From Earnings Risk to Consumption Risk

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Macroeconomics III

Idea

- So far, we have studies earnings uncertainty.
- From a welfare perspective, we care about consumption.
- How does earnings risk translate into consumption fluctuations in the data?
- We have a model of minimal insurance (only self-insurance).

  Is the insurance consistent with the data?

  Could private markets provide more insurance?

Blundell et al. (2008)

Idea

- Measure consumption responses to income shocks in the data.
- Differentiate between persistent and transitory income shocks.
- For this, we require panel data on income and consumption.
- PSID: Panel data on income and food consumption.

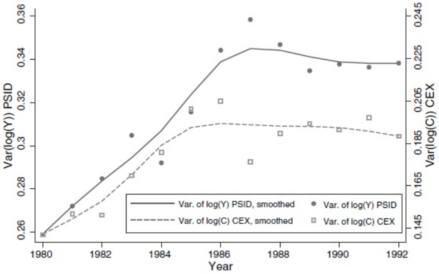
Creating Consumption Panel Data

The CEX has cross-sectional data on (non)-durable consumption. Idea, estimate a food demand equation:

$$f_{it} = W_{it}\mu + p_t\theta + \beta(D_{it})c_{it} + e_{it}$$

- W_{it} are household observables.
- p_t are consumption prices.
- c_{it} is total (non)-durable consumption.
- D_{it} are household observables.
- Knowing μ, θ, and β allows us to impute c_{it} is the PSID.
- Sample are continuously married $30 - 65$ households.

Inequality over Time



- Since 1985, income and consumption dispersion diverged.
- Possible explanations:

  the type of income shocks have changed.

  insurance against income shocks has changed.

Income Process

$$\begin{aligned} logY_{it} &= Z_{it}\varphi + P_{it} + v_{it} \\ P_{it} &= P_{it-1} + \zeta_{it} \\ v_{it} &= \epsilon_{it} + \theta_t \epsilon_{it}. \end{aligned}$$

- Log-income has three components.
- A household observable component Z_{it}.
- Permanent unobserved shocks ζ_{it}.
- Transitory unobserved shocks ϵ_{it}.

Income and Consumption

Time varying insurance coefficients against permanent (ϕ_{it}) and transitory (ψ_{it}) shocks:

$$\Delta logc_{it} = \phi_{it}\zeta_{it} + \psi_{it}\epsilon_{it} + \xi_{it}$$

- When $\phi_{it} = \psi_{it} = 0$, there is full insurance.
- When $\phi_{it} = \psi_{it} = 1$, there is no insurance.

Two Important Assumptions

$$\text{NF: } cov(\Delta logc_{it}, \zeta_{it+n}) = cov(\Delta logc_{it}, \epsilon_{it+n}) = 0$$

Today's consumption does not respond to future shocks. For this, the information set of the household and econometrician need to be the same.

$$\text{SM: } cov(\Delta logc_{it}, \zeta_{it-1}) = cov(\Delta logc_{it}, \epsilon_{it-2}) = 0$$

Today's consumption does not respond to shocks too far in the past. For this, there may not be, among other things, habit formation.

Identification

Covariance of income growth:

$$cov(\Delta y_t, \Delta y_{t+s}) = \begin{cases} var(\zeta_t) + var(\Delta v_t) & \text{if } s = 0 \\ cov(\Delta v_t, \Delta v_{t+s}) & \text{if } s \neq 0 \end{cases}$$

Income inequality grew due to increase in permanent or transitory shocks.

Covariance of consumption growth:

$$cov(\Delta c_t, \Delta c_{t+s}) = \phi_t^2 var(\zeta_t) + \psi_t^2 var(\epsilon_t) + var(\xi_t)$$

Consumption inequality grew due to decrease in insurance, or increase in income uncertainty.

Identification II

Covariance of income and consumption growth:

$$cov(\Delta c_t, \Delta y_{t+s}) = \begin{cases} \phi_t var(\zeta_t) + \psi_t var(\epsilon_t) & \text{if } s = 0 \\ \psi_t cov(\epsilon_t, \Delta v_t) & \text{if } s > 0 \end{cases}$$

Estimate by GMM.

