Are Children Decisions-Makers within the Household

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Outline

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Motivation

- Children absent from most household behaviour models and when present, considered as « bystanders » instead of « actors ».

- Until recently, adults of a household were not even considered as distinct economic agents : unitary model.
  - Does not respect methodological individualism (each individual has his own preferences).

Motivation

- Cooperative (collective) models:
  - Closer to methodological individualism : each parent is an economic agent, but yet not children.
  - When treated, children are incorporated through the "caring" of their parents (Bourguignon 1999) or treated as household public good (Blundell, Chiappori, Meghir 2005).

Motivation

- Experiments show that « at age 7 children's choices about consumption goods show clear evidence of rationality » (Harbaugh, Krause and Berry, 2001). Tests based on GARP.

- They also show that children « display good bargaining skills as early as 7 years old » (Harbaugh, Krause and Liday, 2003). Tests based on ultimatum and dictator games.

Motivation

- Dangers of not recognizing children as economic agents:
  - Incomplete explanations of some behaviour (drop up from high school, child labor, food allocation within household)
  - Misleading intrahousehold welfare analysis (impact of minimum wage, welfare program conditional on living arrangements).
  - Inefficient estimates of household demands (ignore restrictions imposed by the righ number of decision-makers)

Motivation

- Recent (noncooperative) bargaining models incorporating children (Burton, Phipps and Curtis 2002; Lundberg, Romich and Tsang 2007; Hao, Hotz and Jin 2008):
  - Do not concern consumption (which is our concern here).
  - Do not provide rigourous econometric tests on whether the child is a decision-maker or not.

Objectives of the paper

- Determine whether children over a certain age and living with their parents are decision-makers within the household.
- Focus on decision-making process for couple living with a child aged 16 years and over (16 years: school leaving age in our sample; work and labor earnings become a credible possibility).
- Focus on consumption decisions (not labor supply).
- Data from U.K. Family Expenditure Surveys (FES).

Objectives of the paper

- Based on the collective model.
  - Supported by evidence in many circumstances (Vermeulen 2002, Chiappori and Donni 2006).
  - Provides information on the (minimal) number of intra-household decision-makers.
- Endogeneity of living arrangements: problem of selection bias.
  - Analysis by age group (16-21 and 21 and over). Conjecture that selection less important for 16-21.
- Analysis by gender.

Collective Model with Multi-person Households (reminder)

(Browning and Chiappori 1998; Chiappori and Ekeland 2006)

- **Assumption 1**: Each member i of the household, $i = 1, ..., S+1$, has her or his own preferences over the N consumption goods of the household. A member can be decision-maker or not.
- **Assumption 2**: The decision-making process leads to Pareto-efficient choices.
  - Collective rationality = assumptions 1 + 2 $\Longrightarrow$ household is on the Pareto frontier of the household utility possibility set.
- **Assumption 3** : The decision process depends on K distribution factors that are independent of individual preferences and that do not globally modify the household's budget constraint.
  - Distribution factors don't affect the Pareto frontier, only the location on it : they change the bargaining power of the household members.

Collective Model with Multi-person household

- Under collective rationality, there exist $S+1$ Pareto weights $\mu_1(\boldsymbol{\pi}, \mathbf{y}) \geq 0, \ldots, \mu_{S+1}(\boldsymbol{\pi}, \mathbf{y}) \geq 0$, with $\sum_{i=1}^{S+1} \mu_i = 1$, such that the consumption choices, $\mathbf{x}$, by the household are the solution to the following program:

$$\underset{\mathbf{x}}{MAX} \sum_{i=1}^{S+1} \mu_i(\boldsymbol{\pi}, \mathbf{y}) U_i(\mathbf{x}), \qquad \text{(P)}$$

subject to

$$\boldsymbol{\pi}'\mathbf{x} = 1.$$

- $\mu_i(\boldsymbol{\pi}, \mathbf{y})$ reflects the influence of member i's preferences in decision-making. N.B. Usually, it is assumed that $\mu_i = 0$ for children living with parents (children are not decision-makers). Not here.

