Alternative Basic Income Mechanisms: An Evaluation Exercise with a Microeconometric Model

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Alternative Basic Income Mechanisms: An Evaluation Exercise With a Microeconometric Model*

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Abstract – We develop and estimate a microeconometric model of household labour supply in four European countries with differing economies and welfare policy regimes: Denmark, Italy, Portugal and the United Kingdom. We then simulate, under the constraint of constant total net-tax revenue (fiscal neutrality), the effects of various hypothetical tax-transfer-reform basic-income policies: Guaranteed

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Minimum Income, Work Fare, Participation Basic Income and Universal Basic Income. We produce indexes and criteria by which the reforms can be ranked and compared to current tax-transfer systems. The exercise can be considered as one of empirical optimal taxation, where the optimization problem is solved computationally rather than analytically. Many versions of basic income policies would be superior to the current system, and the most successful are not means-tested (Universal or Participation Basic Income) and adopt progressive tax rules. If constraints other than fiscal neutrality are considered, such as the implied top marginal tax rate or the effect on female labour supply, the picture changes: unconditional policies remain optimal and feasible in Denmark and the United Kingdom; while in Italy and Portugal universal policies appear instead to be too costly in implied top marginal tax rates and adverse effects on female participation – conditional policies such as Work Fare emerge as more desirable there.

Keywords – basic income, labour supply models, optimal taxation, tax reforms, welfare evaluation

1. Introduction

Some form of basic income support – in a limited and conditional version – is now implemented in most European countries, acting through the fiscal system, the pension system, or the transfers related to children. The dimensions of these interventions, however, are modest overall and selective in character. All the policies implemented vary greatly in eligibility, equivalence scales, household definition, monitoring, supplementary measures, recipients' duties, etc. The idea of a basic income support that is close to a universal coverage of citizens and that is of an amount sufficient to permanently and significantly reduce poverty is far from being accepted and implemented. Critical arguments with respect to basic income have been motivated mainly by the assumption that it would introduce strong disincentives to work and would require high tax rates to finance it. As a matter of fact, recent proposals or reform implementations in both Europe and the US seem to favour in-work benefits or work-fare policies.[1] Yet, these policies are not necessarily an alternative to some form of universal support, and they do not respond to the distributive and efficiency issues that are specifically addressed by the universalistic policies.

This study analyses behavioural, welfare and fiscal implications of the hypothetical implementation in European countries of tax-transfer reforms embodying some version of a basic income policy. We develop a

[1] A useful survey of current transfer policies in Europe and the debate on reforms is provided by Immervoll et al. (2007).

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microeconometric model of household labour supply for our evaluation. We estimate the model and simulate the effects of the reforms in four European countries that are representative of differing economies and current welfare policy regimes: Denmark, Italy, Portugal and the United Kingdom.

We iteratively adjust reform parameters in the simulation so that the total net-tax revenue collected is the same as the current one. For each country, we then rank the alternative types and versions of tax-transfer reforms. Among the evaluation criteria, we also use a welfarist social welfare function. Therefore, with reference to the class of tax-transfer rules considered, we compute the solution to an optimal taxation problem, with special focus on income transfer mechanisms.

Examples of recent contributions to the empirical design of income transfer mechanisms are Immervoll et al. (2007) and Blundell et al. (2009a). These studies start from optimal taxation formulas obtained by Saez (2002) and assign numerical values to the parameters appearing in those formulas (typically the labour supply elasticities) either by calibration (Immervoll et al., 2007) or by using previous microeconometric estimates (Haan et al., 2007; Blundell et al., 2009a). Instead, we solve the optimal taxation problem computationally by iteratively running the microeconometric model under the constraint of constant total net tax revenue. Under this methodological aspect, our exercise is close to Aaberge et al. (2008) and to Blundell et al. (2009b). The computational approach to solving optimal taxation problems allows for a more general and flexible representation of preferences, agents' heterogeneity and nonstandard constraints on the choice set.

Section 2 defines the alternative basic income policies to be simulated. Section 3 explains the evaluation method. Section 4 reports the main results of the simulations, and Section 5 concludes. The model, the empirical specification, the estimates and some technical details of the simulation method are in the Appendix.

2. The Basic Income Policies

We consider three basic income policy types, which are related both to actual or designed reforms or to results from the optimal-income taxation literature. The first type is the mean-tested transfer, which can take the form of a demogrant, a minimum guaranteed income, a negative income tax, etc. This mechanism envisages a transfer that declines as income approaches a certain threshold; therefore, it implies a high marginal tax rate imposed on (subsidized) low

incomes. Most numerical simulations done with the Mirrlees (1971) model get a tax-transfer schedule with a lump-sum transfer, high marginal tax rates on low income and almost constant marginal tax rates on average and high income. This scenario seems to have inspired many 1970–1990 reforms (implemented or discussed). A second scenario has emerged since the beginning of 2000, with new formulations of Mirrlees' model that make it more amenable to econometric applications and generalize it to include the decision of whether or not to work – not just, as in Mirrlees (1971), the decision of how much to work. This extension is particularly relevant for the design of income support mechanisms. An influential contribution is that of Saez (2002), whose model has been used in various applications (e.g., Immervoll et al., 2007; Haan et al., 2007; Blundell et al., 2009a). A typical result emerging from these studies is the superiority of policies such as in-work benefits, or tax credit on (low) earnings. These mechanisms are also close to the idea of conditional transfers, such as Work Fare (WF). Interestingly, analogous policies have been implemented in part or considered as alternatives to mean-tested transfers in various countries during the last decade. Finally, we have the stream of universal basic income. So far it hasn't become a dominating scenario, but it remains an inspiring idea with oscillating fortunes. The idea has strong philosophical motivations, but also cost-benefit, and efficient incentives arguments are sometimes put forward: universal and unconditional transfers do not incur the costs of verifying and monitoring the eligibility conditions; they do not create poverty traps; they might promote more autonomy and more efficient choices in the educational and occupational career, etc. (Standing, 2008). Atkinson (2002) suggests that various processes in the modern economies might naturally drive the social policy institutions toward the universal basic income scenario.

Table 1 summarizes the structure of the hypothetical tax-transfer reforms that we consider. In the simulation exercise they completely replace the actual tax-transfer system. They are stylized cases representative of the scenarios sketched above: Guaranteed Minimum Income (GMI), Work Fare (WF), Participation Basic Income (PBI) and Universal Basic Income (UBI). For each these four types we distinguish two versions: a flat-tax version, in which the income support mechanism is matched with a fixed marginal-tax rate t applied to incomes above a threshold G; a progressive-tax version, in which the income support mechanism is matched with a simple progressive tax (defined by a constant degree of progressivity τ) that applies to incomes exceeding G. The parameters t and τ are endogenously determined within the reform simulation so that the total net-tax revenue is equal to the one collected under the current

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tax-transfer system. This requires a two-level simulation procedure. At the *low* level, household choices are simulated given the values of the tax-transfer parameters. At the *high* level, the tax-transfer parameters are calibrated so that the total net-tax revenue remains constant.[2] The threshold G is computed as:

$$G = aP\sigma$$

Where:

P = basic poverty line = (1/2) median gross household income;

σ is an equivalence scale that adjusts the basic poverty line according to the number of people (N) in the household (Commissione di Indagine sulla Povertà, 1985):

$$\sigma = \begin{cases} 1.00 & \text{if} \quad N = 2 \\ 1.33 & \text{if} \quad N = 3 \\ 1.63 & \text{if} \quad N = 4 \\ 1.90 & \text{if} \quad N = 5 \\ 2.16 & \text{if} \quad N = 6 \\ 2.40 & \text{for} \quad N \geq 7; \end{cases}$$

a is a proportion: for each reform we simulate four versions with differing values of a: 1, 0.75, 0.50 and 0.25. For example, $G = (0.5)P(1.33)$ means that for a household with 3 components the basic income is ½ the poverty line times the equivalence scale 1.33.

