# Estimating a Collective Household Model with Survey Data on Financial Satisfaction

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# Outline

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- Model
  - Preferences, household consumption technology, sharing rule
- Econometric Issues
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- Estimates
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# Motivation

- The big questions:
  - How large are the returns to scale in household consumption?
  - How are resources allocated within households of multiple individuals?
- Applications
  - Inequality, poverty
  - Benefits (how much? too whom?)
  - Life insurance
  - The effects of divorce law on divorced and married women
  - Tax policy

# Background

- The unitary model
  - Runs counter to methodological individualism
  - Has empirical implications that are rejected by the data (income pooling)
- The collective approach
  - Is the leading class of intra-household model
  - Assumes only efficiency of intra-household decisions
  - With restrictions on preferences, implies “sharing rules” (decentralization)

# Background

- Identification and estimation of intra-household models is difficult
  - Assignable goods
    - Leisure? Male and female clothing?
  - Browning, Chiappori and Lewbel (2003)
    - egoistic preferences
    - Demand patterns

# This paper:

- Use survey data on financial satisfaction to estimate a collective intra-household model
  - Different identifying assumptions
  - Computationally manageable/modest data requirements

→ applications

# Related Literature

- General “happiness” research (Frey and Stutzer, 2002)
- Equivalence Scales
  - “Leyden” approach
  - Schwarze (2003), Kuklys (2003)
- Intra-household
  - Bonke and Browning (2003)

# Data: The European Community Household Panel

- Micro data on living standards in European Countries
- 1994-2001
- 130,000 adults in 60,000 households
- Some “harmonized” national surveys
- Data from most, but not all, countries suitable for our purposes

# Data: Sample

- Individuals living as a single person or as member of a couple without children ("cohabiting")
- Deleted small numbers of cases: same sex couples, zero household income, no usable financial satisfaction response

# Financial Satisfaction

- How satisfied are you with your present financial situation?
  1. Not at all satisfied
  2. Largely unsatisfied
  3. Mildly unsatisfied
  4. Mildly satisfied
  5. Largely satisfied
  6. Fully satisfied

# Table 1: Distribution of Financial Satisfaction, Singles and Couples (no children), ECHP 1994-2001 (column %)

| | Single Men | Single Women | Cohabiting Men | Cohabiting Women |
|---|---|---|---|---|
| | | Netherlands | | |
| 1. very dissatisfied | 3.7 | 5.8 | 1.2 | 1.0 |
| 2. dissatisfied | 7.4 | 9.6 | 2.7 | 2.3 |
| 3. A bit dissatisfied | 13.3 | 16.7 | 8.0 | 7.2 |
| 4. A bit satisfied | 24.7 | 26.0 | 23.7 | 20.7 |
| 5. Satisfied | 35.9 | 29.7 | 44.4 | 45.2 |
| 6. Very satisfied | 14.9 | 12.2 | 19.9 | 23.7 |
| no. obs | 3,991 | 6,220 | 10,749 | 10,747 |
| | | United Kingdom | | |
| 1. finding it very difficult | 3.0 | 3.0 | 1.2 | 1.1 |
| 2. finding it quite difficult | 7.3 | 6.3 | 2.9 | 3.3 |
| 3. just about getting by | 25.8 | 29.7 | 22.9 | 19.7 |
| 4. doing alright | 31.9 | 31.3 | 32.3 | 34.9 |
| 5. living Comfortably | 31.9 | 29.7 | 40.7 | 41.0 |
| no. obs | 3,777 | 6,071 | 9,308 | 9,318 |
| | | Spain | | |
| 1. very dissatisfied | 10.4 | 14.7 | 9.1 | 9.8 |
| 2. dissatisfied | 15.8 | 20.9 | 16.3 | 16.8 |
| 3. A bit dissatisfied | 22.4 | 24.5 | 24.9 | 24.5 |
| 4. A bit satisfied | 24.0 | 21.2 | 25.3 | 24.5 |
| 5. Satisfied | 20.7 | 14.4 | 19.4 | 19.1 |
| 6. Very satisfied | 6.8 | 4.3 | 5.0 | 5.4 |
| no. obs | 2,271 | 4,473 | 8,834 | 8,867 |

# Table 2: Within-Household Patterns of Financial Satisfaction Couples (no children), ECHP 1994-2001

**Netherlands**
**(n=10,737, Row %)**

| | Female partner | | | | | | |
|---|---|---|---|---|---|---|---|
| **Male partner** | 1 | 2 | 3 | 4 | 5 | 6 | **Total** |
| 1. Very dissatisfied | 41.6 | 22.4 | 17.6 | 10.4 | 6.4 | 1.6 | 100 |
| 2. dissatisfied | 7.9 | 33.5 | 30.7 | 16.7 | 8.2 | 3.1 | 100 |
| 3. a bit dissatisfied | 2.3 | 7.3 | 36.2 | 34.5 | 17.3 | 2.4 | 100 |
| 4. a bit satisfied | 0.3 | 1.2 | 9.4 | 44.6 | 38.6 | 5.9 | 100 |
| 5. satisfied | 0.1 | 0.4 | 2.0 | 13.9 | 66.4 | 17.4 | 100 |
| 6. Very satisfied | 0.0 | 0.1 | 0.7 | 3.3 | 24.5 | | 100 |

**United Kingdom**
**(n=9,298) (Row %)**

| | Female partner | | | | | |
|---|---|---|---|---|---|---|
| **Male partner** | 1 | 2 | 3 | 4 | 5 | **Total** |
| 1. finding it very difficult | 30.6 | 31.5 | 27.0 | 10.8 | 0 | 100 |
| 2. finding it quite difficult | 9.9 | 37.4 | 37.7 | 12.8 | 2.2 | 100 |
| 3. just about getting by | 1.5 | 5.7 | 54.1 | 27.9 | 10.8 | 100 |
| 4. doing alright | 0.1 | 1.4 | 13.3 | 56.1 | 29.2 | 100 |
| 5. living Comfortably | 0.1 | 0.3 | 3.9 | 24.2 | 71.5 | 100 |

# Table 2: Within-Household Patterns of Financial Satisfaction Couples (no children), ECHP 1994-2001

**Spain**
**(n=8,782) (Row %)**

| | Female partner | | | | | | |
|---|---|---|---|---|---|---|---|
| **Male partner** | 1 | 2 | 3 | 4 | 5 | 6 | **Total** |
| 1. Very dissatisfied | 60.4 | 21.2 | 10.8 | 4.3 | 2.3 | 1.1 | 100 |
| 2. dissatisfied | 13.6 | 49.4 | 22.4 | 9.6 | 4.1 | 1.0 | 100 |
| 3. a bit dissatisfied | 4.5 | 17.5 | 49.9 | 19.4 | 7.6 | 1.0 | 100 |
| 4. a bit satisfied | 2.7 | 7.0 | 21.6 | 49.1 | 17.2 | 2.4 | 100 |
| 5. satisfied | 1.1 | 3.4 | 9.0 | 24.7 | 54.6 | 7.2 | 100 |
| 6. Very satisfied | 0.7 | 1.8 | 3.9 | 7.1 | 29.5 | 57.1 | 100 |

