CONSUMPTION SMOOTHING AND FAMILY LABOR SUPPLY
(PRELIMINARY AND INCOMPLETE)

Richard Blundell    Luigi Pistaferri    Itay Saporta-Eksten

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Various recent studies interested in measuring response of consumption to shocks to economic resources (wages, earnings, wealth, etc.)


Find significant evidence of smoothing even of persistent shocks
**Research Question**

- What are the **mechanisms** behind such smoothing?

- This paper:
  - Self-insurance (i.e., savings)
  - Labor supply of primary earner
  - Labor supply of secondary earner
  - Other (un-modeled) mechanisms (networks, government, etc.)
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  - ...and tests for "superior information"

Distinctive features:

- Allow for non-separability, heterogeneous preferences, correlated shocks
- Use new data (PSID 1999-2009)
  - Almost comprehensive consumption measure
  - Good quality earnings, hours, asset data
Our Findings

- Evidence of smoothing of male’s and female’s permanent shocks to wages
- Female labor supply plays an important role in smoothing permanent shocks to male wages
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- Female labor supply plays an important role in smoothing permanent shocks to male wages
- Evidence for Frisch substitutability of consumption and hours
  - This facilitates "excess smoothing" of consumption w.r.t. shocks
Our Findings

- Evidence of smoothing of male’s and female’s permanent shocks to wages
- Female labor supply plays an important role in smoothing permanent shocks to male wages
- Evidence for Frisch substitutability of consumption and hours
  - This facilitates "excess smoothing" of consumption w.r.t. shocks
- Little evidence that external sources of insurance matter
Outline

1 Model
   ▶ Primitives: Joint stochastic wage process
   ▶ Approximation
   ▶ Intuition of "insurance" mechanisms

2 Data

3 Results
   ▶ Additive separability
   ▶ Non-separability
   ▶ Insurance accounting

4 Discussion
Model and Approximation
Wage Process

For earner $j = \{1, 2\}$ in household $i$, period $t$, wage growth is:

$$\Delta \log W_{i,j,t} = \Delta X'_{i,j,t} \beta_j + \Delta u_{i,j,t} + v_{i,j,t}$$
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\]

\[
\begin{pmatrix}
  u_{i,1,t} \\
  u_{i,2,t} \\
  v_{i,1,t} \\
  v_{i,2,t}
\end{pmatrix}
\sim i.i.d.
\begin{pmatrix}
  0 \\
  0 \\
  0 \\
  0
\end{pmatrix},
\begin{pmatrix}
  \sigma_{u,1}^2 & \sigma_{u,1,u_2} & 0 & 0 \\
  \sigma_{u,1,u_2} & \sigma_{u,2}^2 & 0 & 0 \\
  0 & 0 & \sigma_{v,1}^2 & \sigma_{v,1,v_2} \\
  0 & 0 & \sigma_{v,1,v_2} & \sigma_{v,2}^2
\end{pmatrix}.
**Transitory vs. Permanent Wage Shock**

- A transitory wage shock
- A permanent wage shock

[Graph showing the comparison between transitory and permanent wage shocks over age]
Household Optimization

Household chooses \( \{ C_{i,t+j}, H_{i,1,t+j}, H_{i,2,t+j} \} \) to maximize

\[
\mathbb{E}_t \sum_{\tau=0}^{T-t} (1 + \delta)^{-\tau} U (C_{i,t+\tau}, H_{i,1,t+\tau} H_{i,2,t+\tau})
\]
Household Optimization

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\]

subject to

\[
C_{i,t} + \frac{A_{i,t+1}}{1 + r} = A_{i,t} + H_{i,1,t}W_{i,1,t} + H_{i,1,t}W_{i,2,t}
\]
Household Optimization

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\]

Under additive separability:

\[
U(C, H_1, H_2) = g_0(C) - g_1(H_1) - g_2(H_2)
\]
**First Order Conditions**

\[
\begin{align*}
U_C &= \lambda_{i,t} \\
U_{H1} &\leq -\lambda_{i,t}W_{i,1,t} \\
U_{H2} &\leq -\lambda_{i,t}W_{i,2,t} \\
\lambda_{i,t} &= \frac{1 + r}{1 + \delta} E_t \lambda_{i,t+1}
\end{align*}
\]

- **Our goal:**
  - Understanding *transmission mechanisms* from wage shocks to consumption and labor supply decisions of two partners
- **No analytical solution with realistic preferences**
Our approach

- Approximate the Euler equations (interior solution)
- Approximate the lifetime budget constraint
- Write consumption and earnings growth as functions of Frisch elasticities, insurance parameters and wage shocks
**Solution and Estimation Approaches**

- **Our approach**
  - Approximate the Euler equations (interior solution)
  - Approximate the life time budget constraint
  - Write consumption and earnings growth as functions of Frisch elasticities, insurance parameters and wage shocks

- **Pros**
  - More transparent than full-fledged MSM
  - Unlike Euler equation framework, obtain "consumption function"
Solution and Estimation Approaches

Our approach

- Approximate the Euler equations (interior solution)
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Pros

- More transparent than full-fledged MSM
- Unlike Euler equation framework, obtain "consumption function"

Cons

- Approximation errors
- Need to specify a wage process
- Still unable to account for corners, so only crude corrections for non-participation
From Hours to Earnings

- Since (in logs):

\[ y = w + h \]

- It follows that:

\[ \frac{\partial y}{\partial w} = 1 + \frac{\partial h}{\partial w} \]

- And so the response of earnings to wage shocks is a simple renomination of the response of hours to wage shocks.
From Hours to Earnings

- Since (in logs):

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\[ \frac{\partial y}{\partial w} = 1 + \frac{\partial h}{\partial w} \]

- And so the response of earnings to wage shocks is a simple renomination of the response of hours to wage shocks.

- From now on, denote with \( c, w, y \) "unexplained" log consumption, wages, earnings.
Approximation of the Euler equation (1)

From $\lambda_{i,t} = \frac{1+\delta}{1+r} E_t \lambda_{i,t+1}$, use a second order Taylor approximation (with $r = \delta$) to yield:

$$\Delta \ln \lambda_{i,t+1} \approx \omega_t + \epsilon_{i,t+1}$$

where

$$\omega_t = -\frac{1}{2} E_t (\Delta \ln \lambda_{i,t+1})^2$$
$$\epsilon_{i,t+1} = \Delta \ln \lambda_{i,t+1} - E_t (\Delta \ln \lambda_{i,t+1})$$

Then use the fact that

$$\Delta \ln U_{C_{i,t+1}} = \Delta \ln \lambda_{i,t+1}$$
$$\Delta \ln U_{H_{i,j,t+1}} = -\Delta \ln \lambda_{i,t+1} - \Delta \ln W_{i,j,t+1}$$
Approximation of the Euler Equation (2)

- Consider now Taylor expansion of $U_{C_{i,t+1}} (= \lambda_{i,t+1})$:

\[
\frac{U_{C_{i,t+1}} - U_{C_{i,t}}}{U_{C_{i,t}}} \approx \frac{C_{i,t+1} - C_{i,t}}{C_{i,t}} \frac{U_{C_{i,t}C_{i,t}}}{U_{C_{i,t}}}
\]

\[
\Delta \ln U_{C_{i,t+1}} \approx -\frac{1}{\eta_{c,p}} \Delta \ln C_{i,t+1}
\]

- and therefore, from

\[
\Delta \ln \lambda_{i,t+1} \approx \omega_{t+1} + \epsilon_{i,t+1}
\]

- get

\[
\Delta \ln C_{i,t+1} = -\eta_{c,p} (\omega_{t+1} + \epsilon_{i,t+1})
\]
Approximation of the Lifetime Budget Constraint

Use the fact that

\[ \mathbb{E}_I \left[ \ln \sum_{i=0}^{T-t} X_{t+i} \right] = \ln \sum_{i=0}^{T-t} \exp \mathbb{E}_{t-1} \ln X_{t+i} \]

\[ + \sum_{i=0}^{T-t} \frac{\exp \mathbb{E}_{t-1} \ln X_{t+i}}{\sum_{j=0}^{T-t} \exp \mathbb{E}_{t-1} \ln X_{t+j}} (\mathbb{E}_I - \mathbb{E}_{t-1}) \ln X_{t+i} \]

\[ + O \left( \mathbb{E}_I \| \xi_T \|^2 \right) \]

for \( X = C, WH \) and appropriate choice of \( \mathbb{E}_I \).

