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ABSTRACT

Tax-Benefit Revealed Redistributive Preferences Over Time: Ireland 1987-2005*

By inverting Saez (2002)'s model of optimal income taxation, we characterize the redistributive preferences of the Irish government between 1987 and 2005. The (marginal) social welfare function revealed by this approach is consistently comparable over time and show great stability despite profound changes in market incomes and important fiscal reforms over the period. Results are robust to numerous checks regarding data, income concepts and elasticities. A comparison with the UK shows marked differences reflecting the narrow political spectrum in Ireland compared to radical changes in British politics over the past 30 years. Some "anomalies" in the revealed social welfare function suggests introducing transfers to the working poor.

JEL Classification: C63, C81, D31, D63, H11, H21, H23, H31

Keywords: social preferences, optimal taxation, labour supply

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1 Introduction

Following the seminal contributions of Mirrlees (1971) and various others, the normative literature on optimal taxation has remained mostly theoretical for many years. The main reason was the absence of reliable information on the ‘true’ distribution of individual abilities. More recently, the use of representative microdata has filled the gap and allowed implementing optimal tax models to question the optimality of actual tax-benefit systems.¹ In addition to the distribution of abilities, there are two fundamental primitives to such empirical applications which are related to efficiency and equity concerns respectively. One is the incentive compatibility constraint faced by government, which is often summarized by the elasticity of labour supply (even though other margins may matter). The other is the social aversion to inequality of a given population/government or more generally the degree of curvature of the social welfare function. While the former object can in principle be retrieved from econometric estimations, the latter, a representation of social preferences, is a fundamental characteristic of a country at a certain point in time and can become itself the subject of investigation.

More specifically, given a country’s characteristics (wage distribution) and assumption concerning elasticities, it is in principle possible to derive the optimal tax schedule for different assumptions about social preferences, and to identify the level of inequality aversion for which optimal and actual tax schedules coincide.² Interestingly, it is possible to follow a somewhat dual approach. That is, the optimal tax model can be inverted on actual effective tax rates to recover the implicit social welfare function that makes the observed system optimal.³ This approach was first suggested in the context of optimal commodity taxation (Stern, 1977, Christiansen and Jansen, 1978, Ahmad and Stern, 1984, Decoster and Schokkaert, 1989, Madden, 1996) or the regulation of utilities (Ross, 1984). It has been applied to optimal income taxation by Bourguignon and Spadaro (2007) using Mirrlees’ model and data for France. Their initial objective was to charac-

¹Of particular interest were the conditions under which confiscatory levels of implicit taxation could be justified at the bottom of the distribution, or, inversely, how new program of income maintenance, like the Earned Income Tax Credit (EITC) in the US, could be grounded on the basis of optimal tax formulas (see the discussions in Saez, 2002, and Choné and Laroque, 2005, among others). Also, an exciting attempt to characterize the complete optimal tax schedule by numerical simulation is made by Aarberge and Columbino (2008).

²This way, Laroque (2004) shows that an optimal schedule derived from rawlsian preferences is close to the actual schedule in France and concludes about the relatively rawlsian nature of social preferences in this country.

³By *effective* marginal tax rate, we understand the implicit tax on a marginal increment of income, which accounts for the payment of income taxes and social contribution but also for the withdrawal of means-tested benefits as earnings increase.

terize the properties of the implicit, tax-revealed social welfare function. Since Mirrlees' model accounts only for behavioural response at the intensive margin, Saez (2002) has suggested a model incorporating both intensive and extensive margins at the cost of some simplification, notably the discretization of the population into income groups. With this setting, the inversion procedure can be easily applied to retrieve the set of social welfare weights that rationalizes the existing tax-benefit system. Recently it has been adopted for international comparisons of welfare regimes (for instance in Blundell et al., 2008).

Equally interesting, it may be applied to characterize the redistributive preferences of a given country over time. This is the purpose of the present paper. We question whether the (marginal) social welfare function revealed by this approach is consistently comparable over time or reflects changes in political forces. We focus on Ireland 1987-2005, a place and time where radical changes affected both market incomes and tax-benefit policies. We implement the inversion of Saez' model for four years spanning this period and focus on single individuals. Another contribution of the present study is to retrieve the labour supply elasticities consistent with the data at use. While most studies postulate reasonable values for elasticities (for instance Saez, 2002, Bourguignon and Spadaro, 2007, Immervoll et al. 2007), we use a discrete choice model to estimate labour supply behaviour and predict elasticities for each period and each income group.⁴

Results show a great stability in the tax-benefit revealed redistributive preferences of the Irish government, despite a rapidly changing economic environment and radical fiscal reforms.⁵ This result is consistent with a narrow political spectrum and a relatively consensual society which guarantee certain continuity in political views. Under these circumstances, the redistribution function based on the inverted optimal tax problem may capture relatively well the nation's true social preferences rather than the views of the party in power. We suggest two extensions. Firstly, we focus on the working poor. Results point to significant changes in relative preferences for this group but overall, the social welfare weight received by this group is particularly low. As a result, the marginal social welfare function is not monotonically decreasing. We show that the correction of such "anomaly" justifies a transfer to the working poor that could be obtained by a simple extension of the existing scheme (the Family Income Supplement). Secondly, we provide similar characterization of redistributive preferences for the UK. This shows

⁴The link between optimal tax literature and the labour supply literature is nicely reviewed by Røed and Strøm (2002).

⁵Starting from a situation with a high tax burden in 1987, important and continuous tax cuts have been carried out through increased tax bands and decreased tax rates. A policy of declining social contribution rates has also been pursued. Social benefits have been considerably raised in real terms at the beginning and the end of the period.

marked differences between the two countries, despite close cultural links. In contrast to stable preferences in Ireland, large variations over time reflect the radical changes in British politics under the Thatcher government and again under New Labour.

Section 2 presents the optimal tax model. Section 3 describes the empirical implementation: the inversion procedure, sample selection, income concepts, the definition of income groups and estimated labour supply elasticities. Section 4 presents the Irish tax-benefit system, its evolution since 1987 and the main results, i.e., the interpretation of time variations in fiscal policies over time in the light of changes in the social welfare weights placed on the different income groups. Section 5 reports the extensions including paths to reform and a comparison with the UK. Section 6 concludes.

2 The Optimal Tax Model

The starting point of Saez (2002) is the standard optimal income tax model. A Paretian government is assumed to maximize a social welfare function subject to an efficiency constraint and a national budget constraint. The social welfare 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 to utilitarian preferences. Actual productivities are not observed so that the government can only rely on second-best taxation based on incomes. The efficiency constraint states that agents modify their labour supply, and hence their taxable income, in response to the level of effective taxation. Responses operate both at the extensive margin (participation decisions) and the intensive margin (hours of work). In particular, high implicit taxes on the most (least) productive ones may reduce their effort (participation) thereby reducing the tax base. Only the intensive margin is considered in the original model of Mirrlees (1971) while empirical evidence points toward an important effect of participation decisions (see Heckman, 1993).

