Countercyclical Risks and Portfolio Choice over the Life Cycle: Evidence and Theory

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Countercyclical Risks

- Countercyclical consumption risk: In a recession, skewness in cross-sectional distribution of consumption growth becomes more negative and helps explain asset pricing puzzle (Constantinides and Ghosh (2017))
- Countercyclical earnings risk: In a recession, skewness in cross-sectional distribution of earnings growth becomes more negative (Guvenen et. al. (2014))

→ **Hypothesis: Countercyclical skewness in earnings growth may lead to countercyclical consumption risk**

Main Research Questions

- PSID:
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  - Any other empirical link can be found? How are consumption (risky asset shares) and earnings risk correlated?

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- PSID:
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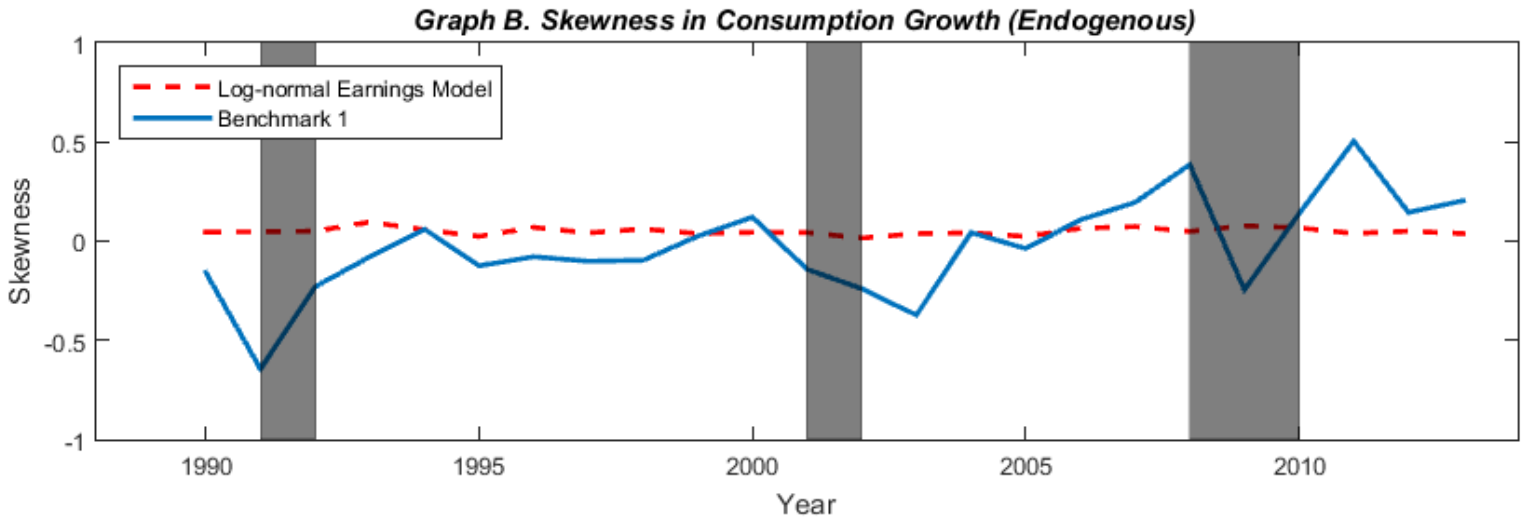
- Structural Life Cycle Model:
  - Can a structural life cycle quantitative model generate this countercyclical skewness in consumption growth?
  - What are the implications of this model on consumption and portfolio choice decisions?

Model Results: Consumption Risk



Empirical Results: PSID

- Calculate skewness from PSID

$$\begin{aligned} \Delta y^*_{irt} &= log(Y^*_{ir,t+2}) - log(Y^*_{irt}) \\ log(Y^*_{irt}) &= log(Y_{irt}) - \hat{f}(t, Z_{irt}) \\ var(\Delta y^*_{irt}) &= 2 \times l_{var,rt} + 2 \times var(\varepsilon_{rt}) \\ skew(\Delta y^*_{irt}) &= 2 \times l_{skew,rt} \end{aligned}$$

where subscript r indicates the region where the household lives.

