Countercyclical Income Risk and Portfolio Choices: Evidence from Sweden

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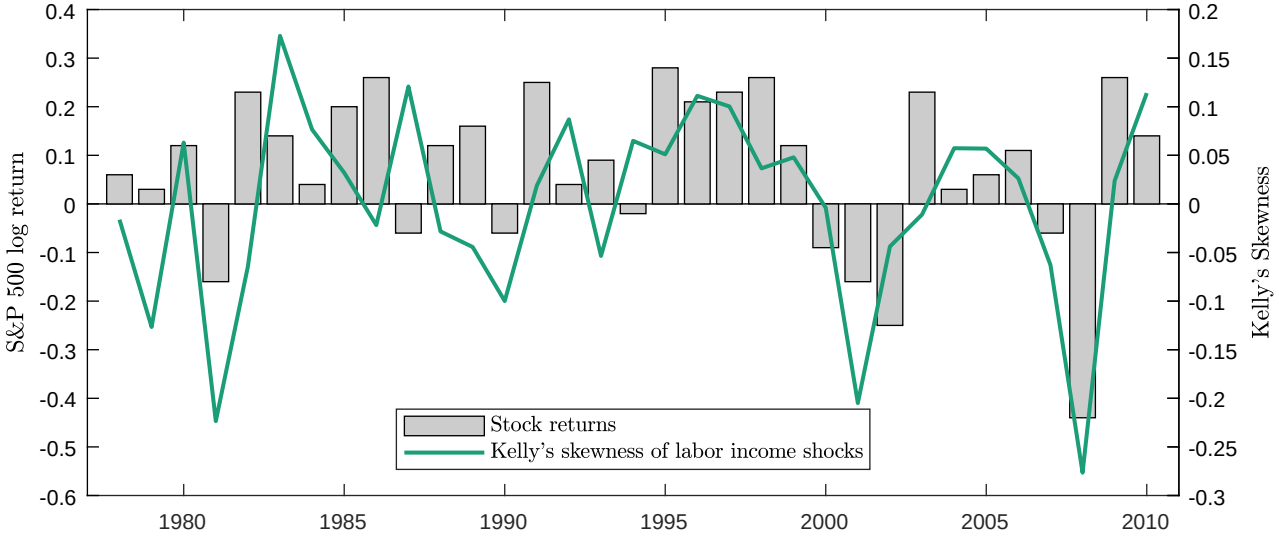
Motivation: Cyclical skewness

- Skewness of labor income risk is cyclical ...

  Guvenen et al. (2014)

- ... and can be hedged by short-selling the stock market



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- **Models with cyclical income risk can explain**:
  - The cross-section of households' equity holdings
    Storesletten et al. (2007), Lynch and Tan (2011), Catherine (2022)
  - The level, volatility and cross-section of asset prices
    Schmidt (2016), Constantinides and Ghosh (2017)

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  - Effect decreases with human capital-to-wealth ratio
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  - Effect is the strongest when consumption risk is considered
- **Cyclical skewness risk does not affect the portfolio of top wealthy households, hence unlikely to explain asset pricing puzzles**

Theory for CRRA agent

- **Optimal equity share in the presence of labor income risk:**

$$\pi = \frac{\mu - r}{\gamma \sigma_s^2} + \left(\frac{\mu - r}{\gamma \sigma_s^2} - \beta_H \right) \frac{H}{W}$$
$$\beta_H = \frac{\mathrm{Cov}(r_{\mathrm{H}}, r_s)}{\sigma_s^2}$$

- **Denote $H_{t-1,it}$ the certainty equivalent of H_{it} in period t-1**

$$\frac{(W_{it} + H_{t-1,it})^{1-\gamma}}{1-\gamma} = \mathbb{E}_{t-1} \left[\frac{(W_{it} + H_{it})^{1-\gamma}}{1-\gamma} \right]$$

- **Workers dislike variance and like (positive) skewness**

$$H_{t-1,it} \approx \overline{H}_{it} - \frac{\gamma}{2} \frac{\mathrm{Var}_{t-1}(H_{it})}{\overline{W}_{it} + \overline{H}_{it}} + \frac{\gamma(\gamma+1)}{6} \frac{\mathrm{Skew}_{t-1}(H_{it})}{\left(\overline{W}_{it} + \overline{H}_{it} \right)^2}$$

What is the market beta of human capital β_H?

