Sixth winter school on inequality and social welfare theory

Measuring Intra-Household Inequality

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Alba di Canazei, January 10-13, 2011

Motivation

Neutrality of intra-household distribution

of income, consumption, or welfare

is generally (implicitly) assumed

in applied welfare analysis

Ex 1 : Welfare impact of Tax and Transfers Policies in France

- Minimum income support (RMI) is joint

- Welfare to work benefit (Prime pour l'emploi) goes to the individual

- Income taxation is joint / individual depending on marital status of the couple

- Unemployment insurance is individual

- Child care subsidies is joint (APE)

- public pensions are mostly individual but those destinated to the poorest are joint (Min. vieillesse)

Ex 2 : Social welfare theory

Individual utilities aggregated in a SWF

-> Inequality or welfare indices

-> Poverty lines

What about families?

-> unitary view: SWF of the family included in the SWF. This affects individual weigths

A Basic Intuition:

if we assume **intra-household equality**, the HH can be the unit of analysis…

Ex 2 : Social welfare theory

… Some kind of welfare analysis can be implemented on an individual basis using household data without observing intra-household inequality.

There exist weaker restrictions than intra-household equality

→ See Eugenio Peluso presentation

Ex 2 : Social welfare theory

More precisely: (Peluso and Trannoy, JET, 2007)
Generalized Lorenz Analysis is preserved from HH to individual case iff the « intra-household sharing rule » is concave wrt HH income.

For Relative Lorenz Analysis, stronger conditions, such as linearity of the sharing rule, are needed.

For decomposing inequality indices in between & within inequality, the sharing rule must be known.

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Child poverty: it is not obvious that a child living in a rich household does not suffer from deprivation.

Domestic violence: This is an extreme shape of intra-household inequality. In general, one family member can be discriminated within his own family

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Why intra-household inequality has been ignored for so long by economists?

- **Philosophical reason**: family sphere was private and outside the field before Becker

- **Practical perspective**: unobservability of the « black box »: what happens inside the household?

- **Absence of interest in gender topics**: families are largely made of heterosexual couples.

Apart from that is there a theoretical reason to consider intra-household inequality ?

…I think yes… some conjectures…

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Conj. 1/ Intertemporal analysis of poverty/inequality

« Family Life cycle »: household characteristic (family status changes over time, as well as people who compose the household…)

Generally, …& more frequently

Life length of HH of type j < life length of individuals

Apart from that is there a theoretical reason to consider intra-household inequality ?

…I think yes… some conjectures…

Conj. 2/ Endogenize household characteristics in an heterogenous households welfare analysis

Taking into account : why do people divorce, form union, remarry, become single parents etc.?
Requires an adequate measure of individual welfare

FRAMEWORK

Framework

Use the Intra-household Sharing-Rule concept
(see R. Rees presentation)

Define SWF for the household (with/without prices) with separable individual utilities
→ **Derive Demand functions for the HH**

Representation of HH behaviour in a decentralized way where each member maximizes his own utility subject to his/her share of HH income.

Framework

« Collective » version (Chiappori shape for the SWF)
No intra-household externality
« Material well-being » view

$$MAX_{X_f,X_m} W\left(U_f\left(X_f\right), U_m\left(X_m\right)\right) = \lambda(.)U_f\left(X_f\right) + \left(1-\lambda\left(.\right)\right)U_m\left(X_m\right)$$
$$\text{s.t. } P(X_f + X_m) \leq I$$
$$\lambda(P, I_f, I_m, \text{distribution factors})$$

Decentralisation → sharing rule

$$\max U_i\left(X_i\right)$$
$$\text{s.t. } PX_i \leq \phi_i, \text{ for } i = f,m \qquad \text{where} \qquad \phi_f + \phi_m = I$$

Indirect SWF $W\left(V_f\left(P,\phi_f\right), V_m\left(P,\phi_m\right)\right)$

Framework

No intra-household externality - « Welfare » view

$$MAX_{L_f, L_m}\ \lambda(.)U_f(X_f, L_f) + (1-\lambda(.))U_m(X_m, L_m)$$

$$\text{s.t. } P(X_f + X_m) + w_f L_f + w_m L_m \leq I$$

$$\text{s.t. } L_i \leq T; L_i \geq 0$$

Interior solution → Decentralisation → sharing rule

$$MAX\ U_i(X_i, L_i)$$

$$\text{s.t. } PX_i + w_i L_i \leq \phi_i$$

Same principle

Now Φ is the share of HH full income I

MEASURING METHODS FOR Φ (toolbox)

1) **Direct survey evidence approach**
2) **Using HH Demand with Exclusive goods**
   - → Parenthesis
   - → A « Naïve » demand approach
   - → Semi parametric approach with fix prices
   - → Overidentifying restrictions
   - → Within estimation
3) **Controlling for economies of scale and/or externalities**
   - → « Easy » approach
   - → Non-structural – semi-parametric control
   - → Structural and semi-parametric control with prices

1) Direct survey evidence

Material well-being view: the easiest way
Just observe prices, individual demands, and sum-up !

