Methods for Evaluating Efficiency and Welfare Effects of Fiscal and Social Policies

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Testbooks

1. Bourguignon F., M. Bussolo and L.A. Pereira da Silva, “The Impact of Macroeconomics Policies on Poverty and Income Distribution. Macro-Micro Evaluation Techniques and Tools”, Palgrave Macmillan and World Bank, (2008).

2. Bourguignon F., and L.A. Pereira da Silva, “The Impact of Economics Policies on Poverty and Income Distribution. Evaluation Techniques and Tools”, Oxford University Press and World Bank, (2003).

3. Spadaro A., “Microsimulation as a Tool for the Evaluation of Public Policies: Methods and Applications", FBBVA, Madrid, (2007).

Papers
a long list on the web

Evaluation of public policies : a general introduction

Introduction 1: the demand for for evaluation

- The rising demand for 'accountability' of policy-makers
  - Democracy: are governments holding on commitments ?
  - Efficacy of public spending: cost/benefit analysis

Demand …

- Policy (quantitative) evaluation as the main instrument of 'accountability'
  - The quantitative bias of modern societies
  - Economic rationality and marketization of societies
  - Voters' fatigue about doctrinal or political discourses:

    "what actually works and what does not work"
  - Need to know about distributional impact of policies

Demand…

- Changes in the practice of evaluation
  - Evaluation is evolving from :
    - Intuitive ex-ante justification of policies (through structural analysis or possibly through doctrinal arguments)
  - To:
    - Causal ex-post structural analysis
    - Randomized experimentation as in "hard" sciences
  - But numerous intermediate stages
- One way or another, evaluation now is at the heart of the reflection on policies

Introduction 2: the various methodological dimensions of policy evaluation

- Policy reform = Change in rules governing public supply of goods and services, including regulations of all sorts
- "Evaluation" = impact of policy reforms on various dimensions of social welfare:
  - Aggregate (GDP per capita)
  - Distributional (income level)
  - Social (characteristics other than income)
  - Environmental
  - …
- Objective: use evaluation to check adequation to initial goals and improve the policies by modifying its design or its parameters

Methodological dimensions …

- Logical equivalence between 'evaluation' of policies and 'incidence' analysis
  - Tax or public spending 'incidence' = how the various agents in the economy are affected?
- Accounting vs. behavioral evaluation
- Partial vs. General equilibrium, micro vs. macro
- Ex-ante vs. ex-post
- Average vs. Marginal effects of policy reforms (the additional € taxed or spent)
- Qualitative vs. Quantitative
- The various dimensions of distribution: vertical, horizontal (including geography)

Outline of this general introduction: basics of ex-ante evaluation

1. The basics of 'incidence' analysis in taxation
2. Closing the analysis with a macro model

(Illustration with the creation of a CO2 tax)

3. Extending to public spending
4. Ex-post techniques

An example of policy reform:

- The Goverment introduces a tax on goods and services proportional to the CO2 emission per unit
- First impact:
  - producers simply pass on the tax change to consumers
  - consumers lose purchasing power or 'real income'
- Second impact
  - What does the government do with tax proceeds?
  - Second round of reform (for instance, reduction of income tax) (Partial equilibrium, *incidence analysis*)
- Third impact: consumers change behavior, producers adapt, structure of the economy is modified (General equilibrium)

1. Incidence analysis: Welfare impact of price changes on consumers

- Changes in welfare due to changes in tax and benefit system: the *equivalent income variation* aproach

Indirect utility function

$$V_i(p, y_i) = U_i(x^M(p, y_i)) \text{ with } x^M(p, y_i) = \text{Argmax}\{U_i(x_i) \text{ s.t. } px_i \leq y_i\}$$

Change in income: $\Delta V_i = V_y^i \Delta y_i$

It follows that any change in welfare ΔV_i can be made equivalent to a change of income :

$$\boxed{\Delta y_i^* = \Delta V_i / V_y^i}$$

Equivalent income variation of price changes: the enveloppe theorem

- Changes in welfare due to changes in prices

  Change in welfare:

$$\Delta V_i = \sum_j V_{ij} \Delta p_j$$

Sheppard's lemma or enveloppe theorem:

$$V_{ij} = -V_y . x_{ij} (p, y_i)$$

it follows that the *equivalent income variation* is "proportional" to :

$$\Delta y_i^* = -\sum_j x_{ij} \Delta p_j$$

Marginal utility equivalent change in income = change in the value of initial consumption basket.

Principles and limitations of "micro-simulation"

- With preceding simple identity, easy to compute welfare changes due to CO_2 tax for all consumers (accounting microsimulation). What is needed is:
  - Representative household survey with information on spending ("budget survey")
  - Impact of CO_2 tax on consumer prices (microsimulation model)
- But, how should we evaluate the change in government budget and the corresponding variation in other taxes?
- This requires taking into account *changes in consumption* and goes beyond "accounting".

$$\Delta X_j = \sum_i \sum_k \frac{\partial x_{ij}}{\partial p_k} \Delta t_k \quad \Delta T = \sum_j X_j . \Delta t_j + \sum_j t_j \Delta X_j$$

Changes in consumption …

$$\Delta X_j = \sum_i \sum_k \frac{\partial x_{ij}}{\partial p_k} \Delta t_k \quad \Delta T = \sum_j X_j . \Delta t_j + \sum_j t_j \Delta X_j$$

Full analysis thus requires knowledge of consumption behavior, not only for the good being taxed but also all others.

Possible to handle this step at the aggregate rather than disaggregated level.

Knowledge of aggregate consumption rather than micro-economic behavior needed

Link with general equilibrium

What to do with the budget surplus?

Somewhat parallel question unless evaluation of tax change is combined with evaluation of another policy that leaves the government budget unchanged (the double dividend story)

Practically: an arbitrary reference may be chosen, for instance a proportional reduction in the income tax

It is essential that evaluation be made at constant budget or macroeconomic environment

If not, one evaluates two policies at the same time

Combining various tax reforms

The preceding "enveloppe theorem" can be generalized to

$$\Delta y_i = -\Sigma_j(c_{ij}-q_{ij}) \,.dp_j + \Sigma_k X_{ik} dp_k + dT_i$$

which allows for a more general representation of the tax system – including income and wealth tax as well as lump-sum transfers (T)

Limitations of theoretical model behind accounting micro-simulation

- Enveloppe theorem justifying accounting micro-simulation applies under particular conditions:
  1. Small changes in prices
  2. No quantitative constraint
  3. Equal marginal utility of income for all
- Practically these conditions may not be met, which requires more detailed behavioral modeling
- Note, however, that point 3 is easy to take care of: simple weighing of households needed

2. Closing the analysis with some macro-modeling tool

- Consumption price changes applied at household level may be arbitrary or may result from a complex sequence of general equilibrium effects
- A CO2 tax affects consumption prices by changing both the structure of prices, firms' decisions about output and investment, households' consumption and saving decisions, and the government budget constraint.
- Applied general equilibrium models with 'representative agents' are able to represent the 'passing on' of policy instruments into prices changes that will permit the evaluation of distributional welfare effects.

Example: a dynamic Computable General Equilibrium model of a CO2 tax in the US economy

- Goulder (2002)
- Dynamic model (2002-25) with rational (perfect) expectations and a detailed energy sector
- Main features of the model
  - Energy sector: existence of a synthetic fuel sector starting to 'produce' in 2025 ('backstop technology')
  - Fossil fuel prices exogenous (imports)
  - Representative firm in each sector maximizing inter-temporal profits with investment adjustment costs.
  - Representative consumer optimizing intertemporally
  - Annual budget constraint for the government
  - Perfectly competitive markets
  - C02 tax implemented in US only
  - Transversality conditions at 2050

Sectoral disaggregation of Goulder's model

Industries

1. Agriculture and Non-Coal Mining
2. Coal Mining
3. Crude Petroleum and Natural Gas
4. Synthetic Fuels
5. Petroleum Refining
6. Electric Utilities
7. Gas Utilities
8. Construction
9. Metals and Machinery
10. Motor Vehicles
11. Miscellaneous Manufacturing
12. Services (except housing)
13. Housing Services

Consumer goods

1. Food
2. Alcohol
3. Tobacco
4. Utilities
5. Housing Services
6. Furnishings
7. Appliances
8. Clothing and Jewelry
9. Transportation
10. Motor Vehicles
11. Services (except financial)
12. Financial Services
13. Recreation, Reading, & Misc.
14. Nondurable, Non-Food Household Expenditure
15. Gasoline and Other Fuels
16. Education
17. Health

Industry impact of CO2 tax
(percentage changes with respect to base run)

	Constant carbon tax (25%) + lump-sum transfer		Carbon tax growing at 7% annually+lump-sum transfer	
	2000	2025	2000	2025
Tax included output ***prices***				
Coal mining	45.8	54.4	53.2	105.8
Oil and gas	15.4	9.7	17.6	19.1
Petrleum refining	9.3	6.6	10.7	12.8
Electric utilities	1.2	3.7	1.5	6.5
Metal and Machinery	-0.6	-0.6	-0.7	-1.2
Other industries	-0.5	-0.6	-0.6	-1.2
Output				
Coal mining	-17.9	-26	20.3	-39.2
Oil and gas	-3.5	-1.8	-5.1	-5.2
Petroleum refining	-6.8	-5	-7.7	-9.3
Electric utilities	-1.9	-3.6	-2.2	-6.3
Metal and Machinery	-1	-1.1	-1.1	-1.8
Other industries	-0.4	-0.6	-0.5	-1
After tax ***profits***				
Coal mining	-35.6	-26.6	-38.6	-40.5
Oil and gas	-4.8	-1.9	-6.4	-5.5
Petroleum refining	-8.3	-5	-9.2	-9.8
Electric utilities	-6.2	-3.7	-6.8	-6.9
Metal and Machinery	-2.7	-2.6	-2.8	-4.5
Other industries	-1	-1.3	0	-2.5

Emission, revenues and efficiency costs

	Constant carbon tax (25%) + lump-sum transfer	Carbon tax growing at 7% annually+lump-sum transfer
	2025 or 2002-50	2025 or 2002-50
Emissions		
Percentage change	-14.9	-22.9
Present value of carbon tax revenues	2113	3553
Efficiency cost (billion $)		
Absolute (Billion $)	1190	2228
Per ton of C02 reduction ($)	104	126
Per dollar of carbon tax revenue	0.563	0.63

Lessons to be learned from the CO_2 tax example

- The duality of policy evaluation: macro-micro
- The consistency of the two approaches (does macro yield the same budget surplus as micro?) and how to do the reconciliation
- The fundamental importance of distributional impact (political economy)
- The importance of behavioral responses
- Specificity of policies – or "programs" with no macro or general equilibrium effects
- Note: could experimentation or ex-post approach to evaluation be relevant in the present case (?)

3. Evaluating the distributional effects of public spending

- From a redistributive point of view, tax-benefit systems seem to be negative sum games
- This is because taxes cover the cost of numerous goods provided freely by the public sector (public goods or 'publicly provided private goods': education, health care, defense, justice, …)
- When evaluating a tax increase aimed at financing an improvement or an extension in the quality of education, the analyst should consider both the welfare effect of the tax and how much education improved.

Delivery of public goods

- Reforms that increase the quality of service delivery without change in tax payments do increase welfare, an effect to be taken into account when evaluating public policies
- It is to be expected that the beneficiaries of these policies will be the users of public services.
- Distributional impact of public spending depends on who the consumers of public services are.

Examples of distributional issues in the debate on public goods

- Free public university education benefits the top of the income distribution but is paid by the whole community
- Fear of the privatization of the health care system that would diminish its powerful egalitarian role
- Geographical distribution of public spending (police) on security
- Subsidizing opera houses,
- …..

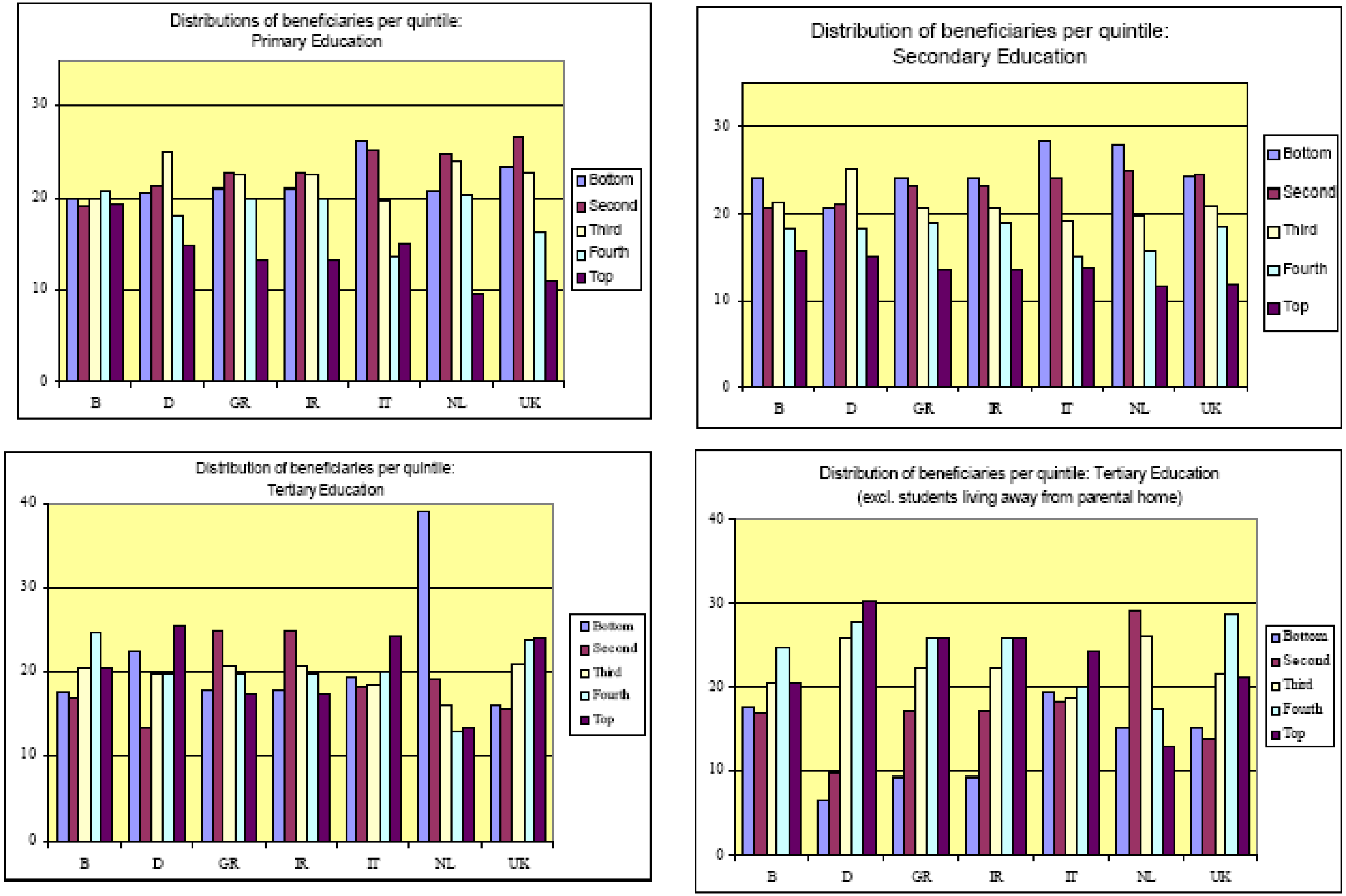
How to evaluate public provision and financing of specific goods:Incidence analysis

- Fundamental questions:
  - 'Value' of the goods provided or financed by the State:
    1. Willingness to pay approach: objective or subjective
    2. Accounting cost-side approach (National Accounts convention)
- In the first case, an issue is that of a possible aggregate discrepancy between cost and value
- In both cases, an important issue is that of who benefits from the public goods
- Most common solution to the welfare evaluation of public spending is to allocate total value according to consumption
- Alternative: probabilistic risk approach_

Examples of incidence analysis of public spending in education

(European countries, Callan, Smeeding and Tsanoglou, 2007)

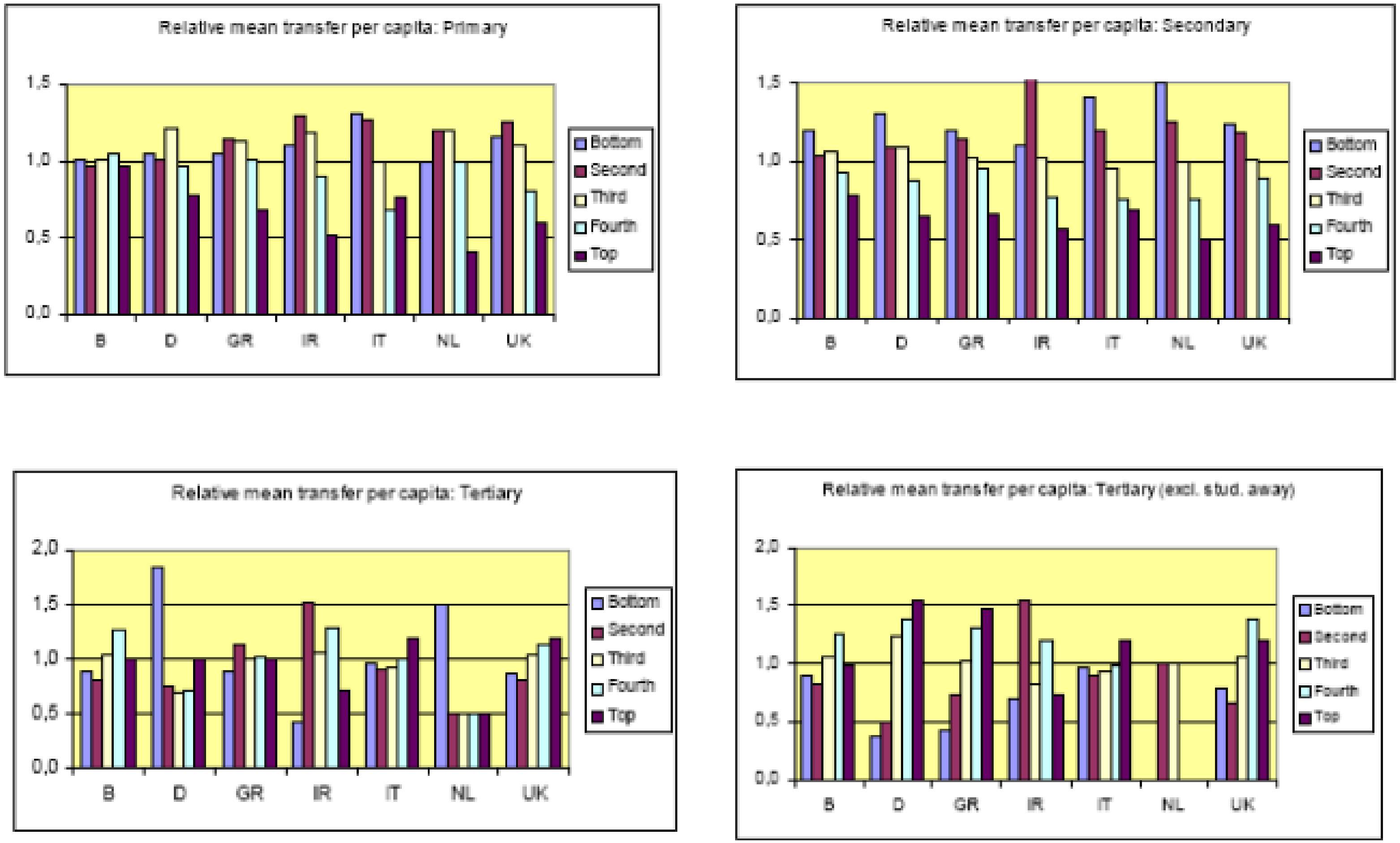
Graph 3. Distribution of beneficiaries per quintile



Examples of incidence analysis of public spending in education

(European countries, Callan, Smeeding and Tsanoglou, 2007)

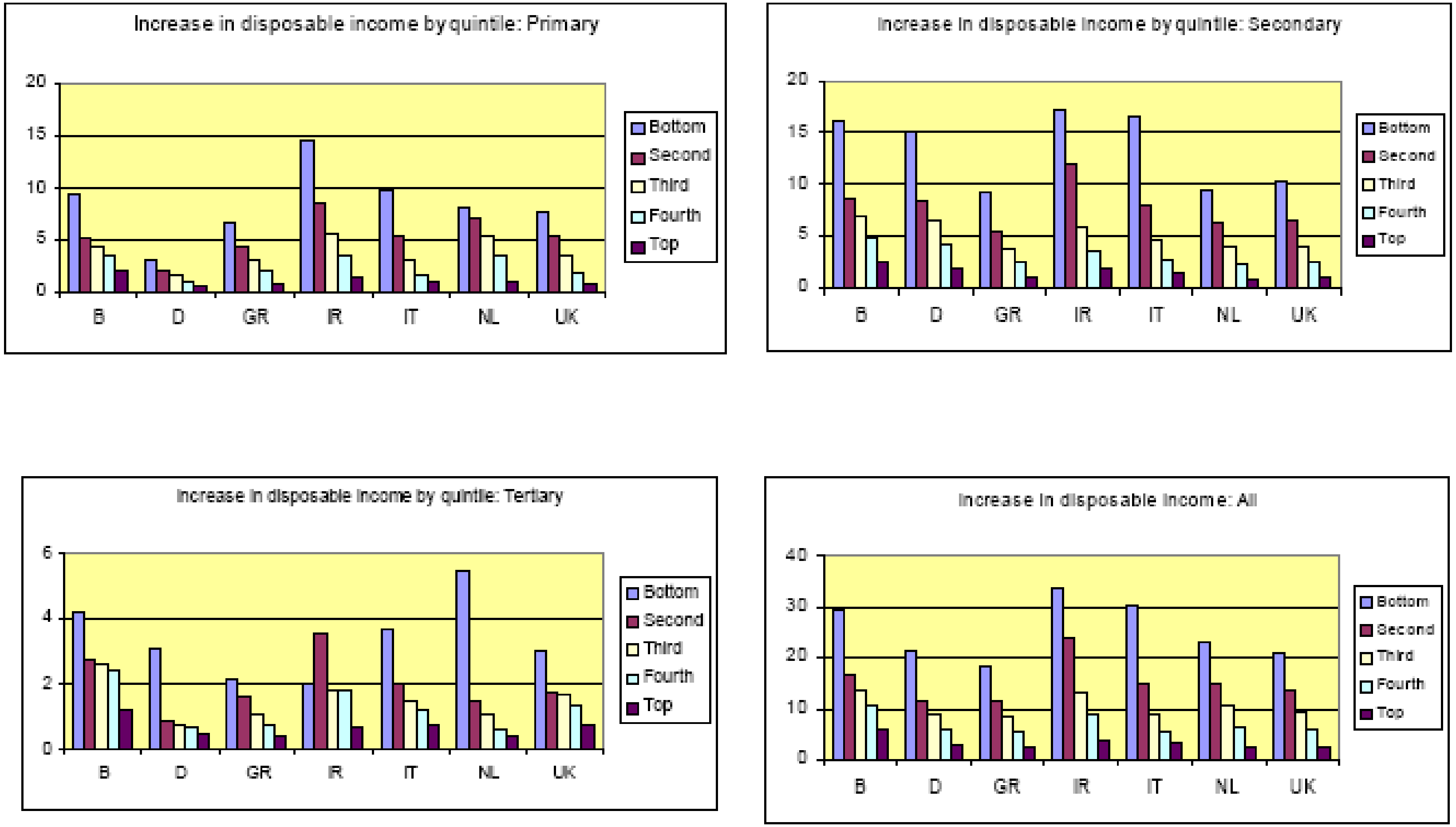
Graph 6. Relative mean transfer per capita



Examples of incidence analysis of public spending in education

(European countries, Callan, Smeeding and Tsanoglou, 2007)

Graph 8. Proportional increase in disposable income per quintile



Theoretical pitfalls in standard evaluation of the distributional impact of education

- Standard incidence analysis assigns to every household with a child in the (public) educational system a cash transfer for the public provision of education.
  - Transfer = average cost of education for the public sector
- Spending appears highly progressive for primary and secondary education, measured by either cost or willingness-to-pay (Harberger's prescription) andhighly regressive for tertiary education
- Numerous applications in developing countries: from Meerman (79), Selowski (79) to van de Walle (95) and developed countries (university education).