We used gross income rather than net income in computing the basic poverty line P in order to make it independent of the country-specific 1998 tax-transfer systems. This procedure gives us a poverty line somewhat higher than what is typically adopted. However, we can articulate our evaluations on the basis of the value of a.

All the tax-transfer rules are defined in terms of household income. The datasets we were able to access at the moment of estimation and simulation contained the net household income computed according to the exact tax rule in each country: therefore the estimation accounts for the appropriate tax rule, whether based on individual taxation, joint taxation or some other mechanism.

[2] The calibration of the revenue-constant values of the tax-transfer parameters is performed by the algorithm Amoeba written for STATA.

However the datasets did not contain the individual unearned gross incomes. Therefore we decided to formulate the reforms in terms of total household income (i.e., as joint tax-transfer rules).

GMI has a 100% transfer reduction rate of the negative income tax proposal that was conceived, originally and independently, by Friedman (1962) and Tobin et al. (1967). As long as gross household income Y is below G the household receives a transfer $G - Y$. Otherwise $Y - G$ is taxed according to the flat rule or the progressive rule.

Table 1. Set of policies

GMI	Flat Tax (FT)	$C = \begin{cases} G \text{ if } Y \le G \\ G + (1-t)(Y-G) \text{ if } Y > G \end{cases}$
	Progressive Tax (PT)	$C = \begin{cases} G \text{ if } Y \le G \\ G + (Y-G)^{(1-\tau)} \text{ if } Y > G \end{cases}$
WF	Flat Tax (FT)	$C = \begin{cases} G \text{ if } Y \le G \text{ and } \max\left(h_F, h_M\right) \ge 20 \\ Y \text{ if } Y \le G \text{ and } \max\left(h_F, h_M\right) < 20 \\ (1-t)Y \text{ if } Y > G \text{ and } \max\left(h_F, h_M\right) < 20 \\ G + (1-t)(Y-G) \text{ if } Y > G \text{ and } \max\left(h_F, h_M\right) \ge 20 \end{cases}$
	Progressive Tax (PT)	$C = \begin{cases} G \text{ if } Y \le G \text{ and } \max\left(h_F, h_M\right) \ge 20 \\ Y \text{ if } Y \le G \text{ and } \max\left(h_F, h_M\right) < 20 \\ Y^{(1-\tau)} \text{ if } Y > G \text{ and } \max\left(h_F, h_M\right) < 20 \\ G + (Y-G)^{(1-\tau)} \text{ if } Y > G \text{ and } \max\left(h_F, h_M\right) \ge 20 \end{cases}$
PBI	Flat Tax (FT)	$C = \begin{cases} G + (1-t)Y \text{ if } \max\left(h_F, h_M\right) > 0 \\ (1-t)Y \text{ if } \max\left(h_F, h_M\right) = 0 \end{cases}$
	Progressive Tax (PT)	$C = \begin{cases} G + Y^{(1-\tau)} \text{ if } \max\left(h_F, h_M\right) > 0 \\ Y^{(1-\tau)} \text{ if } \max\left(h_F, h_M\right) = 0 \end{cases}$
UBI	Flat Tax (FT)	$C = G + (1-t)Y$
	Progressive Tax (PT)	$C = G + Y^{(1-\tau)}$

WF is similar to GMI, but the transfer to households with $Y < G$ is given only if the husband or the wife (or both) work at least 20 hours weekly. In a similar version this rule is discussed and evaluated by Fortin et al. (1993). This system is close to some reforms recently introduced in the US and the United Kingdom

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and currently discussed in continental Europe (Earnings Tax Credit, in-work benefits, etc.). WF belongs to a more general family of policies that induce "notches" into the household budget constraint (Blinder et al. 1985).

PBI is similar to a proposal made by Atkinson (1996, 1998) where a basic amount of income G is transferred to everyone provided he or she is engaged in some *participation* activity (work, child-care, training, etc.). We simulate a version where the condition is that at least one of the partners works (any number of hours).

UBI is the basic version of the system discussed by Van Parijs (1995) and is also known in the policy debate as "citizen income" or "social dividend" (Meade, 1972; Van Trier, 1995). Under this rule, every household unconditionally receives a transfer equal to G.

Gross income Y (in PBI and UBI) or $Y - G$ (in GMI and WF) is taxed according to a flat tax (defined by a constant marginal tax rate t) or according to a progressive rule defined by a constant degree of progressivity.

3. Evaluation Method

We develop a microeconometric model of household labour supply that is capable of simulating the household choices, taxes paid, transfers received, net available income and attained utility level given any tax-transfer rule regime, under the constraint of a constant total net tax revenue.

In the Appendix we provide a detailed description of the model. Here we offer an intuitive overview. Although we actually treat couples, for the sake of simplicity the following illustration considers singles.

The model assumes households are endowed with unearned income I and a market productivity that commands a wage rate w. They face a set of opportunities ("jobs") characterized by hours of market work required (h) and gross earnings (wh). The opportunity set includes nonmarket "jobs" (i.e., activities – such as child care or education – outside the labour market, with $h = 0$ and therefore $wh = 0$). Opportunity sets can differ across households, both in terms of wage rates and in terms of availability of market jobs (including the case of no market job available). The tax-transfer rule (actual or simulated) transforms the gross incomes (I, wh) into the net available income C. The household preferences upon alternative jobs are represented by a utility function $U(h, C, Z)$, where Z denote a set of household characteristics (age, children, etc.). The model assumes households choose a job – among the available ones – so as to maximize $U(h, C, Z)$. Under this assumption, the observed choices reveal the household

preferences, and with appropriate datasets and statistical procedures it is therefore possible to estimate the utility function $U(h, C, Z)$. Once we have estimated the utility function, we can simulate what the household choices would be when facing a different opportunity set, e.g., one induced by a tax-transfer reform.

For the estimation and simulation exercise we present in this article, we use EUROMOD datasets from four countries: Denmark (European Community Household Panel Survey (ECHP) 1998), Italy (Survey of Household Income and Wealth (SHIW) 1998), Portugal (European Community Household Panel Survey (ECHP) 1998) and United Kingdom (Family Resources Survey (FRS) 2003).[3]
The selection criteria are as follows:

- Couples (either married or unmarried);
- Partners either employed, unemployed or inactive (students, self-employed and disabled are excluded);
- Both partners aged 20–55.

These criteria are common in the literature on behavioural evaluation of tax reforms. The choices of people under age 20 or over age 55 are not going to be significantly affected by the policies we simulate. On the other hand, the singles and the self-employed are certainly affected, although it remains to be seen whether their responses are significantly different from the couples included in our sample.[4]

The model shows robustness, since it has been estimated with many alternative empirical specifications with no remarkable differences in the simulation results. A model with a similar structure has been used in an out-of sample prediction test by Aaberge et al. (2008) with highly satisfactory results.

In order to illustrate some of the behavioural implications of the estimated model, in Table 2 we report the wage elasticities of labour supply, i.e., the percentage change in labour supply as a response to a 1% increase in the wage rate. Labour supply can be seen as composed of two parts. One part is the number of people willing to work, the so-called participants. The other part is the

[3] The EUROMOD project produces comparable datasets and microsimulation algorithms for computing the household budget sets given a specific tax-transfer rule. EUROMOD was originally developed at the Cambridge University Department of Economics and then at Essex under the direction of Holly Sutherland. An initial overview of the EUROMOD project is provided by Bourguignon et al. (2000). We chose to use these four countries because, when developing and estimating the model, we had limited access to EUROMOD datasets: the four datasets used were the only ones accessible containing sufficient and comparable information and that still provided some variety of economic and institutional environment. We are currently extending the exercise to all the European countries covered by EUROMOD.