Collective Model with Multi-person household

- The household social welfare function depends on prices (π) and distribution factors ($\mathbf{y}$) through their effects on the Pareto weights.
  - The Pareto weights are assumed to be continuous and twice-differentiable in π and $\mathbf{y}$.
  - The vector of structural demands on aggregate household goods can be written as: $\tilde{\xi}\left(\pi, \mu(\pi, \mathbf{y})\right)$.
  - But only observe : $\xi(\pi, \mathbf{y})$ since $\mu(\pi, \mathbf{y})$ is not observed.
- $\xi(\pi, \mathbf{y}) \equiv \tilde{\xi}\left(\pi, \mu(\pi, \mathbf{y})\right)$ can generate testable restrictions: 1) on the effects of prices, 2) the effects of distribution factors, and 3) on the relationship between the effects of prices and the effects of distribution factors.

Testable Restrictions

- **Restriction 1 on prices' effect (SR(S): symmetry + rank at most S)**

  If $\xi(\pi, \mathbf{y}) \equiv \tilde{\xi}(\pi, \mu(\pi, \mathbf{y}))$ then the Slutsky matrix associated with $\xi(\pi, \mathbf{y})$ and denoted by $\mathbf{S}(\mathbf{y}, \pi)$, can be decomposed as:

  $$\mathbf{S}(\mathbf{y}, \pi) = \Sigma(\mathbf{y}, \pi) + \mathbf{R}(\mathbf{y}, \pi),$$

  where Σ is a negative-definite symmetric matrix and $\mathbf{R}$ a matrix with $rank[\mathbf{R}] \leq S$

  Proof: Browning and Chiappori (1998)

- **Interpretation** : A compensated change in prices influences the demand for goods not only through the standard Slutsky effects but also through Pareto weights. Since there are at most S linearly independent Pareto weights, $rank[\mathbf{R}] \leq S$.

Testable Restrictions

- **Equivalent observable restriction on prices' effects**

  If restriction 1 is satisfied and we observe the antisymmetric matrix $\mathbf{M}(\mathbf{y}, \pi) \equiv \mathbf{S}(\mathbf{y}, \pi) - \mathbf{S}(\mathbf{y}, \pi)'$ (which is equal to $\mathbf{R}(\mathbf{y}, \pi) - \mathbf{R}'(\mathbf{y}, \pi)$), then $rank[\mathbf{M}] \leq 2S$: testable restriction.

  Proof : Browning and Chiappori (1998)

- Restriction binding only if number of goods N such that

$N > 2(S + 1)$. In our case, one needs at least 7 goods (we have 11).

Testable Restrictions

- **Corollary 1 on the minimal number of decision-makers**

  Under collective rationality, and based on prices effects, the household behaves as if there were $H = rank(\mathbf{M})/2$ (plus one) persons participating in the decision process.

  as if : There can be more decision-makers:

  - Some preferences may be identical.
  - Some members may have same Pareto weights.
  - Some Pareto weights may not depend on prices, only on distribution factors.

Testable Restrictions

- **Restriction 2 on the distribution factors' effects**

  If $\xi(\pi, \mathbf{y}) \equiv \tilde{\xi}(\pi, \mu(\pi, \mathbf{y}))$ and define $\mathbf{Y} \equiv \mathbf{D}_y \xi$ then $rank[\mathbf{Y}] \leq S$.

  Interpretation: The distribution factors impact on household demands through Pareto weights. Since there are at most S linearly independent Pareto weights, then $rank[\mathbf{Y}] \leq S$.

- Restriction binding only if $K > S$. In our case, needs at least three distribution factors.

- **Corollary 2 on the number of decision-makers**

  Under collective rationality, and based on factors distributions effects, the household behaves as if there were $H = rank(\mathbf{Y})$ (plus one) persons participating in the decision process.

Testable Restrictions

- **Restriction 3 on the link between prices and factor distributions effects**

  Assume that $\text{rank}(\mathbf{M}) = 2S$. Under collective rationality, $\mathbf{Y} \equiv \mathbf{D}_y \xi$ can be written as a linear combination of $\mathbf{M}$.

Proof : Chiappori and Ekeland (2006): generalization of Browning and Chiappori (1998).

- **Interpretation:** Variations in distribution factors and compensated variations in prices (purged from Slutsky effects) both impact on consumption choices through Pareto weights (decision process).