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- Regress $\Delta_k c_{it}$ on $\Delta_k l_{skew,rt}$

$$\Delta_k c_{it} = \beta q_{i,t-k} + \gamma \Delta_k h_{it} + \psi \Delta_k w_{it} + \rho \Delta_k l_{skew,rt} + \kappa \Delta_k l_{var,rt} + \epsilon_{it}$$

- Preference shifters ($\Delta_k h_t$): changes in some household characteristics between $t-k$ and t, changes in family size, changes in the number of childeren and sets of dummies for house ownership, business ownership
- Life-cycle controls (q_{t-k}): age, age^2, indicators for completed high school and college education and their interaction with age and age^2, dummy variables for gender and their interaction with age and age^2, marital status, health status, the number of children, the number of people, inheritance...
- Sample Selection: marital status unchanged from $t-k$ to t, no assets moved out or in, no household heads retired at t, no liquid wealth or financial wealth less than $\$10,000$; no missing information on consumption or food consumption, no zero consumption or zero food consumption

Consumption ($\Delta_k c$) and Earnings Risk

Explanatory variable	All households	Stockholders	Nonstockholders
	Liquid assets		
$\Delta_k l_{skew}$	0.102^{***}	0.165^{***}	0.013
	(0.018)	(0.045)	(0.044)
$\Delta_k l_{var}$	−0.905	−0.947	−0.823
	(0.934)	(0.833)	(0.831)

- Consumption growth and changes in skewness in earnings shocks are positively correlated
- Heterogeneity matters: Vissing-Jørgensen (2002) focuses on different EIS, while here it is the third moment that has different effects
- Similar results for financial wealth

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- Stockholders: A one standard deviation increase in skewness of earnings shocks is associated with a 14.12% increase in consumption. Meanwhile, a one standard deviation increase in variance of earnings shocks decreases consumption by 7.15%.
- Correlation between consumption growth and changes in skewness in earnings shocks for stockholders is statistically and economically significant

Consumption Risk ($\Delta_k c_{skew}$) and Earnings Risk

Explanatory variable	All households	Stockholders	Nonstockholders
	Liquid assets		
$\Delta_k l_{skew}$	0.040^{***}	0.202^{***}	0.007
	(0.004)	(0.012)	(0.011)
$\Delta_k l_{var}$	0.539	0.207	0.670
	(0.589)	(0.431)	(0.542)

- Changes in skewness in consumption growth and changes in skewness in earnings shocks are positively correlated
- Countercyclicality could be transmitted from skewness in earnings shocks to skewness in consumption growth
- Similar results for financial wealth

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- Stockholders: A one standard deviation increase in skewness of earnings shocks is associated with a 48.74% increase in consumption risk. Meanwhile, a one standard deviation increase in variance of earnings shocks increases consumption risk by 2.02%.
- Correlation between changes in skewness in consumption growth and changes in skewness in earnings shocks for stockholders is statistically and economically significant

Portfolios and Earnings Risk

Explanatory variable	All households	Stockholders	Nonstockholders
		Liquid assets	
$\Delta_k l_{skew}$		0.008^{***}	
		(0.004)	
$\Delta_k l_{var}$		-0.174^{***}	
		(0.078)	

- Increases in skewness in earnings shocks is associated with increases in risky asset share
- Increases in variance in earnings shocks is associated with decreases in risky asset share, consistent with Guiso, Jappelli and Terlizzese (1996)
- Similar results for financial wealth

Summary of results

- Changes in skewness in earnings shocks and consumption growth are positively correlated
- Changes in skewness in earnings shocks and changes in skewness in consumption growth are positively correlated, and both skewnesses are countercyclical
- Heterogeneity matters: The effect is statistically significant for stockholders, not for nonstockholders
- Changes in skewness in earnings shocks and changes in risky asset share are significantly psitively correlated for stockholders

Can a structural life cycle quantitative model generate these results?

Structural Life Cycle Model: Labor Income

$$y_{it} = v_{it} + \varepsilon_{it}$$

where $y_{it} = \log Y_{it}$, ε_{it} is temporary shock to labor income, normally distributed with mean $-\sigma_\varepsilon^2/2$, variance σ_ε^2, and v_{it} is given by

$$v_{it} = f(t, Z_{it}) + v_{i,t-1} + u_{it}$$

u_{it}, permanent shock, is uncorrelated with ε_{it}. It is distributed as a mixture normal distribution

$$u_{it} = \begin{cases} u_{it}^1 \sim N(\mu_{1s(t)}, \sigma_{1s(t)}^2) & \text{with prob. } p_1 \\ u_{it}^2 \sim N(\mu_{2s(t)}, \sigma_{2s(t)}^2) & \text{with prob. } 1 - p_1 \end{cases}$$

The expansion/recession state is denoted by $s(t)$.