- **Effect of news regarding the distribution of human capital shocks:**
  - change in H:

$$\Delta H_{t-1,t} \approx \Delta \overline{H}_t - \frac{\gamma}{2\left(\overline{W}_t + \overline{H}_t\right)} \cdot \Delta \text{Var}_{t-1}(H_t) + \frac{\gamma(\gamma+1)}{6\left(\overline{W}_t + \overline{H}_t\right)^2} \cdot \Delta \text{Skew}_{t-1}(H_t),$$

  - immediate return:

$$\frac{\Delta H_{t-1,t}}{H_{t-1,t}} \approx \frac{\Delta \overline{H}_t}{H_{t-1,t}} - \frac{\gamma}{2}\omega_H \cdot \Delta \text{Var}_{t-1}(\epsilon_t) + \frac{\gamma(\gamma+1)}{6}\omega_H^2 \cdot \Delta \text{Skew}_{t-1}(\epsilon_t).$$

    where $\omega_H = \frac{\overline{H}_{it}}{\overline{W}_{it}+\overline{H}_{it}}$ and $\epsilon_t = \frac{H_t}{\overline{H}_t}$ the scaled distribution of H_t.

- **Market beta of human capital:**

$$\beta_H = \frac{\text{Cov}\left(\frac{\Delta \overline{H}_t}{H_t}, r_s\right)}{\sigma_s^2} - \frac{\gamma}{2}\omega_H \frac{\text{Cov}\left(\Delta \text{Var}(\epsilon), r_s\right)}{\sigma_s^2} + \frac{\gamma(\gamma+1)}{6}{\omega_H}^2 \frac{\text{Cov}\left(\Delta \text{Skew}(\epsilon), r_s\right)}{\sigma_s^2}$$

Predictions

- **Optimal equity share decrease with the three components of the human capital beta:**
  - Covariance of income shocks with returns
  - Countercyclical variance
  - Cyclical skewness
- **Hedging motive is large for workers with high human-capital-to-wealth ratios**

Swedish Data

- **Non financial disposable income from 1982 to 2015**
  - Includes wages, government transfers and entrepreneurial earnings
  - Industry of employment and level of education
- **Household's balance sheet from 1999-2007**
  - Holdings at the security level at the end of the year
  - Real-Estate
  - Debts...

Income risk measures

1. **Create 321 groups by industry of employment and level of education**

2. **Compute unexpected change in log disposable income**

$$y_{it} - y_{it-1} = \dot{f}(a_{it-1}, g_{it-1}) + \hat{\varepsilon}_{it} \tag{1}$$

   - $\dot{f}(a, g)$ is a third-order polynomial estimated for each group
   - $\hat{\varepsilon}_{it}$ as our empirical measure of the unexpected change in log disposable income

3. **For each year and goup, we compute cross-sectional moments of income shock distribution**

   - Mean
   - Variance
   - Skewness (not standardized)

Income risk and stock market returns

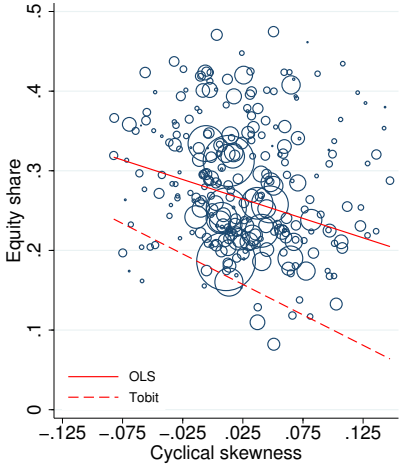
- **For each group, we get three time-series: mean income shock, variance and skewness**

- **We evaluate each group's ability to hedge against income risk moments by short-selling the stock market**

$$\text{Moment}_{gt} = \beta_{1,g} \times \text{Market Return}_t + \beta_{2,g} \times \text{Market Return}_{t-1} + u_g$$