**Kappa Statistics**

| | **Expected Agreement, %** | **Actual Agreement, %** | **Kappa (SE)** |
|---|---|---|---|
| **Netherlands** | 30.4 | 58.6 | 0.41 (0.006) |
| **United Kingdom** | 32.6 | 61.1 | 0.42 (0.007) |
| **Spain** | 19.9 | 51.8 | 0.40 (0.005) |

# Table 3: Changes in Financial Satisfaction
# Singles and Couples (no children), ECHP 1994-2001

**Note:** change in satisfaction >=2 means considerable improvement, <=-2 means considerable deterioration

**Netherlands**
**(column %)**

| | Male | | | | female | | | |
|---|---|---|---|---|---|---|---|---|
| Change in Satisfaction | single single | single cohabiting | cohabiting single | cohabiting cohabiting | single single | Single cohabiting | cohabiting single | cohabiting cohabiting |
| <=-2 | 5.1 | 7.9 | 8.7 | 4.0 | 5.8 | 3.3 | 16.9 | 3.6 |
| -1 | 19.0 | 17.9 | 30.2 | 18.5 | 19.7 | 10.8 | 27.9 | 18.4 |
| 0 | 46.8 | 40.0 | 36.5 | 52.1 | 43.8 | 31.7 | 37.2 | 53.7 |
| 1 | 21.2 | 17.9 | 16.7 | 20.6 | 23.0 | 29.2 | 12.6 | 20.1 |
| >=2 | 7.9 | 16.4 | 7.9 | 4.8 | 7.7 | 25.0 | 5.5 | 4.2 |
| Obs. | 2,891 | 140 | 126 | 7,971 | 4,704 | 120 | 183 | 7,966 |

**United Kingdom**
**(column %)**

| | Male | | | | female | | | |
|---|---|---|---|---|---|---|---|---|
| Change in Satisfaction | single single | single cohabiting | cohabiting single | cohabiting cohabiting | single single | Single cohabiting | cohabiting single | cohabiting cohabiting |
| <=-2 | 3.5 | 2.9 | 8.9 | 2.9 | 3.7 | 2.2 | 7.9 | 2.8 |
| -1 | 16.2 | 14.3 | 23.1 | 15.5 | 16.7 | 16.4 | 28.3 | 15.0 |
| 0 | 57.5 | 43.6 | 42.0 | 60.2 | 54.1 | 36.6 | 42.9 | 61.2 |
| 1 | 18.4 | 30.0 | 18.9 | 17.8 | 20.3 | 30.6 | 17.3 | 17.4 |
| >=2 | 4.4 | 9.3 | 7.1 | 3.7 | 5.21 | 14.2 | 3.7 | 3.6 |
| Obs. | 2,743 | 140 | 169 | 7,150 | 4,741 | 134 | 191 | 7,168 |

# Table 3: Changes in Financial Satisfaction Singles and Couples (no children), ECHP 1994-2001

**Spain**
**(column %)**

| | Male | | | | female | | | |
|---|---|---|---|---|---|---|---|---|
| Change in Satisfaction | single single | single cohabiting | cohabiting single | cohabiting cohabiting | single single | Single cohabiting | cohabiting single | cohabiting cohabiting |
| <=-2 | 13.6 | 13.3 | 5.2 | 12.6 | 13.2 | 15.8 | 28.7 | 12.9 |
| -1 | 20.0 | 22.2 | 26.0 | 21.3 | 21.3 | 15.8 | 24.3 | 21.3 |
| 0 | 31.7 | 20.0 | 39.0 | 30.2 | 30.0 | 29.0 | 19.9 | 30.1 |
| 1 | 20.0 | 26.7 | 11.7 | 21.8 | 21.5 | 23.7 | 13.2 | 20.8 |
| >=2 | 14.8 | 17.8 | 18.2 | 14.1 | 14.0 | 15.8 | 14.0 | 14.9 |
| Obs. | 1,621 | 45 | 77 | 6,403 | 3,401 | 38 | 136 | 6,433 |

**Test of Gender Equality**
**(p-values)**

| | S-P | P-S |
|---|---|---|
| **Netherlands** | 0.020 | 0.246 |
| **United Kingdom** | 0.635 | 0.523 |
| **Spain** | 0.856 | <0.001 |

# Descriptive Analysis: Main Messages

- Partners view their finances differently
- Changes in financial satisfaction with changes in cohabitation differ by gender
- Patterns differ across countries

- We need a model

# Model - Preferences

$$V_{ict} = \alpha_{ct}(z_{ict}) + \beta_{ct} \ln x_{ict} + \mu_i + \varepsilon_{ict}, \qquad (2)$$

- PIGLOG
- egoistic preferences, sharing rule
- Direct (dis)utility from cohabitation is additively separable

# Household Income and Private Consumption

- Singles:

$$x_{ict} = y_{ict} . \qquad (3)$$

- Couples:

$$x_{ict} = \eta_{ict} F^{-1}(y_{ict}) . \qquad (4)$$

# Household Income and Private Consumption

$$(x^1 + x^2) = \frac{y}{A}$$

$$x_{ict} = \eta_{ict} \frac{y_{ict}}{A}. \qquad (5)$$

$$\eta^1 = \frac{e^{\gamma(p,y,w)}}{1 + e^{\gamma(p,y,w)}} \qquad (6)$$

$$\gamma(p, y, w) = \gamma_{ct}^0 + \gamma_{ct}^1 \ln y + \gamma_{ct}^2 w^1 \qquad (7)$$

# Empirical Implementation

- Linearize

$$\ln(1+e^{\gamma_{ct}^0+\gamma_{ct}^1 \ln y+\gamma_{ct}^2 w^1}) \approx \ln(1+e^{\gamma_{ct}^0}) + \frac{e^{\gamma_{ct}^0}}{1+e^{\gamma_{ct}^0}}(\gamma_{ct}^1 \ln y + \gamma_{ct}^2 w^1)$$

# Final Specification

Singles

$$V_{ict} = \alpha_{ct}(z_{ict}) + \beta_{ct} \ln y_{ict} + \mu_i + \varepsilon_{ict}$$

Cohabiting Men

$$V_{ict} = \alpha_{ct}(z_{ict}) + \beta_{ct} \left\{ \begin{array}{l} -\ln(1+e^{\gamma^0_{ct}}) - \dfrac{e^{\gamma^0_{ct}}}{1+e^{\gamma^0_{ct}}}(\gamma^1_{ct} \ln y + \gamma^2_{ct} w^1) \\ + \ln y_{ict} - \ln A \end{array} \right\} + \mu_i + \varepsilon_{ict},$$

