

Revisiting the cost of children: theory and evidence from Ireland

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Motivation

- Goal is to infer sharing of resources in households using economic theory
- Hence original measure of (direct) child financial poverty
 - usual def: poor child = child in poor household
 - reconciliation with more direct measures of deprivation (Nolan and coauthors)
- Direct policy implications studied in previous (theoretical) work
 - commodity tax/subsidies versus child benefit (Bargain and Donni, 2008)
 - e.g., welfare impact of abolishing the VAT reduction on child clothing ?

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Introduction

- Intra-household sharing: usually no direct measures
 - child good is not everything
 - shared goods, public goods?
- Economic theory: more assumption on household rationality and individual preferences
 - empirically, use of exclusive goods to infer information on sharing
- State of the art in household modeling
 - so called 'collective model' (Chiappori, 1988)
 - assume Pareto efficiency of household decisions
 - no specific decision-making process assumed (Nash)
- The share of resource accruing to them is simply the cost of children
 - interpretation esp. if children are no decision maker
- So our work is therefore at the junction of these two literatures

Economic literature on cost of children

- 'Old' literature on children and equivalence scales
- Fundamental identification problem (Pollak and Wales, 1992)
 - analogy to cost of living / but price does not affect welfare directly
 - variation in family characteristic does / what is a household welfare index?
 - children provide direct welfare/ impossible to identify their cost
- Additional assumptions required, for instance Rothbarth (1954)
 - use of adult exclusive goods
 - formalized in Gronau (1991)
- Application for Ireland : E. Garvey and coauthors
- **But:** no economies of scale in the household

Literature on household models

- Recently refined versions of collective models
 - domestic production, public goods, etc.
- Two recent influential papers:
 - complete identification of the sharing rule (use of singles)
 - accounting for scale economies
- Browning, Chiappori, Lewbel (2006, BCL): indifference scales
- Lewbel and Pendakur (2008, LP): no need for price variation
 - of interest if little spatial variation and limited time variation, as here
- **But:** not much about children in the collective model literature
 - Blundell et al. (2005), Bourguignon (1999), Dauphin et al. (2008)

This contribution

- Collective model for couples with children
 - whether children have 'power' or not does not matter
 - young children (<16 ; in first attempt: <5)
- We model resource sharing (between wife, husband and child) and scale economies
- Identification relies on:
 - single individuals (as in BCL and LP)
 - adult-specific goods (Rothbarth)
- Empirical application on 2005 Irish household budget survey

Some notations

- households: $n = 1$ (single), 2 (couple), 3 (couple + a child)
- individuals: $j = 1$ (male), 2 (female), 3 (child)
- goods: $k = 1, \dots, K$
- total **log** household expenditure x
- resource share of person j (if $n > 1$): $\eta_{j,n}$

- **log individual** expenditure:

$$\phi_j = x \text{ if } n = 1$$

$$\phi_j = \log \eta_{j,n} + x \text{ if } n > 1$$

- "basic" budget share function for good k : $w_j^k(p, \phi_j)$
- three stages: (1) price variation, (2) no price variation, (3) identification

Economies of scale

- Representation from Barten (1964)
- Price of good k : p^k
- Scale economies parameter: $A^k < 1$
 - ex: expenditure $p^k q^k$, 'true' consumption $g^k = \frac{3}{2} q^k$
 - expenditure on 'true' consumption: g^k
 - that is: implicit price of $\frac{2}{3} p^k$
- Shadow price of the good: $A^k p^k$
 - polar case: public good, i.e. $A^k = 1/2$ for a couple
- Indirect utility function: $V_j(Ap, \phi_j)$

Independence of Base

- Convenient assumption in Lewbel and and Pendakur (2008):

Assumption 1: *IB restriction*

$$V_j(Ap, \phi_j) = V_j(p, \frac{\phi_j}{S_{j,n}(A, p)})$$

- Price changes due to Barten terms summarized by a single-valued function $S_{j,n}(A, p)$
 - deflator measures the cost savings experienced by person j resulting from scale economies
 - gains of living with others summarized by lower cost-of-living term
 - Barten parameters are IB and so is this deflator
 - IB restricts how indirect utility responds to changes in prices