[4] Our project's current development includes singles and self-employed.

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number of hours the participants are willing to work. The right-hand panel of Table 1 concerns the participation elasticity. For each country, the Table tells us the percentage change in the number of participants (male or female) as a response to a 1% increase of the (male or female) wage rate. For example, in Denmark the female participation elasticity with respect to the female wage rate (defined here as "the own wage female participation elasticity") is 0.82%. Again in Denmark, the male participation elasticity with respect to the female wage rate (i.e., the cross male participation elasticity) is close to zero, -0.06%. The left-hand side of the Table concerns the total labour supply effect, i.e., it includes both the participation effect and the hour effect. The own wage female participation elasticity in Denmark is 1.55%. It tells us the total change in the number of hours the female population is willing to work, accounting for the changes both in the number of participants and in the number of hours worked by the participants. If we subtract the participation elasticity from the total elasticity we get the conditional hour elasticity 1.55% - 0.82% = 0.73%. Table 2 shows that the behavioural responses vary a lot both by gender and by country. The heterogeneity of behavioural responses is crucial in shaping the effects of the tax-transfer reforms on different segments of the population and in different countries.

Table 2. Elasticities of labour supply with respect to the wage rate

Total Expected Hours of Work	Male Wage Rate				Participation Rate	Male Wage Rate			
	Denmark	Italy	Portugal	UK		Denmark	Italy	Portugal	UK
Male	0.20	0.09	1.11	0.15	Male	0.12	0.29	0.33	0.28
Female	0.29	0.07	0.67	0.20	Female	0.19	0.07	0.52	0.13
	Female Wage Rate					**Female Wage Rate**			
	Denmark	Italy	Portugal	UK		Denmark	Italy	Portugal	UK
Male	-0.36	-0.24	0.01	-0.29	Male	-0.06	-0.15	0.02	-0.04
Female	1.55	1.65	1.78	1.99	Female	0.82	1.44	1.24	0.95

Since the tax-transfer reforms in general have different effects on different households we need a criterion to *aggregate* all the micro-effects into a synthetic index to compare and evaluate the reforms. Sen (1974, 1976) proposed comparing

statuses of the economy by computing what is now known as Sen's Social Welfare function, namely $\mu(1 - I)$, where μ is the average income and I is the Gini coefficient of the income distribution. This index has the intuitive appeal of expressing social welfare as the product of an efficiency measure (average income, i.e., the average size of the pie's slices) times a familiar equality measure (1 – Gini coefficient, i.e., the equality of the pie's slices). We apply the same idea in two of the four criteria we use to evaluate the reforms. The criteria are defined as follows:

S(C) = Social Welfare (income based). It is the same Sen's index as explained above.

S(U) = Social Welfare (utility based). This is the same as S(C) but with utility replacing income. Let $v^n(\Re)$ be the maximum utility attained by household n (computed as explained in Section A.6 of the Appendix). We then consider the sample average of $v^n(\Re)$: $\mu(\Re) = \sum_n v^n(\Re)$. Let $I(\Re)$ be the Gini coefficient of the sample distribution of $v(\Re)$. The utility-based Social Welfare function under the tax-transfer regime $\Re$ is then defined as follows:[5]

$$S_{\Re}(U) = \mu(\Re)\big(1 - I(\Re)\big).$$

W(U) = proportion of utility winners, i.e., households whose attained maximum utility increases after the reform.

W(C) = proportion of income winners, i.e., households whose net available income increases after the reform.

These four criteria enlarge the perspective from which the reforms might be judged. Given our approach, in principle S(U) should be the appropriate criterion. However in the policy debate, net available income C and therefore Sen's S(C) are more commonly used as measures of welfare. Also, the number of winners conveys useful information on the degree of consensus the reform is likely to receive.

The reforms are simulated under the constraint of being fiscally neutral, i.e., they generate the same total net-tax revenue as the current 1998 system. However, besides fiscal neutrality, other constraints might be relevant in view of

[5] For a theoretical justification of this social welfare function (as a member of a wider class) see Aaberge (2007) and Aaberge et al. (2008).

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the feasibility of the reforms. Therefore we also consider the implications of accounting for the top marginal-tax rate required and for the change in the female participation rate. The top marginal-tax rate is relevant not so much for the incentives (which are taken into account by the behavioural model) but rather for the political economy implications (e.g., support of or aversion to by high-income households). The effects on female participation rates might also be important from both socioeconomic and political economy perspectives. For example, a substantial increase in female participation rates is one of the Lisbon goals.

4. Results of the Simulation

In Table 3 we illustrate some of the behavioural and fiscal effects of basic income policies.[6] For each country, the Table reports results for the 1998 system, the best policy based on S(U), and the best policy based on S(U) also taking into account the additional constraints on the top marginal-tax rate and on female participation mentioned in Section 3. Overall, the reforms implement a larger redistribution compared to the 1998 system, which entails a lower Gini coefficient. There are some negative effects on labour supply, which can be due to higher transfers or to higher top marginal-tax rates. A lower labour supply translates itself into a somewhat lower average net available income. Therefore an efficiency-equality trade-off emerges. Typically, however, the loss of efficiency is more than compensated by the reduction in inequality, so that most of the reforms improve upon the current systems when judged according to Sen's Social Welfare function. Note that the losses in efficiency are rather modest, the reason for which is twofold. First, higher top marginal-tax rates mostly have an impact on high income households whose labour supply elasticity is low. Second, higher transfers – at the aggregate level – negatively effect labour supply, but such an effect is moderated by two factors: 1. intrahousehold interactions might imply that the reduction in one partner's supply is partly compensated for by an increase in the other partner's supply; and 2. for some households with a low income level, leisure might be an inferior good, so that an increase in unearned income might induce a higher labour supply.

[6] Detailed numerical results illustrating the behavioural and welfare effects of the reforms are available upon request from the corresponding author.

Table 3. Behavioural and fiscal effects of basic income policies

	Transfers	TMT	h_male	h_female	C	Gini	S(C)
Denmark							
Current	1,317	0.54	38.06	27.93	3371	0.33	2265
UBI+PT(*a*=1)*	1,576	0.52	38.35	29.64	3399	0.28	2437
UBI+PT(*a*=1)**	1,576	0.52	38.35	29.64	3399	0.28	2437
Italy							
Current	189	0.42	35.79	14.38	1815	0.24	1388
GMI+PT(*a*=1)*	339	0.80	32.32	11.93	1587	0.11	1414
WF+PT(*a*=0.75)**	63	0.36	36.19	14.04	1830	0.20	1460
Portugal							
Current	69	0.35	41.44	24.49	896	0.35	581
UBI+PT(*a*=.75)*	397	0.55	39.80	21.78	805	0.22	631
WF+PT(a=0.75)**	47	0.19	42.06	24.49	904	0.37	571
United Kingdom							
Current	192	0.40	44.92	23.49	2523	0.21	1991
UBI+PT(*a*=.75)*	1,263	0.60	43.27	21.39	2413	0.14	2078
UBI+PT(*a*=.25)**	421	0.26	45.89	23.75	2569	0.22	2017

Notes: * Policy with highest S(U)
** Policy with highest S(U) accounting for the additional constraints

