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TAX-BENEFIT SYSTEMS IN EUROPE
AND THE US:
BETWEEN EQUITY AND EFFICIENCY

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Tax-Benefit Systems in Europe and the US: Between Equity and Efficiency[1]

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Abstract

Whether observed differences in redistributive policies across countries are the result of differences in social preferences or efficiency constraints is an important question that paves the debate about the optimality of welfare regimes. To shed new light on this question, we estimate labor supply elasticities on microdata and adopt an inverted optimal tax approach to characterize the redistributive preferences embodied in the welfare systems of 17 EU countries and the US. Implicit social welfare functions are broadly compatible with the fiction of an optimizing Paretian social planner. Some exceptions due to generous demogrant transfers are consistent with the ignorance of behavioral responses by some European governments and are partly corrected by recent policy developments. Heterogeneity in leisure-consumption preferences somewhat affect the international comparison in degrees of revealed inequality aversion, but differences in social preferences are significant only between broad groups of countries.

JEL Classification: H11, H21, D63, C63

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[1]This paper uses EUROMOD version D9. EUROMOD is continually being improved and updated and the results presented here represent the best available at the time of writing. Any remaining errors, results produced, interpretations or views presented are the authors' responsibility. This paper uses data from the European Community Household Panel (ECHP) User Data Base made available by Eurostat; the Austrian version of the ECHP made available by Statistik Austria; the Panel Survey on Belgian Households (PSBH) made available by the University of Liège and the University of Antwerp; the Estonian Household Budget Survey (HBS) made available by Statistics Estonia; the Income Distribution Survey made available by Statistics Finland; the Enquête sur les Budgets Familiaux (EBF) made available by INSEE; the public use version of the German Socio Economic Panel Study (GSOEP) made available by the German Institute for Economic Research (DIW), Berlin; the Greek Household Budget Survey (HBS) made available by the National Statistical Service of Greece; the EU Statistics in Incomes and Living Conditions (SILC) made available by Eurostat; the Living in Ireland Survey made available by the Economic and Social Research Institute; the Survey of Household Income and Wealth (SHIW) made available by the Bank of Italy; the Socio-Economic Panel Survey (SEP) made available by Statistics Netherlands through the mediation of the Netherlands Organisation for Scientific Research - Scientific Statistical Agency; the Polish Household Budget Survey (HBS) made available by the Polish Central Statistical Office and prepared by the Economics Department of Warsaw University; the Income Distribution Survey made available by Statistics Sweden; and the Family Expenditure Survey (FES), made available by the UK Office for National Statistics (ONS) through the Data Archive. Material from the FES is Crown Copyright and is used by permission. Neither the ONS nor the Data Archive bears any responsibility for the analysis or interpretation of the data reported here. An equivalent disclaimer applies for all other data sources and their respective providers.

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1 Introduction

The level of redistribution via tax and transfer programs differs greatly across welfare regimes. It is not clear whether this is due to contrasted redistributive tastes or simply the fact that some countries face tighter efficiency constraints, i.e., redistribution is less easily achieved because of more elastic labor supply. This question paves the debate about the optimality of tax-benefit systems in industrialized countries and the comparisons that can be made of these systems. As yet, it has not received a comprehensive treatment given the difficulty to obtain comparable information about labor supply responsiveness across countries (see Evers et al., 2008, and our companion paper Bargain et al., 2011). For instance, recent attempts using optimal tax theory to compare the implicit cost of redistribution (Immervoll et al., 2007) or the tax-benefit treatment of couples (Immervoll et al., 2011) across many European countries have relied on "plausible" elasticities from the literature but had no information about the actual cross-country differences in labor supply behavior.

The present paper aims to fill this gap by bringing optimal tax theory to the data. Using harmonized household surveys for 17 EU countries and the US, we first estimate the labor supply elasticities consistent with the optimal income tax model of Saez (2002). We then invert this model to characterize the redistributive preferences embodied in actual tax-benefit systems. In this way, usual observations about tax-benefit systems are directly cast in terms of social welfare language, and we quantify the extent to which inequality aversion truly differs across countries once country-specific labor supply behavior is accounted for.

An important contribution of the paper is to provide elasticities which are coherent with the optimal tax model and accordingly estimated on the same micro data used for the optimal tax inversion. Since there is no natural experiment that can be used to capture behavioral parameters in a comparable way across countries, we opt for a structural model which is specified and estimated in the same fashion for all countries. Importantly, this model can account for the comprehensive effect of tax-benefit policies on household budgets, which makes estimated behavior consistent with the efficiency constraints of national social planners in the optimal tax characterization. Also, nonlinearities and discontinuities from tax-benefit rules improve the identification of the empirical model, together with demographic heterogeneity and some spatial and time variation in net wages. For this purpose, the present study benefits from a unique set of comparable data and from tax-benefit calculators made available for numerous European countries (EUROMOD) and the US (TAXSIM).

Our main results are as follows. The inversion procedure shows that tax-benefit-revealed social welfare functions for all countries display some taste for redistribution and do not systematically reject the assumption of Paretian governments. Yet the implicit social welfare function is not always concave in Continental and Nordic Europe precisely because of the choice of generous demogrant policies, which imply high effective taxation on the working poor. The assumption that behavioral responses were by and large ignored by governments at the time demogrant policies (means-tested social assistance programs) were implemented partly corrects these inconsistencies. Interestingly, further corrections can be seen in recent years, mainly due to the introduction of in-work support to the working poor. This possibly reflects a change in preferences (towards more desert-sensitive redistribution) and/or a reassessment of behavioral responses (elasticities that policy advisors have in mind may well have come closer to "true" elasticities, i.e., those recovered by econometric estimations in recent years). With these elasticities we find that international heterogeneity in work-consumption preferences plays some role – yet our results essentially show that differences in the degree of inequality aversion are significant only across broad groups of countries. Revealed inequality aversion is consistent with direct evidence on citizens' redistributive views when comparing the US and Continental and Nordic Europe.[1]

The paper is structured as follows. Section 2 briefly reviews the related literature. Section 3 presents the optimal tax model of Saez (2002) and the inversion procedure. Section 4 describes the empirical labor supply model. Section 5 presents the main elements of the empirical implementation (data, selection, estimated labor supply elasticities). Section 6 briefly describes the redistributive and incentive potentials of national tax-benefit systems and discusses the results of the revealed social preferences analysis. Section 7 concludes.

2 Related Literature

The normative literature of the 1970s, following the seminal contribution of Mirrlees (1971), had remained mostly theoretical due to the lack of reliable information on the 'true' distribution of individual abilities. More recently, the increasing availability of representative household datasets has allowed implementing Mirrlees' model to question the optimality of actual tax-benefit systems (e.g., in Diamond, 1998, Saez, 2001, 2002). In particular, some authors have focused on how generous welfare schemes (and confiscatory implicit taxation) at the bottom of the distribution could be grounded on the basis of optimal tax formulas in some European countries (see Diamond, 1998, Choné and Laroque, 2005). Overall, however, empirical applications remain scarce because little is known about the two fundamental primitives of the model – which are directly related to efficiency and equity concerns – namely labor supply behavior and social preferences, respectively. In most applications some "plausible" assumptions are made for both components. We briefly review the relevant literature for each of them.

2.1 Social Preferences

For social preferences, available studies typically choose reasonable levels of social inequality aversion to characterize optimal tax schedules. In the primal problem it is possible to verify which degree of inequality aversion makes the optimal schedule closest to the actual one. Hence, the representation of redistributive preferences for a country at a certain point in time can itself become the object of investigation. In fact, the inverse optimal problem allows directly

[1] In a similar spirit, the inversion approach is used by Gordon and Cullen (2011) to recover the degree of redistribution by the federal state in the US and migration elasticities across states that are implicit in the observed effective net tax schedules. Linking tax-implicit preferences with direct evidence on people's ethical view is suggested in our analysis and relates to other studies focused on redistributive preferences (e.g., Corneo and Fong, 2008), comparisons between tax preferences and actual tax schedules (Singhal, 2008) or more causal explanations on generosity differences across welfare states (Algan et al., 2011).

recovering the redistributive preferences implicit in actual policies. This dual approach was first suggested in the context of optimal commodity taxation (see Decoster and Schokkaert, 1989, for an application and additional references). It has been extended to the Mirrlees' income tax problem by Bourguignon and Spadaro (2010) who characterize the properties of the tax-revealed social welfare function and provide an illustration on French data. In particular, they check whether revealed social welfare functions pass minimum consistency checks (i.e., are compatible with the fiction of an optimizing Paretian planner). We apply this approach in a systematic way to characterize the equity-efficiency trade-off in many European countries and the US.[2] However, instead of relying on 'reasonable' labor supply elasticities taken from the literature, we estimate country-specific elasticities which are consistent with Saez' optimal tax model and based on the same micro data. A parallel and independent study by Blundell et al. (2009) follows the same approach but focuses on single mothers in Germany and the UK. Our analysis covers a much larger number of countries, providing a broader pictures of the potential contrasts in tax-revealed social preferences, notably between Continental Europe and the US. Furthermore, we provide additional results and alternative explanations of cross-country differences.

2.2 Labor Supply Elasticities

Optimal tax applications most often refer to plausible elasticities drawn from the labor supply literature. However, even if a relative consensus has been reached on certain aspects, notably that wage elasticities of labor supply are positive, usually smaller than 1 and larger for married women (Blundell and Macurdy, 1999), there is little agreement on their magnitude or how they differ across countries. Even within a country, the size of elasticities can vary greatly depending on the period of investigation or various methodological aspects (see Evers et al., 2008, Bargain et al., 2011). Our attempt in this paper is to capture the labor supply responses that are consistent with the same microdata used for optimal tax characterization and estimated in a comparable manner for all countries. In this way, our work completes Immervoll et al. (2007), who compare tax-benefit systems across countries using "reasonable" labor supply estimates and sensitivity analysis about plausible differences across countries. These authors suggest an interesting measure of the efficiency cost of marginal transfers from the rich to the poor in 15 EU countries. Under their assumptions of neutral redistributive preferences, and with uniform elasticities across countries, further redistribution to the workless poor would imply very large efficiency losses in some countries. If governments are ready to bear such costs, this must reflect highly Rawlsian redistributive views. We directly characterize these potential differences in (tax-benefit revealed) social preferences, while using estimated work-consumption preferences.

Extensive versus Intensive Margins. A well-known problem with the Mirrlees' model is that it accounts only for behavioral responses at the intensive margin. The crucial role of the extensive margin, i.e., changes in participation decisions, has been recognized in the optimal

[2] An ancestor of the present paper, Bargain and Spadaro (2008), and a follow-up available as Spadaro (2008), differ from what we do here in many respects. In particular, the present paper integrates optimal tax analysis with own labor supply estimations for each country and extends the analysis to a large set of countries – including the US, among others.

tax literature at least since Diamond (1980). Explicitly incorporating participation decisions is also important empirically, since this margin is probably the main channel of labor supply adjustments (Heckman, 1993). For this reason it is often suspected that responsiveness is larger among low income groups, which fundamentally affect welfare analyses. In particular, Eissa et al. (2008) show that normative conclusions of policy evaluations in the US completely change when recognizing that participation elasticities can be significantly larger in lower part of the distribution. As is made clear in Immervoll et al. (2007), this particularly affects the debate about whether redistribution should be directed to the workless poor (through traditional demogrant policies) or to the working poor (via in-work support). This point is also central to our analysis, as we illustrate how the policy choices made by past governments in Continental/Nordic Europe may reveal little desert-sensitive redistributive preferences together with extreme underestimations of participation elasticities. For a comprehensive characterization, we adopt the discrete version of the optimal tax model by Saez (2002), in which the population is partitioned into income groups. This simplification allows both intensive and extensive margins to be incorporated relatively easily. In our empirical analysis, labor supply behavior is estimated at the individual level and then used to calculate elasticities along both margins at the income group level. The present paper provides novel evidence about labor supply responsiveness along the income distribution (to our knowledge, there is only suggestive evidence based on extensions of the Earned Income Tax Credit (EITC) for single mothers, e.g., Eissa and Liebman, 1996, and few estimates from structural models as explained below).

Single Individuals. We restrict our analysis to a homogenous group of the population, just like Blundell et al. (2009) who focus on single mothers. However, we choose a different group for two reasons. First, from a practical point of view, sample sizes of single mothers would be too small to obtain robust results for most countries. Second and more important, policies aiming at single mothers may also be inspired by non-welfarist objectives such as minimizing child poverty. Saez (2002)'s (welfarist) optimal tax framework is not appropriate in this case. Therefore, we prefer to look at childless single individuals in order to extract the vertical equity concerns incorporated in tax-benefit regimes. Despite the large increase in the number of single individuals over the last few decades, the labor supply behavior of childless single men and women has received relatively little attention. Part of this is due to the fact that changes in tax and welfare policies, used in recent studies to measure labor supply responsiveness, have essentially concerned families with children.[3] To our knowledge, only a few studies report estimates for childless singles, often based on the estimation of structural models with tax-benefit simulations. For Italy, the Netherlands and Germany, Aaberge et al. (2002), Euwals and van Soest (1999) and Bargain et al. (2009) report wage elasticities for childless single individuals of around .08, $.03 - .18$ and $.1 - .2$ respectively. Bishop et al. (2009) study all single women over a long period (1979-2003) in the US, using a simple estimation of hours and participation on repeated cross-sections. Their study reports small elasticities and, more specifically, a significant decline

[3] This explains why the labor supply of single mothers has received a greater coverage. This literature has typically focused on the responses to changes in welfare programs in the US and the UK (see for instance Eissa and Liebman, 1996, using changes in the EITC, and the survey of Hotz and Scholz, 2003). Lone parents comprise only a small fraction of all single individuals, however, even if it is important for welfare considerations.

in wage elasticities for childless women (from .24 to .13). The limited evidence available thus points to weak labor supply responsiveness of childless singles, at least compared to married women and single mothers. Yet, these studies often ignore the heterogeneity that may exist among single people and, as stressed above, the crucial point that low-wage singles may show more responsiveness on the extensive margin. We are aware of only two studies which provide detailed estimates, using structural models with taxation. For the UK, Meghir and Phillips (2008) report a participation wage elasticity of .27 for unskilled single men and of zero for those with college education. For Italy, Aaberge et al. (2002) report participation elasticities as high as .5 for single men in the lower part of the income distribution and almost zero higher up.

3 Theoretical Background

3.1 The Optimal Tax Model

The model of Saez (2002) is based on the standard, Mirrlees optimal income tax framework. That is, a Paretian government is assumed to maximize a social welfare function subject to an efficiency constraint and a national budget constraint. This function aggregates individual utility levels, which themselves depend on disposable household income (equivalent to consumption in a static framework) and leisure. The form of the social welfare function characterizes the government's taste for redistribution, ranging from Rawlsian preferences, where the government cares only about the worst-off individual, to utilitarian preferences, where all individuals are weighted equally. Actual productivity is not observed, so that the government can only rely on second-best taxation based on income. The efficiency constraint, or incentive-compatibility constraint, states that agents modify their labor supply, and hence their taxable income, in response to the level of effective taxation.

Saez (2002) assumes that potential workers can be aggregated into $I+1$ discrete groups comprising I groups of individuals who work, ranked by increasing gross income levels Y_i ($i = 1,...I$), and a group $i=0$ of non-workers. For each level of market income Y_i, there is a corresponding level of disposable income $C_i = Y_i - T_i$, where T_i is the effective tax paid by group i (it is *effective* in the sense that it includes all taxes and social contributions, minus all transfers). Non-workers may receive a negative tax, i.e., a positive transfer $-T_0$, identical to C_0 by definition, and often referred to as a demogrant policy (minimum income, social assistance, etc.). Proportion h_i measures the share of group i in the population. With this discretized setting, Saez (2002) shows that optimal taxation has the following form:

$$\frac{T_i - T_{i-1}}{C_i - C_{i-1}} = \frac{1}{\zeta_i h_i} \sum_{j=i}^{I} h_j \left[1 - g_j - \eta_j \frac{T_j - T_0}{C_j - C_0}\right] \text{ for } i = 1, ..., I, \tag{1}$$

with η_i and ζ_i the elasticities at the extensive and intensive margins respectively, and g_i the set of marginal social welfare weights assigned by the government to groups $i = 0, ..., I$. Note that $\frac{T_i - T_{i-1}}{C_i - C_{i-1}}$ is nothing else than $\frac{T_i'}{1-T_i'}$ in the standard formulation of optimal tax rules, with $T_i' = \frac{T_i - T_{i-1}}{Y_i - Y_{i-1}}$ the effective "marginal" tax rate (EMTR) faced by group i. It is not exactly marginal in the usual sense, but is defined at the income group level. Formula (1) is very comparable to the usual Mirrlees' rule. In particular, the level of marginal taxation is inversely related to the size of the group and the intensive margin elasticity ζ_i. A noticeable difference, however, is the presence of the extensive margin elasticity η_i (see Diamond, 1980). Importantly for our analysis of actual tax-benefit system, if it tends to zero, the model is simply a discrete version of Mirrlees and negative marginal tax rates resulting from in-work support – such as the US EITC – are never optimal, since they discourage productive workers at the intensive margin. However, the larger the extensive elasticity, the more likely are optimal schedules featuring smaller guaranteed income for non-workers and larger in-work support (and possibly negative marginal taxes at low income levels, see Saez, 2002, Choné and Laroque, 2005).