Goal: obtain a mapping from wage innovations to innovations in consumption (marginal utility of wealth)
CONSUMPTION AND EARNINGS GROWTH

The ‘Simple’ Separable Case

\[
\begin{pmatrix}
\Delta c_t \\
\Delta y_{1,t} \\
\Delta y_{2,t}
\end{pmatrix}
\sim
\begin{pmatrix}
0 & 0 & \kappa_{c,v_1} & \kappa_{c,v_2} \\
\kappa_{y_1,u_1} & 0 & \kappa_{y_1,v_1} & \kappa_{y_1,v_2} \\
0 & \kappa_{y_2,u_2} & \kappa_{y_2,v_1} & \kappa_{y_2,v_2}
\end{pmatrix}
\begin{pmatrix}
\Delta u_{1,t} \\
\Delta u_{2,t} \\
v_{1,t} \\
v_{2,t}
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+ \begin{pmatrix}
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where

\[
\kappa_{c,v_j} = (1 - \pi_{i,t}) s_{i,j,t} \frac{\eta_{c,p} \left(1 + \eta_{h_{j,w_j}}\right)}{\eta_{c,p} + \left(1 - \pi_{i,t}\right) \eta_{h,w}}
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\[
\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]}
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\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \overset{\text{Frisch}}{\rightarrow} \kappa_{y_j,v_j} \overset{\text{Marshall}}{\rightarrow}
\]

- \(\pi_{i,t} \approx \frac{\text{Assets}_{i,t}}{\text{Assets}_{i,t} + \text{Human Wealth}_{i,t}}\) and \(s_{i,j,t} \approx \frac{\text{Human Wealth}_{i,j,t}}{\text{Human Wealth}_{i,t}}\)

- \(\eta_{x,y}\) is the Frisch elasticity of \(x\) w.r.t. \(y\)
Introduce now $\beta$, representing insurance over and above savings and labour supply $\rightarrow$ networks, etc.

Key transmission parameter becomes:

\[
\kappa_{c,v_j} = (1 - \beta) (1 - \pi_{i,t}) s_{i,j,t} \frac{\eta_{c,p} \left( 1 + \eta_{h_j,w_j} \right)}{\eta_{c,p} + (1 - \beta) (1 - \pi_{i,t}) \eta_{h,w}}
\]
**Interpretation: Consumption response to J’s permanent wage shock**

\[
\kappa_{c,v_j} = (1 - \beta) (1 - \pi_{i,t}) s_{i,j,t} \frac{\eta_{c,p} \left(1 + \eta_{h_j,w_j}\right)}{\eta_{c,p} + (1 - \beta) (1 - \pi_{i,t}) \eta_{h,w}}
\]

- Increases with \(s_{i,j,t}\) (J’s earnings play heavier weight)
- Declines with \(\pi_{i,t}\) (accumulated assets allow better insurance of shocks)
- Declines with \(\beta\) (outside insurance allows more smoothing)

---

**Blundell, Pistaferrri, Saporta () Consumption and Family Labor Supply**

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**INTERPRETATION: Consumption response to J’s permanent wage shock**

\[ \kappa_{c,v_j} = (1 - \beta) (1 - \pi_{i,t}) \frac{s_{i,j,t} \eta_{c,p} \left( 1 + \eta_{h,\omega_j} \right)}{\eta_{c,p} + (1 - \beta) (1 - \pi_{i,t}) \eta_{h,\omega}} \]

- increases with \( s_{i,j,t} \) (j’s earnings play heavier weight)
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- declines with \( \eta_{h_j,w_j} \) ("added worker" effect)
- declines with \( \eta_{h_j,w_j} \) only if J’s labor supply responds negatively to own permanent shock. In one-earner case true if

\[
(1 - \beta) (1 - \pi_{i,t}) - \eta_{c,p} > 0
\]
**Identification Issues**

**Problem:** $\beta$ is not identified separately from $\pi$

Human wealth is projected using observables that evolve deterministically (e.g. age).
Identification Issues

Problem: $\beta$ is not identified separately from $\pi$

Solution: Back out $\pi$ from the data and estimate $\beta$

$$\pi_{i,t} \approx \frac{\text{Observed in PSID}}{\text{Projected lifetime earnings}} \frac{\text{Assets}_{i,t}}{\text{Human Wealth}_{i,t} + \text{Assets}_{i,t}}$$

Human wealth is projected using observables that evolve deterministically (e.g. age).
Data
DATA AND SAMPLE SELECTION

- **PSID** biennial 1999-2009:
  - PSID consumption went through a major revision in 1999
    - ~70% of consumption expenditures. Very good match with NIPA
    - The sum of food at home, food away from home, gasoline, health, transportation, utilities, etc.
    - Main items that are missing: clothing, recreation, alcohol and tobacco
  - Earning and hours for each earner
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- We focus on
  - Married couples, male aged 30-65
  - Working males (93% in this age group)
  - Stable household composition
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- **We focus on**
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  - Working males (93% in this age group)
  - Stable household composition

- **Methodology:** Use covariance restrictions that theory imposes on \( \Delta c_{i,t} \), \( \Delta y_{i,1,t} \) and \( \Delta y_{i,2,t} \)
ECONOMETRICS ISSUES

- Measurement error
  - For consumption, use martingale assumption and mean-reversion
  - For wages, use external estimates from Bound et al. (1994)
Econometrics Issues

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- Non-Participation
  - ~20% of women in our sample work 0 hours in a given year
  - We correct our variances and covariances using standard Heckman selection strategies
    - Does not make a huge difference
    - But our exclusion restrictions may have low power
**Econometrics Issues**

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- **Inference**
  - Multi-step procedure
  - Block bootstrap standard errors
Results: Separable Case
## Wage Parameters Estimates

<table>
<thead>
<tr>
<th>Sample</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
</tr>
<tr>
<td>Trans.</td>
<td>$\sigma_{u_1}^2$</td>
</tr>
<tr>
<td>Perm.</td>
<td>$\sigma_{v_1}^2$</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
</tr>
<tr>
<td>Trans.</td>
<td>$\sigma_{u_2}^2$</td>
</tr>
<tr>
<td>Perm.</td>
<td>$\sigma_{v_2}^2$</td>
</tr>
<tr>
<td><strong>Correlation of shocks</strong></td>
<td></td>
</tr>
<tr>
<td>Trans.</td>
<td>$\sigma_{u_1,u_2}$</td>
</tr>
<tr>
<td>Perm</td>
<td>$\sigma_{v_1,v_2}$</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td></td>
</tr>
</tbody>
</table>
Barred Out s by Age

\[ s_{i,t} \approx \frac{\text{Human Wealth}_{\text{male},i,t}}{\text{Human Wealth}_{i,t}} \]
Backed Out $\pi$ by Age

$$\pi_{i,t} \approx \frac{\text{Assets}_{i,t}}{\text{Assets}_{i,t} + \text{Human Wealth}_{i,t}}.$$
### Results for the Separable Case