Data

- Series of cross-sectional data from the U.K. Family Expenditure Survey (1982-1993).
- Information at the household level on expenditures on non-durable and durable goods, income of each household member.
  - 11 categories of non durable goods
  - Prices observed monthly at the country level (12 years x 12 months = 144 different prices per good)
- Sample of 2745 households composed of three persons: husband, wife living with one child aged 16 years and over. Husbands aged less than 65, wives aged less than 60. Gross income positive for each person.
  - Data are censured : observations conditional on household arrangements

Econometric Approach

- Closely follow Browning and Chiappori (1998).
- Assume separability between non durable goods and durable goods (two-stage budgeting).
- Estimation done for non durable goods (conditionally on total expenditures on these goods).
- Three distribution factors (extension of Browning-Chiappori 1998):
  - log(husband's income),
  - log(wife's income)-log(husband's income);
  - log(child's income)-log(husband's income).
- Endogeneity of total expenditure on nondurable goods taken into account (also tests for exogeneity of distribution factors)

Econometric Approach

- System of demands QUAIDS (Quadratic Almost Ideal Demand System): Bank *et. al.* 1997, Blundell and Robin 1999, Browning *et al.* 2007.
  - allow flexible Engel's curves (rank 3 demand system):

$$\mathbf{w} = \boldsymbol{\alpha} + \Theta\mathbf{y} + \Gamma\mathbf{p} + \boldsymbol{\beta}\left(\ln(m) - a(\mathbf{p})\right) + \boldsymbol{\lambda}\frac{\left(\ln(m)-a(\mathbf{p})\right)^2}{b(\mathbf{p})} + \boldsymbol{\nu},$$

where $\mathbf{y}$:vector of distribution factors, $\mathbf{p}$: vector of log(prices), m: household's total expenditure on non-durable goods

- Inclusion of observable heterogeneity (vector $\mathbf{z}$):

$$a(\mathbf{p},\mathbf{z}) = \boldsymbol{\alpha}_0 + \boldsymbol{\alpha}(\mathbf{z})'\mathbf{p} + \frac{1}{2}\mathbf{p}'\Gamma\mathbf{p}$$

$$b(\mathbf{p},\mathbf{z}) = \exp(\boldsymbol{\beta}(\mathbf{z})'\mathbf{p}).$$

where $\mathbf{z}$: vector of control dummies (nine regional variables, three seasonal dummies, car and home ownership).

Econometric Approach

- Adding-up and homogeneity of degree zero in prices and expenditure are imposed (homogeneity not rejected).

- The model is estimated by Iterated Linear least Squares (Blundell and Robin 1999): efficient approach to estimate conditionally linear demand systems (here the model is linear, conditional on $a(\mathbf{p}, \mathbf{z})$ and $b(\mathbf{p}, \mathbf{z})$).

- Extented to account for the endogeneity of total expenditure on nondurable goods. Orthogonal decomposition of the error term $\boldsymbol{\nu}$ (control function):

  $$\boldsymbol{\nu} = \rho \mathbf{u} + \boldsymbol{\epsilon}.$$

  $\mathbf{u}$ estimated using the residuals of a regression of the log of nondurable expenditure on a set of instruments (age, age^2 and education of both spouses and child, gross income of wife and child, a yearly trend, and the *log* of the price index).

Table 1: Descriptive Statistics

Variable	Mean	Std error
Budget shares		
Food	0.287	0.168
Alcohol	0.063	0.086
Tobacco	0.056	0.078
Clothing	0.094	0.109
Leisure	0.036	0.072
Transportation	0.034	0.058
Service (domestic phone)	0.047	0.047
Restaurant	0.052	0.054
Personal goods (P.G.) (personal care)	0.057	0.078
Recreational goods (R.G.)	0.120	0.095
Distribution Factors		
$\log(Y_H)$	5.131	0.934
$\Delta \log(Y_{WH})$	-1.324	1.765
$\Delta \log(Y_{CF})$	-1.089	1.774
Household characteristics		
Log total expenditure	4.241	0.613
Quarter1	0.298	0.457
Quarter2	0.263	0.440
Quarter3	0.214	0.410
North	0.069	0.254
Yorks/Humerside	0.102	0.302
North West	0.115	0.319
East Midlands	0.079	0.270
West Midlands	0.104	0.305
East Anglia	0.039	0.194
Greater London	0.073	0.261
South East	0.190	0.392
South West	0.078	0.268
Car	0.832	0.374
House	0.489	0.500
Age husband	52.071	6.551
Age wife	49.449	5.812
Age child	20.952	4.131
Sex child 1=male	0.577	0.494
Education husband	10.425	2.188
Education wife	10.450	2.885
Education child	9.494	4.773
Sample size	2745	

Note : The amounts are expressed in sterling pounds.