Based on this model, Saez (2002) aggregates individuals into $I + 1$ discrete groups comprising I groups of individuals who do work, ranked by increasing gross income levels Y_i ($i = 1, \dots, I$), and a group consisting of those who do not work (group $i = 0$). One implicit assumption in the model is that the property of agent monotonicity (Spence-Mirrlees condition) is verified. In the present framework, it means that types 0 to I are ranked according to productivity levels so that Y_i increases with i . The proportion h_i measures the share of group i in the population. To each level of market income Y_i corresponds a level of consumption (disposable income) $C_i = Y_i - T_i$, where T_i is the

effective tax paid by group i . Non-workers receive a transfer $-T_0$ identical to C_0 by definition. Saez (2002) shows that optimal taxation has the following form:

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

The left-hand side is the extra tax paid when moving from group $i-1$ to group i , divided by the gain in disposable income. In this expression, the information about social preferences is summarized by g_i , the weight assigned by the government to group i . This weight mingles the ‘pure’ social weight (the derivative of the implicit social welfare function integrated over all the workers within this group) and the individuals’ marginal utility of income. However, as argued by Saez (2002), it is preferably the object of our attention because of its useful interpretation. Indeed it represents the (per capita) marginal social welfare of transferring one euro to an individual in group i , expressed in terms of public funds.

The efficiency constraint is explicitly accounted for by the presence of two elasticities. Individuals choose whether or not to participate (extensive margin) and which group to choose (intensive margin). The intensive (or mobility) elasticity, ζ_i , and the extensive (participation) elasticity, η_i , are defined as:

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

$$\eta_i = \frac{C_i - C_0}{h_i} \frac{\partial h_i}{\partial (C_i - C_0)}; \quad (3)$$

The *mobility elasticity* ζ_i 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 labour supply to the neighbouring choice. This elasticity is different from the traditional wage-elasticity of worked hours which is defined as the increase in working time when wages increase by 1%. The *participation elasticity* η_i 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%.

Income effects are traditionally ignored in theoretical models of income taxation (often based on quasi-linear preferences). When income effects are ruled out, an additional constraint emerges from Saez (2002)’s model that normalizes weights as follows:⁶

$$\sum_i h_i g_i = 1. \quad (4)$$

⁶Including them substantially complicates the analysis (see Saez, 2002, Bourguignon and Spadaro, 2007), and the special benchmark case presented here can therefore be seen as an acceptable approximation.

Empirical evidence generally supports this assumption (see Blundell and MaCurdy, 1999). We also find very small income effects in our labour supply estimations and hence impose this normalizing restriction which turns out to be useful for the inversion of the model, as explained below.

3 Empirical Implementation

3.1 Retrieving the Social Welfare Weights

We aim to invert the model to recover the (marginal) social welfare weights g_i and , therefore, some information on the shape of the social welfare function (see Bourguignon and Spadaro, 2007, for the original suggestion of this inversion procedure, initially in a Mirrlees framework). While it is customary to compare fiscal systems in terms of effective average and marginal tax rates, degree of progressivity or degree of redistribution (e.g., change in Gini due to the impact of tax-benefit systems), this approach additionally accounts for the efficiency constraint faced by the government. For instance, low transfer to the workless poor may be due to large participation elasticities rather than to low taste for redistribution. Hence, this approach offers an original way of characterizing tax-benefit systems and interpreting the usual available information directly in terms of social welfare language / implicit redistributive preferences.

Using expression (1), it is straightforward to obtain:

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

for the last group and

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

for groups $i = 1, \dots, I - 1$, which allows us to derive recursively the weights g_I to g_1 using observed incomes Y_i , net taxes T_i and disposable incomes C_i . Finally, the weight g_0 for the inactive group is obtained using normalization (4).

3.2 Selection

The data at use are described in the Appendix – our main results are based on the Household Budget Surveys 1987, 1994, 1999 and 2005. We select potential salary workers in the age range 18 – 64 (i.e., exclude pensioners, student, farmers and self-employed).⁷

⁷The share of profit versus wages is not observed and disposable income of self-employed are typically under-reported.

To keep up with the logic of the optimal tax model, we exclude all households where capital income represents more than 25% of total gross income.

The treatment of the family composition in the optimal tax framework is a difficult task. The (unsatisfactory) solution adopted in almost all applications is to focus on one homogenous demographic group at a time, implicitly assuming some separability between intra- and inter-group redistribution.⁸ Most applications focus on one-adult households, either single individuals or single mothers (for instance in Blundell et al., 2008). Very few applications consider couples since it is not clear which labour supply elasticity should be used (that of the first earner, of the second earner, a mixture, etc.) – to our knowledge, only Haan and Navarro (2008) have tried to extent the present procedure to the case of couples using a collective model.⁹

We follow the same path as previous studies and focus on single men and women without children.¹⁰ While this restricts considerably the scope of the analysis, we still capture the intentions of the planner in terms of vertical equity when looking at singles. In other words, the extent to which rich singles are taxed (or poor single are compensated by transfers) informs us about social preferences in the country. Note that there is no particular reason to differentiate our analysis between men and women since there is no gender-specific tax/benefit treatment. Yet we account for gender differences in the labour supply estimation. Differences in terms of labour supply elasticities are not significant.

3.3 Income Groups and Income Concepts

The definition of the $I + 1$ groups in Saez' model necessarily bears some arbitrariness in the way the population is partitioned. This fact is hardly discussed in the literature (Saez, 2002, Blundell et al., 2008, Bourguignon and Spadaro, 2007). Since we aim to compare social welfare weights in different years, the problem becomes more acute and apparent in our context. We first opt for a small number of income groups ($I + 1 = 6$) which helps to

⁸Aggregating different demographic groups in the same social welfare function poses fundamental difficulties in terms of welfare comparisons and choices of equivalence scales. In particular, the chosen equivalence scale should be that of the social planner herself and not "imposed from outside". One could consider inverting the optimal tax model with demographic heterogeneity in order to retrieve the implicit equivalence scale of the tax-benefit system, as suggested by Muellbauer and van de Ven (2003). However, retrieving both social welfare weights and equivalence scales at the same time sounds challenging.

⁹The simplification used by Bourguignon and Spadaro (2007) in the framework of the Mirrlees model is to treat multi-adult households as one entity with an "average" productivity and a common "effort" supply (and hence a common elasticity). With less restrictive household representations and estimated elasticities, the question of how to treat couples however remain. Immervoll et al. (2006) choose to include all working-age individuals but ignore the joint decision process for those in couples.

¹⁰Sample sizes are too small to consider single mothers – a possible reflection of the fact that divorce was legalized recently in Ireland (the first divorces occurred in 1997).

achieve meaningful comparisons over time (or across countries). By construction, group 0 is identified as the population with zero market income in the model (the ‘idle poor’). We then suggest a baseline where the 5 other groups are simply quintiles of the (nonzero) gross income distribution. In addition, we suggest a robustness check in the Appendix where alternative definitions are used – it reveals that the main results are not very sensitive to the choice among reasonable partitioning.¹¹

The descriptive statistics are reported in Table 1. Since the population is relatively homogenous, we focus on the main ingredients of the model in this table, including the levels of gross income Y and disposable income C per group and the group sizes. Since our analysis focuses on the redistributive function of the government, the nature of the net tax $T = Y - C$ deserves further explanations. It consists essentially of the main income tax and payment of social contributions (PRSI) minus the benefits received by single individuals (Jobseekers Benefit/Allowance, Rent Allowance Supplement, Supplementary welfare allowance). We discuss the Irish tax-benefit system more in detail in the Appendix and summarize its main elements in Table 2.