- **Depending on the moment, $\beta_{1,g} + \beta_{2,g}$ gives us measures of covariance, countercyclical variance and cyclical skewness**

Overview – Cyclical skewness and stock holdings



Micro-level analysis

$$\begin{aligned} \mathrm{Y}_{it} = \quad & \beta_1 \cdot \text{Covariance}_{it} + \beta_2 \cdot \text{Countercyclical variance}_{it} \\ & + \beta_3 \cdot \text{Cyclical skewness}_{it} + \text{controls}_{it} + \upsilon_t + \varepsilon_{it} \end{aligned}$$

- Y_{it}:
  - equity share

- *Controls*:
  - group average of unconditional variance and skewness of income shock
  - demographics: age, gender, household size and dummy variables identifying entrepreneurs and immigrants
  - human capital, real-estate, financial assets and debt (scaled by total wealth), log of total wealth

Equity Share (Tobit)

$$\begin{aligned}\text{Risky Share}_{it} = \quad & \beta_1 \cdot \text{Covariance}_{it} + \beta_2 \cdot \text{Countercyclical variance}_{it} \\ & + \beta_3 \cdot \text{Cyclical skewness}_{it} + \text{controls}_{it} + \upsilon_t + \varepsilon_{it}\end{aligned}$$

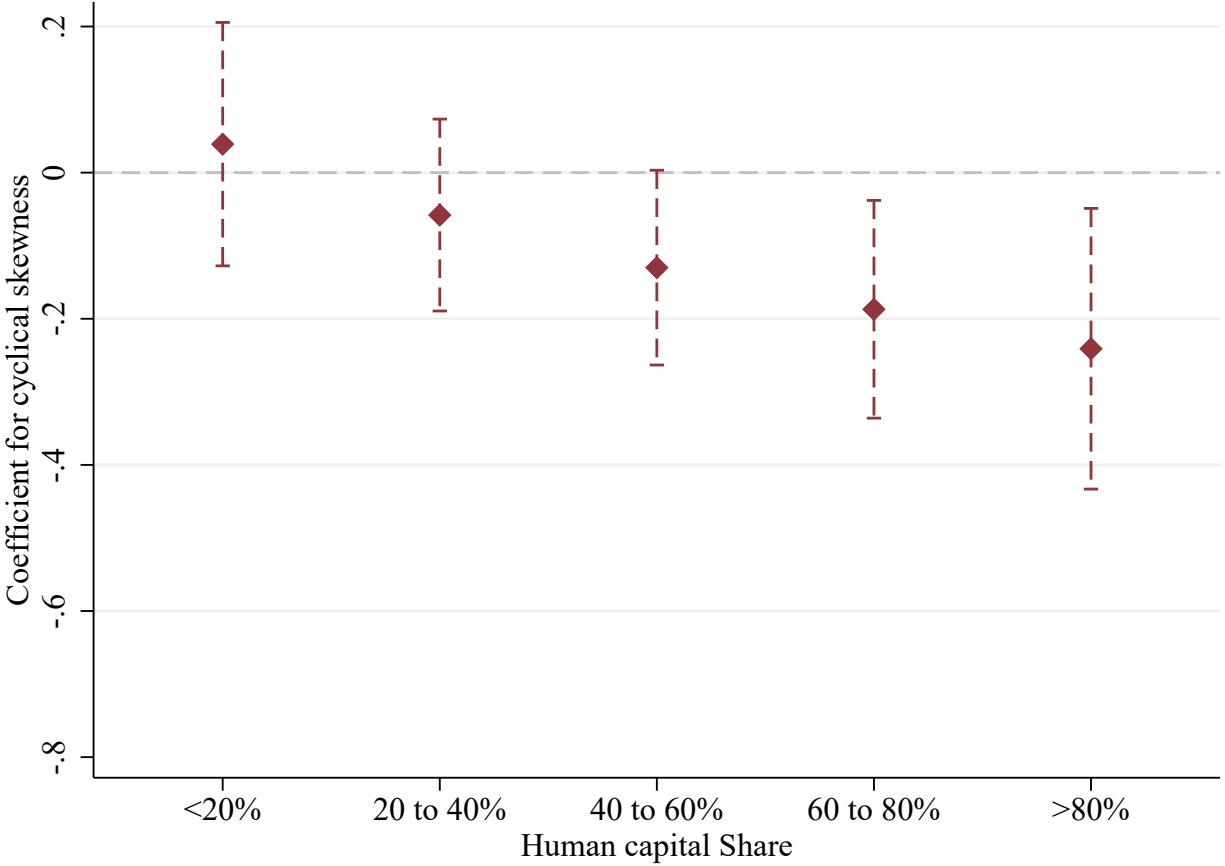
	(1)	(2)	(3)	(4)	(5)
Cyclical skewness	-1.113***			-0.878***	-0.298***
	(-2.92)			(-5.17)	(-3.22)
Countercyclical variance		-0.647		-0.216	0.532***
		(-0.84)		(-0.69)	(2.64)
Covariance			-0.517	-0.445	0.168
			(-0.70)	(-1.45)	(0.94)
Demographics				Yes	Yes
Wealth composition				Yes	Yes
Education group FE					Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	32,934,044	32,934,044	32,934,044	32,933,774	32,933,774
Pseudo R2	0.006	0.004	0.004	0.190	0.198