Transfers: Average annual transfers received per household (1998 Euros)
TMT: Top marginal tax rate
h_male: Average weekly hours of work by males (including nonparticipants)
h_female: Average weekly hours of work by females (including nonparticipants)
C: Monthly net available income per household (1998 Euros)
Gini: Gini coefficient of C
S(C): Sen's Social Welfare = C*(1- Gini)

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Table 4. Summary evaluation of alternative basic income policies (Continued on next page)

		Denmark				Italy				Portugal				United Kingdom			
	Value of *a*	S(U)	S(C)	W(U)	W(C)	S(U)	S(C)	W(U)	W(C)	S(U)	S(C)	W(U)	W(C)	S(U)	S(C)	W(U)	W(C)
GMI + FT	1.00					A°*	C°*	C°*		C*	C*						
	0.75					C*		C*								C*	C*
	0.50							A*	C*								C
	0.25							C	C								C
WF + FT	1.00					C*	C*	C*	C*	C*	C*			C*	C*		
	0.75						C	C	C						C	C	C
	0.50						C	C	C								C
	0.25								C								C
PBI + FT	1.00	C	A	C	B	C°*	B°*	C°*	C°*		A°*			C°*	C°*	C°*	
	0.75			C	C	C°*	C°*	C°*	C°*	B*	C*			B°*	B°*	C°*	
	0.50			C	C	C*	C*	C*	C*	C*	C*			C*	C*	C*	C*
	0.25						C	C	B	C					C	C	C
UBI + FT	1.00	C	B	B	A	A°*		C°*	C°*	C°*	C°*			C°	C°	C°	
	0.75	C		C	C	B°*		C°*	C°*	C*	C*			B°*	C°*	C°*	
	0.50			C	C			C*	C*	C*	C*			C*	C*	C*	C*
	0.25							C*	C*						C*	C*	C*

Table 4. (Continued)

		Denmark				Italy				Portugal				United Kingdom			
	Value of *a*	S(U)	S(C)	W(U)	W(C)	S(U)	S(C)	W(U)	W(C)	S(U)	S(C)	W(U)	W(C)	S(U)	S(C)	W(U)	W(C)
GMI + PT	1.00					A°*	C°*	C°*		C*	C*			C*	C*	C*	
	0.75					C*	C*	C*								C*	C*
	0.50					C*		B*	C*								C
	0.25							C	C								C
WF + PT	1.00					C*	C*	C*	C*	C	C			C*	C*		
	0.75					C	C	C	C						C	C	C
	0.50						C	C	C								C
	0.25								C								C
PBI + PT	1.00	B	C	A	C	C°*	A°*	C°*	C°*	C°*	B°*	C°*	C°*	C°*	C°*	C°*	
	0.75	C		C	C	C°*	C°*	C°*	C°*	B*	C*	A*	C*	A°*	A°*	C°*	C°*
	0.50			C		C*	C*	C*	C*	C*	C*	C*	C*	C*	C*	C*	C*
	0.25						C	C	A			B*	C*		C	B	A
UBI + PT	1.00	A	C	A	C	A°*		C°*		C°*	C°*	C°*	C°*	C°*	C°*	C°*	
	0.75	C		C	C	B°*	C°*	C°*		A°*	C°*	C°*	C°*	A°*	C°*	C°*	
	0.50						C*	C*	C*	C*	C*	C*	C*	C*	C*	C*	C*
	0.25						C*	C*	C*			C*	C*	C	C	A	B

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Next, we rank the policies in terms of social welfare effects. Table 4 summarizes the main results, and the evaluation criteria are explained in Section 3. For each country and each criterion, we grade a reform as follows:

- A, if it is the best one in that country according to that criterion;
- B, if it is the second best in that country according to that criterion; or
- C, if it performs better than the current tax-transfer system in that country according to that criterion.

Table 4 also Gives information about the additional constraints discussed at the end of Section 3. The implications of these additional constraints are signalled in the Table by symbols added to the grades (A, B or C) explained above. We add a degree symbol "°" to a grade if that reform in that country requires a top marginal-tax rate higher than 55%. We chose this figure as a hypothetical, politically feasible upper limit because it is close to the top marginal-tax rate applied to personal incomes in European countries; in 2000, the four highest top effective marginal-tax rates applied in Europe are 60.0% (Netherlands), 55.4% (Sweden), 54.3% Denmark and 53.8% (Germany).[7] We add an asterisk "*" if that reform in that country implies a reduction of the female participation rate.

For the moment, we will ignore these added symbols and discuss the grades. First, as we show in Table 4, for each country there are many reforms that would improve on the current system according to at least one of the criteria. Italy appears to be the country most amenable to a reform, in the sense that any type of basic income reform would improve on the current status. From this viewpoint, the United Kingdom comes second after Italy, Portugal is third and last comes Denmark. Denmark already has a successful policy of income support that is difficult to improve on.

Second, we observe that, overall, the most successful reforms are PBI and UBI, and in particular their progressive versions – PBI+PT and UBI+PT get 12 "A", 8 "B" and 75 "C", while PBI+FT and UBI+FT get 3 "A", 11 "B" and 67 "C". Therefore there seems to be some indication of the superiority of unconditional policies. An exception is GMI in Italy, where it shows a performance comparable to that attained by PBI and UBI. The good performance of the unconditional policies seems to be due to the combination of two elements: 1. they have a stronger equalizing effect; and 2. the negative effect on labour supply is moderated by the absence of *poverty traps* (present in systems like GMI or WF) and turns out to be comparable to the one implied by conditional policies.

[7] OECD tax database (http://www.oecd.org/ctp/taxdatabase).

A third observation is that progressive systems seem to perform somewhat better than flat systems do. We already noted that the progressive versions of PBI and UBI get higher grades overall than their non-progressive versions. But this is true also of GMI. This is due to the interaction between the pattern of labour supply elasticities and the structure of the tax rule. Optimal taxation theory tells us that if the main goal of the design of the tax-transfer rule were efficiency, i.e., the maximization of the pie's size, then, loosely speaking, we should impose higher taxes on people who are less responsive to the economic incentives; more precisely – other things being equal – the marginal tax rate imposed on a given income level should be higher (lower) the lower (higher) is the labour supply elasticity (with respect to wage rates) of households at that income level. Most numerical exercises applying optimal taxation results typically assumed a constant elasticity of labour supply, which obviously contributes to producing an almost flat tax profile. However, a pervasive result in the microeconometric analysis of labour supply behaviour is the inverse relationship between income level and labour supply elasticity. Members of households with higher income tend to show a lower elasticity of labour supply, and the opposite is true of members of households with lower incomes. The intuition behind these empirical findings is that people earning higher incomes typically work more (so that it is difficult for them to work even more) and occupy jobs with better non-precuniary benefits (so that they are relatively less responsive to monetary incentives). Progressive rules apply higher marginal tax rates on higher incomes and lower marginal tax rates on lower incomes. Therefore the progressive rules tend to exploit more efficiently the elasticity profile. Moreover, they also contribute to a more equal distribution of income or of utility.[8]

Based on the S(U) criterion and ignoring again the additional markings, the best reforms turn out to be as follows:

Denmark: UBI+PT (a=1);

Italy: either GMI+PT (a=1) or UBI+PT (a=1);

[8] Detailed evidence on labour supply elasticity is available: for example, Aaberge et al. (2002) for Italy and Aaberge et al. (2008) for Norway. Aaberge et al. (2008) compute an optimal tax rule that requires lower (higher) tax rates on lower (higher) incomes as compared to the current rule. A superficial interpretation of the first results reported by Mirlees (1971) contributed to the widespread idea that the optimal tax rule is close to a flat one, and possibly even regressive. More recently this idea has been questioned on both the theoretical and the empirical bases: see Aaberge et al. (2008), Tuomala (1990, 2008), Røed et al. (2002) and Keen et al. (2006). Note that these analyses adopt a pure welfarist criterion, i.e., maximization of the social welfare function. There are other dimensions (administrative simplicity, compliance, etc.) along which the flat rules might have important advantages (Keen et al., 2006).