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Model (price variation)

- Write Barten and deflator in **log** terms for convenience:

$$V_j(\alpha + p, \phi_j) = V_j(p, \phi_j - \log s_{j,n}(\alpha, p))$$

- From Roy's identity, easy to show that :

$$\omega_{j,n}^k(\alpha + p, \phi_j) = d_{j,n}^k(\alpha, p) + w_j^k(p, \phi_j - \log s_{j,n}(\alpha, p))$$

With

$$d_j^k(\alpha, p) = \frac{\partial \log s_{j,n}(\alpha, p)}{\partial p^k}$$

l.h.s. = individual facing Barten prices (=in household)

r.h.s = basic budget share function w_j^k of individual with s -adjusted income

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Model (cross section)

No price variation (cross-section)

- Assume all households face the same price vector: p taken out
- Barten scale economies replaced by demographic characteristics z
- We also replace ϕ_j by its expression
- This results in:

$$\omega_{j,n}^k(x + \log \eta_{j,n}(z), z) = d_{j,n}^k(z_j) + w_j^k(x - \log l_{j,n}(z), z_j),$$

with

$$\log l_{j,n}(z) = \log s_{j,n}(z_j) - \log \eta_{j,n}(z)$$

- $l_{j,n}(z)$ is an *indifference scale*:

$$V_j(\alpha p, \log \eta_{j,n} + x) = V_j(p, \log l_{j,n} + x)$$

- circumvent the fundamental identification problem of equivalence scales

Collective model

- Assumed efficiency, and separability in the household welfare function
- Two-stage decision-making process: (1) sharing rule, (2) individual optimization
- Individual resources: $\eta_{j,n} \exp(x)$
- Individual demand on good k :

$$\eta_{j,n} \exp(x) \times \omega_{j,n}^k(x + \log \eta_{j,n}(z), z)$$

- Household expenditures on good k = sum of individual expenditures
- Hence household budget share:

$$\begin{aligned} W_n^k(x, z) &= \sum_{j=1}^n \eta_{j,n}(z) \omega_{j,n}^k(x + \log \eta_{j,n}(z), z) \\ &= \sum_{j=1}^n \eta_{j,n}(z) \left[d_{j,n}^k(z_j) + w_j^k(x - \log l_{j,n}(z), z_j) \right]. \end{aligned}$$

Identification

- Single individuals ($n = 1$): neither sharing nor scale economies:

$$W_1^k(x, \mathbf{z}) = w_j^k(x, \mathbf{z}_j) + \varepsilon_1^k, \quad \text{for } j = 1, 2$$

- Childless couple ($n = 2$):

$$W_2^k(x, \mathbf{z}) = \sum_{j=1}^2 \eta_{j,2}(\mathbf{z}) \left[d_{j,2}^k(\mathbf{z}_j) + w_j^k(x - \log l_{j,2}(\mathbf{z}), \mathbf{z}_j) \right] + \varepsilon_2^k.$$

- Basic share $w_j^k(\cdot, \mathbf{z}_j)$ known from singles
- Take derivative w.r.t x :

$$\nabla_x W_2^k(x, \mathbf{z}) = \sum_{j=1}^2 \eta_{j,2}(\mathbf{z}) \nabla_x w_j^k(x - \log l_{j,2}(\mathbf{z}), \mathbf{z}_j),$$

- Functions $\eta_{1,2}(\mathbf{z})$ and $l_{j,2}(\mathbf{z})$ generically identified (requires enough nonlinearity)

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The model: identification

- Couple with one child ($n = 3$):

$$W_3^k(x, \mathbf{z}) = \sum_{j=1}^3 \eta_{j,3}(\mathbf{z}) \left[d_{j,3}^k(\mathbf{z}_j) + w_j^k (x - \log l_{j,3}(\mathbf{z}), \mathbf{z}_j) \right] + \varepsilon_3^k.$$