Cohabiting Women

$$V_{ict} = \alpha_{ct}(z_{ict}) + \beta_{ct} \left\{ \begin{array}{l} \gamma^0_{ct} + \gamma^1_{ct} \ln y + \gamma^2_{ct} w^1 - \ln(1+e^{\gamma^0_{ct}}) \\ - \dfrac{e^{\gamma^0_{ct}}}{1+e^{\gamma^0_{ct}}}(\gamma^1_{ct} \ln y + \gamma^2_{ct} w^1) + \ln y_{ict} - \ln A \end{array} \right\} + \mu_i + \varepsilon_{ict},$$

# Combined Reduced Form

$$
\begin{aligned}
V_{ict} = {} & \pi^0_{ct}(z_{ict}) + \pi^1_{ct} \ln y_{ict} + \pi^2_{ct} D^c + \pi^3_{ct} D^c D^f \\
& + \pi^4_{ct} D^c D^f \ln y_{ict} + \pi^5_{ct} D^c D^f w^1_{ict} \\
& + \pi^6_{ct} D^c (1 - D^f) \ln y_{ict} + \pi^7_{ct} D^c (1 - D^f) w^1_{ict} \\
& + \mu_i + \varepsilon_{ict}
\end{aligned}
$$

# Econometric Issues: Measuring Utility

$$
\begin{aligned}
FS_{ick} &= 6 \Leftrightarrow V_{ict} > k_5 \\
FS_{ick} &= 5 \Leftrightarrow k_5 > V_{ict} > k_4 \\
FS_{ick} &= 4 \Leftrightarrow k_4 > V_{ict} > k_3 \\
FS_{ick} &= 3 \Leftrightarrow k_3 > V_{ict} > k_2 \\
FS_{ick} &= 2 \Leftrightarrow k_2 > V_{ict} > k_1 \\
FS_{ick} &= 1 \Leftrightarrow k_1 > V_{ict}
\end{aligned}
$$

- Ordered Probit

# Recovering Structural Parameters

- Minimum distance step (fast)

$$\pi^{0}_{ct}(z_{ict}) = \alpha_{ct}(z_{ict})$$

$$\pi^{1}_{ct} = \beta_{ct}$$

$$\pi^{2}_{ct} = -\beta_{ct}(\ln A + \ln(1+e^{\gamma^{0}_{ct}}))$$

$$\pi^{3}_{ct} = \beta_{ct}\gamma^{0}_{ct}$$

$$\pi^{4}_{ct} = \beta_{ct}\left(1-\frac{e^{\gamma^{0}_{ct}}}{1+e^{\gamma^{0}_{ct}}}\right)\gamma^{1}_{ct} = \frac{\beta_{ct}\gamma^{1}_{ct}}{1+e^{\gamma^{0}_{ct}}}$$

…..etc.

# Unobserved Heterogeneity

- Pooled probit consistently estimates

$$\pi^{k} / (1 + \sigma_{\mu}^{2})^{1/2}$$

- This is sufficient to identify $A, \gamma$
- Random effects probit requires strict exogeneity, no “serial correlation”
- Add Chamberlain/Mundlak terms in household size (requires strict exogeneity)

# Constraining the Returns to Scale Parameter

- Parameterize $$A = \frac{1 + 2\exp(a)}{2 + 2\exp(a)}$$

  to impose $$0.5 \leq A \leq 1$$

- Minimum distance step slower (now nonlinear) but whole procedure still fast.

# Results

- Estimate separately by country; full set of time effects
- Specifications
  - Base
  - + Mundlak/Chamberlain terms
- Estimates:
  - Reduced form parameters
  - Structural Parameters
  - Estimated Shares

# Comparison Points

- Returns to scale ($A$) ($2A$=equivalence scale)
  - OECD: 0.85, 0.75
  - “Square-root”: 0.7
  - Schwarze (2003): 0.61-0.63
  - Browning, Chiappori, Lewbel: 0.79
- Sharing rule (BCL):
  - Women’s share increasing in household income, >0.5 at median household income
  - No effect of income shares (contradicts Browning et al., 1994)

# Table 4: Selected Means, by Country
# Singles and Couples (no children), ECHP 1994-2001

| | ln real household income at PPP | Female income share (Couples only) |
|---|---|---|
| Denmark | 9.74 | 0.41 |
| Netherlands | 9.81 | 0.29 |
| Belgium | 9.74 | 0.27 |
| Ireland | 9.46 | 0.27 |
| Italy | 9.49 | 0.29 |
| Greece | 8.98 | 0.24 |
| Spain | 9.31 | 0.20 |
| Portugal | 8.88 | 0.32 |
| United Kingdom | 9.74 | 0.37 |

Notes: Household income is the sum of personal incomes. Personal income is net, and is the sum all income components, over the year preceding the survey.

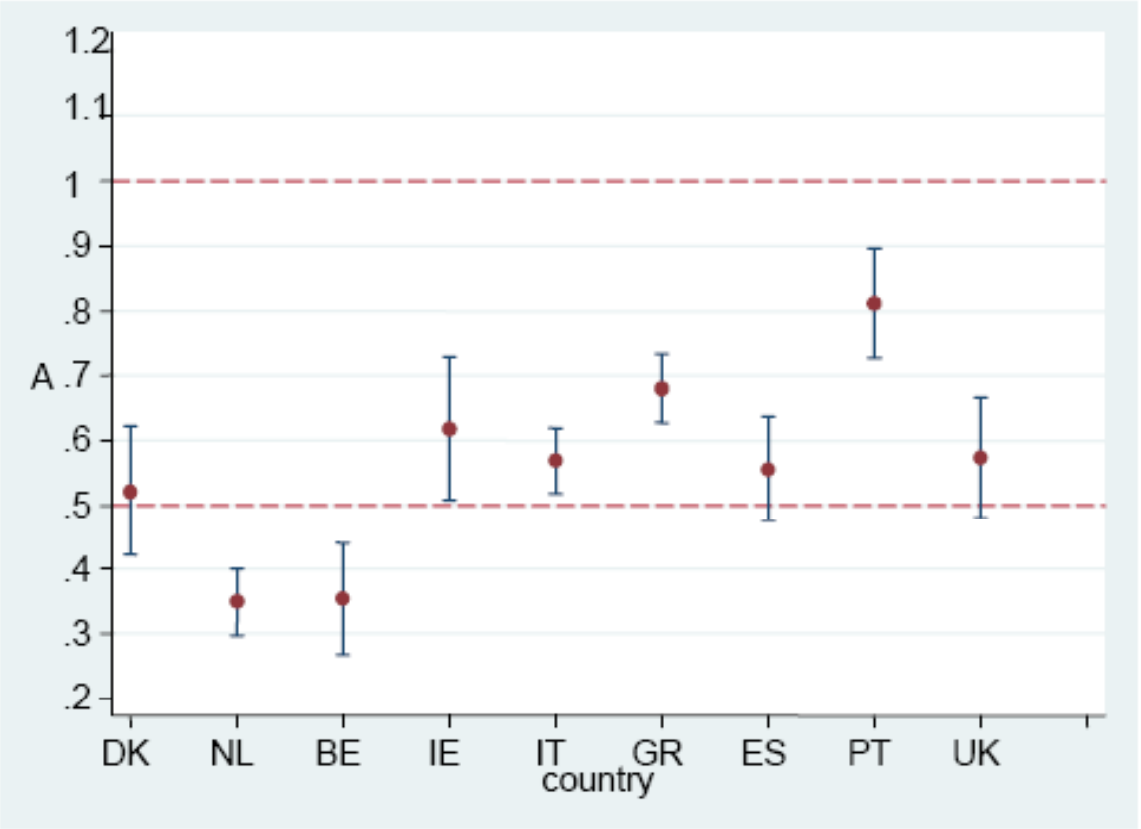
# Table 5a: Reduced Form Parameter Estimates (Base Specification)