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Portugal: UBI+PT (a=0.75);

UK: either UBI+PT (a=0.75) or PBI+PT (a=0.75).

The picture can change substantially if we also account for the additional constraints mentioned above and signalled by the marks attached to the grades shown in Table 3. If we assume that the reforms requiring a top marginal tax rate higher than 55% or implying a reduction of the female participation rate are not feasible, then many reforms exit the social planner's opportunity set. Denmark is not affected by the additional constraints: all the reforms satisfy them. On the other hand, in Portugal only two reforms survive: PBI+FT (a=0.25) and WF+PT (a=1). What is left in Italy crucially depends on the evaluation criterion. If S(U) is used, then the only feasible and welfare-improving reform is WF+PT (a=0.75). If one uses other evaluation criteria more reforms remain acceptable (various versions of GMI, WF and PBI). Also for the United Kingdom the set of acceptable reforms depends on the evaluation criterion. According to S(U), only UBI+PT (a=0.25) remains acceptable.

Limiting ourselves again to the S(U) criterion, among the feasible policies left after accounting for the additional criteria, the new best reforms are now as follows:

Denmark: UBI+PT (a=1);

Italy: WF+PT (a=0.75);

Portugal: WF+PT (a=0.75);

UK: UBI+PT (a=0.25).

The superiority of the unconditional policies is preserved in Denmark and the United Kingdom, but not in Italy and Portugal where WF turns out to be the best choice.

A fourth observation based on Table 4 is a significant variability across countries. This is probably one of the implications of using a flexible microeconometric model that is capable of capturing enough of the heterogeneity of household characteristics and heterogeneity between countries. Immervoll et al. (2007) find that in-work benefits (close to our WF) dominate – on a social welfare basis – more universal policies (close to our UBI or GMI). The picture emerging from our exercise is less clear-cut: as a matter of fact, a purely social welfare-based evaluation would suggest a slight superiority of the universal policies. The analysis of Immervoll et al. (2007) is based on theoretical optimal

taxation results (Saez, 2002) that require restrictive assumptions on preferences and choices (no income effects, no interaction among partners, little heterogeneity in behaviour), which might contribute to explaining the differences between their results and ours.

5. Conclusions

We developed a microeconometric model of household labour supply, which allows simulating the effects of complex reforms of the tax-transfer rules. We estimated the model for four European countries (Denmark, Italy, Portugal and United Kingdom). We then simulated the effects of introducing various alternative types of basic income policies keeping total net-tax revenue constant. We report many indexes and criteria according to which the performances of the alternative policies can be ranked. As long as the evaluation is based on welfarist criteria (i.e., a social welfare function or the number of utility-based winners), four general suggestions emerge clearly:

1. universal policies tend to perform better;
2. progressive tax rules seem more efficient in exploiting the pattern of behavioural responses;
3. every country has vast policy space for improving on the current status; and
4. countries differ significantly in tax-transfer reforms performance.

When, besides fiscal neutrality, the other constraints (top marginal tax rate and female participation) are also taken into account, clearly the size of the feasible policies is reduced. If, for example, we set an upper limit of 55% to the top marginal tax rate and drop the policies that imply a reduction in female participation rate, the country-specific results tend to diverge. On the one hand, countries like Denmark and the United Kingdom seem still able to support Universal Basic Income systems as optimal policies. On the other hand, in countries like Italy and Portugal the price of supporting unconditional policies seems too high and policies like WF emerge as more appropriate.

The question of what configurations of country-specific characteristics lead to such divergent results cannot be solved within the limits of the modelling effort illustrated in this article and requires further investigation. In exercises based on theoretical optimal taxation results (such as Immervoll et al., 2007) one can directly identify a correspondence between optimal tax rules and a few parameters such as labour supply elasticities or moments of the skills distribution. The exercise presented in this article is an example of computational

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optimal taxation (as in Aaberge et al., 2008; Blundell et al., 2009b). The welfare properties of tax-transfer reforms are identified by simulating detailed microeconometric models. The identification of the mapping from country-specific characteristics to optimal reforms requires a large variety of datasets and new theoretical and statistical concepts that are objects of our current research.

Appendix. The Microeconometric Model

Household Behaviour

The basic modelling framework is similar to the one adopted, among others, by Van Soest (1995), Aaberge et al. (1995, 1999, 2000a, 2000b, 2004, 2008), Duncan et al. (1996), i.e. the Random Utility model.[9] We will consider households with two decision-makers (i.e. couples) aged 20 - 55. Of course there might be other people in the household, but their behaviour is taken as exogenous.

Household n is assumed to solve the following problem:

$$\text{(A.1)} \qquad \begin{aligned} &\max_{C,h_F,h_M} U^n(C,h_F,h_M) \\ &h_F \in \Omega \\ &h_M \in \Omega \\ &C^n = R(w_F^n h_F, w_M^n h_M, y^n) \end{aligned}$$

Where

$U^n\left(C,h_F,h_M\right)$ = utility function

h_g = average weekly hours of work required by the j-th job in the choice set for partner g, g = F (female) or g = M (male);

Ω = set of 12 discrete values (see Appendix A.3);

w_g^n = hourly wage rate of partner g;

y^n = vector of exogenous household gross incomes;

[9] Surveys of various approaches to modelling labour supply for tax reform simulation are provided by Blundell et al. (1999), Creedy et al. (2005), Bourguignon et al. (2006) and Meghir et al. (2008).

C^n = net disposable household income;

R = tax-transfer rule that transforms gross incomes into net available household income. In the estimation samples the tax-transfer rules are those actually applied in the four countries and are replicated by the EUROMOD microsimulation algorithms.[10]

The first two constraints of problem (A.1) say that the hours of work h_s are chosen within a discrete set of values Ω including also 0 hours. This discrete set of h values can be interpreted as the actual choice set (maybe determined by institutional constraints) or as approximations to the true (possibly continuous) choice set.

The third constraint says that net income C is the result of a tax-transfer rule R applied to gross incomes.

We write the utility function $U^n(C, h_F, h_M, \varepsilon)$ as the sum of a systematic part and a random component:

$$\text{(A.2)} \quad V(C, h_F, h_M; Z^n, \vartheta) + \varepsilon = V(R(w_F^n h_F, w_M^n h_M, y^n), h_F, h_M; Z^n, \vartheta) + \varepsilon$$

Where Z^n is a vector of household characteristics, ϑ is a vector of parameters to be estimated and ε is a random variable capturing the effect of unobserved (by the econometrician) variables upon the evaluation of (C, h_F, h_M) by household n.

This interpretation of the random variable ε is the same that was offered by McFadden in his presentations of the Conditional Logit model (McFadden, 1974). Besides the observed variables, there are characteristics of the job or of the household-job match that are observed by the household but not by the econometrician. The random variable ε is meant to account for the contribution to utility by those characteristics. Most of the labour supply literature adopting the Conditional Logit framework tends instead to favour a different interpretation, where the true utility function is just the component V of expression A.2 and the random variable ε is an optimization error. An implication of this interpretation is that, at the end, the econometrician is assumed to know more than the household itself: the econometrician knows that

[10] This article uses EUROMOD version 27a. The results represent the best available simulation at the time. Any errors are the authors' responsibility. EUROMOD uses microdata from 12 sources for 15 countries. This article uses data from the European Community Household Panel (ECHP) database by Eurostat; the Survey of Household Income and Wealth (SHIW95) by the Bank of Italy; and the Family Expenditure Survey (FES) by the UK Office for National Statistics (ONS) through the Data Archive. FES material, used here by permission, is Crown Copyright. Neither the ONS nor the Data Archive bears responsibility for what is reported here. An equivalent disclaimer applies for all other data sources and their providers.