Retirement income:

$$y_{it} = log(\lambda) + v_{ik}$$

where λ is constant replacement rate and $k = 46$.

Baseline Calibration: Exogenous Inputs

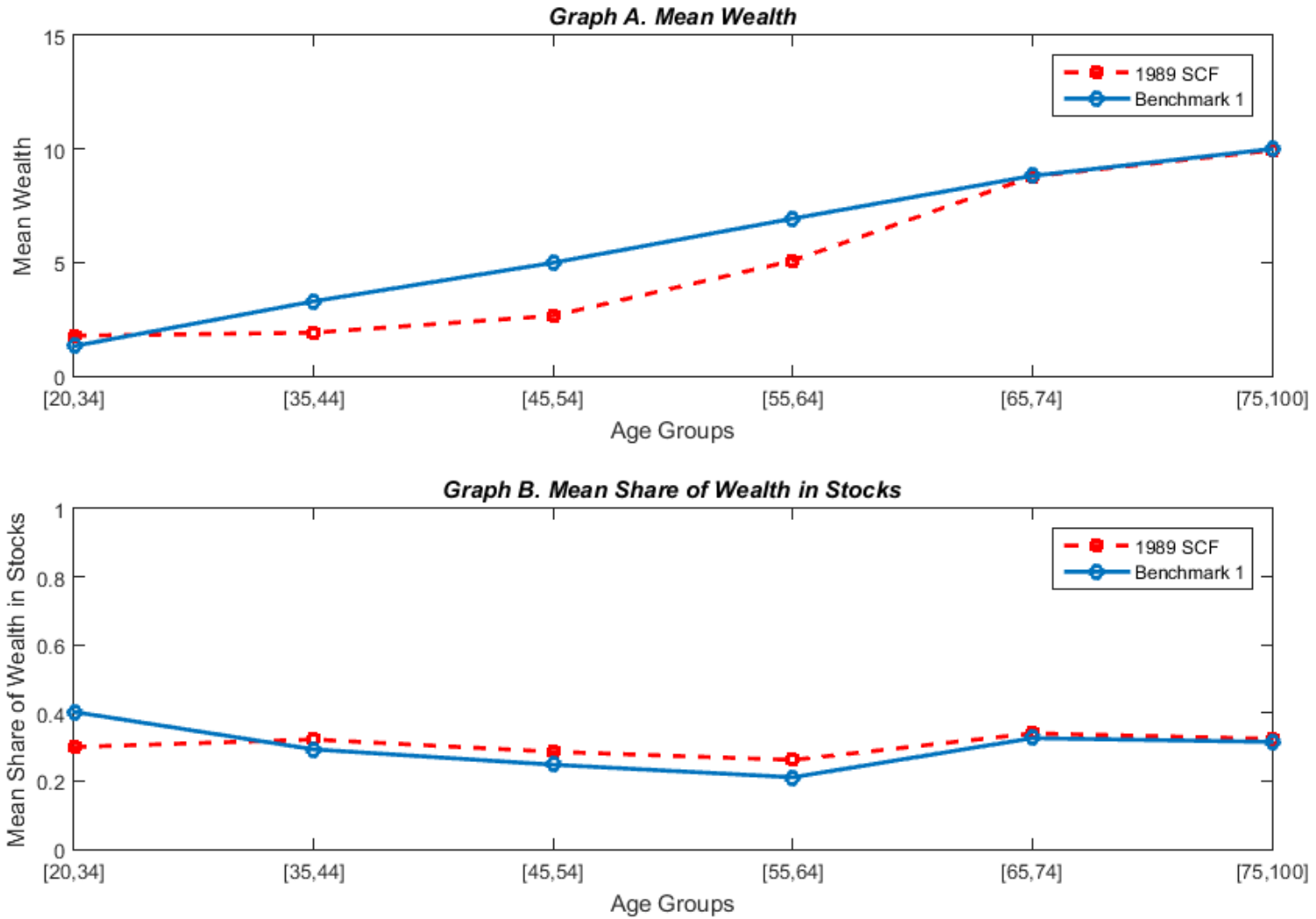
Labor income: Guvenen et. al. (2014)

Panel A. Labor income process	
Replacement ratio (λ)	0.68
Standard deviation of transitory shocks (σ_ε)	0.1
Probability of mixture normal distribution (p_1)	0.49
Normal distribution 1 mean during booms (μ_{1b})	0.207
Normal distribution 2 mean during booms (μ_{2b})	−0.110
Normal distribution 1 standard deviation during booms (σ_{1b})	0.212
Normal distribution 2 standard deviation during booms (σ_{2b})	0.076
Normal distribution 1 mean during recessions (μ_{1r})	−0.173
Normal distribution 2 mean during recessions (μ_{2r})	0.162
Normal distribution 1 standard deviation during recessions (σ_{1r})	0.212
Normal distribution 2 standard deviation during recessions($\sigma_{2,r}$)	0.003