4. Ex-post program evaluation: experimental and quasi-experimental methods

Introduction

- Ex-post means that 'results' from policy, or more realistically *program* being evaluated can be 'observed'
- Experimental methods based on randomly chosen 'treatment' and 'control' groups
- With experimental methods, effect of a policy given by simple difference between treatment and control group: essentially a 'reduced form' approach to policy.
- Quasi-experimental methods: treatment and control groups not chosen randomly, issue of the selection bias.
- Correction of selection bias can be obtained from various approaches, based one way or another on specific assumptions.

Outline

1. Experimental methods: full randomization and simple differences
2. Quasi-experimental methods: correcting for the selection bias
   - Diiferences in differences
   - Propensity Score Matching
   - Instrumental variables
3. Examples of application
4. Limitations of pure experimental approach

1. Experimental methods: full randomization and simple differences

- Basic model:

$$y_i = X_i\beta + \alpha P_i + u_i \qquad (1)$$

Where y_i is the policy outcome of interest, X_i a set of individual characteristics, P_i a dummmy variable indicating participation to the program, and u_i the effect of all unobserved variables

- The principle of randomization: P_i=0 and P_i=1 observed on fully random samples.
- This guarantees that u_i and P_i are independent so that OLS on (1) yields an unbiased estimates of α (In effect first term in (1) not needed)

Simple differences in means as estimated effect of intervention

$$\hat{\alpha} = \bar{y}(P_i = 1) - \bar{y}(P_i = 0) \qquad (2)$$

With

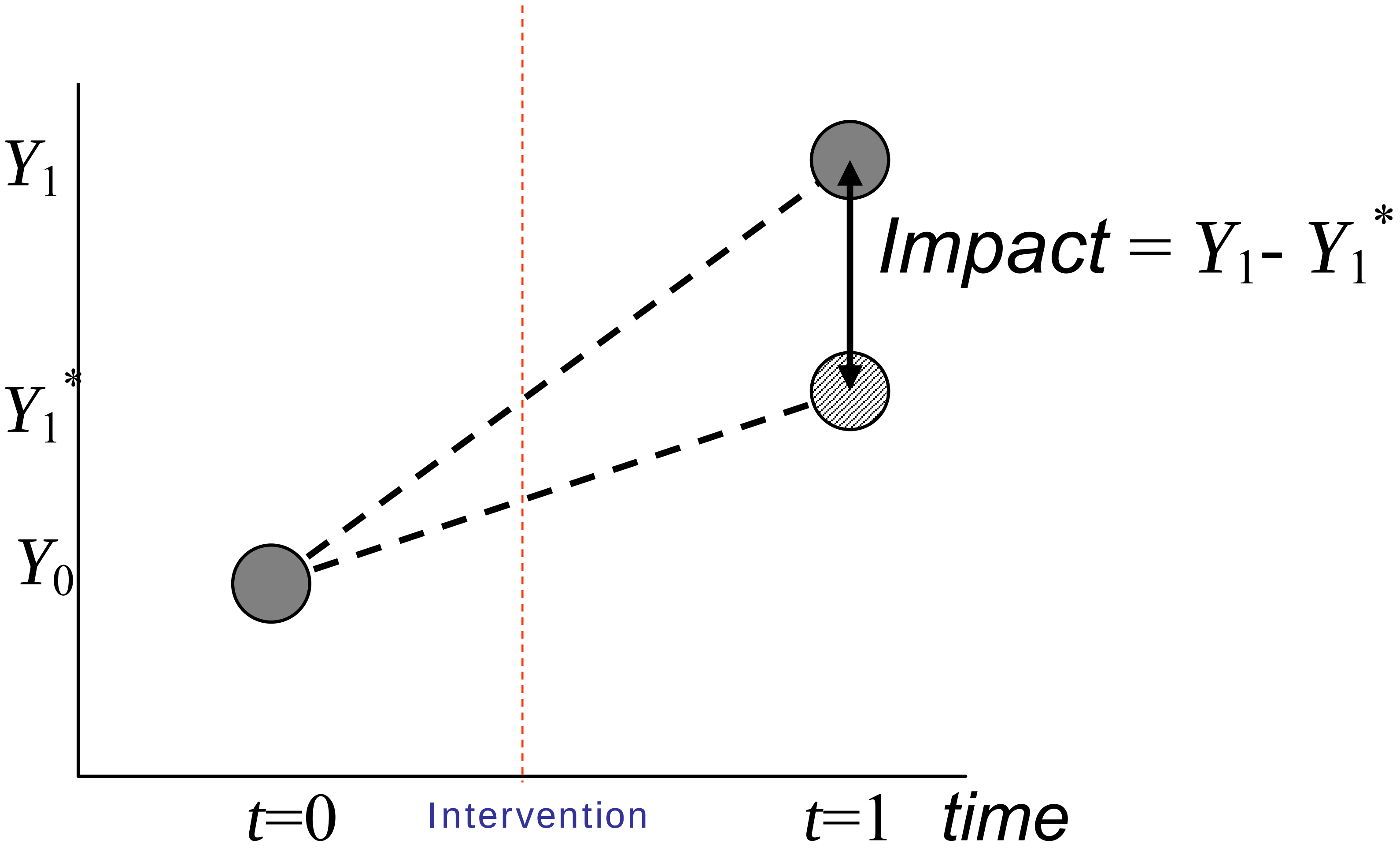
$$V(\hat{\alpha}) = \frac{1}{N_1} V(y / P_i = 1) + \frac{1}{N_0} V(y / P_i = 0) \qquad (3)$$

Caution: observations may not be independent – e.g. geographical rather than individual randomization.

Applications

- Numerous applications:
  - Biology
  - Economics:
    - Negative income tax (example of RSA)
    - Self-sufficiency program
    - Active Labor Market Programs (Bloom et al., 1997)
    - Deworming (Miguel and Kemer, 2004)
    - Teacher incentives
    - Vouchers (Angrist et al., 2002)
    - …
- For social programs, however, randomization is generally rare (ethical/political resistance; selective non-compliance).

Simple differences: graphical illustration

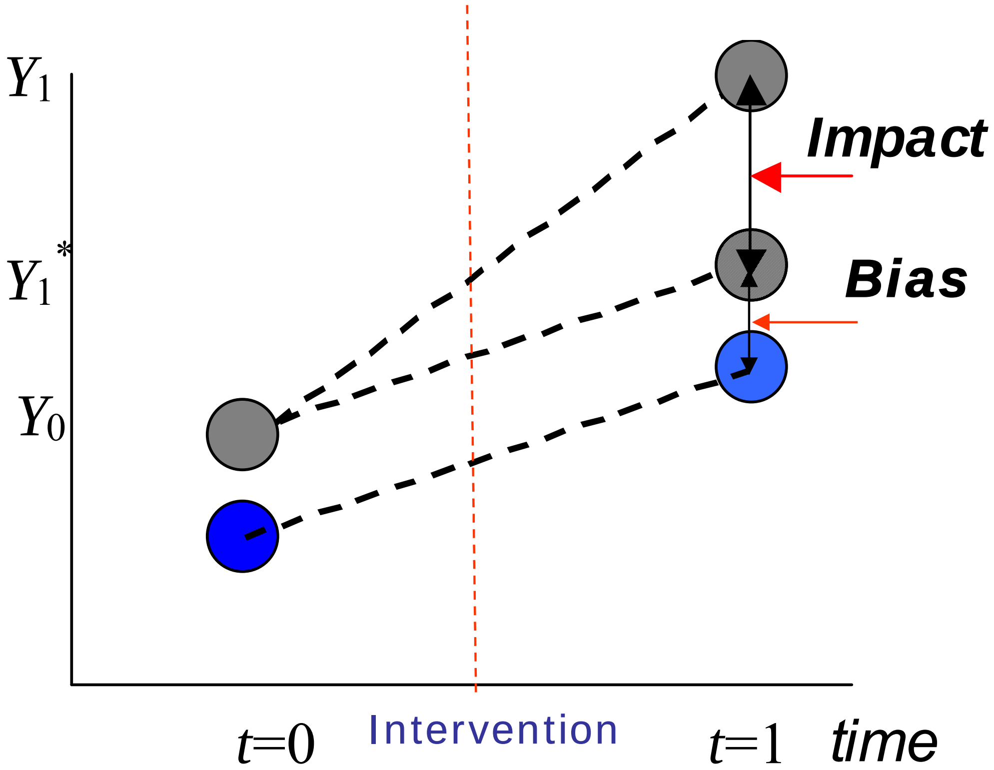


2. Introducing selection bias

- Case where treatment and control groups are not random draws from the whole population ("selection" bias)
- Single difference would then be a biased estimator of the impact of the treatment since it incorporates differences in the composition of the two groups
- If corresponding bias is constant over time, a way of estimating it is to compare the outcomes of interest prior to the treatment (baseline)
- This leads to the diff-in-diff estimator (Bertand et al., 2002)

Introducing selection bias

Additive/time-invariant bias: "diff-in-diff"



Diff in diff

$$y_{it} = X_{it}\beta + aP_i + \alpha P_i.Dum(t=1) + u_i$$

Double difference:

$$\hat{\alpha} = \left[\bar{y}(t=1, P_i=1) - \bar{y}(t=1, P_i=0)\right] - \left[\bar{y}(t=0, P_i=1) - (t=0, P_i=0)\right]$$

And expression corresponding to (3) above for variance of the estimate

Note that data are not (necessarily) panel; usual case: "base-line" + post-intervention survey

Diff in diff: practical importance of the baseline survey

As one may not be completely sure that both control and treatment groups are random samples of the same population, it is always better to take a baseline survey

Then "diff-in-diff" estimates are applied to difference between follow-up survey and baseline

3. Other methods to correct for selection bias

- Instrumental variables (Angrist et al., 1996; Heckman, 1997)

$$y_i = X_i\beta + \alpha\hat{P}_i + u_i \quad \hat{P}_i = (X_i, Z_i).\hat{\gamma}$$

with Z independent from u_i (exclusion restriction).

- Matching techniques (Rosenbaum and Rubin, 1983; Heckman, Ichimura and Todd, 1997)
  - Apply diff-in-diff to observations in treatment and control groups with identical attributes X and Z. This permits dealing with a selection bias that varies with X and Z.
  - Problem is that this may require a large number of observations or only rough treatment of heterogeneity in selection bias

Other methods to correct for selection bias

- More powerful approach: Propensity score matching (PSM)
  - Compute the probability that an observation will be in the treatment group (Logit-like analysis): P(X)
  - Then match each observation in the treatment group by "nearest" neighbors, in terms of P(X), in the control group
  - Then apply single differences to these two groups of observations

$$\Delta\bar{y} = \sum_i \omega_i \left[y_{i1} - \sum_j W_{ij} y_{ij0} \right]$$

- Rosenbaum and Rubin (1983): outcome independent of participation (prior to intervention) given X → outcome independent of participation given P(X)

Propensity score matching (PSM): some remarks

- PSM may be applied to single cross-section (follow-up survey) assuming some strong determinant of participation is observed.
- Diff-in-diff should be combined with PSM in the case where changes over time of the outcome contains heterogeneity with respect to observables
- Taking into account the effects of observables on outcomes:

$$\Delta\bar{y} = \sum_i \omega_i \left[y_{i1} - X_i \hat{\beta}_0 - \sum_j (W_{ij} y_{ij0} - X_{ij} \hat{\beta}_0) \right]$$

- Possible to stratify the effects of the program by X
- W_{ij} : Common support (eliminate observations in the control group with participation probabilities outside the range observed for treatement group)

(PSM): remarks (end)

- PSM is the observational analogue of an experiment in which placement is independent of outcomes
- The difference is that a pure experiment does not require the untestable assumption of independence conditional on observables.
- But PSM requires good data.
- In comparisons with results of a randomized trial it is found that PSM can achieve a good approximation
- Much experiment on a US training program, Heckman et al. (1997) and Dehejia and Wahba (1999) better than the non-experimental regression-based methods studied by Lalonde (1986) for the same program.

Example: Progresa (Oportunidades) in Mexico

- Progresa = Conditional Cash Transfer Program (Education + health care and nutrition)
- Implemented in rural Mexico starting in 1998
- Sequencing of program starts done randomly: randomization design
- Intensively and extensively analyzed program

Eligibility criterion and cash transfer schedule of Progresa

Eligibility: "score" based on multiple criteria below some threshold

(defined at locality level)

Table 1.1 PROGRESA monthly cash transfer schedule (nominal pesos)

Grant	January–June 1998	July–December 1998	January–June 1999	July–December 1999
Educational grant per child (conditioned on child school enrollment and regular attendance)				
Primary				
Third grade	65	70	75	80
Fourth grade	75	80	90	95
Fifth grade	95	100	115	125
Sixth grade	130	135	150	165
Secondary				
First—male	190	200	220	240
Second—male	200	210	235	250
Third—male	210	220	245	265
First—female	200	210	235	250
Second—female	220	235	260	280
Third—female	240	255	285	305
Grant for school materials per child				
Primary—September	—	In-kind	—	110
Primary—January	40	—	45	—
Secondary—September	—	170	—	205
Grant for consumption of food per household (conditioned on attending scheduled visits to health centers)				
Cash transfer	95	100	115	125
Maximum grant per household	585	625	695	750

Source: Hernandez, Gomez de Leon, and Vasquez (1999).

Size of the program

Table 1.5 PROGRESA transfers to beneficiary households from November 1998 to October 1999 (pesos)

	Beneficiary households						Poor households residing in control localities		
Recipient	Household size	Total value of consumption (food) [non-food]	Average monthly transfers received	Average monthly *alimento* transfer	Average monthly *beca* transfer	Average monthly school utilities transfer	Household size	Total expenditures (food) [non-food]	Transfers as a percentage of non-beneficiaries expenditures
All poor households	5.81	1190 (947) [242]	197	99	91	8	5.47	1039 (806) [233]	19.54%
Households with pre-school-aged children	6.58	1289	202	101	93	8	6.41	1092	18.7%
Households with school-aged children	6.59	1311	239	101	128	11	6.40	1155	20.9%
Households with heads aged 60 or older	4.35	936	138	93	41	3	4.23	880	16.5%

Source: Calculations based on transfer data provided by PROGRESA averaged across the 12-month period between November 1998 and October 1999 (deflated to November 1998 prices). Consumption and family size averaged across the three rounds of the ENCEL surveys in November 1998, June 1999, and November 1999.

Evaluation surveys

Table 3.2 Number of households and individual members covered in each survey round

Survey round	Coverage	Non-eligible ($E = 0$) Control ($T = 0$)	Non-eligible ($E = 0$) Treatment ($T = 1$)	Eligible ($E = 1$) Control ($T = 0$)	Eligible ($E = 1$) Treatment ($T = 1$)	All
Pre-program/baseline census/survey						
ENCASEH Nov 97	Households	2,048	3,233	7,173	11,623	24,077
	Individuals	5,791	8,765	17,114	27,366	59,036
ENCEL-Mar 98	Households	1,925	3,048	6,567	10,549	22,059
	Individuals	n.a.	n.a.	n.a.	n.a.	n.a.
Post-program surveys						
ENCEL-Nov 98	Households	2,058	3,272	7,158	11,585	24,073
	Individuals	6,147	9,290	17,793	28,258	61,488
ENCEL-Jun 99	Households	1,837	2,932	6,655	10,682	22,106
	Individuals	5,361	8,090	16,406	25,775	55,632
ENCEL-Nov 99	Households	1,921	2,902	6,818	10,475	22,116
	Individuals	5,804	8,421	17,219	26,000	57,444

Notes: The terms eligible ($E = 1$) or non-eligible ($E = 0$) are based on the final list of eligible households constructed by the PROGRESA administration (see Chapter 5 for more details).
The March 1998 ENCEL survey collected information at the individual level only for children between birth and six years of age. No information was collected at the individual level for adult members.

The various situations of households in experimental localities

Table 3.1 Decomposition of the sample of all households in treatment and control villages

Description	Treatment locality where PROGRESA is in operation ($T = 1$)	Control locality where PROGRESA operations are delayed ($T = 0$)
Eligible for PROGRESA benefits ($E = 1$)	A $E = 1, T = 1$	B $E = 1, T = 0$
Non-eligible for PROGRESA benefits ($E = 0$)	C $E = 0, T = 1$	D $E = 0, T = 0$

Various estimates of treatment effects

Simple difference:

Cross section

$$CSDIF = E(Y(t)|T = 1, E = 1) - E(Y(t)|T = 0, E = 1) \quad \text{for } t = 1, 2, 3, \ldots.$$

Simple difference

Before-after

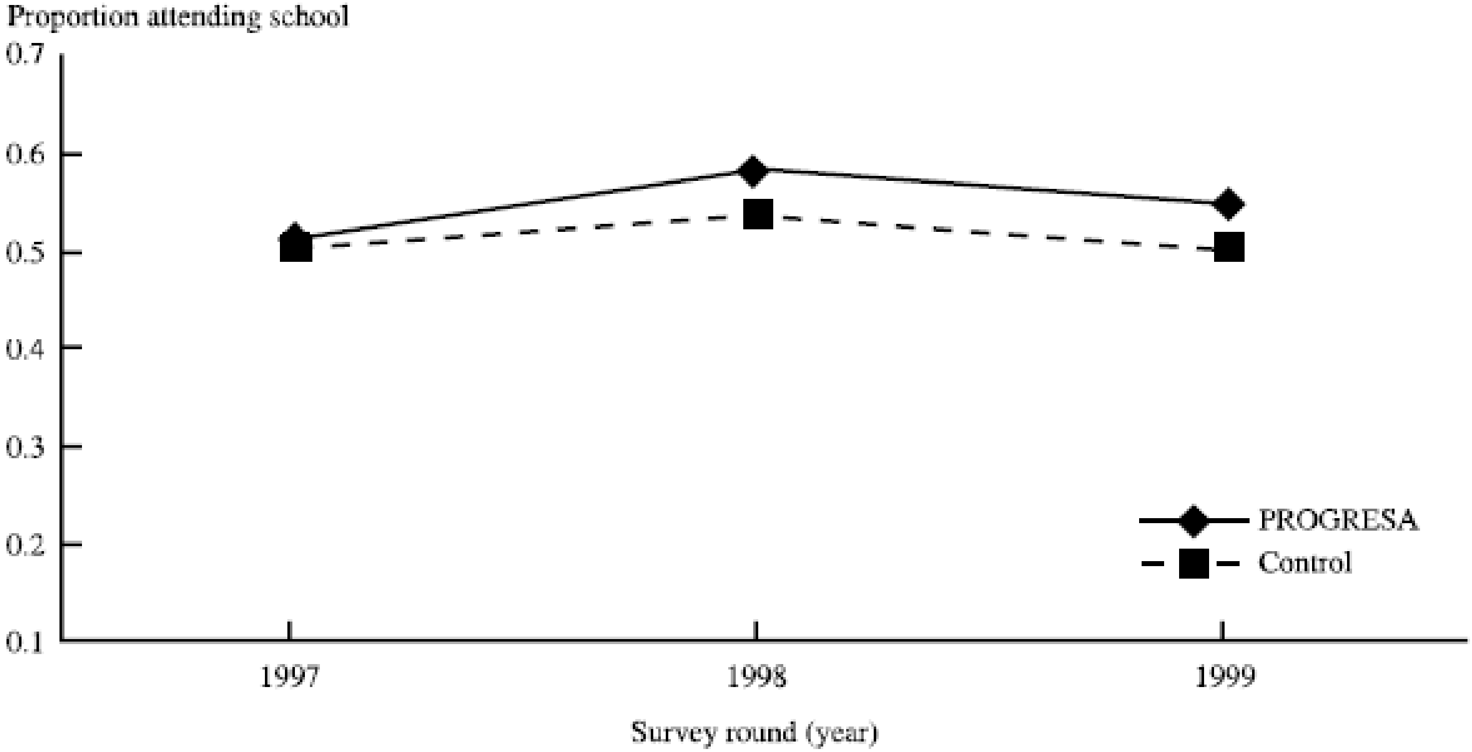
$$BADIF = E(Y(t = 1)|\, T = 1, E = 1) - E(Y(t = 0)|\, T = 1, E = 1).$$

Double difference

$$2DIF = [E(Y(t = 1)|\, T = 1, E = 1) - E(Y(t = 1)|\, T = 0, E = 1)] - [E(Y(t = 0)|\, T = 1, E = 1) - E(Y(t = 0)|\, T = 0, E = 1)].$$

Numerous applications with alternative estimation techniques…. Education (Skoufias, 2005)

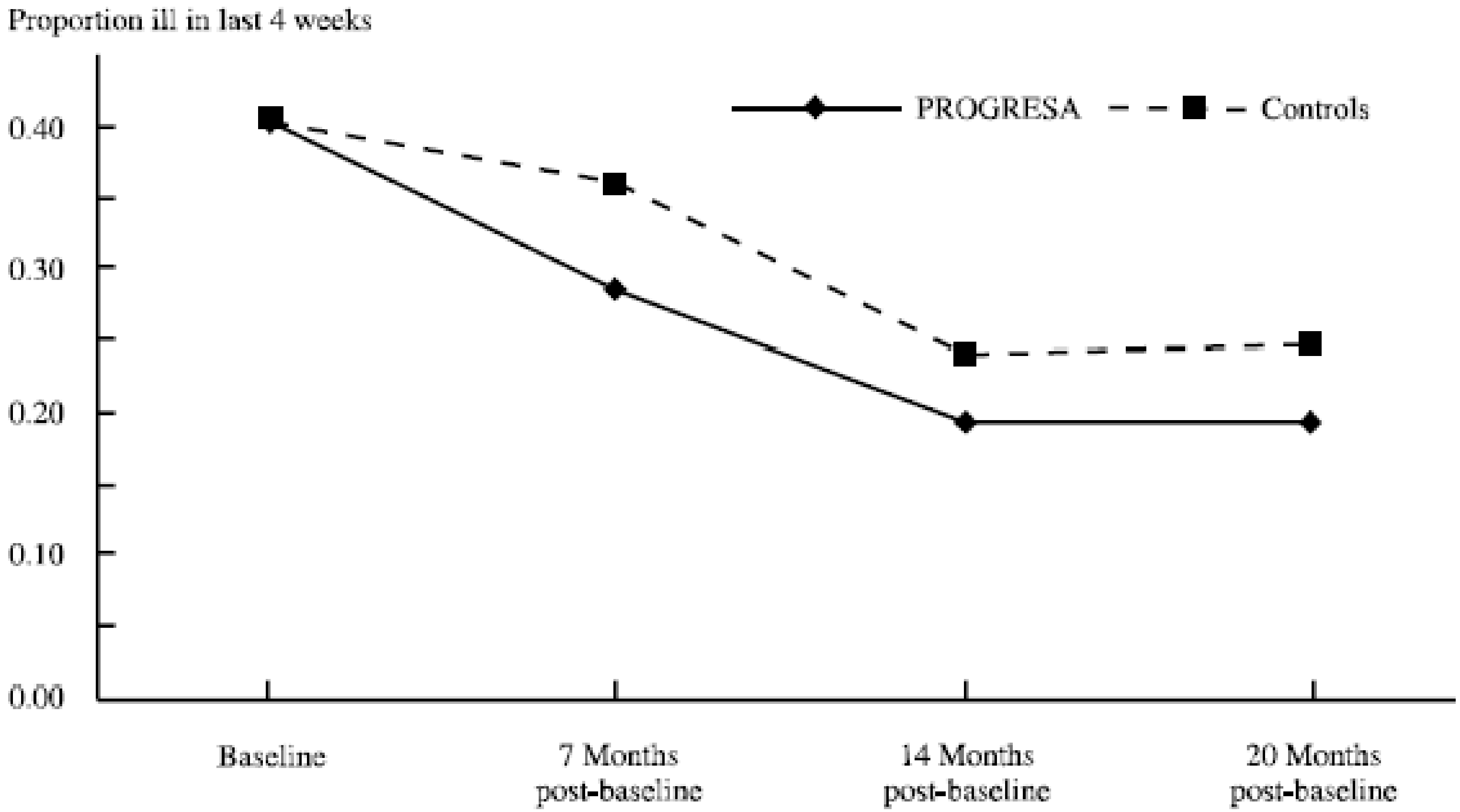
Figure 6.2b School attendance of children 12–17 years old



Source: Author's calculation.