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the true utility is V, while the households base their choice on a wrong utility level U. We find this interpretation less acceptable than the one originally proposed by McFadden, so here we follow the latter. The interpretation we adopt implies that we cannot test for the (local) quasi-concavity of the utility function: we estimate V, and we could make a test on V, but the true utility function is not V but U, and U is a function of an unknown random variable ε.

Under the assumption that ε is i.i.d. extreme value, it is well known that the probability that household n subject to tax-transfer regime R chooses $h_F = f, h_M = m$ is given by

$$\text{(A.3)} \quad P^n(f,m;\vartheta,R) = \frac{\exp\left\{V\left(R(w_F^n f, w_M^n m, y^n), f, m; Z^n, \vartheta\right)\right\}}{\sum_{h_F \in \Omega}\sum_{h_M \in \Omega} \exp\left\{V\left(R(w_F^n h_F, w_M^n h_M, y^n), h_F, h_M; Z^n, \vartheta\right)\right\}} .$$

Empirical Specification of Preferences

We choose a quadratic specification since it is linear in parameters and it represents a good compromise between flexibility and ease of estimation:

$$\text{(A.4)} \quad \begin{aligned} V = {} & \theta_C C + \theta_F (T - h_F) + \theta_M (T - h_M) + \\ & + \theta_{CC} C^2 + \theta_{FF} (T - h_F)^2 + \theta_{MM} (T - h_M)^2 + \\ & + \theta_{CF} C (T - h_M) + \theta_{CM} C (T - h_M) + \theta_{FM} (T - h_F)(T - h_M) \end{aligned}$$

where T denotes total available time.

Some of the above parameters θs are made dependent on household or individual characteristics:

$$\text{(A.5)} \quad \begin{aligned} \theta_F &= \beta_{F0} + \beta_{F1}\left(\text{Age of the wife}\right) + \beta_{F2}\left(\text{\#Children}\right) + \\ &\quad + \beta_{F3}\left(\text{\#Children under 6}\right) + \beta_{F4}(\text{\#Children 6-10}) \\ \theta_M &= \beta_{M0} + \beta_{M1}\left(\text{Age of the husband}\right) + \beta_{M2}\left(\text{\#Children}\right) + \\ &\quad + \beta_{M3}\left(\text{\#Children under 6}\right) + \beta_{M4}(\text{\#Children 6-10}) \\ \theta_C &= \beta_{C0} + \beta_{C1}\left(\text{\#Children}\right) + \beta_{C2}\left(\text{\#Children under 6}\right) + \\ &\quad + \beta_{C3}(\text{\#Children 6-10}). \end{aligned}$$

Empirical Specification of the Opportunity Sets

We assume that each partner can choose between 10 values (from 1 to 80) of weekly hours of work. Each value is randomly drawn from one of the following ten intervals: 1–8, 9–16, 17–24, 25–32, 33–40, 41–48, 49–56, 57–64, 65–72, 73–80. Moreover they can also choose to be out of work, either as nonparticipants or as unemployed (therefore there are two distinct alternatives with zero hours of work: we further clarify this point at the end of this section). Thus each household chooses among 144 alternatives. In order to compute net household income C for each household job contained in $\Omega \times \Omega$, we use the EUROMOD Microsimulation model. In other words EUROMOD mimics the tax-transfer rule R. Wage rates for those not employed are imputed on the basis of a wage equation estimated on the employed subsample and corrected for sample selection.

Although generating the alternatives in the opportunity set with a probabilistic sampling seems to provide a better performance – especially in reform simulation – as compared to the most common usage of imputing a fixed and equal set of alternatives to everyone, here we adopt a simpler method, especially in view of making the model easily replicable, modifiable and accessible to a large audience (for example, the EUROMOD users). A comparison and evaluation of different procedures to specify the choice set is provided by Aaberge et al. (2009).

Most countries show a more or less pronounced concentration of people around hours corresponding to full-time, part-time and nonworking. The model outlined above is typically unable to reproduce these peaks. A useful procedure consists of adding dummies. We define the following dummies for part-time, full-time, overtime, working and not working but looking for work (the excluded condition being "not working and not looking for work"):

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$$D_{g1}\left(h_g\right)=\begin{cases}1 \text{ if } 17\leq h_g \leq 32\\ 0 \text{ otherwise}\end{cases}$$

$$D_{g2}\left(h_g\right)=\begin{cases}1 \text{ if } 33\leq h_g \leq 48\\ 0 \text{ otherwise}\end{cases}$$

(A.6) $$D_{g3}\left(h_g\right)=\begin{cases}1 \text{ if } 49\leq h_g\\ 0 \text{ otherwise}\end{cases}$$

$$D_{g4}\left(h_g\right)=\begin{cases}1 \text{ if } 0< h_g\\ 0 \text{ otherwise}\end{cases}$$

$$D_{g5}\left(h_g\right)=\begin{cases}1 \text{ if } h_g = 0 \text{ and looking for work}\\ 0 \text{ otherwise}\end{cases}$$

with g = F (female) or M (male).

Aaberge et al. (1995, 1999) provide a formal justification of this procedure. Assuming a non-uniform probability density function of the alternatives in the opportunity set and adopting a convenient empirical specification of the density function leads to rewriting the choice probabilities $P^n(f,m;\vartheta,R)$ as follows:

(A.7) $$\frac{\exp\left\{V\left(R(w_F^n f, w_M^n m, y^n), f, m; Z^n, \theta\right)+\sum_{k=1}^{5}\gamma_{Fk}D_{Fk}\left(f\right)+\sum_{k=1}^{5}\gamma_{Mk}D_{Mk}\left(m\right)\right\}}{\sum_{h_F\in\Omega}\sum_{h_M\in\Omega}\exp\left\{V\left(R(w_F^n h_F, w_M^n h_M, y^n), h_F, h_M; Z^n, \theta\right)+\sum_{k=1}^{5}\gamma_{Fk}D_{Fk}\left(h_F\right)+\sum_{k=1}^{5}\gamma_{Mk}D_{Mk}\left(h_M\right)\right\}}$$

where the γ's and the θs are parameters to be estimated and where Z^n denotes the vector of characteristics (specified in expression A.5) of household n.

If (f^n, m^n) is the observed choice for the n-th household, the ML estimate of ϑ is:

(A.8) $$\vartheta^{ML}=\arg\max_{\vartheta}\sum_{n=1}^{N}\ln P^n(f^n,m^n;\vartheta,R).$$

An uncommon feature of the model we are adopting here is the treatment of unemployment (as differing from nonparticipation) as a choice. The unemployment status entails a utility level that differs from both employment and nonparticipation. Depending on the opportunities available in the opportunity set and on the cost of accessing such opportunities, choosing employment, nonparticipation or unemployment might be the optimal choice.

Certainly the opportunity of choosing to be unemployed (and to receive, for example, unemployment benefits) rather than to be a nonparticipant is not open to everyone: this is accounted for by the dummy D_{g5} defined above.

Estimates

For the estimation and simulation exercise presented in this article we use datasets from four countries: Denmark (European Community Household Panel Survey (ECHP) 1998), Italy (Survey of Household Income and Wealth (SHIW) 1998), Portugal (European Community Household Panel Survey (ECHP) 1998) and United Kingdom (Family Resources Survey (FRS) 2003). The selection criteria are as follows:

- Couples (either married or unmarried);
- Partners either employed, unemployed or inactive (students, self-employed and disabled are excluded);
- Both partners aged 20–55.