→ Bonke and Browning (2006) work on a unique data :
DHES 1000 households
Intra-household consumption sharing

Specific Survey design Principles:
- Standard expenditure survey with consumption diaries
- Every HH member fill in the questionnaire
- **For whom** each item was bought question

1) Direct survey evidence

The « TO WHOM question » answers:

« mainly for her » ,« mainly for him », « for the household », « for the children », « for someone else »

→ allows assigning private consumption within the family $\Phi_i = \Sigma_{j=1}^{J} p_i^j X_i^j$

« who consumes what in which quantities »

Direct observation of Xf and Xm

Compare female and male share of total HH expenditures

2) MEASURING THE SHARE USING HH DEMAND AND EXCLUSIVE GOODS (NO INTRA-HH EXTERNALITY … FOR THE MOMENT)

2) Using HH Demand and Exclusive goods

Back to the black box problem…. HH Demand is observed

→ **Assume/Find « exclusive type of goods »**
Assignable (we know who consumes what because of the characteristics of the good). Private & No externality

Examples:
Calories intake (Haddad and Kanbur EJ 1990)
Clothes (Browning and al. JPE 1994; Couprie and al. JPUB 2010)
Leisure time (many references …)

2) Using HH Demand and Exclusive goods

PARENTHESIS

Identification of the derivatives of the sharing rule is achieved non parametrically see Chiappori and Ekeland

widespread case since Chiappori 1992
Lf and Lm the exclusive goods observed.
Xf and Xm private (but unobserved!) consumption.

Φ' can be obtained as a function of derivatives on the observed demand of exclusive goods Lf and Lm.

2) Using HH Demand and Exclusive goods:

THE « NAIVE » DEMAND APPROACH

Assumption: same individual utility function if single or in couple, one HH member, one exclusive good. Simply:

$$L_i\left(W_i^s, P, \Phi_t^s\right) \text{ where } i = f \text{ or } m \text{ and } s = \text{family status}, \Phi_i^s = I_i^s$$

Then shape for the sharing rule: condition on heterogeneity (depends on W, P, preference heterogeneity and distribution factors)

Identification « between » … critics !!!! (Bourguignon et al. 1994, Lise and Seitz (2010),…)

2) Using HH Demand and Exclusive goods:

A SEMI PARAMETRIC APPROACH, FIX PRICES

(Couprie, Peluso, Trannoy - JPUB 2010)

Assumption: same income effect in Engel curves : « Li() »

Engel curve for a single individual

$$L_i = L_i\left(I_i\right) + X\beta + \varepsilon \ (+ \text{ endogeneity, monotonicity})$$

Engel curve for couple (conditionned by determinants of the power balance)

$$L_i^c = L_i\left(\Phi\left(I \text{ HH income}, \text{distribution factors}\right)\right) + X\beta^c + \varepsilon^c$$

Prediction based on inverting the non parametric part

$$\Phi_i = L_i^{-1}\left(L_i^c - X\beta - \varepsilon\right)$$

Engel Curve singles

Exclusive consump. couple

Controlling for shifting Engel curves due to obs & unobs. heterogeneity

➡ Simulation Bootstrap

2) Using HH Demand and Exclusive goods:

OVERIDENTIFYING RESTRICTIONS

Identity Assumption applied to all HH members (male and female for example)

parametric

Statistically testable overidentifying restriction derived from $\Sigma_{i=1}^{n}\Phi_i = I\ (\text{HH income})$

non-param

Same condition allow prediction errors imputation for the sharing rule… and calculate confidence intervals for the sharing rule

Even though the assumption is strong, there remains a possibility of inference

2) Using HH Demand and Exclusive goods:

WITHIN IDENTIFICATION

(Couprie, EJ 2007)

Same Assumption : identity of preferences accross marital status but **applied to the same individuals** accross time

➡ Time-use panel → adequate welfare measure

➡ Answer to the selection bias critique

Family status changes are predetermined
Income Endogeneity instrumented using past incomes

2) Using HH Demand and Exclusive goods:

As you can see… these methods of measure of the share remain imperfect…

… is no figure better than imprecise estimates ?

Improvements & tests are possible

Lots of things to do in this field:
extension of the welfare analysis to time-use, to multiple decision-makers, child well-being, non parametric etc…

-> & proper control of economies of scales, externalities of consumption is necessary

3) CONTROLLING FOR THE ECONOMIES OF SCALE / EXTERNALITIES

3) Controlling for economies of scale and/or externalities (within HH)

THE « EASY » APPROACH

Widespread assumption: hicksian separability between consumptions and intra-HH public good(s) D

$U_i\left(X_i, L_i; D\right)$ such that $MRS^i_{X,L}$ does not depend on D

➡ "2-step budgeting" approach at the HH level

➡ 2nd-step sharing rule is overall sharing rule

Practically Just remove public consumption (in term of good or time) from household expenditures) and care for endogeneity problem

BUT… rejected by the data (Donni, 2009)

3) Controlling for economies of scale and/or externalities (within HH)

A NON STRUCTURAL APPROACH (Couprie et al. JPUB 2010)

$$y_{ip} = \alpha g(Y_i) + f_p(Y_i^*)$$

Individual income

public expend.

private consump. of the 'poorest'

couple private expenditures $\alpha \in \left[\frac{1}{2}, 1\right]$

Degree of publicness (no need of a pure public good).

Non structural specification

The sharing rule approach

- Each household contains a *dominated* and a *dominant* type.
- Reduced model: two sharing functions
  - $f_g(Y)$ Public sharing function $0 \leq f'_g(Y) \leq 1$

    $Y - f_g(Y) = \tilde{y}$ total expenditure for private goods
  - $f_p(\tilde{y})$ Private sharing function

How to define "individualized incomes"?