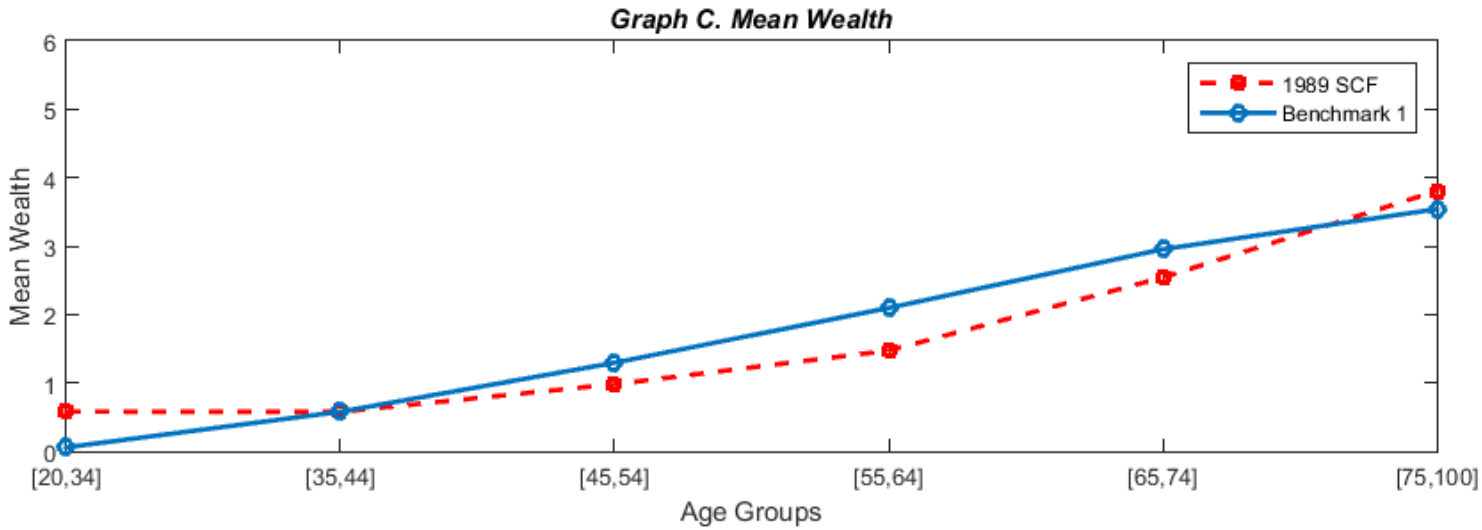
Baseline Calibration with 1989 SCF Data: Preference Parameters and Bequest Motive

Benchmark 1			Stockholders			Non-stockholders	
			Data	Model		Data	Model
Discount factor (β)	0.98	(mean W/Y work phase)			0.98		
		$20-34$	1.772	1.315		0.580	0.057
		$35-44$	1.907	3.289		0.577	0.578
		$45-54$	2.653	4.989		0.980	1.294
		$55-64$	5.078	6.933		1.471	2.095
Strength of bequest motive (b)	2.0	(mean W/Y retirement)			0.5		
		$65-74$	8.785	8.819		2.540	2.953
		$75-64$	9.934	10.002		3.805	3.539
Coefficient of relative risk aversion (γ)	6.8	(mean α)			1.6		
		$20-34$	0.300	0.403			
		$35-44$	0.322	0.293			
		$45-54$	0.286	0.248			
		$55-64$	0.262	0.211			
		$65-74$	0.340	0.326			
		$75-100$	0.324	0.315			
Elasticity of intertemporal substituion (ψ)	0.5				1/1.6		

Baseline Calibration with 1989 SCF Data: Life-cycle Profiles (Stockholders)



Baseline Calibration with 1989 SCF Data: Life-cycle Profiles (Nonstockholders)



Consumption Policy Functions

Model vs Data: Simulation Method

- Simulation from 1989 to 2013; given information from 1989 SCF, we simulate life-cycle optimal stock holdings, labor income and wealth for each household.

