Consumption Inequality and Family Labor Supply

Chair Lecture "Professor Carlos Lloyd Braga"

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University of Minho, 2013

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  2. Taxes and welfare: (earnings→ income)
  3. Assets: Saving and borrowing (income→ consumption)
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- How should we design policies to best insure these shocks?

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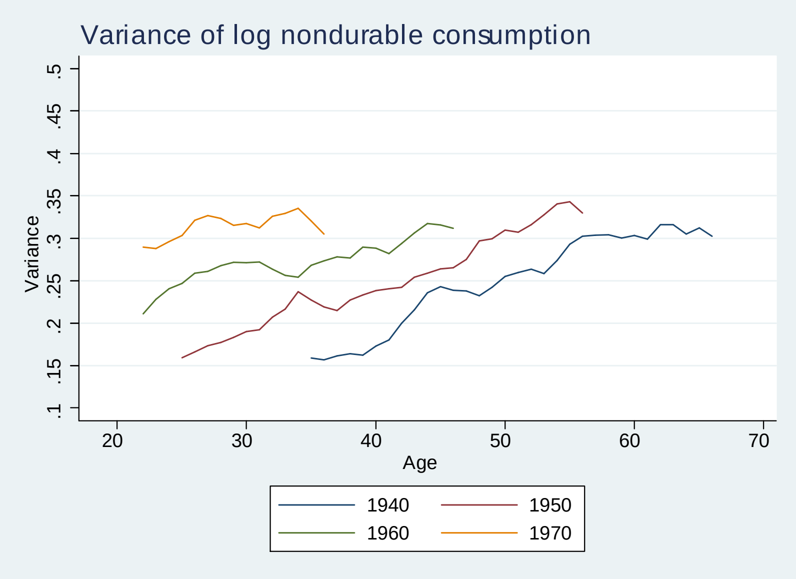
- Some consumption inequality descriptives....

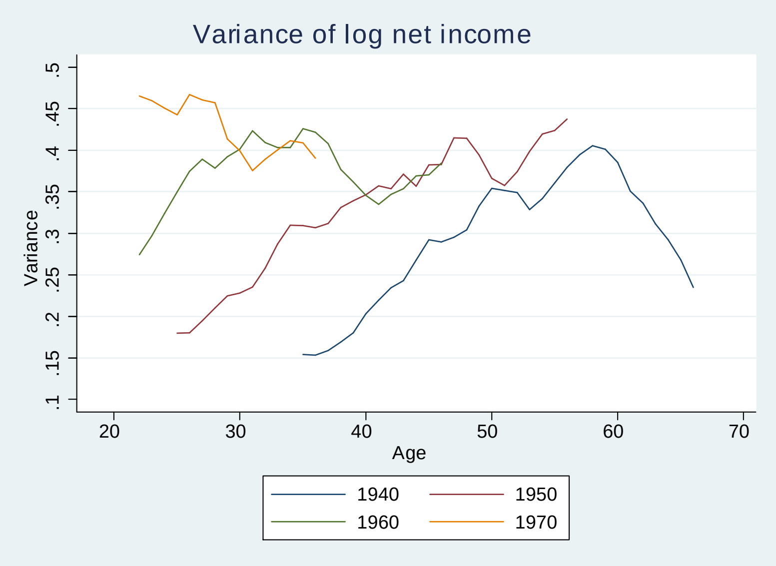
Consumption Inequality in the UK

By age and birth cohort



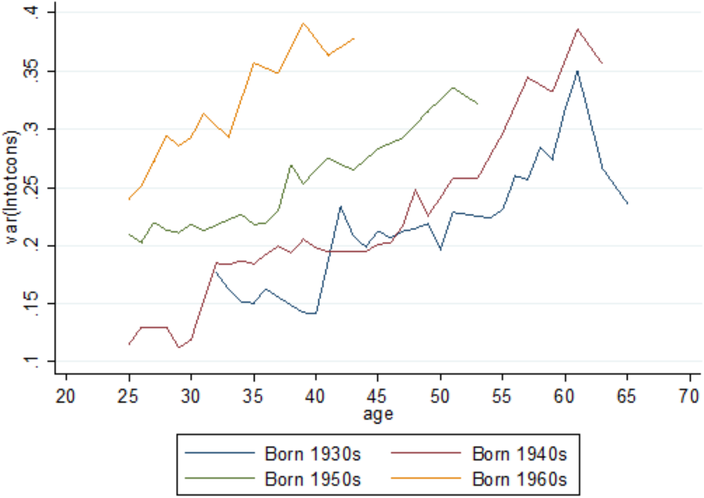
Income Inequality in the UK

By age and birth cohort



Consumption Inequality in the US

By age and birth cohort



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- The existing literature (references in paper) usually relates movements in consumption to predictable and unpredictable income changes as well as persistent and non-persistent shocks to economic resources.
- A little background on the empirical strategy for income and consumption dynamics behind these results...

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To set the scene, consider consumer i (of age a) in time period t, has log income $y_{it}(\equiv \ln Y_{i,a,t})$ written

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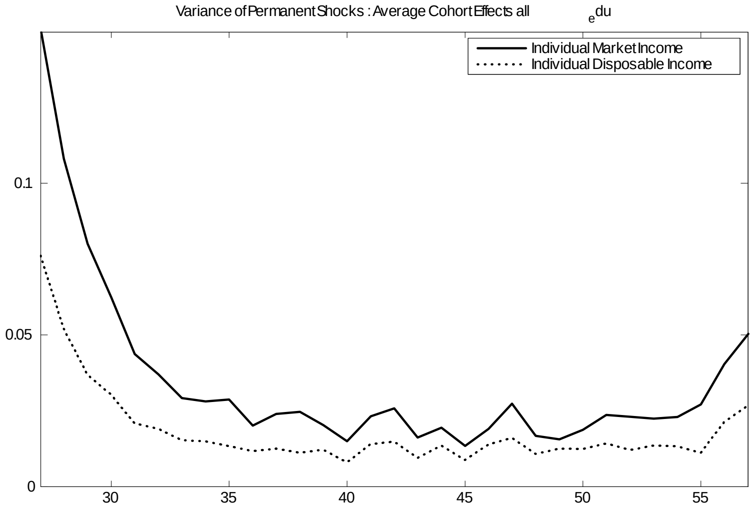
• Detailed work on Norwegian population register panel data....