- We assume

$$y_p = af_g(Y) + f_p(\tilde{y})$$

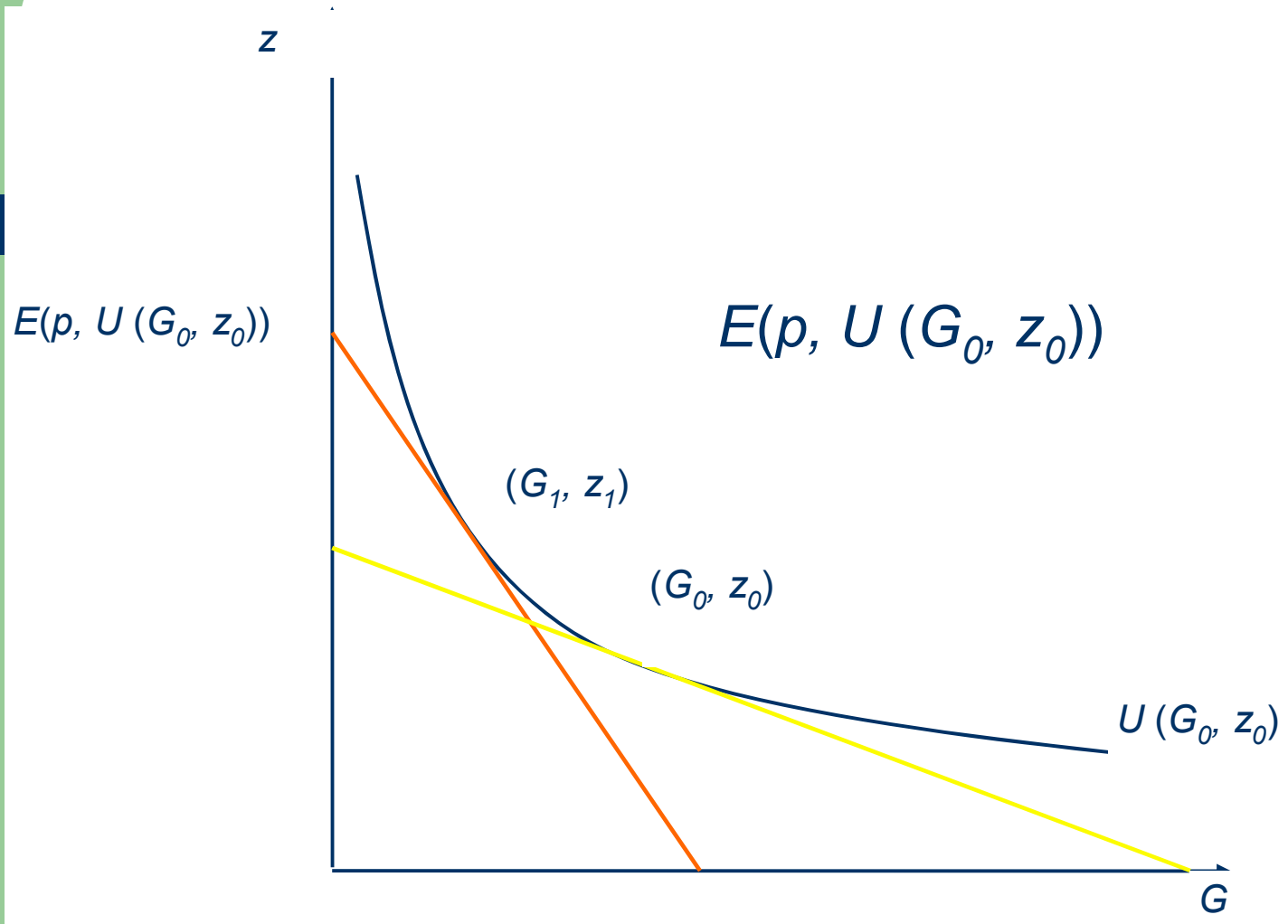
$$y_r = af_g(Y) + f_r(\tilde{y})$$

With $\frac{1}{2} \leq a \leq 1$

If $a = \frac{1}{2}$ ➔ Brennan's definition

If $a = 1$ ➔ Maximum expenditure for a single in order to buy the same bundle consumed living in couple.

Microfounded: The “individual equivalent” income



The “individualized income: alpha=1”