Note also that the definitions of the elasticities at the intensive and extensive margins are rather specific in the present context. They are defined as:

$$\zeta_i = \frac{C_i - C_{i-1}}{h_i} \frac{\partial h_i}{\partial (C_i - C_{i-1})} \tag{2}$$

$$\eta_i = \frac{C_i - C_0}{h_i} \frac{\partial h_i}{\partial (C_i - C_0)}. \tag{3}$$

The former captures the percentage increase in group i when $C_i - C_{i-1}$ is increased by 1%, and is defined under the assumption that individuals are restricted to adjust their labor supply to the neighboring choice. The latter, the extensive or participation elasticity, is defined as the percentage of individuals in group i who stop working when the difference between the disposable income out of work and at earnings point i is reduced by 1%. These elasticities are notably different from the traditional wage-elasticity of hours (participation) which are defined as the increase in working time (participation rate) when wage rates increase by 1%.

In expression (1) social preferences are summarized by the set of weights g_i. These weights mingle the "primitive" social weight, i.e., the derivative of the implicit social welfare function integrated over all the workers within group i, and the individuals' marginal utility of income (theoretical models often rely on quasi-linear preferences, e.g., in Saez, 2001, so the latter is equal to 1). Hence, as argued by Saez (2002), these weights provide a more direct and transparent interpretation than the primitive weights and are preferably the object of our attention. Indeed, they represent the (per capita) *marginal social welfare of transferring one euro to an individual in group i*, expressed in terms of public funds. Given this definition, the Saez model does not require the specification of utility functions, since the marginal utility of income is incorporated in g_i. The only assumption made on preferences is that there is no income effect – a traditional restriction in this literature – which is supported by our empirical results as discussed below.[4] When income effects are ruled out, an additional constraint emerges from the Saez model which normalizes weights as follows:

$$\sum_i h_i g_i = 1. \tag{4}$$

[4] In the empirical part we choose a flexible utility function to estimate labor supply elasticities (see also robustness checks in Appendix B). Zero income effect is not imposed a priori in our estimation but checked a posteriori. We find small or insignificant effects, so that the assumption made here is acceptable as a first approximation.

3.2 Retrieving the Marginal Social Welfare Weights

The inverse optimal tax problem is relatively straightforward (see also Bourguignon and Spadaro, 2010). Rather than retrieving the optimal tax schedule under certain assumptions about elasticities and social preferences, we invert formula (1) to infer weights g_i from the knowledge of income levels Y_i (from the data), tax levels T_i (or disposable incomes $C_i = Y_i - T_i$, obtained by microsimulation) and elasticities (obtained by econometric estimations on the same data). More precisely, expression (1) directly gives the weight on the last group:

$$g_I = 1 - \eta_I \frac{T_I - T_0}{C_I - C_0} - \zeta_I \frac{T_I - T_{I-1}}{Y_I - Y_{I-1}}. \tag{5}$$

From equation (5) weights g_{I-1} to g_1 for groups $i = 1, ..., I-1$ can be derived recursively using:

$$g_i = 1 - \eta_i \frac{T_i - T_0}{C_i - C_0} - \zeta_i \frac{T_i - T_{i-1}}{Y_i - Y_{i-1}} + \frac{1}{h_i} \sum_{j=i+1}^{I} h_j \left[1 - g_j - \eta_j \frac{T_j - T_0}{C_j - C_0} \right] \tag{6}$$

The weight g_0 for the group of non-workers is obtained using normalization (4). Weights g_i correspond in part to the marginal social welfare function in the continuous model à la Mirrlees. Therefore, a necessary condition for the implicit social welfare function to be Paretian, i.e. non-decreasing at all productivity levels, is that weights are positive. We shall check this property in our empirical results. Note that both the behavioral elasticities η_i and ζ_i and the group sizes h_i are endogenous to the tax-benefit system. This means that the proportions h_i observed in the data and the elasticities estimated on the same data cannot be used to derive the optimal tax-benefit schedule in Saez' primal problem. Yet they can be used in the dual approach retained here as the actual schedule is assumed to verify the optimality rule (1).[5]

4 Labor Supply Estimation

4.1 Methodological Issues

A contribution of the present paper is to estimate, for a large number of countries, the behavioral elasticities η_i and ζ_i which are consistent with the data, i.e., the distribution of gross and net incomes Y_i and C_i used to recover tax-benefit-revealed social preferences. Ideally, we would like to use a generally agreed-upon standard estimation approach that also allows comparable elasticity measures across countries. There is no consensus on this matter, however. Estimates of continuous labor supply models, i.e., the Hausman approach, are often contaminated by

[5] Think of a no-tax initial scenario: the social planner sets tax rates optimally according to (1) and to the values of parameters η_i, ζ_i, h_i that prevail in the no-tax situation. Agents would then respond to this policy, so that elasticities and group sizes (in particular the number of non-workers) would change. This in turn invalidates equation (1), i.e., tax levels are no longer optimal, and the optimal tax rule must be applied again, generating further responses, etc. Clearly, it must be assumed that at least one fixed point exists in which the left and right-hand sides of equation (1) are consistent. When using population shares and elasticities estimated on actual data, the actual tax-benefit system as deemed optimal is precisely such a fixed point. Note that using the primal problem to derive optimal tax schedules from labor supply estimations would require a model in which tax formulas are based directly on utility functions rather than (endogenous) summary elasticity measures. Interesting attempts are suggested by Blundell and Shephard (2008) and Aaberge and Columbino (2008).

measurement errors and by assuming wage exogeneity. That is, unobserved characteristics (e.g., being hard-working) influence both wages and work preferences so that estimates obtained from cross-sectional wage variation across individuals are potentially biased. Recent practice has focused on natural experiments, and notably changes in tax-benefit regulations, which can be used to assess labor supply responsiveness in a more robust way as reforms provide exogenous variations in net wages. Obviously, no such reform can be found to estimate labor supply elasticities in a comparable way across many different countries. Hence, we opt for a flexible discrete-choice model, as used in well-known labor supply studies for Europe (van Soest, 1995, Blundell et al., 2000) or the US (Hoynes, 1996, Eissa and Hoynes, 2004). With this approach, it is easy to account for the complete effect of of tax-benefit policies on household budgets, and identification is partly obtained by nonlinearities and discontinuities caused by these policies, as discussed below. This method also requires the explicit parameterization of consumption-leisure preferences as it assumes that labor supply decisions can be reduced to choosing among a discrete set of possibilities (e.g., inactivity, part-time and full-time). Thus, there is no need to restrict preferences and, in particular, to impose their convexity. We nonetheless check the effect of choosing different specifications for the utility function. Discrete models also account directly for both participation and working-time decisions (non-participation is just one of the discrete options), which is important, as motivated in the previous section. The main potential drawback is the fact that in this approach the number of hour choices is typically limited to commonly agreed durations of work in order to maintain computational feasibility. We shall check whether moving closer to the continuous case affects the estimated elasticities (see also Heim, 2009).

4.2 The Empirical Model

Specification. We essentially follow van Soest (1995), Hoynes (1996) and Blundell et al. (2000) and refer to these studies for more technical details. We specify consumption-leisure preferences using a quadratic utility function, i.e., the utility of household k choosing the discrete choice $j = 1, ..., J$ can be written as:

$$U_{kj} = V_{kj}(c_{kj}, h_{kj}) + \epsilon_{kj} \tag{7}$$

$$\text{with } V_{kj}(c_{kj}, h_{kj}) = \alpha_{ck}c_{kj} + \alpha_{cc}c_{kj}^2 + \alpha_{hk}h_{kj} + \alpha_{hh}h_{kj}^2 + \alpha_{ch}c_{kj}h_{kj} - f_{kj}, \tag{8}$$

with household consumption c_{kj} and worked hours h_{kj}. In the deterministic utility V_{kj}, coefficients on consumption and worked hours – α_{ck} and α_{hk} – are household-specific as they vary linearly with several taste-shifters (gender, polynomial form of age, region) and incorporate random components (so the model allows for unobserved heterogeneity and unrestricted substitution patterns between alternatives). The fit is improved by the introduction of fixed costs of work f_{kj}, as in Blundell et al. (2000), equal to zero if $j = 1$ (inactivity) and non-zero for $j > 1$. They essentially capture the fact that there are very few observations with a small positive number of working hours. These costs also depend on observed characteristics, including region and education level, which may proxy possible differences in job search costs, as suggested by van Soest and Das (2000). Note that fixed costs are only parametrically identified, i.e., a very flexible utility function could pick up the gap in the distribution at few hours (see van Soest et al., 2001). This militates in favor of relaxing usual regularity conditions on leisure/labor supply (see Heim and Meyer, 2003). More generally, as we specify utility directly and not a labor supply function, tangency conditions are not required, and hence we simply check quasi-concavity of the utility function *a posteriori*. The only restriction to our model is the imposition of increasing monotonicity in consumption, which seems a minimum requirement for meaningful interpretation and policy analysis. For each hour choice j, disposable income is calculated as a function $c_{kj} = d(w_k h_{kj}, m_k)$ of labor income $w_k h_{kj}$ and non-labor income m_k. The tax-benefit function d is simulated using calculators, which we present in the next section. Wages w_k are predicted using calculated wage rates from data information on workers and Heckman-corrected wage estimations. The deterministic utility is completed by i.i.d. error terms ϵ_{ij} for each choice assumed to represent possible observational errors, optimization errors or transitory situations. Under the assumption that error terms follow an extreme value type I (EV-I) distribution, the (conditional) probability for each household of choosing a given alternative has an explicit analytical solution (a logistic function of deterministic utilities at all choices). The unconditional probability is obtained by integrating out the disturbance terms (unobserved heterogeneity and the wage error term) in the likelihood. In practice, the model is estimated by maximizing the simulated likelihood function, which is done by averaging the conditional probability over quasi random draws ($r = 100$) generated by Halton sequences, as suggested by Train (2003).[6]

Identification. First of all, we predict wages for all observations, as explained above, in order to reduce some of the bias due to measurement errors on wages stemming from the division bias. In addition, accounting fully for tax-benefit policies helps to create some variation in net wage between people with the same gross wage. That is, individuals face different effective tax schedules, i.e., different actual marginal tax rates or benefit withdrawal rates, because of their different circumstances (disability status, age, family compositions, home-ownership status) or different levels of non-labor income. Using nonlinearities and discontinuities generated by the tax-benefit system in this way is a frequent identification strategy in the empirical literature based on static discrete models and cross-sectional data (see van Soest, 1995, Blundell et al. 2000). Furthermore, we benefit here from some time and spatial variation that can produce additional exogenous variations in net wages. For seven countries, we dispose of two years of data. The three-year interval between the two corresponding tax-benefit systems, 1998 and 2001, gives us some guarantee that enough exogenous changes in tax-benefit policies occurred over time. For most countries, we also have regional variation in tax-benefit rules and, hence, in net wages. This source of identification has been extensively used in the US (variations across states in the income tax code, in benefits rules and the EITC are used in labor supply studies, e.g., Hoynes, 1996, Meyer and Rosenbaum, 2001, and Eissa and Hoynes, 2004). For EU member states, housing benefits vary in almost all countries at the municipality or county level, taking

[6] We also insist on the fact that the two-stage approach used here is common practice (see Creedy and Kalb, 2005). Simultaneous estimations of wages and labor supply seem the ideal approach, yet this approach is rarely adopted (among exceptions, see Laroque and Salanié, 2001). The reason is that tax-benefit simulations must be run at each iteration of the ML estimation, which requires that they are available in the same computer language (this is not the case with the tax simulator EUROMOD) and which also takes more time (which would not be feasible given the large number of countries we are dealing with).

into account local differences in housing costs (exceptions are Belgium, Italy, Portugal and Spain). In Estonia, Hungary and Poland, local governments provide different supplements to almost all benefits, including child benefit/allowance and social assistance. Regional variation in the latter also exists in Denmark, Germany, Italy and Spain. In addition, taxation often varies locally.[7] The tax-benefit simulators at use and demographic information in our datasets allow us to account for all these differences across households in our sample. We believe that the present approach constitutes a reasonable trade-off between comparability attempt and a reasonable identification strategy on cross-sectional data (see also Bargain et al., 2011).

Elasticities. In the present nonlinear model, labor supply elasticities cannot be derived analytically but are calculated by numerical simulations using the estimated model. For standard wage (income) elasticities at the individual level, we simply predict changes in labor supply following a marginal uniform increase in wage rates (non-labor income). We have checked that results are similar when wage elasticities are calculated by simulating either a 1% or a 10% increase in gross wages (unearned incomes). We follow a calibration method which is consistent with the probabilistic nature of the model at the individual level. For each household, we repeatedly draw a set of $J+1$ random terms from an EV-I distribution (together with unobserved heterogeneity terms of the model), which generate a perfect match between predicted and observed choices. The same draws are kept when predicting labor supply responses to an increase in wages or non-labor income. Averaging individual responses over a large number of draws provides robust transition matrices. The particular elasticities used in the optimal tax model, η_i and ζ_i, make it necessary to translate the individual responses among hour categories to changes among income groups. To do so, we aggregate individual responses at the income group level for non-marginal changes in disposable income, according to definitions in expressions (2) and (3). A similar procedure is used in Blundell et al. (2009). Standard errors are obtained by repeated random draws of the preference parameters from their estimated distributions and by applying the calibration procedure for each draw.

Limitations. Our estimations follow the bulk of the literature in that we ignore response margins other than labor supply. As usually done in the literature, we assume full benefit take-up. More refined estimations accounting for the stigma of welfare program participation would require precise data information on actual receipt of benefits, which is not always available or reliable in interview-based surveys (see Blundell et al., 2000). We also assume full tax compliance and ignore migration in the behavioral model. This is certainly acceptable as a first approximation, especially as we focused on workers (and excluded capitalists), so that taxable

[7] County and municipality flat taxes in Nordic countries can vary substantially (ex: $22.8-27.8\%$ in Denmark; $16.5-21\%$ in Finland; $29-36\%$ in Sweden). Regional variations in church tax rates are significant in Finland and Germany. Note that the mere choice of paying church tax is also a relatively exogenous variation across individuals in all countries which have it. Social insurance contributions can vary by region (e.g., in Germany). Other regional variation exists and concerns tax rates (the Netherlands, Portugal and Spain via imputed rents), tax credits (Belgium), tax deductions (Italy) and council taxes (the UK). Note that for the EU, information on tax-benefit rules for each country is available at: www.iser.essex.ac.uk/research/euromod (together with modeling choices and validation of EUROMOD). For the US, tax-benefit rules (and TAXSIM) are presented in detail at www.nber.org/~taxsim/.

income essentially coincides with labor income. While it is suspected that top earners react along different margins, such as investment in human capital, migration or tax evasion, Saez (2004) shows that this is concentrated at the very top (1%) of the distribution. Also, the optimal tax framework is usually not equipped to deal with these dynamic issues (an exception is Simula and Trannoy, 2006, on tax emigration) and hardly any empirical evidence exists on the extent of these effects. We have also assumed that fertility and marital status are fixed. Even if it is likely that social systems influences behavior in this respect (see, e.g., Hoynes, 1996), those kind of adjustments are difficult to incorporate in an optimal tax framework and evidence on the precise reactions is again rare and mixed.