| | DK | NL | BE | IE | IT | GR | ES | PT | UK |
|---|---|---|---|---|---|---|---|---|---|
| $Ln(income_{it})$ ($\pi^1$) | 0.362*** | 0.422*** | 0.346*** | 0.511*** | 0.608*** | 0.759*** | 0.367*** | 0.595*** | 0.375*** |
| | (0.043) | (0.031) | (0.044) | (0.061) | (0.035) | (0.032) | (0.033) | (0.035) | (0.030) |
| $Couple_{it}$ ($\pi^2$) | -0.114** | -0.0353 | -0.0287 | -0.253*** | -0.128*** | -0.257*** | -0.211*** | -0.336*** | -0.139*** |
| | (0.048) | (0.038) | (0.054) | (0.066) | (0.040) | (0.047) | (0.039) | (0.049) | (0.043) |
| $Couple_{it}$*$female_{it}$ ($\pi^3$) | 0.229*** | 0.360*** | 0.254*** | 0.275*** | 0.0933* | 0.0809 | 0.259*** | 0.131** | 0.184*** |
| | (0.062) | (0.049) | (0.072) | (0.085) | (0.054) | (0.058) | (0.051) | (0.061) | (0.055) |
| Couple*female*ln(income) ($\pi^4$) | 0.132** | 0.147*** | -0.0258 | 0.0159 | -0.0275 | -0.0345 | 0.197*** | -0.0678 | 0.260*** |
| | (0.062) | (0.047) | (0.062) | (0.082) | (0.045) | (0.038) | (0.048) | (0.044) | (0.044) |
| $Couple_{it}$*$female_{it}$*income_share_$female_{it}$ ($\pi^4$) | -0.317** | -0.253*** | -0.151 | -0.399*** | -0.0349 | -0.155** | -0.134* | -0.297*** | -0.158 |
| | (0.14) | (0.081) | (0.11) | (0.12) | (0.074) | (0.064) | (0.071) | (0.083) | (0.099) |
| $Couple_{it}$*$male_{it}$*$ln(income_{it})$ ($\pi^6$) | 0.263*** | 0.120*** | 0.0152 | 0.0217 | 0.0167 | 0.0202 | 0.208*** | -0.0209 | 0.284*** |
| | (0.063) | (0.046) | (0.064) | (0.084) | (0.045) | (0.037) | (0.048) | (0.043) | (0.045) |
| $Couple_{it}$*$male_{it}$*income_share_$female_{it}$ ($\pi^7$) | -0.756*** | -0.216*** | -0.169 | -0.256** | -0.262*** | -0.436*** | -0.337*** | -0.779*** | -0.371*** |
| | (0.14) | (0.078) | (0.10) | (0.13) | (0.070) | (0.064) | (0.071) | (0.081) | (0.097) |
| $Female_{it}$ | -0.0912* | -0.212*** | -0.140** | -0.133** | -0.121*** | -0.120** | -0.244*** | -0.225*** | -0.103** |
| | (0.048) | (0.041) | (0.059) | (0.067) | (0.047) | (0.053) | (0.044) | (0.054) | (0.045) |
| (Upper) secondary $education_{it}$ | 0.0413 | 0.216*** | 0.356*** | 0.348*** | 0.412*** | 0.356*** | 0.364*** | 0.203*** | 0.192*** |
| | (0.037) | (0.033) | (0.043) | (0.061) | (0.049) | (0.042) | (0.034) | (0.065) | (0.030) |
| Post secondary $education_{it}$ | -0.00471 | 0.127*** | 0.121*** | 0.209*** | 0.263*** | 0.350*** | 0.217*** | 0.126** | 0.153*** |
| | (0.033) | (0.028) | (0.035) | (0.045) | (0.028) | (0.034) | (0.032) | (0.053) | (0.033) |
| $Age_{it}$ | -0.0185*** | -0.0350*** | -0.0268*** | -0.0318*** | 0.00436 | -0.00627 | 0.000368 | -0.0159*** | -0.0357*** |
| | (0.0047) | (0.0042) | (0.0057) | (0.0066) | (0.0042) | (0.0042) | (0.0038) | (0.0042) | (0.0040) |
| $Age_{it}^2$ | 0.000386*** | 0.000414*** | 0.000376*** | 0.000449*** | -0.0000229 | 0.0000643* | 0.0000711** | 0.000124*** | 0.000432*** |
| | (0.000047) | (0.000041) | (0.000052) | (0.000062) | (0.000039) | (0.000037) | (0.000036) | (0.000039) | (0.000039) |
| Home owner yes/no | 0.253*** | 0.418*** | 0.419*** | 0.138** | 0.203*** | 0.226*** | 0.187*** | 0.294*** | 0.426*** |
| | (0.031) | (0.024) | (0.038) | (0.056) | (0.026) | (0.032) | (0.026) | (0.027) | (0.029) |