<table>
<thead>
<tr>
<th></th>
<th>$E(\pi)$</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance from savings</td>
<td>0.181</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Insurance over and above savings</td>
<td>0.741</td>
<td>(0.311)</td>
</tr>
<tr>
<td>EIS of consumption</td>
<td>0.201</td>
<td>(0.087)</td>
</tr>
<tr>
<td>Frisch elasticity labor supply (male)</td>
<td>0.431</td>
<td>(0.107)</td>
</tr>
<tr>
<td>Frisch elasticity labor supply (female)</td>
<td>0.831</td>
<td>(0.153)</td>
</tr>
</tbody>
</table>

#### Benchmarks

- $\eta_{c,p}$: "The evidence that emerges from micro studies...is that the EIS for consumption...is just below 1" (Attanasio, 1999)
- $\eta_{h_1,w_1}$: Early evidence (MaCurdy, 1981) points to low elasticities (0-0.5); more recent work (Chetty, 2010) suggest larger elasticities (0.3-0.8)
- $\eta_{h_2,w_2}$: Heckman and MaCurdy (1980) find an elasticity of 1.6
Frisch vs. Marshallian Elasticities

\[ \Delta c_{i,t} \approx 0.13 \sigma_{i,1,t} + 0.07 \sigma_{i,2,t} \]

\[ \Delta y_{i,1,t} \approx 1.43 \Delta u_{i,1,t} + 1.15 \sigma_{i,1,t} - 0.16 \sigma_{i,2,t} \quad (0.1) \]

\[ \Delta y_{i,2,t} \approx 1.83 \Delta u_{i,2,t} - 0.54 \sigma_{i,1,t} + 1.53 \sigma_{i,2,t} \quad (0.2) \]
Excess Smoothing

- $\beta$ appears too high - too much insurance?
- **Sensitivity** analyses
  - Non-Participation correction
  - Measurement error assumptions
  - Age criteria
  - Average vs. individual assets when constructing $\pi_{i,t}$
  - Different weighting matrices

Model fit:
- Excellent for hourly wage moments
- Variance of consumption growth is understated
- Covariance of consumption growth and wages is overstated
- Zero-restriction test on omitted moments rejects the null: $p$-value = 1.4%
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Removing Additive Separability
Removing Additive Separability: Theory

Approximating the first order conditions (intensive margin):

\[ \Delta c_{i,t} \approx \left( \eta_{c,w_1} + \eta_{c,w_2} - \eta_{c,p} \right) \Delta \ln \lambda_{i,t} + \eta_{c,w_1} \Delta w_{i,1t+1} + \eta_{c,w_2} \Delta w_{i,2t+1} \]

Interpretation:

- IC and H substitutes (\( \eta_{c,w_j} < 0 \)): Excess smoothing
- IC and H complements (\( \eta_{c,w_j} > 0 \)): Excess sensitivity

Illustration: A negative transitory wage shock (\( \Delta \ln \lambda_{i,t} = 0 \))

Separability (\( \eta_{c,w_j} = 0 \)): Minimal decrease in consumption (actually, zero in our setup) and hours decrease

- IC and H substitutes: consumption decrease is attenuated (may become increase)
Approximating the first order conditions (intensive margin):

\[ \Delta c_{i,t} \approx \left( \eta_{c,w_1} + \eta_{c,w_2} - \eta_{c,p} \right) \Delta \ln \lambda_{i,t} \\
+ \eta_{c,w_1} \Delta w_{i,1t+1} + \eta_{c,w_2} \Delta w_{i,2t+1} \]

Interpretation:
- C and H substitutes (\( \eta_{c,w_j} < 0 \)) \( \Rightarrow \) Excess smoothing
- C and H complements (\( \eta_{c,w_j} > 0 \)) \( \Rightarrow \) Excess sensitivity
Removing Additive Separability: Theory

- Approximating the first order conditions (intensive margin):

\[
\Delta c_{i,t} \approx \left( \eta_{c,w_1} + \eta_{c,w_2} - \eta_{c,p} \right) \Delta \ln \lambda_{i,t} \\
+ \eta_{c,w_1} \Delta w_{i,1t+1} + \eta_{c,w_2} \Delta w_{i,2t+1}
\]

- Interpretation:
  - C and H substitutes \((\eta_{c,w_j} < 0)\) ⇒ Excess smoothing
  - C and H complements \((\eta_{c,w_j} > 0)\) ⇒ Excess sensitivity

- Illustration: A negative transitory wage shock \((\Delta \ln \lambda_{i,t} = 0)\)
  - Separability \((\eta_{c,w_j} = 0)\): Minimal decrease in consumption (actually, zero in our setup) and hours decrease
  - C and H substitutes: consumption decrease is attenuated (may become increase)
**An Illustration**

Under separability

- \( W \) transitorily
- \( H \) (Frisch)
- \( Y = WH \)
- \( C \) a tiny bit due to budget constraint effect

Under non-separability

\( W \) transitorily
\( H \) (Frisch)
\( Y = WH \)
\( C \) a tiny bit due to budget constraint effect
Under separability

W ↓ transitorily
H ↓ (Frisch)
Y = WH ↓
C ↓ a tiny bit due to budget constraint effect

Under non-separability

W ↓ transitorily
H ↓ (Frisch)
Y = WH ↓
C ↓ a tiny bit due to budget constraint effect, but:
C ↑ if C,H are subst.
Removing Additive Separability: Moments

\[
\begin{pmatrix}
\Delta c_{i,t} \\
\Delta y_{i,1,t} \\
\Delta y_{i,2,t}
\end{pmatrix}
\sim
\begin{pmatrix}
\kappa_{i,c,u_1} & \kappa_{i,c,u_2} & \kappa_{i,c,v_1} & \kappa_{i,c,v_2} \\
\kappa_{i,y_1,u_1} & \kappa_{i,y_1,u_2} & \kappa_{i,y_1,v_1} & \kappa_{i,y_1,v_2} \\
\kappa_{i,y_2,u_1} & \kappa_{i,y_2,u_2} & \kappa_{i,y_2,v_1} & \kappa_{i,y_2,v_2}
\end{pmatrix}
\begin{pmatrix}
\Delta u_{i,1,t} \\
\Delta u_{i,2,t} \\
\nu_{i,1,t} \\
\nu_{i,2,t}
\end{pmatrix}
\]

where (for \( j = 1, 2 \))

\[
\kappa_{i,c,u_j} = \eta_{c,w_j}; \quad \kappa_{i,y_j,u_j} = 1 + \eta_{h_j,w_j}; \quad \kappa_{i,y_j,u_-j} = \eta_{h_j,w_-j}
\]

and:

\[
\kappa_{c,v_j} = \eta_{c,w_j}
\]

\[
+ \left( \eta_{c,p} - \eta_{c,w_j} - \eta_{c,w_-j} \right) \left[ (1 - \pi_t) (1 - \beta) \left( s_{jt} + \overline{\eta_{h,w_j}} \right) - \eta_{c,w_j} \right]
\]

\[
\frac{1}{(1 - \pi_t) (1 - \beta) \left( \overline{\eta_{h,w_j}} + \overline{\eta_{h,w_-j}} + \overline{\eta_{h,p}} \right) - \eta_{c,w_j} - \eta_{c,w_-j} + \eta_{c,p}}
\]
Transmission coefficients ($\kappa$) now depends also on "Frisch" cross-elasticities.
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Frisch elasticities of consumption and hours w.r.t. wages are identified from responses to transitory shocks:

- $\kappa_{i,c,u_j} = \eta_{c,w_j}$: Frisch elasticity of consumption and earner $j$'s wages
- $\kappa_{i,y_j,u_{-j}} = \eta_{h_j,w_{-j}}$: Frisch elasticity of hours of earner $j$'s and wages of earner $-j$
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- $\kappa_{i,c,u_j} = \eta_{c,w_j}$: Frisch elasticity of consumption and earner $j$'s wages
- $\kappa_{i,y_j,u_{-j}} = \eta_{h_j,w_{-j}}$: Frisch elasticity of hours of earner $j$'s and wages of earner $-j$