5 Empirical Implementation

5.1 Data and Tax-Benefit Simulations

We aim to replicate the analysis for a large panel of countries that reflect a variety of welfare regimes and possibly contrasting labor supply elasticities. We use datasets, for the US, 14 EU states prior to May 1st, 2004 (the so-called EU-15 except Luxembourg) and three new member states (NMS) – Estonia, Hungary and Poland. The different datasets used respect the basic requirements for our exercise, i.e., they provide a representative sample of the population (and in particular of income distributions), with comparable variable definitions across countries and all the necessary information on income and socio-demographics to estimate labor supply behavior.

The fundamental information required by the optimal tax model is the effective tax $T_i = Y_i - C_i$, which is the aggregation of all direct taxes and transfers in a given income group. To avoid errors on the reporting of taxes paid or transfers received as often encountered in household microdata, we simulate as precisely as possible the amount of benefits each household is entitled to and the taxes and social contributions it should pay, and hence its actual level of disposable income, then aggregate disposable income to obtain C_i for each income group $i = 0, ..., I$. Tax-benefit simulations are also necessary for the labor supply estimations. Indeed, for each household k in each country, we calculate the level of disposable income c_{kj} at each choice j in order to proceed with the estimation of the discrete model as explained above. Tax-benefit simulations are performed as follows. For Europe we use EUROMOD, a tax-benefit calculator designed to simulate the redistributive systems of the EU-15 as well as several NMS. This is a unique tool to obtain a complete picture of the redistribution and the incentives to work generated by European welfare regimes. An introduction to EUROMOD, a descriptive analysis of taxes and transfers in the EU member states and robustness checks are provided by Sutherland (2007) and Immervoll (2004). EUROMOD has been used in several empirical studies, notably in the comparison of European welfare regimes by Immervoll et al. (2007, 2011). For the US, tax-benefit calculations are conducted using TAXSIM (version v9), the NBER calculator presented in Feenberg and Coutts (1993) and augmented by simulations of social transfers. It has been used in combination with Current Population Survey (CPS) data in several applications (e.g, Eissa et al., 2008, or Eissa and Hoynes, 2011).

The datasets at use are presented in Tables A.1 and A.2 (third row). These household surveys have been assembled within the framework of the EUROMOD project for the EU-15, and combined with tax-benefit simulations for years 1998, 2001 or both. For the NMS, data were collected for the year 2005, and policies simulated for that year, in a more recent development of the EUROMOD project.[8] For the US, we use the 2006 IPUMS version (Integrated Public Use Microdata Series) of the CPS, which contains information for the year 2005.

The data selection is as follows. We extract samples of potential salary workers aged 18 to 64, excluding pensioners, student, farmers and the self-employed. To keep up with the logic of the optimal tax model, we exclude all households where capital income represents more than 25% of the total gross income. Most importantly, we focus on *childless single men and women.* This restricts the scope of the analysis, but we show in the results section that redistribution analyses conducted on single individuals reflect a large share of the differences in redistributive potentials across selected countries. This selection was necessary, and a reasonable choice to make, for at least two reasons. Firstly, aggregating different demographic groups within a social welfare function poses fundamental difficulties in terms of interpersonal comparisons (see attempts in Aaberge and Colombino. 2008).[9] Focusing on one homogenous demographic group at a time – here childless singles – implicitly assumes some separability in the social planner's program, with a first stage redistribution between demographic groups and a second stage with vertical redistribution within homogenous groups (see Bourguignon and Spadaro, 2010). Secondly, it is not at all clear which labor supply elasticities should be used if couples were to be included in the analysis. Immervoll et al. (2007) allocate different elasticities to different demographic groups but ignore the issue of joint labor supply decision in couples. As in Blundell et al. (2009), we prefer to focus on one-adult households.

5.2 Income Groups and Income Concepts

We partition the population of each country into a small number of groups, $I+1=6$, in order to ease cross-country comparisons. In our baseline, group 0 is composed of inactive individuals who report neither labor income nor replacement income (such as unemployment benefit). Indeed, contributory benefits can be seen as pure insurance in most countries, where payments are closely linked to workers' past earnings through social security contributions (SSC). For that reason, we interpret unemployment benefits (UB) as delayed salaries and treat them *stricto sensus* as replacement incomes, i.e., those who receive this insurance are treated as workers in our baseline.[10] In our view it would not make much sense to mix in group 0 high-skilled

[8] Note that we make use of those policy years available in EUROMOD at the time of writing (1998, 2001 or 2005, as indicated above). For comparison, we use TAXSIM simulations for the year 2005. Hopefully, future developments of the EUROMOD project will allow extending our results to more recent data (and more countries).

[9] Even if (well-behaved) money metric utility measures could be derived to express household welfare in a meaningful common unit – which is far from obvious in the current state of the art – the proper equivalence scale to use is unknown. Indeed, this would be the one used by the social planner herself and not any arbitrary scale that would impose some re-ranking and bias measures of vertical equity (see Lambert and Ramos, 1997). Muellbauer and van de Ven (2004) retrieve implicit equivalence scales embodied in actual tax-benefit systems. Along this line, one could consider inverting the optimal tax model on a heterogeneous population in order to retrieve both implicit equivalence scales and social welfare weights. This sounds challenging but is not impossible.

[10] This is also consistent with the pure supply-side logic of the optimal tax model, in which involuntary unemployment is ignored and job seekers who claim benefits are treated as (potential) workers. For explicit introduction

workers who receive high levels of UB (when replacement rates are very high, as in Nordic countries) together with low-skilled workers who live on welfare (social assistance). We make some exceptions to this treatment, however, in the case of, Ireland, Poland and the UK. For these countries, UB are paid according to flat rates and have no strong link to past contributions, hence are treated as redistribution.[11] Next, groups $i = 1, ..., I$ are simply calculated as income quintiles among workers. In Appendix B we show that results are not too sensitive to alternative choices regarding the treatment of UB recipients and the definitions of income groups.

The descriptive statistics of our selected sample are reported in Tables A.1 and A.2 in the Appendix. Since the selected population is relatively homogenous by definition, we do not report usual demographic characteristics and essentially focus on the characteristics of the discretized income groups – the main ingredients of the model – including group shares h_i, average levels of gross income Y_i and disposable income C_i for each group $i = 0, ...I$, and effective "marginal" tax rates T'_i as defined above. The redistributive and incentive characteristics of each national system as captured in these tables are commented extensively in the section on results.

5.3 Labor Supply Elasticities

In our baseline labor supply model, we make use of a discretization with $J = 7$ choices, from 0 to 60 hours/week with a step of 10 hours. This allows us to capture as much as possible the country-specific variations in work hours. Nonetheless, we check alternative choice sets in the robustness analysis (Appendix B). We first comment on estimations and the model fit, then turn to the estimated elasticities.

Estimates and Fit. Estimates are broadly in line with usual findings, in that taste shifters related to age most often display a parabolic pattern and are often, but not systematically, significant.[12] Costs of work are most often significantly positive. Higher education leads to lower costs, which can be interpreted as lower job search costs for educated workers (see van Soest and Das, 2001). Pseudo-R2 reported in Table A.3 (Appendix A) range from .15 in Sweden to .36 in several countries. Yet they cannot be interpreted as standard R2 and a more meaningful assessment consists of the comparison between observed and predicted choices. In Table A.3, we see that the model fits the data reasonably well, in the sense that predicted participation rates and predicted mean hours according to the model are very similar to the ones observed in the samples (the discrepancy is less than 5% in almost all cases). In addition, we represent the complete hour distributions for the three cases with the largest discrepancies (Belgium 1998, Ireland 1998 and Portugal 2001). Generally, differences in mean hours are due to discrepancies between observed and predicted participation rates, as is the case for Ireland (Portugal) where non-participation is overestimated (underestimated). In Belgium the discrepancies are due to the model not being able to reproduce the hours distribution completely. In general, the model

of involuntary unemployment and search decisions in an optimal tax model, see Boone and Bovenberg (2004).

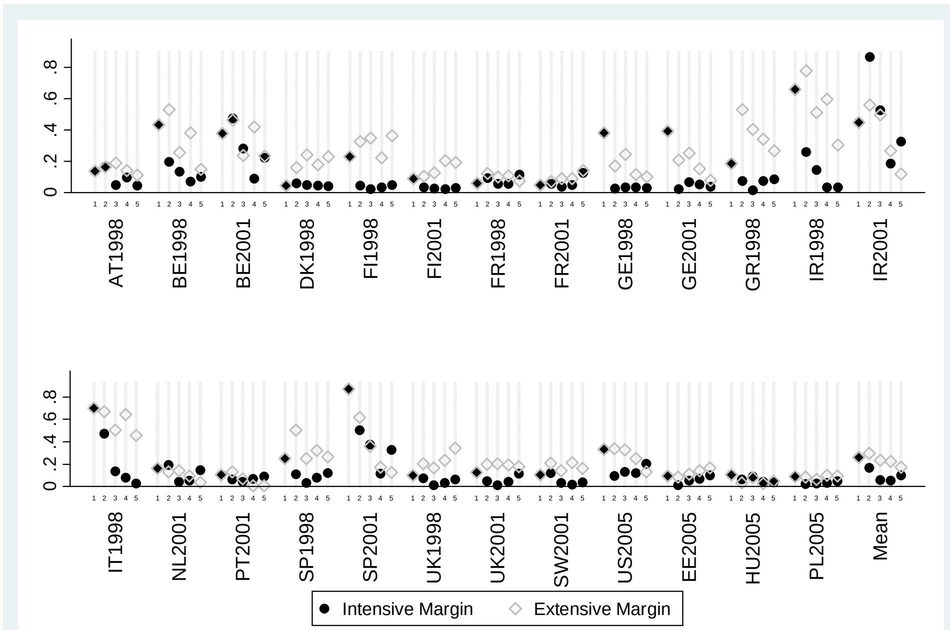
[11] In fact, the treatment of unemployment insurance has little effect for these countries since, for singles, payments of UB are very similar to levels of income support. Non-contributory social transfers and contributory UB are described in Tables A.6, A.7 and A.8 in the Appendix and commented in the next section.

[12] For lack of space, we do not report detailed tables of estimated preference parameters for the 18 countries under study. They are available from the authors on request (see also Bargain et al., 2011).

does not predict the bunching of hours at 40 hours per week very well, which is a common problem with fitting this type of model to data on weekly hours worked (see Euwals and van Soest, 1999, for example). We can see that the 30 hours/week option and, to a lesser extent, the overtime option (50 hours/week) are slightly overpredicted, even in cases where the fit is very good (we provide an illustration for France 2001). Since most of the response to financial incentives occurs at the extensive margin, a satisfying fit in terms of participation rates is the most important aspect for our analysis.

Traditional Elasticities. We first produce standard income and wage elasticities – defined as change in hours or participation for marginal changes in unearned incomes or wage rates. We aim at checking and comparing the results with the existing literature, noticing however that evidence for single men and women is relatively limited, as recalled above (see Bargain et al., 2011, for a complete comparison). Mean elasticities are reported in the upper panels of Tables A.4 and A.5 (Appendix A). *Wage elasticities* of hours and participation are in line with recent evidence based on discrete choice models. Elasticities are particularly small in France (see Evers et al., 2008), the Netherlands (see Euwals and van Soest, 1999) as well as in Austria, Denmark, Hungary, Poland and Portugal (countries for which we are not aware of any available results for single individuals, except Bargain et al., 2011). They are especially large in Ireland (as supported by Callan et al., 2009), Italy (see Aaberge et al., 2002) and Spain. Other countries show intermediary values, which correspond to small elasticities around .1 – .2, for instance in Germany (see also Haan and Steiner, 2006). Hour elasticities, which incorporate both change in hours for those in work and participation effects, are close to participation elasticites, which conveys that most of the total hour adjustment occurs at the extensive margin (a usual result in the literature on couples' labor supply). *Income elasticities* are found to be very small in all countries, often not significantly different from zero (Denmark, Italy) and systematically smaller than .1 in absolute value. Only a few countries show significant elasticities between .02 and .06 (Hungary, Ireland, Sweden). The elasticities for the remaining countries are smaller than .01. Ignoring income effects in the theoretical model and for the selected population is therefore a reasonable approximation.

Saez Elasticities. Saez elasticities at the extensive and intensive margins, η_i and ζ_i, are reported in the lower panels of Tables A.4 and A.5 (Appendix A) for the income groups of workers $i = 1, ..., I$, together with bootstrapped standard errors. For a more convenient comparison across countries, point estimates are also shown in Figure 1 below. Given the specific definition of these elasticities, we do not expect their magnitude to match exactly the standard wage elasticities of hours and participation as discussed above. Yet the marked differences observed across countries mirror previous results, in particular the larger elasticities at the *extensive margin* in Ireland, Italy and Spain, in contrast to particularly small response in France, the Netherlands, Portugal and the NMS. Importantly, as discussed above, most of the extensive margin response is due to groups 1 and 2, the low income groups. Extensive responses then tend to decrease with income levels. As in Blundell et al. (2009), we find that elasticities at the *intensive margin* are much smaller than participation elasticities, except for group 1, for which intensive and extensive elasticities are by definition identical (see equations 2 and 3). Together with slightly larger elasticities for the last group, possibly due to backward-bending labor supply, this yields a U-shaped average pattern over the different quintiles. In Figure 2 we first provide a visual comparison of extensive margin elasticities across countries, with mean elasticities over income groups $i \geq 1$ and confidence intervals based on bootstrapped standard errors. Estimates appear to be relatively precise in general, yet 95% confidence bounds can be as broad as $.4 - .8$ for Italy or $.2 - .5$ for Ireland. As we shall see, this may affect the international comparability of tax-benefit revealed social inequality aversion. The bottom graph simply compares Saez' participation elasticities with traditionally defined elasticities. Even if the former are slightly larger, we confirm there that both types of elasticity capture the international differences in labor income responsiveness.



Notes: This Figure represents estimated Saez' extensive and intensive margin elasticities for the five groups of workers (for group 1, extensive and intensive margins are equal by definition).

Figure 1: Saez' Elasticities at the Extensive/Intensive Margins (Point Estimates)

The Role of Tax-Benefit Policies on Elasticity Comparisons. Finally, we investigate whether cross-country differences are genuine or are in fact due to existing tax-benefit systems themselves (recall that elasticities are endogenous to tax-benefit policies). For simplicity, we proceed with traditional wage elasticities of participation (detailed results for these checks are available from the authors upon request). Since different tax-benefit policies may affect the gross wage increment differently, we numerically simulate effective marginal tax rates (EMTR) and calculate elasticities when incrementing *net* wages by 1%. In this way, we cancel out differences in EMTR across countries due to different tax schedules or benefit withdrawal rates. We find that cross-country variation is barely affected when accounting for differences in implicit taxation of labor income (as expected, elasticities after a 1% increase in net wage are slightly larger than our base elasticities). Since tax-benefit systems can also affect hours and

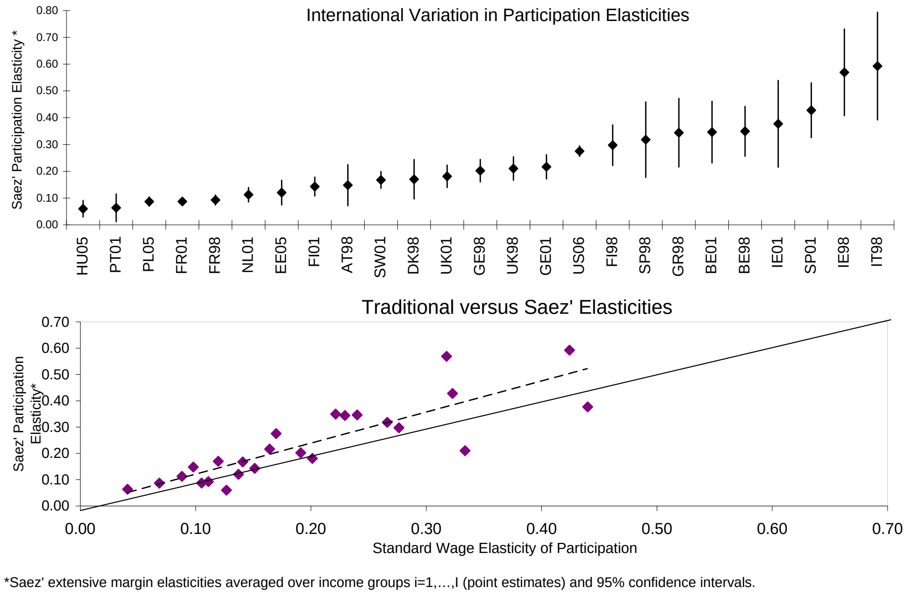


Figure 2: Extensive Margin Elasticities: Comparisons

participation and, in this way, the size of elasticities, we have also simulated a scenario where existing tax-benefit systems are withdrawn completely (or, alternatively, replaced by a uniform flat tax system, which yields similar conclusions). As expected, given this radical reform, labor supply increases while elasticities mechanically decrease in almost all countries. Importantly, countries with larger responses in the baseline also tend to have larger responses in the no-tax-benefit counterfactual situation. These results thus suggest that individual work-consumption preferences are sufficiently heterogeneous between countries to explain significant differences in efficiency constraints (see again Bargain et al, 2011 for additional results).