- no observation of the "basic" budget share functions for children
- equivalence scale terms $d_{3,3}^k(\mathbf{z}_3)$ and $\log s_{3,3}(\mathbf{z})$ meaningless and set to 0 (normalization)

Assumption 2: *existence of an adult-exclusive good (Rothbarth)*

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The model: identification

- Suppose that good j is an adult-specific good:

$$W_3^j(x, \mathbf{z}) = \sum_{j=1}^2 \eta_{j,3}(\mathbf{z}) \left[d_{j,3}^j(\mathbf{z}_j) + w_j^j (x - \log l_{j,3}(\mathbf{z}), \mathbf{z}_j) \right] + \varepsilon_3^j.$$

- Then functions $l_{j,3}(\mathbf{z})$ and $\eta_{j,3}(\mathbf{z})$ (for $j = 1, 2$) can be identified according to the previous methodology
- Resource share of the child:

$$\eta_{3,3}(\mathbf{z}) = 1 - \sum_{j=1}^2 \eta_{j,3}(\mathbf{z})$$

- From this, identify his/her budget share
- More than 1 child ($n > 3$), requires

Assumption 3: *two children with same \mathbf{z}_j , whatever their sibling rank, have the same utility functions and hence the same basic share function w_j^k*

Empirical implementation

- Sample: single male, female, childless couples, couples with one child
- Data from the 2005 Irish household budget survey
- Workers, aged 25-64, children < 5 (temporary), no other household members
- Iterated SURE estimation of the complete system of household Engel curves
- Goods: food, vices, adult clothing (differentiate male and female), transport, leisure, pers. g&s, household operation, child good (strengthen identification)
 - shares sum up to 1, so system of $N-1$ goods
 - omitted good is housing

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Empirical implementation

- Parameterization that balances flexibility and empirical tractability

- "Basic" budget share function:

$$w_j^k(\phi, \mathbf{z}_j) = a_j^{k0} + \mathbf{a}_j^{k'} \mathbf{z}_j + (\phi - \mathbf{e}_j' \mathbf{z}_j) b_j^k + (\phi - \mathbf{e}_j' \mathbf{z}_j)^2 c_j^k \quad \text{for } j = 1, 2 \text{ and } k = 1, \dots, K-1,$$

for a given level of log individual expenditures ϕ

- Parameters are gender specific but do not depend on the demographic type n
 - e.g. the "basic" budget share functions are the same for single women and for women living in a couple
- Demographics \mathbf{z}_j affecting preferences (i.e. translate and deflate the log expenditure) and scale economies (deflator)
 - male and female age and education, a dummy for car ownership and one for urban/rural.

- Resource shares:

$$\eta_{j,n}(\mathbf{z}) = \frac{\exp(\boldsymbol{\phi}'_{j,n}\mathbf{z})}{\sum_{j=1}^n \exp(\boldsymbol{\phi}'_{j,n}\mathbf{z})},$$

- Log scale function that translates expenditure within the basic budget shares:

$$\log s_{j,n}(\mathbf{z}_j) = \sigma_{j,n}^0 + \boldsymbol{\sigma}'_{j,n}\mathbf{z}_j,$$

where $\boldsymbol{\sigma}_{j,n}$ is a vector of parameters. In principle, it can vary with all the variables used in preferences (vector \mathbf{z}_j).

- Scale function that translates the basic budget shares $d_{j,n}^k(\mathbf{z}_j)$

$$d_{j,n}^k(\mathbf{z}_j) = d_{j,n}^{0k}.$$

- price effects typically difficult to measure, so this price elasticity kept constant

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Empirical implementation

- Correlation between ε_n^k in budget share function and the log total expenditure
- Correction by augmenting the specification with the errors $\hat{v}_{n,x}$ and \hat{v}_{n,x^2} from first-step estimations of x and x^2 on exogenous variables and instruments
 - See Blundell and Robin, 1999, 2000, Banks et al, 1997
 - instr = log household gross income and its square
- High sensitivity to the choice of instruments, in a similar way as in GMM estimations
- Hereafter, economies of scale and sharing rules are calculated at sample means