For identification, we impose symmetry of Frisch elasticities.
## Removing Additive Separability: Results

<table>
<thead>
<tr>
<th></th>
<th>(1) Additive separab.</th>
<th>(2) Non-separable</th>
<th>(3) Non-separable w/ $\beta = 0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E(\pi)$</td>
<td>0.181 (0.007)</td>
<td>0.181 (0.007)</td>
<td>0.181 (0.007)</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.741 (0.311)</td>
<td>$-0.120$ (0.682)</td>
<td>0</td>
</tr>
<tr>
<td>$\eta_{c,p}$</td>
<td>0.201 (0.087)</td>
<td>0.437 (0.227)</td>
<td>0.448 (0.165)</td>
</tr>
<tr>
<td>$\eta_{h1,w1}$</td>
<td>0.431 (0.107)</td>
<td>0.514 (0.141)</td>
<td>0.497 (0.143)</td>
</tr>
<tr>
<td>$\eta_{h2,w2}$</td>
<td>0.831 (0.153)</td>
<td>1.032 (0.613)</td>
<td>1.041 (0.480)</td>
</tr>
<tr>
<td>$\eta_{c,w1}$</td>
<td>$-.-$ (0.060)</td>
<td>$-0.141$ (0.061)</td>
<td>$-0.141$ (0.061)</td>
</tr>
<tr>
<td>$\eta_{h1,p}$</td>
<td>$-.-$ (0.035)</td>
<td>0.082 (0.036)</td>
<td>0.082 (0.036)</td>
</tr>
<tr>
<td>$\eta_{c,w2}$</td>
<td>$-.-$ (0.218)</td>
<td>$-0.138$ (0.176)</td>
<td>$-0.158$ (0.176)</td>
</tr>
<tr>
<td>$\eta_{h2,p}$</td>
<td>$-.-$ (0.256)</td>
<td>0.162 (0.207)</td>
<td>0.185 (0.207)</td>
</tr>
<tr>
<td>$\eta_{h1,w2}$</td>
<td>$-.-$ (0.060)</td>
<td>0.128 (0.074)</td>
<td>0.120 (0.074)</td>
</tr>
<tr>
<td>$\eta_{h2,w1}$</td>
<td>$-.-$ (0.121)</td>
<td>0.258 (0.148)</td>
<td>0.242 (0.148)</td>
</tr>
</tbody>
</table>
Removing the Separability Assumption

\[ \Delta c_{i,t} \approx -0.14 \Delta u_{i,1,t} - 0.14 \Delta u_{i,2,t} + 0.38 v_{i,1,t} + 0.21 v_{i,2,t} \]

\[ \Delta y_{i,1,t} \approx 1.51 \Delta u_{i,1,t} + 0.13 \Delta u_{i,2,t} + 0.98 v_{i,1,t} - 0.23 v_{i,2,t} \]

\[ \Delta y_{i,2,t} \approx 0.26 \Delta u_{i,1,t} + 2.03 \Delta u_{i,2,t} - 0.81 v_{i,1,t} + 1.32 v_{i,2,t} \]
**Fit of Model with Non-separability**

- Wage fit unchanged

- Doing better with $E \left[ (\Delta c_t)^2 \right]$ and $\Delta y_{1,t}, \Delta y_{2,t}$ moments but not with $\Delta c_t, \Delta w_{j,t}$

- Removing zero restrictions:
  - Better match: $E [\Delta w_{1,t} \Delta c_{t-2}]$ and $E [\Delta w_{2,t} \Delta c_{t-2}]$
  - Worse match for others...
  - Model implies symmetries which are not rejected (p-value 0.06 for male and 0.31 for female)
**INTERPRETATION: INSURANCE VIA LABOR SUPPLY (SHOCK TO MALE WAGES)**

The average response of total earnings to a permanent shock to the male’s wages:

\[
\frac{\partial \Delta y}{\partial v_1} = s \left( \frac{\partial \Delta y_1}{\partial v_1} \right)_{\hat{s}=0.69} + (1-s) \left( \frac{\partial \Delta y_2}{\partial v_1} \right)_{1-\hat{s}=0.31} = 0.44
\]

\[
\hat{k}_{y_1,v_1} = 0.98, \quad \hat{k}_{y_2,v_1} = -0.81
\]
The average response of total earnings to a permanent shock to the male’s wages:

\[
\frac{\partial \Delta y}{\partial \nu_1} = \frac{s}{\text{hat } s = 0.69} \times \left( \frac{\partial \Delta y_1}{\partial \nu_1} \right)_{\hat{\kappa}_{y_1, \nu_1} = 0.98} + (1 - s) \times \left( \frac{\partial \Delta y_2}{\partial \nu_1} \right)_{1 - \text{hat } s = 0.31} \times \left( \frac{\partial \Delta y_2}{\partial \nu_1} \right)_{\hat{\kappa}_{y_2, \nu_1} = -0.81} = 0.44
\]

Response of consumption to a 10% permanent decrease in the male’s wage rate ($\nu_1 = -0.1$):

- fixed labor supply and no insurance: -6.9%
**INTERPRETATION: INSURANCE VIA LABOR SUPPLY (SHOCK TO MALE WAGES)**

The average response of total earnings to a permanent shock to the male’s wages:

\[
\frac{\partial \Delta y}{\partial v_1} = s \left( \hat{\beta}_1 = 0.69 \right) * \frac{\partial \Delta y_1}{\partial v_1} + (1 - s) * \frac{\partial \Delta y_2}{\partial v_1} = 0.44
\]

\[
\hat{\kappa}_{y_1, v} = 0.98 \\ 1 - \hat{s} = 0.31 \\ \hat{k}_{y_2, v} = -0.81
\]

Response of consumption to a 10% permanent decrease in the male’s wage rate \((v_1 = -0.1)\):

- fixed labor supply and no insurance \(-6.9\%\)
- with family labor supply adjustment \(-4.4\%\)
INTERPRETATION: INSURANCE VIA LABOR SUPPLY (SHOCK TO MALE WAGES)

The average response of total earnings to a permanent shock to the male’s wages:

\[
\frac{\partial \Delta y}{\partial v_1} = \underbrace{s}_{\hat{s} = 0.69} \ast \underbrace{\frac{\partial \Delta y_1}{\partial v_1}}_{\hat{\kappa}_{y_1,v_1} = 0.98} + \underbrace{(1 - s)}_{1 - \hat{s} = 0.31} \ast \underbrace{\frac{\partial \Delta y_2}{\partial v_1}}_{\hat{\kappa}_{y_2,v_1} = -0.81} = 0.44
\]

Response of consumption to a 10% permanent decrease in the male’s wage rate ($v_1 = -0.1$):

- fixed labor supply and no insurance: -6.9%
- with family labor supply adjustment: -4.4%
- with family labor supply adjustment and other insurance: -3.8%
INTERPRETATION: INSURANCE VIA LABOR SUPPLY (SHOCK TO MALE WAGES): BY AGE

Response of Consumption to a 10% Permanent Decrease in the Male’s Wage Rate

- Fixed labor supply and no insurance
- With family labor supply adjustment
- With family labor supply adjustment and other insurance

Age of household head

30-34 35-39 40-44 45-49 50-54 55-59 60-65
The average response of total earnings to a permanent shock to the female’s wages:

$$\frac{\partial \Delta y}{\partial v_2} = s \frac{\partial \Delta y_1}{\partial v_2} + (1 - s) \frac{\partial \Delta y_2}{\partial v_2} = 0.25$$

Response of consumption to a 10% permanent decrease in the female’s wage rate ($v_2 = -0.1$):

- fixed labor supply and no insurance \(-3.1\%\)
- with family labor supply adjustment \(-2.5\%\)
- with family labor supply adjustment and other insurance \(-2.1\%\)
**Interpretation: Insurance Via Labor Supply (Shock to Female Wages): By Age**

Response of Consumption to a 10% Permanent Decrease in the Female’s Wage Rate

**Legend:**
- Red diamonds: fixed labor supply and no insurance
- Green circles: with family labor supply adjustment
- Blue triangles: with family labor supply adjustment and other insurance

**Axes:**
- X-axis: Age of household head (30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-65)
- Y-axis: Consumption response
Chart: Marshallian Elasticities: By Age

- **Age of household head**
- **Wife's Marshallian Elasticity**
- **Head's Marshallian Elasticity**

<table>
<thead>
<tr>
<th>Age of household head</th>
<th>Wife's Marshallian Elasticity</th>
<th>Head's Marshallian Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discussion
Discussion (1)

- Evidence for consumption and leisure Frisch complementarity
- Large changes in hours
  - Fall of consumption at retirement or unemployment
  - Appears consistent with substitutability, not complementarity
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  - Fall of consumption at retirement or unemployment
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How to Reconcile?