Health (Skoufias, 2005)

Figure 6.3a Incidence of illness for newborns to two-year-olds



Consumption (direct and indirect effects, Angelucci and de-Giorgi, 2008)

Table 1: Average monthly food consumption per adult equivalent - levels and differences.

	Non-poor				Poor		
	Nov. 1998	May. 1999	Nov. 1999		Nov. 1998	May. 1999	Nov. 1999
Control	222.61	213.69	206.71		159.96	159.92	153.7
	[179.76]	[212.19]	[232.56]		[112.19]	[158.33]	[126.72]
Treatment	216.38	233.06	224.08		175.80	185.66	184.31
	[166.82]	[303.79]	[285.61]		[136.59]	[193.81]	[172.25]
				No controls			
ITE	**-6.24**	**19.37**	**17.36**	**ATE**	**15.84**	**25.74**	**30.61**
	[7.58]	**[10.50]***	**[9.70]***		**[4.86]*****	**[5.80]*****	**[5.15]*****
Obs.	4643	3855	4285		10973	9659	10554
				Controls			
ITE	**-5.20**	**20.72**	**18.84**	**ATE**	**15.49**	**24.42**	**29.86**
	[7.47]	**[10.19]****	**[9.42]****		**[4.75]*****	**[5.64]*****	**[4.79]*****
Obs.	4624	3838	4266		10936	9630	10518

Note: the amounts are in pesos; the exchange rate is roughly 10 pesos per USD.
We report the standard deviations of the means and the standard errors, in square brackets, of the treatment effects. The latter are clustered at the village level.
***, **, * indicates significance at the 1, 5, 10 % level respectively.
The set of conditioning variables we add to the regressions in the left panel are: household poverty index, land size, head of household gender, age, whether speak indigenous language, literacy; at the locality level poverty index and number of households. All variables are at 1997 values.

Other applications:

- Nutrition
- Visits to clinic
- Child height
- Adult health status
- Intra-household allocation of time
- Labor supply
- ….
- Cos-benefit analysis (relatively little developed)

4. Limitations of the experimental approach

- Technical: issue of "randomness"

  Spillovers, externalities and general equilibrium

  (Some observations in "control groups" may be indirectly affected by treatment=

- Other limitations: feasibility (ethical, statistical)
- Political economy (delays in producing results, risk of failure, cost)
- Problem of generalizing
  – Possible influence of context
  – Little information on effects of alternative designs
- Need for and difficulty of 'meta-evaluation' (Greenber and Shroder, 2004)

Effects on labour supply of the implementation of an in-work benefit for Spanish mothers

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Some trends…

… trend toward **active welfare state**

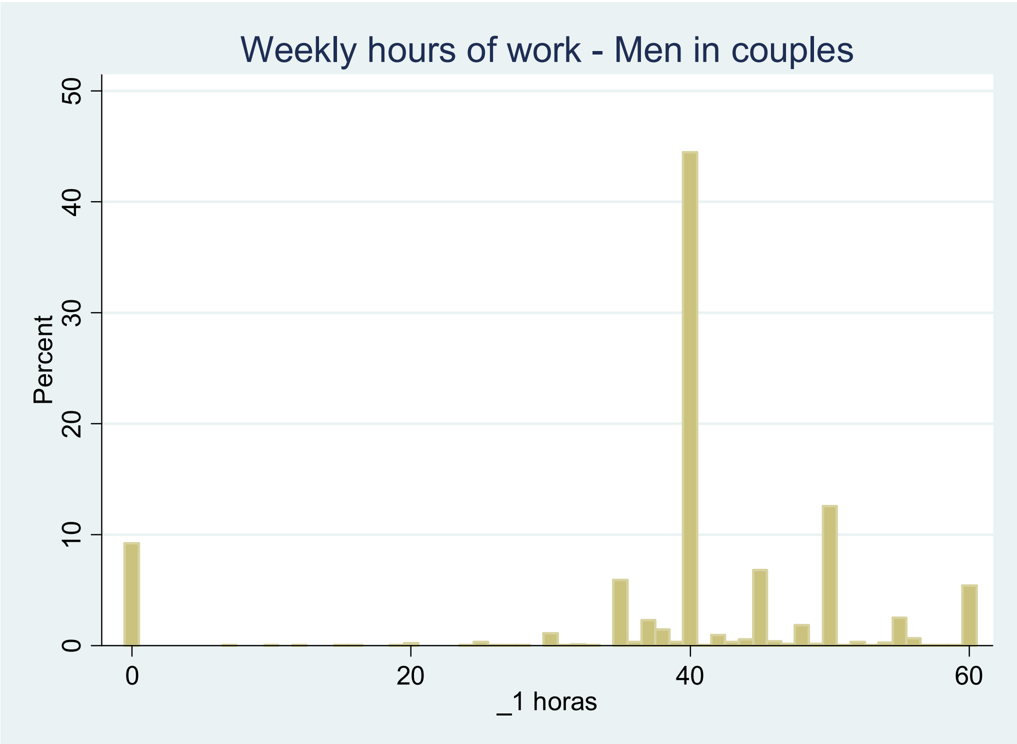
- Several **European countries** have implemented some sort of an **in-work benefits or tax credits:**
  - In **UK**: Working family tax credit (WFTC, 2000)
  - In **Belgium** (Crédit d'impôt sur les bas revenus de l'activité professionnelle, in 2001)
  - In **France**: Prime pour l'emploi or, more recently, the Revenu de Solidarité Active (RSA) replaced the RMI. RSA tries to avoid some of the labour disincentives of the previous system
  - In **Sweden** (as previously commented)
  - Etc.
- In **Spain** 2003 they introduced a very modest tax credit for working mothers

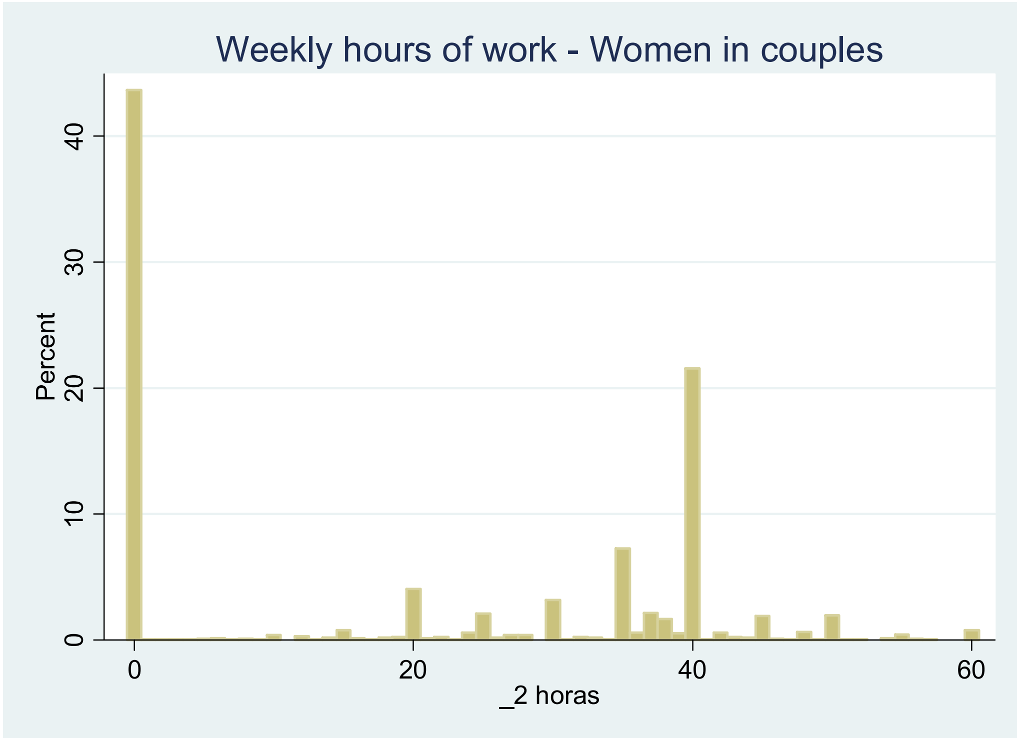
Why is interesting an in-work benefit in Spain?

- In-work benefits could be especially relevant in Spain where…
  - High rate of female non-participation
    - 1995: almost 60% of the women living in couples (between 25-65 years old) are not working
    - 2006: 43%
    - It has decreased but still far from other EU countries
  - Part-time jobs are scarce in Spain (as a consequence of demand restrictions in the labour market)
  - Less generous social benefits than in other UE countries
- Consequently, it is hard to reconcile family burden and professional careers, especially in the case of mothers with young children

Hours of work

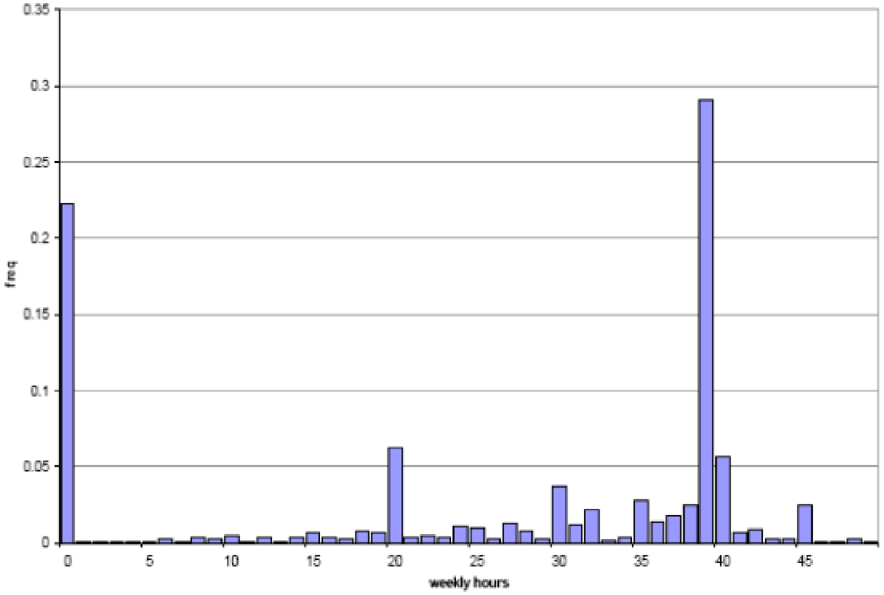
Spain





Working hours of Women living in couples in other countries

France



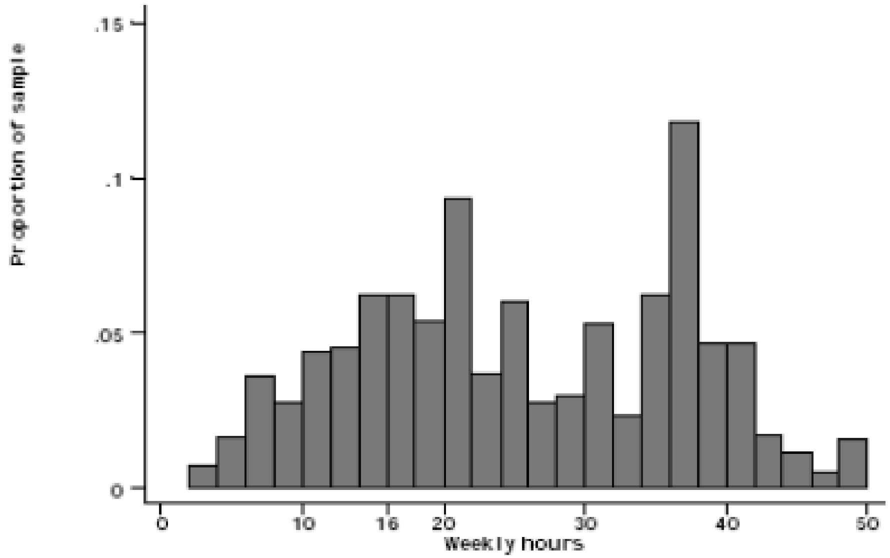
Distribution of Working Hours for Women with Employed Partners (selection)

Data from 1995

Source: Bargain (2006)

UK

Women in couples



Data from the early nineties

with 30% of no-participation

Source: Blundell et. al (2002)

Aim of the work

- Construct a behavioural microsimulation model to evaluate public policies *ex ante*
- Structural estimation of a discrete labour supply model
- Compute elasticities (on participation and working hours)
- Simulate the effect of a hypothetical reform of the in-work benefit

Results:

- An increase of the generosity of the system can encourage mothers to work without a big disincentive to their partners, but the cost of the reform can be high

Related work

UK

- Working family tax credit (WFTC, 2000)
  - Deeply analyzed by people from the IFS
  - Duncan & McCrae (1999) or Blundell et al. (2002)

US

- Earned Income Tax Credit (EITC)
  - Hoynes (1996)
  - Keane & Moffitt (1998)

France, Germany and Finland

- Bargain & Orsini (2006) analyze hypothetical in-work benefits in those countries using EUROMOD

Sweden: Aaberge & Flood (2009) - Recent reform

Italy: Figari (2009) – Hypothetical reform

Etc…

Outline

1. Simulated scenarios
2. Discrete labour supply model
3. Data
4. Microsimulation model: NITSIM
5. Econometric Results
6. Policy simulations
7. Conclusions

1. Simulated scenarios

Baseline: 2007 PIT and SS contributions

Main characteristics of the PIT:

- Capital income taxed at a flat rate (18%)
- Rest of income taxed progressively

Table 2: Tax schedule

2006		**2007**	
Up to	Tax rate	Up to	Tax rate
4,162	15%	17,360	24%
14,357.52	24%	32,360	28%
26,842.32	28%	52,360	37%
46,818	37%	Over 52,360	43%
Over 46,818	45%		

Table 1: Personal and family allowances

	2006	2007	Change
Personal allowance	3,400	5,050	49%
Age >65	800	900	13%
Increase for >75	+1,000	+1,100	10%
Children allowance:			
1st child	1,400	1,800	29%
2nd children	1,500	2,000	33%
3rd children	2,200	3,600	64%
4th children (or more)	2,300	4,100	78%
Increase for <3-year-old	+1,200	+1,400	17%

1. Simulated scenarios (2)
Reform: working mother tax credit

Actual

- 100 euros/month for working mothers
- Bounds:
  - Social security contributions
  - Having children <3 years old

Proposal

- 100 euros/month for working mothers **per children**
  - For each children below 15 years old
- Aid independent of the social contributions

2. Discrete labour supply model

- Characteristics:
  - A utility function (U) is estimated directly
  - There is a finite number of alternatives
- Procedure:
  - There are *i* households and *j* alternatives

$$Max_h \quad \mathrm{U(y, h_m, h_f, Z}, \varepsilon)$$

subject to $$y \leq w_m l_m + w_f l_f + \mu - T(l_m, l_f, w_m, w_f, \mu, Z)$$

  - It is assumed that individuals choose the alternative that maximizes their utility
  - If we assume a Weibull distribution of ε, the model is the conditional logit model (McFadden model) and it can be estimated by ML

2. Discrete labour supply model (3) Specification

- We use a quadratic utility function:

$$U^*(y, h_m, h_f, Z_m, Z_f, Z) = \alpha_{yy} y^2 + \alpha_{h_m h_m} h_m^2 + \alpha_{h_f h_f} h_f^2 + \alpha_{y h_m} y h_m +$$

$$+ \alpha_{y h_f} y h_f + \alpha_{h_h h_f} h_m h_f + \beta_y y + \beta_{h_m} h_m + \beta_{h_f} h_f + \varepsilon_{h_m h_f}$$

with observed heterogeneity in the betas

$$\beta_y = \beta_{y0} + \beta'_y Z$$

$$\beta_{h_m} = \beta_{h_m 0} + \beta'_{h_m} Z_m$$

$$\beta_{h_f} = \beta_{h_f 0} + \beta'_{h_f} Z_f$$

And fixed costs which are subtracted from the disposable income (for women who are working)

$$FC = Z_{fc} \beta_{fc}$$

3. Data

- EU-SILC (Statistics on Income and Living Conditions)
  - We use the 2006 Spanish cross-sectional sample: more than 12000 households
  - We select couples which are between 25 and 65 years old which are potential workers: 3607 observations

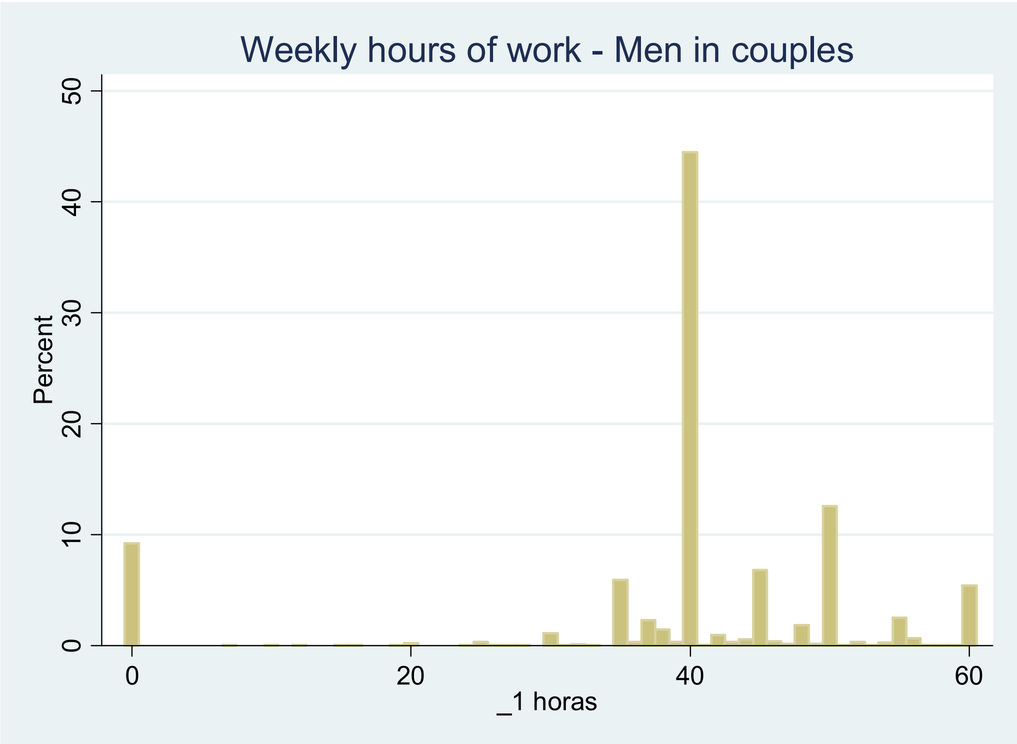
4. Microsimulation model

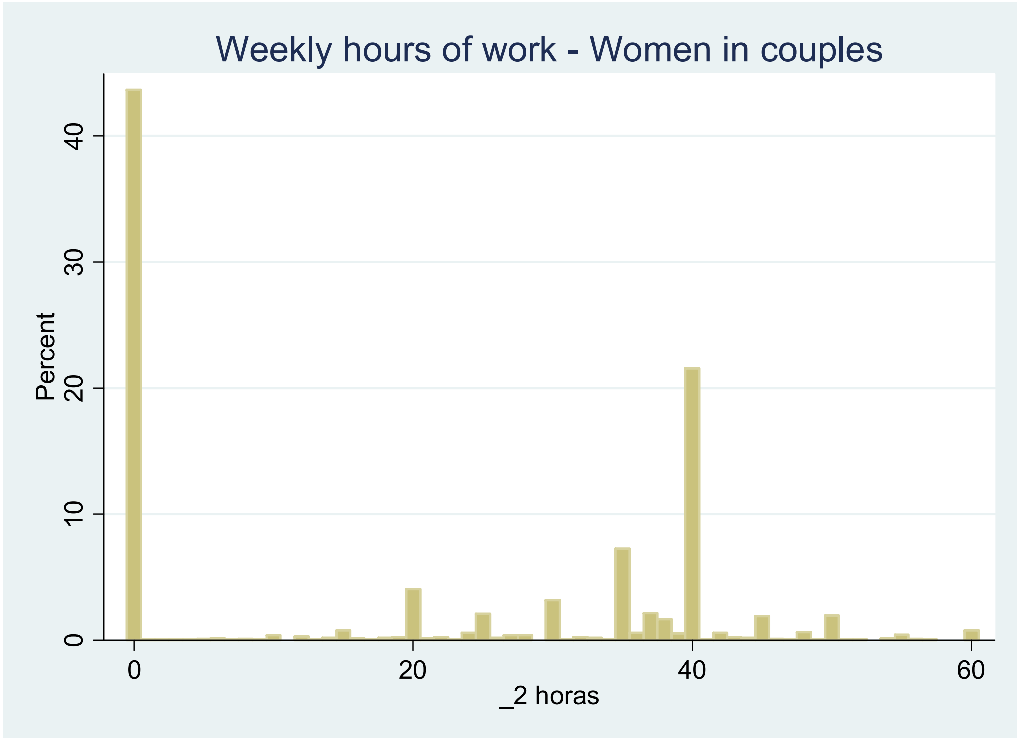
- Given a wage rate, we compute the gross income of each household under each alternative
  - Men: not-working (0 hours), full-time worker (40 hours) and working overtime (50 hours)
  - Women: not-working (0 hours), part-time worker (25 hours) and full-time worker (40 hours)

  $\Rightarrow$ 9 alternatives per household
- Wage rates are computed as:
  - Current weekly income / weekly hours of work
  - For those workers who are not actually working we predict the wage rate

Hours of work

Spain





5. Econometric results: The utility function

Variable	Coefficient
Income^2	-0.283***
Hours of leisure of the male^2	-45.464***
Hours of leisure of the female^2	-83.472**
Income x Hours of leisure of the male	1.922***
Income x Hours of leisure of the female	0.929
Hours of leisure of the male x Hours of leisure of the female	-4.049
Income	1.896**
x Age of the male	0.039
x Age of the female	0.211*
x 1(Children 0-3)	-0.278
x 1(Children 3-15)	-0.391
Hours of leisure of the male	91.527***
x Age of the male	1.651***
x Age of the male square	0.841***
x 1(Children 0-3)	-0.278
x 1(Children 3-15)	-0.625***
Hours of leisure of the female	140.225**
x Age of the female	0.062
x Age of the female squared	0.968***
x 1(Children 0-3)	2.416
x 1(Children 3-15)	2.941***
Fixed costs	1.418***
x 1(big city)	-0.03
n. Children	0.116***
Number of observations	3607
Log likelihood	-6347.925

Note. The variables have been rescaled as follows:
Income = disposable income in euros/20,000;
Hours of leisure = (24x7 – weekly hours of work)/160;
Age = (age in years – 40)/10.