Life-cycle Income Dynamics

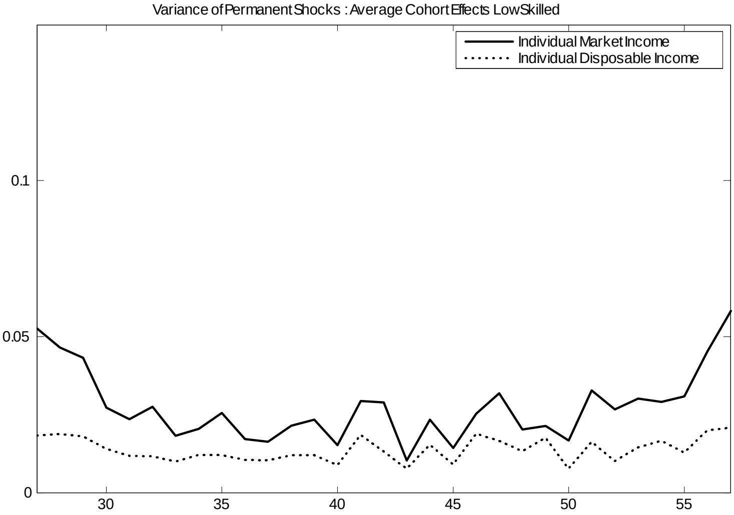
Variance of permanent shocks over the life-cycle



Source: Blundell, Graber and Mogstad (2013), Norwegian Population Panel.

Life-cycle Income Dynamics

Norwegian population panel (low skilled)



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CONSUMPTION GROWTH AND INCOME "SHOCKS"

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$$\Delta \ln C_{it} \cong \Gamma_{it} + \Delta Z'_{it}\varphi^c + \kappa_{cvt} v_{it} + \kappa_{c\varepsilon t}\varepsilon_{it} + \xi_{it} \quad (1)$$

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- For example, Blundell, Low and Preston (QE, 2013) show in the permament-transitory model, for any birth-cohort

$$\Delta \ln C_{it} \cong \Gamma_{it} + \Delta Z'_{it}\varphi^c + (1-\pi_{it})v_{it} + (1-\pi_{it})\gamma_{Lt}\varepsilon_{it} + \xi_{it}$$

where

$$\pi_{it} \approx \frac{\text{Assets}_{it}}{\text{Assets}_{it} + \text{Human Wealth}_{it}}$$

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▶ With $(1-\pi_{it})$ measured through asset data we can examine mechanisms in addition to self-insurance.

▶ But typically use (1), as asset data is poorly measured and estimate the $\kappa_t's$ as a catch-all for all forms of insurance - until recently!

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- And "non-separabilities" between consumption and work?

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- Here I'll briefly present results with new data from the PSID 1999-2009.
    - *More comprehensive consumption* measure - over 70% of the budget.
    - *Asset* data collected in every wave - housing, financial, mortgage and other debt.

Descriptive Statistics for Consumption

PSID Consumption						
	1998	2000	2002	2004	2006	2008
Consumption	27,290	31,973	35,277	41,555	45,863	44,006
Nondurable Consumption	6,859	7,827	7,827	8,873	9,889	9,246
Food (at home)	5,471	5,785	5,911	6,272	6,588	6,635
Gasoline	1,387	2,041	1,916	2,601	3,301	2,611
Services	21,319	25,150	28,419	33,755	36,949	35,575
Food (out)	2,029	2,279	2,382	2,582	2,693	2,492
Health Insurance	1,056	1,268	1,461	1,750	1,916	2,188
Health Services	902	1,134	1,334	1,447	1,615	1,844
Utilities	2,282	2,651	2,702	4,655	5,038	5,600
Transportation	3,122	3,758	4,474	3,797	3,970	3,759
Education	1,946	2,283	2,390	2,557	2,728	2,584
Child Care	601	653	660	689	648	783
Home Insurance	430	480	552	629	717	729
Rent (or rent equivalent)	8,950	10,645	12,464	15,650	17,623	15,595
Observarions	1,872	1,951	1,984	2,011	2,115	2,221

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.

Descriptive Statistics for Assets and Earnings

PSID Assets, Hours and Earnings

	1998	2000	2002	2004	2006	2008
Total assets	332,625	352,247	382,600	476,626	555,951	506,823
Housing and RE assets	159,856	187,969	227,224	283,913	327,719	292,910
Financial assets	173,026	164,567	155,605	192,995	228,805	214,441
Total debt	72,718	82,806	98,580	115,873	131,316	137,348
Mortgage	65,876	74,288	89,583	106,423	120,333	123,324
Other debt	7,021	8,687	9,217	9,744	11,584	14,561
First earner (head)						
Earnings	54,220	61,251	63,674	68,500	72,794	75,588
Hours worked	2,357	2,317	2,309	2,309	2,284	2,140
Second earner (wife)						
Participation rate	0.81	0.8	0.81	0.81	0.81	0.8
Earnings (conditional on participation)	26,035	28,611	31,693	33,987	36,185	39,973
Hours worked (conditional on participation)	1,666	1,691	1,697	1,707	1,659	1,648
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Wage Process

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

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- Allow the variances to differ by across the life-cycle and across the business cycle.

Wage Parameters Estimates

Baseline

Sample			All
Males	Trans.	$\sigma^2_{u_1}$	0.033 (0.007)
	Perm.	$\sigma^2_{v_1}$	0.032 (0.005)
Females	Trans.	$\sigma^2_{u_2}$	0.012 (0.006)
	Perm.	$\sigma^2_{v_2}$	0.043 (0.005)
Correlation of shocks	Trans.	ρ_{u_1,u_2}	0.244 (0.22)
	Perm	ρ_{v_1,v_2}	0.113 (0.07)

Extended Transmission Parameters:

Consumption growth:

$$\Delta \ln C_{it} \cong \kappa_{cv_1t} v_{i,1t} + \kappa_{cv_2t} v_{i,2t} + \kappa_{cu_1t} \Delta u_{i,1t} + \kappa_{cu_2t} \Delta u_{i,2t} + \xi_{it}$$

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

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- increases with $s_{i,j,t}$ (j's earning share)
- increases wtih tolerance of intertemporal fluctuations.
- declines with "added worker" effect - Marshallian labour supply elasticity.
- similar transmission equations for family labour supply.