Several comments can be made. Firstly, in Ireland (and the UK), the link between the cost of contributions and the value of social insurance benefits is not so strong, so that it seems reasonable to treat contributory benefits (and social security contributions) as part of the state’s redistribution function. Also, rates of payment for social insurance benefits have moved very closely in line with those for social assistance benefits. However, further research should also consider alternative definitions of the income concepts used in the present approach. In particular, it is an open question as to what constitutes a publicly provided social insurance based benefit or a state transfer (see Rochet, 1996, or Borsch-Supan and Reil-Held, 2001, on the redistributive effects of health insurance and pension contributions).¹² Secondly, Table 1 shows the very rapid progression of labour income levels over time and especially during the core of the "Celtic Tiger" economic boom (second half of the 1990s). At the same time, we observe a decrease in the size of group 0 also due to better economic conditions. Lastly, the difference between out-of-work

¹¹Note that the mobility elasticity is dependent on how many groups there are (more groups make it easier to move and hence the elasticity is larger). Yet note that in the optimal tax formula, the mobility elasticity is weighted by the group size. If there are more groups, then mobility elasticities are larger but some people move only “within the broader groups”. Also, we have tried alternative inversions with 11 rather than 6 groups and results are not fundamentally different.

¹²In some countries, public pensions and unemployment benefits are closely linked to workers’ past earnings through social security contributions when active, and hence can be interpreted as delayed salaries and more akin to private insurance (see the discussions in Bargain and Callan, 2008, Bourguignon, 1999).

and in-work incomes is small for group 1. This is due to the fact that working poor are excluded from any form of redistribution. Indeed they do not receive social transfers, which are tapered away at a high rate, and in-work transfers do not exist for childless singles. This can be seen in Table 1 where we calculate effective "marginal" tax rates $(T_i - T_{i-1})/(Y_i - Y_{i-1})$. Those are as high as 79% on group 1 (working poor) in 1994. This will have important consequences on our results.

Table 1: Description of the Discretized Population of Single Individuals

Income Groups	1987	1994	1999	2005
<i>Cut-off points (gross income)</i>				
1	138	149	252	387
2	203	249	392	580
3	269	375	554	780
4	395	513	732	1,114
<i>Gross income Y_i (note: $Y_0 = 0$)</i>				
1	77	81	158	257
2	177	207	328	486
3	233	302	468	680
4	326	439	634	917
5	553	704	978	1581
<i>Disposable income C_i</i>				
0	55	79	105	157
1	82	96	168	275
2	144	184	270	427
3	178	236	368	548
4	228	313	462	711
5	359	471	685	1148
<i>Effective "Marginal" Tax Rate</i>				
1	64%	79%	60%	54%
2	38%	30%	40%	34%
3	40%	45%	30%	37%
4	45%	44%	44%	32%
5	42%	40%	35%	34%
<i>Group size h_i (in %)</i>				
0	0.31	0.25	0.19	0.12
1	0.14	0.15	0.16	0.18
2	0.14	0.15	0.16	0.18
3	0.14	0.15	0.16	0.18
4	0.14	0.15	0.16	0.18
5	0.14	0.15	0.16	0.18

Notes: Group 0 = non-participants. Other groups: income quintiles among participants. All incomes in Euro per week

3.4 Labour Supply Elasticities

Labour supply estimation and the method used to predict elasticities are described in the Appendix. We have calculated "standard" income and wage elasticities to provide a comparison with the empirical literature, as well as the specific elasticities ζ_i and η_i used in the optimal tax model and defined in expressions (2) and (3). Results go as follows.

We find very small income elasticities, around -0.02 , which are not significantly different from zero. Traditional wage elasticities of hours and participation are in line with the empirical literature (see Blundell and MaCurdy, 1999), around 0.35 in the 1990s and significantly smaller in 2005 (around 0.10). This decline is consistent with increased labour force participation over time (this trend is documented by Heim, 2007, for the US). Specific results for Ireland exist in the literature but usually focus on couples. It is nonetheless worth reporting these results for married men since their elasticities are usually not very different from those of single individuals. This is indeed the case in these Irish studies: 0.15 (Callan and van Soest, 1996), 0.25 (Callan et al., 2009) and 0.11 (Bargain and Doorley, 2009) using data for years 1987, 1995 and 2000 respectively.

For the year 2005, we find *Saez' participation elasticities* around 0.20 in low-income groups and 0.12 in high income groups. This is relatively comparable to Blundell et al. (2008), who report a range of 0.08 – 0.28 (0.08 – 0.18) for the UK (Germany), even if these authors focus on single mothers, a group with traditionally lower participation rates and larger elasticities. Nevertheless, these are very moderate elasticities which are in line with the above evidence on the size of more conventional measures of labour supply responsiveness. For previous years, we find larger elasticities, from 0.5 – 0.6 in groups 1 and 2 down to 0.4 for higher income groups, which is in line with the time trend discussed above. By definition, *mobility elasticities* are identical to participation elasticities for group 1. We find moderate sizes for higher income groups, from 0.3 for group 2 to 0.1 higher up in the income distribution in the 1990s and smaller in 2005.

Note that the optimal tax rule in (1) depends heavily on whether labour supply responses are concentrated at the intensive or extensive margin. When the extensive elasticity is assumed to be zero, the model boils down to a discrete version of Mirrlees' model and gives identical results. In particular, negative marginal tax rates resulting from in-work transfers (like the EITC in the US) are never optimal since they discourage productive workers at the intensive margin. However, the larger the extensive elasticity, the more likely are optimal schedule featuring smaller guaranteed income for non-workers and larger in-work support, with possibly negative marginal taxes at low income levels (see Saez, 2002, Choné and Laroque, 2005). Present results, as in Blundell et al. (2008),

point to larger responses at the extensive margin. As a matter of fact, Ireland and the UK operate in-work transfers to the working poor, in the form of the Family Income Supplement and the Working Tax Credit respectively, but not for single individuals (only starting 2003 in the UK). We discuss this point more extensively below and suggest paths to reform.

4 Tax-Benefit Revealed Social Preferences

4.1 Political and Economic Context

Since our objective is to interpret the tax-benefit developments in light of the redistributive intentions of the government, it is good to first recall the economic and political context of the period under investigation. In terms of politics, Ireland has been characterised by relative stability over the period of our analysis: Fianna Fail has been in power either alone or through coalitions since its return to government in 1987 except for the period December 1994-June 1997 when a coalition including the second largest party, Fine Gael, along with Labour and the Democratic Left were in power. More generally, the political spectrum in Ireland is relatively narrow: the two main parties, Fianna Fail and Fine Gael, represent the vast majority of the electorate and both lie towards the centre of the political spectrum. This political context thus conveys that the social preferences exhibited in our results are not due to individual party preferences but a fair representation of "average" redistributive preferences in the nation. As will be shown, the British context is radically different.