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- Once households die at 100, they are dropped from the simulation
- Simulate stockholders and non-stockholders separately; combine them together with realized participation rate

Model vs Data: Portfolios and Earnings Risk

Explanatory variable	Benchmark 1	PSID
$\Delta_k l_{skew}$	0.006^{***}	0.008^{***}
	(0.001)	(0.004)
$\Delta_k l_{var}$	-0.011	-0.174^{***}
	(0.007)	(0.078)

- Similar significance and sign for the coefficient in front of changes in skewness
- No significant effect for changes in variance in the model

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Model vs Data: Consumption and Earnings Risk

Explanatory variable	All households	Stockholders	Nonstockholders
	Panel A. Benchmark 1		
$\Delta_k l_{skew}$	0.025^{***}	0.051^{***}	0.011^{***}
	(0.001)	(0.002)	(0.001)
$\Delta_k l_{var}$	-0.138	-0.110	-0.095
	(0.087)	(0.074)	(0.061)
	Panel B. PSID		
$\Delta_k l_{skew}$	0.102^{***}	0.165^{***}	0.013
	(0.018)	(0.045)	(0.044)
$\Delta_k l_{var}$	-0.905	-0.947	-0.823
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Model vs Data: Consumption Risk and Earnings Risk

Explanatory variable	All households	Stockholders	Nonstockholders
	Panel A. Benchmark 1		
$\Delta_k l_{skew}$	0.317^{*}	0.422^{***}	0.014^{***}
	(0.018)	(0.016)	(0.001)
$\Delta_k l_{var}$	0.246	0.208	0.215
	(0.175)	(0.168)	(0.177)
	Panel B. PSID		
$\Delta_k l_{skew}$	0.040^{***}	0.202^{***}	0.007
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Model vs Data: Causality of Earnings Risk on Consumption Risk

- Introduce a dummy variable for boom
- Calculate the correlations between skewness in consumption growth and dummy variable

	Log-normal earnings model	Log-normal earnings model with business cycle	Benchmark 1
All households	0.023	0.287	0.345*
	(0.213)	(0.203)	(0.200)
Stockholders	0.030	0.312	0.756***
	(0.213)	(0.199)	(0.140)
Nonstockholders	−0.003	0.269	0.307
	(0.213)	(0.205)	(0.206)

- Countercyclical skewness in earning shocks leads to statistically significantly countercyclical consumption risk