# Table 5b: Structural Parameter Estimates (Base Specification)

| | DK | NL | BE | IE | IT | GR | ES | PT | UK |
|---|---|---|---|---|---|---|---|---|---|
| **Sharing Rule Parameters** | | | | | | | | | |
| Intercept ($\gamma^0$) | 0.323* | 0.619*** | 0.670*** | 0.329* | 0.174** | 0.136* | 0.407*** | 0.248** | 0.176 |
| | (0.17) | (0.12) | (0.23) | (0.17) | (0.089) | (0.075) | (0.13) | (0.10) | (0.14) |
| Ln(income) ($\gamma^1$) | -0.392** | -0.0574 | -0.0858 | 0.0413 | -0.0790 | -0.0718 | -0.250* | -0.0426 | -0.297** |
| | (0.18) | (0.11) | (0.19) | (0.16) | (0.070) | (0.044) | (0.14) | (0.069) | (0.14) |
| Female Income Share ($\gamma^2$) | 1.565*** | 0.356 | 0.374 | 0.0963 | 0.439*** | 0.400*** | 0.813*** | 0.988*** | 0.809** |
| | (0.59) | (0.24) | (0.41) | (0.35) | (0.17) | (0.12) | (0.26) | (0.21) | (0.37) |
| **Household Consumption Technology (returns to scale parameter)** *(Given equal allocation, the equivalence scale is 2A)* | | | | | | | | | |
| $A$ | 0.522*** | 0.349*** | 0.353*** | 0.619*** | 0.569*** | 0.681*** | 0.555*** | 0.811*** | 0.574*** |
| | (0.050) | (0.026) | (0.043) | (0.055) | (0.025) | (0.026) | (0.041) | (0.043) | (0.046) |
| **Estimated Female Consumption Shares, Mean Household Income and Alternative Female Income Shares** | | | | | | | | | |
| $\eta^1(\overline{\ln(y)}, 0.25)$ | 0.514*** | 0.647*** | 0.660*** | 0.581*** | 0.538*** | 0.535*** | 0.610*** | 0.545*** | 0.520*** |
| | (0.057) | (0.027) | (0.051) | (0.042) | (0.022) | (0.019) | (0.030) | (0.027) | (0.040) |
| $\eta^1(\overline{\ln(y)}, 0.50)$ | 0.516*** | 0.667*** | 0.681*** | 0.587*** | 0.566*** | 0.559*** | 0.657*** | 0.605*** | 0.571*** |
| | (0.038) | (0.026) | (0.049) | (0.040) | (0.023) | (0.018) | (0.031) | (0.023) | (0.033) |
| $\eta^1(\ln(y), 0.75)$ | 0.709*** | 0.686*** | 0.701*** | 0.593*** | 0.592*** | 0.584*** | 0.701*** | 0.663*** | 0.619*** |
| | (0.043) | (0.031) | (0.056) | (0.048) | (0.027) | (0.021) | (0.036) | (0.024) | (0.039) |
| $\eta^1(\overline{\ln(y)}, \overline{w})$ | 0.580*** | 0.650*** | 0.661*** | 0.582*** | 0.543*** | 0.534*** | 0.600*** | 0.562*** | 0.544*** |
| | (0.042) | (0.027) | (0.050) | (0.041) | (0.022) | (0.019) | (0.031) | (0.025) | (0.035) |
| Overidentification test p value | 0.000 | 0.000 | 0.134 | 0.002 | 0.020 | 0.000 | 0.000 | 0.000 | 0.000 |

# Figure 1: Estimates of the Returns to Scale in Household Consumption (*A*) (Base Specification)



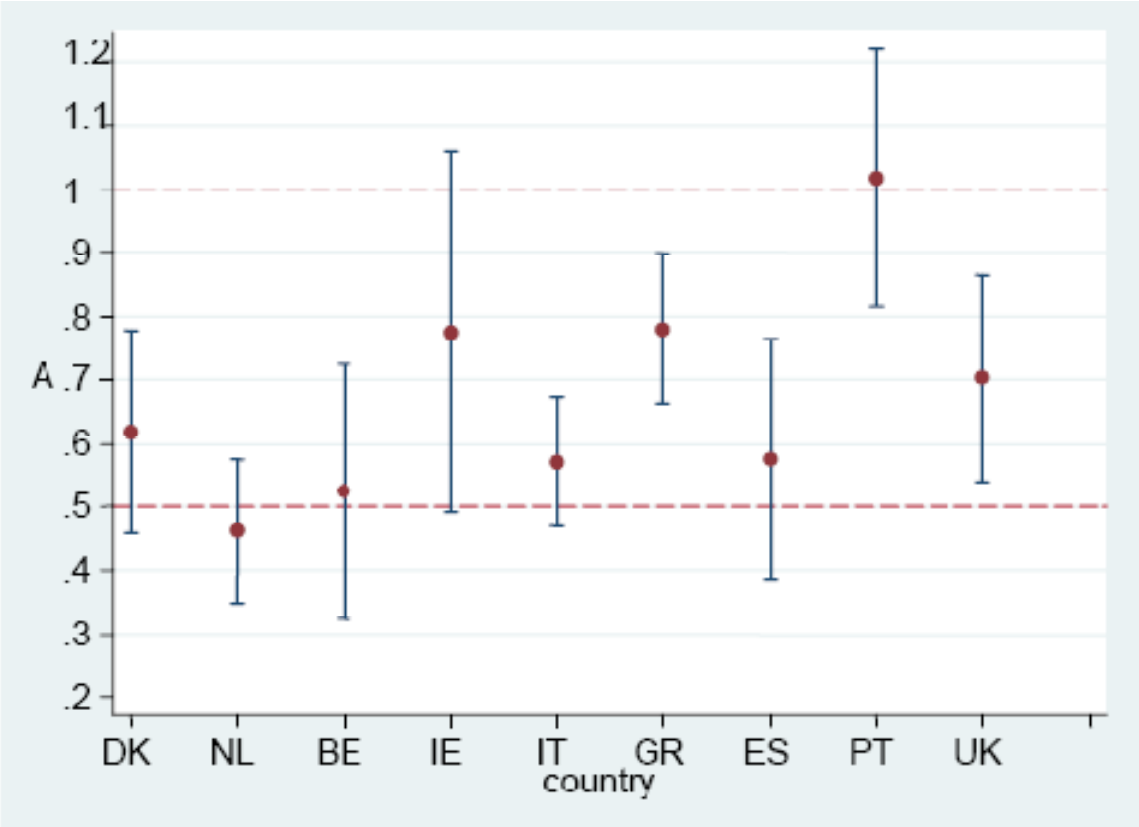
# Table 6a: Reduced Form Parameter Estimates (Chamberlain/Mundlak Estimator)