The Irish economy over the period under investigation has experienced rapid and important changes. The difficult economic situation of the 1980s was characterized by high public debt and high unemployment. The Fine Gael government managed to stabilise the public finances but did not succeed in curbing unemployment which reached 17% by 1987. Nonetheless, public finance stabilisation meant that at its return to power, Fianna Fail had more flexibility with regard to fiscal policy. The second half of the 1990s has been characterized by an unprecedented period of economic growth (average annual growth rate of 6.5%), the "Celtic tiger" era, and a sharp decline in unemployment that had already started in the early 1990s (from nearly 17 % in 1987 down to 14 % in 1994 and just above 4% over the first half of the 2000s).

4.2 Tax-Benefit Policy Changes over 1987-2005

With this context in mind, we can interpret the tax-benefit policy developments since 1987. The main changes in tax and benefit parameters are reported in Table 2 in the Appendix, with all monetary figures in real terms (2005 Euros). As suggested above, policy changes reflect more the spirit of the time and a pragmatic management of economic circumstances than any radical political change. Crucially, 1987 saw the beginning of a “social partnership” process, with centralised bargaining between unions, employers and government on pay and on wider policy issues such as tax and welfare. In return for relatively modest wage increases the government committed itself to relaxing spending cuts (thus increasing public sector employment), taking actions to increase private sector employment and reforming the tax system (Programme for National Recovery, 1987).¹³ While taxes had remained high in the 1980s, the result of this agreement was the abolition of the top marginal tax rate (58%) and a reduction in the standard tax rate (from 35% to 27%) by 1994. While tax thresholds were relatively low by today’s standard, we observe a substantial increase after 1994. The 1987-1994 period was also characterized by substantial increases in certain social welfare rates.¹⁴ Hence the 1987-1994 period seems characterized by substantial redistribution towards the lower and upper end of the income distribution via increases in social welfare rates and tax cuts (see Callan and Nolan, 1999).

The aforementioned social partnership compromise carried on in the following periods with a widening of the tax bands and continuous reductions in income tax rates and social insurance rates. As reported in Table 2, the standard tax rate declined from 27 to 20% and the higher tax rate from 48% to 42% over 1994-2005. On the benefit side, however, social welfare rates stagnated in real terms between 1994 and 1999. As a result, several studies show that the middle and upper end of the income distribution progressed more rapidly than the poorest over the period (Nolan et al., 2000, ch. 10, Nolan and Maitre, 2000). In fact, while inequality decreased during this time thanks to the dramatic change in the Irish economy and in particular the fall in unemployment – see Gini coefficients in Table 2 – the contribution of policy changes was to increase inequality (Bargain and Callan, 2008).

During the 2000-2005 period, the positive economic situation and declining unemployment rates meant that tax cuts could continue while a large increase in Unemployment

¹³Note that the fact that wage rates may depend on tax rates is not accounted for in the optimal tax model.

¹⁴This was initiated by the harmonisation of benefit rates in response to recommendations by the Commission on Social Welfare (1986). In particular a substantial increase in unemployment benefit and unemployment allowance occurred (29% increase in real terms) – these benefits had been left below benefit average in the past and caught up particularly on old age state pensions.

Benefit was more easily affordable – we report a 15% increase in real terms in Table 2. Redistributive intentions were already announced in the National Anti-Poverty Strategy (NAPS), with a set of measures to ensure that "that the impact of very rapid economic, social and demographic change reduces social inequalities and social polarisation. . . .(and) that the benefits of social economic management and growth are distributed fairly" (Combat Poverty Agency, 2001).

4.3 Characterizing Social Preferences

Overall, it seems that the Irish government has achieved important fiscal reforms over the period under study. Yet, since the period has been characterized by important changes in market income, it is a priori difficult to know if the government has favoured some income groups in this redistribution process or has simply ensured that the rising tide indeed lifted all the boats. The results of the inverted optimal tax approach should shed some new light on this question.

We first present the social welfare weights as derived from the above methodology and using average estimated elasticities over all periods (Figure 1). The pattern of (marginal) social welfare weights derived from this exercise displays reasonable properties. A necessary condition for the implicit social welfare function to be Paretian, i.e., non-decreasing at all productivity levels, is that weights be positive. We find that it is the case here, even if weights on working poor are very small. The pattern is also consistent with some social aversion to inequality, with the largest social weight placed on the poorest (group 0). This naturally translates the effect of transfers at the bottom and the progressivity of the tax system for higher incomes. Yet the marginal social welfare function is not monotonically decreasing with income groups (i.e., the social welfare function is not concave at all income levels). It is relatively flat for the top 3 groups, reflecting little taste for redistribution among the richest, and shows a pronounced dip for group 1 (and to some extent for group 2), which is due to very high implicit marginal tax rates on the working poor and rationalized in the optimal tax model by small social welfare weights. It is all the more so as participation elasticities are high – in that case, the efficiency cost of maintaining generous transfers to the workless poor but no in-work transfers to the working poor is necessarily higher and can only be justified in the model by placing relatively high weights on the former and small weights on the latter.¹⁵ A "correction"

¹⁵This result is not specific to Ireland but a common feature to many European countries with means-tested transfers to the workless poor. Because of means-testing benefits at the bottom of the skill distribution and progressive taxation at the top, a U-shaped distribution of effective marginal tax rates is often encountered in industrialized countries. Many authors have tried to justify this profile by means

of the social welfare function can be naturally suggested and takes the form of in-work support for (childless) single individuals – see next section.

Replicating the procedure for different years allows us to characterize time variations in tax-benefit revealed social preferences. The striking result in Figure 1 is that despite important tax-benefit reforms and rapid economic changes that occurred over the period, the marginal social welfare function looks very stable over time. While the differences in levels observed for groups 2-5 over time seem marginal, the only significant change that we can witness concerns groups 0 and 1 (see confidence interval analysis in the Appendix). The absolute weight on group 0 in Figure 1 reflects the strong increase in real terms of social benefits between 1987 and 1994 and between 1999 and 2005 (and real-term stagnation over 1994-1999). Group 1 is not concerned by the redistributive policy at the two extremes of the distribution occurring between 1987 and 1994 (tax cuts at the top and increase in unemployment benefits for the non-participants), which explains the significant drop in its social welfare weight in 1994. This is partly corrected in the following years since the working poor benefit from an extension of the tax-free bracket (its upper threshold increases by 30% in real terms between 1994 and 2000) and become exempt from social contribution (the upper limit for PRSI exemption increases from EUR 128 to 378 in real terms between 1994 and 2000), as described in Table 2.

Naturally, some of these results can be affected if we account for the changes in elasticities. In fact, average elasticities used in Figure 1 are very close to the estimated values for years 1994 and 1999. Yet variations in elasticities for 1987 and 2005 affect the results for these two years, as can be seen in Figure 2. Slightly larger elasticities in 1987 lead to a higher weight on group 0 (and lower weights on other groups) since redistribution is more costly in efficiency terms. Differences are very small nonetheless. For year 2005, much smaller elasticities and hence lower efficiency costs of the redistributive system in force that year means that weights on the workless poor must be lower than previously found (and weights higher up in the distribution larger). This way, the boost in transfers occurring in the 2000s and commented above does not denote a change in redistributive tastes but simply the fact that redistributing became easier as the efficiency constrained is relaxed.

