfemp=yes	7.21***	-0.00***	-0.00***		6.27***	-0.00***	0.00***	
	(0.15)	(0.00)	(0.00)		(0.27)	(0.00)	(0.00)	
UEprobAgg		0.01**	0.00*			0.05***	0.04***	
		(0.00)	(0.00)			(0.00)	(0.00)	
UEprobInd		0.03***	0.02***			0.05***	0.04***	
		(0.00)	(0.00)			(0.00)	(0.00)	
Intercept	4.64***	3.75***	3.28***	5.72***	12.42***	12.21***	10.16***	11.16***
	(0.05)	(0.12)	(0.12)	(0.07)	(0.10)	(0.24)	(0.25)	(0.14)
N	54029	47331	47331	47457	50730	44382	44382	44517
R2	0.05	0.00	0.01	0.00	0.01	0.01	0.04	0.01

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Perveived risks and household spending

$$E_{i,t}(\Delta C_{i,t+12}) = u_0 + u_1 \overline{\text{risks}}_{i,t}(\Delta Y_{i,t+12}) + \xi_{i,t}$$

	spending I	spending II	spending III	spending IIII	spending IIIII	spending IIIIII	spending IIIIIII
incexp	0.39***						
	(0.08)						
rincexp		-0.04*					
		(0.02)					
incvar			0.07***				
			(0.02)				
rincvar				0.07***			
				(0.01)			
UEprobAgg						0.04***	
						(0.01)	
UEprobInd					-0.01		
					(0.01)		
incskew							0.21
							(0.43)
N	55673	50997	55465	52099	54315	85468	55029
R2	0.00	0.00	0.00	0.00	0.00	0.00	0.00

- Higher perceived risks → higher expected spending growth.

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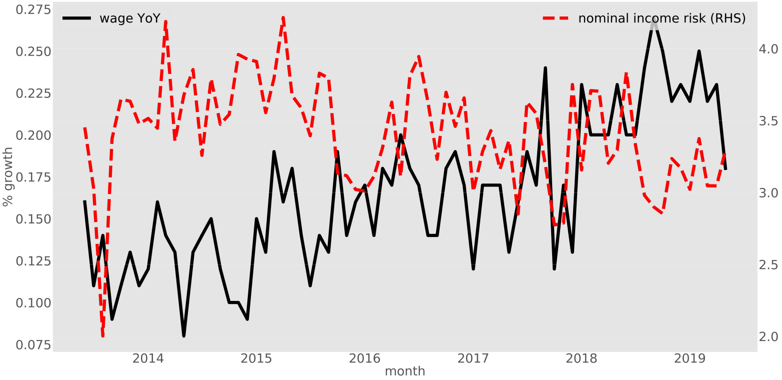
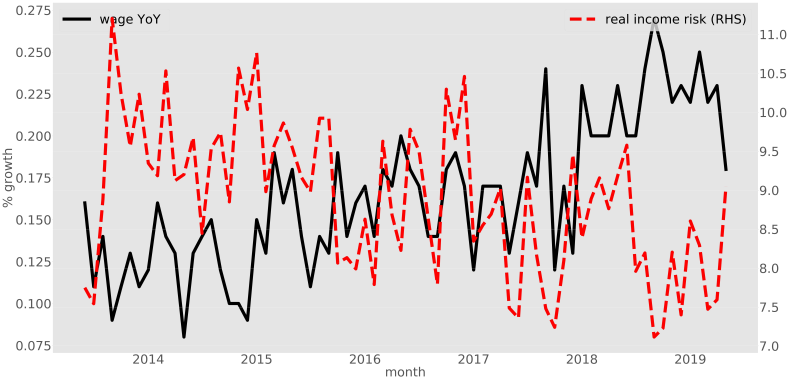
Perceived real risks and past wage growth

- $\overline{\text{var}}_t$
- $log(\text{wage}_t) - log(\text{wage}_{t-3})$



Perceived real income risks and past wage growth

- $\overline{\text{rvar}_t}$
- $log(\text{wage}_t) - log(\text{wage}_{t-3})$



Perceived risks and labor market conditions

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

$$\forall k = 1...6$$

k	varMean	iqrMean	rvarMean	varMed	iqrMed	rvarMed
1	-2.046**	-0.801***	-10.437***	-0.269	-0.191	-5.121***
2	-3.823***	-1.193***	-12.287***	-0.021	0.009	-5.292***
3	-2.942***	-0.938***	-9.642***	-0.147	-0.077	-4.445***
4	-3.261***	-0.994***	-9.021***	-0.142	-0.094	-4.467***
5	-2.312**	-0.892***	-6.792**	-0.441**	-0.252*	-4.718***
6	-3.419***	-1.207***	-10.791***	-0.412**	-0.274**	-5.466***

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