- Possible theoretical explanations: Extensive vs. Intensive margin
  - Fixed costs paid at employment (extensive margin): Buy a suit
  - Other goods substitute with hours (intensive margin): Utilities
  - Blundell and Laroque (2011) derive a model with both margins
**Discussion (2)**

- We estimated "conditional" Euler equations, controlling for changes in hours (intensive margin) and changes in participation (extensive margin).
- Use lags as IVs.
We estimated "conditional" Euler equations, controlling for changes in hours (intensive margin) and changes in participation (extensive margin).

Use lags as IVs

(Noisy) results, but consistent with this idea:

<table>
<thead>
<tr>
<th></th>
<th>Regression results</th>
<th>First Stage F-stats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>ΔEMPₜₜ(male)</td>
<td>0.144</td>
<td>0.144</td>
</tr>
<tr>
<td></td>
<td>(0.369)</td>
<td>(0.369)</td>
</tr>
<tr>
<td>Δhₜₜ(male)</td>
<td>-0.0728</td>
<td>-0.0127</td>
</tr>
<tr>
<td></td>
<td>(0.175)</td>
<td>(0.0207)</td>
</tr>
<tr>
<td>ΔEMPₜₜ(female)</td>
<td>0.456**</td>
<td>0.362*</td>
</tr>
<tr>
<td></td>
<td>(0.199)</td>
<td>(0.186)</td>
</tr>
<tr>
<td>Δhₜₜ(female)</td>
<td>-0.220**</td>
<td>-0.171*</td>
</tr>
<tr>
<td></td>
<td>(0.0999)</td>
<td>(0.0939)</td>
</tr>
</tbody>
</table>

Sample                                  All      EMPₜₜ(male)=1 EMPₜₜ(male)=1
Instruments                              2, 4 lags 2, 4 lags 4 lag
Observations                             7,247    6,678    6,678

Δxₜ is defined as (xₜ-xₜ₋₁)/[0.5(xₜ+xₜ₋₁)].
**Discussion (3)**

- Concavity of preferences. Use the fact that:

\[
\begin{pmatrix}
\eta_{cp} \frac{c}{p} & \eta_{cw_1} \frac{c}{w_1} & \eta_{cw_2} \frac{c}{w_2} \\
-\eta_{h_1p} \frac{h_1}{p} & -\eta_{h_1w_1} \frac{h_1}{w_1} & -\eta_{h_1w_2} \frac{h_1}{w_2} \\
-\eta_{h_2p} \frac{h_2}{p} & -\eta_{h_2w_1} \frac{h_2}{w_1} & -\eta_{h_2w_2} \frac{h_2}{w_2}
\end{pmatrix}
= \lambda
\begin{pmatrix}
\frac{d^2u}{dc^2} & \frac{d^2u}{dcdl_1} & \frac{d^2u}{dcdl_2} \\
\frac{d^2u}{dl_1dc} & \frac{d^2u}{dl_1^2} & \frac{d^2u}{dl_1dl_2} \\
\frac{d^2u}{dl_2dc} & \frac{d^2u}{dl_2dl_1} & \frac{d^2u}{dl_2^2}
\end{pmatrix}^{-1}
\]

Does not reject concavity at average values of wages, hours, consumption.

- Information. Consumption growth should be correlated with future wage growth if individuals have more information than the econometrician (Cunha et al., 2008).
  - Test has p-value 13%
Conclusions

- We estimate a life cycle model with two earners and labor supply decisions and find:
  - **Smoothing**: The average household can smooth at least 62% of male and 79% of female permanent wage shocks
  - **Added worker effects**: Female labor supply plays an important role in consumption smoothing
  - **Non-separability**: Evidence for Frisch substitutability of consumption and hours (intensive margin), and Frisch complementarity of spouses’ leisures
  - **No outside insurance**: Once family labor supply, assets and taxes are properly accounted for their is little evidence of additional insurance
**Extensions**

- How large are approximation errors?
- Liquidity constraints
- Nonseparability of consumption and hours vs. fixed cost of labor
- Adjustment cost in hours
- Intra-family allocation issues
## Appendix: Descriptive Statistics for Consumption

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>27,290</td>
<td>31,973</td>
<td>35,277</td>
<td>41,555</td>
<td>45,863</td>
<td>44,006</td>
</tr>
<tr>
<td>Nondurable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption</td>
<td>6,859</td>
<td>7,827</td>
<td>7,827</td>
<td>8,873</td>
<td>9,889</td>
<td>9,246</td>
</tr>
<tr>
<td>Food (at home)</td>
<td>5,471</td>
<td>5,785</td>
<td>5,911</td>
<td>6,272</td>
<td>6,588</td>
<td>6,635</td>
</tr>
<tr>
<td>Gasoline</td>
<td>1,387</td>
<td>2,041</td>
<td>1,916</td>
<td>2,601</td>
<td>3,301</td>
<td>2,611</td>
</tr>
<tr>
<td>Services</td>
<td>21,319</td>
<td>25,150</td>
<td>28,419</td>
<td>33,755</td>
<td>36,949</td>
<td>35,575</td>
</tr>
<tr>
<td>Food (out)</td>
<td>2,029</td>
<td>2,279</td>
<td>2,382</td>
<td>2,582</td>
<td>2,693</td>
<td>2,492</td>
</tr>
<tr>
<td>Health Insurance</td>
<td>1,056</td>
<td>1,268</td>
<td>1,461</td>
<td>1,750</td>
<td>1,916</td>
<td>2,188</td>
</tr>
<tr>
<td>Health Services</td>
<td>902</td>
<td>1,134</td>
<td>1,334</td>
<td>1,447</td>
<td>1,615</td>
<td>1,844</td>
</tr>
<tr>
<td>Utilities</td>
<td>2,282</td>
<td>2,651</td>
<td>2,702</td>
<td>4,655</td>
<td>5,038</td>
<td>5,600</td>
</tr>
<tr>
<td>Transportation</td>
<td>3,122</td>
<td>3,758</td>
<td>4,474</td>
<td>3,797</td>
<td>3,970</td>
<td>3,759</td>
</tr>
<tr>
<td>Education</td>
<td>1,946</td>
<td>2,283</td>
<td>2,390</td>
<td>2,557</td>
<td>2,728</td>
<td>2,584</td>
</tr>
<tr>
<td>Child Care</td>
<td>601</td>
<td>653</td>
<td>660</td>
<td>689</td>
<td>648</td>
<td>783</td>
</tr>
<tr>
<td>Home Insurance</td>
<td>430</td>
<td>480</td>
<td>552</td>
<td>629</td>
<td>717</td>
<td>729</td>
</tr>
<tr>
<td>Rent (or rent equivalent)</td>
<td>8,950</td>
<td>10,645</td>
<td>12,464</td>
<td>15,650</td>
<td>17,623</td>
<td>15,595</td>
</tr>
<tr>
<td>Observations</td>
<td>1,872</td>
<td>1,951</td>
<td>1,984</td>
<td>2,011</td>
<td>2,115</td>
<td>2,221</td>
</tr>
</tbody>
</table>