The above sample-selection criteria we adopted are common in the literature on behavioural evaluation of tax reforms. The choices of people under age 20 or over age 55 are not going to be significantly affected by the policies we simulate. On the other hand, the singles and the self-employed are certainly affected, although it remains to be seen whether their responses differ significantly from the couples included in our sample. Our project's current development includes singles and self-employed.

Expression A.7 can be used with country-specific samples to compute the Likelihood function to be maximized in order to obtain country-specific estimates of the parameters θ and γ. We also follow a different route: pooling the four country-specific samples into a unique sample, then using expression A.7 enriched by allowing β_{C0}, β_{F0}, β_{M0} (expression A.5) and all the γ's (expression A.7) to vary between countries. Microeconometric models of labour supply are typically estimated on one country-specific cross section sample: as a consequence, all the households face the same tax rule. However, with the procedure using the pooled sample, the households face different tax rules. This should provide a sharper identification of the preference parameters.

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Table A.1. Parameter estimates

	Italy (or common)	Denmark - Italy	Portugal - Italy	UK - Italy
β_{F0}	0.272***	0.024	-0.048***	-0.040***
β_{F1}	0.916e-03***			
β_{F2}	0.410e-02***			
β_{F3}	0.013***			
β_{F4}	0.685e-02***			
β_{M0}	0.072***	0.039***	0.027***	-0-046***
β_{M1}	-0.553e-04			
β_{M2}	-0.461e-02**			
β_{M3}	0.839e-03			
β_{M4}	0.223e-02			
β_{C0}	0.536e-03***	0.205e-03**	0.289e-02***	0.141e-03
β_{C1}	0.369e-04			
β_{C2}	0.425e-04			
β_{C3}	0.107e-03**			
θ_{CC}	-2.700e-08***			
θ_{FF}	-0.211e-02***			
θ_{MM}	-0.7912-03***			
θ_{CF}	-0.319e-07***			
θ_{CM}	0.811e-07***			
θ_{FM}	0.798e-03***			
γ_{F1}	1.620***	-1.257***	-2.467***	-2.291***
γ_{F2}	3.238***	-0.254	-1.851***	-3.223***
γ_{F3}	1.658***	0.706	-2.251***	-2.180***
γ_{F4}	-4.203***	4.865***	1.090***	2.658***
γ_{F5}	-1.803***	2.822***	0.102	-0.519**
γ_{M1}	1.638***	-0.996*	-1.027**	-1.626***
γ_{M2}	4.757***	-0.317	-0.108	-2.781***
γ_{M3}	3.582***	0.398	-0.336	-2.426***
γ_{M4}	-2.558***	10.111***	1.229**	1.343***
γ_{M5}	-0.139	6.816***	-1.341***	-0.971**

Notes: * = significance < 10%; ** = significance < 5%; *** = significance < 1%
For the meaning of the coefficient symbols, see equations A.4, A.5, and A.7.

The estimates based on the pooled sample (which contains 5,330 observations) are reported in Table A.1.[11] The results are overall satisfactory in terms of statistical significance and economic interpretation. Some of the parameters are allowed to change between countries. Differences in parameters among the countries can be due to a host of institutional or cultural factors that can be accounted for (by allowing some of the parameters to differ) but not explained within our modelling approach. When the parameters are allowed to differ, the first column of estimates reports the parameter value specific for Italy while the other columns report the difference of the country-specific parameter (respectively for Denmark, Portugal or United Kingdom) compared to the Italy-specific parameter. Otherwise, the first column reports the estimates of the parameters assumed as common among the countries.

The crucial preference parameters are the following:

β_{C0} and θ_{CC} (related to the marginal utility of income);

β_{F0} and θ_{FF} (related to the marginal utility of wife's leisure);

β_{M0} and θ_{MM} (related to the marginal utility of husband's leisure).

The other parameters $\beta's$ and $\theta's$ measure the effects of various interactions of leisure times and income among themselves and with household characteristics.

The marginal utility of income and the marginal utility of wife's and husband's leisure appear to be positive and decreasing (at least at the observed choices).

The wife's and the husband's leisure appear to be complements, in the sense that more leisure for one of them has a positive effect on the marginal utility of leisure of the other one.

The parameters γ's reflect differences between the countries with respect to the availability of the various opportunities and with respect to specific utility gains or losses (besides those due to income and leisure) attached to them. There appear to be large differences between the countries in the estimated values of these parameters. This result is hardly surprising given the large differences

[11] The estimates and the simulations based on country-specific samples are available upon request from the authors. While the country-specific and the pooled estimates might differ based on a coefficient-by-coefficient comparison, the simulation results are similar.

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between the countries with regard to the institutional environment and the labour market structure and regulations.

Simulation Method

The estimated model is used to simulate the effects of alternative hypothetical tax-transfer reforms. Suppose we are interested in some alternative tax-transfer rule $\Re$. Let $P^n(f,m;\vartheta^{ML},\Re)$ be the probability that household n chooses (f,m) under the $\Re$ tax-transfer regime, computed on the basis of the estimated parameters ϑ^{ML}, i.e.,

$$\text{(A.9)} \quad \frac{\exp\left\{V\left(\Re(w_F^n f, w_M^n m, y^n), f, m; Z^n, \theta^{ML}\right) + \sum_{k=1}^{5}\gamma_{Fk}^{ML} D_{Fk}(f) + \sum_{k=1}^{5}\gamma_{Mk}^{ML} D_{Mk}(m)\right\}}{\sum_{h_F\in\Omega}\sum_{h_M\in\Omega}\exp\left\{V\left(\Re(w_F^n h_F, w_M^n h_M, y^n), h_F, h_M; Z^n, \theta^{ML}\right) + \sum_{k=1}^{5}\gamma_{Fk}^{ML} D_{Fk}(h_F) + \sum_{k=1}^{5}\gamma_{Mk}^{ML} D_{Mk}(h_M)\right\}}.$$

Suppose we are interested in simulating the expected value of some function $\varphi^n(f,m)$: it might be the net available income under the new rule, hours worked, taxes paid, etc. Then we compute the expected value of that variable after the policy is implemented as follows:

$$\text{(A.10)} \qquad E(\varphi^n(f,m)) = \sum_{f\in\Omega}\sum_{m\in\Omega}\varphi^n(f,m)P^n(f,m;\vartheta^{ML},\Re).$$

Maximum Expected Utility

In Section 3 of the main text we define the utility-based Social Welfare function, which requires the computation of the expected maximum utility attained by household n under tax-transfer regime, $v^n(\Re)$. We use the following expression:[12]

$$\text{(A.11)} \quad v^n(\Re) = \ln\left(\sum_{h_F\in\Omega}\sum_{h_M\in\Omega}\exp\left\{V\left(R(w_F^n h_F, w_M^n h_M, y^n), h_F, h_M; \overline{Z}, \theta^{ML}\right) + \sum_{k=1}^{5}\gamma_{Fk}^{ML} D_{Fk} + \sum_{k=1}^{5}\gamma_{Fk}^{ML} D_{Mk}\right\}\right).$$

where $\overline{Z}$ denotes the vector of sample average values of household characteristics. We use $\overline{Z}$ as reference value in order to ensure interpersonal

[12] For the derivation of this expression, see McFadden (1978) and Ben-Akiva et al. (1985). The same methodology for empirical welfare evaluation is used by Colombino (1998).

comparison of utility among different households (Deaton and Muellbauer, 1980).

References

Aaberge, R. (2007) "Gini's Nuclear Family," *Journal of Economic Inequality* 5 (3), pp. 305–322.