Portfolio Differences between Identical Twins

$$\begin{aligned}\Delta\pi^*_{jt} = \quad & b_1 \cdot \Delta\text{Covariance}_{jt} + b_2 \cdot \Delta\text{Countercyclical variance}_{jt} \\ & + b_3 \cdot \Delta\text{Cyclical skewness}_{jt} + b_c \cdot \Delta\text{Controls}_{jt} + u + \varepsilon_{jt}\end{aligned}$$

	(1)	(2)	(3)	(4)	(5)
ΔCyclical skewness	-0.311*			-0.501***	-0.422**
	(-1.80)			(-2.66)	(-2.23)
ΔCountercyclical variance		0.129		0.378	0.504
		(0.46)		(1.18)	(1.57)
ΔCovariance			0.108	-0.063	0.081
			(0.50)	(-0.24)	(0.30)
ΔDemographics				Yes	Yes
ΔWealth composition				Yes	Yes
ΔEducation FE					Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	34,460	34,460	34,460	34,460	34,460
Pseudo R2	0.000	0.000	0.000	0.035	0.035

Role of Human Capital-to-Wealth Ratio



Household-level Portfolios

			Two Earners	
	Single Person	One-Earner Couple	Spouse Cyclical Skewness: Lower	Higher
	(1)	(2)	(3)	(4)
Cyclical skewness	-0.280***	-0.316***	-0.209**	-0.371***
	(-2.97)	(-2.64)	(-2.20)	(-4.32)
Countercyclical variance	0.415**	0.490*	0.116	0.320*
	(2.09)	(1.71)	(1.02)	(1.75)
Covariance	0.282	0.267	-0.094	0.021
	(1.61)	(1.24)	(-0.80)	(0.10)
Demographics (head)	Yes	Yes	Yes	Yes
Wealth composition (household-level)	Yes	Yes	Yes	Yes
Education FE (head)	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	11,949,315	166,817	4,006,106	3,271,029
Pseudo R2	0.226	0.255	0.252	0.267

Labor-market-implied Consumption Risk

- **Market beta of consumption implied by income shocks**

$$\pi W = \left(\frac{\mu - r}{\gamma \sigma_s^2} - \beta_C \right) (W + H)$$
$$\beta_C = \frac{\beta_H H}{W + H}$$