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Empirical implementation: selection

Sample selection - HBS 2005

no of obs	6884	100%
keep if head (and potential partner) aged 25-64 @	4832	70%
keep couples (with 0-3 children) or childless singles"	2931	43%
keep if neither head nor potential partner is retired	2804	41%
keep if head full time workers* or singf head inactive (87,94)/active(99,05)	2291	33%
keep if partner inactive (87 and 94) / active (99, 05)**	1642	24%

* *employee or selfemp*

** *employee or selfemp, full or part time*

@ *there is indeed 48% of households which comprise more than 3 children or more than 2 adults*

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Empirical implementation: descr. statistics

	Single women	Single men	Childless couples	Couples & 1 child	Couples & 2 children
Age (head)	45.2 (9.9)	43.8 (10.7)	42.4 (11.6)	38.0 (7.9)	40.3 (6.9)
Years of education (head)	15.5 (3.5)	14.4 (3.4)	14.6 (3.6)	14.6 (3.1)	14.1 (2.8)
Living in city	0.86 (0.34)	0.72 (0.45)	0.69 (0.46)	0.67 (0.47)	0.62 (0.49)
Tenant	0.15 (0.35)	0.16 (0.36)	0.12 (0.32)	0.06 (0.25)	0.07 (0.25)
Have a car	0.84 (0.37)	0.82 (0.38)	0.95 (0.21)	0.97 (0.18)	0.99 (0.09)
Wage ratio (wf/wm)	n.a.	n.a.	0.90 (0.50)	0.93 (0.52)	0.97 (0.58)
Total expenditure (EUR/week)	477 (235)	412 (220)	700 (305)	770 (306)	824 (327)

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Empirical implementation: descr. statistics

Budget shares

Food	0.18 (0.08)	0.21 (0.09)	0.22 (0.08)	0.22 (0.07)	0.24 (0.08)
Vices	0.06 (0.06)	0.10 (0.10)	0.07 (0.06)	0.07 (0.06)	0.05 (0.05)
Men's clothing	0.00 (0.00)	0.03 (0.08)	0.02 (0.05)	0.01 (0.03)	0.01 (0.03)
Women's clothing	0.06 (0.09)	0.00 (0.00)	0.03 (0.05)	0.03 (0.04)	0.03 (0.04)
Child's clothing	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.02 (0.02)	0.03 (0.03)
Transport	0.12 (0.09)	0.13 (0.10)	0.14 (0.08)	0.13 (0.08)	0.13 (0.07)
Leisure	0.14 (0.08)	0.15 (0.11)	0.16 (0.10)	0.14 (0.08)	0.16 (0.10)
Household operations	0.10 (0.07)	0.09 (0.08)	0.10 (0.07)	0.11 (0.07)	0.09 (0.05)
Pers. goods & services	0.06 (0.07)	0.02 (0.03)	0.04 (0.05)	0.12 (0.10)	0.12 (0.11)
Housing	0.05 (0.04)	0.07 (0.06)	0.05 (0.03)	0.05 (0.03)	0.05 (0.03)
Sample size	213	191	369	250	343

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Empirical results: scale economies

Models		A	B	C	D
Dummies for car holders and urbaners in preference translator		Y			
in both preference translator and deflator			Y	Y	Y
Account for scale economies (C= Rothbarth)		Y	Y		Y
Endogeneity of log expenditure (quadratic)					Y
Economies of scale	men, no child	0.76 (0.16)	0.63 (0.15)	1.00	0.43 (0.13)
	men, 1 child	0.69 (0.20)	0.63 (0.19)	1.00	0.53 (0.17)
	women, no child	0.55 (0.12)	0.61 (0.13)	1.00	0.61 (0.16)
	women, 1 child	0.48 (0.16)	0.56 (0.16)	1.00	0.53 (0.17)