$pG_0 + z_0$

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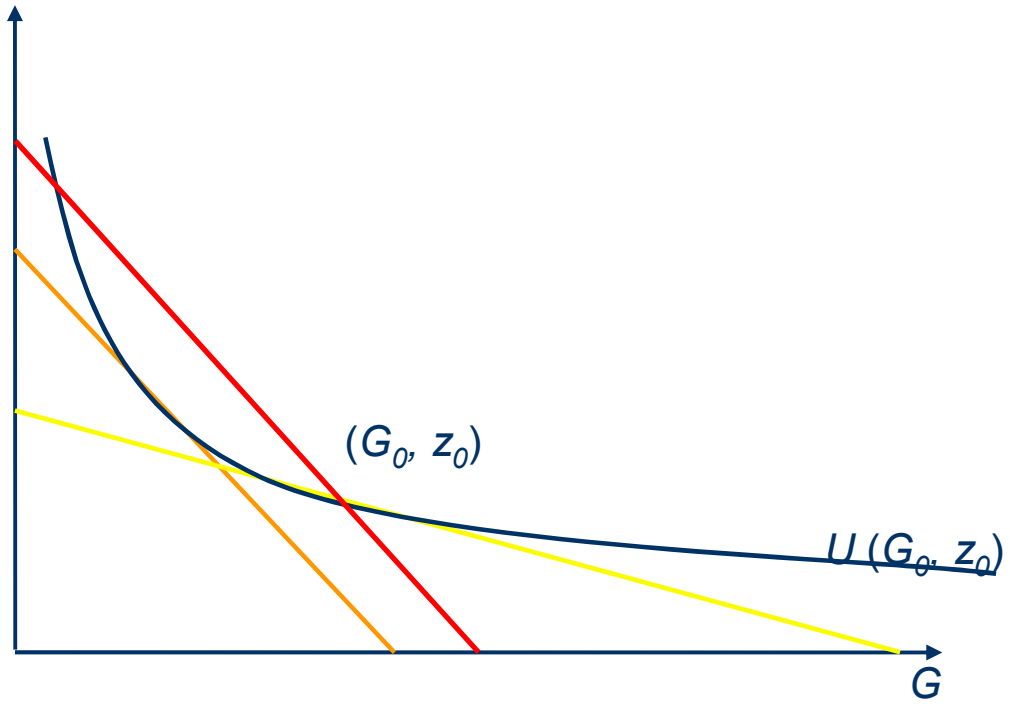
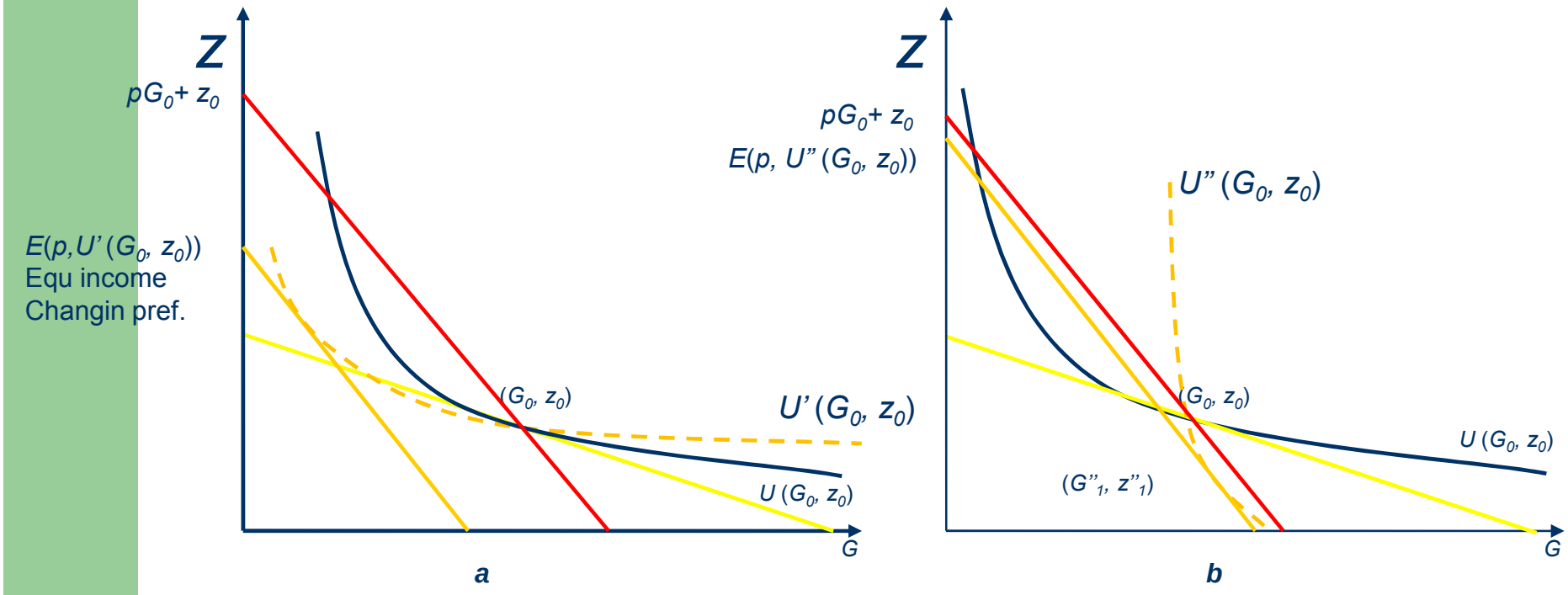
$E(p, U(G0, z0))$
for given U



Individualized income and preference heterogeneity



$pG_0 + z_0 = Max\,(E(p, Us\,(G_0, z_0))$, for any *Us* *quasi-concave*

3) Controlling for economies of scale and/or externalities (within HH)

A NON STRUCTURAL APPROACH (Browning et al. BCL 2009)

- Material welfare view only.
- Parametric demand system for the household (AIDS)
- Specification of a sharing rule
- Identity of preferences (conditional on obs. heterogeneity) across marital status
- Consumption externalities of any shape controlled using a transformation matrix:

3) Controlling for economies of scale and/or externalities (within HH)

STRUCTURAL APPROACH (Browning et al. BCL 2009)

$$\max_{x^f, x^m, z} \mu(p/y)U^f(x^f) + U^m(x^m)$$

« private good equivalent consumption »

$$\text{subject to } x = x^f + x^m$$

« obs. hh. Private Good Consump. » → $z = F(x)$ ← Function that could represent - Externalities of various shapes

$$p'z = y$$ ← Budget constraint

NOW SOME RESULTS

Some Results : Full-information. Material well-being. DK. (Browning and Bonke, 2006)

	For whom				
Good	Household	Husband	Wife	Children	Other
Food at home	79.3	3.5	2.9	4.2	1.1
Vices	53.6	24.8	12.8	4.2	3.1
Clothing	6.6	16.7	34.8	25.1	15.7
Household services	75.7	5.6	5.1	3.6	7.3
Transportation	62.2	18.1	14.2	3.4	0.6
Recreation	48.2	13.2	10.8	14.0	12.2
Personal services	33.1	11.6	33.9	13.3	6.7
Total share	57.3	13.7	14.3	9.5	5.2
Total (DKK)	67,888	16,497	17,282	12,429	6,650
Total (Euro)	9,052	2,200	2,304	1,657	887

The first eight rows give the percentage of the expenditure on the good that is spent by the recipient in the column heading.