Note that the elasticities used here are consistent with the data – which we (and Blundell et al., 2008) have motivated as a contribution of our work compared to posited

of an optimal tax framework (see Diamond, 1998, Saez, 2001, for the US, Piketty, 1997, Bourguignon and Spadaro, 2000, Choné and Laroque, 2005, for France, among others). Yet the social welfare function that could justify such profile, given that responses are mainly at the extensive margin, exhibits irregularities such as the one described here.

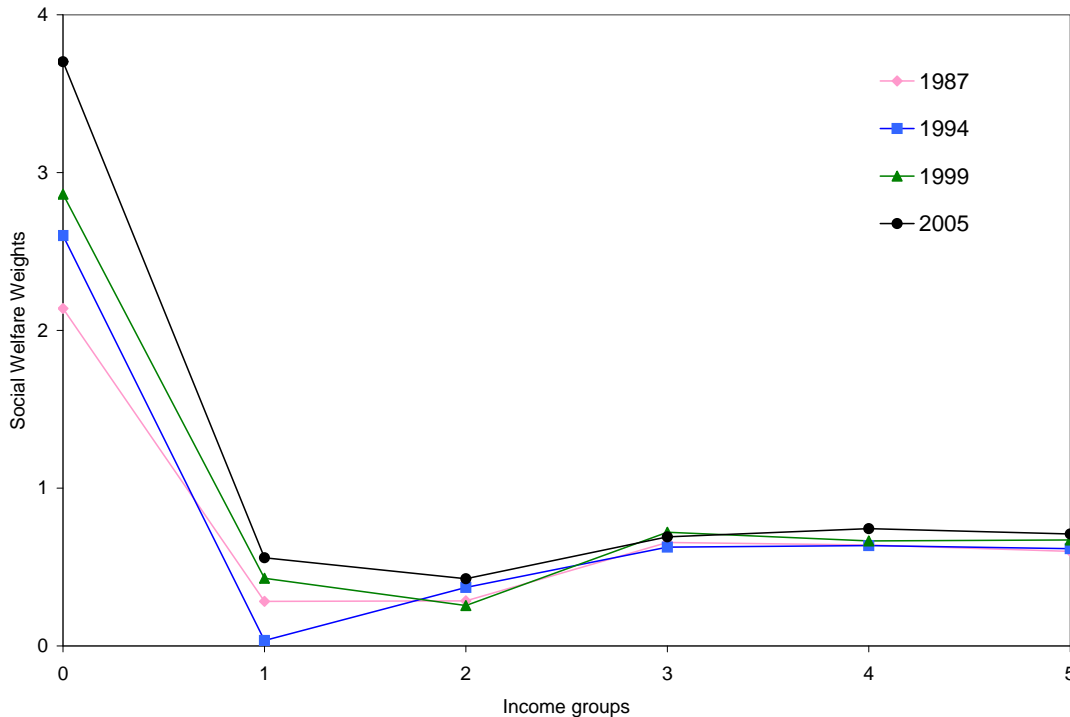


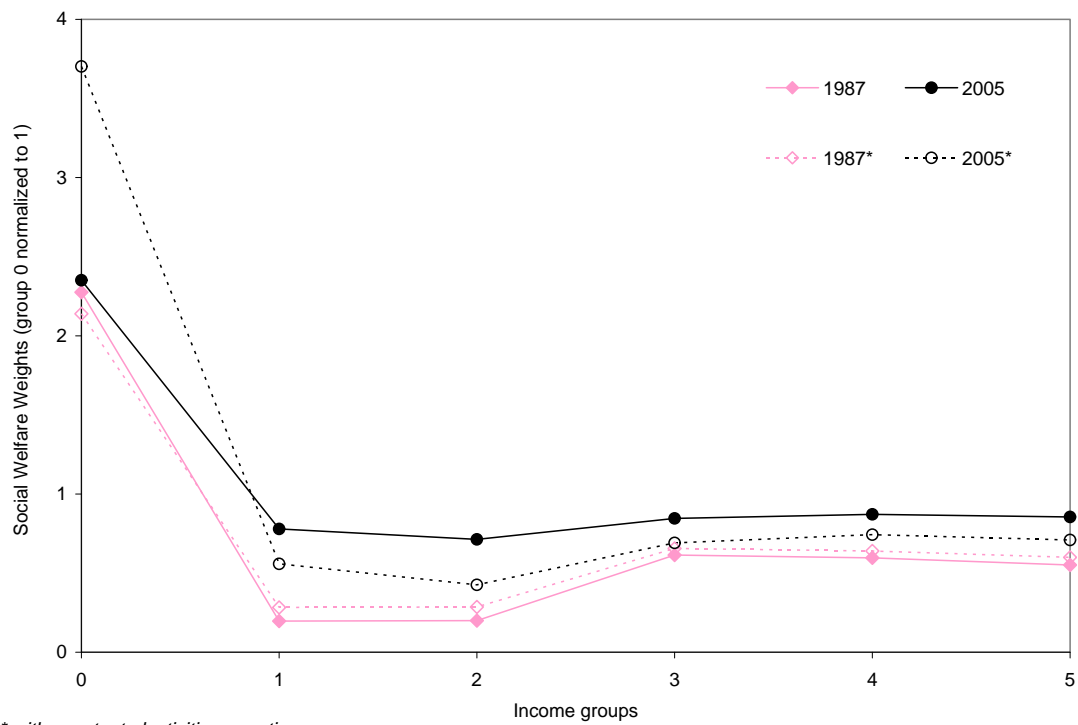
Figure 1: Social Welfare Weights, Baseline (HBS, Cutoffs based on quintiles)

or calibrated elasticities in the past literature. Yet, nothing guarantees that they coincide with the representation of the efficiency constraint that Irish policy makers have. Even if they did, we only account for labour supply responses while other margins affecting the tax base exist (work effort, tax evasion, etc., see Feldstein, 1995, or Goolsbee, 2000, among others). In this situation, suggesting a sensitivity analysis based on high/low elasticity scenarios remains a sensible option. In the robustness analysis presented in the Appendix, we essentially suggest using the bounds of the estimated 95% confidence interval to check the sensitivity of our results to elasticity size.

5 Extensions

5.1 Reshaping the Irish Fiscal System

The previous characterization of the changes in tax-benefit policies shows that the high implicit taxation of the working poor has been reduced over time – with a notable increase in the corresponding social welfare weight. Yet that weight remains smaller than for most groups. In Figure 3, we suggest a simple "correction" of the marginal social welfare function. The objective is to increase the weight on groups 1 and 2 and to make the marginal



* with constant elasticities over time

Figure 2: Social Welfare Weights, Year-specific Elasticities (HBS, Cutoffs based on quintiles)

social welfare function monotonically decreasing all along. In addition, we impose meaningful constraints, namely revenue neutrality and the fact that transfers to group 0 cannot be reduced. After some experimentation, we have found that these constraints – and the fact that social welfare weights are interdependent – considerably reduce the number of solutions to this problem. The solution we have reached numerically is not unique but other reforms would depart only very marginally from this one. The result is represented in the left panel of Figure 3.

