Consumption and Labor Supply with Partial Insurance: An Analytical Framework

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Measurement of risk sharing
Measurement of risk sharing

Three broad questions:

1. Fraction of individual shocks that transmits to consumption

2. Insurability of the recent increase in U.S. inequality

3. Life-cycle shocks vs. initial conditions in determining inequality
Measurement of risk sharing

Two complementary approaches:

1. **Structural model** \(\Rightarrow\) risk sharing as equilibrium outcome

   - Sensitive to assumed market structure and insurance channels
Measurement of risk sharing

Two complementary approaches:

1. **Structural model** ⇒ risk sharing as equilibrium outcome
   - Sensitive to assumed market structure and insurance channels

2. **Quantify overall risk sharing** from data ⇒ agnostic about sources
   - Requires long, high-quality panel data on \((c, y)\)
Our approach

1. **Structural equilibrium model** with non-contingent bond, labor supply, and redistributive taxation

2. **Flexible financial market structure** that does not hardwire agents’ access to insurance
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Analytical tractability

- Closed-form equilibrium cross-sectional (co-)variances of \((w, h, c)\)
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**Analytical tractability**

- Closed-form equilibrium cross-sectional (co-)variances of \((w, h, c)\)

**Labor supply data informative about risk-sharing**

- Like \(c, h\) react differently to insurable vs. uninsurable shocks to \(w\)
ECONOMIC ENVIRONMENT
Demographics and preferences

- **Demographics**: perpetual youth – constant survival probability $\delta$

- **Preferences** over sequences of consumption and hours worked:

$$
E_b \sum_{t=b}^{\infty} (\beta \delta)^{t-b} u(c_t, h_t; \varphi)
$$

$$
u(c_t, h_t; \varphi) = \frac{c_t^{1-\gamma} - 1}{1 - \gamma} - \exp(\varphi) \frac{h_t^{1+\sigma}}{1 + \sigma}
$$

where $\varphi \sim F_{\varphi,b}$ is distaste for work relative to consumption
Technology and individual endowments

- **Technology**: linear in aggregate effective labor
  - Competitive labor market: wage = individual productivity
Technology and individual endowments

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  - Competitive labor market: wage $= \text{individual productivity}$

- **Individual wage**: sum of two orthogonal components (in logs):

  $$\log w_t = \alpha_t + \varepsilon_t$$
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  \[
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  \]

  \[
  \alpha_t = \alpha_{t-1} + \omega_t \quad \text{with} \quad \omega_t \sim F_{\omega,t}
  \]
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\alpha_t = \alpha_{t-1} + \omega_t \quad \text{with} \quad \omega_t \sim F_{\omega,t}
\]

\[
\varepsilon_t = \kappa_t + \theta_t \quad \text{with} \quad \theta_t \sim F_{\theta,t}
\]

\[
\kappa_t = \kappa_{t-1} + \eta_t \quad \text{with} \quad \eta_t \sim F_{\eta,t}
\]

At labor market entry, agents draw \( \alpha^0 \sim F_{\alpha^0,b} \) and \( \kappa^0 \sim F_{\kappa^0,b} \)
Private risk-sharing

1. **Non-state-contingent bond** traded in zero net supply

2. **Insurance claims** traded against shocks to $\varepsilon$ only
   - Implements other (residual) insurance arrangements: financial markets, family, etc.
   - Alternative interpretation: *foreseeable* fluctuations in wages

Heathcote-Storesletten-Violante, "Consumption and Labor Supply with Partial Insurance"
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Partial insurance: between bond economy and complete markets

- \[ \frac{\text{var}(\alpha_t)}{\text{var}(\log(w_t))} \rightarrow 0: \text{complete markets economy} \]
- \[ \frac{\text{var}(\varepsilon_t)}{\text{var}(\log(w_t))} \rightarrow 0: \text{bond economy} \]
Government

- **Government**: runs a progressive tax/transfer scheme

  ➤ Device for redistribution and financing of expenditures

  ➤ Two-parameter function maps pre-government earnings \((y_t = w_t h_t)\) to disposable earnings \((\tilde{y}_t)\)

\[
\tilde{y}_t = \lambda y_t^{1-\tau}
\]

\(\tau\) measure the degree of progressivity
EQUILIBRIUM
Equilibrium

• In equilibrium, there is no bond trade among households

• Sharp dichotomy between shocks:
  - $\varepsilon_t$ perfectly insured
  - $\alpha_t$ uninsured privately, but smoothed through labor supply and progressive taxation
Link to Constantinides and Duffie (1996)

- (i) CRRA, (ii) zero initial wealth, (iii) zero net wealth, (iv) unit root shocks to log disposable income $\Rightarrow$ no bond-trade equilibrium
(i) CRRA, (ii) zero initial wealth, (iii) zero net wealth, (iv) unit root shocks to log disposable income ⇒ no bond-trade equilibrium

Our environment micro-founds unit root disposable income:

1. **Primitive exogenous process**: wages
2. **Labor supply**: exogenous wages → endogenous earnings
3. **Non-linear taxation**: pre-tax earnings → after-tax earnings
4. **Private risk-sharing**: earnings → post-trade disposable income
5. **No bond-trade**: disposable income = consumption
Hours worked

\[ \log h_t^a (\varphi, \alpha, \varepsilon) = -\hat{\varphi} + \left( \frac{1 - \gamma}{\hat{\sigma} + \gamma} \right) \alpha + \frac{1}{\hat{\sigma}} \varepsilon + H_t^a \]

where \( \hat{\varphi} \equiv \frac{\varphi}{\hat{\sigma} + \gamma} \) and \( \frac{1}{\hat{\sigma}} \equiv \frac{1 - \tau}{\sigma + \tau} \)

- Hours worked decrease in effort cost \( \hat{\varphi} \)
- Response to \( \varepsilon \) proportional to tax-modified Frisch elasticity
- Response to \( \alpha \) depends on \( \gamma \) which controls wealth effect
Consumption

$$\log c^a_t (\varphi, \alpha) = -(1 - \tau) \cdot \hat{\varphi} + (1 - \tau) \cdot \left( \frac{1 + \hat{\sigma}}{\hat{\sigma} + \gamma} \right) \alpha + C^a_t$$

- Independent of the insurable shock $\varepsilon$
- Heterogeneity in $\hat{\varphi}$ compressed by tax progressivity
- Response to $\alpha$ mediated by labor supply and tax progressivity
- Random walk, displays excess smoothness relative to PIH
IDENTIFICATION AND ESTIMATION
Data, identification, and estimation

Parameters

- Time invariant: preference parameters and measurement error
- Time varying: life-cycle shocks and cohort effects in productivity

Moments

- Cross-sectional (co-)variances of \((w, h, c)\), conditional on age/time

Data

- CEX (1980-2006) and PSID (1967-2006)

Identification

- Yes, even without consumption data (with external estimate of \(\nu_{\mu y}\))
Answers to the Three Questions
Pass-through coefficient

- Pass-through from permanent wage shocks to consumption:

\[
\phi_{t}^{w,c} \equiv \frac{cov(\Delta \log c_t, \omega_t + \eta_t)}{var(\omega_t + \eta_t)}
\]
Pass-through coefficient

• Pass-through from permanent wage shocks to consumption:

$$\phi_{t}^{w,c} \equiv \frac{cov(\Delta \log c_t, \omega_t + \eta_t)}{var(\omega_t + \eta_t)} = (1 - \tau) \cdot \frac{1 + \hat{\sigma}}{\hat{\sigma} + \gamma} \cdot \frac{v_{\omega t}}{v_{\omega t} + v_{\eta t}}$$

▶ progressive taxation ($\tau = 0.27$) $\rightarrow 0.73$

▶ labor supply ($\gamma = 1.5, \hat{\sigma} = 2.6$) $\rightarrow 0.87$

▶ private insurance ($v_{\omega} = 0.007, v_{\eta} = 0.004$) $\rightarrow 0.63$

• Overall, we estimate: $\phi_{t}^{w,c} = 0.40$
Risk-sharing over time

\[ \Delta var_t(\log w) = \Delta var_t(\alpha) + \Delta var_t(\varepsilon) \]

\[ \Delta var_t(\log c) = (1 - \tau)^2 \left(\frac{1 + \hat{\sigma}}{\hat{\sigma} + \gamma}\right)^2 \Delta var_t(\alpha) \]
Risk-sharing over time

\[
\Delta \text{var}_t(\log w) = \Delta \text{var}_t(\alpha) + \Delta \text{var}_t(\varepsilon)
\]

\[
\Delta \text{cov}_t(\log w, \log h) = \left(\frac{1 - \gamma}{\hat{\sigma} + \gamma}\right) \Delta \text{var}_t(\alpha) + \frac{1}{\hat{\sigma}} \Delta \text{var}_t(\varepsilon)
\]
### Lifecycle inequality decomposition

<table>
<thead>
<tr>
<th>Total Variance of Logs</th>
<th>Percent Contribution to Total Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial Heterogeneity</td>
</tr>
<tr>
<td></td>
<td>Preferences</td>
</tr>
<tr>
<td>$W$</td>
<td>0.35</td>
</tr>
<tr>
<td>$H$</td>
<td>0.11</td>
</tr>
<tr>
<td>$C$</td>
<td>0.16</td>
</tr>
</tbody>
</table>

All components are orthogonal $\Rightarrow$ decomposition is unique
Why preference heter. is a source of inequality

\[ \text{cov}_t(\log w, \log h) = \left( \frac{1 - \gamma}{\hat{\sigma} + \gamma} \right) \text{var}_t(\alpha) + \frac{1}{\hat{\sigma}} \text{var}_t(\varepsilon) - \nu_{\mu h} < 0 \]

\[ \text{cov}_t(\log h, \log c) = (1 - \tau) \text{var}_t(\hat{\phi}) + \frac{(1 - \tau)(1 + \hat{\sigma})(1 - \gamma)}{(\hat{\sigma} + \gamma)^2} \text{var}_t(\alpha) > 0 \]

\[ \gamma = 1.5 \Rightarrow \text{var}_t(\hat{\phi}) > 0 \]