Changes in Income Process

- Growth in early 80's inequality due to larger permanent shocks.

- Growth in late 80's inequality due to larger transitory shocks.

Consumption Insurance

	Whole sample	No college	College
ϕ	0.6423	0.9439	0.4194
(Partial insurance perm. shock)	(0.0945)	(0.1783)	(0.0924)
ψ	0.0533	0.0768	0.0273
(Partial insurance trans. shock)	(0.0435)	(0.0602)	(0.0550)

- Time changes in budget elasticity of food.
- Find constant insurance parameters.
- Perfect insurance against "transitory shocks".
- Partial insurance against permanent shocks.
- Almost no insurance for low skilled households.
- Insurance shows no life-cycle pattern.

Ways of Insurance

Consumption: Income: Sample:	Nondurable net income baseline	Nondurable earnings only baseline	Nondurable male earnings baseline
ϕ	0.6423	0.3100	0.2245
(Partial insurance perm. shock)	(0.0945)	(0.0574)	(0.0493)
ψ	0.0533	0.0633	0.0502
(Partial insurance trans. shock)	(0.0435)	(0.0309)	(0.0294)

- Insurance much larger when looking at earnings

  Government insurance is important.

- Insurance yet larger when looking at male earnings

  Insurance through family labor supply is important.

Ways of Insurance II

Consumption: Income: Sample:	Nondurable net income baseline	Nondurable excluding help baseline	Nondurable net income low wealth	Nondurable net income high wealth	Total net income low wealth
ϕ	0.6423	0.6215	0.8489	0.6248	1.0342
(Partial insurance perm. shock)	(0.0945)	(0.0895)	(0.2848)	(0.0999)	(0.3517)
ψ	0.0533	0.0500	0.2877	0.0106	0.3683
(Partial insurance trans. shock)	(0.0435)	(0.0434)	(0.1143)	(0.0414)	(0.1465)

- Negligible role of family transfers.
- Low insurance for households with low wealth.
- Low wealth have no insurance against permanent shocks when including durables

  They use durables as means of insurance (delay purchase).

  Even transitory shocks no longer well insured.

Kaplan and Violante (2010)

Kaplan and Violante (2010)

- BPP provide estimates for consumption insurance.
- Is a model of self-insurance consistent with these?
- BPP have strong assumptions about consumption and income process.
- How are estimates biased when relaxing these?

The Model

- CRRA preferences over consumption.
- Households live to T, retire at T^{ret}.
- Certain life-cycle income growth κ_t.
- Uncertain income $Y_{i,t}$ and certain social security $P(\tilde{Y}_i)$.
- Creates life-cycle profile in savings.

Budget constraint

$$C_{i,t} + A_{i,t+1} = \begin{cases} (1+r)A_{i,t} + Y_{i,t} & \text{if working} \\ (1+r)A_{i,t} + P(\tilde{Y}_i) & \text{if retired} \\ A_{i,t+1} \geq \underline{A} & \end{cases}$$

Income

$$I_{ih} = \begin{cases} exp(y_{ih}) & \text{if } h \leq t1 \\ S_i & \text{otherwise} . \end{cases}$$

Pre-retirement income generalizes the BPP process where ρ may differ from one:

$$y_{ih} = \kappa_h + z_{ih} + \epsilon_{ih}$$
$$z_{ih} = \rho z_{ih-1} + \nu_{ih}$$

Bringing the Model to the Data

Goal is to parameterize risk and insurance over the life-cycle.

- Uncertainty: Estimate variances of pre-tax income in the data.
- Government insurance: Convex taxes and social security legislation.
- Self-insurance: Match average net-wealth holdings.
- Borrowing constraints: Natural and zero constraint.