Density of female share of private HH expenditures Full info, material well-being. DK. (Browning and Bonke, 2006)

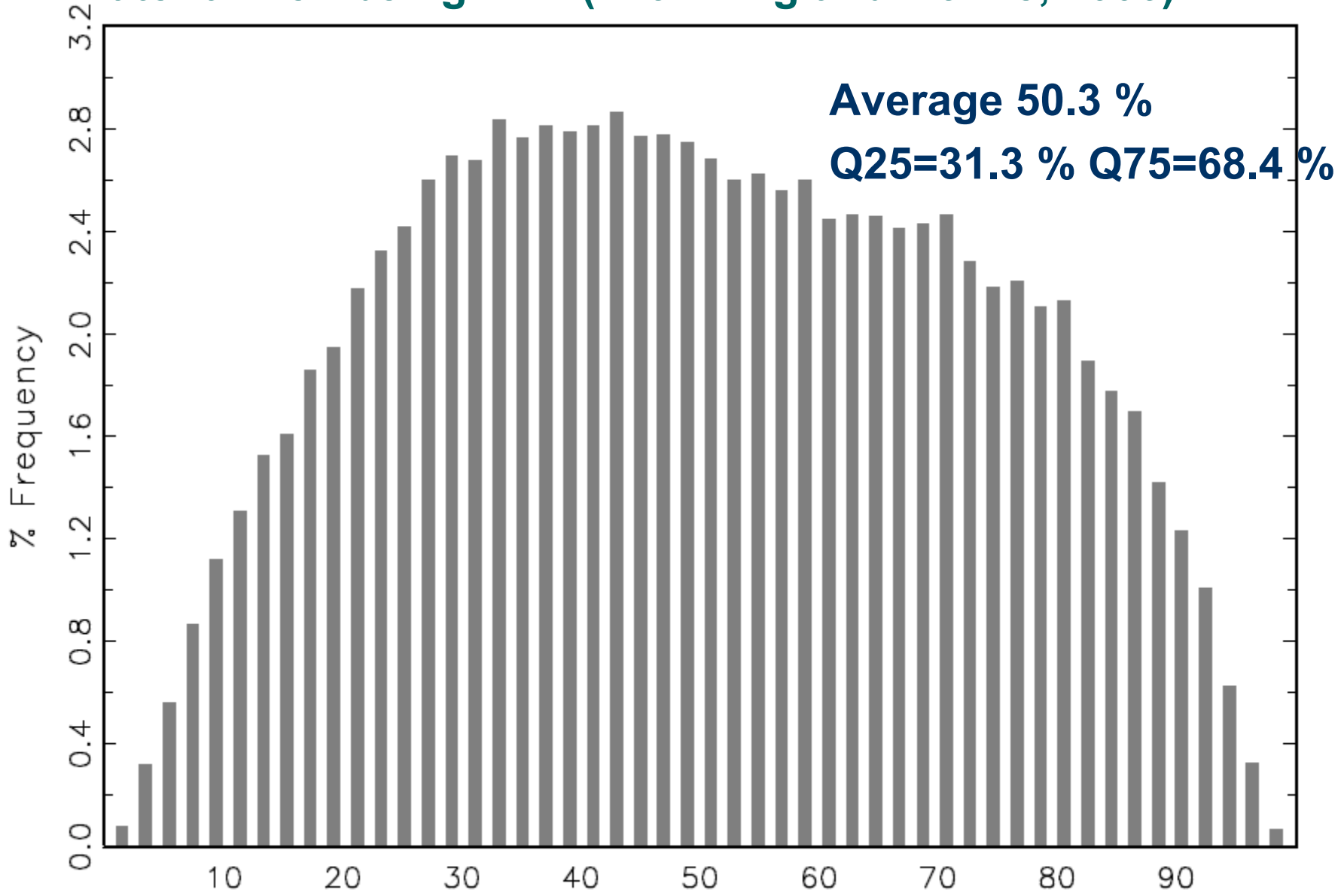
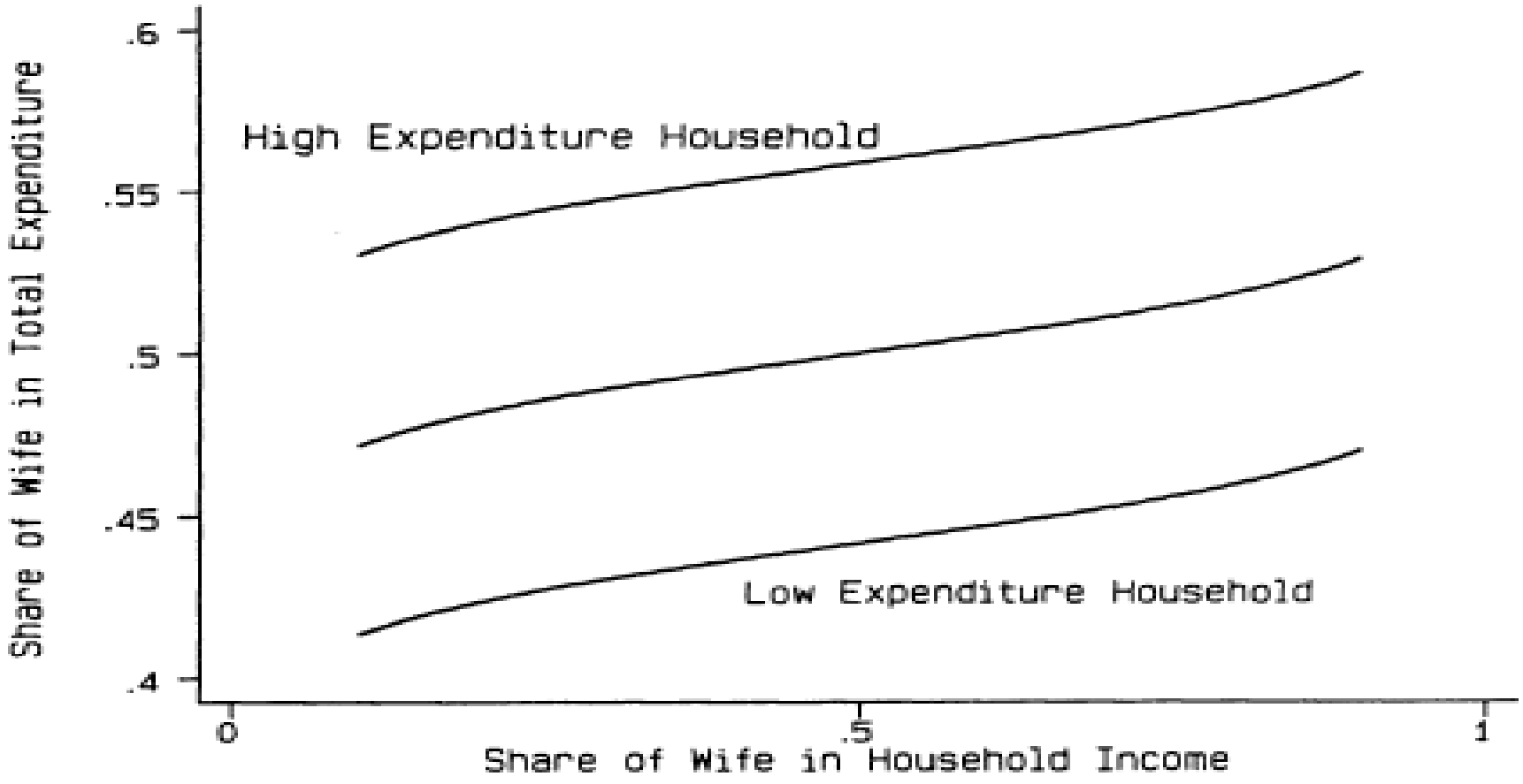