Identification with asset data

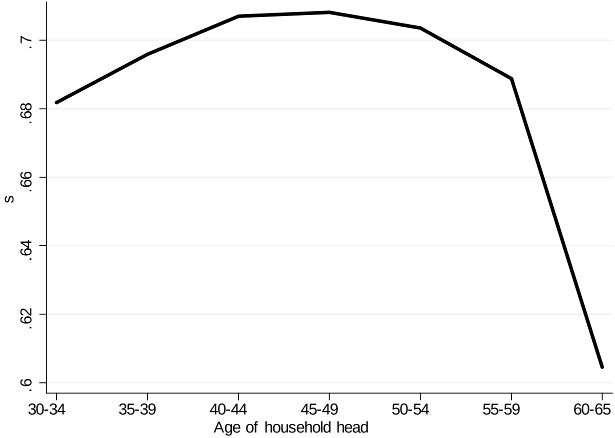
- Note that β is not identified separately from π
- Back out π from the data and estimate β

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

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

Distribution of s by Age

$$s_{i,t} \approx \frac{\text{Human Wealth}_{male,i,t}}{\text{Human Wealth}_{i,t}}:$$



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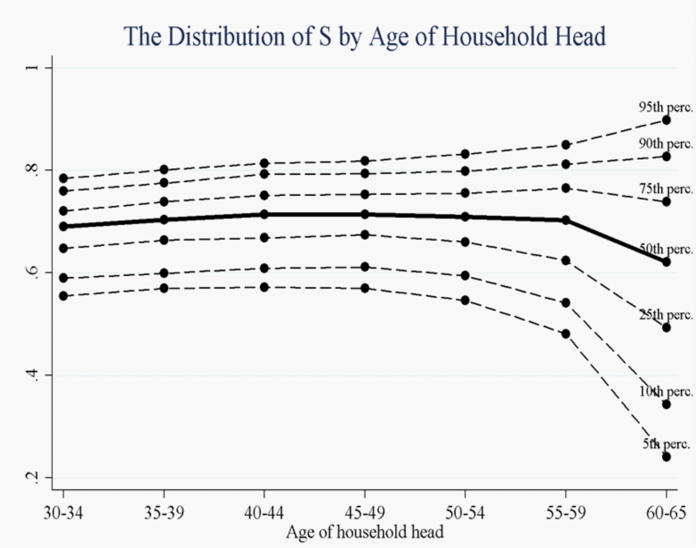

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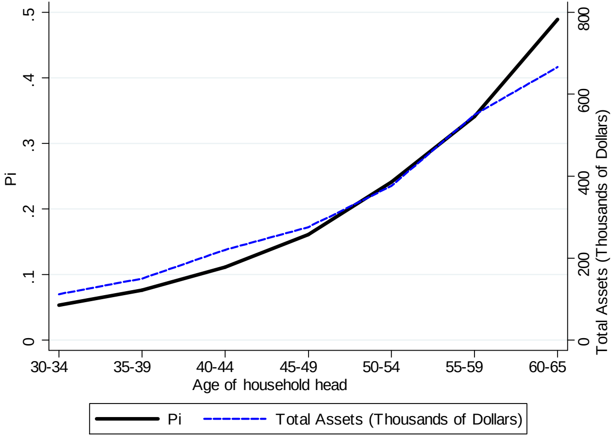

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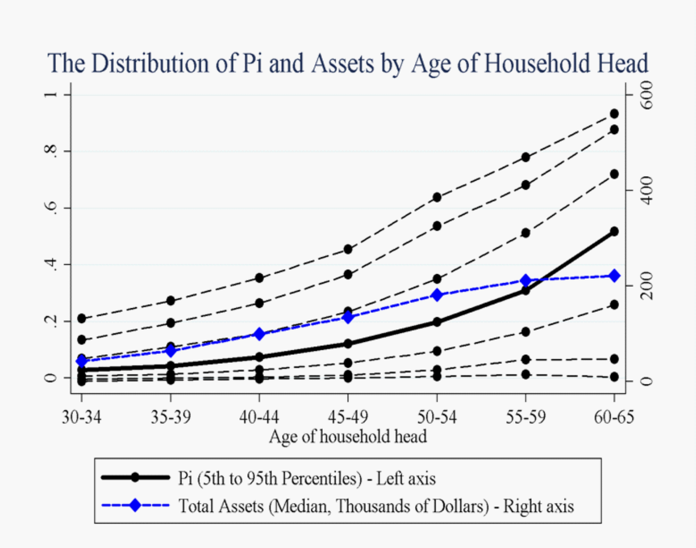
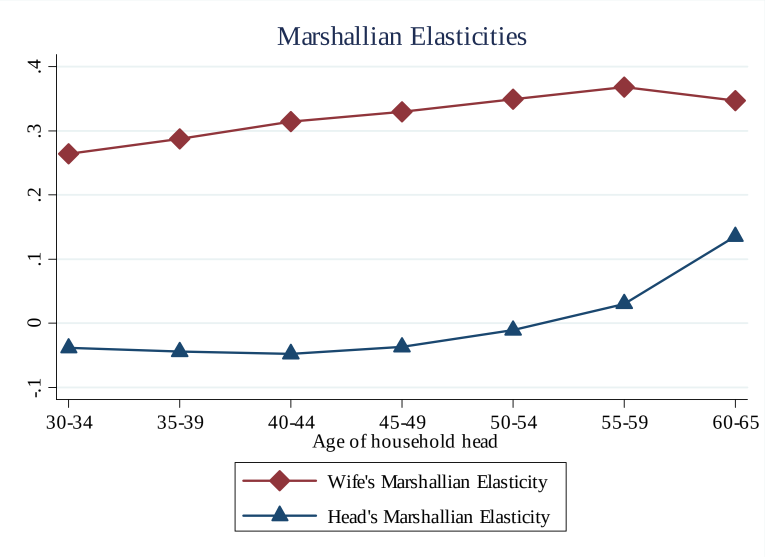