*parameter significant at 10%,
** parameter significant at 5%,
*** parameter significant at 1%

6. Policy simulations

Labour supply

	Pre-reform	Post-reform	Change
Participation			
Male	91.02	90.97	-0.05%
Female	56.32	59.96	6.45%
Hours			
Male	3974.8	3970.2	-0.11%
Female	2029.1	2154.9	6.20%

Elasticities at the intensive at extensive margin. Responses in percentage points of an increase of 10% (elasticities)

	Change in	Increase in female wage rate	Increase in male wage rate
Females	**Participation**	**2.6**	0.24
	Working hours	**5.1**	0.23
Males	**Participation**	-0.34	**1.76**
	Working hours	-0.42	**2.12**

6. Policy simulations (3)

	Pre-reform	**Post-reform**			
		without response	**Change**	**with response**	**Change**
Cost					
Income Tax	10,650,859	8,721,694	-18.11%	8,574,936	-19.49%
Income Tax (excluding in-work benefit)	11,058,094	11,058,094	0.00%	11,207,391	1.35%
In-work mother benefit	407,235	2,336,400	473.72%	2,632,455	546.42%
Social security contributions	7,742,663	7,742,663	0.00%	7,825,826	1.07%
Tax collection	18,393,522	16,464,357	-10.49%	16,400,762	-10.83%
Efficiency					
Gross Income (in millions)	109.76	109.76	0.00%	110.86	1.00%

7. Conclusions

1. We construct a behavioural microsimulation model for the Spanish population
2. We estimate a discrete model of labour supply for the couples
3. We analyze the effect of an in-work benefit. More precisely, we relax the bounds of the existing working mother tax credit (ages of the children and maximum amount)
4. In-work benefits can increase female labour supply, but the reform we simulate has a high cost in terms of tax collection

Redistribution and Polarization Impact of the European Redistribution Architecture: an Analysis Using Microsimulation Techniques

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Introduction

Recent trends in economic and socio-demographic variables determined the rise of new demands of social protections that the actual Spanish model is unable to fully cover. For that reason, in the last years, the political and economic debate has been characterized by several proposals pushing for the reform of the Spanish welfare state.

- ✖ Spain belongs to what has been called "the Southern European (or Mediterranean)" welfare state regime (Esping Andersen 1990, 1999, Ferrera, 1996).
- ✖ Some reform proposals look toward a system more market oriented. Their reference model is the liberal type of welfare capitalism, which embodies individualism and the primacy of the market (for example, the UK system).
- ✖ There are also supporters of the Continental Europe Bismarkian social protection models. They push for the adoption of the so-called world of conservative corporatist welfare states, which is typified by a moderate level of decommodification (for example, the French system).
- ✖ Finally there are proposals of reforms in the spirit of the universalism observed in the Northern European countries: the so-called social-democratic world of welfare capitalism (for example, the Danish system).

	Social democracy	**Corporativist**	**Liberal**	**Southern-European**
	Strong	**Medium**	**Weak**	**Weak**
	Universalism	Familiarism	Individual responsibility	Familiarism
	Denmark	Finland, Germany, France	UK	Spain, Italy

Whatever reform is implemented, it is important to have a clear picture of the impact it may cause on the economy.

In what follow we try to offer some elements of evidence of these effects. We will analyse the impact upon efficiency, income distribution and polarization of the replacement of the actual Spanish redistribution system with several European schemes (one for each “model”). In particular we simulate schemes similar to the ones enforced in France, UK and Denmark (corporatist, liberal and social-democratic respectively).

The efficiency, inequality and polarization analysis will be performed using behavioural microsimulation techniques.

The two main aims of the contribution are:

1) to offer some elements of clarification of the debate regarding the reforms of the welfare state in Spain by perform comparatives with other European welfare state regimes and

2) to show the potential of behavioural microsimulation models as powerful tools for the ex ante evaluation of public policies and their distributional and polarization impacts.

Definitions (Bourguignon and Spadaro, JoEI 2006):

•Microsimulation models allow simulating the effects of a policy on a sample of economic agents (individual, households, firms) at the individual level.

•Policy evaluation is based on representations of the economic environment of individual agents, their budget constraints and possibly their behavior.

•A policy simulation then consists of evaluating the consequences of a change in the economic environment induced by a policy reform on a vector of indicators of the activity or welfare for each individual agent in a sample of observations.

GladHispania is a microsimulation model of the Spanish Tax-Benefit system

It is a:

- Static
- Partial equilibrium
- With behavior

It focuses on direct taxation (PIT and SS)

It allows to simulate any change in those figures

It uses the Spanish ECHP as a database

Simulated scenarios: The baseline is the 1999 Spanish tax-benefit system.

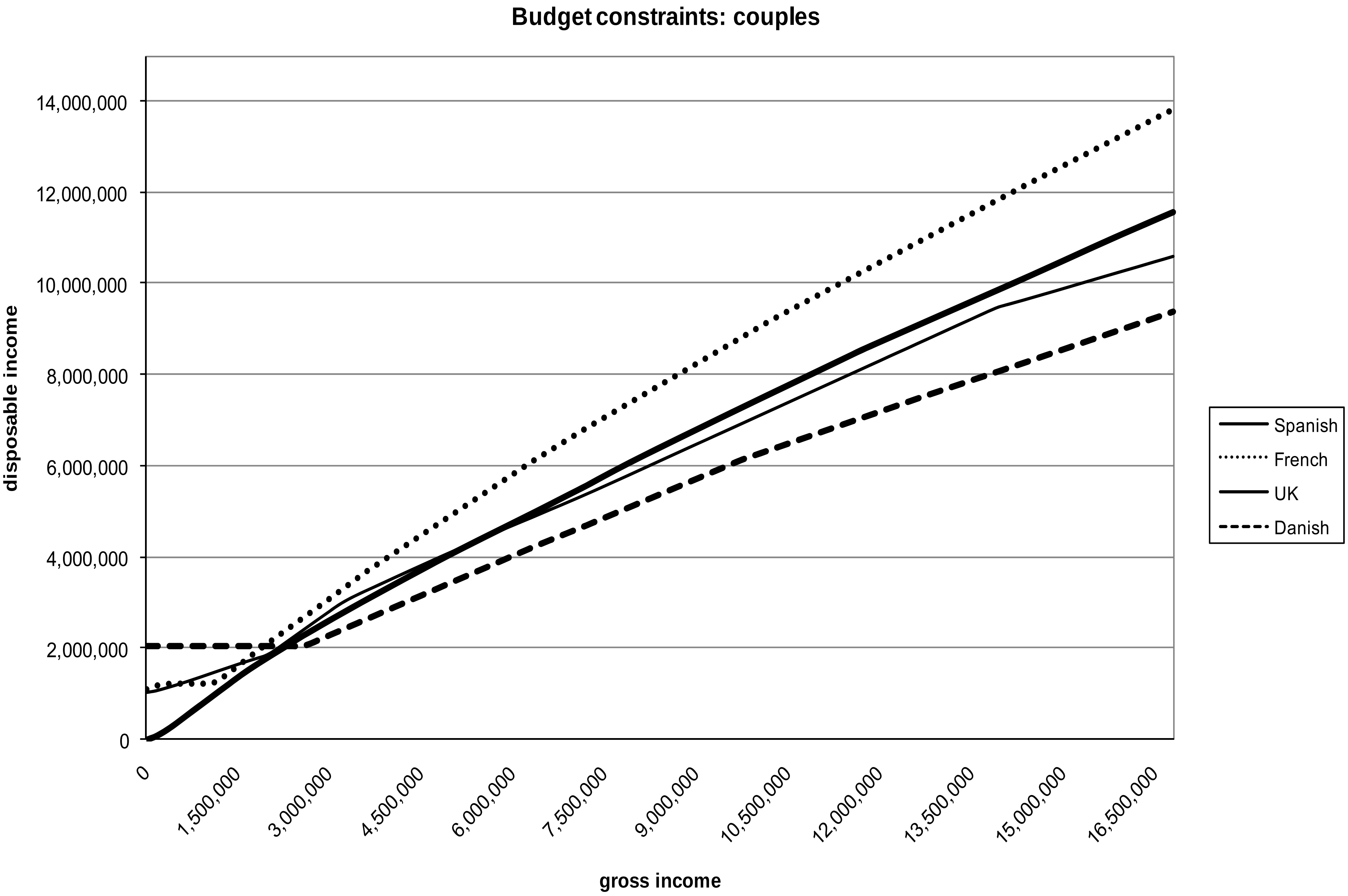
In order to simulate a system with the UK characteristics, we have simulated the following instruments: the income tax, the child benefit, the working families' tax credit and the income support.

The French redistribution instruments that we model are: the "allocations familiales" , the "Revenue Minimum d'Insertion" , and the income tax.

The simulated social-democratic scenario is a simplification of the Danish one. In particular we model family allowances, social assistance and personal income taxation.

Spanish system[1]		**UK system**		**French system[2]**		**Danish system**	
up to	Tax rate	up to	Tax rate	up to	Tax rate	allowance	Tax rate
3,606	18.0%	2,956	10%	3,947	0.0%	4,481	6.25%
12,621	24.0%	48,284	22%	7,764	10.5%	23,867	6.00%
24,642	28.3%	over 48,284	40%	13,667	24.0%	37,148	15.00%
39,666	37.2%			22,129	33.0%		
66,111	45.0%			36,007	43.0%	4,481	31.75%[3]
over 66,111	48.0%			44,404	48.0%		
				over 44,404	54.0%		

Notes: (1) PIT tax rates schedules in 1999 are the same in 2001 (2) The tax schedule for France refers to the 1998 system. (3) In Denmark there is an important local tax that varies across regions. We have taken an average tax rate of 31.75%, which respect the total maximum marginal tax of 59%.



Budget constraints: couples
disposable income
gross income
0
2,000,000
4,000,000
6,000,000
8,000,000
10,000,000
12,000,000
14,000,000
0
1,500,000
3,000,000
4,500,000
6,000,000
7,500,000
9,000,000
10,500,000
12,000,000
13,500,000
15,000,000
16,500,000
Spanish
French
UK
Danish

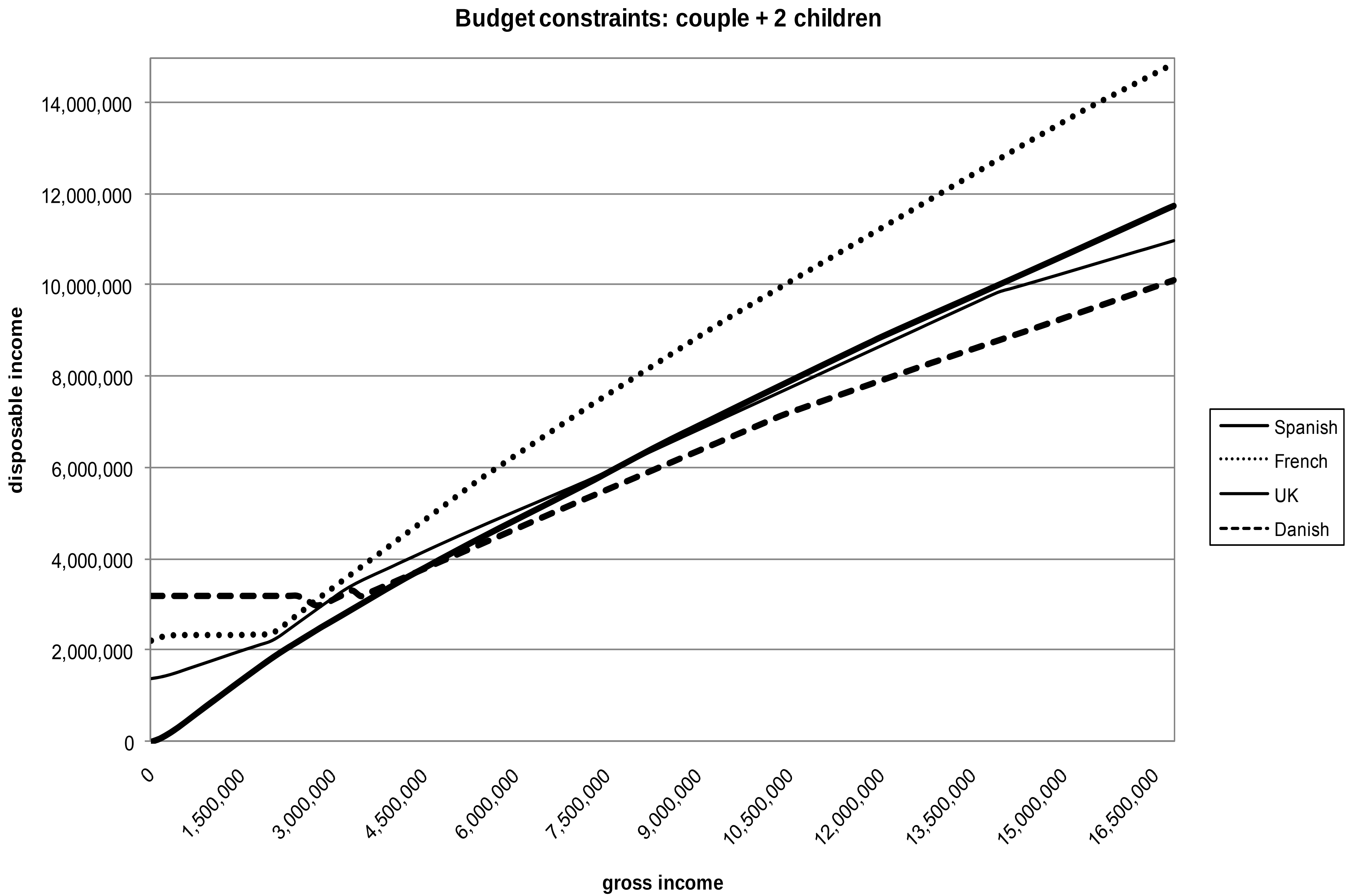

Budget constraints: couple + 2 children
disposable income
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
0
1,500,000
3,000,000
4,500,000
6,000,000
7,500,000
9,000,000
10,500,000
12,000,000
13,500,000
15,000,000
16,500,000
gross income
Spanish
French
UK
Danish

Figure 2a: Singles

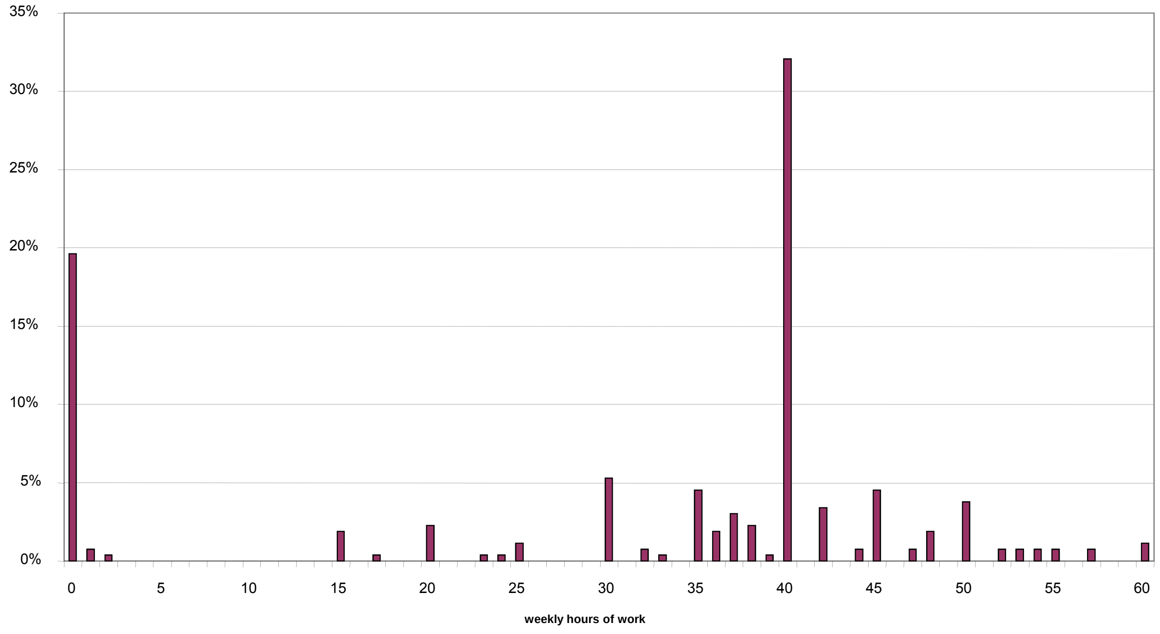


Figure 2b: Couples - Spouse

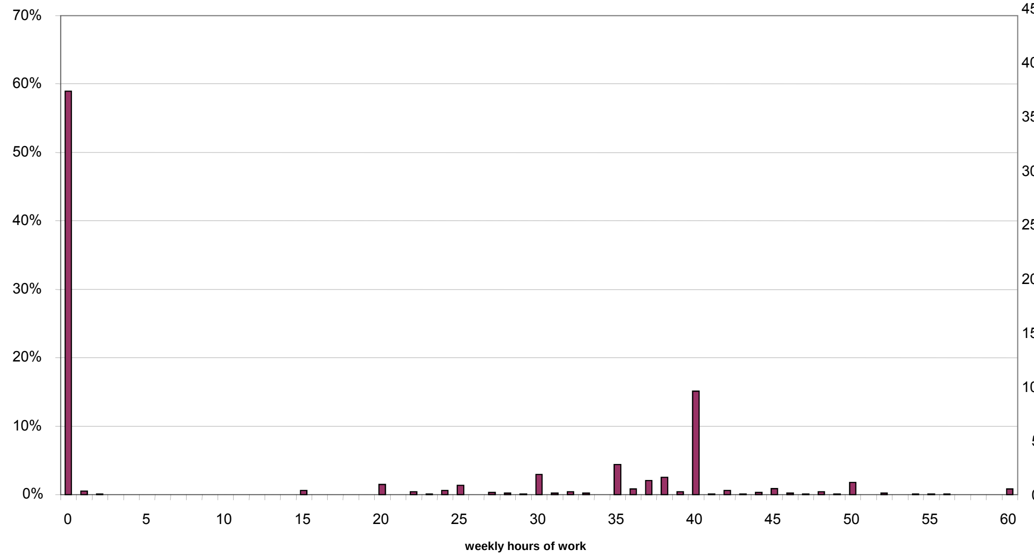
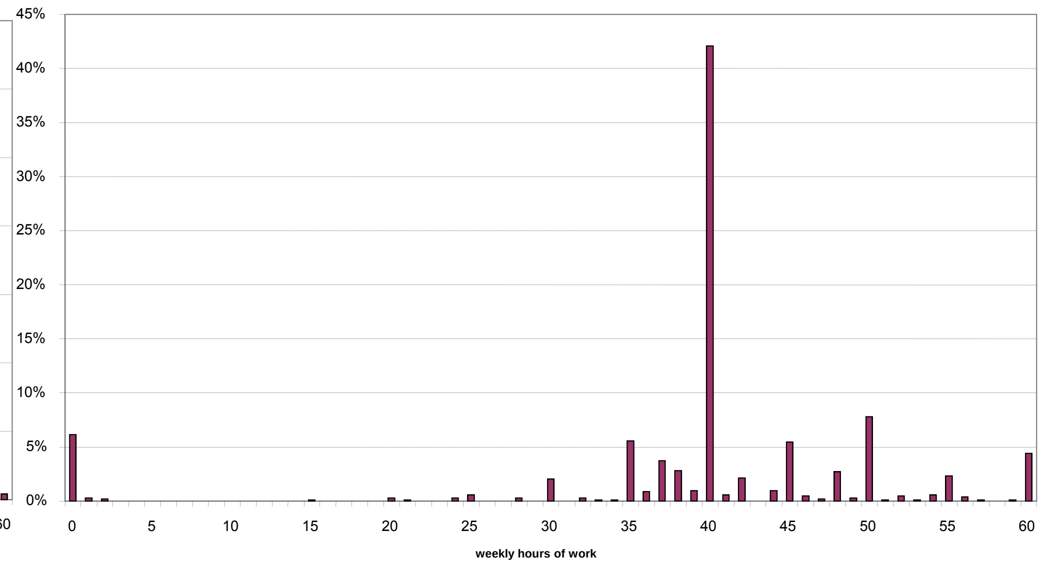


Figure 2b: Couples – Household head



Model specification and estimation: Aaberge et al. (1995) and van Soest (1995).

- Characteristics:
  - An utility function is estimated directly
  - There are a finite number of alternatives (K)

    $h_j = \{h_1, h_2, \ldots, h_K\}$
- Procedure:
  - There are *i* individuals and *j* alternatives
- We adopt the flexible quadratic utility function (as in Keane and Moffit, 1998, and Blundell *et al.*, 2000):

$$U^*(y, h, Z) = \alpha_{yy}\, y^2 + \alpha_{hh}\, h^2 + \alpha_{yh}\, yh + \beta_y(Z)\, y + \beta_h(Z)\, h + \varepsilon_{hi}$$

for the singles subsample, and

$$U^*(y, h_h, h_c, Z_h, Z_c, Z) = \alpha_{yy} y^2 + \alpha_{h_h h_h} h_h^2 + \alpha_{h_c h_c} h_c^2 + \alpha_{y h_h} y h_h + \alpha_{y h_c} y h_c + \alpha_{h_h h_c} h_h h_c + \beta_y y + + \beta_{h_h} h_h + \beta_{h_c} h_c + \varepsilon_{h_h h_c}$$

for couples.