Notes: PSID data from 1999-2009 PSID waves. PSID means are given for the main sample of estimation: married couples with working males aged 30 to 65. SEO sample excluded. PSID rent is imputed as 6% of reported house value for homeowners. Missing values in consumption and assets sub-categories were treated as zeros.
### Appendix: Descriptive Statistics for Assets and Earnings

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Total assets</td>
<td>332,625</td>
<td>352,247</td>
<td>382,600</td>
<td>476,626</td>
<td>555,951</td>
<td>506,823</td>
</tr>
<tr>
<td>Housing and RE assets</td>
<td>159,856</td>
<td>187,969</td>
<td>227,224</td>
<td>283,913</td>
<td>327,719</td>
<td>292,910</td>
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<tr>
<td>Financial assets</td>
<td>173,026</td>
<td>164,567</td>
<td>155,605</td>
<td>192,995</td>
<td>228,805</td>
<td>214,441</td>
</tr>
<tr>
<td>Total debt</td>
<td>72,718</td>
<td>82,806</td>
<td>98,580</td>
<td>115,873</td>
<td>131,316</td>
<td>137,348</td>
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<tr>
<td>Mortgage</td>
<td>65,876</td>
<td>74,288</td>
<td>89,583</td>
<td>106,423</td>
<td>120,333</td>
<td>123,324</td>
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<tr>
<td>Other debt</td>
<td>7,021</td>
<td>8,687</td>
<td>9,217</td>
<td>9,744</td>
<td>11,584</td>
<td>14,561</td>
</tr>
<tr>
<td>First earner (head)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earnings</td>
<td>54,220</td>
<td>61,251</td>
<td>63,674</td>
<td>68,500</td>
<td>72,794</td>
<td>75,588</td>
</tr>
<tr>
<td>Hours worked</td>
<td>2,357</td>
<td>2,317</td>
<td>2,309</td>
<td>2,309</td>
<td>2,284</td>
<td>2,140</td>
</tr>
<tr>
<td>Second earner (wife)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation rate</td>
<td>0.81</td>
<td>0.8</td>
<td>0.81</td>
<td>0.81</td>
<td>0.81</td>
<td>0.8</td>
</tr>
<tr>
<td>Earnings (conditional on participation)</td>
<td>26,035</td>
<td>28,611</td>
<td>31,693</td>
<td>33,987</td>
<td>36,185</td>
<td>39,973</td>
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<tr>
<td>Hours worked (conditional on participation)</td>
<td>1,666</td>
<td>1,691</td>
<td>1,697</td>
<td>1,707</td>
<td>1,659</td>
<td>1,648</td>
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<tr>
<td>Observations</td>
<td>1,872</td>
<td>1,951</td>
<td>1,984</td>
<td>2,011</td>
<td>2,115</td>
<td>2,221</td>
</tr>
</tbody>
</table>

Notes: PSID data from 1999-2009 PSID waves. PSID means are given for the main sample of estimation: married couples with working males aged 30 to 65. SEO sample excluded. PSID rent is imputed as 6% of reported house value for homeowners. Missing values in consumption and assets sub-categories were treated as zeros.
### Appendix: Wage Parameters by Assets and Age

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</thead>
<tbody>
<tr>
<td>Sample</td>
<td>All</td>
<td>1\textsuperscript{st} asset tercile</td>
<td>2\textsuperscript{nd}, 3\textsuperscript{rd} asset terciles</td>
<td>age&lt;40</td>
<td>age&gt;=40</td>
</tr>
<tr>
<td>Males Trans. $\sigma^2_{u1}$</td>
<td>0.033 (0.007)</td>
<td>0.03 (0.009)</td>
<td>0.042 (0.009)</td>
<td>0.042 (0.013)</td>
<td>0.028 (0.008)</td>
</tr>
<tr>
<td>Perm. $\sigma^2_{v1}$</td>
<td>0.035 (0.005)</td>
<td>0.027 (0.006)</td>
<td>0.039 (0.007)</td>
<td>0.025 (0.009)</td>
<td>0.039 (0.007)</td>
</tr>
<tr>
<td>Females Trans. $\sigma^2_{u2}$</td>
<td>0.012 (0.005)</td>
<td>0.023 (0.009)</td>
<td>0.011 (0.007)</td>
<td>0.02 (0.015)</td>
<td>0.01 (0.005)</td>
</tr>
<tr>
<td>Perm. $\sigma^2_{v2}$</td>
<td>0.046 (0.004)</td>
<td>0.036 (0.007)</td>
<td>0.05 (0.006)</td>
<td>0.053 (0.013)</td>
<td>0.042 (0.005)</td>
</tr>
<tr>
<td>Correlations of Shocks Trans. $\sigma_{u1,u2}$</td>
<td>0.202 (0.159)</td>
<td>-0.264 (0.181)</td>
<td>0.39 (0.197)</td>
<td>0.459 (0.28)</td>
<td>0.115 (0.201)</td>
</tr>
<tr>
<td>Perm. $\sigma_{v1,v2}$</td>
<td>0.153 (0.06)</td>
<td>0.366 (0.142)</td>
<td>0.096 (0.066)</td>
<td>0.041 (0.174)</td>
<td>0.162 (0.063)</td>
</tr>
<tr>
<td>Observations</td>
<td>8,191</td>
<td>2,626</td>
<td>5,565</td>
<td>2,172</td>
<td>6,019</td>
</tr>
</tbody>
</table>

Correlations of Shocks

BLUNDELL, PISTAFFERI, SAPORTA (2012) CONSUMPTION AND FAMILY LABOR SUPPLY MARCH 2012
### Appendix: Separable Case by Assets and Age

<table>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>All</td>
<td>1st</td>
<td>2nd, 3rd</td>
<td>age&lt;40</td>
<td>age&gt;=40</td>
</tr>
<tr>
<td>Insurance from savings</td>
<td>E(π)</td>
<td>0.181</td>
<td>0.043</td>
<td>0.245</td>
<td>0.068</td>
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<tr>
<td></td>
<td>β</td>
<td>0.781</td>
<td>0.814</td>
<td>0.792</td>
<td>-0.077</td>
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<tr>
<td></td>
<td></td>
<td>(0.033)</td>
<td>(0.04)</td>
<td>(0.046)</td>
<td>(0.194)</td>
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<tr>
<td>Elasticity of intertemporal substitution of consumption</td>
<td>η_{c,p}</td>
<td>0.284</td>
<td>1.154</td>
<td>0.171</td>
<td>0.349</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.047)</td>
<td>(0.6)</td>
<td>(0.04)</td>
<td>(0.057)</td>
</tr>
<tr>
<td>Frisch elasticity of labor supply (male)</td>
<td>η_{h1,w1}</td>
<td>0.471</td>
<td>0.407</td>
<td>0.4</td>
<td>0.385</td>
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<tr>
<td></td>
<td></td>
<td>(0.042)</td>
<td>(0.065)</td>
<td>(0.045)</td>
<td>(0.053)</td>
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<tr>
<td>Frisch elasticity of labor supply (female)</td>
<td>η_{h2,w2}</td>
<td>1.115</td>
<td>1.044</td>
<td>1.024</td>
<td>1.519</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.07)</td>
<td>(0.103)</td>
<td>(0.084)</td>
<td>(0.147)</td>
</tr>
<tr>
<td>Observations</td>
<td>8,191</td>
<td>2,626</td>
<td>5,565</td>
<td>2,172</td>
<td>6,019</td>
</tr>
</tbody>
</table>
Variable Definitions