Results: With and Without Separability

	(1) Additive separ.	(2) Non-separab.	(3) Non-separab.
$E(\pi)$	0.181 (0.008)	0.181 (0.008)	0.181 (0.008)
β	0.741 (0.085)	-0.120 (0.098)	0
$\eta_{c,p}$	0.201 (0.077)	0.437 (0.124)	0.448 (0.126)
η_{h_1,w_1}	0.431 (0.097)	0.514 (0.150)	0.497 (0.150)
η_{h_2,w_2}	0.831 (0.133)	1.032 (0.265)	1.041 (0.275)
η_{c,w_1}	-.-	-0.141 (0.051)	-0.141 (0.053)
$\eta_{h_1,p}$	-.-	0.082 (0.030)	0.082 (0.031)
η_{c,w_2}	-.-	-0.138 (0.139)	-0.158 (0.121)
$\eta_{h_2,p}$	-.-	0.162 (0.166)	0.185 (0.145)
η_{h_1,w_2}	-.-	0.128 (0.052)	0.120 (0.064)
η_{h_2,w_1}	-.-	0.258 (0.103)	0.242 (0.119)

Marshallian Elasticities: By Age



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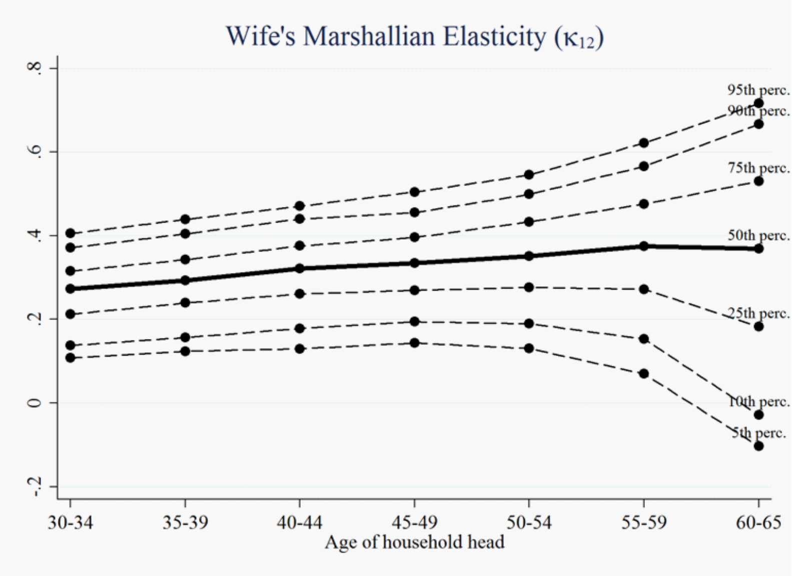

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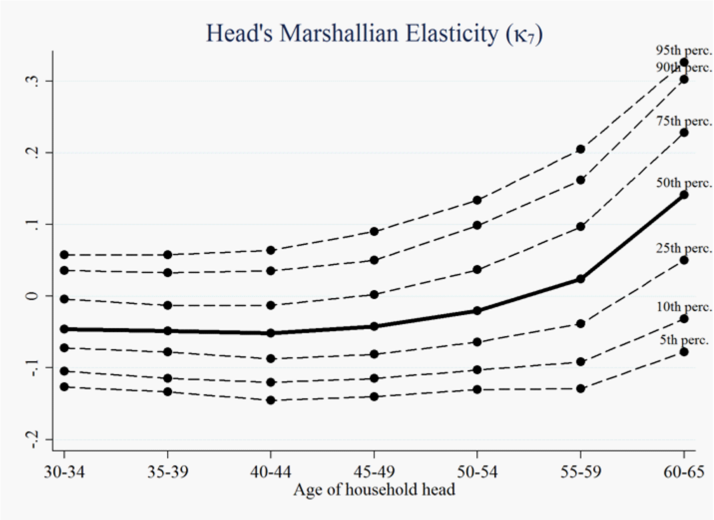

Interpretation: Insurance Via Labor Supply (Shock to Male Wages)

The average response of total earnings ($y = y_1 + y_2$) to a permanent shock to the male's wages:

$$\frac{\partial \Delta y}{\partial v_1} = \underbrace{s}_{\widehat{s}=0.69} * \underbrace{\frac{\partial \Delta y_1}{\partial v_1}}_{\widehat{\kappa}_{y_1,v_1}=0.98} + \underbrace{(1-s)}_{1-\widehat{s}=0.31} * \underbrace{\frac{\partial \Delta y_2}{\partial v_1}}_{\widehat{\kappa}_{y_2,v_1}=-0.81} = 0.44$$