Table 7. Percentage Group Contributions to P_α Poverty Measures using ϕ, ϕ_1, and ϕ_2

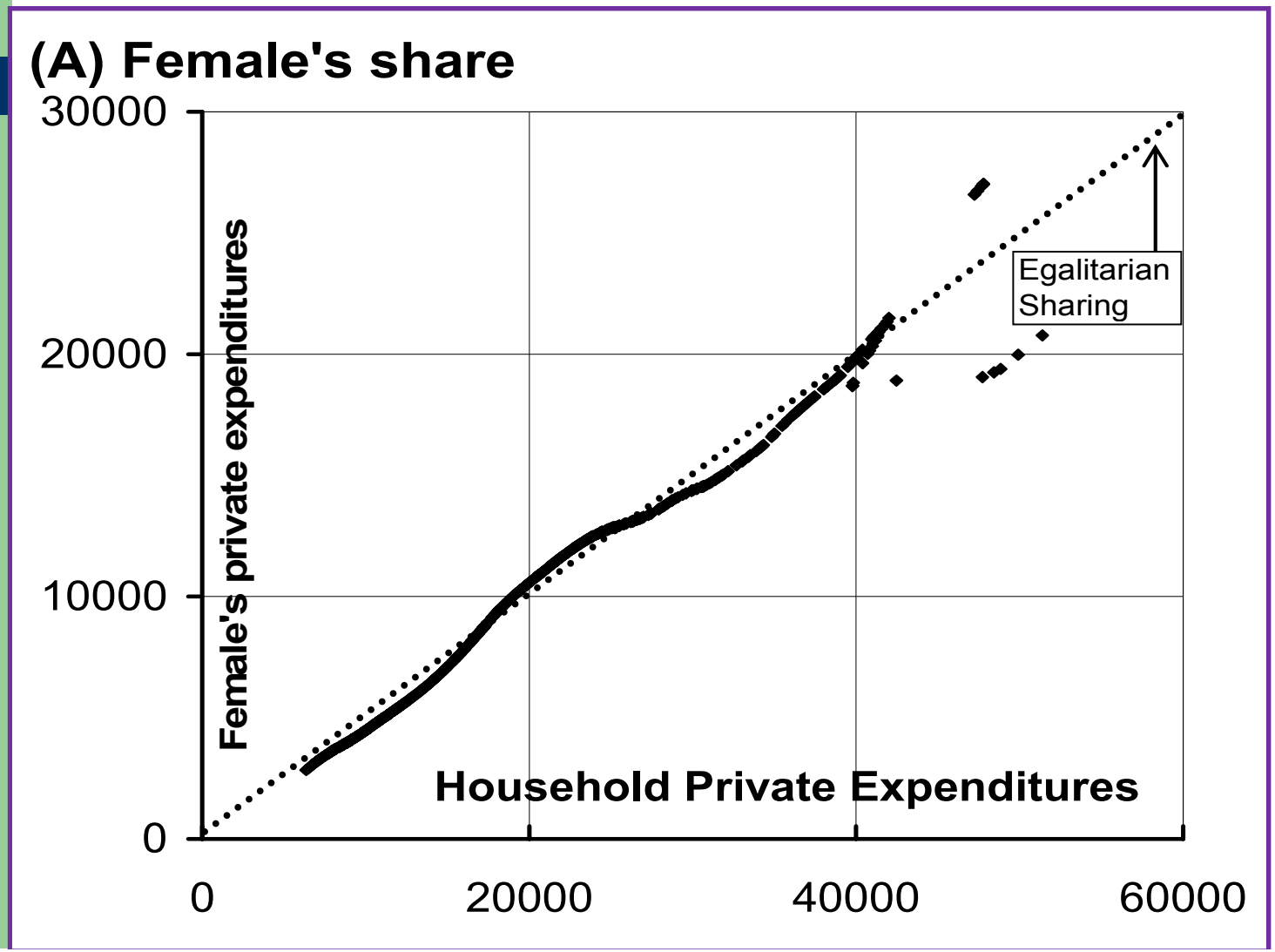
H&K calories intaket in Philippines 1989