| | DK | NL | BE | IE | IT | GR | ES | PT | UK |
|---|---|---|---|---|---|---|---|---|---|
| $Ln(income_{it})$ ($\pi^1$) | 0.363*** | 0.424*** | 0.346*** | 0.511*** | 0.607*** | 0.761*** | 0.368*** | 0.595*** | 0.375*** |
| | (0.044) | (0.031) | (0.044) | (0.061) | (0.035) | (0.032) | (0.033) | (0.035) | (0.030) |
| $Couple_{it}$ ($\pi^2$) | -0.0832 | -0.130* | -0.0700 | -0.647*** | -0.163** | -0.297*** | -0.161* | -0.374*** | -0.215*** |
| | (0.067) | (0.070) | (0.085) | (0.13) | (0.078) | (0.088) | (0.084) | (0.094) | (0.061) |
| $Couple_{it}$*$female_i$ ($\pi^3$) | 0.0985 | 0.297*** | 0.111 | 0.532*** | 0.162 | -0.0116 | 0.194* | 0.0405 | 0.135 |
| | (0.091) | (0.094) | (0.13) | (0.16) | (0.11) | (0.11) | (0.12) | (0.12) | (0.086) |
| Couple*female*ln(income) ($\pi^4$) | 0.130** | 0.144*** | -0.0269 | 0.0141 | -0.0273 | -0.0376 | 0.197*** | -0.0697 | 0.260*** |
| | (0.063) | (0.048) | (0.062) | (0.083) | (0.045) | (0.038) | (0.048) | (0.044) | (0.044) |
| $Couple_{it}$*$female_i$*$income\_share\_female_{it}$ ($\pi^4$) | -0.310** | -0.241*** | -0.146 | -0.395*** | -0.0361 | -0.153** | -0.134* | -0.293*** | -0.148 |
| | (0.14) | (0.081) | (0.11) | (0.12) | (0.075) | (0.064) | (0.071) | (0.083) | (0.100) |
| $Couple_{it}$*$male_i$*$ln(income_{it})$ ($\pi^6$) | 0.264*** | 0.118** | 0.0157 | 0.0245 | 0.0168 | 0.0196 | 0.207*** | -0.0205 | 0.285*** |
| | (0.063) | (0.046) | (0.064) | (0.084) | (0.045) | (0.037) | (0.049) | (0.043) | (0.045) |
| $Couple_{it}$*$male_i$*$income\_share\_female_{it}$ ($\pi^7$) | -0.755*** | -0.212*** | -0.167 | -0.245* | -0.262*** | -0.435*** | -0.337*** | -0.779*** | -0.368*** |
| | (0.14) | (0.079) | (0.10) | (0.13) | (0.070) | (0.064) | (0.071) | (0.081) | (0.097) |
| $Female_i$ | -0.102** | -0.214*** | -0.146** | -0.129* | -0.116** | -0.125** | -0.248*** | -0.231*** | -0.105** |
| | (0.051) | (0.044) | (0.062) | (0.069) | (0.049) | (0.056) | (0.046) | (0.057) | (0.048) |
| (Upper) secondary $education_i$ | 0.0423 | 0.215*** | 0.357*** | 0.347*** | 0.413*** | 0.357*** | 0.364*** | 0.204*** | 0.192*** |
| | (0.037) | (0.034) | (0.043) | (0.061) | (0.049) | (0.042) | (0.034) | (0.065) | (0.030) |
| Post secondary $education_i$ | -0.00412 | 0.125*** | 0.121*** | 0.207*** | 0.263*** | 0.351*** | 0.217*** | 0.127** | 0.152*** |
| | (0.033) | (0.028) | (0.035) | (0.045) | (0.028) | (0.034) | (0.032) | (0.053) | (0.033) |
| $Age_{it}$ | -0.0186*** | -0.0350*** | -0.0267*** | -0.0315*** | 0.00439 | -0.00634 | 0.000320 | -0.0160*** | -0.0358*** |
| | (0.0047) | (0.0042) | (0.0057) | (0.0066) | (0.0042) | (0.0042) | (0.0038) | (0.0042) | (0.0040) |
| $Age_{it}^2$ | 0.000388*** | 0.000414*** | 0.000376*** | 0.000446*** | -0.0000232 | 0.0000656* | 0.0000716** | 0.000125*** | 0.000434*** |
| | (0.000047) | (0.000041) | (0.000052) | (0.000062) | (0.000039) | (0.000037) | (0.000036) | (0.000039) | (0.000039) |
| Home owner yes/no | 0.252*** | 0.417*** | 0.417*** | 0.135** | 0.203*** | 0.225*** | 0.187*** | 0.294*** | 0.424*** |
| | (0.031) | (0.024) | (0.038) | (0.057) | (0.026) | (0.032) | (0.026) | (0.027) | (0.029) |
| $\overline{Couple_i}$ | -0.0360 | 0.104 | 0.0449 | 0.414*** | 0.0377 | 0.0443 | -0.0535 | 0.0424 | 0.0859 |
| | (0.079) | (0.078) | (0.100) | (0.14) | (0.089) | (0.10) | (0.092) | (0.11) | (0.075) |
| $\overline{Couple*female_i}$ | 0.150 | 0.0674 | 0.154 | -0.261 | -0.0753 | 0.103 | 0.0693 | 0.0999 | 0.0542 |
| | (0.11) | (0.11) | (0.15) | (0.18) | (0.12) | (0.13) | (0.13) | (0.13) | (0.10) |
| Joint Statistical significance, Mundlak terms – pvalue | 0.077 | 0.001 | 0.039 | 0.003 | 0.761 | 0.088 | 0.894 | 0.1 | 0.002 |

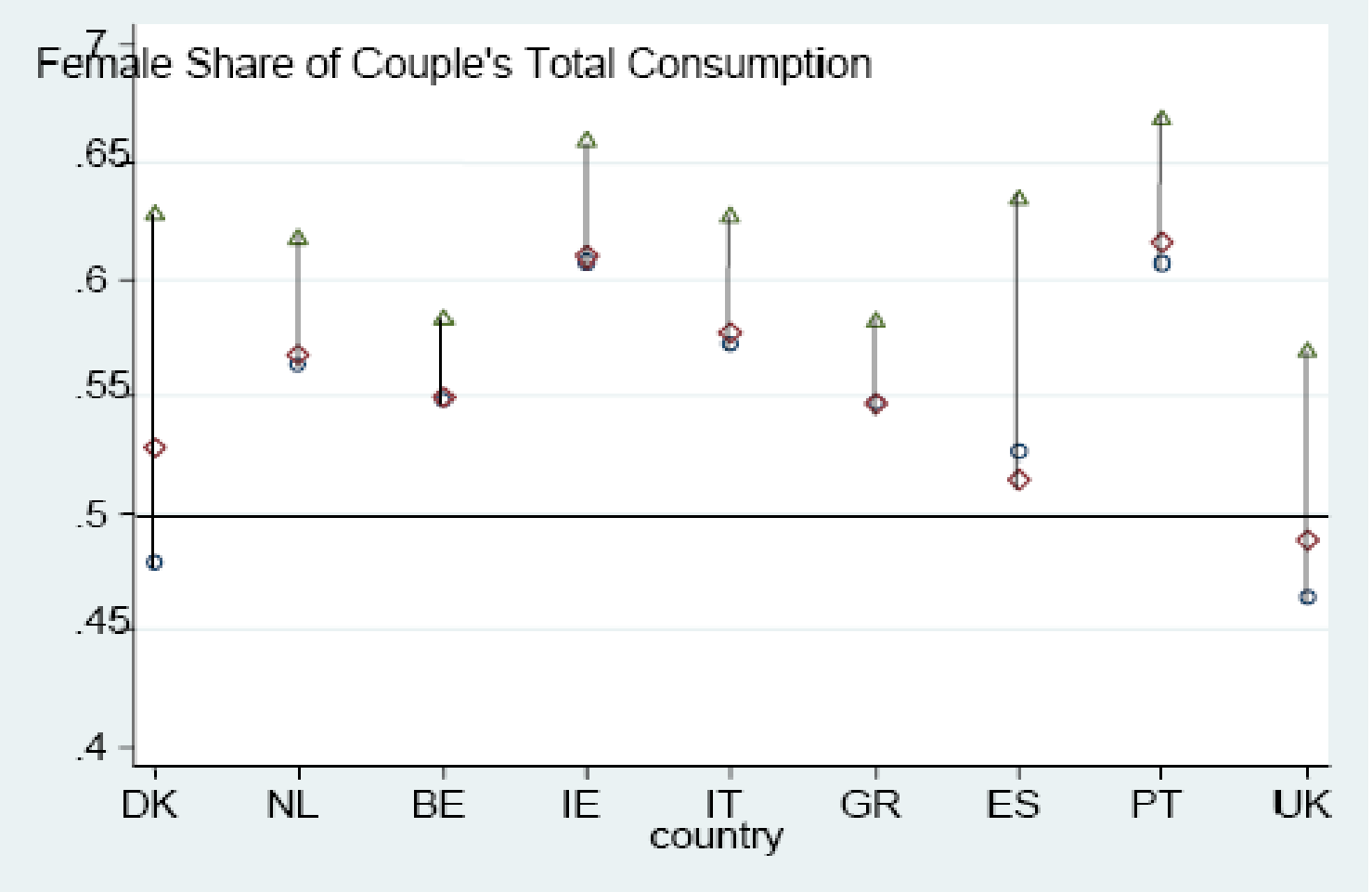
# Table 6b: Structural Parameter Estimates (Chamberlain/Mundlak Estimator)