Benchmark 2

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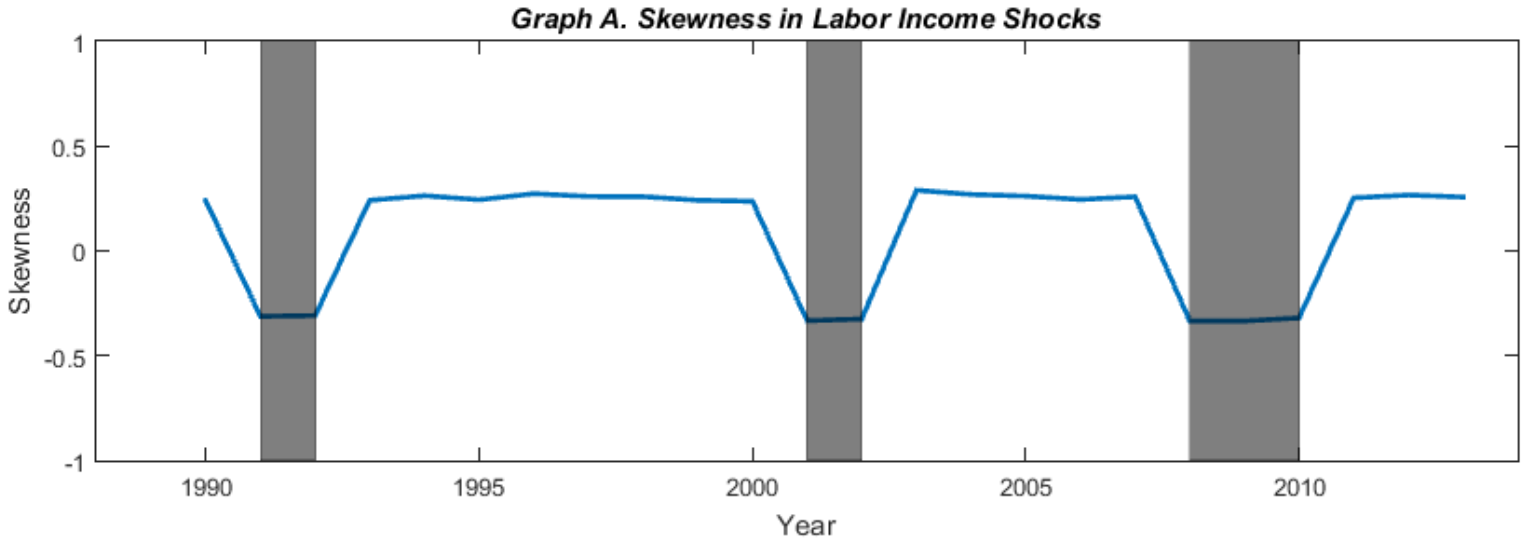