6 Main Results

6.1 National Tax-Benefit Systems: An Overview

Before presenting the main results, we suggest a brief overview of the redistributive policies in the countries under study. Tables A.6, A.7 and A.8 in Appendix A summarize the rules governing taxes, contributions and transfers for working-age single individuals in the EU and the US. Our aim is to show the diversity of situations that may, to some extent, reveal important differences in political and normative views across countries. For that purpose we present a suggestive characterization of the redistributive and incentive potentials of the different tax-benefit systems. Both dimensions will be integrated in the optimal tax approach that follows.

Redistributive Effects. We consider the three main groups of policy instruments – benefits, SSC and taxes – and how they affect Gini coefficients for each country. We could use decomposition of inequality indices by income sources, but prefer a more visual check in Figure A.1 (Appendix A) by calculating the Gini for different income concepts, starting from gross incomes then including gradually each of the policy instruments (incomes are equivalized by the modified OECD scale).[13] The percentage reduction in Gini coefficients is mostly due to transfers.[14] In Continental and Nordic Europe, benefits alone bring the Gini coefficient below the .35 mark. For these countries, redistribution to the poor through means-tested social assistance is substantial. In contrast, it is absent in Southern Europe and the US (with the exception of some disability benefits), at least when our selection of childless singles is considered. In some countries in the middle of the ranking, such as Ireland and the UK, benefits (and non-contributory income support in particular) also help to reduce considerably the initially high levels of market income inequality. SSC levied on earnings (and sometimes on benefits) are generally designed as flat-rate schemes and, hence, are relatively neutral in terms of redistribution. The effect of income taxation is more important. Taxes naturally have a larger redistributive impact than transfers in countries where the latter are small (e.g., Hungary or the US). They sometimes have a significant role even when benefits are generous (e.g., in Denmark). The degree of vertical redistribution due to progressive income tax schedules depends on a complex mix of tax level, tax progressivity and scope (tax base), as studied in Wagstaff et al. (1999). Low income usually earners do not pay taxes thanks to tax allowances or tax-free brackets. International rankings on the levels of public spending (and in particular spending on redistribution) mirror tax levels, with lower taxation in Southern and Eastern Europe and the US at one end and high tax redistribution in Nordic countries at the other.

Figure A.2 first plots the Gini-reduction effect of tax-benefit policies as previously defined, i.e., which include UB as part of the redistribution function, against the same effect when UB are treated as market income. We see that the international ranking is broadly preserved ($corr = .91$). That is, countries with high levels of redistribution through the tax-benefit system alone also provide high replacement rates to the unemployed (the latter may make the system even more redistributive than when mere tax-benefit policies are accounted for, for instance in Denmark). As argued before, we shall treat UB as pure insurance in our main results in order to be consistent with the logic of the optimal tax model. Figure A.2 also compares redistributive effects in our selection of working-age childless singles with effects for the whole population. As expected, more redistribution occurs in the latter because many transfers are available only for families with children (or are more generous for these families), notably social assistance (e.g., TANF in the US) and in-work support (e.g., in-work transfers, such as the US EITC or the UK WFTC). Interestingly, however, the figure shows a high correlation (.90), i.e., countries which do not redistribute much among childless single individuals do not redistribute much in general. Thus, the views of each social planner in terms of vertical equity is well reflected by the selected group of single individuals, which is reassuring for the analysis that follows.

Incentive Effects. Incentive effects of tax-benefit systems are summarized by EMTRs as reported in Tables A.1 and A.2 (Appendix A) and compared graphically in Figure 3 below. To

[13] In Figure A.1, we report results only for childless single individuals. Additional results for the whole sample show that Gini of disposable income are in line with common wisdom (notably Gottschalk and Smeeding, 1997).

[14] This result holds whatever the order in which policy instruments are added to (or withdrawn from) gross income. The order retained here is justified by the fact that benefits are taxable in some countries (so that certain combinations, such as gross income minus SSC and taxes, would lead to negative incomes).

be consistent with the optimal tax model, EMTRs are calculated at the income group level, i.e., $\frac{T_i - T_{i-1}}{Y_i - Y_{i-1}}$, as previously defined. This is slightly different from other studies which sometimes define EMTRs at the individual level (e.g., Immervoll et al., 2007). Our characterization is nonetheless very much in line with previous international comparisons (see Immervoll, 2004). In Figure 3 the upper quadrants show that in Continental (left) and Nordic (right) European countries, EMTRs are larger in upper income groups, due to progressive taxation. In addition, they are particularly large for group 1 (and sometimes group 2). Such high implicit taxation on poor workers is due to high withdrawal rates of means-tested social assistance programs together with the absence of transfers to the working poor (they are excluded from any form of redistribution for the years under consideration, with a few exceptions). Combining the two factors explains a U-shaped pattern of EMTRs extensively discussed in the literature (e.g., Immervoll, 2004).[15] The lower panels show EMTRs in Eastern European countries and Anglo-Saxon countries (left) and Southern Europe (right). In contrast to Continental/Nordic Europe, the overall level of net taxation is lower, and the distribution of EMTR flatter, with a few exceptions. This characterizes the absence of social assistance schemes in most of these countries. In the US, and to some lesser extent in the UK and Ireland, redistribution is usually targeted to those in-work and with children (hence it is not apparent in our results). Yet social assistance (Income Support) in the UK is not marginal and also creates high implicit taxation among low-wage workers, which is not compensated by tax credits in the case of childless singles for the years under consideration. There are other exceptions on the income tax side, notably fairly higher tax levels can be observed in some Eastern countries (Poland, Hungary) as well as in Ireland and Italy. Tax progressivity is also more pronounced in the income tax schedule of several Southern countries (Greece, Portugal, Italy).

6.2 Tax-Benefit Revealed Redistributive Preferences

We now move to our core results. The main set of results is shown in Figure 4 where we present, for each country, the marginal social welfare weights g_i for the six income groups $i = 0, ..., 5$, as derived from the inverse optimal tax approach and calculated on the basis of estimated labor supply elasticities. Recall that each of these weights represents the dollar equivalent value for governments of distributing an extra dollar uniformly to individuals working in group i. Notice that while the patterns of welfare weights can be compared across countries, the exact magnitude for each income group cannot be directly compared because the normalization (4) is country-specific. Blundell et al. (2009) suggest expressing all weights relatively to the weight of group 0. Given the large number of countries, our choice is to summarize the shape of redistributive preferences in a single-valued index. To do so, we use the parameterization suggested by Saez (2002) to relate weights and net incomes, i.e.:

$$g_i = 1/(p \cdot C_i)^{\gamma} \quad \text{for all } i = 0, ..., I. \tag{9}$$

[15] Tables A.1 and A.2 also report effective participation tax rates (EPTR), defined as $\frac{T_i - T_0}{Y_i - Y_0}$ for $i = 1, ..., I$. They add to the picture that implicit taxation when leaving assistance and taking up a job on the labor market is very high in these countries.

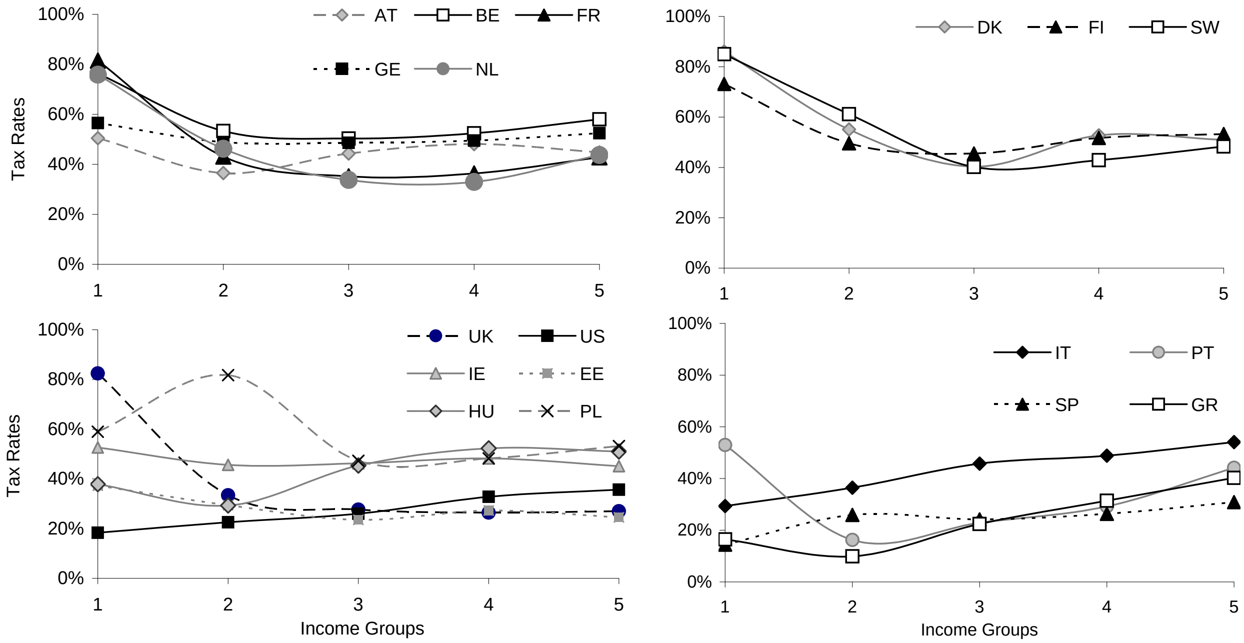


Figure 3: Effective Marginal Tax Rates

In this expression, p denotes the marginal value of public funds and γ is a scalar parameter reflecting the social aversion to inequality. The higher γ the more pro-redistribution social preferences are, from $\gamma = 0$ (utilitarian preferences) to $\gamma = +\infty$ (the Rawlsian criterion). In practice, Saez (2002) states that γ values around .25 (1) imply a reasonably low (high) taste for redistribution, while a value of 4 is high enough to proxy the Rawlsian benchmark. Using the values of g_i obtained by inverting the optimal tax model, we estimate expression (9) to recover the parameter γ for each country.

Overall Patterns and Consistency. From results in Figure 4 we first check whether tax-benefit revealed marginal social welfare functions exhibit reasonable properties. A necessary condition for them to be Paretian, i.e., non-decreasing at all productivity levels, is that weights be positive. Our results show that this is the case for all countries and all income groups, even if weights are close to zero in some specific cases concerning groups 1 and 2, which we shall discuss in length below.[16] Next we discuss the shape of the implicit social welfare functions and compare the countries' degree of "Rawlsianity". We first see that the patterns are consistent with some social aversion to inequality, with the largest welfare weight placed on the poorest, the workless poor of group 0, in all countries. Yet this weight is particularly small, and the overall pattern relatively flat, in places where demogrant policies are absent or marginal, i.e., in Southern Europe, Hungary, Estonia and the US. In these countries, revealed preferences are close to utilitarianism. There are some exceptions and notably a slightly lower weight on

[16] Using the confidence interval of estimated elasticities confirms that Paretianity is not rejected, except for the UK, Sweden, Finland, Belgium and Germany. For these countries, the welfare weight on group 1 turns negative when the upper bound elasticity is used. The latter is implausibly high, however.

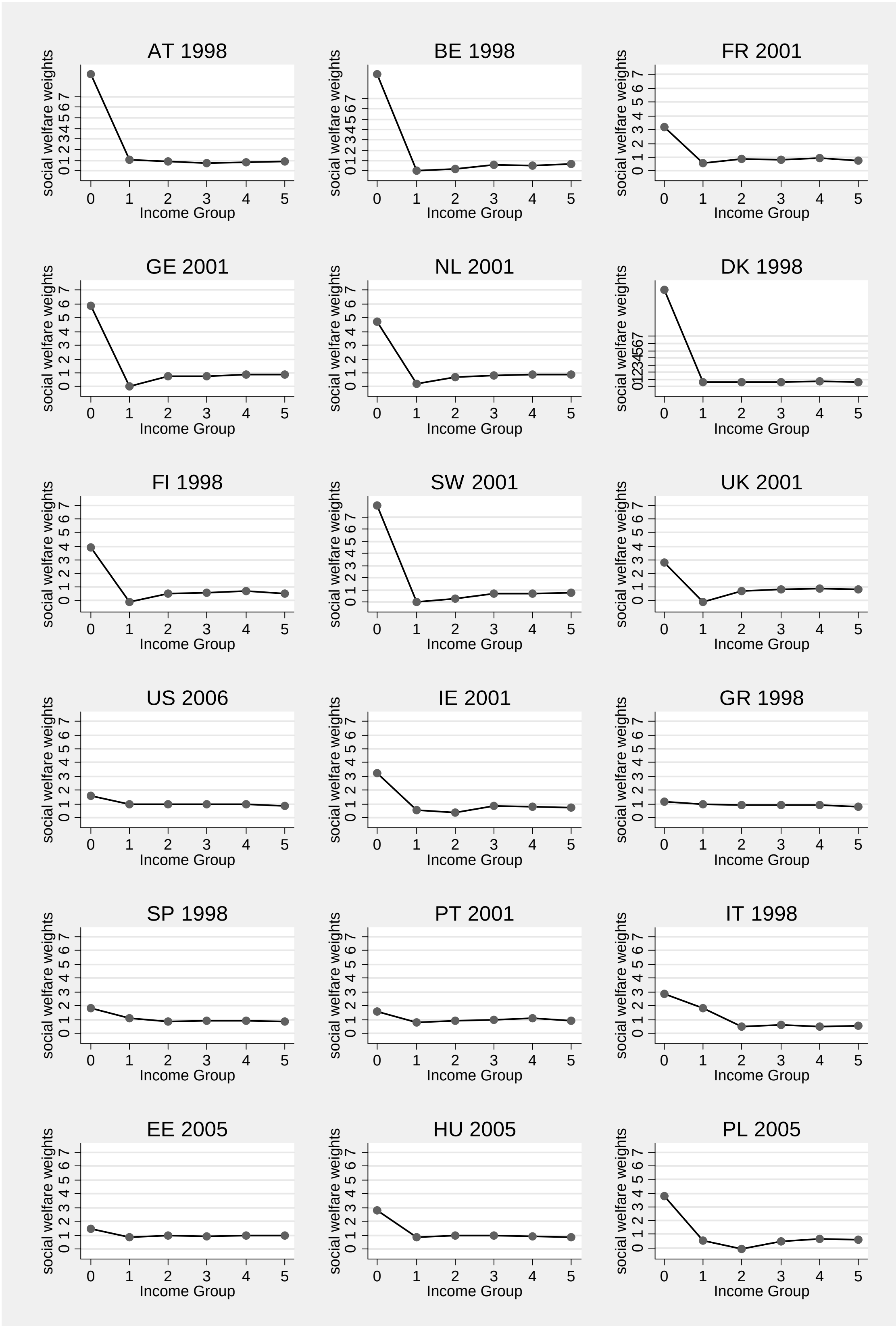


Figure 4: Marginal Social Welfare g_i

the top income group due to progressive taxation in some countries, consistent with the more pronounced progressivity in EMTRs as discussed above (e.g., in Portugal and Greece). We have also shown that implicit tax levels are higher in Italy, which is reflected here by the fact that welfare weights are significantly lower than 1 in the upper half of the distribution. All the other countries operate some non-marginal transfers towards the bottom of the distribution. As a result, the weights on group 0 are much higher (sometimes very high, as is the case for Austria, Denmark, Sweden and Belgium). At the same time, weights on group 1 (and sometimes 2) are extremely small in most of these systems. This result does not come as a surprise. It simply reflects the way the optimal tax model rationalizes the very high distortions imposed on the working poor, as previously discussed.[17] For these countries the concavity of the implicit social welfare function is not ensured at all income levels. This apparent inconsistency may reveal two things: (i) it is likely that governments had completely different beliefs about the extent of behavioral responses than what is measured by the econometrician, at the time generous social assistance programs were implemented; (ii) governments may have simply neglected the working poor, which represent a relatively small population in countries with highly regulated labor markets (as compared to the US for instance), and implicitly placed higher weights on the workless poor. Interestingly, the policy trend observed in these countries in the more recent years precisely consists in a correction of this feature, as discussed below.