Insurance Coefficients

- The model provides insurance coefficients for the two cases of borrowing constraints.
- Using simulated-data, the authors replicate the BPP estimation approach.
- The model also allows to compute the true insurance coefficients:

$$\phi^{\epsilon} = 1 - \frac{cov(\Delta \ln c_{ih}, \epsilon_{ih})}{var(\epsilon_{ih})} \quad (1)$$

$$\phi^{\nu} = 1 - \frac{cov(\Delta \ln c_{ih}, \nu_{ih})}{var(\nu_{ih})}. \quad (2)$$

Insurance Coefficients II

Table 1—Results from the Benchmark Models with NBC and ZBC

	Permanent shock			Transitory shock		
	Data BPP	Model BPP	Model TRUE	Data BPP	Model BPP	Model TRUE
Natural BC	0.36 (0.09)	0.22	0.23	0.95 (0.04)	0.94	0.94
Zero BC	0.36 (0.09)	0.07	0.23	0.95 (0.04)	0.82	0.82

- Almost full insurance against transitory shocks.
- Data shows more insurance against permanent shocks.
- Insurance to permanent shocks biased downwards.

  Particularly with zero borrowing constraint.

Source of Bias

The BPP model assumes short memory:

$$cov(\Delta \ln c_{i,t}, \epsilon_{i,t-2}) = 0 \tag{3}$$
$$cov(\Delta \ln c_{i,t}, \nu_{i,t-1}) = 0. \tag{4}$$

This assumption obviously holds when (i) financial markets are complete, (ii) households cannot save, and (iii) in the Friedman permanent income model, where we have seen that

$$\Delta c_t = \nu_{it} + \frac{r}{1+r} \frac{1}{1 - ((1+r))^{-(T-t+1)}} \epsilon_{it}, \tag{5}$$

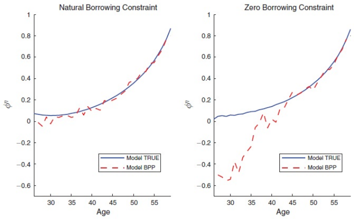
i.e., today's consumption changes depend only on today's shocks.

Source of Bias II

The key difference here is the borrowing constrain:

- It turns out $cov(\Delta logc_{i,t}, \epsilon_{i,t-2}) < 0$.
- When close to BC, $cov(\Delta logc_{i,t-2}, \epsilon_{i,t-2}) < 0$.
- As result, I want to increase consumption in the future.
- With concave utility, and uncertainty, rise in consumption takes time.

Life-Cycle Profiles (Permanent Shocks)



- Insurance rises with age in the model for two reasons:
  - Households accumulate retirement and precautionary wealth.
  - "Permanent" shocks become more transitory towards retirement.
- BPP should underestimate insurance for young.
- Why does the data show no life-cycle profile?

Advanced Information

The BPP model also assumes no foresight:

$$cov(\Delta \ln c_{i,t}, \epsilon_{i,t+1}) = 0 \quad (6)$$
$$cov(\Delta \ln c_{i,t}, \nu_{i,t+1}) = 0. \quad (7)$$

- Knowing shock 1 period ahead

  makes little difference for permanent shocks.

- Knowing part of earnings at birth leads to

  upwards bias with NBC.

  downward bias with ZBC.

Krueger and Perri (2006)

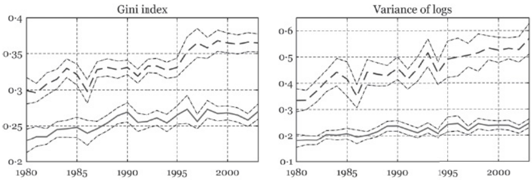
The Idea

- Income inequality increased over the last decades.
- Income uncertainty increased.
- Consumption inequality increased by less.
- More income uncertainty increases incentives for risk sharing.
- Build a model with incomplete markets and endogenous private insurance (limited commitment).

Data

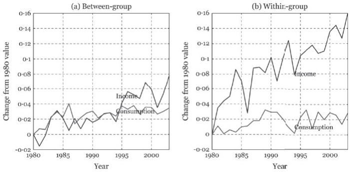
- They use the Consumer Expenditure Survey.
- 1980-2004, households are interviewed for 1 year.
- Quarterly consumption information.
- Biannual income information.
- Income after taxes and transfers.
- Non-durable consumption plus service flows from durables.
- To obtain household measure of consumption they use an adult equivalence measures.