- **Countercyclical consumption risk**

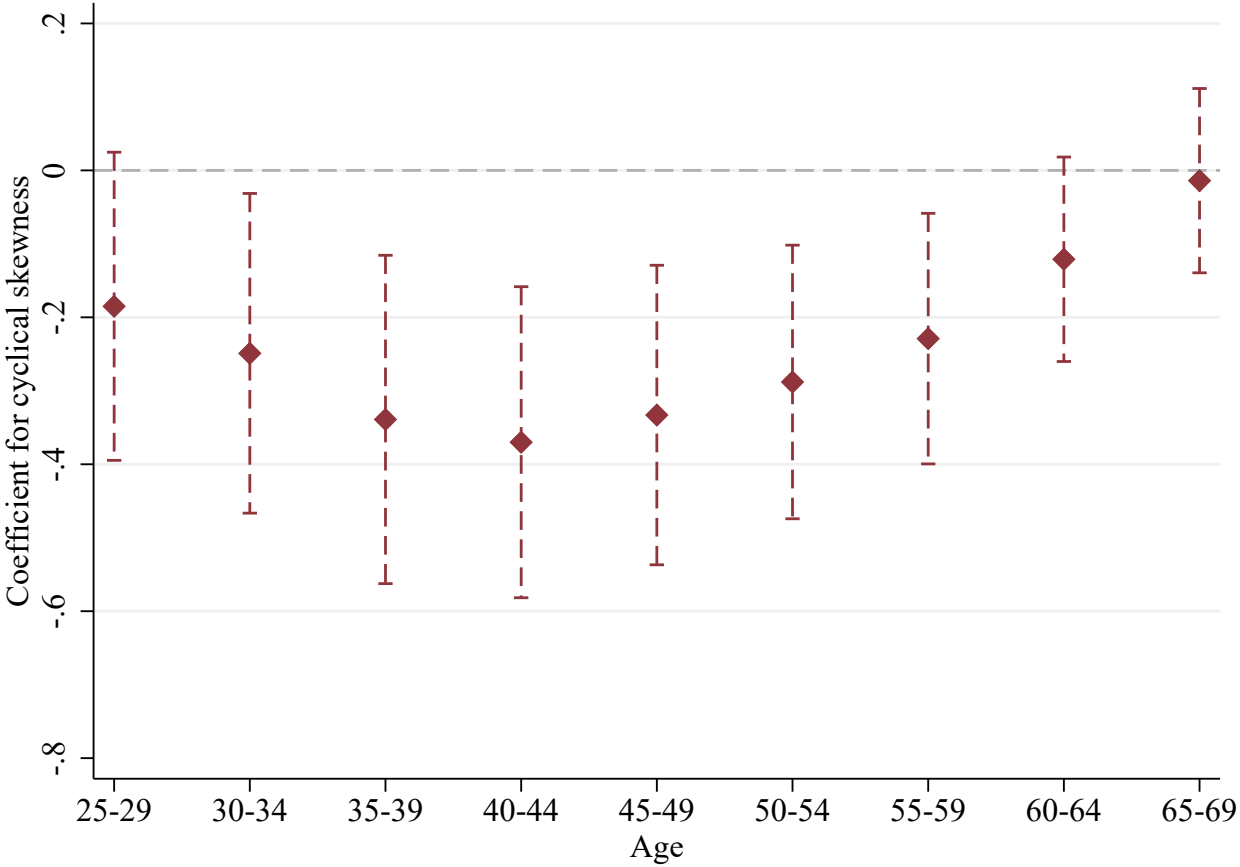
$$\text{Cyclical Skewness}(\dot{c})_{it} = \left(\frac{H_{it}}{W_{it} + H_{it}} \right)^3 \text{Cyclical Skewness}(\eta)_{g(i)}$$

  - $\dot{c}_{it}$ is the unexpected change in log lifetime consumption
  - η permanent income shock