Table 1: Parameter Estimates of the Demand System – Full Sample

Variable	Food	Alc.	Tobac.	Cloth.	Leisure	Trans.	Serv.	Rest.	P.G.	R.G.
					DISTRIBUTION FACTORS					
$\log(Y_H)$	0,011	-0,002	0,002	-0,002	-0,002	-0,002	0,000	0,002	0,001	-0,005
	(3,614)	(1,131)	(1,173)	(0,919)	(1,236)	(1,201)	(0,285)	(1,179)	(0,668)	(2,483)
$\Delta \log(Y_{WH})$	0,003	0,000	0,000	0,000	-0,002	-0,001	0,000	0,001	0,000	0,001
	(1,842)	(0,408)	(0,303)	(0,356)	(2,057)	(0,890)	(0,298)	(1,092)	(0,065)	(1,497)
$\Delta \log(Y_{CH})$	0,001	0,000	0,002	0,001	0,000	0,000	0,000	0,000	0,001	-0,003
	(0,382)	(0,088)	(2,109)	(0,568)	(0,212)	(0,433)	(0,120)	(0,090)	(0,959)	(3,629)
					PRICE VARIABLES					
Γ-Food	-0,527	-0,079	-0,072	-0,018	0,139	0,102	-0,113	0,004	0,062	0,199
	(5,190)	(1,276)	(1,396)	(0,249)	(2,644)	(2,293)	(3,079)	(0,093)	(0,996)	(3,085)
Γ-Alcohol	-0,069	-0,030	-0,059	0,001	0,010	0,032	-0,005	0,003	0,016	-0,044
	(1,808)	(1,270)	(3,031)	(0,031)	(0,484)	(1,876)	(0,364)	(0,163)	(0,675)	(1,812)
Γ-Tobacco	0,000	0,089	0,027	0,032	-0,013	-0,003	-0,141	0,002	0,060	0,003
	(0,006)	(4,048)	(1,438)	(1,263)	(0,721)	(0,196)	(10,849)	(0,111)	(2,723)	(0,148)
Γ-Clothing	0,101	0,052	0,026	0,006	-0,055	-0,027	0,024	0,025	0,018	-0,044
	(1,723)	(1,460)	(0,852)	(0,152)	(1,824)	(1,048)	(1,139)	(1,014)	(0,492)	(1,183)
Γ-Leisure	0,069	0,009	-0,019	0,034	-0,024	0,020	-0,025	0,010	0,013	-0,020
	(3,052)	(0,639)	(1,610)	(2,143)	(2,088)	(1,968)	(3,006)	(1,123)	(0,947)	(1,372)
Γ-Transportation	-1,120	-0,294	0,027	0,387	0,195	0,123	-0,093	0,101	-0,174	0,167
	(9,103)	(3,941)	(0,437)	(4,522)	(3,070)	(2,277)	(2,095)	(2,001)	(2,322)	(2,134)
Γ-Services	-2,645	0,087	-0,288	0,578	0,555	0,138	0,090	-0,048	0,282	0,186
	(7,403)	(0,402)	(1,578)	(2,323)	(3,006)	(0,882)	(0,698)	(0,325)	(1,295)	(0,818)
Γ-Restaurant	1,390	-0,516	-0,076	-0,615	-0,460	-0,162	0,262	-0,005	0,114	0,026
	(6,311)	(3,869)	(0,674)	(4,012)	(4,042)	(1,673)	(3,305)	(0,051)	(0,847)	(0,189)
Γ-Personal	1,230	0,556	0,269	-0,053	-0,085	-0,144	-0,186	-0,063	-0,068	-0,003
	(3,745)	(2,795)	(1,607)	(0,231)	(0,504)	(0,996)	(1,578)	(0,467)	(0,341)	(0,014)
Γ-Recreational	0,893	-0,146	0,114	-0,098	-0,157	-0,095	0,219	0,015	-0,364	-0,352
	(3,656)	(0,987)	(0,915)	(0,579)	(1,247)	(0,884)	(2,495)	(0,151)	(2,444)	(2,265)
					SPECIFICATION TESTS†					
Total Expend (Residual)	-0,131	0,009	-0,009	0,021	0,038	-0,004	-0,012	-0,005	-0,021	0,015
T-Stat.	(25,924)	(2,964)	(3,622)	(6,016)	(14,367)	(1,692)	(6,670)	(2,277)	(6,677)	(4,527)
Over-Ident. $\chi^2_{(13)}$	10,963	8,736	7,547	1,830	3,792	1,113	12,668	0,762	8,019	16,279

† The first line reports the parameter estimates of the residuals from an auxiliary regression of total expenditures on a series of instrumental variables. The second line reports the χ^2 statistics of the over-identification test of the instrumental variables.