Trends in Inequality



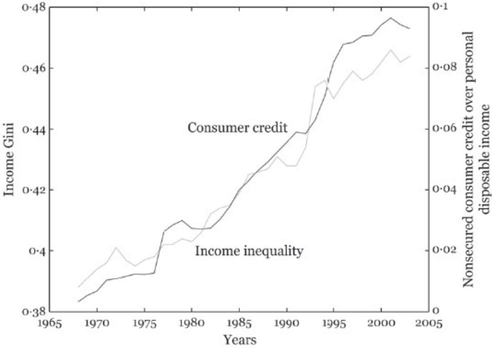
- Substantial increase in income inequality.
- Much smaller increase in consumption inequality.

Trends in Inequality II



- Control for worker observables (groups).
- Between group consumption inequality tracks income inequality.
- Within group consumption inequality almost flat.
- Idea: Changing returns to observables may be difficult to insure. However, risk among similar people could be insured.

Trends in Credit



- Consumer credit expanded together with income inequality suggesting, indeed, more insurance.

A Simple Model

- To build intuition, they start with a simple model.
- Time is discrete.
- Households discount the future with β.
- 2 agents, each with stochastic labor income $1 + \epsilon$ and $1 - \epsilon$.

  The probability for each is $\pi(s_t) = \frac{1}{2}$ every period.
- Each agent receives r capital income per period.

Preferences

Let $s^t = (s_0 .... s_t)$ be the event history of income shocks, and $\pi(s^t)$ its time 0 probability. The value function is

$$U(c^j) = (1-\beta)\sum_{t=0}^{\infty}\sum_{s^t}\beta^t\pi(s^t)u(c_t^j(s^t)).$$

Now define the continuation value after the realization of a particular history

$$U(c^j, s^t) = (1-\beta)\sum_{\tau=t}^{\infty}\sum_{s^\tau|s^t}\beta^{\tau-t}\pi(s^\tau|s^t)u(c_\tau^j(s^\tau)).$$

Risk Sharing

- Agents have incentives for risk sharing.
- Each period, they can write a contract conditional on next period realization of the income shock.
- After the shock realization, any agent can cancel the risk sharing arrangement.
- In that case, each agent goes to autarky where each agents consume only its stochastic labor income. Let $e = (e^1, e^2)$ be the autarky allocation.

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- In that case, each agent goes to autarky where each agents consume only its stochastic labor income. Let $e = (e^1, e^2)$ be the autarky allocation.
- Agent with $1 + \epsilon$ has incentives doing so.

Conditions for Risk Sharing

For risk sharing, period allocation needs to satisfy

$$U(c^j, s^t) \geq U(e^j) = (1-\beta)\sum_{\tau=t}^{\infty}\sum_{s^\tau|s^t}\beta^{\tau-t}\pi(s^\tau|s^t)u(e^j_\tau(s^\tau)).$$

Where the value of autarky solves

$$U(1+\epsilon) = (1-\beta)u(1+\epsilon) + \frac{\beta}{2}[u(1+\epsilon)+u(1-\epsilon)]$$
$$U(1-\epsilon) = (1-\beta)u(1-\epsilon) + \frac{\beta}{2}[u(1+\epsilon)+u(1-\epsilon)]$$

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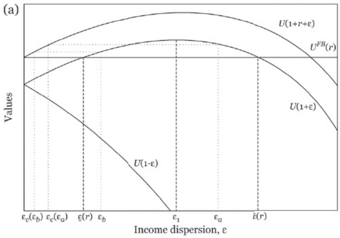
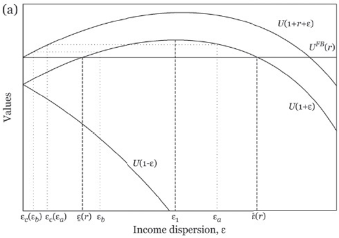
Optimal risk sharing contract (if exists): Make high agent indifferent.

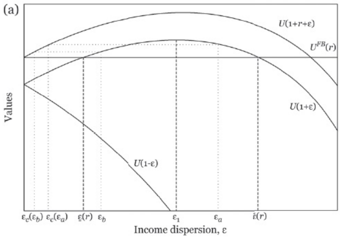


- Full risk sharing U^{FB} a flat line.