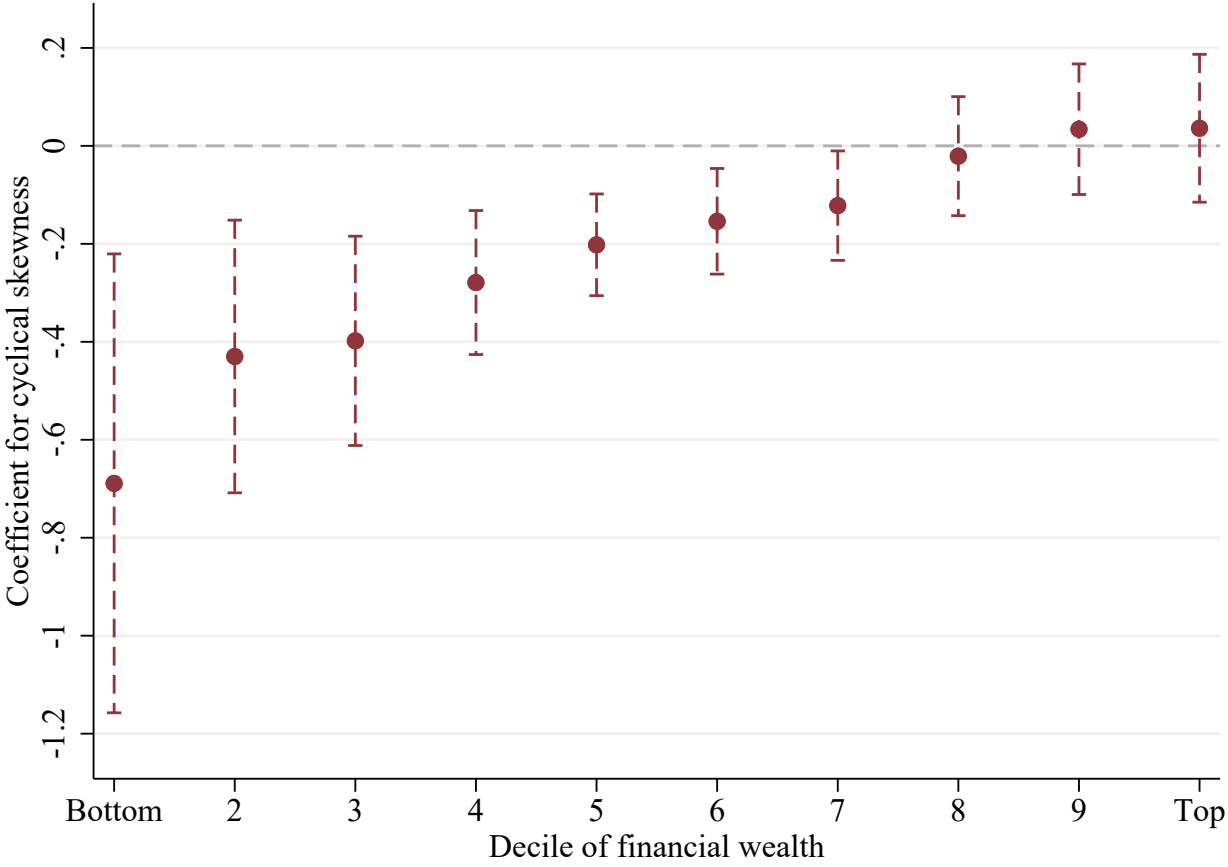
Equity Share (Tobit)

	(1)	(2)	(3)	(4)	(5)	(6)
Cyclical skewness	-2.519***			-1.236***	-0.412***	-0.553***
	(-8.38)			(-4.15)	(-2.67)	(-4.55)
Countercyclical variance		-3.387***		0.370	0.520	0.000
		(-3.51)		(0.53)	(1.25)	(0.00)
Covariance			0.698	0.486	1.173***	1.756***
			(1.08)	(0.99)	(4.22)	(5.82)
Demographics				Yes	Yes	Yes
Wealth composition				Yes	Yes	Yes
Education FE					Yes	Yes
Industry FE						Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32,936,703	32,936,703	32,936,703	32,933,774	32,933,774	32,933,774
Pseudo R2	0.017	0.008	0.004	0.126	0.148	0.156

Life-cycle Profile of Equity Share



No Effect on Wealthy Population



Conclusion

- **Workers with higher cyclical skewness risk invest less in stocks**
- **Portfolio effect is stronger for high human capital-to-wealth ratio**
- **... and thus affects the life-cycle profile of equity holdings**
- **Cyclical skewness does not matter at the top of the wealth distribution and thus is unlikely to explain the equity premium**