  - *y = disposable income – fixed costs*
  - It is assumed that individuals choose the alternative that maximizes his utility

Model specification and estimation: Log-likelihood

- We assume that ε follows a Weibull distribution

- The log-likelihood function:

- This is the McFadden or conditional logit model

Results: Efficiency

		Spanish system									
Combination of working hours (household head_spouse)		0_0	0_25	0_40	40_0	40_25	40_40	50_0	50_25	50_40	total
Danish system	0_0		0.00	0.00	0.10	0.00	**0.10**	0.31	0.00	0.00	1.14
	0_25	0.00		0.00	**0.21**	0.00	0.00	0.00	0.00	0.10	0.41
	0_40	0.10	0.00		0.31	**0.31**	**0.41**	0.10	0.10	0.00	4.86
	40_0	0.00	0.00	0.00		0.00	0.10	0.21	0.10	0.10	37.23
	40_25	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.10	6.83
	40_40	0.00	0.00	0.10	0.00	0.00		0.10	0.00	0.00	17.58
	50_0	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	22.23
	50_25	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	2.28
	50_40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		7.45
	total	0.72	0.10	3.62	37.33	7.03	17.99	22.96	2.48	7.76	**100.00**

		Spanish system									
Combination of working hours (household head_spouse)		0_0	0_25	0_40	40_0	40_25	40_40	50_0	50_25	50_40	total
French system	0_0		0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.83
	0_25	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	0_40	0.00	0.00		0.10	0.00	0.00	0.00	0.00	0.00	3.72
	40_0	0.00	0.00	0.00		0.00	0.00	0.00	0.10	0.00	36.50
	40_25	0.00	0.00	0.00	0.00		0.00	0.10	0.00	0.00	6.93
	40_40	0.00	0.00	0.00	0.00	0.00		0.10	0.00	0.00	17.89
	50_0	0.00	0.00	0.00	0.83	0.00	0.10		0.00	0.00	23.68
	50_25	0.00	0.00	0.00	0.00	0.10	0.00	0.00		0.00	2.48
	50_40	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00		7.86
	total	0.72	0.10	3.62	37.33	7.03	17.99	22.96	2.48	7.76	**100.00**

		Spanish system									
Combination of working hours (household head_spouse)		0_0	0_25	0_40	40_0	40_25	40_40	50_0	50_25	50_40	total
UK system	0_0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72
	0_25	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
	0_40	0.00	0.00		0.21	0.00	0.10	0.00	0.00	0.00	3.93
	40_0	0.00	0.00	0.00		0.00	0.00	0.31	0.10	0.10	37.64
	40_25	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.10	7.14
	40_40	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	17.89
	50_0	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	22.65
	50_25	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	2.38
	50_40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		7.55
	total	0.72	0.10	3.62	37.33	7.03	17.99	22.96	2.48	7.76	**100.00**

Results: Efficiency

With such evidence, two points should be stressed:

1. the majority of households are on the diagonal, which implies that they do not alter their labour supply;
2. the higher the marginal tax rate, the greater are the labour supply effects.

It is also interesting to look at changes in labour supply behaviour of spouses. It must be noted that, in around 95% of the sample, they are women. It is clear that female labour supply and participation is stimulated under the Danish system. 0.53% of women increase their labour supply after the reform (Danish system) against 0.1% under the French system and -0.11% under the UK system.

The measure of polarization

According the axiomatic discussion in Duclos, Esteban and Ray (2004) the functional form of $T(i,a)$ is chosen such that

$$P_\alpha(f) \equiv \iint f(x)^{1+\alpha} f(y)|x-y|dydx,$$

where α is arbitrary chosen such that $\alpha \in [.25,1]$.[6]

Finally, considering any distribution function F with associated density f and mean μ, the polarization index can be written as

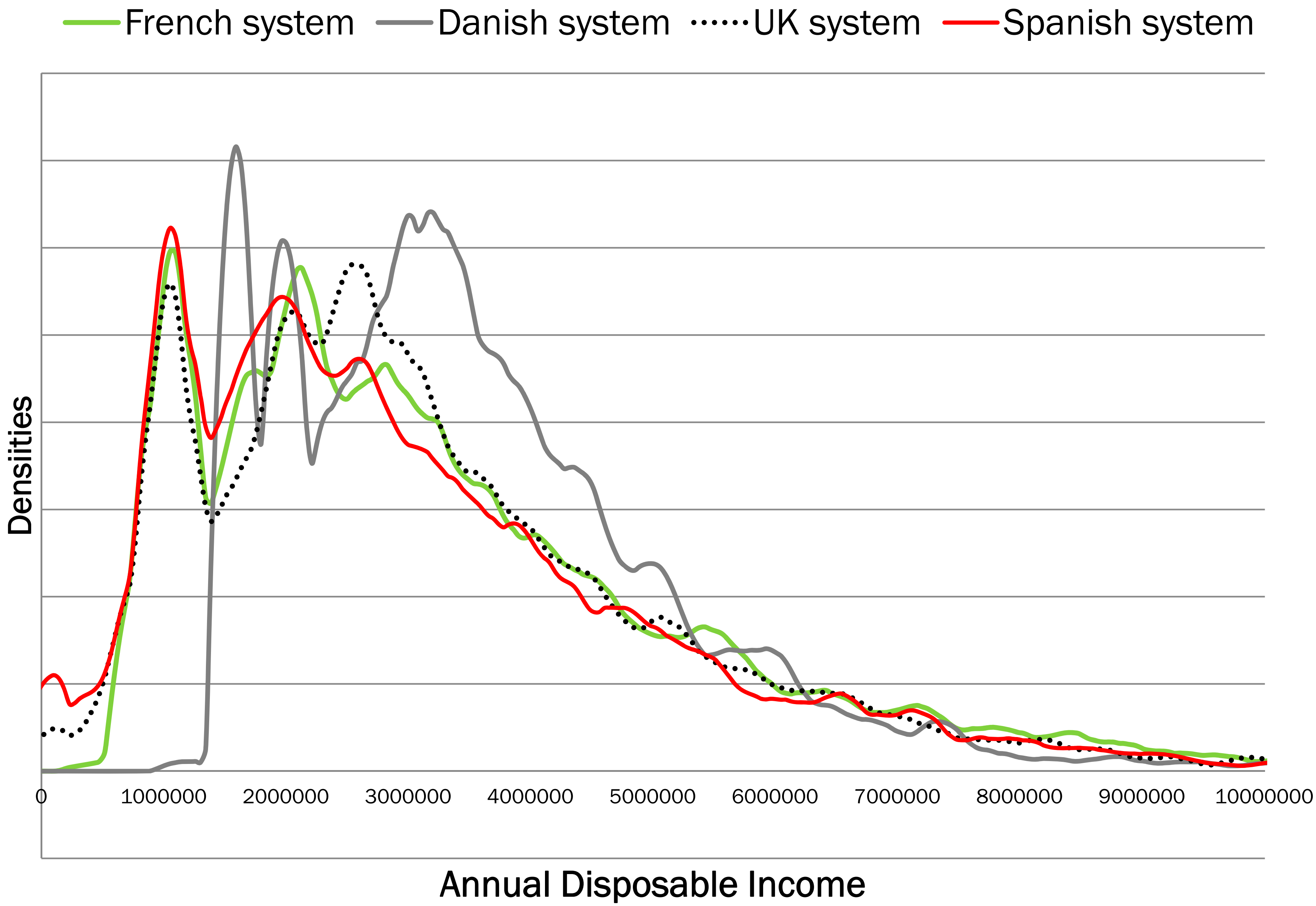
$$P_\alpha(F) = \int_y f(y)^\alpha a(y)dF(y),$$

with $a(y) = \mu + y(2F(y)-1) - 2\int_{-\infty}^{y} xdF(x)$.

An individual located at x in the distribution of the characteristic feels alienation with respect to another individual located at y according to their distance $|x-y|$ and identifies with the group depending on the density at x, $f(x)$.

$$P^*(\boldsymbol{F}) = \sum_{j=1}^{M} \sum_{k \neq j} \iint_{x\,y} f_j(x)^\alpha |x-y| dF_j(x) dF_j(y).$$

Results: Inequality and Polarization



Results: Inequality and Polarization

Table 8. Inequality and Polarization indexes

	Gini	alpha = 0.25	alpha = 0.5	alpha = 0.75	alpha = 1
Spanish system	0.3604 (0.0053)	0.2735 (0.0031)	0.2206 (0.0022)	0.1845 (0.0018)	0.1577 (0.0018)
UK system	0.3084 (0.0037)	0.2463 (0.0024)	0.2086 (0.0018)	0.1831 (0.0016)	0.1644 (0.0017)
French system	0.3373 (0.0044)	0.2631 (0.0027)	0.2172 (0.0020)	0.1854 (0.0017)	0.1616 (0.0016)
Danish system	0.2230 (0.0040)	0.1982 (0.0027)	0.1901 (0.0024)	0.1909 (0.0027)	0.1975 (0.0034)

Table 11. Polarization by age class

		Spanish system	Danish system	French system	UK system
Gini	Less than 35	0.3291 (0.0132)	0.1811 (0.0094)	0.2731 (0.0073)	0.2643 (0.0087)
	Between 35 and 60	0.3467 (0.0073)	0.2193 (0.0057)	0.3120 (0.0060)	0.2975 (0.0050)
	More than 60	0.3680 (0.0081)	0.2272 (0.0057)	0.3733 (0.0071)	0.3236 (0.0070)
alpha=.5	Less than 35	0.2125 (0.0064)	0.1615 (0.0064)	0.1983 (0.0042)	0.1881 (0.0043)
	Between 35 and 60	0.2143 (0.0031)	0.1792 (0.0032)	0.2066 (0.0028)	0.2003 (0.0023)
	More than 60	0.2372 (0.0042)	0.2447 (0.0052)	0.2478 (0.0041)	0.2422 (0.0046)
alpha=1	Less than 35	0.1533 (0.0046)	0.1681 (0.0066)	0.1619 (0.0045)	0.1514 (0.0034)
	Between 35 and 60	0.1541 (0.0024)	0.1764 (0.0035)	0.1599 (0.0023)	0.1559 (0.0019)
	More than 60	0.1866 (0.0045)	0.3643 (0.0129)	0.1968 (0.0047)	0.2303 (0.0069)

Table 12. Polarization by gender for singles (no children)

		Spanish system	Danish system	French system	UK system
Gini	Couples	0.3478 (0.0056)	0.2141 (0.0043)	0.3228 (0.0047)	0.2981 (0.0040)
	Males	0.4021 (0.0161)	0.2373 (0.0134)	0.3801 (0.0154)	0.3427 (0.0135)
	Females	0.4275 (0.0245)	0.1620 (0.0228)	0.4237 (0.0255)	0.3088 (0.0274)
alpha=.5	Couples	0.2157 (0.0023)	0.1868 (0.0026)	0.2123 (0.0021)	0.2034 (0.0019)
	Males	0.2467 (0.0093)	0.2364 (0.0127)	0.2481 (0.0102)	0.2328 (0.0088)
	Females	0.2982 (0.0216)	0.2724 (0.0394)	0.3336 (0.0252)	0.2811 (0.0283)
alpha=1	Couples	0.1566 (0.0019)	0.2027 (0.0041)	0.1617 (0.0018)	0.1615 (0.0017)
	Males	0.1750 (0.0076)	0.2974 (0.0206)	0.1860 (0.0083)	0.1888 (0.0098)
	Females	0.3084 (0.0297)	0.7559 (0.1099)	0.3927 (0.0380)	0.4082 (0.0471)

Table 13. Polarization by education

		Spanish system	Danish system	French system	UK system
Gini	Graduate	0.3139 (0.0131)	0.2550 (0.0106)	0.3025 (0.0104)	0.2750 (0.0087)
	Secondary	0.2988 (0.0116)	0.2029 (0.0080)	0.2792 (0.0092)	0.2631 (0.0088)
	Primary	0.3304 (0.0052)	0.1913 (0.0036)	0.3049 (0.0040)	0.2814 (0.0040)
alpha=.5	Graduate	0.2061 (0.0066)	0.1897 (0.0060)	0.2041 (0.0054)	0.1912 (0.0043)
	Secondary	0.2010 (0.0056)	0.1804 (0.0060)	0.1981 (0.0050)	0.1903 (0.0043)
	Primary	0.2108 (0.0021)	0.1846 (0.0026)	0.2071 (0.0019)	0.2004 (0.0019)
alpha=1	Graduate	0.1557 (0.0048)	0.1609 (0.0047)	0.1546 (0.0036)	0.1487 (0.0029)
	Secondary	0.1482 (0.0032)	0.1799 (0.0076)	0.1527 (0.0035)	0.1515 (0.0030)
	Primary	0.1529 (0.0017)	0.2165 (0.0047)	0.1568 (0.0015)	0.1647 (0.0020)

Table 14. Polarization by working position

		Spanish system	Danish system	French system	UK system
Gini	Other positions	0.3696 (0.0064)	0.2087 (0.0033)	0.3444 (0.0056)	0.3057 (0.0045)
	Employee	0.2851 (0.0082)	0.2134 (0.0051)	0.2788 (0.0069)	0.2489 (0.0044)
	Self employed	0.3755 (0.0183)	0.1918 (0.0101)	0.2779 (0.0132)	0.2927 (0.0095)
alpha=.5	Other positions	0.2286 (0.0029)	0.2059 (0.0028)	0.2280 (0.0029)	0.2163 (0.0025)
	Employee	0.1950 (0.0040)	0.1737 (0.0028)	0.1940 (0.0034)	0.1805 (0.0020)
	Self employed	0.2324 (0.0097)	0.1739 (0.0070)	0.1981 (0.0077)	0.1992 (0.0046)
alpha=1	Other positions	0.1681 (0.0028)	0.2565 (0.0062)	0.1763 (0.0028)	0.1866 (0.0032)
	Employee	0.1585 (0.0034)	0.1694 (0.0031)	0.1574 (0.0027)	0.1510 (0.0015)
	Self employed	0.1670 (0.0073)	0.1939 (0.0085)	0.1669 (0.0066)	0.1629 (0.0043)

The results show that the scenarios simulated have little impact on the efficiency of the economy (as measured by labour supply effects).

Concerning inequality the Danish system is the best one. To a lower degree, a result in this same direction can be achieved also adopting the French and UK systems.

However, when we take into consideration income polarization the situation is much less clear:

The results of our analysis in term of polarization show how important it is to consider not only redistribution effects. The decision of which reform should be implemented appears not so easy as if we were considering only income inequality.

Question: how much a policy maker should weight this additional polarization information?

To finish we cite a Nobel Prize:

"...There are, it seems to me, only two promising approaches to making well-based recommendations about public policy. One is to use a welfare function of some form and develop the theory of optimal policy.
The other is to model the existing state of affairs in some manageable way, and on that basis to display the likely effects of changes in government policy, these effects being displayed in sufficient detail to make rational choice among alternative policies possible.
If a welfare function were used to evaluate the changes predicted, the second approach would come fairly close to the first, and in fact, there is a closer theoretical relationship"

in Mirrlees, (1986) "The Theory of Optimal Taxation", in Handbook of Mathematical Economics, vol. III, Arrow and Intriligator eds, North Holland, Amsterdam. Chap. 24, pag. 1198.

Indirect Tax Reforms: The Case of Spain

Introduction

Alternative title of the presentation:

When the MATHS can say something about real world….

For example: **It is possible to implement Pareto improving indirect tax reforms in Spain?**

Related work:

- ***India (Ahmad and Stern,1984)***
- ***Norway (Christiansen and Jansen, 1978),***
- *Belgium (Decoster and Schokkaert, 1990),*
- *Canada (Cragg, 1991),*
- *Germany (Kaiser and Spahn, 1989),*
- *Italy (Brugiavini and Weber, 1988 and Liberati, 2001)*
- *Pakistan (Ahmad and Stern, 1991).*
- *Ireland (Madden, 1995)*
- *Greece (Kaplanoglou and Newbery, 2003)*

The theory (Diamond-Mirrlees):

- Production side:
  - Constant returns to scale.
  - Producer prices (*p*) are fixed.

- The government requires an amount T of resources collected via taxes (*t*) on goods.
  - Goods are indexed by *i, i=1…N.*

- Household factor incomes are fixed.
  - Consumer price: $q_i = p_i + t_i \longrightarrow dq = dt$.
  - Household are indexed by *h, h=1… H.*

The Problem:

The government solves the following maximization problem:

$$\underset{\{t_1,t_2,\dots,t_n\}}{\text{Max.}}\ W = W\left(V^1(q_1,\dots q_n), V^2(q_1,\dots,q_n)\dots,\ V^H(q_1,\dots,q_n)\right)$$

st. $T = \sum_{i=1}^{n} t_i X_i$ where $X_i = \sum_{h=1}^{H} x_i^h$

Solving with K.T.

$$L = W\left(V^1(q_1,\dots q_n), V^2(q_1,\dots,q_n)\dots,\ V^H(q_1,\dots,q_n)\right) + \lambda\left(\sum_{i=1}^{n} t_i X_i - \overline{T}\right)$$

Definition *Marginal Revenue Cost*: **cost at the margin in terms of revenue forgone when a tax is lowered so as to provide one extra unit in welfare**

$$\lambda_i = \frac{\partial R / \partial t_i}{\partial W / \partial t_i}$$

$$\beta^h = \frac{\partial W}{\partial V^h} \frac{\partial V^h}{\partial m} \qquad \frac{\partial W}{\partial t_i} = -\sum_h \beta^h x_i^h$$

$$\frac{\partial R}{\partial t_i} = r_i = X_i + \sum_k t_k \frac{\partial X_k}{\partial t_i} = X_i\left(1 + \sum_k \frac{q_k X_k}{q_i X_i} \cdot \frac{t_k}{q_k} \frac{q_i \partial X_k}{X_k \partial q_i}\right) = X_i\left(1 + \sum_k \frac{\omega_k \tau_k \varepsilon_{ki}}{\omega_i}\right)$$

$$\lambda_i = \frac{\sum_h q_i x_i^h \left(1 + \sum_h \sum_k \frac{\omega_k^h \tau_k \varepsilon_{ki}^h}{\omega_i^h}\right)}{\sum_h \beta^h q_i x_i^h}$$

τ is the tax on good *k* as a proportion of consumer price and ε is the uncompensated cross-price elasticity of good *k* with respect to good *i* f.o.c implies that MRC (λ) should be equal for all goods.

PARETO IMPROVING TAX REFORM PRINCIPLE:

if $MRC_i > MRC_s$ then higher t_i and lower t_s

Second order conditions are satisfied given the concavity of the Social Welfare Function.

Data Requirements

Four elements of data:

1. Household expenditure on goods (from a survey).
2. Demand derivatives (from a demand system estimation).
3. Effective taxes.
4. Welfare weights.

1. Spanish Household Budget Continuous Survey:

- Provided by the 'Instituto Nacional de Estadística'.
- Available since 1984.
- It provides trimester and annual information about household resources and their expenditure on goods.
- The survey established the interview of households throughout 8 quarters.
- We used a longitudinal panel for year 1998. It has 9.891 observations and it represents 12.089.302 households and a population of 39.505.758.

2. Demand system estimation:

- Quadratic Almost Ideal Demand System (QUAIDS) for 16 commodities groups.
- The sample for the demand system estimation covers the period 1985-1997. (Change of methodology)
- Method of estimation: two stage least squares and non-linear instrumental variables.

3. Taxes:

- We use the effective taxes for each commodity group that was computed using a weighting sum of the different taxes for each good.

Some descriptive statistics and the effective taxes:

	Expenditure per equivalent adult				
Commodities	*mean*	*median*	*standard deviation*	*budget share*	*Effective tax (%)*
1.Food & non-alcoholic drinks	1821.72	1675.40	1028.28	0.1995	6.037
2.Alcoholic beverages	79.83	18.46	170.95	0.0077	16
3.Tobacco	179.20	86.43	248.13	0.0196	16
4.Clothing & footwear	729.01	554.75	689.14	0.0708	16
5.Housing expenditure	2242.79	1962.82	1410.55	0.2398	0
6.House keeping & services	918.65	668.06	924.31	0.0896	15.87
7.Fuel for housing	130.12	83.70	130.83	0.0139	16
8.Services	307.94	154.24	457.82	0.0290	2.46
9.Petrol	374.90	263.89	437.28	0.0362	16
10.Private transport services	290.24	156.15	392.70	0.0258	9.13
11.Public transport services	98.20	18.98	185.80	0.0094	7
12.Communications	202.65	166.41	166.95	0.0210	16
13.Leisure	1584.18	1080.10	1754.09	0.1362	6.98
14.Education	192.46	30.30	393.97	0.0163	12.64
15.Other non-durable goods	178.94	103.88	298.27	0.0183	11.56
16.Durable goods	1025.48	188.43	2606.16	0.0670	16

4. Definition of welfare weights

Consider an additive iso-elastic social welfare function (Atkinson):

$$W = \sum_h U^h$$

where

$$\begin{cases} U^h(I^h) = \dfrac{k(I^h)^{1-e}}{1-e} & if\ e \geq 0, e \neq 1 \\ U^h(I^h) = k\log(I^h) & if\ e = 1 \end{cases}$$

$$U'(I^h) = \quad \beta^h = \left(\frac{I^1}{I^h}\right)^e$$

Where I^h is the equivalent income of household *h*

Values of λ_i for different levels of inequality aversion.

The higher the rank the higher the taxes (ex. *Other non-durable goods*)

Commodities	Effective tax (%)	e=0	rank	e=1	rank	e=2	rank	e=5	rank
1.Food & non-alcoholic drinks	6.037	**0.9816**	12	**0.4025**	10	**0.2056**	6	**0.0722**	5
2.Alcoholic beverages	16	**1.1698**	5	**0.4435**	4	**0.2119**	5	**0.0668**	6
3.Tobacco	16	**1.3537**	2	**0.5499**	2	**0.2774**	2	**0.0953**	2
4.Clothing & footwear	16	**0.9604**	15	**0.3564**	15	**0.1661**	15	**0.0485**	13
5.Housing expenditure	0	**1.1183**	9	**0.4360**	6	**0.2170**	4	**0.0750**	4
6.House keeping & services	15.87	**1.0021**	11	**0.3701**	12	**0.1754**	11	**0.0551**	11
7.Fuel for housing	16	**1.1377**	7	**0.4417**	5	**0.2189**	3	**0.0761**	3
8.Services	2.46	**0.9811**	13	**0.3593**	14	**0.1669**	14	**0.0495**	12
9.Petrol	16	**1.1468**	6	**0.4265**	7	**0.1982**	8	**0.0578**	8
10.Private transport services	9.13	**1.2956**	3	**0.4573**	3	**0.2044**	7	**0.0563**	9
11.Public transport services	7	**0.9717**	14	**0.3601**	13	**0.1710**	12	**0.0553**	10
12.Communications	16	**1.1158**	10	**0.4168**	8	**0.1977**	9	**0.0613**	7
13.Leisure	6.98	**1.1213**	8	**0.3842**	11	**0.1676**	13	**0.0445**	15
14.Education	12.64	**0.8244**	16	**0.2700**	16	**0.1136**	16	**0.0282**	16
15.Other non-durable goods	11.56	**26.9443**	1	**10.3604**	1	**5.0223**	1	**1.6167**	1
16.Durable goods	16	**1.2179**	4	**0.4149**	9	**0.1785**	10	**0.0447**	14

Observation (1):

(a) The rank correlations suggest that the rankings, and thus the tax reform recommendations, show relatively strong sensitivity to the value of *e*. See for example the rank correlation among foods and leisure

- This result suggests that distributional considerations matter a lot in the ranking of goods.
- Indirect taxes seem to be a relatively efficient means of addressing distributional issues and reducing inequality in Spain.
- This is in contrast with previous results on Developed Countries.