| | DK | NL | BE | IE | IT | GR | ES | PT | UK |
|---|---|---|---|---|---|---|---|---|---|
| **Sharing Rule Parameters** | | | | | | | | | |
| Intercept ($\gamma^0$) | 0.109 | 0.273 | 0.198 | 0.447* | 0.313* | 0.185 | 0.0589 | 0.472** | -0.0456 |
| | (0.25) | (0.20) | (0.38) | (0.26) | (0.18) | (0.15) | (0.28) | (0.19) | (0.22) |
| Ln(income) ($\gamma^1$) | 0.343* | 0.125 | 0.110 | 0.00541 | 0.0783 | 0.0780* | 0.331* | 0.0812 | 0.366* |
| | (0.21) | (0.12) | (0.19) | (0.16) | (0.070) | (0.044) | (0.19) | (0.069) | (0.19) |
| Female Income Share ($\gamma^2$) | 1.209* | 0.446* | 0.286 | 0.444 | 0.450*** | 0.285** | 0.892*** | 0.532** | 0.846** |
| | (0.66) | (0.26) | (0.45) | (0.34) | (0.17) | (0.13) | (0.31) | (0.26) | (0.40) |
| **Household Consumption Technology (returns to scale parameter)** *(Given equal allocation, the equivalence scale is 2A)* | | | | | | | | | |
| $A$ | 0.618*** | 0.463*** | 0.525*** | 0.775*** | 0.571*** | 0.780*** | 0.576*** | 1.018*** | 0.702*** |
| | (0.080) | (0.057) | (0.100) | (0.14) | (0.051) | (0.059) | (0.095) | (0.10) | (0.081) |
| **Estimated Female Consumption Shares, Mean Household Income and Alternative Female Income Shares** | | | | | | | | | |
| $\eta^1(\overline{\ln(y)}, 0.25)$ | 0.479*** | 0.563*** | 0.548*** | 0.608*** | 0.573*** | 0.547*** | 0.526*** | 0.607*** | 0.464*** |
| | (0.081) | (0.050) | (0.095) | (0.064) | (0.044) | (0.036) | (0.068) | (0.048) | (0.060) |
| $\eta^1(\overline{\ln(y)}, 0.50)$ | 0.554*** | 0.590*** | 0.566*** | 0.634*** | 0.600*** | 0.565*** | 0.581*** | 0.638*** | 0.517*** |
| | (0.056) | (0.044) | (0.088) | (0.057) | (0.041) | (0.033) | (0.059) | (0.038) | (0.050) |
| $\eta^1(\ln(y), 0.75)$ | 0.627*** | 0.617*** | 0.583*** | 0.659*** | 0.627*** | 0.582*** | 0.634*** | 0.668*** | 0.569*** |
| | (0.053) | (0.044) | (0.088) | (0.057) | (0.041) | (0.032) | (0.055) | (0.032) | (0.050) |
| $\eta^1(\overline{\ln(y)}, \overline{w})$ | 0.527*** | 0.568*** | 0.549*** | 0.610*** | 0.578*** | 0.545*** | 0.515*** | 0.616*** | 0.489*** |
| | (0.063) | (0.049) | (0.095) | (0.063) | (0.043) | (0.036) | (0.070) | (0.045) | (0.054) |
| Overidentification test p value | 0.000 | 0.000 | 0.138 | 0.022 | 0.062 | 0.000 | 0.000 | 0.000 | 0.000 |