Sensitivity to Elasticity Size. We pursue our social welfare characterization with a series of sensitivity checks around the *estimated values* of behavioral elasticities. We essentially focus on different scenarios regarding participation elasticities (results for key groups 0 and 1 depend less crucially on the intensive margin, cf. Saez, 2002). We are mainly interested in international comparisons, and hence report in Figure 5 the revealed social inequality aversion parameters γ obtained under different scenarios.[18] First of all, we check the consequences of ignoring cross-country differences in the size of participation elasticity. Indeed, previous applications of optimal tax theory usually use uniform values drawn from the literature. For each income group $i = 1, ..., 5$, we apply the estimated participation elasticity averaged over all countries. Results are compared to a scenario with uniform participation elasticities as used in Immervoll et al. (2007), i.e., from .4 in group 1 to 0 in group 5 with step .1. Results in the top-left quadrant of Figure 5 show that the international ranking in levels of implicit inequality aversion is much in line with the standard redistribution analysis, placing Southern countries and the US at a low level of inequality aversion (around .25), while Nordic and Continental European countries show more Rawlsian preferences (around 1 or above). In addition, it transpires that elasticities used in Immervoll et al. (2007) do a good job in representing mean estimates: the ranking is the same in both scenarios, with similar magnitudes of inequality aversion.[19]

[17] There are exceptions, e.g., Denmark, where a small extensive-margin elasticity on group 1 compensates this effect (cf. Table A.4).

[18] Not to overload the graphs, we take the mean inequality aversion over the two periods when two years of data are available. A specific sub-section is dedicated to time change below.

[19] It is slightly smaller using the elasticities in Immervoll et al. (2007) because the distance between g_0 and g_I is smaller, as a result of lower responses in upper income groups (in contrast to their assumption, our estimates point to non-zero elasticities at the top).

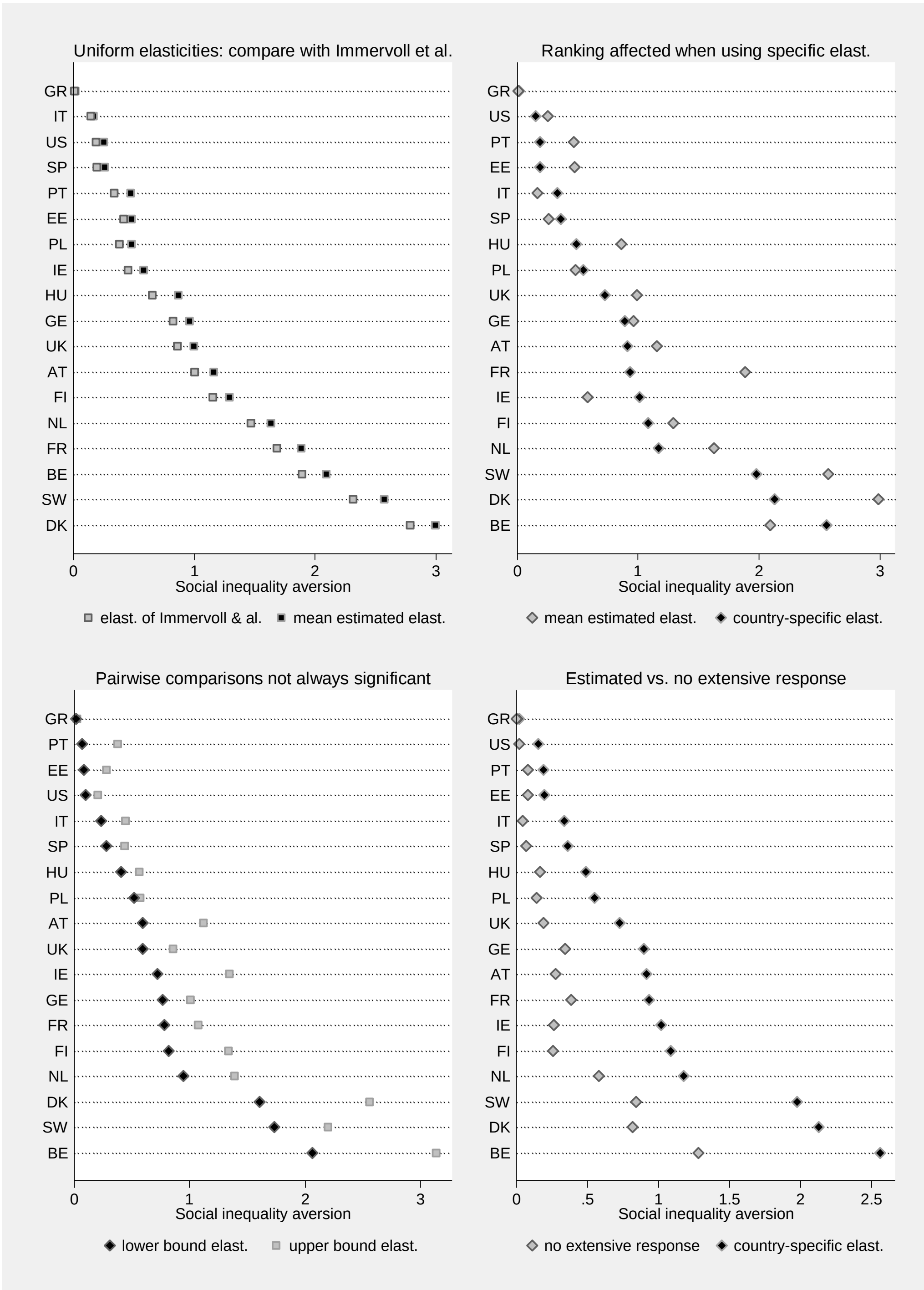


Figure 5: Tax-benefit Revealed Social Inequality Aversion γ

Next, one of our main contribution is to check whether cross-country differences in labor supply matter. The top-right panel compares the uniform elasticity scenario (based on mean estimated elasticities) to the results based on country-specific estimates (i.e., the levels of inequality aversion embodied in the patterns of Figure 4). The ranking is affected to some extent. For instance, countries with small, below-average elasticities appear automatically "less Rawlsian" because the efficiency constraint is not as tight as previously assumed with the mean elasticities. Interestingly, there is now less variation across countries when "true" elasticities are accounted for, with Continental Europe, the UK, Ireland and Finland around 1, Southern/Eastern Europe and the US at lower levels, and Scandinavian countries plus Belgium far above 1.

We also replicate the inversion procedure when using the limit values of the 95% confidence interval of estimated participation elasticities. This directly leads to confidence bounds on marginal social welfare weights as depicted for the US and France in Figure 6. In that example we observe that the weight on group 0 is significantly larger in France than in the US, and weights on higher groups are significant smaller (and smaller than 1). Without ambiguity, we can say that under estimated behavioral responses, the implicit preferences in the French welfare regime are more Rawlsian than in the US system. Differences are not significant for all pairs of countries, however. Transformed into social inequality aversions, results in the bottom-left quadrant of Figure 5 confirm significantly lower aversion in the US compared to France, but show an incomplete ordering over all countries. In fact, we can distinguish the same three groups of countries as delineated above, but differences between countries within a group are usually insignificant (for instance differences between Scandinavian countries in the top group).

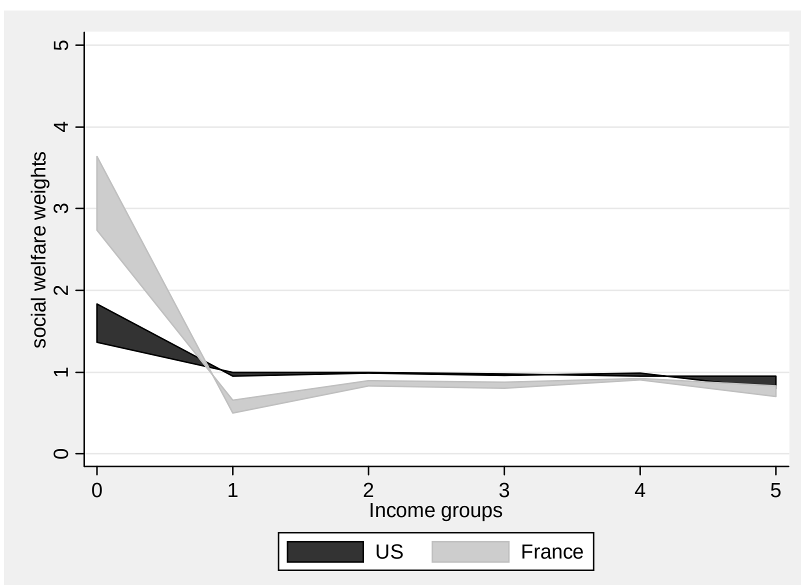


Figure 6: Tax-Benefit Revealed Social Welfare: US and France

Elasticities: from Econometrics to Politics. We have just characterized the redistributive preferences embodied in actual tax-benefit system when predictions of a structural model about labor supply elasticity are taken seriously. If we assume instead that governments had completely different priors about behavioral responses, we may retain an extreme scenario where elasticities are set to zero. As argued above, this may well apply to the context of Continental and Nordic European countries when generous demogrant policies were designed.[20] To illustrate this situation, the bottom-right quadrant of Figure 5 compares our baseline results to revealed inequality aversion in the case where extensive elasticities are zero. While the international ranking is roughly preserved, the absolute aversion level mechanically decreases. More interestingly, differences between some countries decrease (e.g. Sweden/Denmark vs. the Netherlands). To further analyze this point, Figure 7 compares the two scenarios when results are cast in terms of welfare weights. We focus on four countries with generous demogrant policies and high implicit taxation on group 1 (and group 2 in Sweden and the Netherlands). When setting participation elasticities to zero, irregularities on group 1 (and 2) partly disappear, i.e., the distribution of marginal social welfare weights becomes flatter. Smaller and more similar weights on group 0 can be observed and are consistent with the lower and more similar levels of inequality aversion discussed above. Admittedly, weights on group 1 (and 2) are still lower than for most other groups because the policy behind the result has not changed, i.e., the model still rationalizes the fact that workless poor receive substantial transfers, while working poor receive nothing (in addition, intensive margin elasticities are non-zero and are actually associated to a move from 1 to 0 for the working poor). However, and most importantly, our results show that the likely understatement of behavioral responses by policy makers, together with a genuine desire to redistribute to the poorest, partly explains past inconsistencies in implicit social welfare patterns.

Time Change and Recent Trends. We exploit the fact that two years of data are available for some countries. Results are presented for Finland, France, Ireland and the UK in Figure 8 for the policy years 1998 and 2001. On the one hand, very little policy changes occurred for childless singles in France and the UK over the period.[21] Reassuringly, in Figure 8, results for the two years are consistently similar. On the other hand, more significant time changes can be observed for Finland and Ireland. As discussed in Bargain and Callan (2010), several policy changes have occurred over the short period 1998-2001 that contributed to increase inequalities in Finland (notably a reduction in tax progressivity) and narrow the gap between groups 0 and 1, as can be seen in Figure 8. "Incentive trap reforms" were carried out as early as the late 1990s in Finland, with tax incentives on low-wage work (via extensions of tax allowance) and slow nominal adjustment on social transfers, which actually increased financial gains to work (Laine, 2002). In Ireland, substantial cuts in income tax have clearly reduced the redistributive effect of the system. The overall curve is higher in 2001 because of a change in relative group

[20] This is witnessed in numerous policy reports of the late 1990s in several EU countries, which highlighted the fact that safety net designed to prevent extreme poverty possibly became responsible for work disincentives and "inactivity traps" (see references in Bargain and Doorley, 2011). The same concern that welfare programs had pushed part of the population into a state of welfare dependency had previously led to the 1996 welfare reforms in the US.

[21] For instance, the 1999 boost in the UK in-work support, the WFTC reform, is not apparent as it concerns families with children, and what can be seen here is only an increase of weight 0 due to nominal adjustments of income support.

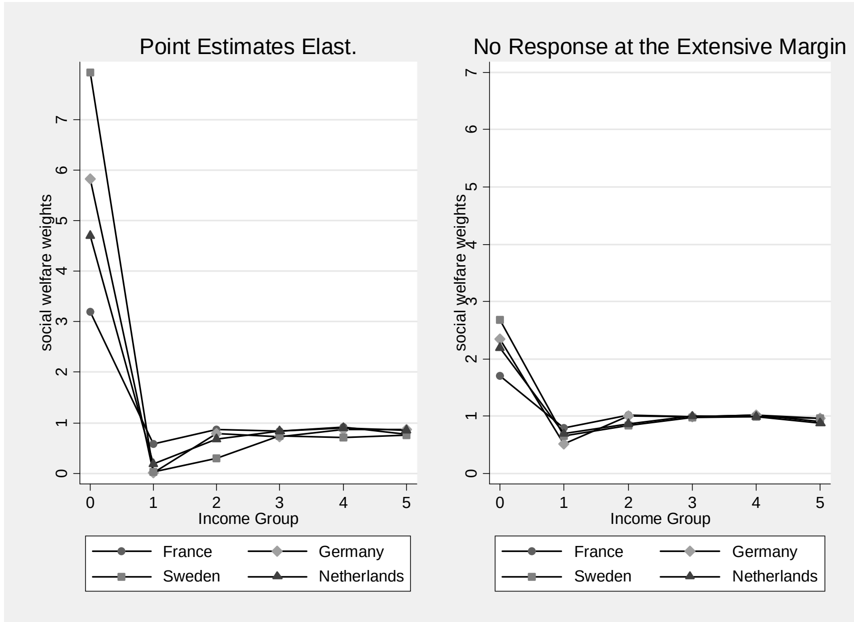


Figure 7: Tax-Benefit Revealed Social Welfare: Estimated versus Under-estimated Extensive Responses (2001)

size – in particular group 0 became smaller – but an extension of the tax-free bracket and moderation on social assistance have also contributed to improve the relative position of group 1. Similar reforms have taken place in other countries, but unfortunately for a more recent period that is not covered by our data and tax-benefit simulations. Some countries have also lowered tax rates for low-wage earners or reduced social assistance (in particular Denmark since 2003). Two important types of measures also deserve particular attention as they focus precisely on the workless/working poor divide. Firstly, in-work supports have been implemented since 2001, in the form of refundable earned income tax credits (in France, cf., Stancanelli, 2008; the Netherlands and Belgium from 2002 to 2004, cf. Orsini, 2006) or exemptions of SSC (in Germany with the "mini-job" reform, cf. Steiner and Wrohlich, 2005; in Belgium after 2004).[22] Interestingly, most of these reforms consist of individualized schemes and hence directly affect the group of childless singles under study.[23] Secondly, several countries have implemented activation policies (for instance within the Hartz IV reform in Germany) or extended existing ones (as in Nordic countries and notably in Denmark) – see Eichhorst and Konle-Seidl (2006). This type

[22] A possible change in social values in Continental Europe may have occurred, and the role of Anglo-Saxon influence and international convergence in this process is potentially important (see Banks et al., 2005), notably with respect to the principle of "making work pay". Note that some of these reforms were, however, relatively small and unlikely to have changed the weight on group 1 much. This is the case with the French earned income tax credit, which is included in our simulation for 2001 and is so small that it has almost no effect. For that country, things changed more radically in 2009, with a major reform consisting in reducing the withdrawal rate of social assistance from 100% to 38%.