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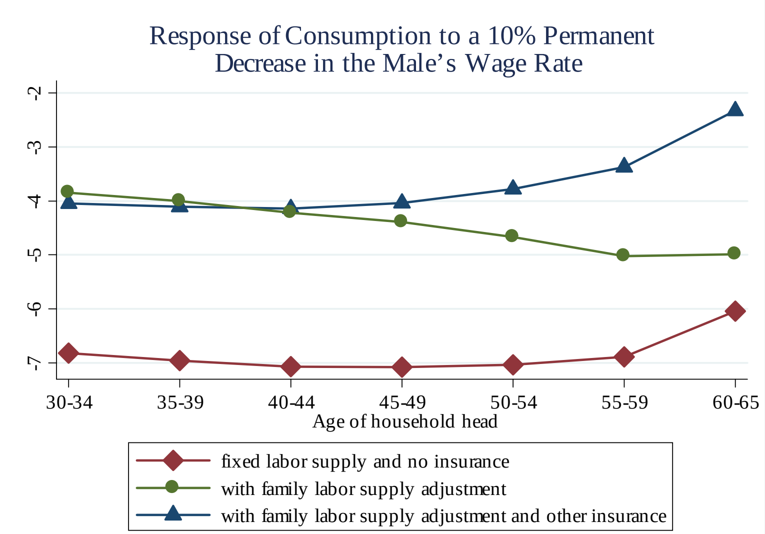
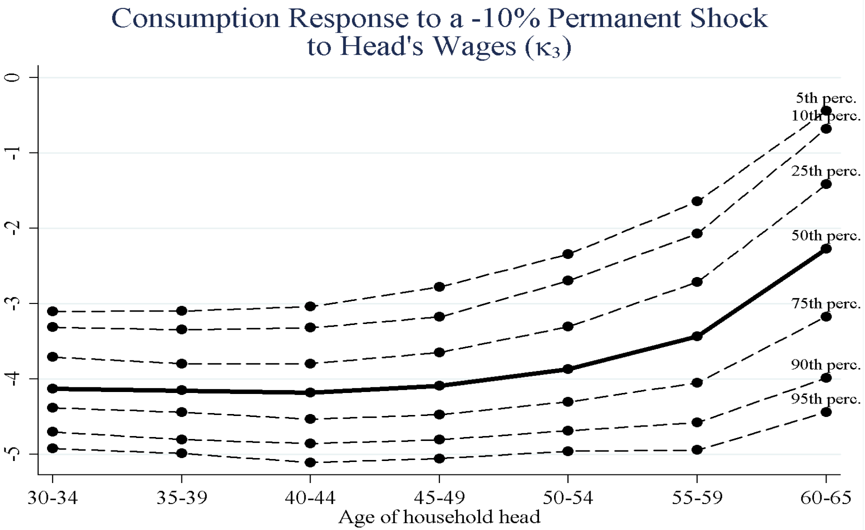
with family labor supply adjustment and other insurance	-3.8%

Insurance via Labor Supply (Shock to Male Wages): By Age



INSURANCE VIA LABOR SUPPLY (SHOCK TO MALE WAGES): BY AGE



Interpretation: Insurance via Labor Supply (Shock to Female Wages)

The average response of total earnings to a permanent shock to the female's wages:

$$\frac{\partial \Delta y}{\partial v_2} = \underbrace{s}_{0.69} * \underbrace{\frac{\partial \Delta y_1}{\partial v_2}}_{\kappa_{y_1,v_2}=-0.23} + \underbrace{(1-s)}_{0.31} * \underbrace{\frac{\partial \Delta y_2}{\partial v_2}}_{\kappa_{y_2,v_2}=1.32} = 0.25$$

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

two earners, fixed labor supply and no insurance	-3.1%

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with family labor supply adjustment	-2.5%

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- Showing the value, and possibilities for collecting, good panel data on consumption, earnings and assets.

And gathering up the results...

- Need to allow for non-stationarity over the life-cycle and over time
  - variances (of persistent shocks) display an U-shape over the (working) life-cycle,
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- Once family labor supply, assets and taxes (and benefits) are properly accounted for, there is little evidence for additional insurance
  - lots to be done to dig deeper into these, and other, mechanisms.
  - consider detailed consumption components....

Consumption Inequality and Family Labor Supply

Chair Lecture "Professor Carlos Lloyd Braga"

Richard Blundell

University College London & Institute for Fiscal Studies

University of Minho, 2013

Many thanks!

Extra Slides

Results by age, education and asset selections

	Baseline	Age 30-55	Some college+	Top 2 asset terc.
$E(\pi)$	0.181	0.142	0.202	0.245
β	−0.120	−0.177	0.117	−0.046
	(0.098)	(0.089)	(0.072)	(0.084)
$\eta_{c,p}$	0.437	0.465	0.368	0.343
	(0.124)	(0.044)	(0.05)	(0.04)
η_{h_1,w_1}	0.514	0.467	0.542	0.388
	(0.150)	(0.036)	(0.045)	(0.037)
η_{h_2,w_2}	1.032	1.039	0.858	0.986
	(0.265)	(0.099)	(0.097)	(0.105)
η_{c,w_1}	−0.141	−0.113	−0.162	−0.127
	(0.051)	(0.018)	(0.022)	(0.016)
$\eta_{h_1,p}$	0.082	0.065	0.087	0.07
	(0.030)	(0.01)	(0.012)	(0.009)
η_{c,w_2}	−0.138	−0.083	−0.142	−0.129
	(0.139)	(0.029)	(0.032)	(0.154)
$\eta_{h_2,p}$	0.162	0.097	0.169	0.154
	(0.166)	(0.034)	(0.038)	(0.038)
η_{h_1,w_2}	0.128	0.101	0.115	0.079
	(0.052)	(0.011)	(0.012)	(0.01)
η_{h_2,w_1}	0.258	0.205	0.255	0.172
	(0.103)	(0.022)	(0.027)	(0.021)

Note: Specifications (2) to (4) - Non-bootstrap s.e.'s

Concavity and Advance Information

- **Concavity of preferences**. Use the fact that:

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

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  - Appendix shows concavity cannot rejected, and is numerically satisfied at average values of wages, hours, consumption.

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  - Appendix shows concavity cannot rejected, and is numerically satisfied at average values of wages, hours, consumption.

- **Advance Information**. Consumption growth should be correlated with future wage growth (Cunha et al., 2008, and BPP 2008).
  - Test has p-value 13%

Results: Extensive Margin

- Estimate a "conditional" Euler equation, controlling for changes in hours (intensive margin) and changes in participation (extensive margin)

Results: Extensive Margin

- Estimate a "conditional" Euler equation, controlling for changes in hours (intensive margin) and changes in participation (extensive margin)

	Regression results		First stage F-stats	
	(1)	(2)	(1)	(2)
$\Delta EMP_t(Male)$	0.144 (0.269)		23.4	
$\Delta h_t(Male)$	−0.073 (0.075)	−0.013 (0.021)	26.3	135.5
$\Delta EMP_t(Female)$	0.356 (0.169)	0.362 (0.176)	98.4	91.2
$\Delta h_t(Female)$	−0.220 (0.100)	−0.171 (0.094)	86.5	77.7
Sample	All	EMP_t(Male)=1		
Instruments	2^{nd},4^{th} lags	2^{nd},4^{th} lags		