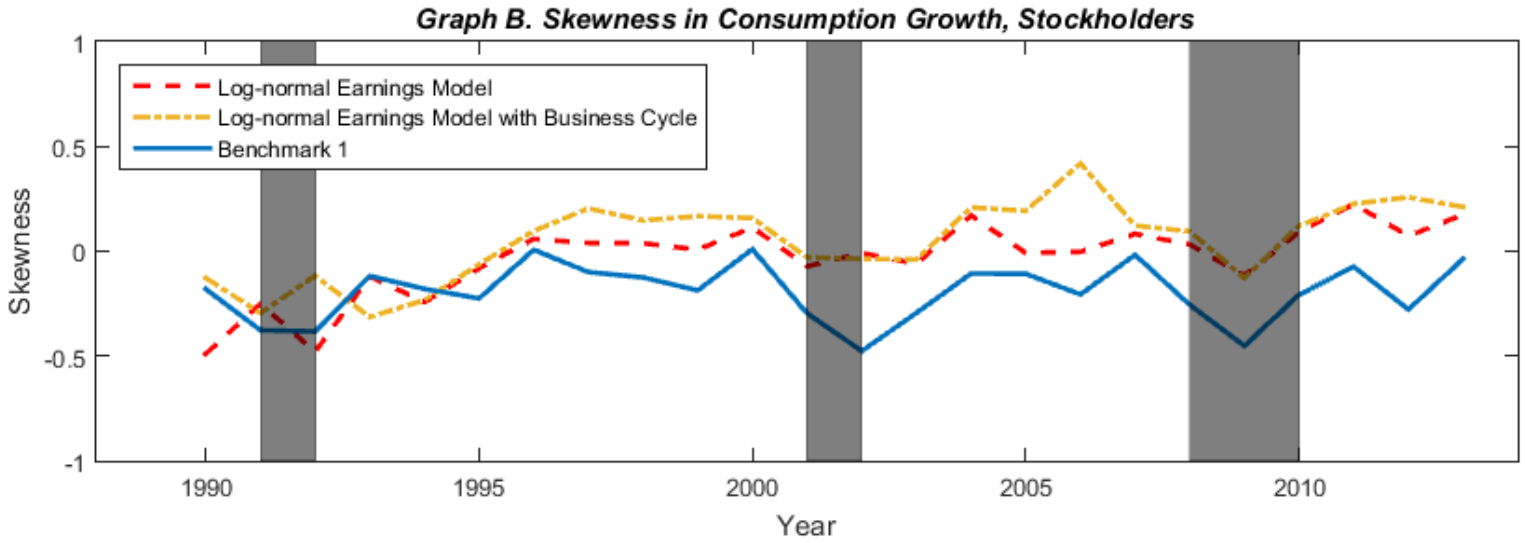
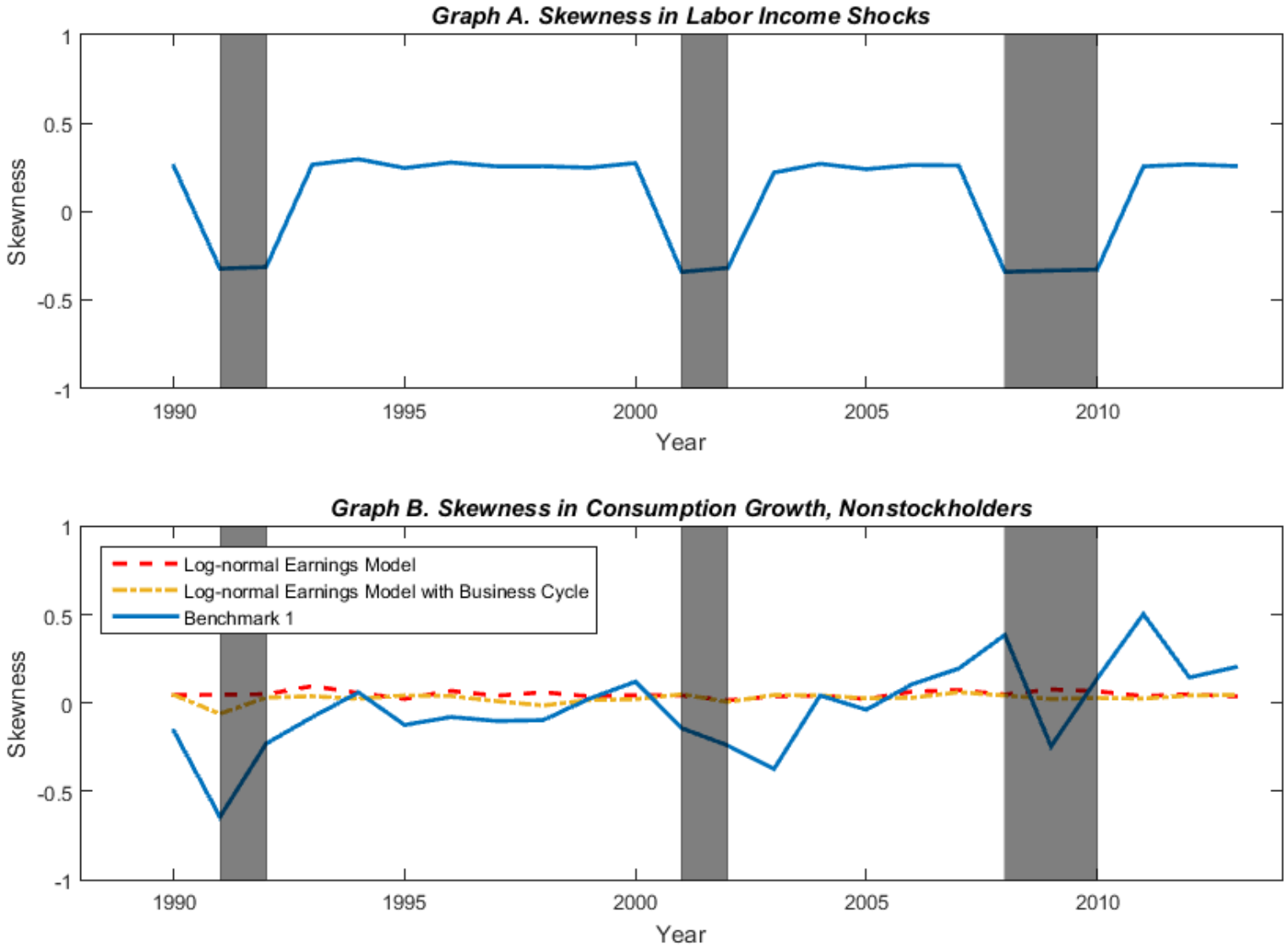
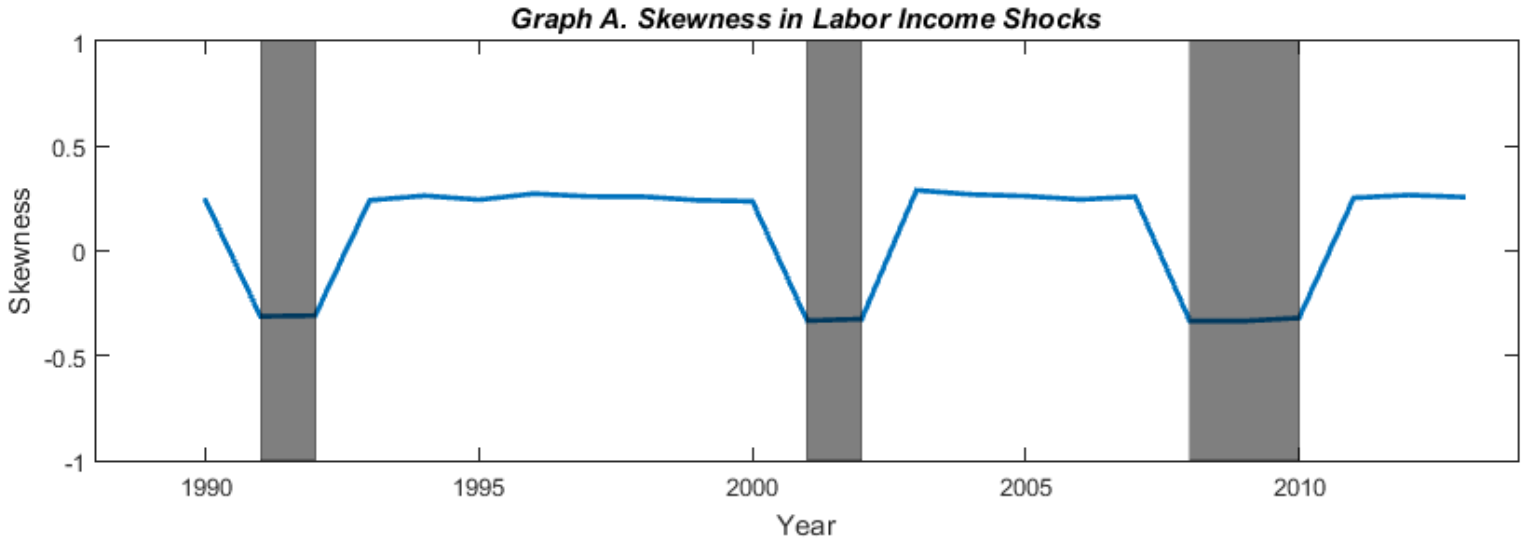