GROUP	N	$P_0(\phi)$	$P_1(\phi)$	$P_2(\phi)$	$P_0(\phi_1)$	$P_1(\phi_1)$	$P_2(\phi_1)$	$P_0(\phi_2)$	$P_1(\phi_2)$	$P_2(\phi_2)$
ALL	2800	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Corn	1565	53.8	52.9	52.1	53.3	52.4	52.1	52.9	52.6	52.5
Sugar	1082	37.5	37.5	37.9	37.9	37.2	37.0	38.3	37.0	36.5
No Crop	233	8.7	9.6	10.0	8.7	10.4	10.9	8.8	10.4	11.0
Owner	695	23.5	22.8	22.6	23.5	22.3	21.9	23.9	22.6	22.5
Mix	516	17.3	16.5	15.7	16.4	16.2	14.7	17.0	16.3	15.0
Tenant	758	25.8	25.1	25.1	26.1	24.6	24.6	26.0	24.3	24.1
Labourer	580	21.3	22.2	22.7	21.8	22.9	24.0	20.8	22.6	23.7
Other Ten	331	12.2	13.4	13.9	12.1	14.1	14.8	12.3	14.1	14.8
Corn Own	341	11.6	11.7	11.7	11.3	11.5	11.5	11.5	11.7	12.0
Corn Mix	310	11.0	10.5	10.2	9.9	11.0	10.2	10.1	11.1	10.4
Corn Share	549	18.7	17.6	17.1	18.9	17.1	17.4	18.7	17.0	17.5
Corn Lab	267	9.1	9.4	9.3	9.8	9.2	9.1	9.1	9.0	8.8
Sug Own	354	11.9	11.1	11.0	12.2	10.7	10.4	12.4	10.9	10.5
Sug Mix	206	6.3	6.0	5.6	6.5	5.2	4.4	7.0	5.2	4.5
Sug Rent	209	7.1	7.5	7.9	7.2	7.5	7.2	7.2	7.3	6.6
Sug Lab	313	12.2	12.9	13.4	12.0	13.7	15.0	11.7	13.6	14.9
Other Occ	233	8.7	9.6	10.0	8.7	10.4	10.9	8.8	10.4	11.0
Corn Othrnt	98	3.4	3.7	3.9	3.4	3.7	3.9	3.4	3.7	3.8
Male	1484	53.1	52.6	52.3	51.7	51.0	50.6	51.8	51.2	50.6
Female	1396	46.9	47.4	47.7	48.3	49.0	49.4	48.2	48.8	49.4
Adult*	1191	28.6	22.3	19.9	40.5	40.1	40.0	40.5	40.1	40.0
Non-Adult	1689	71.4	77.7	80.1	59.5	59.9	60.0	59.5	59.9	60.0

Bourguignon et. Al 1994 Canada, 80's. « Naive « approach. Exclulsive good is clothes



Couprie et al. 2010 – French HH 2000 – non parametric « naive » estimate with clothes



Couprie et al. 2010 – French HH 2000 – non parametric « naive » estimate with clothes

TAB 4: Female sharing rule prediction results

	DEF 1	DEF 2	DEF3
Predicted female private expenditures	11997.5	10961.8	9323.4
	(6382.3)	(5315.8)	(4818.4)
Predicted male private expenditures	13067.4	11837.8	11064.5
	(6278.2)	(5345.5)	(5715.1)
HH predicted private – observed	-494.43	274.49	2964.6
	(4068.4)	(4267.8)	(5647.5)
Predicted share of female private expenditures	0.4752	0.4801	0.4608
	(0.0541)	(0.0561)	(0.0696)
Private expenditures of the `dominated'	11597.3	10472.0	8953.5
	(6263.4)	(5235.6)	(4809.0)
The 'dominated' individual is the female	0.6472	0.6103	0.6818
	(0.4785)	(0.4884)	(0.4666)
Observations lost due to support condition	4%	3%	20%

BCL 2009 estimate , Canadian data, structural approach

Model	A	B	C	D
Wife's share η	0.5	0.5	0.55	0.55
$A_k \leq 1, \forall k$	No	Yes	No	Yes
Scale economy $R \times 100$	27	41	27	39
indiff. scale $S^f \times 100$	58	68	63	74
indiff. scale $S^m \times 100$	56	70	50	63

Table 5: Adult equivalence scales

Model C : 2 singles require 27% more of HH income to achieve the same level of welfare as if they were in a couple.

The female would require 68% of HH income

The male would require 70% of HH income… to achieve the same level of welfare single as Now.

Vermeulen 2004, Belgian data 2000, structural approach

Tableau 2: Echelles d'equivalence intra-familiales et économies d'échelle d'un couple belge moyen en 2000

x	z	μ	u^f	u^m	x^f	x^m	s^f_{coll}	s^m_{coll}	e_{coll}
20902.78	0.38	0.27	7.42	6.64	16613.44	9718.15	0.79	0.46	1.32
27672.98	0.38	0.38	7.73	7.37	19900.30	14065.13	0.72	0.51	1.28
33136.04	0.38	0.48	7.84	7.82	21340.12	18816.54	0.64	0.57	1.25
20902.78	0.45	0.25	7.45	6.56	16851.10	9435.74	0.81	0.45	1.32
27672.98	0.45	0.35	7.77	7.31	20352.55	13560.83	0.74	0.49	1.28
33136.04	0.45	0.45	7.89	7.77	21973.68	18147.65	0.66	0.55	1.26
20902.78	0.50	0.23	7.47	6.50	17049.86	9196.36	0.82	0.44	1.32
27672.98	0.50	0.33	7.80	7.25	20738.80	13123.94	0.75	0.47	1.28
33136.04	0.50	0.42	7.92	7.72	22525.20	17556.49	0.68	0.53	1.26

Notes: x: dépenses annuelles en euro pour biens non durables ; z: part de la femme dans le revenu commun; μ : position de négociation de l'homme; u^j : niveau d'utilité pour j (j=f,m); x^j : dépenses minimales pour atteindre, étant seul, le niveau de bien-être qu'on aurait en vivant en couple; $s^j_{coll} = x^j / x$; e_{coll} : économies d'échelle de la vie en couple.