- Consumption measure
  - The sum of food at home, food away from home, gasoline, health, transportation, utilities, etc.
  - Main items that are missing: clothing, recreation, alcohol and tobacco
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  - Main items that are missing: clothing, recreation, alcohol and tobacco

- Asset measure
  - Liquid assets, pensions, cars, house value and real estate net of mortgages and other debt
Variable Definitions

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  - Liquid assets, pensions, cars, house value and real estate net of mortgages and other debt

- **Hourly wage measure**
  - The ratio of annual earnings and annual hours
**Variable Definitions**

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  - The ratio of annual earnings and annual hours
**NIPA-PSID Comparison**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>PSID Total</td>
<td>3,276</td>
<td>3,769</td>
<td>4,285</td>
<td>5,058</td>
<td>5,926</td>
<td>5,736</td>
</tr>
<tr>
<td>NIPA Total</td>
<td>5,139</td>
<td>5,915</td>
<td>6,447</td>
<td>7,224</td>
<td>8,190</td>
<td>9,021</td>
</tr>
<tr>
<td>ratio</td>
<td>0.64</td>
<td>0.64</td>
<td>0.66</td>
<td>0.7</td>
<td>0.72</td>
<td>0.64</td>
</tr>
<tr>
<td>PSID Nondurables</td>
<td>746</td>
<td>855</td>
<td>887</td>
<td>1,015</td>
<td>1,188</td>
<td>1,146</td>
</tr>
<tr>
<td>NIPA Nondurables</td>
<td>1,330</td>
<td>1,543</td>
<td>1,618</td>
<td>1,831</td>
<td>2,089</td>
<td>2,296</td>
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<tr>
<td>ratio</td>
<td>0.56</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.57</td>
<td>0.5</td>
</tr>
<tr>
<td>PSID Services</td>
<td>2,530</td>
<td>2,914</td>
<td>3,398</td>
<td>4,043</td>
<td>4,738</td>
<td>4,590</td>
</tr>
<tr>
<td>NIPA Services</td>
<td>3,809</td>
<td>4,371</td>
<td>4,829</td>
<td>5,393</td>
<td>6,101</td>
<td>6,725</td>
</tr>
<tr>
<td>ratio</td>
<td>0.66</td>
<td>0.67</td>
<td>0.7</td>
<td>0.75</td>
<td>0.78</td>
<td>0.68</td>
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</table>

Note: PSID weights are applied for the non-sampled PSID data (47,206 observations for these years). Total consumption is defined as Nondurables + Services. PSID consumption categories include food, gasoline, utilities, health, rent (or rent equivalent), transportation, child care, education and other insurance. NIPA numbers are from NIPA table 2.3.5. All numbers are nonminal.
Variance of Residual Consumption, Earnings and Wages Growth

Blundell, Pistaferri, Saporta () Consumption and Family Labor Supply March 2012 56 / 66
Covariance of Earnings and Wages between Spouses

- Wages (head) and Wages (wife)
- Wages (head) and Earnings (wife)
- Wages (wife) and Earnings (head)

BLUNDELL, PISTAFERRI, SAPORTA (2012) | CONSUMPTION AND FAMILY LABOR SUPPLY | MARCH 2012
Covariances of Consumption with Earnings and Wages

Wages and Earnings (head)

Wages and Earnings (wife)

Wages (head) and Wages (wife)

Wages (wife) and Earnings (head)

Wages (head) and Earnings (wife)
Covariances with Lagged Growth

Consumption

Wages (head)

Wages (wife)

Earnings (head)

Earnings (wife)
Inference

- Multi-step estimation procedure:
  - Regress $c_{i,t}, y_{i,j,t}, w_{i,j,t}$ on observable characteristics, and construct the residuals $\Delta c_{i,t}, \Delta y_{i,j,t}$ and $\Delta w_{i,j,t}$
  - Estimate the wage parameters using the conditional second order moments for $\Delta w_{i,1,t}$ and $\Delta w_{i,2,t}$
  - Estimate $\pi_{i,t}$ and $s_{i,t}$ using asset and (current and projected) earnings data
  - Estimate preference parameters using restrictions on the joint behavior of $\Delta c_{i,t}, \Delta y_{i,j,t}$ and $\Delta w_{i,j,t}$

- Will correct standard errors by the block bootstrap (disregarded for the time being)

- GMM strategy - identity matrix
Fit of Model

- Fit of hourly wage moments is excellent

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data</th>
<th>Model (Separable)</th>
<th>Model (NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[\Delta w_{1,t}\Delta w_{1,t-2}]$</td>
<td>-0.0991</td>
<td>-0.0991</td>
<td>-0.0991</td>
</tr>
<tr>
<td>$E[(\Delta w_{1,t})^2]$</td>
<td>0.2679</td>
<td>0.2679</td>
<td>0.2679</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t}\Delta w_{2,t-2}]$</td>
<td>-0.064</td>
<td>-0.064</td>
<td>-0.064</td>
</tr>
<tr>
<td>$E[(\Delta w_{2,t})^2]$</td>
<td>0.2191</td>
<td>0.2191</td>
<td>0.2191</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t}\Delta w_{2,t}]$</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t}\Delta w_{2,t-2}]$</td>
<td>-0.002</td>
<td>-0.0039</td>
<td>-0.0039</td>
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<tr>
<td>$E[\Delta w_{2,t}\Delta w_{1,t-2}]$</td>
<td>-0.0059</td>
<td>-0.0039</td>
<td>-0.0039</td>
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</table>
**Fit of Model (2)**

Fit of other moments slightly more problematic:

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<th>Data</th>
<th>Model (Separable)</th>
<th>Model (NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[(\Delta c_t)^2]$</td>
<td>0.0963</td>
<td>0.0671</td>
<td>0.0791</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta c_{t-2}]$</td>
<td>-0.0325</td>
<td>-0.0325</td>
<td>-0.0332</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta w_{1,t}]$</td>
<td>0.0021</td>
<td>0.0098</td>
<td>0.0186</td>
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<tr>
<td>$E[\Delta c_t \Delta w_{2,t}]$</td>
<td>0.0021</td>
<td>0.0089</td>
<td>0.0158</td>
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<tr>
<td>$E[\Delta c_t \Delta y_{1,t}]$</td>
<td>0.0115</td>
<td>0.011</td>
<td>0.0093</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta y_{2,t}]$</td>
<td>0.0039</td>
<td>0.0105</td>
<td>-0.0094</td>
</tr>
<tr>
<td>$E[(\Delta y_{1,t})^2]$</td>
<td>0.3148</td>
<td>0.3006</td>
<td>0.3001</td>
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<tr>
<td>$E[(\Delta y_{2,t})^2]$</td>
<td>0.4777</td>
<td>0.4615</td>
<td>0.4656</td>
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<tr>
<td>$E[\Delta w_{1,t} \Delta y_{1,t}]$</td>
<td>0.2089</td>
<td>0.2385</td>
<td>0.2325</td>
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<tr>
<td>$E[\Delta w_{1,t} \Delta y_{2,t}]$</td>
<td>0.1514</td>
<td>0.1956</td>
<td>0.1732</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t} \Delta y_{1,t}]$</td>
<td>0.0037</td>
<td>0.0036</td>
<td>-0.0162</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t} \Delta y_{2,t}]$</td>
<td>0.018</td>
<td>0.0147</td>
<td>0.0114</td>
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<table>
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<th>Model (NS)</th>
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<td>$E[\Delta y_{1,t} \Delta y_{2,t}]$</td>
<td>0.0092</td>
<td>-0.0121</td>
<td>0.0115</td>
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<tr>
<td>$E[\Delta y_{1,t} \Delta y_{1,t-2}]$</td>
<td>-0.1067</td>
<td>-0.0962</td>
<td>-0.1102</td>
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<tr>
<td>$E[\Delta y_{2,t} \Delta y_{2,t-2}]$</td>
<td>-0.1289</td>
<td>-0.0847</td>
<td>-0.1229</td>
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<tr>
<td>$E[\Delta w_{1,t} \Delta y_{1,t-2}]$</td>
<td>-0.0681</td>
<td>-0.0763</td>
<td>-0.0808</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t} \Delta y_{2,t-2}]$</td>
<td>-0.0395</td>
<td>-0.019</td>
<td>-0.0265</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t} \Delta w_{1,t-2}]$</td>
<td>-0.0774</td>
<td>-0.0763</td>
<td>-0.0808</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t} \Delta w_{2,t-2}]$</td>
<td>-0.0332</td>
<td>-0.019</td>
<td>-0.0265</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t} \Delta y_{2,t-2}]$</td>
<td>0.0131</td>
<td>-0.0083</td>
<td>-0.0204</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t} \Delta y_{1,t-2}]$</td>
<td>-0.0084</td>
<td>-0.0058</td>
<td>-0.0097</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t} \Delta w_{2,t-2}]$</td>
<td>-0.004</td>
<td>-0.0058</td>
<td>-0.0097</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t} \Delta w_{1,t-2}]$</td>
<td>-0.0084</td>
<td>-0.0083</td>
<td>-0.0204</td>
</tr>
</tbody>
</table>
Fit of Model (3)