The corresponding reform is achieved by a transfer to the working poor – of around EUR 60 per week for workers in group 1 – financed by a progressive increase in taxation for higher income levels. It results in an increase of disposable incomes of groups 1, 2 and 3 by 17%, 10% and 1% respectively, and a decrease in disposable incomes of groups 4 and 5 by 6% and 7% respectively. The impact of the reform on the budget constraints of single individuals is represented in the right panel of Figure 3. The hump generated by the reform for weekly gross incomes around EUR 250-500 (groups 1 and 2) is very similar to those obtained when simulating the hypothetical impact of the British working tax credit in Ireland or an extension of the existing in-work benefit, the Family Income Supplement, to childless households (see Bargain and Doorley, 2009). Thus a consistent adjustment of the Irish social welfare function would justify the implementation of such reforms. Note that many European systems are characterized by the same "anomaly" concerning the working poor – as a matter of fact, many of these countries have undertaken this type of reform by implementing individualized in-work transfers.¹⁶

5.2 An International Comparison

We have produced similar results for the UK using the Family Expenditure Survey – this data set allows us to cover a slightly larger period than for Ireland, i.e., to include the pre-Thatcher situation (see the data section in the Appendix). Elasticities are drawn from Bargain et al. (2010).

Institutions in the two countries share some similarities and many policies have been labelled in the same way at certain periods. For instance, the Family Income Supplement in force in Ireland was the old system of in-work transfer in the UK, before family tax credits were implemented. Yet the political context is radically different, with a broader

¹⁶This includes earned income tax credit in France and the Netherlands (see Stancanelli, 2008) and exemptions of social security contributions for low-wage earners in Belgium or Germany (see Steiner and Wrohlich, 2005). The generous tax credit in force in the UK has also been extended to childless households in 2003.

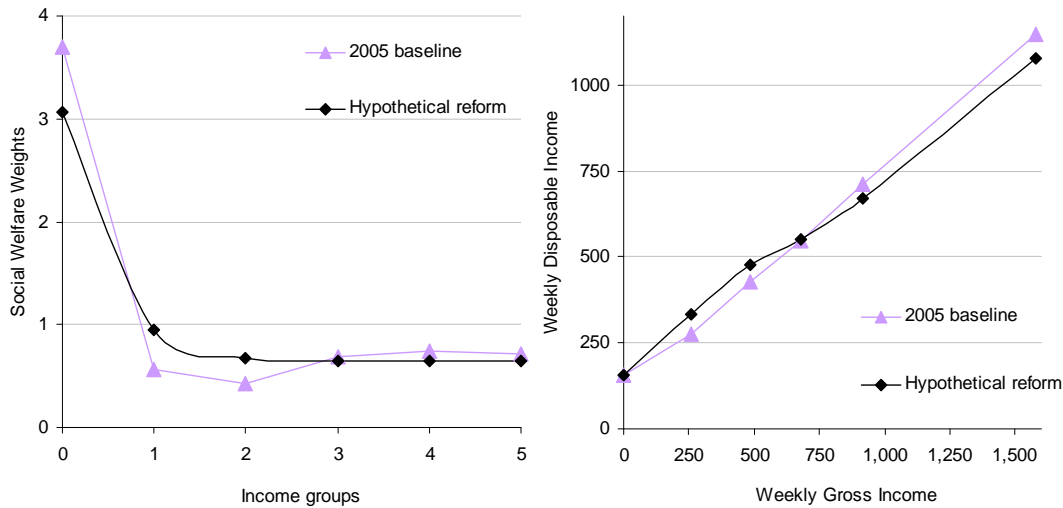


Figure 3: "Correcting" the Redistributive Function

political spectrum and marked ideological contrasts between the two largest parties, the Conservatives and the Labour party.¹⁷

The marginal social welfare function for the UK is represented in Figure 4. If we consider year 2005, the overall pattern is very similar to the Irish one, with highest weights on group 0 and a flat curve for the rest of the income distribution. The levels are also similar, with weights on higher income groups at about a third of that on group 0.

However, the time variation is striking. The situation in 1979, with extremely high marginal tax rates set by 'Old Labour', ties in with the extremely low weights placed on taxpayers in upper income groups – the most Rawlsian situation observed in our results. In the following period, the very important tax cuts implemented by the Thatcher government are particularly visible, with the extreme jump in the social weights on higher income groups.¹⁸ Finally, the patterns for 1999 and 2005 show modest variations compared to the Conservative era. At the time Labour believed that removing ambiguity with regards to taxation policy was crucial if Labour were to succeed in gaining power. The

¹⁷Labour were in power since 1974 then lost the 1979 election to the Conservatives. The 'New Right' era saw the application of the Thatcherism political ideology. Margaret Thatcher was Prime Minister for 11 years before losing the party leadership to John Major. Labour won the 1997 general election and Tony Blair took over as Prime Minister for 10 years.

¹⁸Under 'Old Labour' 11 tax rates existed of which the top tax rate was 83%. Upon the return to a Conservative government, the number of tax rates was reduced to 6 and top marginal tax rates were cut. A further consolidation occurred in 1988, creating a system with just two tax rates 25% and 40%, hence another radical tax cut.

top tax rate was not changes and in 1999, the basic rate of tax was halved to 10%.¹⁹ In effect, we see little change concerning top incomes. At the same time, New Labour developed an extensive redistributive policy but only part of it can be observed here – with some increases in the weights of group 0 – since we focus on single individuals (the 1999 extension of tax credits targeted to the working poor and the boost in income support affected mainly families with children and pensioners, cf. Riddell, 2008).

The comparison between Figures 1 and 4 is striking. Huge variations occurred in the UK as a result of changes in government. In contrast, we have observed very stable social preferences in Ireland, consistent with the relative political stability in this country and, more fundamentally, a broad social consensus (it is likely that more frequent changes of majority would have led to the same result). To characterize this contrast, we parameterize the marginal social welfare weights as suggested by Saez (2002):

$$g_i = 1/(p \cdot C_i)^\gamma \tag{7}$$

where p denotes the marginal value of public funds and γ is a scalar parameter reflecting the social aversion to inequality. The higher γ , the higher the redistributive tastes of the government ($\gamma = +\infty$ corresponds to the Rawlsian criterion while $\gamma = 0$ corresponds to utilitarian preferences). Using the values of g_i obtained by inversion of the optimal tax model, we estimate the log of expression (7) to recover the parameter γ for each country and each point in time. Results are presented in Figure 5. Clearly, tax-benefit revealed social aversion to inequality remains constant over time in Ireland, while it strongly decreases with the first Conservative government and gradually increases afterwards. ‘New Labour’ indicating a move away from its traditional left-wing position to a more centre-left approach, it may not be surprising to witness a relative convergence between the two countries in the recent period.