Couprie 2007 – British HH–parametric within estimate, time-use, working couples

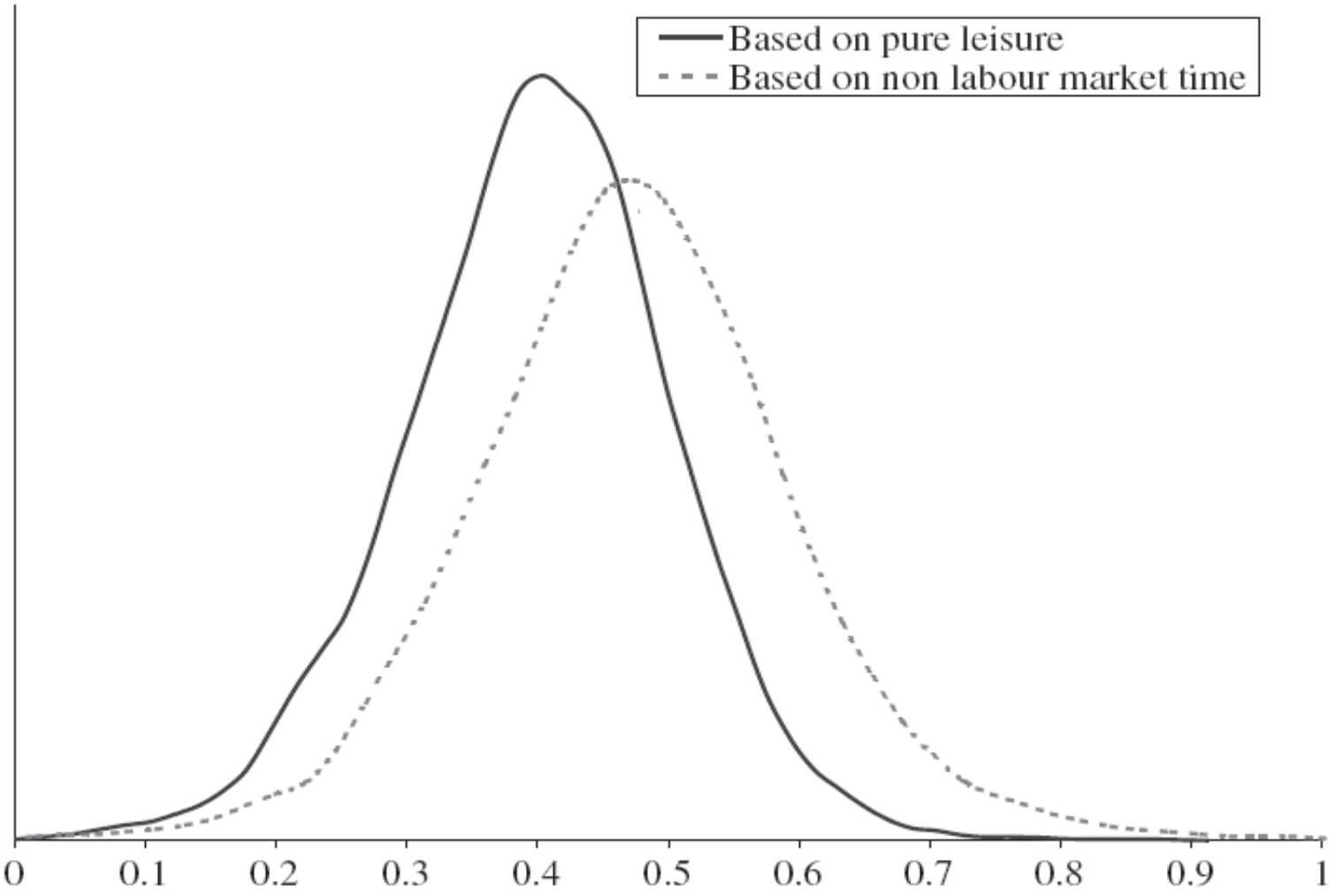


Fig. 1. *Distribution of Female's Ratio of Household's Private Expenditures*

Couprie 2007 – British HH–parametric within estimate, time-use

Quantiles of The Predicted Female's Share of Private Expenditure

	Non-labour market time (I)	Pure leisure (II)	Without wage gap*
5%	0.2732	0.2237	0.3969
10%	0.3209	0.2677	0.4109
25%	0.3949	0.3364	0.4288
50%	0.4698	0.4026	0.4432
75%	0.5400	0.4665	0.4579
90%	0.6065	0.5264	0.4713
95%	0.6530	0.6423	0.4790
Mean	0.4668	0.3999	0.4415
Standard Error	0.1166	0.1032	0.0262
Q75-Q25	0.1451	0.1301	0.0291

*Equal wage rates between spouses are imposed, household full income and parameters are left unchanged (II).

B&B DK Cons. Direct: **Average 0.503 (0.012) Q75-Q25=0.371**

Me UK Time (working couples) : **Average 0.399 (0.103) Q75-Q25=0.130**

Me FR Cons naïve : **Average 0.480 (0.056)**

BCL Cons structural : **Average 0.55 Q75-Q25=0.01**

Vermeulen Belgian : **Average 0.45**