Observation (2):

(b) Need to correct externalities. The consumption of goods such as alcohol, tobacco and petrol may give rise to social costs, which can be reduced by the imposition of corrective taxes.

Since we do not incorporate such effects in this model, it is possible that the observed rankings of these goods is explained by this factor.

Tax-Benefit Revealed Social Preferences

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Basic question: it is possible to justify the most salient features of existing systems by some optimal tax argument à la "Mirrlees (1971)".
Diamond (1998), Saez (2001)
Salanié (1998), Piketty (1997), Choné and Laroque (2005)
Bourguignon and Spadaro (2000; 2002)

Methodology: "Inversion of the optimal problem" (see Kurz 1968, Ahmad and Stern 1984), Bourguignon and Spadaro (2000; 2002).

Outline of the talk:
-theoretical results
-empirical implementation
-the case of France

The theory

$$V[w,T(\,)] = U(c^*,L^*);\quad (c^*,L^*) = \arg\max[U(c,L);\, \mathrm{c} = wL - T(\,)]$$

$$V[w,w] = U(c(w),Y(w)/w)$$

$$V[w,w'] = U(c(w'),Y(w')/w)$$

$$\underset{T()}{Max}\int_{w_0}^{Z} G\{V[w,T(\,)]\} f(w)dw$$

$$\int_{w_0}^{Z} T(wL^*)\, f(w)dw \geq Q$$

$$V[w,w] \geq V[w,w']$$

$$U(c,L) = c - B(L) \qquad B(L) = (1+\frac{1}{\varepsilon})^{-1} L^{1+\frac{1}{\varepsilon}} \quad L^* = w^{\varepsilon}[1 - T'(wL^*)]^{\varepsilon}$$

$$H\left[L(w),V(w),\mu(w),\lambda\right]=\left[G(V)+\lambda\left(wL-c-Q\right)\right]f(w)+\mu(w)\frac{L}{w}B_L(L)$$

(p. foc 1) $$\frac{\partial H()}{\partial L}=\lambda\left(w-B_L\right)f(w)+\mu(w)\frac{(LB_L)_L}{w}=0$$

(p. foc 2) $$\frac{\partial H()}{\partial V}=-\frac{\partial\mu(w)}{\partial w}\Rightarrow\left[G'(.)-\lambda\right]f(x)=-\frac{\partial\mu(w)}{\partial w}$$

that, after integration and making use of the transversality condition $\mu(Z)=0$

implies that $\int_w^Z\left(1-\frac{G'(.)}{\lambda}\right)f(x)dx=-\frac{\mu(w)}{\lambda}$

Consolidating the two and making use of the f.o.c of problem (1.2) we obtain the condition (4) on the marginal tax rate *t(y)*.

$$\frac{t(y)}{1-t(y)}=\left(1+\frac{1}{\varepsilon}\right)\frac{1-F(w)}{wf(w)}\left[1-\frac{S(w)}{S(w_0)}\right]$$

$$S(w)=\frac{1}{\left[1-F(w)\right]}\int_w^Z\frac{G'\left[V(x,T(xL)\right]}{\lambda}f(x)dx$$

It is well-known (for the **Mangasarian theorem**) that the Pontryagin Maximum Principle that leads to the optimality conditions (p. foc 1) and (p.foc 2) are **necessary and sufficient** provided that *H(.)* is ***differentiable and concave*** in the variables *(L,V)* jointly. Given that in our case *H* is separable in *(L,V)*, the Mangasarian theorem needs that:

D) $\frac{\partial^2 G(.)}{\partial V^2} < 0$ (e.g. the concavity of social welfare function. It ensures the concavity of the Hamiltonian with respect to *V*).

E) $\frac{\mu(w)}{\lambda} < wf(w)\frac{B_{LL}}{[LB_L]_{LL}}$ (from $\frac{\partial^2 H()}{\partial L^2} < 0$ it ensures the concavity of the Hamiltonian with respect to the control variable *L*).

Consistency with agent maximizing behavior and Spence-Mirrlees condition (this condition ensure that the first order approach to the incentive compatibility constraint is sufficient, see Ebert 1992).

A) $t(y) < 1$ for any *w* (from the f.o.c. of problem 1.2);

B) $t'(y) > \frac{U_{LL} + U_{cc}[w(1-t(y))]^2}{w^2 U_c} = \frac{U_{LL}}{w^2} = -\frac{(1-t(y))}{\varepsilon y}$ for any *w* (from the s.o.c. of problem 1.2);

C) $\frac{\partial C}{\partial w} > 0$ without taxes; this is the Spence-Mirrlees condition

If one of the conditions A, B, C, D and E does not hold, then it is the whole optimization concept behind Mirrlees framework that would become doubtful. It would indeed be very difficult to assume that the redistribution authority attempts to maximize a non-concave welfare function if other than trivial redistributions policies are observed.

Of course, from a mathematical point of view we cannot completely rule out a maximizing behavior. The point is that we are not able to characterize it.

If, on the contrary, conditions A, B, C, D and E hold then:

$$S(w) = 1 - \frac{t(y)}{1-t(y)} \frac{\varepsilon}{1+\varepsilon} \frac{w.f(w)}{1-F(w)}$$

$$\frac{t(y)}{1-t(y)} = \left(1+\frac{1}{\varepsilon}\right)\frac{1-F(w)}{wf(w)}\left[1-\frac{S(w)}{S(w_0)}\right]$$

$$\frac{G'\left[V(w,T(y)\right]}{\lambda} = 1 + \left(\frac{\varepsilon}{1+\varepsilon}\right)\left(\frac{t(y)}{1-t(y)}\right)\left[1+\eta(w)+\nu(y)\frac{1+\varepsilon}{1-t(y)+\varepsilon\nu(y)t(y)}\right]$$

$$\nu(y) = yt'(y)/t(y) \qquad \eta(w) = wf'(w)/f(w)$$

Proposition 1. *A necessary condition for the social welfare function making the observed effective marginal tax rate schedule, t(w), optimal with respect to the observed distribution of productivities, f(w) to be Paretian - e.g. non-decreasing everywhere- is that :*

$$t(w) \leq \frac{\frac{1+\varepsilon}{\varepsilon}\frac{1-F(w)}{w.f(w)}}{1+\frac{1+\varepsilon}{\varepsilon}\frac{1-F(w)}{w.f(w)}} \quad for\ all\ w \in [w_0, Z]$$

Alternative interpretation: **Laffer Bound Test**

Where the distribution may be approximated by a Pareto with parameter *a*, given that $\frac{w.f(w)}{[1-F(w)]} = a$, it comes that: $t(w) \leq \frac{1+1/\varepsilon}{1+1/\varepsilon + a}$

For instance, with not unreasonable figures like *a* = 3 and ε =0.5, this condition states that a redistribution system where the marginal tax rate would exceed 50 per cent could be deemed 'optimal' only on the basis of a non-Paretian social welfare function.

***Proposition 2**. If the elasticity of the marginal tax rate and the density function are bounded, then there exists a threshold for the wage elasticity of labor supply below which the social welfare function is necessarily non-decreasing everywhere.*

$$\frac{G'\left[V(w,T(y)\right]}{\lambda} = 1 + \left(\frac{\varepsilon}{1+\varepsilon}\right)\left(\frac{t(y)}{1-t(y)}\right)\left[1+\eta(w)+\nu(y)\frac{1+\varepsilon}{1-t(y)+\varepsilon\nu(y)t(y)}\right]$$

This property shows **the importance of the assumption made on the wage sensitivity of labor supply** to judge the optimality of a given redistribution system. Any redistribution system may be said to optimize a Paretian social welfare function, provided that the redistribution authority has a low enough estimate of the wage elasticity of labor supply.

***Proposition 3**. Wherever the marginal tax rate is increasing with income, a sufficient condition for the social welfare function to be everywhere non-decreasing is:*

$$t(w) \leq \frac{1+\varepsilon}{1-\eta(w)\varepsilon} \qquad (12)$$

Again, this proposition is directly derived from (9). It is of relevance in connection with the discussion on whether the marginal tax rate curve must be U-shaped – see Diamond (1998) and Saez (2001). In that part where the marginal tax rate is increasing, that is for high incomes, (12) gives an upper limit for the marginal tax rate – in the reasonable case where is negative $\eta(w)$ of course.

Income Effects

$$U(c, L) = A(c) - B(L)$$

$$\frac{t(y)}{1-t(y)}\psi[c(w)] = (1+\frac{1}{\varepsilon}).\frac{1-F(w)}{w.f(w)}.[\overline{\psi}[c(w)] - S(w)]$$

$$\psi[c(w)] = \frac{1}{A'(c)} \qquad \overline{\psi}[c(w)] = \frac{1}{1-F(w)}\int_w^z \psi[c(w)]f(x)dx$$

Proposition 4. *A necessary condition for the social welfare function to be Paretian is that :*

$$t(y) \leq \frac{\frac{1+\varepsilon}{\varepsilon}\frac{1-F(w)}{w.f(w)}\frac{\overline{\psi}[c(w)]}{\psi[c(w)]}}{1+\frac{1+\varepsilon}{\varepsilon}\frac{1-F(w)}{w.f(w)}\frac{\overline{\psi}[c(w)]}{\psi[c(w)]}} \quad \textit{for all } w \in [w_0, Z]$$

Note that $\frac{\overline{\psi}[c(w)]}{\psi[c(w)]} \geq 1$ implies that the inclusion of income effect mitigate the possibility to be Non Paretian.

Empirical Implementation: A) **individual vs household level**; **B) net vs gross rate of taxation.** 3 key ingredients

1) estimates of the elasticity of labor supply, ε

In the case of France, Bourguignon and Magnac (1991), Piketty (1998), Donni (2000), Bargain (2005), Choné et al. (2003) and Laroque and Salanié (2002). Values between **0.1-0.2 are found for men** and an average of **0.5 is found for married women** - and slightly more **(0.6 to 1) if they have children** (Piketty 1998, Bargain, 2005, Choné et al. 2003). This second result is mainly driven by participation effects.

which is the right one for households?..second member..!
(Paper by Kreiner et al. 2006)

2) the distribution *f(w)*
you can use wages or "productivities" i.e:

$$w = Y^{\frac{1}{1+\varepsilon}} [k(1 - t(Y))]^{\frac{-\varepsilon}{1+\varepsilon}}$$

3) the marginal rate of taxation, *t(w):* computed by microsimulation model (**net and gross**)

$$t(y) = \frac{\Delta Taxes + \Delta Benefits}{\Delta Gross\ Income} = 1 - \frac{\Delta Yd}{\Delta y}$$

-*Important: t(w), f(w) and derivatives computed by Adaptive kernel smoothing techniques*.

Problems with:

1) *Irrational behavior*: ...solved à la Hausman
2) *Scarcity of data at the upper tails of the distribution*: .....only for the last 4-5 centiles

Figure 1. Kernel smoothed marginal tax rates for singles: net and gross scenarios

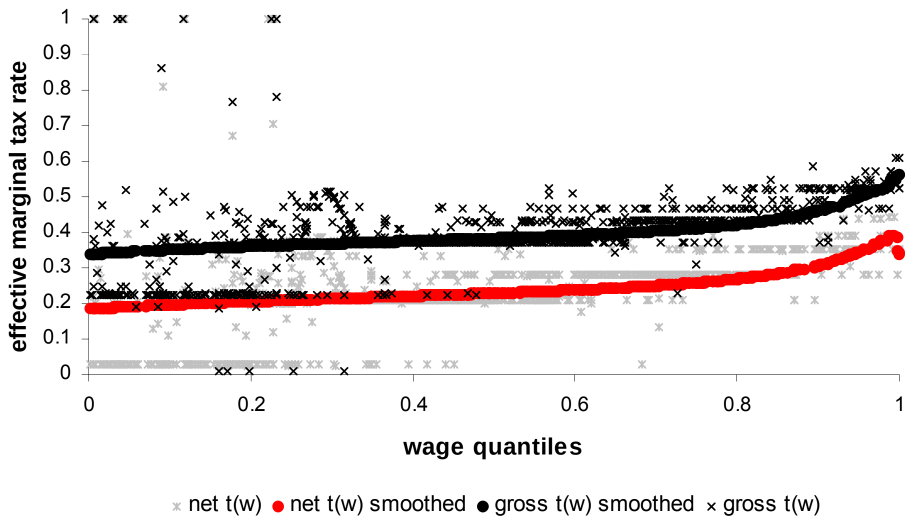


Figure 2. Kernel wage densities for singles: net and gross scenario

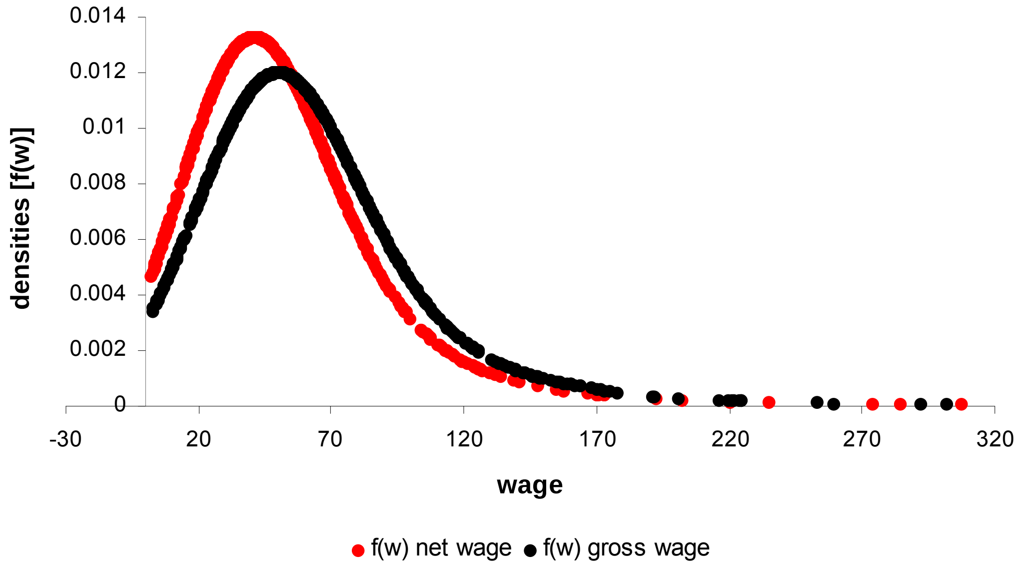


Figure 3. Social marginal welfare for singles (on net wages)

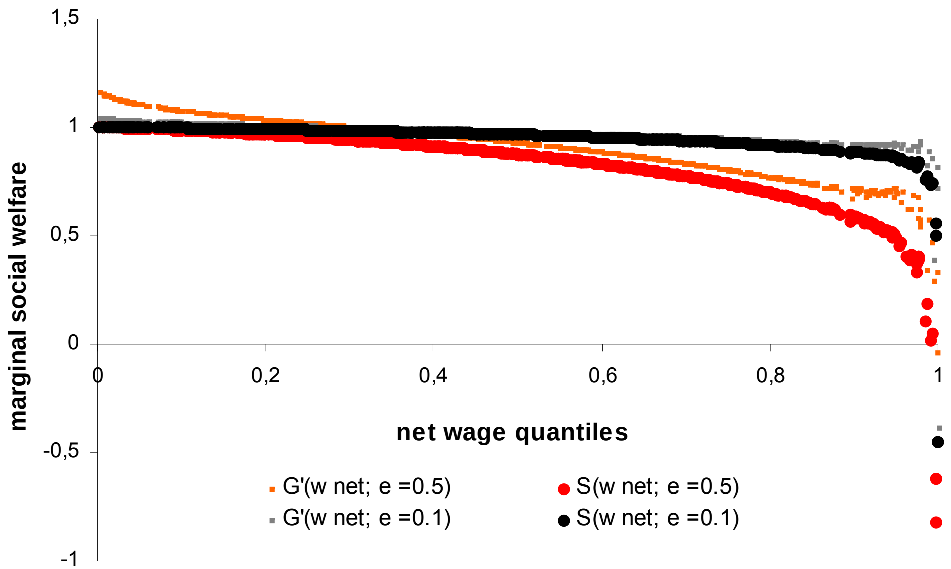


Figure 4. Social marginal welfare for singles (on gross wages)

Figure 5. Kernel productivity densities for singles

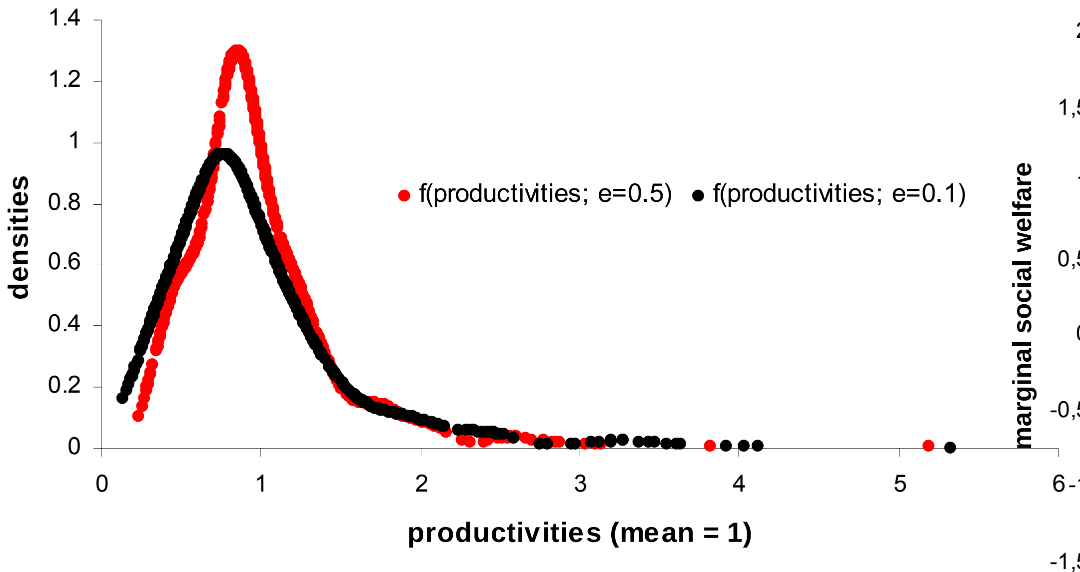


Figure 6. Social marginal welfare for singles (on productivities)

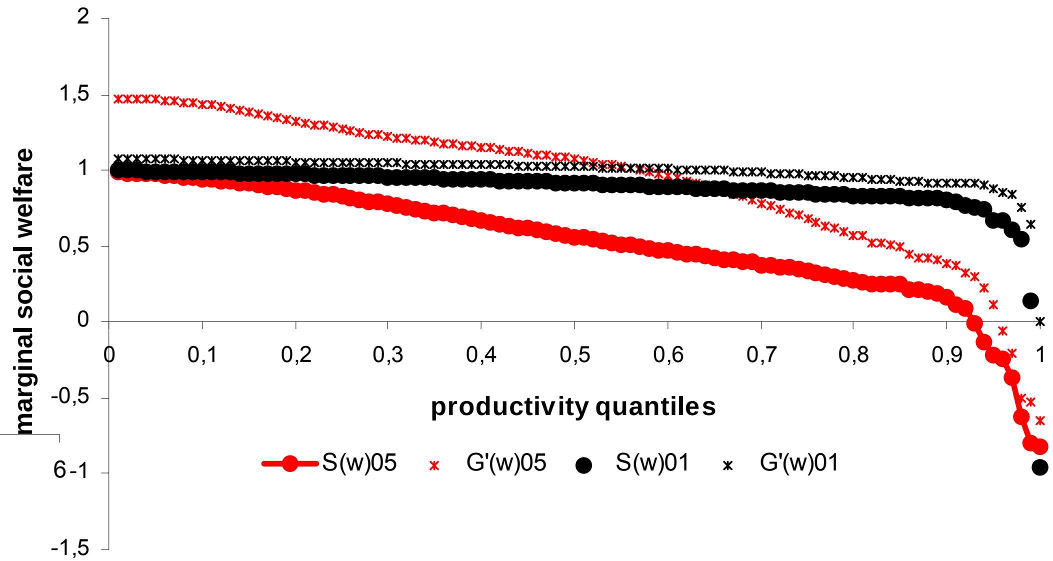


Figure 7. Gross kernel smoothed marginal tax rates for all households

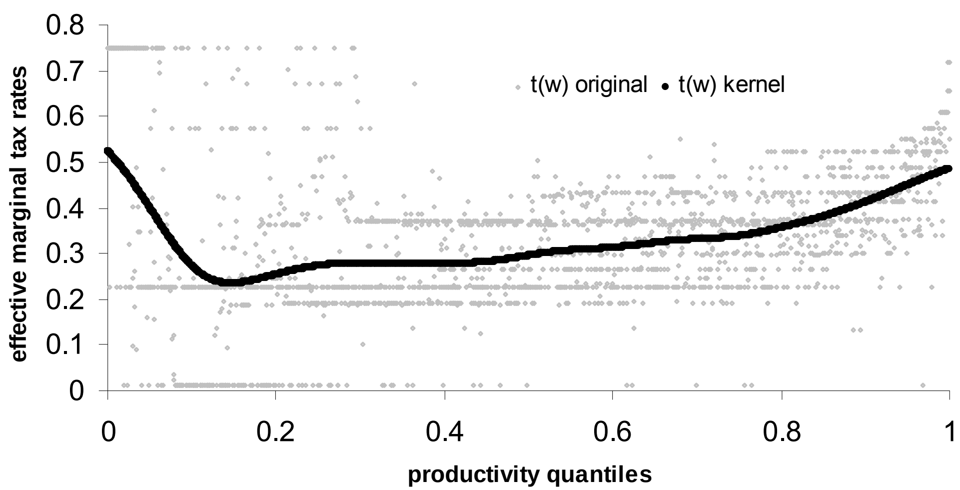


Figure 8. Kernel productivity densities for all households

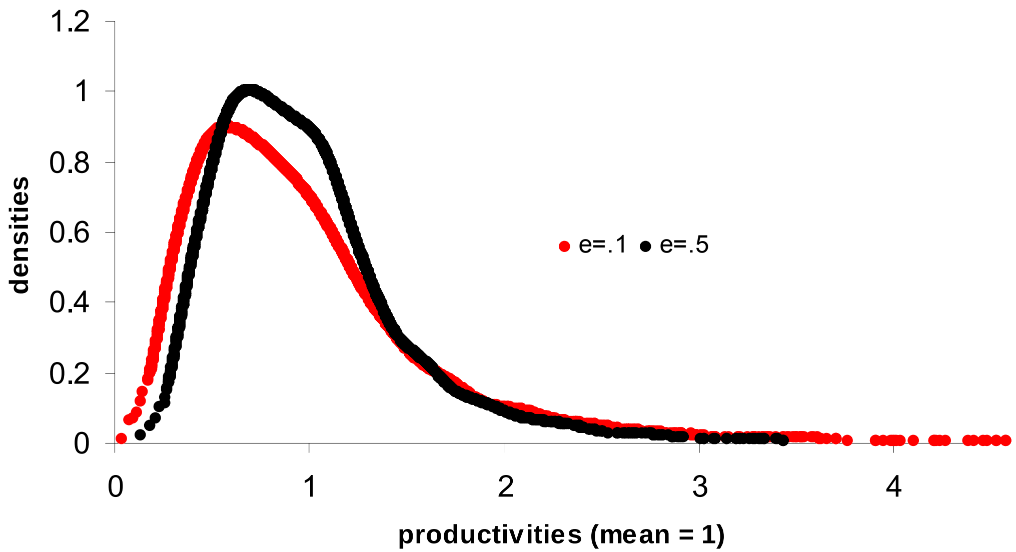


Figure 9. Social marginal welfare for all household (on productivities)