Aaberge, R. and U. Colombino (2008) "Designing Optimal Taxes With a Microeconometric Model of Labour Supply," CHILD Working Paper #06/2008.

Aaberge, R., U. Colombino and S. Strøm (1999) "Labor Supply in Italy: An Empirical Analysis of Joint Household Decisions, With Taxes and Quantity Constraints," *Journal of Applied Econometrics* 14 (4), pp. 403–422.

Aaberge, R., U. Colombino and S. Strøm (2000a) "Labour Supply Responses and Welfare Effects From Replacing Current Tax Rules by a Flat Tax: Empirical Evidence From Italy, Norway and Sweden," *Journal of Population Economics* 13 (4), pp. 595–621.

Aaberge, R., U. Colombino and S. Strøm (2004) "Do More Equal Slices Shrink the Cake? An Empirical Evaluation of Tax-Transfer Reform Proposals in Italy," *Journal of Population Economics* 17 (4), pp. 767–785.

Aaberge, R., U. Colombino, S. Strøm and T. Wennemo (2000b) "Joint Labor Supply of Married Couples: Efficiency and Distribution Effects of Tax and Labor Market Reforms," in L. Mitton, H. Sutherland and M. Weeks (Eds.) *Micro-simulation Modelling for Policy Analysis: Challenges and Innovations*. Cambridge: Cambridge University Press.

Aaberge, R., U. Colombino and T. Wennemo (2002) "Heterogeneity in the Elasticity of Labour Supply in Italy and Some Policy Implications," CHILD Working Paper #21/2002.

Aaberge, R., U. Colombino and T. Wennemo (2009) "Evaluating Alternative Representations of the Choice Sets in Models of Labour Supply," *Journal of Economic Surveys* 23 (3), pp. 586–612.

Aaberge, R., J. K. Dagsvik and S. Strøm (1995) "Labour Supply Responses and Welfare Effects of Tax Reforms," *Scandinavian Journal of Economics* 97 (4), pp. 635–659.

Atkinson, A. B. (1996) "The Case for a Participation Income," *The Political Quarterly* 67 (1), pp. 67–70.

Atkinson, A. B. (1998) *Poverty in Europe*. Oxford: Blackwell.

Atkinson, A. B. (2002) How Basic Income Is Moving up the Policy Agenda: News From the Future, Paper (revised version) presented at the 9th BIEN International Congress, 13 September 2002, Geneva.

Ben-Akiva, M. and S. R. Lerman (1985) *Discrete Choice Analysis*. Cambridge, MA: The MIT Press.

Blinder, A. and H. Rosen (1985) "Notches," *American Economic Review* 75 (3), pp. 736–747.

DOI: 10.2202/1932-0183.1162

Blundell, R., M. Brewer, P. Haan and A. Shephard (2009a) "Optimal Income Taxation of Lone Mothers: An Empirical Comparison for Britain and Germany," *Economic Journal* 119 (535), pp. F101–F121.

Blundell, R. and A. Shephard (2009b) "Employment, Hours of Work and the Optimal Taxation of Low Income Families," mimeo.

Bourguignon, F., C. O'Donoghue, J. Sastre-Descals, A. Spadaro and F. Utili (2000) "Eur3: a Prototype European Tax-Benefit Model: Issues and Initial Experiments," in A. Gupta and V. Kaipur (Eds.) *Microsimulation in Government Policy and Forecasting*. Amsterdam: North Holland.

Bourguignon, F. and A. Spadaro (2006) "Microsimulation as a Tool for Evaluating Redistribution Policies," ECINEQ 2006-20.

Colombino, U. (1998) "Evaluating the Effects of New Telephone Tariffs on Residential Users' Demand and Welfare. A Model for Italy," *Information Economics and Policy* 10 (3), pp. 283–303.

Commissione di Indagine sulla Poverta' (1985) "La Poverta' in Italia," Presidenza del Consiglio dei Ministri, Roma.

Creedy, J. and G. Kalb (2005) "Discrete Hours Labour Supply Modelling: Specification, Estimation and Simulation," *Journal of Economic Surveys* 19 (5), pp. 697–734.

Deaton, A. and J. Muellbauer (1980) *Economics and Consumer Behavior*. Cambridge: Cambridge University Press.

Duncan, A. and C. Giles (1996) "Labour Supply Incentives and Recent Family Credit Reforms," *Economic Journal* 106 (434), pp. 142–155.

Fortin, B., M. Truchon and L. Beausejour (1993) "On Reforming the Welfare System: Workfare Meets the Negative Income Tax," *Journal of Public Economics* 51 (2), pp. 119–151.

Friedman, M. (1962) *Capitalism and Freedom*. Chicago: University of Chicago Press.

Haan, P. and K. Wrohlich (2007) "Optimal Taxation: The Design of Child Related Cash- and In-Kind-Benefits," IZA Discussion Papers 3128.

Immervoll, H., H. J. Kleven, C. T. Kreiner and E. Saez (2007) "Welfare Reforms in European Countries: A Microsimulation Analysis," *Economic Journal* 117 (1), pp. 1–44.

Keen, M., Y. Yitae Kim and R. Varsano, (2006) "The 'Flat Tax(es)': Principles and Evidence," IMF WP 06/218.

McFadden, D. (1974) "Measurement of Urban Travel Demand," *Journal of Public Economics* 3 (4), pp. 303–328.

McFadden, D. (1978) "Modelling the Choice of Residential Location," in A. Karlquist, L. Lundquist, F. Snickard and J.J. Weilbull (Eds.) *Spatial Interaction Theory and Planning Models*. Amsterdam: North-Holland.

Meade, J. (1972) "Poverty in the Welfare State," *Oxford Economic Papers* (new series) 24 (3), pp. 289–326.

Meghir, C. and D. Phillips (2008) "Labour Supply and Taxes," Institute for Fiscal Studies, WP 08/04.

Mirlees, J. A. (1971) "An Exploration in the Theory of Optimal Income Taxation," *Review of Economic Studies* 38 (2), pp. 175–208.

OECD Tax Database. http://www.oecd.org/ctp/taxdatabse.

Røed, K. and S. Strøm (2002) "Progressive Taxes and the Labour Market – Is the Trade-Off Between Equality and Efficiency Inevitable?," *Journal of Economic Surveys* 16 (1), pp. 77–110.

Saez, E. (2002) "Optimal Income Transfer Programs: Intensive Versus Extensive Labor Supply Responses," *Quarterly Journal of Economics* 117 (3), pp. 1039–1073.

Sen, A. (1974) "Information Bases of Alternative Welfare Approaches: Aggregation and Income Distribution," *Journal of Public Economics* 3 (4), pp. 387–403.

Sen, A. (1976) "Real National Income," *Review of Economic Studies* 43 (1), pp. 19–39.

Standing, G. (2008) "How Cash Transfers Promote the Case for Basic Income," *Basic Income Studies* 3 (1), pp. 1–30.

Tobin, J., J. Pechman and P. Mieszkowski (1967) "Is a Negative Income Tax Practical?," *Yale Law Journal* 77 (1), pp. 1–27.

Tuomala, M. (1990) *Optimal Income Tax and Redistribution*. Oxford: Clarendon Press.

Tuomala, M. (2008) "On Optimal Non-linear Income Taxation: Numerical Results Revisited," *International Tax and Public Finance* (forthcoming).

Van Parijs, P. (1995) *Real Freedom for All*. Oxford: Oxford University Press.

Van Soest, A. (1995) "Structural Models of Family Labour Supply," *Journal of Human Resources* 30 (1), pp. 63–88.

Van Trier, W. (1995) "Every One a King," Department of Sociology, Katholieke Universiteit Leuven, Leuven.

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