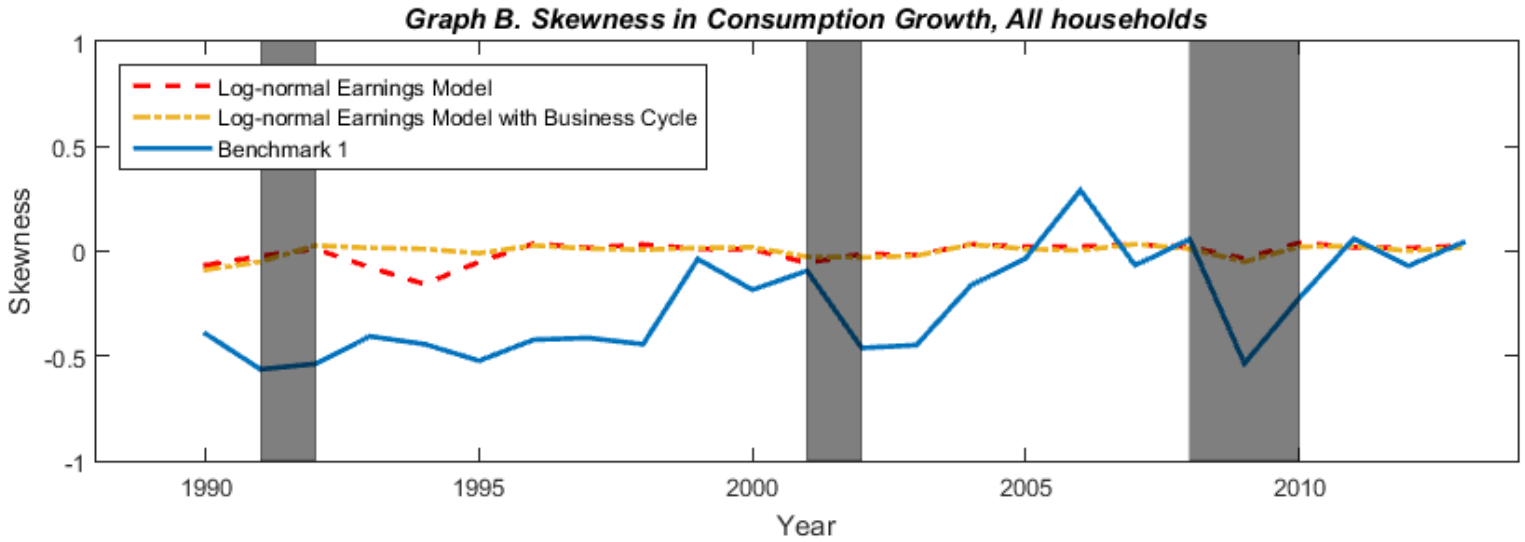


Consumption Risk: Nonstockholders



Consumption Risk: All Households





Conclusion

- PSID:
  - Consumption is positively correlated with skewness in earnings shocks
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  - Heterogeneiety matters: The important role of skewness across stockholders and nonstockholders
  - Risky asset share is positively correlated with skewness in earnings shocks for stockholders

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- Structural Life Cycle Model:
  - Life-cycle model with business cycle variation in expected growth and skewness in earnings shocks generates similar results as PSID
  - Countercyclical skewness in earnings generates countercyclical skewness in consumption growth

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  - → **Overall, this life-cycle model is good, as it generates similar results as PSID, even without calibration to match these**