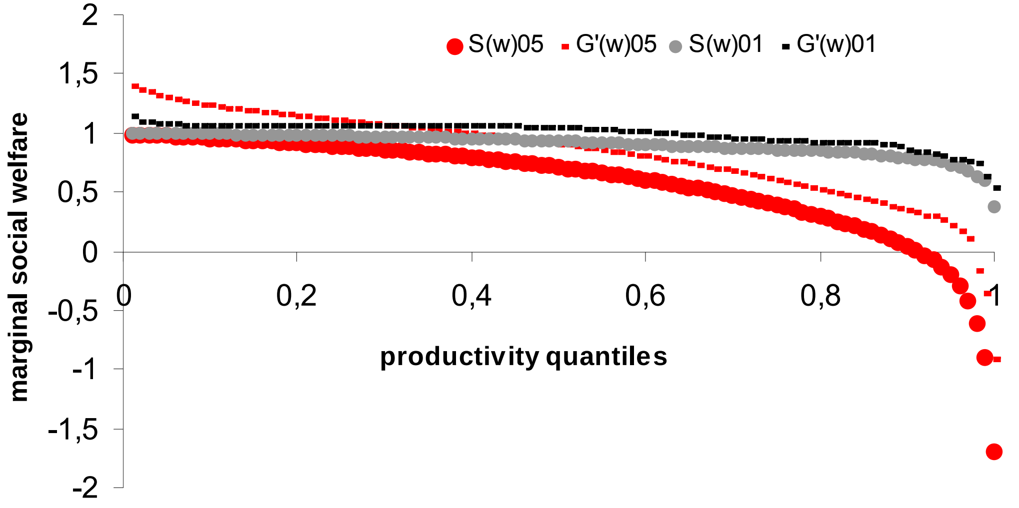
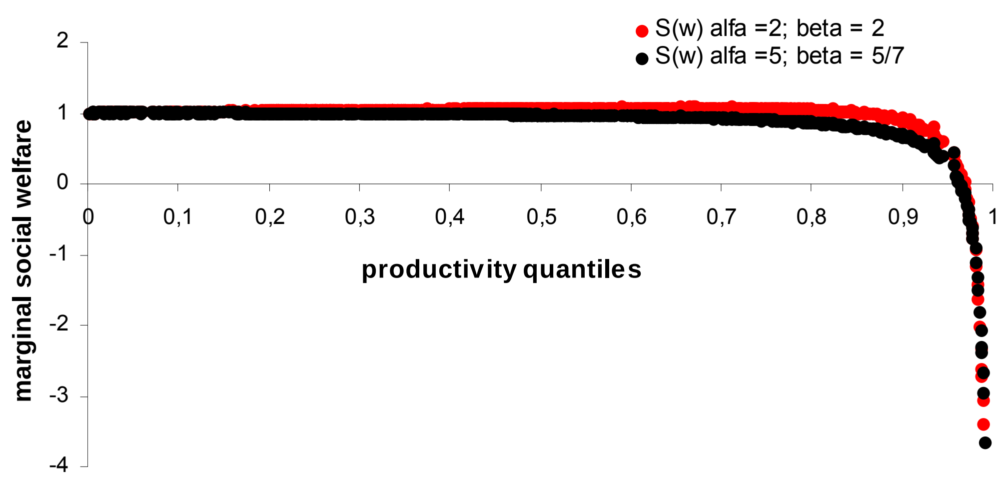


Figure 10. Paretianity test on social marginal welfare for singles (on gross wages) with income effects



Intensive vs Extensive labour supply framework

Saez (2002), [Laroque (2005); Blundell et al. (2006)]

$$\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\mu_i h_i} \sum_{j \geq i}^{I} h_j \left[1 - g_j - \chi_j \frac{T_j - T_0}{C_j - C_0} \right]$$

-*Ti* is net tax paid by group *i* and

-*Ci* is the net household income of this group,

-Non-workers receive benefits *-T0*, by definition identical to *C0*.

-*gi*, the marginal weight the government assigns to group *i*. This weight represents the value (expressed in terms of public funds) of giving an additional dollar to an individual in group *i*.

The **intensive elasticity** is defined as:

$$\mu_i = \frac{C_i - C_{i-1}}{h_i} \frac{dh_i}{d(C_i - C_{i-1})}$$

And it is related with the classical one with:

$$\mu_i = \frac{Y_i}{Y_i - Y_{i-1}} \varepsilon_i$$

The **extensive elasticity** is

$$\chi_i = \frac{C_i - C_0}{h_i} \frac{dh_i}{d(C_i - C_0)}$$

$$g_i = 1 - \chi_i \frac{T_i - T_0}{C_i - C_0} - \mu_i \frac{T_i - T_{i-1}}{C_i - C_{i-1}} + \frac{1}{h_i} \sum_{j=i+1}^{I} h_j \left[1 - g_j - \chi_j \frac{T_j - T_0}{C_j - C_0} \right]$$

$$g_0 = (1 - \sum_{i=1}^{I} h_i g_i) / h_0$$

$$g_I = 1 - \chi_I \frac{T_I - T_0}{C_I - C_0} - \mu_I \frac{T_I - T_{I-1}}{C_I - C_{I-1}}$$

Note that if participation elasticity = 0:

$$\frac{T_I - T_{I-1}}{C_I - C_{I-1}} \leq \frac{1}{\mu_I}$$

Equivalent of Proposition 1 (Paretianity condition)

- Sample of singles aged 18 to 65, in which students and individuals with non-labor income above 10 per cent of total income are eliminated

- The final sample used in this exercise contains 1028 singles (963 working).

- The rate of nonlabor force participation (zero yearly earnings reported) for this group is around 9 percent.

- We present only the case in which the redistribution system includes income taxes, assimilated contributions like the 'Cotisation Sociale Généralisée', all non-contributory benefits and the contribution to health insurance (this redistribution system has been referred to as 'gross' in the previous section).

I	Y_i	C_i	T_i	h_i	***F(Y)***
0	0	12000	-12000	0,09	*9%*
1	48857	35919	12939	0,08	*17%*
2	74340	54398	19942	0,09	*26%*
3	91116	64926	26190	0,09	*35%*
4	105954	73144	32811	0,09	*44%*
5	121247	80750	40497	0,09	*53%*
6	135790	87779	48011	0,09	*63%*
7	152870	95747	57122	0,09	*72%*
8	175352	106173	69179	0,09	*81%*
9	215857	123988	91869	0,09	*90%*
10	408454	217915	190539	0,10	*100%*

Scenario				Scenario			
A	*i*	**Low (0, 1, 2)**	**High (others)**	**F**	*i*	**Low (0, 1, 2)**	**High (others)**
	χ	0	0		χ	0.5	0
	ε	0.1	0.1		ε	0.5	0.5
B	*i*	**Low (0, 1, 2)**	**High (others)**	**G**	*i*	**Low (0, 1, 2)**	**High (others)**
	χ	0	0		χ	1	0
	ε	0.5	0.5		ε	0	0.1
C	*i*	**Low (0, 1, 2)**	**High (others)**	**H**	*i*	**Low (0, 1, 2)**	**High (others)**
	χ	0.5	0		χ	1	0
	ε	0	0.1		ε	0.1	0.1
D	*I*	**Low (0, 1, 2)**	**High (others)**	**I**	*i*	**Low (0, 1, 2)**	**High (others)**
	χ	0.5	0		χ	1	0
	ε	0.1	0.1		ε	0.5	0.1
E	*I*	**Low (0, 1, 2)**	**High (others)**	**L**	*i*	**Low (0, 1, 2)**	**High (others)**
	χ	0.5	0		χ	1	0
	ε	0.5	0.1		ε	0.5	0.5

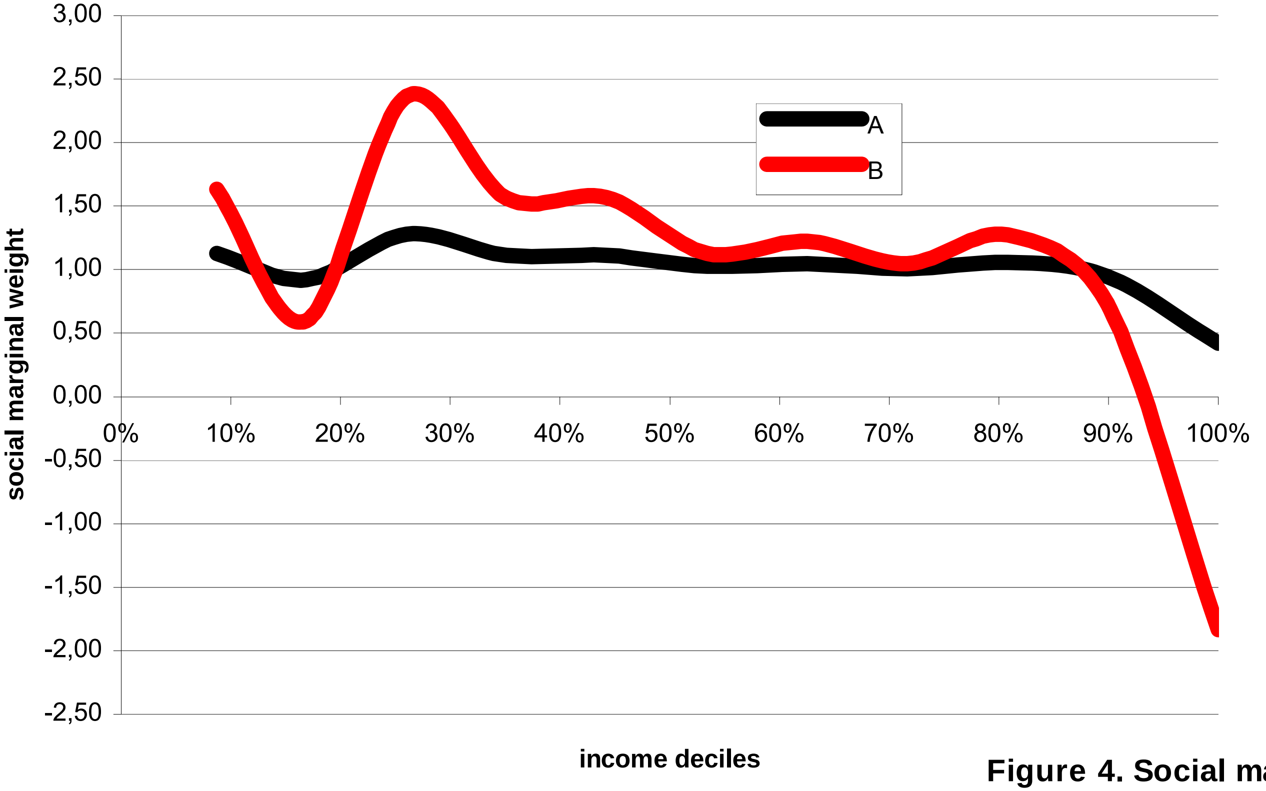


Figure 4. Social marginal welfare for singles (on gross wages)

		No participation effects		Medium participation elasticity				High participation elasticity			
i	***F(Y)***	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**L**
0	*9%*	1,13	1,63	1,88	2,01	2,52	2,52	2,76	2,89	3,40	3,40
1	*17%*	0,92	0,60	0,48	0,40	0,08	0,08	**-0,04**	**-0,12**	**-0,44**	**-0,44**
2	*26%*	1,28	2,36	0,95	0,90	0,70	1,99	0,57	0,53	0,33	1,61
3	*35%*	1,11	1,56	1,11	1,11	1,11	1,56	1,11	1,11	1,11	1,56
4	*44%*	1,12	1,57	1,12	1,12	1,12	1,57	1,12	1,12	1,12	1,57
5	*53%*	1,03	1,13	1,03	1,03	1,03	1,13	1,03	1,03	1,03	1,13
6	*63%*	1,05	1,22	1,05	1,05	1,05	1,22	1,05	1,05	1,05	1,22
7	*72%*	1,01	1,05	1,01	1,01	1,01	1,05	1,01	1,01	1,01	1,05
8	*81%*	1,06	1,28	1,06	1,06	1,06	1,28	1,06	1,06	1,06	1,28
9	*90%*	0,95	0,73	0,95	0,95	0,95	0,73	0,95	0,95	0,95	0,73
10	*100%*	0,42	**-1,84**	0,42	0,42	0,42	**-1,84**	0,42	0,42	0,42	**-1,84**

Resuming the results of the empirical application for France

In the case of the net marginal tax rates, the social welfare function is increasing and concave everywhere.

In the case of the gross marginal tax rates,

1) either redistribution authorities maximise a Paretian social welfare function (i.e. increasing and concave) but have a low subjective estimate of labour supply elasticity.
2) Or they expect higher labour supply elasticities, in which case they have non-Paretian preferences, possibly shaped by political economy mechanisms.

Which one of the two explanations is the most plausible?

The key element for the answer clearly is the size of the labour supply elasticity. Looking at the results in the literature on the econometrics of labour supply an elasticity of substitution of 0.5 appears to be within the range of estimates for households' second workers, which seems the relevant concept to use when households are considered as a single agent. .

Conclusions: Two lessons may be drawn from all this exercise.

1) Some doubt about the idea that the real world is as if a redistribution authority were maximizing some well behaved (Paretian) social welfare function.

a) Either the redistribution authority does not optimise at all
b) Or it under-estimates the labour supply response to taxation
c) Or it has non-Paretian social preferences.

This conclusion is not really surprising. To some extent, cases a) and c), which seem the most likely, are even reassuring. Indeed, tax-benefit schedules in the real world appear to result more from political economy forces than the pursuit of some well defined social objective.

2) Practical interest of reading actual tax-benefit systems through the social preferences that they reveal.

The instrument developed in this paper offers another interesting perspective. By drawing marginal social welfare curves consistent with a tax-benefit system before and after reforms, it is possible to characterize in a more precise way the distributional bias of the reform.

Future extensions: Which subjective evaluation for labour supply elasticity? General equilibrium approach; Multi-dimensional nature of the heterogeneity; Dynamics and uncertainty.

Optimal Taxation, Social Contract and The Four Worlds of Welfare Capitalism

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Optimal Taxation, Social Contract and The Four Worlds of Welfare Capitalism

General Framework:

This paper contributes to the debate regarding the **typology of welfare states** by offering a formal theorizing drawing from the **optimal taxation literature** (Mirrlees 1971) and allowing for comparative research on the **structure of the Welfare State** taking explicitly into account the **efficiency concerns** of the redistribution policies.

The starting point:

In their excellent survey about the debate regarding Esping-Andersen's typology of welfare states*, Arts and Gelissen (2002) reconstruct several typologies of welfare states in order to establish, first, whether real welfare states are quite similar to others or whether they are rather unique specimens, and, second, whether there are three ideal-typical worlds of welfare capitalism or more.

They conclude that "***real welfare states are hardly ever pure types and are usually hybrid cases*** *and that the issue of ideal-typical welfare states cannot be satisfactorily answered* ***given the lack of formal theorizing and the still inconclusive outcomes of comparative research****. In spite of this conclusion there is plenty of reason to continue to work on and with the original or modified typologies*".

**(1990) "Three Worlds of Welfare Capitalism"*
**(1999) Social Foundations of Post-industrial Economies.*

Objectives:

a) Check if it is possible to justify the most salient features of existing systems by some optimal tax argument à la "Mirrlees (1971)". Diamond (1998), Saez (2001, 2002), Salanié (1998), Piketty (1997), Choné and Laroque (2005), Bourguignon and Spadaro (2000; 2002, 2008)

b) Offer a formal theorizing allowing the identification (if possible) of *ideal-typical welfare states* in the spirit of the Esping Andersen (1992) qualitative analysis of European welfare regimes.

What we do:

a) we use the formal setting of the optimal tax theory to try to identify the level of Rawlsianism of some European social planner starting from the observation of the real data and redistribution systems and

b) we use it as a test of the Esping Andersen (and others) classification.

How: with the "Inversion of the optimal problem" technique (see Kurz 1968, Ahmad and Stern 1984), Bourguignon and Spadaro (2002, 2008).

Results

a) Redistribution systems in these countries are **consistent with the hypothesis of an optimizing redistribution authority.**

b) **Applied Optimal Taxation validates Esping Andersen.**
There appears to be a clear coincidence of high decommodification and high Rawlsianism in the Scandinavian, social-democratically influenced welfare states (Denmark). There is an equally clear coincidence of low decommodification and utilitarianism in the Anglo–Saxon liberal model (UK) and in the Southern European welfare states (Italy and Spain). Finally, the Continental European countries (Finland, Germany and France) group closely together in the middle of the scale, as corporatist and etatist..

Welfare States classification [Arts and Gelissen (2002)]

	Social democracy	*Corporativist*	*Liberal*	*Southern European*
Degree of decommodification	Strong	Medium	Weak	Weak
Ideological reference point	Universalism	Social Hierarchy, Family	Individual responsibility	Family
Degree of defamiliarization	Strong	Weak	Strong	Weak
Countries	Denmark	Finland, Germany, France	UK	Spain, Italy

Definition:

Degree of defamiliarization

-the degree to which the market and/or the state play a role in providing services to individuals that were traditionally provided by the family)

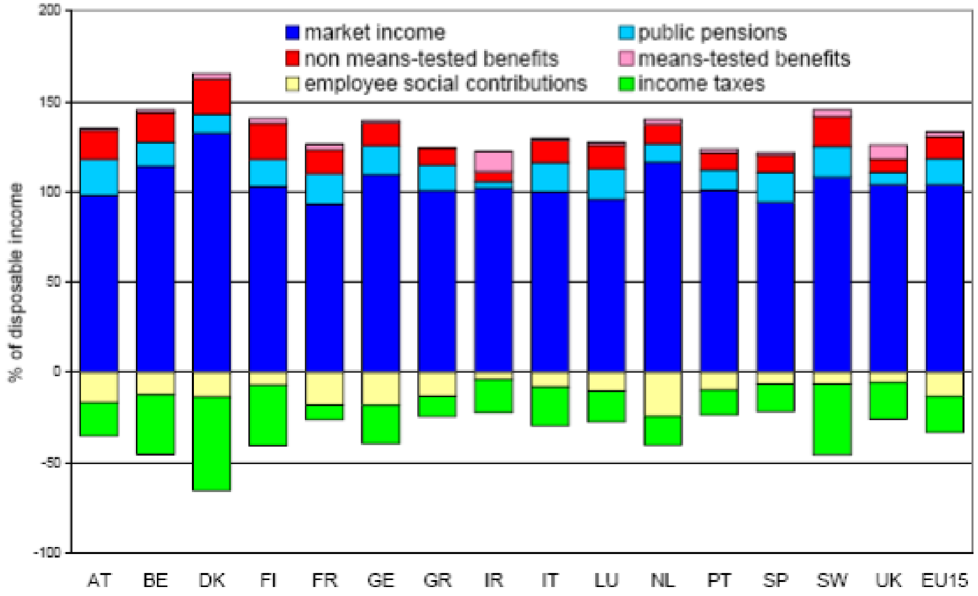
Degree of decommodification:

-the degree to which a person can maintain a livelihood without reliance on the market

Claim: *A redistribution system allowing for a high level of subsidies directed to non working people implies a high level of decommodification*

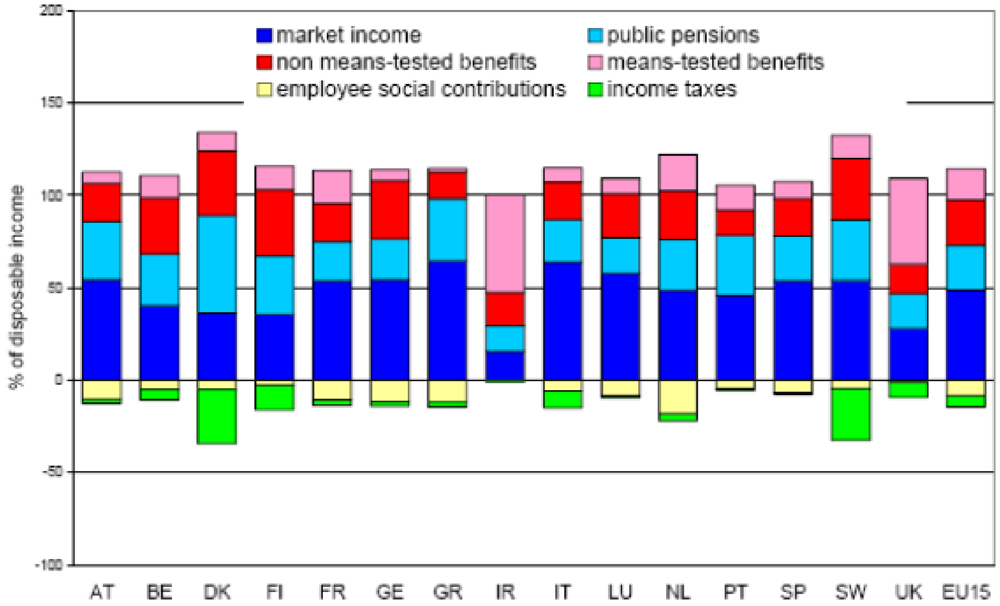
$\Rightarrow$ ***there is a strong analogy between a social planner that want to***

Market Income, Taxes, Benefits and Replacement Incomes, as a proportion of disposable incomes