Results

- Each distribution factor has a significant impact on at least two goods (specially food, tobacco, and recreational goods).
- Many coefficients of relative prices are significant.
- Ownership of a car or a house does not have significant impact on the consumption of nondurables (consistent with separability assumption).
- Quadratic term for the log of total expenditure: significant for all goods, except food and personal goods.
- Exogeneity of expenditure on nondurable goods rejected for 9 of the 10 demands.
- Joint test of over-identification and validity of instruments not rejected.

Results

- Sequential tests (starting with the most restrictive model).
- Tests based on prices (matrix $\mathbf{M}$) : Wald tests
  - Joint test of collective model with (as if) one decision-maker (rank($\mathbf{M}$) $=0$)) : unitary model
  - Rejected$\Longrightarrow$joint test of collective model with (as if) two decision-makers (rank($\mathbf{M}$) $=2$))
  - Rejected$\Longrightarrow$joint test of collective model with (as if) three decision-makers (rank($\mathbf{M}$) $=4$))
  - Rejected$\Longrightarrow$reject collective model
- Tests based on distribution factors (matrix Θ) :Kleibergen and Paap (2006) tests:
  - Similar approach based on rank of matrix Θ: 0, 1, 2, reject collective model.
- Tests based on prices and distribution factions: uses rank($\mathbf{M}|\Theta$).

Rank Tests

- Tests based on prices (matrix $\mathbf{M}$) :use Wald tests
  - Advantages
    - Allows to take into account of the antisymmetry of the matrix.
    - Do not have to estimate the model under the null.
  - disadvantage
    - Not invariant to algebrically equivalent parametrizations of the null (non-linear restrictions).
- Tests based on distribution factors (matrix Θ) : Kleibergen and Paap (2006) tests based on singular values of matrix.
  - Advantage
    - Invariant to algebrically equivalent parametrizations of the null.
- Tests based on prices and distribution factions: KP

Table 1: χ^2 Test Statistics

	Rank of M			Rank of Θ			Rank of $(M\|\Theta)$
	(Proposition 2)			(Proposition 3)			(Proposition 4)
(Rank)	0	2	4	0	1	2	4
(DF)	45	28	15	30	18	8	54
SAMPLE:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Complete	445.549	62.599	3.981	167.759	106.345	19.533	
	(0.000)	(0.000)	(0.998)	(0.000)	(0.000)	(0.012)	
Daughters	277.261	41.350	1.923	103.334	37.285	9.138	1.667
	(0.000)	(0.049)	(0.999)	(0.000)	(0.005)	(0.331)	(0.999)
Sons	221.508	27.261		124.588	97.011	34.794	
	(0.000)	(0.504)		(0.000)	(0.000)	(0.000)	
Children 16–21	298.235	49.132	2.135	130.334	92.474	7.843	2.012
	(0.000)	(0.008)	(0.999)	(0.000)	(0.000)	(0.449)	(0.999)
Children 22+	186.407	23.254		128.780	33.381	9.081	
	(0.000)	(0.720)		(0.000)	(0.015)	(0.336)	

† Probability under the null between parentheses.

Conclusion

- Households whose child is aged 16-21: behaviour consistent with collective rationality + as if three decision-makers

- Households with daughters (irrespective of their age): behaviour consistent with collective rationality + as if three decision-makers.

- Households whose child is at least 22 years of age: less convincing. Behaviour consistent with collective rationality + as if *at least* two decision-makers.

- Evidence for sons inconclusive. Collective rationality rejected when tests based on distribution factors.

- Important conclusion: incorrect to assume that teenagers (and daugthers) are not decision-makers.

Conclusion (extensions)

- Find age at which a child becomes a decision-maker within in the household.
- Check collective rationality + number of decision-makers for couples with several (more than one) children (or elderly). Is order of children important for bargaining power ?
- Application to polygamy (*e.g.*, Dauphin, Fortin, Lacroix 2007).
- Test for collective rationality with private goods or caring (and recover the sharing rules, if CR not rejected).
- Endogeneity of household arrangements.
- Tests on non-parametric demand systems (Haag *et al.* 2007)