Moreover, we impose that certain moments are zero:

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<tr>
<th>Moment</th>
<th>Data</th>
<th>Model (Separable)</th>
<th>Model (NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[\Delta c_t \Delta w_{1,t-2}]$</td>
<td>-0.0005</td>
<td>0</td>
<td>0.0016</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta w_{2,t-2}]$</td>
<td>0.0018</td>
<td>0</td>
<td>0.0027</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta y_{1,t-2}]$</td>
<td>-0.0065</td>
<td>0</td>
<td>0.0057</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta y_{2,t-2}]$</td>
<td>0.0034</td>
<td>0</td>
<td>0.0082</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t} \Delta c_{t-2}]$</td>
<td>0.0046</td>
<td>0</td>
<td>0.0016</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t} \Delta c_{t-2}]$</td>
<td>0.0026</td>
<td>0</td>
<td>0.0027</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t} \Delta c_{t-2}]$</td>
<td>0.0005</td>
<td>0</td>
<td>0.0057</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t} \Delta c_{t-2}]$</td>
<td>0.0006</td>
<td>0</td>
<td>0.0082</td>
</tr>
</tbody>
</table>

Joint test that they are zero: $p-value = 0.024$
Fit of model with non-separability (1)

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data</th>
<th>Model (Separable)</th>
<th>Model (NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[\Delta c_t^2]$</td>
<td>0.0963</td>
<td>0.0671</td>
<td>0.0791</td>
</tr>
<tr>
<td>$E[\Delta c_t\Delta c_{t-2}]$</td>
<td>-0.0325</td>
<td>-0.0325</td>
<td>-0.0332</td>
</tr>
<tr>
<td>$E[\Delta c_t\Delta w_{1,t}]$</td>
<td>0.0021</td>
<td>0.0098</td>
<td>0.0186</td>
</tr>
<tr>
<td>$E[\Delta c_t\Delta w_{2,t}]$</td>
<td>0.0021</td>
<td>0.0089</td>
<td>0.0158</td>
</tr>
<tr>
<td>$E[\Delta c_t\Delta y_{1,t}]$</td>
<td>0.0115</td>
<td>0.011</td>
<td>0.0093</td>
</tr>
<tr>
<td>$E[\Delta c_t\Delta y_{2,t}]$</td>
<td>0.0039</td>
<td>0.0105</td>
<td>-0.0094</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t}\Delta y_{2,t}]$</td>
<td>0.3148</td>
<td>0.3006</td>
<td>0.3001</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t}\Delta y_{1,t-2}]$</td>
<td>-0.1067</td>
<td>-0.0962</td>
<td>-0.1102</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t}\Delta y_{2,t-2}]$</td>
<td>-0.1289</td>
<td>-0.0847</td>
<td>-0.1229</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t}\Delta y_{1,t-2}]$</td>
<td>-0.0681</td>
<td>-0.0763</td>
<td>-0.0808</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t}\Delta y_{2,t-2}]$</td>
<td>-0.0395</td>
<td>-0.019</td>
<td>-0.0265</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t}\Delta w_{1,t-2}]$</td>
<td>-0.0774</td>
<td>-0.0763</td>
<td>-0.0808</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t}\Delta y_{1,t}]$</td>
<td>0.0131</td>
<td>-0.0083</td>
<td>-0.0204</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t}\Delta w_{2,t-2}]$</td>
<td>-0.0084</td>
<td>-0.0083</td>
<td>-0.0204</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t}\Delta w_{1,t-2}]$</td>
<td>-0.004</td>
<td>-0.0058</td>
<td>-0.0097</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t}\Delta w_{2,t-2}]$</td>
<td>-0.0084</td>
<td>-0.0083</td>
<td>-0.0204</td>
</tr>
</tbody>
</table>

- Doing better with $E \left[ (\Delta c_t)^2 \right]$ and $\Delta y_{1,t}, \Delta y_{2,t}$ moments but not with $\Delta c_t, \Delta w_j,t$. 

Blundell, Pistaferri, Saporta () Consumption and Family Labor Supply March 2012 64 / 66
Fit of model with non-separability (2)

<table>
<thead>
<tr>
<th>Moment</th>
<th>Data</th>
<th>Model (Separable)</th>
<th>Model (NS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E[\Delta c_t \Delta w_{1,t-2}]$</td>
<td>-0.0005</td>
<td>0</td>
<td>0.0016</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta w_{2,t-2}]$</td>
<td>0.0018</td>
<td>0</td>
<td>0.0027</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta y_{1,t-2}]$</td>
<td>-0.0065</td>
<td>0</td>
<td>0.0057</td>
</tr>
<tr>
<td>$E[\Delta c_t \Delta y_{2,t-2}]$</td>
<td>0.0034</td>
<td>0</td>
<td>0.0082</td>
</tr>
<tr>
<td>$E[\Delta w_{1,t} \Delta c_{t-2}]$</td>
<td>0.0046</td>
<td>0</td>
<td>0.0016</td>
</tr>
<tr>
<td>$E[\Delta w_{2,t} \Delta c_{t-2}]$</td>
<td>0.0026</td>
<td>0</td>
<td>0.0027</td>
</tr>
<tr>
<td>$E[\Delta y_{1,t} \Delta c_{t-2}]$</td>
<td>0.0005</td>
<td>0</td>
<td>0.0057</td>
</tr>
<tr>
<td>$E[\Delta y_{2,t} \Delta c_{t-2}]$</td>
<td>0.0006</td>
<td>0</td>
<td>0.0082</td>
</tr>
</tbody>
</table>

- Better match: $E[\Delta w_{1,t} \Delta c_{t-2}]$ and $E[\Delta w_{2,t} \Delta c_{t-2}]$
- Model implies symmetries which are rejected for male (p-value 0.02) but not for female (p-value 0.35)
**Literature Review**

- **Consumption smoothing**
  - Incomplete markets model: Hall and Mishkin (1982), Kaplan and Violante (2010), Hryshko (2011)
    - Private information and Limited commitment: Attanasio and Pavoni (2010), Krueger and Perri (2011)
  - Superior information: Primiceri and van Rens (2009), Kaufmann and Pistaferri (2010), Guvenen and Smith (2011)


- **Non-separability between consumption and leisure**: Heckman (1974), Browning, Deaton and Irish (1985), Browning and Meghir (1991), Hall (2009)