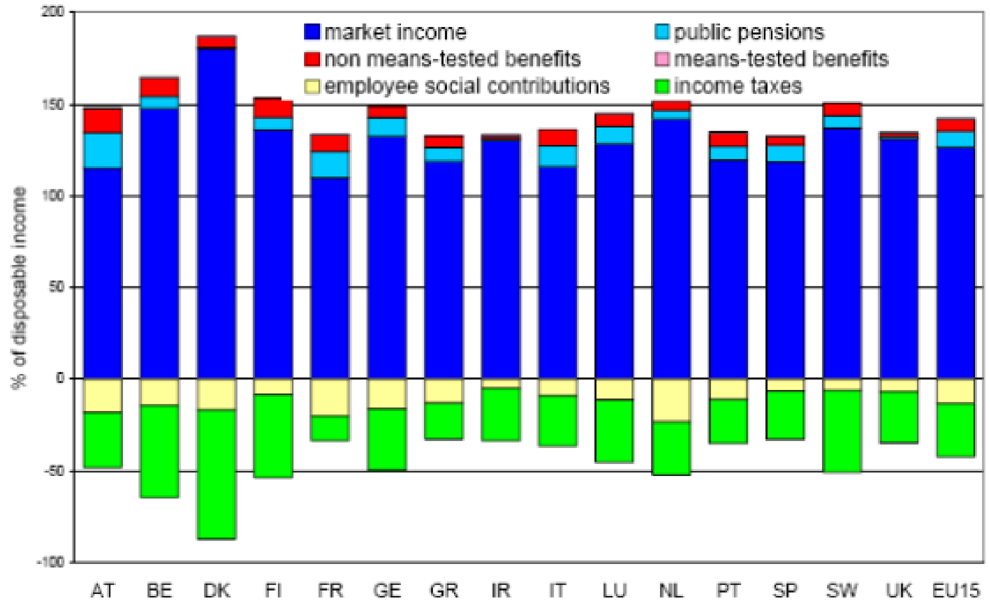


Source: EUROMOD (See http://www.iser.essex.ac.uk/msu/emod/emodstats/index.php)

All households



Source: EUROMOD (See http://www.iser.essex.ac.uk/msu/emod/emodstats/index.php)

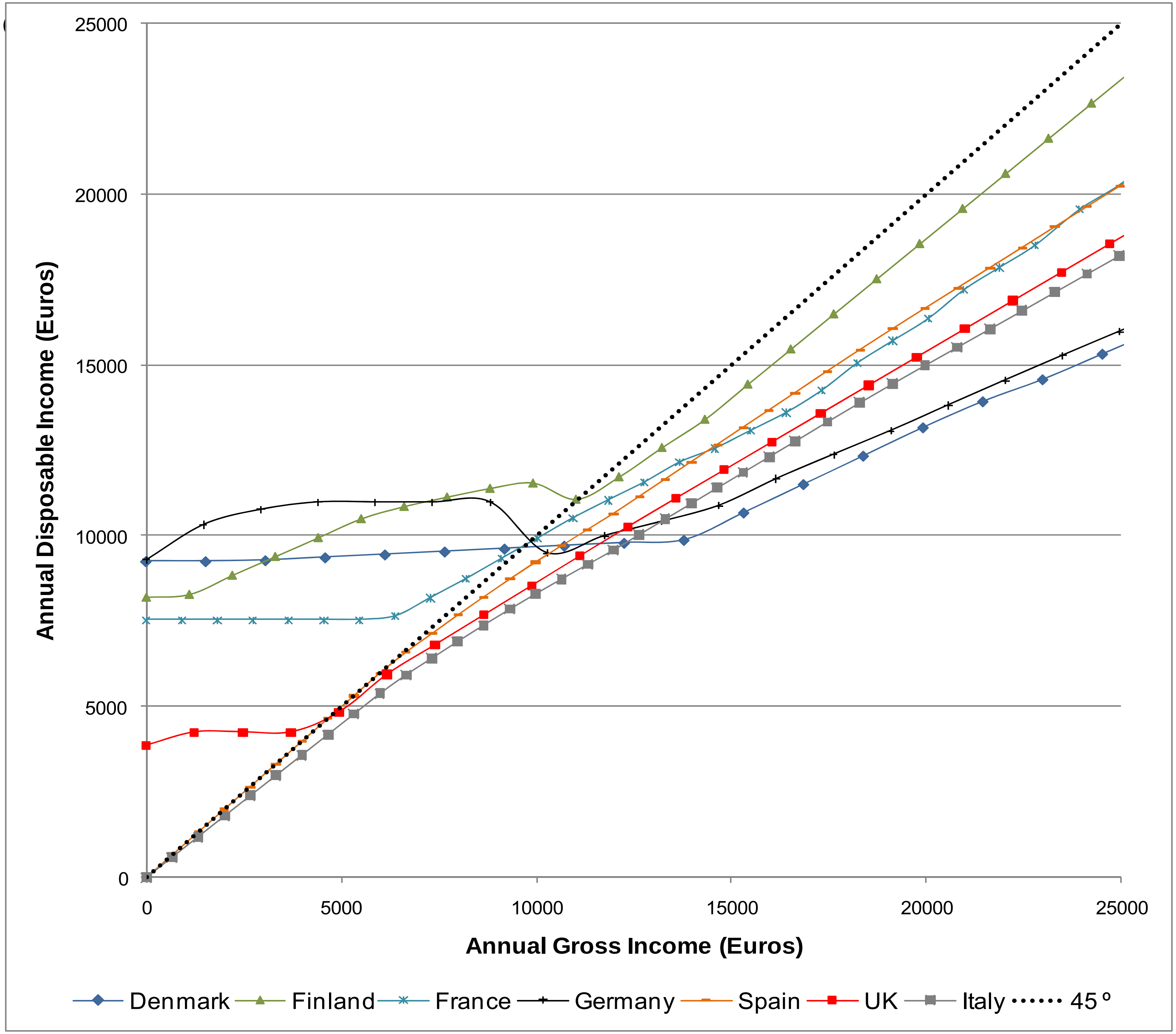


Source: EUROMOD (See http://www.iser.essex.ac.uk/msu/emod/emodstats/index.php)

Bottom decile

Top decile

Microsimulated Budget constraints for hypothetical households: Singles (low incom



Theory

The Social Planner problem is:

$$\text{Max}_{[T_0,\ldots T_I]} \int_{w_0}^{Z} \alpha(w) V(w) f(w) dw$$

$$\text{s.t}: \quad (c_i^*, i^*) = \text{Argmax}\{U(w, c_i, i);\ c_i = Y_i - T_i,\ i \in [0,1,..I]\}$$

$$V[w] = U(w, c^*, i^*)$$

$$\sum_i h_i T_i \geq \overline{T}$$

h_i is the % of agents choosing *I*; T_i is net tax paid by group *I*

The optimal tax formula is:

$$\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\mu_i h_i} \sum_{j \geq i}^{I} h_j \left[1 - g_j - \chi_j \frac{T_j - T_0}{C_j - C_0}\right]$$

-C_i is the net household income of group *i*,

-Non-workers receive benefits – *To*, by definition identical to *Co*.

$$g_i = \frac{1}{\lambda h_i} \int_{w \in i} \alpha(w) \frac{\partial V(w)}{\partial c_i} f(w)$$

is the marginal weight the government assigns to group *i*. This weight represents the value (expressed in terms of public funds) of giving an additional dollar to an individual in group *i*. λ is the Lagrange multiplier associated to the aggregate budget constraint.

The **intensive elasticity** is defined as: $\mu_i = \frac{C_i - C_{i-1}}{h_i} \frac{dh_i}{d(C_i - C_{i-1})}$

And it is related with the classical one with: $\mu_i = \frac{Y_i}{Y_i - Y_{i-1}} \varepsilon_i$

The **extensive elasticity** is $\chi_i = \frac{C_i - C_0}{h_i} \frac{dh_i}{d(C_i - C_0)}$

The inversion of the optimal problem (Bourguignon and Spadaro 2000, 2008)

$$g_i = 1 - \chi_i \frac{T_i - T_0}{C_i - C_0} - \mu_i \frac{T_i - T_{i-1}}{C_i - C_{i-1}} + \frac{1}{h_i} \sum_{j=i+1}^{I} h_j \left[1 - g_j - \chi_j \frac{T_j - T_0}{C_j - C_0} \right]$$

$$g_0 = (1 - \sum_{i=1}^{I} h_i g_i) / h_0$$

$$g_I = 1 - \chi_I \frac{T_I - T_0}{C_I - C_0} - \mu_I \frac{T_I - T_{I-1}}{C_I - C_{I-1}}$$

Relevant questions:

1) Are social weights decreasing? (Global aversion to inequality)

2) Weights of group 0 ? (Rawlsianism and Decommodification)

3) What drives the results? (efficiency concerns….)

Data and selection

Country	Data	Year	size of selected	weighted no. of singles	proportion of all singles
Denmark	European Community Household Panel	1995	574	417,945	40%
Finland	Income distribution survey	1998	1193	421,447	38%
France	Household Budget Survey	1994/5	1639	3,615,095	40%
Germany	German Socio-Economic Panel	1998	1387	8,242,791	43%
UK	Family Expenditure Survey	1995/6	1227	5,172,454	47%
Italy	Survey of Households Income and Wealth	1996	1482	3,651,857	51%
Spain	European Community Household Panel	1996	738	1,297,780	37%

Selection criteria:

- singles
- potential workers (no pensioners, no student, working age 18-65)
- no substantial capital income (max 10% of earned income)

Incomes:

Y_i: income from wage and self-employment income

C_i: includes taxes, social contributions, transfers and (contributory) unemployment benefits (treated as redistributive transfer here)

Computed with **EUROMOD**

Application: defining groups

Arbitrary definitions but attempt to make it comparable across countries

Type 0: from 0 to part-time paid at minimum wage (rare observation in-between)

Type 1: working poor (up to 1.3x the minimum wage or 1.3x 60% of the median for countries without minimum wage)

Type 2: up to median income

Type 3: up to 1.5 x median income

Type 4: up to 2 x median income

Type 5: above

Cut-off points (monthly gross income in EUR)

groups	Denmark	Finland	France	Germany	Italy	Spain	UK
0	0	0	0	0	0	0	0
1	788	574	515	627	509	399	595
2	2050	1492	1338	1630	1322	1038	1548
3	2628	1823	1674	2094	1695	1331	1984
4	3942	2735	2511	3141	2543	1997	2976
5	5256	3646	3348	4188	3390	2662	3968

Proportions *hi*

groups	Denmark	Finland	France	Germany	Italy	Spain	UK
0	0.06	0.08	0.07	0.05	0.09	0.07	0.15
1	0.25	0.28	0.20	0.24	0.22	0.24	0.17
2	0.20	0.22	0.23	0.20	0.18	0.18	0.21
3	0.37	0.28	0.28	0.32	0.27	0.25	0.25
4	0.07	0.11	0.11	0.13	0.13	0.16	0.12
5	0.06	0.04	0.10	0.06	0.11	0.10	0.10

Gross and disposable monthly income in EUR

groups	Denmark		Finland		France		Germany		Italy		Spain		UK	
	Y_i	C_i	Y_i	C_i	Y_i	C_i	Y_i	C_i	Y_i	C_i	Y_i	C_i	Y_i	C_i
0	0	668	0	623	0	554	0	468	0	30	0	280	0	659
1	1432	1112	1109	969	907	918	1184	1019	686	569	749	917	1101	1149
2	2342	1523	1643	1242	1437	1186	1887	1306	1393	1068	1169	1326	1697	1491
3	3125	1858	2180	1537	2031	1584	2503	1620	1840	1359	1645	1629	2433	1903
4	4499	2424	3136	2027	2864	2216	3563	2229	2326	1650	2255	2054	3371	2575
5	6475	3650	4167	2670	4201	3084	5013	3180	3944	2697	3187	2711	4811	3595

Empirical evidence: Labor supply elasticity of Singles: a brief review

	Country	*Data*	*Selection*	*Extensive elasticity*	*Intensive elasticity*
Kleven and Kreiner (2006a, 2006b)	Denmark	ECHP 97-98	singles	0.45	0.2
Bargain and Orsini (2006)	Finland	IDS 97	single women	0.18 - 0.33	0.18 - 0.34
Bargain and Orsini (2006)	France	HBS 95	single women	0.04 - 0.07	0.08 - 0.14
Laroque and Salanie (2001)	France	Tax revenue 97	single women	0.36	
Bargain and Orsini (2006)	Germany	GSOEP 98	single women	0.08 - 0.15	0.09 - 0.18
Haan and Steiner (2005)	Germany	GSOEP 02	single women	0.01 - 0.09	0.02 - 0.24
			single men	0.06 - 0.19	0.09 - 0.28
Aaberge et al. (1998)	Italy	SHIW 1993	single women	0.06	0.10
			single men	0.08	0.11
Labeaga, Oliver and Spadaro (2007)	Spain	ECHP 95	singles	0.2	0.1
Blundell and MaCurdy (1999)	UK	FES 1980	singles	0.24	

Application: extensive elasticity

Participation elasticity in this model:

$$\chi_i = \frac{C_i - C_0}{h_i} \frac{\partial h_i}{\partial (C_i - C_0)}$$

• Classical participation elasticities from the literature correspond to 1% increase in Y_i rather than in $C_i - C_0 = Y_i - (T_i + C_0)$

• In most cases, $T_i + C_0 > 0$ so that $C_i - C_0$ increase by more than 1% and χ_i is overstated by usual estimates

• The inverse is true only when $T_i < -C_0$, i.e. when transfers to working poor are very large

Numerical application:

For low incomes [for group 0 to 2 (approx. 1st half)]: empirical estimated values in each countries. For high income = 0.

Application: intensive elasticity

Earnings (mobility) elasticity

$$\mu_i = \frac{C_i - C_{i-1}}{h_i} \frac{\partial h_i}{\partial (C_i - C_{i-1})}$$

Classical wage elasticity of labor supply

$$\varepsilon_i = \frac{1-\tau_i}{Y_i} \frac{\partial Y_i}{\partial (1-\tau_i)} \text{ with EMTR } \tau_i = \frac{T_i - T_{i-1}}{Y_i - Y_{i-1}}$$

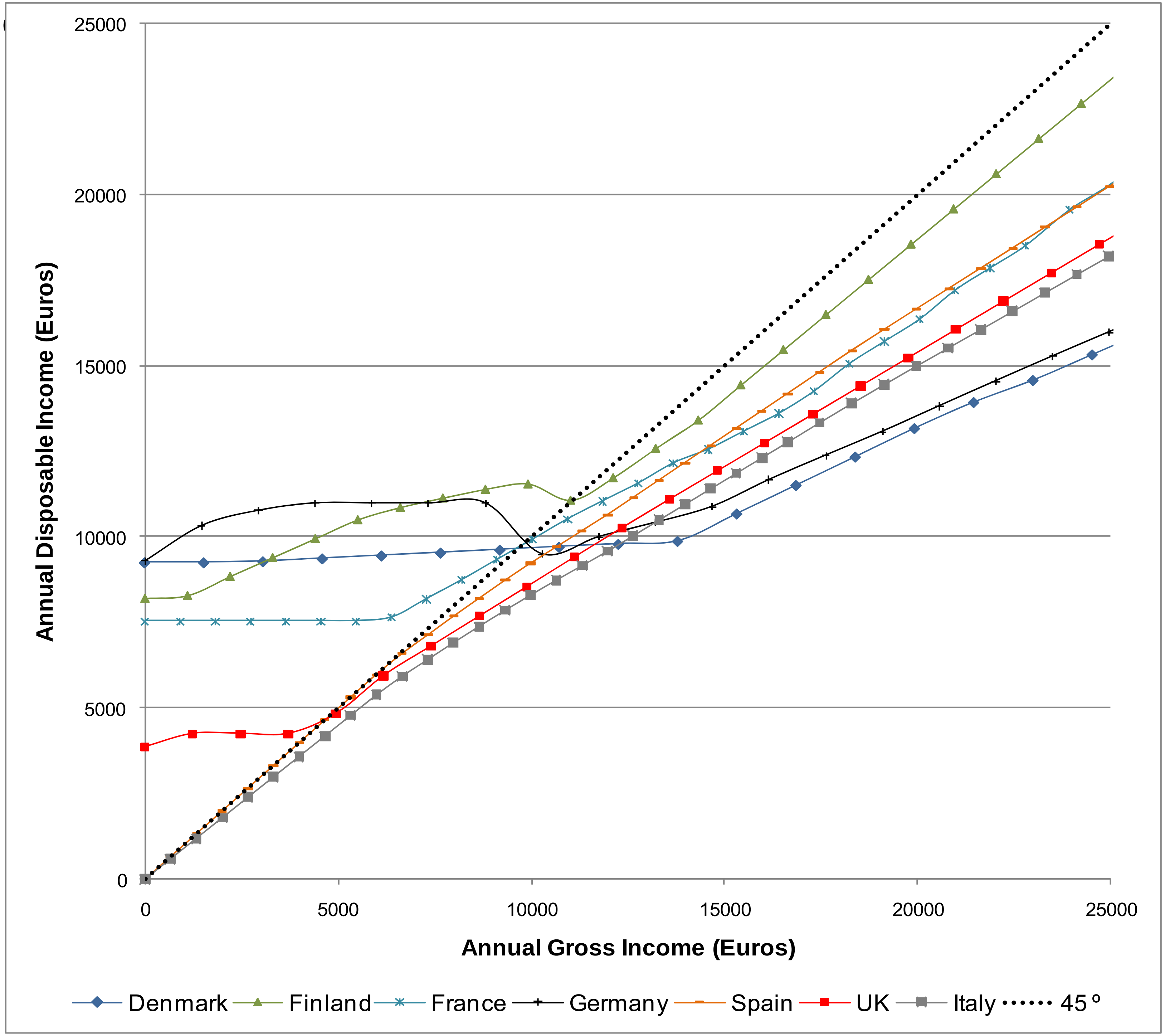
Relating μ and ε:

$$\mu_i (Y_i - Y_{i-1}) = \varepsilon_i Y_i$$

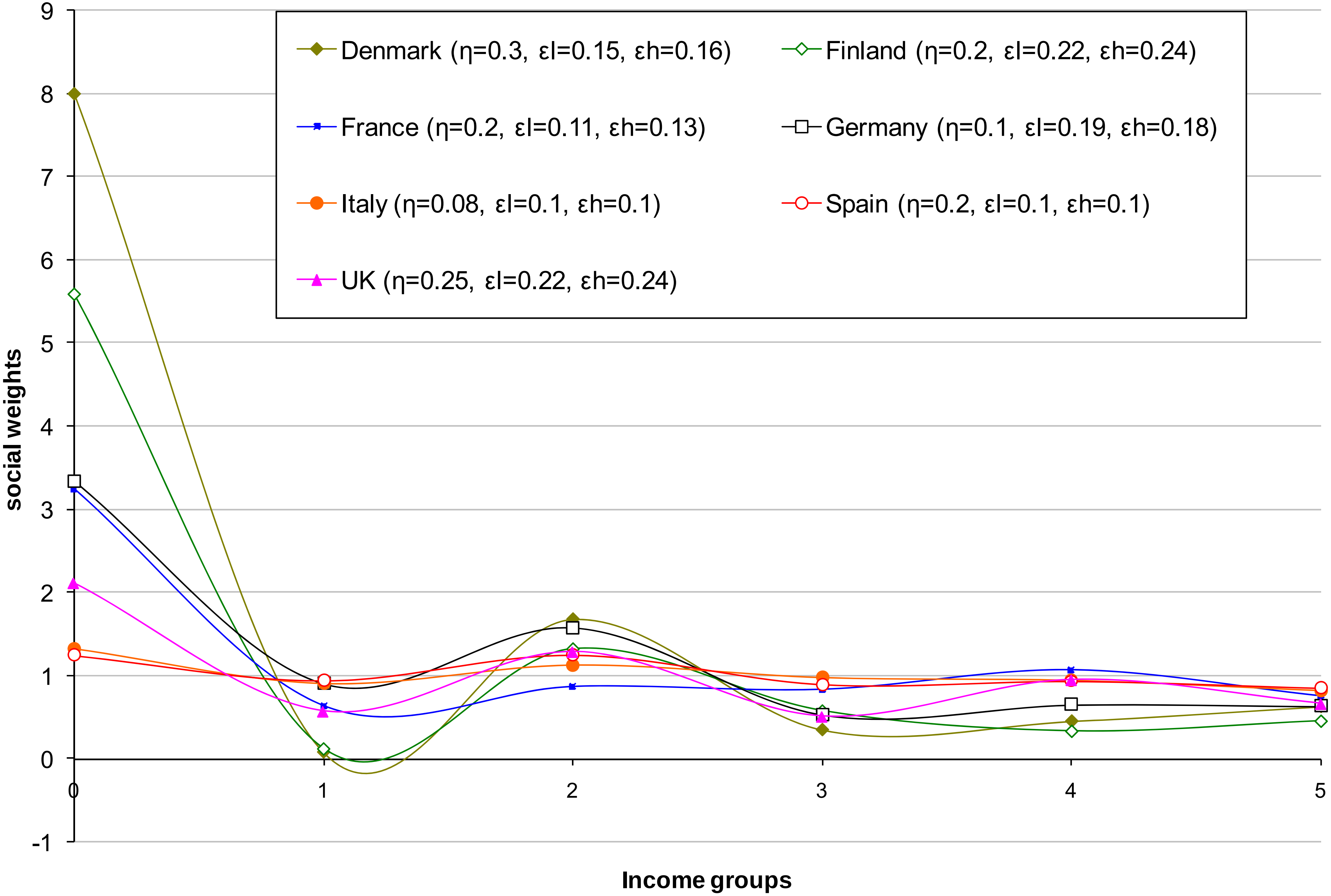
Numerical application (in terms of ε):

Empirical estimated values in each countries dividing in low [for group 0 to 2 (approx. 1st half)] and high income groups.

First intuition given by budget constraints for hypothetical households: Singles (low income



Results: mixed model



Conclusions

Results in line with general intuition on welfare regimes

Equity concerns

- "flat" redistributive tastes in Southern Europe and to some extent in the UK
- generous SA translates into high weight on group 0 in Nordic countries, Germany and France; relatively flat for other groups = close to Rawlsian preferences

Efficiency concerns

- group 1: large distortion (high phase-out rate, esp. in Nordic countries) rationalised by lower social weights
- gap between weights on groups 0 and 1 even larger if high participation elasticity (=reason to accept distortions rationalised by social preferences)

More generally:

a) Result suggests that the redistribution systems in these countries are consistent with the hypothesis of an optimizing redistribution authority.

b) Decommodification higher in Social-democratic and Corporativist

Limits

1. Income taxes and benefits are only **a very small part of the welfare state**. In this sense, our contribution must be seen as a step toward the construction of formal theorizing allowing for better understanding the nature of welfare system and, eventually, to better define (if possible) ideal-typical models starting from the analysis of real welfare state.

2. It is natural to think that real world tax-benefit schedules result more from **political economy forces** than from the pursuit of some well defined social objective. Even though, deriving and comparing social welfare functions implicit in each national system provide a new way to compare countries' tastes for redistribution as embodied in tax-benefit systems.

3. The **family dimension** is completely missing in our analysis. This is an important shortcoming given that the role of the family, and in particular, the substitutability between state and families in providing protection against decommodification risks, is one of the pillars of the EA analysis.

Future work:

1) Account for changes over time are desirable.

1.1) In particular, recent trend toward EITC schemes in Europe may translate a change in social preferences, or the recognition of the disincentive effects.

1.2) Given the importance of the issue of intergenerational solidarity and the role of welfare state in his enhancement it would be interesting, for example, to try to fix a link between the ideal typology proposed in the "EA and others" literature and the theoretical literature on the optimal design of pensions system

2) More attention must be paid to the role of unemployment benefits and social contributions

3) Treats social preferences as endogenously determined