# Figure 2: Estimates of the Returns to Scale in Household Consumption (*A*) (Chamberlain/Mundlak Estimator)



# Figure 3: Estimates of the Female Share of a Couple's Total Consumption



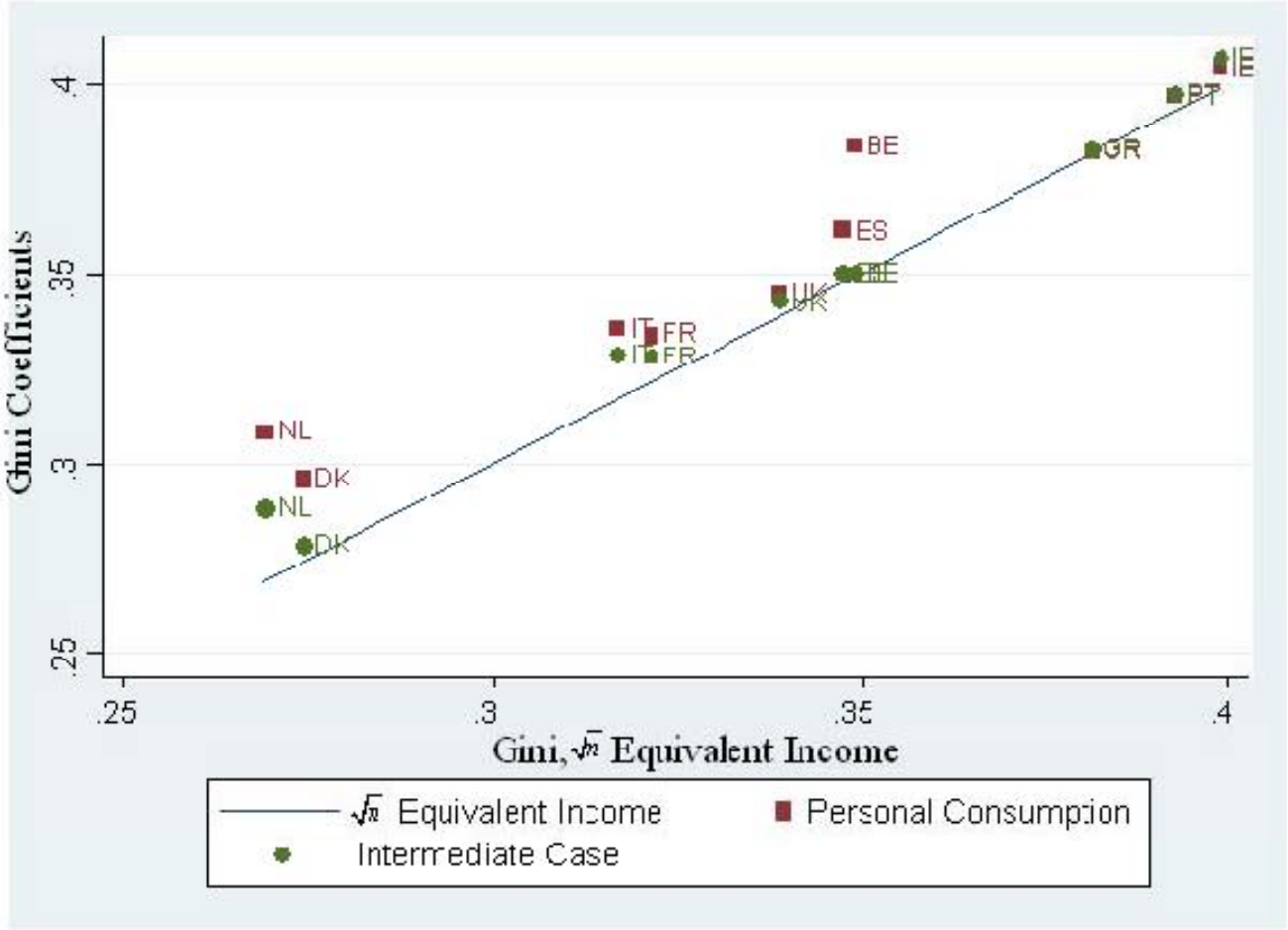
# Table 6b: Structural Parameter Estimates (Chamberlain/Mundlak Estimator, *A* constrained)

| | DK | NL | BE | IE | IT | GR | ES | PT | UK |
|---|---|---|---|---|---|---|---|---|---|
| **Sharing Rule Parameters** | | | | | | | | | |
| Intercept ($\gamma^0$) | 0.510** (0.20) | 0.626*** (0.20) | 0.390 (0.40) | 1.096*** (0.35) | 0.367** (0.18) | 0.237 (0.15) | 0.620** (0.24) | 0.853*** (0.20) | 0.328** (0.17) |
| Ln(income) ($\gamma^1$) | -0.427*** (0.16) | -0.0471 (0.10) | -0.136 (0.20) | -0.0653 (0.17) | -0.0820 (0.072) | -0.0785* (0.044) | -0.149 (0.11) | -0.0742 (0.073) | -0.135 (0.095) |
| Female Income Share ($\gamma^2$) | 1.354*** (0.43) | 0.207 (0.22) | 0.258 (0.43) | 0.183 (0.32) | 0.480*** (0.17) | 0.459*** (0.12) | 0.679*** (0.21) | 1.446*** (0.21) | 0.570** (0.26) |
| **Household Consumption Technology (returns to scale parameter)** *(Given equal allocation, the equivalence scale is 2A)* | | | | | | | | | |
| $A$ | 0.570*** (0.060) | 0.502*** (0.052) | 0.510*** (0.11) | 0.974*** (0.16) | 0.565*** (0.051) | 0.779*** (0.059) | 0.592*** (0.077) | 0.990*** (0.10) | 0.713*** (0.059) |
| **Estimated Female Consumption Shares, Mean Household Income and Alternative Female Income Shares** | | | | | | | | | |
| $\eta^1(\overline{\ln(y)}, 0.25)$ | 0.573*** (0.053) | 0.650*** (0.046) | 0.595*** (0.097) | 0.749*** (0.065) | 0.586*** (0.043) | 0.560*** (0.036) | 0.658*** (0.055) | 0.680*** (0.043) | 0.565*** (0.042) |
| $\eta^1(\overline{\ln(y)}, 0.50)$ | 0.653*** (0.047) | 0.661*** (0.045) | 0.611*** (0.098) | 0.757*** (0.064) | 0.614*** (0.043) | 0.588*** (0.036) | 0.695*** (0.053) | 0.753*** (0.036) | 0.600*** (0.040) |
| $\eta^1(\overline{\ln(y)}, 0.75)$ | 0.725*** (0.050) | 0.673*** (0.047) | 0.626*** (0.10) | 0.766*** (0.066) | 0.642*** (0.044) | 0.615*** (0.037) | 0.730*** (0.052) | 0.814*** (0.031) | 0.633*** (0.043) |
| $\eta^1(\overline{\ln(y)}, \overline{w})$ | 0.625*** (0.048) | 0.652*** (0.045) | 0.596*** (0.097) | 0.750*** (0.065) | 0.591*** (0.043) | 0.559*** (0.036) | 0.650*** (0.055) | 0.701*** (0.041) | 0.581*** (0.040) |
| Overidentification test p value | 0.000 | 0.000 | 0.144 | 0.001 | 0.0.073 | 0.000 | 0.000 | 0.000 | 0.000 |

# Application: Inequality

- We can calculate "personal consumption" as $x_i=\eta_i y_h/A$
- A more traditional approach calculates "Equivalent income" as: $x_i=y_h/E$
- We would like to compare patterns of inequality over countries and time using personal consumption rather than equivalent income.
- For example, what are the effects of differences in female labour force participation on inequality?
- Follows Phipps and Burton (1995) and Lise and Seitz (2004)

# Figure 4: Inequality in Equivalent Income and Personal Consumption



# Conclusion

- Summary:
  - Plausible (high-end) estimates of the returns to scale in consumption
  - Significant effects of female income share on sharing rule in most countries – evidence against the unitary model
- Value:
  - Corroborates other research with very different data
  - Low data and computation demands ➔applications

# Potential Application: The effect of institutions on sharing rule parameters

- For example, how divorce laws affect the labour supply and welfare of married and unmarried women? (Gray, *AER*, 1998; Chiappori et al., *JPE*, 2002)
- More ambitious
- Potential to use cross national variation in institutions

# Final Comment:

- A (possibly) surprising aspect of the estimates is the high consumption shares of women
- But this result is consistent with findings based on other approaches to estimating these models
- Here it reflects the fact that women report a larger improvement in financial satisfaction as they move into cohabitation