Note: Δx_t is defined as $(x_t - x_{t-1})$ / $[0.5\,(x_t + x_{t-1})]$

Wage Parameters by Assets and Age

			(1)	(2)	(3)	(4)	(5)
Sample			All	1st asset tercile	2nd, 3rd asset terciles	age<40	age>=40
Males	Trans.	σ^2_{u1}	0.033	0.03	0.042	0.042	0.028
			(0.007)	(0.009)	(0.009)	(0.013)	(0.008)
	Perm.	σ^2_{v1}	0.035	0.027	0.039	0.025	0.039
			(0.005)	(0.006)	(0.007)	(0.009)	(0.007)
Females	Trans.	σ^2_{u2}	0.012	0.023	0.011	0.02	0.01
			(0.005)	(0.009)	(0.007)	(0.015)	(0.005)
	Perm.	σ^2_{v2}	0.046	0.036	0.05	0.053	0.042
			(0.004)	(0.007)	(0.006)	(0.013)	(0.005)
Correlations of Shocks	Trans.	$\sigma_{u1,u2}$	0.202	-0.264	0.39	0.459	0.115
			(0.159)	(0.181)	(0.197)	(0.28)	(0.201)
	Perm.	$\sigma_{v1,v2}$	0.153	0.366	0.096	0.041	0.162
			(0.06)	(0.142)	(0.066)	(0.174)	(0.063)
Observations			8,191	2,626	5,565	2,172	6,019

Transmission Parameters:

Consumption response to *j*'s permanent wage shock:

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

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- declines with $\eta_{h_{-j},w_{-j}}$ ("added worker" effect)
- declines with η_{h_j,w_j} only if j's labor supply responds negatively to own permanent shock. In one-earner case, true if

$$(1-\beta)(1-\pi_{i,t}) - \eta_{c,p} > 0$$

Data and Sample Selection

- PSID biennial 1999-2009:
  - PSID consumption went through a major revision in 1999
    - ~70% of consumption expenditures. Good match with NIPA
    - The sum of food at home, food away from home, gasoline, health, transportation, utilities, etc.
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- Methodology: Use structural restrictions that 'theory' imposes on the variance covariance structure of $\Delta c_{i,t}$, $\Delta y_{i,1,t}$ and $\Delta y_{i,2,t}$

Some Econometrics Issues

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  - For consumption, use martingale assumption and mean-reversion
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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 $\Delta w_{i,j,t}$
- GMM with standard errors corrected by the block bootstrap.

Non-Separability and Measurement Errors

$$\begin{pmatrix} \Delta w_{i,1,t} \\ \Delta w_{i,2,t} \\ \Delta c_{i,t} \\ \Delta y_{i,1,t} \\ \Delta y_{i,2,t} \end{pmatrix} \simeq \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ \kappa_{c,u_1} & \kappa_{c,u_2} & \kappa_{c,v_1} & \kappa_{c,v_2} \\ \kappa_{y_1,u_1} & \kappa_{y_1,u_2} & \kappa_{y_1,v_1} & \kappa_{y_1,v_2} \\ \kappa_{y_2,u_1} & \kappa_{y_2,u_2} & \kappa_{y_2,v_1} & \kappa_{y_2,v_2} \end{pmatrix} \begin{pmatrix} \Delta u_{i,1,t} \\ \Delta u_{i,2,t} \\ v_{i,1,t} \\ v_{i,2,t} \end{pmatrix} + \begin{matrix} \Delta\xi^{w}_{i,1,t} \\ \Delta\xi^{w}_{i,2,t} \\ \Delta\xi^{c}_{i,t} \\ \Delta\xi^{y}_{i,1,t} \\ \Delta\xi^{y}_{i,2,t} \end{matrix}$$

- where $\zeta^{w}_{i,j,t}$, $\zeta^{c}_{i,t}$ and $\zeta^{y}_{i,j,t}$ are measurement errors in log wages of earner j, log consumption, and log earnings of earner j.

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$$y_{i,a} = \boldsymbol{Z}_{i,a}^{T} \varphi_a + f_{0i} + f_{1i} p_a + y_{i,a}^{P} + \varepsilon_{i,a}$$

where $\beta_i p_a$ is an individual-specific trend, allow non-zero covariance between f_0 and f_1.

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- Allow variances (or factor loadings) of $v_{i,a}$ and $\varepsilon_{i,a}$ to vary with age/time for each birth cohort and education group.

Idiosyncratic Trends

- The idiosyncratic trend term $p_t f_{1i}$ could take a number of forms. Two alternatives are worth highlighting:
  - (a) deterministic idiosyncratic trend:

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- Alternatively, stochastic trends (b) are most likely to occur during periods of technical change when skill prices are changing across the unobserved ability distribution. Formally, this is a calender time effect.

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$$\boldsymbol{p}_a = \begin{cases} \kappa_1 a + 35\,(1-\kappa_1) & \text{if } a \leq 35 \\ a & \text{otherwise} \\ \kappa_2 a + 52\,(1-\kappa_2) & \text{if } a \geq 52 \end{cases}$$

   with knots at age 35 and age 52.

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5. Polynomials up to degree 4.

Covariance structure

- Suppose we observe individual i at age $a = 1, ..., T$, we then have $T - 1$ equations $\Delta^\rho y_{ia}$ ($\equiv y_{i,a} - \rho y_{i,a-1}$). In vector form

$$\Delta^\rho \boldsymbol{y}_i = \left((1-\rho)\,\boldsymbol{\iota}, \Delta^\rho \boldsymbol{p}_a \right) \begin{pmatrix} f_{0i} \\ f_{1i} \end{pmatrix} + \boldsymbol{v}_i + \Delta^\rho \boldsymbol{\varepsilon}_i.$$

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- The Variance-Covariance matrix in general has the form: $\text{Var}(\Delta^\rho \boldsymbol{y}_i) = \boldsymbol{\Omega} + \boldsymbol{W}$ where $\mathbf{W} =$

$$\begin{pmatrix} \sigma_2^2 + \omega_2^2 + \rho^2\omega_1^2 & -\rho\omega_2^2 & 0 & 0 \\ -\rho\omega_2^2 & \sigma_3^2 + \omega_3^2 + \rho^2\omega_2^2 & -\rho\omega_3^2 & 0 \\ 0 & -\rho\omega_3^2 & \ddots & -\rho\omega_{T-1}^2 \\ 0 & 0 & -\rho\omega_{T-1}^2 & \sigma_T^2 + \omega_T^2 + \rho^2\omega_{T-1}^2 \end{pmatrix}$$