It would be interesting to compare our results – which could be interpreted as some form of revealed preferences – to alternative, more direct measures of redistributive preferences. In the political economy literature, some surveys attempt to measure people’s attitude toward inequality, for example the International Social Survey Program (ISSP) used in Corneo and Grüner (2002).²⁰ These authors focus on a question about "whether it is the responsibility of the government to reduce differences in income between people with

¹⁹"The justice for me is concentrated on lifting incomes of those that don't have a decent income. It's not my ambition to make sure that David Beckham earns less money" (Tony Blair, 2001).

²⁰Also in behavioural economics, experiments are conducted to assess preferences of a group (see for instance Fehr and Schmidt, 1999). In the public economic literature, implicit value judgments may be drawn from inequality measures, assuming a natural rate of subjective inequality (see Lambert et al., 2003, Duclos, 2000).

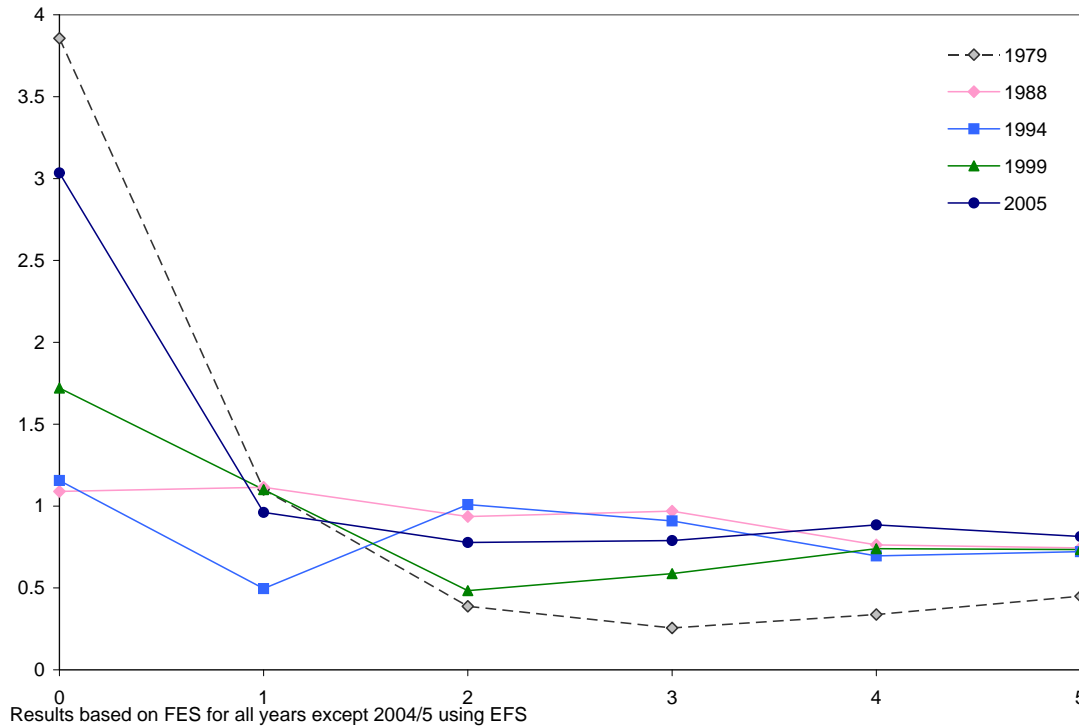


Figure 4: Social Welfare Weights for the UK (FES/EFS, Cutoffs based on quintiles)

high incomes and those with low incomes". It does not perfectly identify redistributive preferences but this is the closest we could find in the ISSP to capture the redistributive and interventionist view of the society. We retrieve this question for Ireland and the UK and form a binary variable ('yes' is *Definitely should be* or *Probably should be*, 'no' is *Probably should not be* or *Definitely should not be*). For the UK, the proportion of 'yes' is 0.74 in the 80s, 0.67 in 1996 and 0.69 in 2006. For Ireland, it is 0.81 (1990), 0.78 (1996) and 0.79 (2006). Interestingly, there are common points with the (tax-benefit) revealed preferences derived in this paper: (1) redistributive tastes are higher in Ireland, (2) they are more stable in this country, (3) we observe a decline in inequality aversion in the UK – which is in fact delayed compared to the implementation of Thatcherian policies. The latter point seems to show that institutions, or policy makers, once in place, can influence social preferences. The influence of policy makers/institutions on the society, and the reverse causality through social choice, have received attention recently – see the review of Alesina and Giuliano (2009) and the effect of political regimes in Alesina and Fuchs-Schündeln (2007) – but relatively little is known about these reciprocal effects.

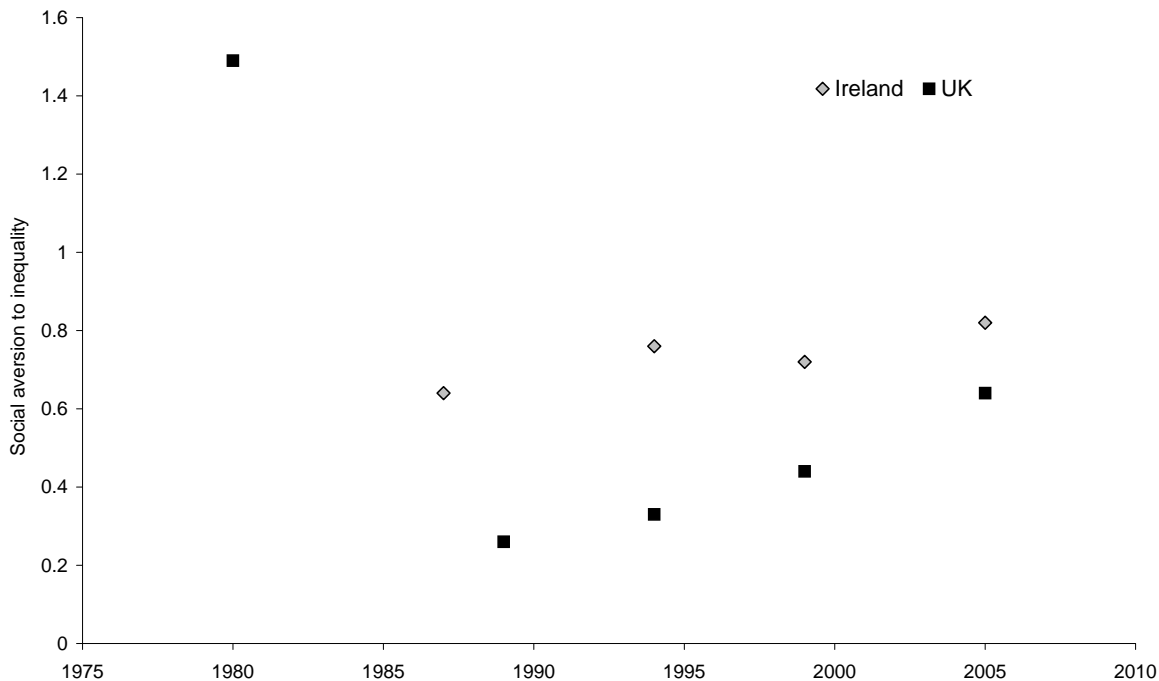


Figure 5: Social Aversion to Inequality: Ireland vs UK

6 Conclusion

Inverting the optimal tax model suggested by Saez (2002), we characterize the redistributive preferences embodied in the Irish tax-benefit system over the period 1987-2005. To account for the efficiency constraint faced by the social planner, we estimate labour supply elasticities for each income group and each period. The Appendix provides numerous checks including alternative sizes for elasticities, alternative income sources and measures of disposable income (either survey-based or simulated by a tax-benefit calculator) and alternative definitions of the income groups. Results show a great stability of social preferences in Ireland, despite a rapidly changing economic environment and radical tax-benefit reforms. This is consistent with a narrow political spectrum and a relatively consensual society – and in complete contrast to the situation in the UK. Radical changes in British politics coincide with rapid changes in the implicit redistributive tastes revealed by the tax-benefit system. In Ireland, in-work financial support to the working poor is advocated as a consistent "correction" of the tax-benefit revealed redistributive function.