[23] The case of the UK is particularly interesting: in the 1990s, the Family Credit followed by the WFTC were operated for working poor households with children only. Following the 2003 reform, the WFTC was split into a child tax credit (aimed at reducing child poverty) and a pure in-work support (the Working Tax Credit, WTC) which became available to all working poor, with or without children.

of workfare policy is rarely simulated since information concerning active job search is missing. However this would boil down to a reduction in the (long-run) expected value of social assistance and hence a decrease in the weight on group 0 (and the gap between 0 and 1) in our framework.

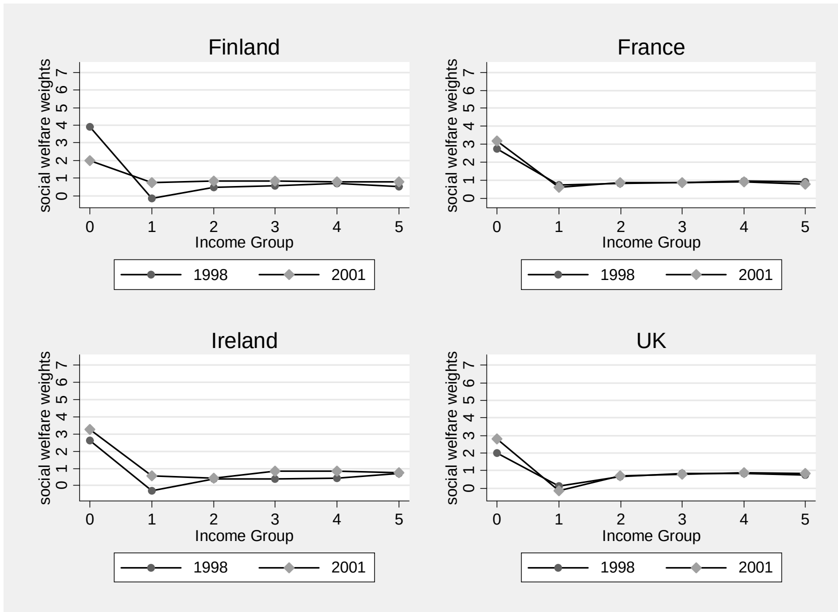


Figure 8: Tax-Benefit Revealed Social Welfare: Time Change

Direct Evidence on Redistributive Tastes. Results of an inverted optimal tax problem, as presented here, can be interpreted as revealed preferences. Hence, it is tempting to compare them to direct measures of social preferences as reported in, e.g., the International Social Survey Program (ISSP), and exploited in the political economy literature. Precisely, several papers studying the role of culture and international differences in redistributive preferences make use of a question about *whether it is the responsibility of the government to reduce differences in income between people with high incomes and those with low incomes* (see, e.g., Corneo and Grüner, 2002, Isaksson and Lindskog, 2009). For a subset of countries for which similar periods are available, we translate answers to this question in a score measure and compare it against our revealed inequality aversion index. Not surprisingly, the most robust result is the divide between the US and Continental/Nordic Europe, mainly because low tastes for redistribution in the US support the low inequality aversion embodied in the tax-benefit system (for a specific analysis of the EU and US difference, see Alesina and Angeletos, 2005). The UK has a somewhat intermediary position. For the rest, citizens of Southern and Eastern countries show the highest levels of support for redistribution, while living among the least redistributive systems. Why redistributive tastes do not translate into more redistributive policies is still an open question, clearly beyond the scope of this paper. Nonetheless, we can say that the broad group of countries with low levels of revealed inequality aversion in our results is mixed and influenced by possibly very different cultural and historical characteristics. For Eastern countries, the negative correlation between declared preferences and revealed inequality aversion is not only consistent with persistent left-wing ideology (Corneo and Grüner, 2002, Alesina and Fuchs-Schündeln, 2007) but also with the increasing public sentiment that the process of income distribution was in fact flawed and inefficient (Grosfeld and Senik, 2010).[24] In Southern Europe, family support is still seen as a substitute to state intervention towards the unemployed and low-wage workers (see Bentolila and Ichino, 2008) – yet political scientists describe Southern systems as an immature version of Continental Corporatist systems (Esping-Andersen, 1990). Strong reliance on the market is observed in the US, together with targeted policies (aimed at child poverty alleviation) and desert-sensitive redistribution, notably through EITC-type of instruments (on the range of safety net instruments, their effectiveness and their evolution over the past 35 years in the US, see Scholz et al., 2009).

7 Conclusion

Deriving social welfare functions implicit in different national tax-benefit systems provides an interesting way of checking how far we are from the fiction of a Paretian social planner and comparing countries' implicit tastes for redistribution. We follow this path by inverting the optimal tax model suggested by Saez (2002) for a large set of countries, i.e., we characterize the social welfare weights that rationalize tax-benefit institutions in the US and 17 European countries. Since we aim to compare pure vertical equity concerns across countries, we focus on a homogenous group – childless singles. To approximate true behavioral responses, we estimate labor supply on the same datasets and retrieve elasticities at the extensive and intensive margins. Heterogeneity in work-consumption preferences affects international comparisons in terms of revealed inequality aversion to some extent. More importantly, as a consequence of the estimated variances of labor supply preferences, differences in tax-benefit revealed social preferences across nations are greatly attenuated. Essential differences remain between broad groups of countries only. Social welfare weights are positive and tend to decrease with income level, with more Rawlsian profiles in Nordic/Continental Europe compared to Eastern/Southern Europe and the US. However, in the former set of countries, transfers to the workless poor – and the absence of transfers to the working poor for the period and group considered – lead to some non-concavity of the implicit social welfare function. This is coherent with the fact that governments' beliefs regarding behavioral responses are not necessarily those of the econometrician – and were possibly greatly understated when generous social assistance schemes were implemented in Europe. Interestingly, policy developments at the turn of the century and in recent years tend to correct this "anomaly" either through the development of individualized in-work support (in the UK and Continental Europe) or activation and workfare policies (in Scandinavian countries). These policy trends possibly denote a reassessment of potential labor supply responses by governments, but also a likely change in social preferences toward more desert-sensitive policies.

[24] Note however that national surveys point to higher tolerance for inequality in Eastern European countries (see Senik, 2008, using the TARKI Hungarian Household Panel, the NORBALT II for Estonia, the national representative household survey for Poland). Hence, according to this alternative data, there would be more similarity between revealed and observed preferences. Senik (2008) relates low preference for redistribution in Eastern countries and the US to beliefs in more income mobility (at least compared to "old" Europe).

Future research could extend our results in various ways. *Firstly*, it is in principle possible to replicate the analysis on different (demographically homogenous) groups. Most interestingly, an examination of couples would show more variations in policies over time and across countries (i.e., EITC and WFTC would enter the analysis). As argued in the text, however, the treatment of joint labor supply decisions in an optimal tax framework is not an easy task (see Kleven et al., 2009). *Secondly*, we have considered a partial optimization problem by looking at direct taxes and transfers. Some other policies may well have redistributive effects, including non-cash benefits (see Haan and Wrohlich, 2007) and public goods like public health and education. In particular, systems where health insurance is financed by proportional to income contributions (or progressive taxation), but tranfers are universal, must generate substantial redistribution. *Thirdly*, tax-benefit policies are part of a broader set of policy decisions including labor market regulations, minimum wages, among others. In that respect, high redistribution towards the workless poor is consistent with high minimum wages and stringent regulations that produce insider/outsider segmentations. Indeed, demogrant policies complement unemployment insurance in this type of labor market, especially for young workers (who have never contributed to social security) or long-term unemployed (who have exhausted their rights). In contrast in Anglo-Saxon countries, more flexible labor markets have generated more working poverty and hence the need for appropriate (in-work) transfers of the EITC-type. These considerations should be better incorporated in the present framework.

Finally, it is natural to think that real world tax-benefit schedules result from complex historical shocks and political economy forces rather than from the pursuit of some well defined social objectives. Nevertheless, the fiction of a social planner can be seen as a proxy for a more complex political model (Coughlin, 1992, shows equivalence between a planner with a weighted social welfare function and a probabilistic voting model with two candidates competing for votes). In fact, very little is known about the complex mechanisms behind tax-benefit policy design in the real world, which involves many dimensions (e.g., labor market policies, as noted above) and agents (e.g., unions, lobbies, experts, international influence) often not accounted for by theory. It would nonetheless be interesting to extend the present approach to some explicit political economy model (see, e.g., Atella et al., 2005) – even if simple representations like the median voter hypothesis are clearly of limited applicability (cf. Alesina and Giuliano, 2011) and social choice models in presence of endogenous labor supply are rare. It could also be interesting to replicate the exercise suggested in this paper with non-welfarist objectives (e.g., Kanbur et al., 2006) or welfare measures that preserve individual heterogeneity (see Decoster and Haan, 2010).

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A Appendix A: Tables and Figures

Table A.1: Description of the Discretized Population of Childless Singles

Country	AT	BE	BE	DK	FI	FI	FR	FR	GE	GE	GR	IE	IE
Year	98	98	01	95	98	01	95	01	98	01	95	95	00
Data	ECHP	PSB	PSB	ECHP	IDS	IDS	HBS	HBS	SOEP	SOEP	HBS	LIS	LIS
Gross income Yi (note: Y0 = 0)													
1	222	203	238	127	190	185	139	189	172	145	113	215	187
2	376	347	392	397	329	356	286	301	373	359	165	371	361
3	452	436	502	545	398	437	360	373	471	490	216	470	454
4	577	532	613	646	481	528	457	467	576	605	263	542	651
5	845	737	856	860	704	769	732	703	814	889	476	724	882
Disposable income Ci													
0	61	96	138	140	110	113	110	151	59	80	1	67	65
1	183	181	214	154	178	181	134	171	148	141	101	199	206
2	277	243	284	282	242	273	217	232	245	250	145	287	334
3	321	286	341	367	279	314	267	276	298	320	189	337	433
4	394	333	394	428	326	368	335	338	345	381	219	374	539
5	533	435	510	518	434	491	519	482	475	520	358	478	689
Effective "Marginal" Tax Rate (EMTR)													
1	45%	58%	68%	89%	64%	64%	83%	89%	49%	58%	12%	38%	24%
2	39%	57%	54%	53%	54%	46%	43%	45%	51%	49%	15%	44%	27%
3	42%	52%	48%	42%	46%	48%	34%	39%	47%	47%	14%	49%	-6%
4	42%	50%	53%	40%	43%	42%	28%	34%	55%	47%	37%	49%	46%
5	48%	50%	52%	58%	51%	49%	33%	39%	45%	51%	35%	43%	35%
Effective Participation Tax Rate (EPTR)													
1	45%	58%	68%	89%	64%	64%	83%	89%	49%	58%	12%	38%	24%
2	43%	57%	63%	64%	60%	55%	62%	73%	50%	53%	13%	41%	25%
3	42%	56%	59%	58%	58%	54%	57%	66%	49%	51%	13%	43%	19%
4	42%	55%	58%	55%	55%	52%	51%	60%	50%	50%	17%	43%	27%
5	44%	54%	57%	56%	54%	51%	44%	53%	49%	51%	25%	43%	29%
Group size hi (in %)													
0	0.04	0.20	0.15	0.19	0.23	0.20	0.12	0.13	0.15	0.12	0.31	0.30	0.13
1	0.19	0.16	0.17	0.16	0.15	0.16	0.18	0.18	0.17	0.18	0.14	0.15	0.18
2	0.19	0.16	0.17	0.16	0.15	0.16	0.17	0.17	0.17	0.17	0.14	0.14	0.20
3	0.19	0.16	0.17	0.16	0.15	0.16	0.18	0.18	0.17	0.18	0.14	0.14	0.15
4	0.20	0.16	0.17	0.16	0.15	0.16	0.18	0.18	0.17	0.17	0.13	0.16	0.19
5	0.18	0.16	0.17	0.16	0.15	0.16	0.17	0.17	0.17	0.17	0.14	0.12	0.16
# observations	206	357	278	518	931	963	1,080	1,013	967	933	164	148	130

This table reports information on income groups for the selected samples. Policy years are 1998, 2001 or 2005. Countries are: AT=Austria, BE=Belgium, DK=Denmark, FI=Finland, FR=France, GE=Germany, GR=Greece, IE=Ireland. Datasets are: ECHP=European Community Household Panel, PSB=Panel Survey on Belgian Households, HBS=Household Budget Survey, IDS=Income Distribution Survey, SOEP=German Socio-Economic Panel, LIS=Living in Ireland Survey. Group 0 = non-participants and $Y_0=0$. Other groups: increasing income levels of participants. EMTR are calculated as $1 - \{C_i - C_{i-1}\}/\{Y_i - Y_{i-1}\}$ and EPTR as $1 - \{C_i - C_0\}/\{Y_i - Y_0\}$ for all income groups i>0. All incomes in euros per week.

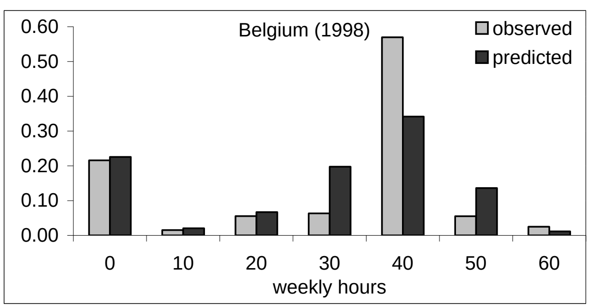
Table A.2: Description of the Discretized Population of Childless Singles (cont.)

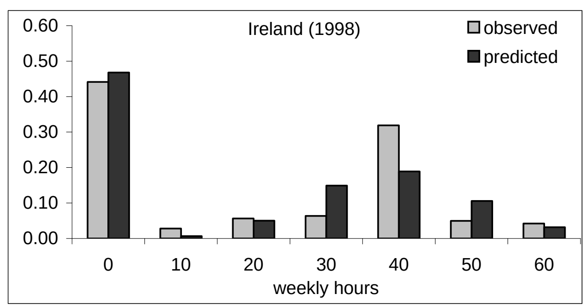
Country	IT	NL	PT	SP	SP	UK	UK	SW	EE	HU	PL	US
Year	95	00	01	96	01	95	01	01	05	05	05	06
Data	SHIW	SOEP	ECHP	ECHP	ECHP	FES	FES	IDS	HBS	HBS	HBS	CPS
Gross income Yi (note: Y0 = 0)												
1	188	189	88	134	165	221	229	172	33	41	36	162
2	314	400	150	238	250	361	397	359	56	72	71	362
3	381	505	222	327	335	463	522	439	77	109	102	528
4	484	617	368	458	423	573	661	522	102	151	141	715
5	632	867	639	649	646	818	999	760	152	267	238	1194
Disposable income Ci												
0	3	137	25	17	6	133	144	151	13	16	3	17
1	129	186	77	126	151	191	205	179	33	44	17	149
2	209	298	128	204	215	289	316	247	48	64	25	303
3	251	361	182	268	281	362	406	293	65	86	40	426
4	299	443	273	364	339	441	507	345	84	105	59	557
5	375	599	416	496	491	622	751	478	120	162	106	863
Effective "Marginal" Tax Rate (EMTR)												
1	33%	74%	41%	19%	13%	74%	73%	84%	38%	33%	60%	18%
2	37%	47%	18%	25%	24%	30%	34%	64%	35%	35%	78%	23%
3	37%	40%	24%	27%	23%	28%	28%	43%	21%	42%	53%	26%
4	53%	27%	38%	27%	34%	28%	28%	36%	23%	55%	50%	30%
5	48%	37%	47%	31%	32%	26%	28%	44%	27%	50%	52%	36%
Effective Participation Tax Rate (EPTR)												
1	33%	74%	41%	19%	13%	74%	73%	84%	38%	33%	60%	18%
2	34%	60%	31%	22%	16%	57%	57%	73%	37%	34%	69%	21%
3	35%	55%	29%	23%	18%	50%	50%	68%	32%	36%	64%	23%
4	39%	50%	33%	24%	21%	46%	45%	63%	30%	42%	60%	25%
5	41%	47%	39%	26%	25%	40%	39%	57%	29%	45%	57%	29%
Group size hi (in %)												
0	0.16	0.10	0.08	0.13	0.09	0.24	0.15	0.11	0.15	0.10	0.19	0.06
1	0.18	0.18	0.20	0.18	0.20	0.15	0.17	0.18	0.17	0.18	0.16	0.19
2	0.16	0.18	0.17	0.17	0.17	0.15	0.17	0.18	0.17	0.18	0.16	0.20
3	0.16	0.18	0.24	0.17	0.18	0.15	0.17	0.18	0.16	0.18	0.16	0.19
4	0.17	0.18	0.13	0.18	0.18	0.15	0.17	0.18	0.18	0.18	0.16	0.18
5	0.16	0.18	0.18	0.17	0.18	0.15	0.17	0.18	0.16	0.18	0.16	0.19
# observations	163	555	106	191	202	561	669	1,768	233	354	1,273	7,053

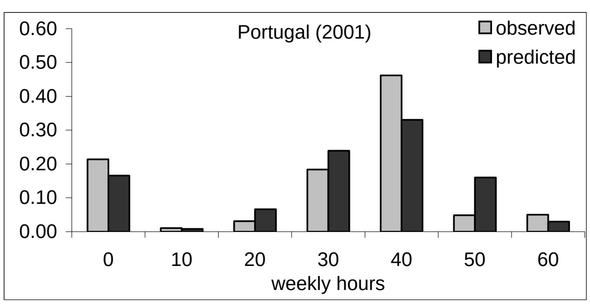
This table reports information on income groups for the selected sample. Policy years are 1998, 2001 or 2005. Countries are: IT=Italy, NL=the Netherlands, PT=Portugal, SP=Spain, UK=the United Kingdom, SW=Sweden, EE=Estonia, HU=Hungary, PL=Poland, US=the United States. Datasets are: ECHP=European Community Household Panel, HBS=Household Budget Survey, IDS=Income Distribution Survey, SOEP=Dutch Socio-Economic Panel, SHIW=Survey of Households Income and Wealth, FES=Family Expenditure Survey, CPS=Current Population Survey. Notes: Group 0 = non-participants and Y0=0. Other groups: increasing income levels of participants. EMTR are calculated as 1 - {Ci - Ci-1}/{Yi -Yi-1} and EPTR as 1 - {Ci - C0}/{Yi - Y0} for all income groups i>0. All incomes in euros per week.