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- For the linear heterogeneous profiles case:

$$\boldsymbol{\Omega} = \left[(1-\rho)\,\boldsymbol{\iota}, \boldsymbol{\xi}_0 \right] \begin{pmatrix} \sigma_0^2 & \rho_{01}\sigma_0\sigma_1 \\ \rho_{01}\sigma_0\sigma_1 & \sigma_1^2 \end{pmatrix} \left[(1-\rho)\,\boldsymbol{\iota}, \boldsymbol{\xi}_0 \right]^T.$$

Removing Additive Separability: Theory

- Approximating the first order conditions (intensive margin):

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

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- Moments

$$\begin{pmatrix} \Delta c_{i,t} \\ \Delta y_{i,1,t} \\ \Delta y_{i,2,t} \end{pmatrix} \simeq \begin{pmatrix} \kappa_{i,c,u_1} & \kappa_{i,c,u_2} & \kappa_{i,c,v_1} & \kappa_{i,c,v_2} \\ \kappa_{i,y_1,u_1} & \kappa_{i,y_1,u_2} & \kappa_{i,y_1,v_1} & \kappa_{i,y_1,v_2} \\ \kappa_{i,y_2,u_1} & \kappa_{i,y_2,u_2} & \kappa_{i,y_2,v_1} & \kappa_{i,y_2,v_2} \end{pmatrix} \begin{pmatrix} \Delta u_{i,1,t} \\ \Delta u_{i,2,t} \\ v_{i,1,t} \\ v_{i,2,t} \end{pmatrix}$$

where (for $j = 1, 2$)

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

Non-linear Taxes

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- Labor supply elasticities (w.r.t. W) are dampened: Return to work decreases as people cross tax brackets

Loading Factor Matrix: Estimates

Response to	Separable case			Non-separable case		
	Consump.	Husband's earnings	Wife's earnings	Consump.	Husband's earnings	Wife's earnings
	(1)	(2)	(3)	(4)	(5)	(6)
v_1	0.13 (0.060)	1.15 (0.067)	−0.54 (0.206)	0.38 (0.057)	0.98 (0.131)	−0.81 (0.180)
v_2	0.07 (0.040)	−0.16 (0.057)	1.53 (0.101)	0.21 (0.037)	−0.23 (0.048)	1.32 (0.087)
Δu_1	0	1.43 (0.097)	0	−0.14 (0.051)	1.51 (0.150)	0.26 (0.103)
Δu_2	0	0	1.83 (0.133)	−0.14 (0.139)	0.13 (0.051)	2.03 (0.265)

- # Heterogeneity:

	(1) Baseline	(2) Age 30-55	(3) Some college+	(4) Top 2 asset terc.	(5) Age variance	(6) Sel.correct.
$E(\pi)$	0.181	0.142	0.202	0.245	0.181	0.176
β	-0.120 (0.198)	-0.177 (0.089)	0.117 (0.072)	-0.046 (0.084)	-0.109 (0.077)	-0.129 (0.076)
$\eta_{c,p}$	0.437 (0.124)	0.465 (0.044)	0.368 (0.05)	0.343 (0.04)	0.42 (0.037)	0.473 (0.041)
η_{h_1,w_1}	0.514 (0.150)	0.467 (0.036)	0.542 (0.045)	0.388 (0.037)	0.575 (0.04)	0.509 (0.038)
η_{h_2,w_2}	1.032 (0.265)	1.039 (0.099)	0.858 (0.097)	0.986 (0.105)	1.005 (0.086)	1.095 (0.092)
η_{c,w_1}	-0.141 (0.051)	-0.113 (0.018)	-0.162 (0.022)	-0.127 (0.016)	-0.15 (0.018)	-0.150 (0.017)
$\eta_{h_1,p}$	0.082 (0.030)	0.065 (0.01)	0.087 (0.012)	0.07 (0.009)	0.087 (0.01)	0.088 (0.01)
η_{c,w_2}	-0.138 (0.139)	-0.083 (0.029)	-0.142 (0.032)	-0.129 (0.154)	-0.11 (0.026)	-0.122 (0.028)
$\eta_{h_2,p}$	0.162 (0.166)	0.097 (0.034)	0.169 (0.038)	0.154 (0.038)	0.129 (0.038)	0.143 (0.033)
η_{h_1,w_2}	0.128 (0.052)	0.101 (0.011)	0.115 (0.012)	0.079 (0.01)	0.141 (0.011)	0.125 (0.01)
η_{h_2,w_1}	0.258 (0.103)	0.205 (0.022)	0.255 (0.027)	0.172 (0.021)	0.285 (0.022)	0.253 (0.021)

Note: Specifications (2) to (6) - Non-bootstrap s.e.'s

Approximation of the Euler equation (1)

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

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

- where

$$\begin{aligned} \omega_t &= -\frac{1}{2}\mathbb{E}_t \left(\Delta \ln \lambda_{i,t+1}\right)^2 \\ \varepsilon_{i,t+1} &= \Delta \ln \lambda_{i,t+1} - \mathbb{E}_t \left(\Delta \ln \lambda_{i,t+1}\right) \end{aligned}$$

- Then use the fact that

$$\begin{aligned} \Delta \ln U_{C_{i,t+1}} &= \Delta \ln \lambda_{i,t+1} \\ \Delta \ln U_{H_{i,j,t+1}} &= -\Delta \ln \lambda_{i,t+1} - \Delta \ln W_{i,j,t+1} \end{aligned}$$

Approximation of the Euler equation (2)

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

$$
\begin{aligned}
U_{C_{i,t+1}} &\approx U_{C_{i,t}} + (C_{i,t+1} - C_{i,t})\, U_{C_{i,t}C_{i,t}} \\
\frac{U_{C_{i,t+1}} - U_{C_{i,t}}}{U_{C_{i,t}}} &\approx \left(\frac{C_{i,t+1} - C_{i,t}}{C_{i,t}} \right) \frac{U_{C_{i,t}C_{i,t}} C_{i,t}}{U_{C_{i,t}}} \\
\Delta \ln U_{C_{i,t+1}} &\approx -\frac{1}{\eta_{c,p}} \Delta \ln C_{i,t+1}
\end{aligned}
$$