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Empirical results: sharing

Models		A	B	C	D
Dummies for car holders and urbaners in preference translator		Y			
in both preference translator and deflator			Y	Y	Y
Account for scale economics (C= Rothbarth)		Y	Y		Y
Endogeneity of log expenditure (quadratic)					Y
Sharing rule	wife's share (no child)	0.51 (0.07)	0.55 (0.06)	0.54 (0.04)	0.63 (0.07)
	wife's share (with girl)	0.41 (0.06)	0.45 (0.07)	0.45 (0.04)	0.51 (0.08)
	wife's share (with boy)	0.39 (0.06)	0.44 (0.06)	0.45 (0.04)	0.48 (0.08)
	girl's share	0.22 (0.07)	0.20 (0.07)	0.18 (0.04)	0.18 (0.07)
	boy's share	0.20 (0.06)	0.19 (0.06)	0.17 (0.04)	0.23 (0.08)

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Empirical results: some coefficients

Models	A	B	C	D
Dummies for car holders and urbaners in preference translator	Y			
in both preference translator and deflator		Y	Y	Y
Account for scale economics (C= Rothbarth)	Y	Y		Y
Endogeneity of log expenditure (quadratic)				Y
Wage ratio on husband's share	-0.066 (0.047)	-0.070 (0.050)	-0.099 (0.063)	-0.012 (0.013)
Wage ratio on child's share	0.026 (0.053)	0.030 (0.050)	0.010 (0.052)	0.084 * (0.030)
Girl dummy on child's share	0.157 (0.110)	0.066 (0.090)	0.068 (0.088)	-0.279 * (0.127)
Number of parameters	161	175	155	237

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Empirical results: scale economies

Results from Garvey (2007)

Engel	girl	median	0.13
Engel	boy	median	0.23
Engel	urban	median	0.24
Engel	rural	median	0.17
Rothbarth	girl	25%	0.12
Rothbarth	girl	median	0.12
Rothbarth	girl	75%	0.11
Rothbarth	boy	25%	0.15
Rothbarth	boy	median	0.16
Rothbarth	boy	75%	0.18

Note: all tables report the resource share of children aged 0-4. Engel equivalence scales are based on expenditures on food while Rothbarth scales are identified on adult clothing. Model C in the present study is similar to the Rothbarth's approach while model B incorporates scale economies. Garvey (2007) makes use of the the HBS 1994 and 1999 while we use HBS 2004/5.

Results from the present study

model C	girl	mean	0.18	(0.04)
model C	boy	mean	0.17	(0.04)
model C	urban	mean	0.17	(0.04)
model C	rural	mean	0.18	(0.04)
model C*	girl	25%	0.13	(0.03)
model C*	girl	median	0.15	(0.04)
model C*	girl	75%	0.18	(0.04)
model C*	boy	25%	0.12	(0.03)
model C*	boy	median	0.14	(0.03)
model C*	boy	75%	0.17	(0.04)
model B*	girl	25%	0.14	(0.05)
model B*	girl	median	0.16	(0.06)
model B*	girl	75%	0.18	(0.07)
model B*	boy	25%	0.13	(0.05)
model B*	boy	median	0.15	(0.06)
model B*	boy	75%	0.17	(0.06)

* sharing rule varies quadratically with gross income

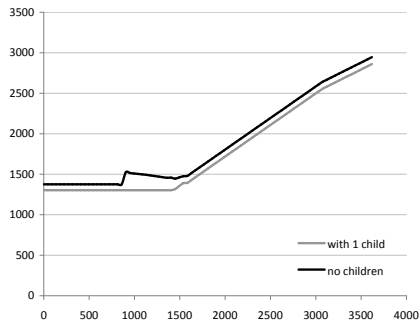
Next steps

- Data issue with older children
- Role of the correction for endogeneity of total expenditure (Blundell and Robin ,1999)
- Instruments to improve identification
- Introduce labor supply (conditional demand system) → child poverty
- Link to policy:
 - actual 'horizontal' redistribution
 - tax/subsidy on child goods versus cash transfer

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[Link to policies](#)

Budget constraints (1 earner couple)



implicit child cost (childless couple=1)