Table A.3: Goodness of Fit: Hour Mean and Distributions

	AT	BE	BE	DK	FI	FR	FR	GE	GE	GR	IE	IE
	98	98	01	98	98	98	01	98	01	98	98	01
Pseudo-R2	0.29	0.33		0.36	0.36	0.24		0.26		0.40	0.33	
Particip.: observed	.88	.78	.81	.80	.78	.83	.83	.80	.82	.66	.56	.73
Particip.: predicted	.90	.77	.82	.80	.76	.83	.84	.79	.80	.64	.53	.71
gap %	*2.8%*	*-1.2%*	*1.4%*	*-0.4%*	*-3.0%*	*-0.5%*	*0.3%*	*-2.0%*	*-3.1%*	*-3.7%*	*-4.8%*	*-1.8%*
Hours: observed	32.8	30.2	31.0	30.7	30.8	31.6	30.2	28.9	29.7	26.6	21.1	24.9
Hours: predicted	33.7	28.6	30.2	30.4	29.6	31.4	30.1	28.4	28.7	25.5	20.3	24.4
gap %	*2.7%*	*-5.2%*	*-2.5%*	*-1.0%*	*-3.8%*	*-0.5%*	*0.0%*	*-1.7%*	*-3.6%*	*-4.2%*	*-3.8%*	*-1.9%*
	IT	NL	PT	SP	SP	UK	UK	SW	EE	HU	PL	US
	98	01	01	98	01	98	01	01	05	05	05	05
Pseudo-R2	0.22	0.27	0.25	0.26		0.27		0.15	0.39	0.36	0.36	0.30
Particip.: observed	.74	.85	.79	.70	.79	.64	.72	.87	.81	.83	.66	.83
Particip.: predicted	.74	.85	.83	.69	.80	.64	.73	.86	.81	.83	.66	.82
gap %	*-1.0%*	*0.7%*	*6.1%*	*-1.9%*	*1.4%*	*0.4%*	*0.9%*	*-0.6%*	*-0.1%*	*-0.6%*	*0.5%*	*-0.7%*
Hours: observed	28.0	30.1	30.2	26.8	30.1	24.5	27.2	30.9	31.9	33.1	24.6	34.5
Hours: predicted	27.9	30.1	31.6	26.3	30.6	24.5	27.4	30.1	31.9	32.8	24.6	34.3
gap %	*-0.4%*	*0.0%*	*4.8%*	*-1.8%*	*1.4%*	*0.2%*	*0.9%*	*-2.5%*	*0.0%*	*-0.8%*	*0.0%*	*-0.6%*







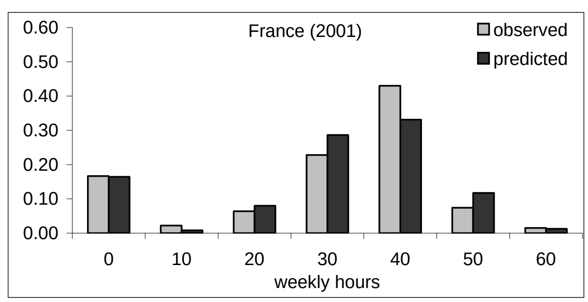


Table A.4: Labor Supply Elasticities

	AT	BE	BE	DK	FI	FI	FR	FR	GE	GE	GR	IE	IE
	98	98	01	95	98	01	95	01	98	01	95	95	00
Standard elasticities													
Wage elasticity - Hours	.13	.25	.31	.09	.27	.16	.14	.13	.20	.17	.24	.25	.50
	(.05)	(.05)	(.06)	(.04)	(.05)	(.03)	(.02)	(.02)	(.03)	(.02)	(.05)	(.07)	(.08)
Wage elasticity - Participation	.10	.22	.24	.12	.28	.15	.11	.11	.19	.16	.23	.32	.44
	(.04)	(.03)	(.05)	(.03)	(.04)	(.02)	(.01)	(.01)	(.02)	(.02)	(.04)	(.06)	(.07)
Income elasticity - Hours	.00	.00	.00	.00	.10	.01	.00	.00	.01	.00	.00	-.03	-.02
	(.00)	(.00)	(.00)	(.01)	(.02)	(.01)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Saez (2002)'s elasticities													
Intensive margin:													
Mean	**.10**	**.16**	**.25**	**.04**	**.08**	**.04**	**.08**	**.06**	**.09**	**.11**	**.09**	**.20**	**.36**
Group 1	.14	.43	.38	.04	.23	.09	.06	.05	.38	.39	.18	.66	.45
	(.06)	(.11)	(.09)	(.01)	(.04)	(.03)	(.01)	(.01)	(.07)	(.08)	(.09)	(.17)	(.08)
Group 2	.17	.20	.47	.06	.05	.03	.09	.06	.03	.02	.07	.26	.86
	(.06)	(.04)	(.10)	(.02)	(.01)	(.01)	(.01)	(.01)	(.01)	(.00)	(.02)	(.11)	(.17)
Group 3	.05	.13	.28	.05	.02	.03	.06	.04	.03	.07	.02	.15	.52
	(.02)	(.03)	(.02)	(.03)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.02)	(.02)	(.05)
Group 4	.10	.07	.09	.04	.04	.02	.06	.05	.03	.05	.07	.03	.19
	(.04)	(.01)	(.01)	(.03)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.02)	(.02)	(.05)
Group 5	.04	.10	.22	.04	.05	.03	.12	.12	.03	.04	.08	.03	.33
	(.02)	(.02)	(.11)	(.03)	(.01)	(.01)	(.02)	(.03)	(.01)	(.01)	(.02)	(.02)	(.05)
Extensive margin:													
Mean	**.15**	**.35**	**.35**	**.17**	**.30**	**.14**	**.09**	**.09**	**.20**	**.22**	**.34**	**.57**	**.38**
Group 1	.14	.43	.38	.04	.23	.09	.06	.05	.38	.39	.18	.66	.45
	(.04)	(.07)	(.05)	(.01)	(.03)	(.02)	(.01)	(.01)	(.04)	(.05)	(.05)	(.08)	(.08)
Group 2	.16	.53	.46	.16	.32	.11	.12	.07	.17	.21	.53	.78	.56
	(.05)	(.08)	(.07)	(.03)	(.05)	(.02)	(.01)	(.01)	(.02)	(.02)	(.10)	(.10)	(.10)
Group 3	.19	.25	.24	.24	.35	.13	.10	.09	.25	.25	.40	.51	.49
	(.05)	(.04)	(.03)	(.06)	(.05)	(.02)	(.01)	(.01)	(.02)	(.02)	(.07)	(.08)	(.08)
Group 4	.14	.38	.42	.18	.22	.20	.11	.09	.11	.15	.34	.60	.27
	(.04)	(.04)	(.07)	(.04)	(.02)	(.02)	(.01)	(.01)	(.01)	(.01)	(.06)	(.05)	(.05)
Group 5	.11	.15	.23	.23	.36	.19	.07	.14	.10	.08	.27	.30	.12
	(.02)	(.02)	(.07)	(.05)	(.05)	(.02)	(.01)	(.01)	(.01)	(.01)	(.05)	(.11)	(.11)

Note: standard elasticities are computed numerically by simulation of responses to a 1% uniform increase in wage rates or unearned income. Saez elasticities are obtained by simulated increases corresponding to 1% of the difference in mean disposable incomes between a given income group and the closest lower group (mobility) or the group of nonworkers (participation). Bootstrapped standard errors in brackets.

Table A.5: Labor Supply Elasticities (cont.)

	IT 95	NL 00	PT 01	SP 96	SP 01	UK 95	UK 01	SW 01	EE 05	HU 05	PL 05	US 06	Mean
Standard elasticities													
Wage elasticity - Hours	.47	.11	.04	.27	.39	.41	.21	.17	.15	.14	.08	.20	.22
	(.10)	(.02)	(.04)	(.07)	(.04)	(.05)	(.03)	(.03)	(.03)	(.03)	(.01)	(.01)	(.04)
Wage elasticity - Participation	.42	.09	.04	.27	.32	.33	.20	.14	.14	.13	.07	.17	.20
	(.09)	(.01)	(.03)	(.06)	(.04)	(.04)	(.02)	(.01)	(.03)	(.03)	(.01)	(.01)	(.03)
Income elasticity - Hours	.03	.00	.00	-.01	-.01	.00	.00	.01	.00	.06	.00	.00	.01
	(.02)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.01)	(.00)	(.01)	(.00)	(.00)	(.00)
Saez (2002)'s elasticities													
Intensive margin:													
Mean	**.28**	**.12**	**.08**	**.12**	**.44**	**.06**	**.07**	**.06**	**.07**	**.07**	**.04**	**.18**	**.13**
Group 1	.70	.16	.11	.25	.87	.10	.13	.11	.10	.11	.09	.33	.26
	(.14)	(.04)	(.26)	(.10)	(.12)	(.02)	(.02)	(.03)	(.03)	(.04)	(.01)	(.01)	(.07)
Group 2	.47	.19	.07	.11	.50	.07	.05	.12	.02	.06	.03	.09	.17
	(.10)	(.04)	(.15)	(.04)	(.06)	(.01)	(.01)	(.02)	(.01)	(.03)	(.01)	(.01)	(.04)
Group 3	.14	.04	.05	.03	.37	.01	.01	.04	.05	.09	.03	.13	.06
	(.03)	(.01)	(.06)	(.01)	(.04)	(.01)	(.01)	(.01)	(.01)	(.02)	(.01)	(.01)	(.01)
Group 4	.08	.05	.07	.08	.11	.03	.04	.02	.07	.05	.03	.12	.05
	(.02)	(.01)	(.05)	(.02)	(.01)	(.01)	(.01)	(.01)	(.02)	(.02)	(.01)	(.01)	(.01)
Group 5	.03	.15	.09	.12	.33	.06	.11	.04	.10	.04	.05	.20	.10
	(.01)	(.16)	(.04)	(.04)	(.12)	(.01)	(.07)	(.03)	(.05)	(.01)	(.01)	(.01)	(.01)
Extensive margin:													
Mean	**.59**	**.11**	**.06**	**.32**	**.43**	**.21**	**.18**	**.17**	**.12**	**.06**	**.09**	**.28**	**.24**
Group 1	.70	.16	.11	.25	.87	.10	.13	.11	.10	.11	.09	.33	.26
	(.11)	(.02)	(.03)	(.07)	(.12)	(.01)	(.01)	(.01)	(.03)	(.03)	(.01)	(.01)	(.04)
Group 2	.67	.13	.13	.50	.62	.21	.20	.21	.08	.03	.09	.34	.30
	(.11)	(.02)	(.04)	(.13)	(.07)	(.02)	(.02)	(.01)	(.02)	(.01)	(.01)	(.01)	(.05)
Group 3	.50	.14	.07	.25	.36	.17	.21	.14	.11	.08	.07	.33	.24
	(.09)	(.01)	(.02)	(.06)	(.03)	(.02)	(.02)	(.01)	(.02)	(.02)	(.01)	(.01)	(.04)
Group 4	.64	.09	.01	.32	.17	.23	.19	.21	.14	.03	.10	.25	.22
	(.11)	(.01)	(.02)	(.05)	(.02)	(.02)	(.02)	(.01)	(.02)	(.01)	(.01)	(.01)	(.03)
Group 5	.46	.04	.01	.26	.12	.34	.18	.17	.17	.05	.09	.13	.17
	(.09)	(.01)	(.02)	(.04)	(.02)	(.04)	(.04)	(.03)	(.03)	(.01)	(.01)	(.00)	(.04)

Note: standard elasticities are computed numerically by simulation of responses to a 1% uniform increase in wage rates or unearned income. Saez elasticities are obtained by simulated increases corresponding to 1% of the difference in mean disposable incomes between a given income group and the closest lower group (mobility) or the group of nonworkers (participation). Bootstrapped standard errors in brackets.

Table A.6: Taxes, Social Contributions and Transfers of Childless Singles

	Austria	Belgium	Denmark	Estonia	Finland	France
Income Tax System						
No of tax bands	4	5	3	1	6	6
Lowest/highest tax band limit * §	17 / 231	24 / 318	12 / 100	21	35 / 223	30 / 336
Lowest/highest tax rate £	.21 / .50	.25 / .55	.40 / .59	.24 / .24	.235 / .557	.185 / .62
Main tax credit*	5					PPE (in 2001)
Employee Social Security Contributions						
SSC exemption below earnings*	13	some SSC rebates				
Lower/upper contrib. limit **	no / 145					
Starting/finishing rate (%)	18.06	13.07	8 + lump sum charge (3% of AW) 3	3	6.6	21.36 / 8.61 (4 rates)
Maximum contribution**	26.1					
Tax deductible	yes	yes	yes		yes	yes
Social Assistance (not taxable, except Denmark)						
Max. amount*	32	39	34 + housing allowance	9 + housing supplements	18 + reasonable housing costs	24
Disregard*		9	up to 9			
Withdrawal rate	1	1	1		1	1
Housing Benefit						
Max. amount*			3	see Social Assistance	17	15
Withdrawal rate			.75		.80	.34
Unemployment Benefits (shown for initial phase of unempl., after waiting period if applicable, for persons aged 30+. Insurance to some extent voluntary in DK and FI)						
Floor*	7	31 (if previously full-time)	56 (if previously full-time)		22	30
Payment Rate**	55% of net	42-60% of gross	90% of gross minus SSC	40-50% of gross	up to 42% of net > 22 (basic benefit)	57-75% of gross, downward scaling factor
Duration	4.5-12 months (dep. on age and contribution)	no limit in general	1+3 years (partly dep. on program participation)	6-12 months (dep. on contribution period)	max. 16.5 months (renewable under conditions)	4-60 months (dep. on age and contribution)
Ceiling*	min(56, 80% of net)	48 (if previously full-time)	68			313
Taxable @	IT: no, SSC: no	IT: reduced, SSC: no	IT: yes, SSC: partly	IT: no, SSC: no	IT: no, SSC: no	IT: yes, SSC: yes

Source: EUROMOD country reports, OECD Benefit and Wages, MISSOC 1998.

Notes: We focus here on taxation and transfers to childless singles (all benefit and tax rates above are for this demographic group) for the year 1998 except PL, HU, EE and US (year 2005/6).