- and therefore, from

$$\Delta \ln \lambda_{i,t+1} \approx \omega_{t+1} + \varepsilon_{i,t+1}$$

- get

$$\Delta \ln C_{i,t+1} = -\eta_{c,p} \left(\omega_{t+1} + \varepsilon_{i,t+1} \right)$$

APPROXIMATION OF THE LIFE TIME BUDGET CONSTRAINT

- Use the fact that

$$\mathbb{E}_I\left[\ln\sum_{i=0}^{T-t} X_{t+i}\right] = \ln\sum_{i=0}^{T-t}\exp\mathbb{E}_{t-1}\ln X_{t+i} + \sum_{i=0}^{T-t}\frac{\exp\mathbb{E}_{t-1}\ln X_{t+i}}{\sum_{j=0}^{T-t}\exp\mathbb{E}_{t-1}\ln X_{t+j}}\left(\mathbb{E}_I-\mathbb{E}_{t-1}\right)\ln X_{t+i} + O\left(\mathbb{E}_I\left\|\xi_t^T\right\|^2\right)$$

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)

Household Decisions in a Unitary Framework

Household chooses $\left\{C_{i,t+j}, H_{i,1,t+j}, H_{i,2,t+j}\right\}_{j=0}^{T-t}$ to maximize

$$\mathbb{E}_t \sum_{\tau=0}^{T-t} (1+\delta)^{-\tau} v\left(C_{i,t+\tau}, H_{i,1,t+\tau}, H_{i,2,t+\tau}; Z_{i,t+\tau}\right)$$

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 Decisions in a Unitary Framework

Household chooses $\left\{C_{i,t+j}, H_{i,1,t+j}, H_{i,2,t+j}\right\}_{j=0}^{T-t}$ to maximize

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subject to

$$C_{i,t} + \frac{A_{i,t+1}}{1+r} = A_{i,t} + H_{i,1,t}W_{i,1,t} + H_{i,1,t}W_{i,2,t}$$

Our approach

- Extend previous work and express the distributional dynamics of consumption and earnings growth as functions of Frisch elasticities, 'insurance parameters' and wage shocks

Consumption and Earnings Growth

The 'Simple' Separable Case

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

Consumption and Earnings Growth

The 'Simple' Separable Case

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

where the key transmission parameters

$$\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]}$$

The 'Simple' Separable Case

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

where the key transmission parameters

$$\kappa_{y_j,u_j} \quad = \quad \left(1+\eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]} \qquad \kappa_{y_j,v_j} \rightarrow \text{[Marshall]}$$

Consumption and Earnings Growth

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

where the key transmission parameters

$$\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]} \qquad \kappa_{y_j,v_j} \rightarrow \text{[Marshall]}$$

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

Consumption and Earnings Growth

The 'Simple' Separable Case

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

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$$\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]} \qquad \kappa_{y_j,v_j} \rightarrow \text{[Marshall]}$$

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

$$\pi_{i,t} \approx \frac{\text{Assets}_{i,t}}{\text{Assets}_{i,t} + \text{Human Wealth}_{i,t}}$$

Consumption and Earnings Growth

The 'Simple' Separable Case

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

where the key transmission parameters

$$\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]} \qquad \kappa_{y_j,v_j} \rightarrow \text{[Marshall]}$$

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

$$s_{i,j,t} \approx \frac{\text{Human Wealth}_{i,j,t}}{\text{Human Wealth}_{i,t}}$$

Consumption and Earnings Growth

The 'Simple' Separable Case

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

where the key transmission parameters

$$\kappa_{y_j,u_j} = \left(1 + \eta_{h_j,w_j}\right) \rightarrow \text{[Frisch]} \qquad \kappa_{y_j,v_j} \rightarrow \text{[Marshall]}$$

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

$$\overline{\eta_{h,w}} = s_{i,j,t}\eta_{h_j,w_j} + s_{i,-j,t}\eta_{h_{-j},w_{-j}}$$

Consumption and Earnings Growth

The 'Simple' Separable Case

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

- Introduce now β, representing insurance over and above savings, taxes and labour supply $\rightarrow$ networks, etc.
- Key transmission parameter becomes:

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

NIPA-PSID Comparison

	1998	2000	2002	2004	2006	2008
PSID Total	3,276	3,769	4,285	5,058	5,926	5,736
NIPA Total	5,139	5,915	6,447	7,224	8,190	9,021
ratio	0.64	0.64	0.66	0.7	0.72	0.64
PSID Nondurables	746	855	887	1,015	1,188	1,146
NIPA Nondurables	1,330	1,543	1,618	1,831	2,089	2,296
ratio	0.56	0.55	0.55	0.55	0.57	0.5
PSID Services	2,530	2,914	3,398	4,043	4,738	4,590
NIPA Services	3,809	4,371	4,829	5,393	6,101	6,725
ratio	0.66	0.67	0.7	0.75	0.78	0.68

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

Identification with non-separability

- When preferences are non-separable, we have:

$$\begin{pmatrix} \Delta c_t \\ \Delta y_{1,t} \\ \Delta y_{2,t} \end{pmatrix} \simeq \begin{pmatrix} \kappa_{c,u_1} & \kappa_{c,u_2} & \kappa_{c,v_1} & \kappa_{c,v_2} \\ \kappa_{y_1,u_1} & \kappa_{y_1,u_2} & \kappa_{y_1,v_1} & \kappa_{y_1,v_2} \\ \kappa_{y_2,u_1} & \kappa_{y_2,u_2} & \kappa_{y_2,v_1} & \kappa_{y_2,v_2} \end{pmatrix} \begin{pmatrix} \Delta u_{1,t} \\ \Delta u_{2,t} \\ v_{1,t} \\ v_{2,t} \end{pmatrix}$$

- $\kappa_{c,u_j} \rightarrow$ non-separability between consumption and leisure j
  $\kappa_{y_j,u_k} \rightarrow$ non-separability between spouses' leisures