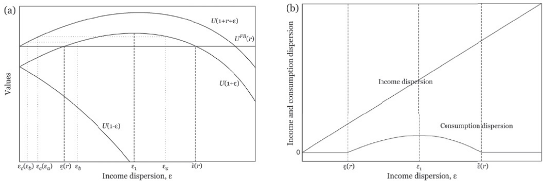
- Full risk sharing U^{FB} a flat line.
- Value of autarky in low state $< U^{FB}$ and decreasing in risk.
- Value of autarky for high state non-monotone.

Uncertainty and Risk Sharing



- Full risk sharing U^{FB} a flat line.
- Value of autarky in low state $< U^{FB}$ and decreasing in risk.
- Value of autarky for high state non-monotone.
- Higher current consumption vs. higher future risk.

Risk Sharing and Consumption Inequality



- Either full, partial, or no risk sharing.
- Risk-sharing non-monotone is risk.

Quantitative Model

- Infinitely lived unit mass of households supplying inelastic labor.
- Households belong to group p_i $i \in \{1, ..., M\}$ representing permanent differences.
- Labor income $\alpha_{i,t} Y_t$

  $\alpha_{i,t}$ group specific deterministic trend.

  Y_t follows Markov process.

- Labor supply: $L_t = \int \sum_{y^t} \alpha_{i,t} Y_t \pi(y^t | y_0) d\Omega_0$.

Insurance Markets

Agents trade one period Arrow securities $a_{t+1}(a_0, y^t, y_{t+1})$ at price $q_t(y^t, y_{t+1})$ and credit line $A_t^i(y^t, y_{t+1})$.

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- More insurance than in Aiyagari resulting from state-contingent claims.
- Not full insurance because only one-period ahead.
- Different from Aiyagari, borrowing constrained is endogenous.

Value Under Insurance

$$V_t(i, a, y^t) = \max_{c_s(a,y^s), a_{s+1}(a,y^s,y_{s+1})} (1-\beta)$$

$$\left\{ u(c_t(a, y^t)) + \sum_{s=t+1}^{\infty} \sum_{y^s|y^t} \beta^t \pi(y^s|y^t) u(c_s(a, y^s)) \right\}$$

$$c_s(a, y^s) + \sum_{y_{s+1}} q_s(y^s, y_{s+1}) a_{s+1}(a, y^s, y_{s+1}) = w_s \alpha_{i,s} Y_s + a_s$$

$$a_{s+1}(a, y^s, y_{s+1}) \geq A_s^i(y^s, y_{s+1})$$

Value Under Autarky

Households can self-insure in autarky using a risk free bond b_{s+1}. This decreases its punitive effect and makes risk sharing more difficult:

$$U_t^{Aut}(i, y^t) = \max_{c_s(a_0, y^s), b_{s+1}(a_0, y^s)} (1-\beta) \left\{ u(c_t(a_0, y^t)) + \sum_{s=t+1}^{\infty} \sum_{y^s|y^t} \beta^t \pi(y^s|y^t) u(c_s(a_0, y^s)) \right\}$$

$$c_s(a_0, y^s) + \frac{b_{s+1}(a_0, y^s)}{1 + r_d} = w_s \alpha_{i,s} Y_s + b_s(a_0, y^{s-1})$$

$$b_{s+1}(a_0, y^s) \geq 0$$

Calibration

- Calibrate to 1980s.
- Impose time trends in $\{\sigma_{\alpha,t}, \sigma_{Y,t}\}_{t=1980}^{2003}$ to match data.
- Move from one steady state to new one

Calibration

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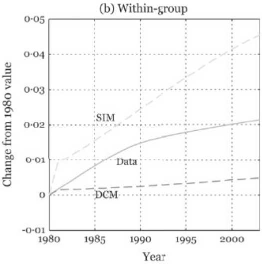
  Compute initial and final steady state.

  Guess the transition path for prices.

  Iterate to convergence.

Results



- Withing group consumption inequality increases

  too much with standard incomplete markets model.

  too little with limited commitment model.

What is Key?

- Loosening borrowing constraints does not help SIM.
- Reducing persistence of shocks reduces increase.
- Abolishing state contingency in DCM makes it almost SIM.

    Endogenous borrowing constraints of little importance.

References

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