* All monetary levels in % of median gross employment income (not including employer social security contributions)

** All monetary level in % of Average Worker Wage (AWW)

§ The lowest bound accounts for std tax-free allowances/deductions/exemptions for single employees, i.e. represents the upper bound of the zero-tax income range

£ Rates include special social security tax. In France, CSG: 7.5% and CRDS: 0.5%. They combine flat-tax municipal taxation and progressive national taxation for Finland and Denmark (municipal tax rates differ between municipalities and we count here the average: 17.5% in Finland, 32.4% in Denmark). In Denmark, a "tax shield" of 59% is applied as the top rate.

@ IT = income tax; SSC = social security contributions

Table A.7: Taxes, Social Contributions and Transfers of Childless Singles (cont.)

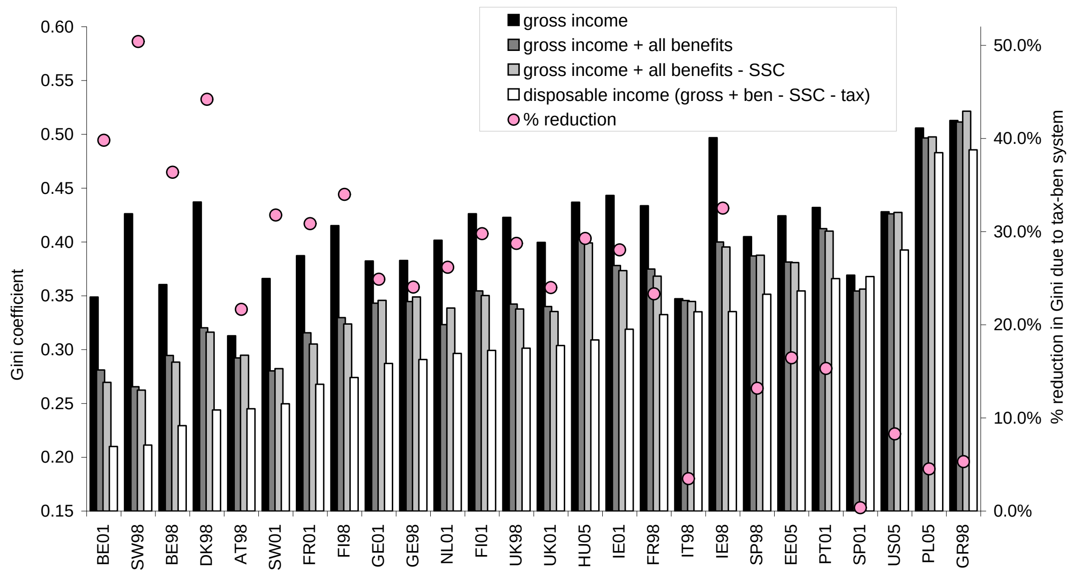
	Germany	Greece	Hungary	Ireland	Italy	Netherlands
Income Tax System						
No of tax bands	3 £	3	2	2	5	4
Lowest/highest tax band limit * §	30 / 252	56 / 478	0 / 82	25 / 80	0 / 118	20 / 212
Lowest/highest tax rate £	.273 / .557	.05 / .45	.18 / .36	.24 / .46	.185 / .455	.36 / .60
Main tax credit * &		max. 15% of accepted expenditure			up to 6	
Employee Social Security Contributions						
Lower/upper contrib. limit **	12 / 150	no / 285		51 / no	no / 371	
Starting/finishing rate [%]	20.85 / 13 (2 rates)	16	8.5 / 5 (2 rates)	4 / 2 (2 rates)	9.19 / 10.19 (2 rates)	32.6 / 5.85 (4 rates) + lump sum charge
Maximum contribution**	27.4	45.6			36.1	32.2
Tax deductible	yes	yes	no	no	yes	partly
Special features	phase-in; +0.25%					extra payments for some employees
Social Assistance (not taxable)						
Max. amount*	13		11	29 + housing supp.	none at the national level	24
Disregard*	4			19 for partner's income		
Withdrawal rate	.75 - 1		1	1		1
Housing Benefit						
Max. amount*	25		2	see Social Assistance	none at the national level	6 (for low rents)
Withdrawal rate	.40					0.54
Unemployment Benefits (shown for initial phase of unempl., after waiting period if applicable, for persons aged 30+)						
Floor*		28				41 (if previous job full-time)
Payment Rate**	60% of net	40-70% of gross	65% of gross	flat-rate: 16 (EUR 96/week)	30% of gross	70% of gross
Duration	6-32 months (dep. on age and contribution)	5-12 months (dep. on employment period)	up to 9 months (dep. on contribution)	13 months	6 months	9-60 months (dep. on employment period)
Ceiling*	125	min. of 126 or 70% of gross	2x the bottom limit, i.e, 90% of minimum old-age pension		66	156
Taxable @	no	IT: reduced, SSC: no	IT: yes, SSC: partly	IT: reduced, SSC: no	IT: yes, SSC: no	IT: yes, SSC: yes

£: In Germany: MTR increases progressively between lower and middle / middle and top tax bands; rates include solidarity surplus tax of 5.5%

&: Employment-related benefits exist in Ireland (FIS) and Italy but do not concern childless single households

Table A.8: Taxes, Social Contributions and Transfers of Childless Singles (cont.)

	Poland	Portugal	Spain	Sweden	United Kingdom	United States
Income Tax System						
No of tax bands	3	6	8	2	3	6
Lowest/highest tax band limit * §	5 / 259	0 / 490	22 / 492	4 / 92	29 / 220	26 / 1066
Lowest/highest tax rate	.19 / .40	.05 / .40	.20 / .56	.30 / .55	.20 / .40	10 / 35
Main tax credit *		3	3		WFTC (not for childless)	EITC (not for childless)
Employee Social Security Contributions						
SSC exemption below earnings threshold *			35	5		
Lower/upper contrib. limit **			no / 165	no / 110	17 / no	
Starting/finishing rate [%]	25.62	11	6.35	7	11 / 1 (2 rates)	7.65 / 1.45 (2 rates)
Maximum contribution**			10.5	7.7		
Tax deductible	partly	yes	yes	yes	no	no
Special features			lump-sum charge below threshold	87.5% can be claimed as tax credit, rest is tax deductible	rebate for some employees	
Social Assistance *(not taxable)*						
Max. amount*	20	20	none at the national level	15 + reasonable housing cost	18	4
Disregard*					2 - 4	occasional income up to USD 120
Withdrawal rate	1	0.8		1	1	1
Housing Benefit						
Max. amount*	15	none at the national level	none at the national level	6 (only if aged <30)	100% of recognised rent; 100% of council tax	
Withdrawal rate				33% (disregard of 18)	65% (housing benefit); 20% (council tax benefit)	
Unemployment Benefits *(shown for initial phase of unempl., after waiting period if applicable, for persons aged 30+. Insurance to some extent voluntary in SW)*						
Floor*		49 (if previous job full-time)	33	28		
Payment Rate**	flat-rate: 26 (EUR 35/week)	65% of gross	70% of gross for 6 months then 60%	80% of gross	flat-rate: 11-14 (EUR 65-83 / week)	53% of gross (average over all States)
Duration	max. 18 months	10-30 months (dep. on age)	dep. on contribution period	10-15 months (dep. on age)	max. 6 months	max. 6 months
Ceiling*		146	75	66	18%	61% of average worker
Taxable @		IT: no, SSC: no	IT: yes, SSC: reduced	IT: yes, SSC: yes	IT: yes, SSC: no	



Sample: selection of childless singles. Bars (left x-axis) represent Gini coefficients of equivalized income for different income concepts from gross/market income to disposable income (gross income +benefits - SSC - taxes). We also represent (right x-axis) the % reduction in Gini due to tax-benefit policies. Countries are ranked according to the Gini of disposable income.

Figure A.1: Redistributive Effects of Tax-Benefit Policies (Singles)

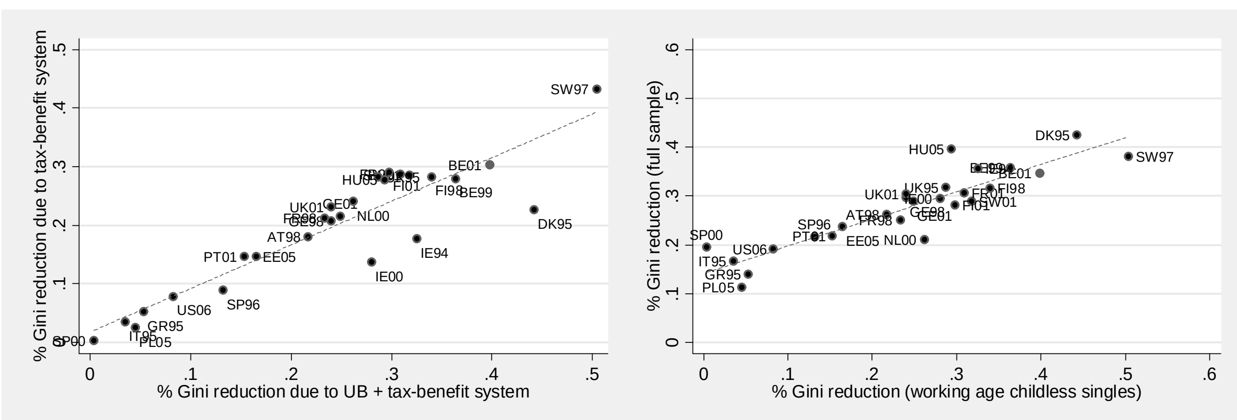


Figure A.2: Vertical Redistribution: Impact of Unemployment Benefits and Sample Selection

B Appendix B: Robustness Checks

B.1 Labor Supply

Discrete choice models are very general as they impose minimum constraints on preferences and allow accounting for complete tax-benefit policies affecting household budgets. We nonetheless check whether our estimates are sensitive to several crucial aspects of the model specification. We focus on the own-wage and income elasticities of total hours and participation. Starting from our baseline specification, i.e., a 7-choice model with quadratic utility and fixed costs, we firstly check whether the way the choice set is discretized plays some role. An alternative model with $J = 4$ choices essentially captures the commonly agreed durations of work: non-participation (0), part-time (20), full-time (40) and overtime (50 hours/week). A narrower discretization with 13 choices, from 0 to 60 hours/week with a step of 5 hours, is more computationally demanding but may better capture country-specific hour distributions and, in fact, get closer to a continuous specification. Secondly, we check whether elasticities are sensitive to the functional form at use. Similar to van Soest et al. (2001) for the Netherlands, we experiment alternative specifications by increasing the order of the polynomial in the utility function: quadratic (baseline) then cubic and quartic. We also change the way flexibility is gained in the model by replacing fixed costs of work, as used in Blundell et al. (2000), by part-time dummies, precisely at the 10, 20 and 30 hour choices, as used in van Soest (1995). These parameters may be interpreted as job search costs for less common working hours (van Soest and Das, 2001), and hence include some of the labor market restriction on the choice set. Results show that elasticity estimates are very stable across model specifications, giving confidence in the results and conveying that the size of elasticities is not driven by methodological choices (detailed tables of result available from the authors; see also Bargain et al., 2011, for a detailed exposition).

B.2 Inverse Optimal Tax Problem

The inverted optimal tax characterization suggested in the present study has relied on some assumptions concerning income group definition and the treatment of UB in particular. We suggest here a robustness check on these two issues.

The Treatment of Replacement Incomes. In our baseline, contributory benefits, essentially UB, were treated as a replacement income derived from a pure insurance mechanism.[25] In some countries, however, unemployment insurance payments are detached from contributions and hence can be interpreted as a form of redistribution. We suggest here a variant that takes an alternative and slightly longer-term perspective by treating all non-workers as if they had exhausted their rights to social security (this may indeed take several months or years, as indicated in Tables A.6, A.7 and A.8). That is, UB are set to zero for job seekers, and they receive

[25] In their baseline, Immervoll et al. (2007) assign UB recipients to group 0, i.e., treat UB as pure redistribution, but recognize that this is a relatively conservative approach. Alternatively, they replace UB by social assistance for job seekers in group 0, which is the same variant presented here. More generally, note that the differences in the extent of social security programs among developed countries, along with the substitution between public and private insurance, have driven the literature to limit redistributive analyses to non-contributive social benefits and taxes.

(simulated) social assistance, when available. The size of group 0 is then necessarily larger in this scenario. Results are presented in the left panel of Figure B.1. Some countries like Denmark appear to favor redistribution slightly less in this case, but the international ranking is broadly preserved. It is reassuring that previous interpretations of our results survive this alternative, reasonable treatment.

Income Groups. The definition of the $I+1$ groups in Saez' model necessarily bears some arbitrariness in the way the population is partitioned. Firstly, we have opted for a small number of income groups ($I+1=6$) to ease comparisons across countries. We check results obtained with $I=11$ groups (10 groups of workers and the unemployed). While some "noise" indeed appears in a few cases, the main results of the paper are preserved (detailed graphs available from the authors). Arguably, opting for a larger number of groups would lead to too small group size for a meaningful interpretation of the optimal tax model (in this case, Paretianity may be violated if group $i=1$ is small enough to capture the few "statically irrational" households who face 100% EMTR in some countries). Secondly, the choice of cut-off points might be critical when trying to make group definitions comparable across countries. By construction, group 0 (workless poor) is identified as the population with zero market income. In our baseline the other groups were simply income quintiles among the workers. We suggest an alternative group definition that places particular focus on the crucial role of group 1 (the working poor) and the tension occurring in the optimal tax model between this group, group 0 and the tax payers ($i>1$).[26] We find that results are mostly insensitive to income group definition (cf. the right panel of Figure B.1). We explain this as follows: (i) with reasonable definitions of group 1, we always capture, to some extent, the gap between groups 0 and 1&2; (ii) the rest of the social welfare weight distribution is relatively flat, so that alternative definitions of higher income groups have little impact.

[26] Since "working poor" is a ill-defined concept, and rather than fixing an arbitrary poverty line, we suggest simply taking $(1+x)$ times the minimum wage (full-time equivalent income) as the income upper bound for that group. This can be used to adopt institutional definitions of working poverty (e.g., , individualized earned income tax credits targeted at the working poor in the early 2000s in France and Belgium relied on such a definition with $x=30\%$, which we adopt here). We use official or implicit national minimum wages as reported by the OECD (Immervoll, 2007). Groups 2 to 5 are then defined in proportion of the median income in order to account consistently for the income distributions of each country. Group 2 is upper bound by the median income, group 3 by 1.5 times the median income and group 4 by twice the median.

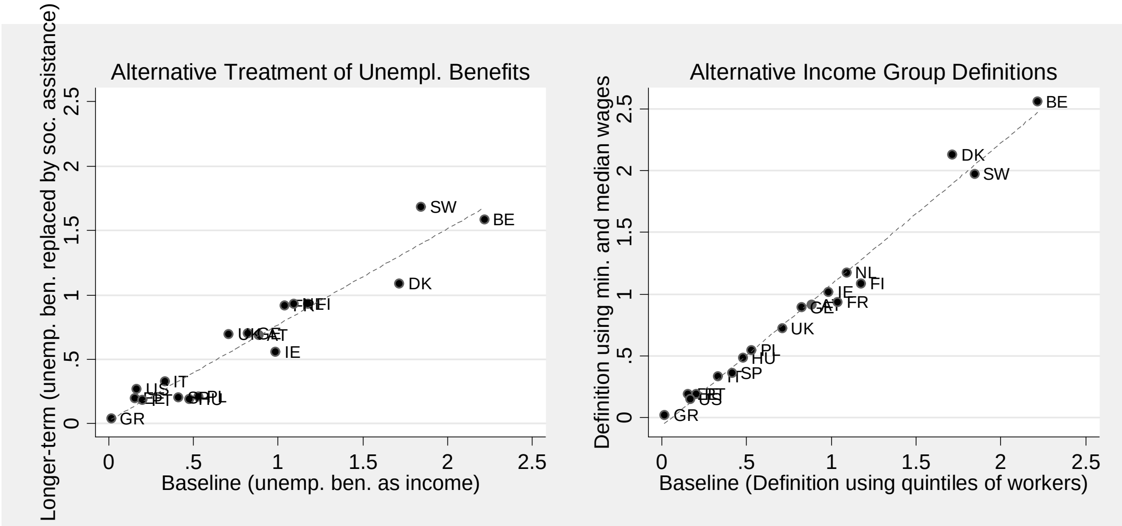


Figure B.1: Revealed Social Inequality Aversion: Robustness Checks