We acknowledge several limitations of our analysis. *Firstly*, the redistributive function of the government characterized in our framework is incomplete. Other direct or indirect

taxes as well as non-cash benefits could be incorporated and may prove important, at least to the extent that they affect different income groups differently.²¹ Including these different components may change the social welfare pattern but not necessarily the time trend and the sharp contrast across countries revealed in the present analysis. *Secondly*, the scope of the analysis was limited to childless single individuals. As noted in the text, it is in principle possible to replicate the analysis on different (demographically homogenous) groups. In particular, looking at couples would show more variations in tax-benefit policies over time. The difficulties to incorporate couples' joint labour supply decisions in an optimal tax framework have been discussed in the text. *Thirdly*, it is also complicated to account for other margins along which households may response to changes in tax-benefit policies. Some authors have nonetheless considered migration and tax evasion (see Simula and Trannoy, 2006) or changes in "productive effort" (see Feldstein, 1995). *Finally*, in the Saez model, non-participating individuals do so because of low net wages. Involuntary unemployment is not present, which may bias the elasticities at the extensive margin and the interpretation of the results – further work is definitely needed in this direction.

Another set of comments concern the more fundamental nature of the exercise. *Firstly*, and arguably, the analysis used in the present paper may neither capture the "true" social preferences of a population nor the redistributive taste of the government in place. The political forces that shape tax systems are certainly more complex and involve other dimensions (labour market policies, wage negotiations, etc.) and numerous actors (social partners, lobbies, etc.). Yet, the Irish and British cases analyzed in this paper seem to provide two contrasted, maybe polar, cases. The stability of the redistributive function in Ireland conveys that the approach reveals something relatively close to the nation's social consensus. The British example seems to reflect more the redistributive function of the party in power. *Secondly*, social preferences are clearly not exogenous nor stable. They affect the nature of governments and the policy making process, while institutions probably affect in turn the redistributive preferences of a nation. A lot of research will be needed to disentangle these aspects. The present approach was a way of characterizing "tax-benefit revealed social preferences" at certain points in time and space but certainly

²¹In particular, property taxation in the form of stamp duties has played an important role in Ireland during the Celtic Tiger period. Indirect taxation could also be incorporated in the analysis (it was increased in the UK under Thatcher), even if its redistributive role is usually meagre (see Sah, 1983, and Madden, 1995, in the Irish context). An extension of the present inverted optimal tax approach to non-cash benefits has been suggested with an application for Germany by Haan and Wrohlich (2007) while Callan and Keane (2008) study the redistributive impact of in-kind transfers in Ireland. Finally, the redistribution effect of public health and education systems should also be investigated (see the formal analysis of Besley and Coate, 1991).

not an attempt to explain where they come from.²² *Thirdly* and lastly, the present characterization made use of the fiction of a maximizing and Paretian social planner. It could be interesting to replicate this type of exercise with non-welfarist objectives and/or have welfarist objectives (see Ooghe and Peichl, 2010, and Kanbur et al., 2006).

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²²On the question of how social preferences are shaped by society’s more exogenous factors like beliefs about fairness and luck, see Alesina and Angelotos (2005). On the link between the design of redistributive policies and social choice, see Coggins and Perali (2000).

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Appendix

Data and Tax/Benefit Variables

The fundamental information required by the model is the level of market income Y_i and the set of taxes and transfers aggregated into a net tax T_i (or, equivalently, disposable income C_i) for each income group i . These different pieces of information are typically provided in household surveys. It is not always possible to obtain comparable information over time, as variable definitions or methods to calculate sample weights change from one wave of data to the next. For the present paper, we have relied essentially on the Irish Household Budget Survey (HBS) that provides consistent and comparable information for years 1987, 1994, 1999 and 2005, with around 7,000 households per wave. Similarly for the UK, we use the Family Expenditure Survey (FES) that is available from 1974 to 2001 and contains a bit less than 7,000 households per year. We choose similar points in time, with some small differences aimed to capture the interesting changes in British politics. Hence we make use of the 1979, 1988, 1994 and 1999 waves, as well as the 2005 wave of the Expenditure and Food Survey (EFS) that replaced FES after 2001.

The robustness analysis below relies on alternative datasets and methods to retrieve information on taxes and transfers in Ireland. This includes the Living in Ireland Survey (LII), a representative panel dataset of the Irish population available from 1994 to 2001. The LII is small (around 4,000 households per year) and the attrition makes that the sample loses some of its representativeness in the later years, despite the addition of a "refreshment" sample in years 2000-01. For the more recent period, an obvious choice is the Irish wave of the EU's Standards in Income and Living Conditions survey (SILC) of the year 2005.²³

Alternatively to information on taxes and benefits as provided in the data, it is possible to use fiscal microsimulation to calculate theoretical taxes/benefits concerning each household. Relying on microsimulation first avoids the problem of misreported taxes or benefits and hence possible measurement errors in disposable income. Reported taxes and benefits may also reflect tax evasion and non-take-up, respectively. This is usually not modelled in microsimulation because the necessary information to account for it is lacking. Benefits which are not claimed could represent a failure of the government to reach intended recipients. In that case, one may argue that theoretical disposable income obtained by microsimulation is a more faithful representation of the initial redistributive intention of the government. However, partial take-up can also be caused voluntarily by the government, through administrative complexity and hassle (see Kleven and Kopczuk, 2008). Since it is difficult to conclude, a sensible approach consists simply in comparing our results when disposable income C_i is either directly taken from the data (and hence reflecting possible measurement errors, benefit non-take-up and tax evasion) or microsimulated.²⁴

Irish Tax-Benefit System

This description refers to parameters summarized in Table 2. Since we focus on working age single individuals, we do not report other benefits, like those targeted at households with children or pensioners.

The Irish income taxation system is relatively simply, with only two marginal rates (20% and 40%) in the recent period and a tax-free bracket obtained by use of tax al-

²³For the early period, we could use the ancestor of the LII, the 1987 Survey of Income Distribution, Poverty and Usage of State Services (IDPU) maintained by the ESRI, which is a nationwide stratified, clustered random sample drawn from the Electoral Register. After a careful examination, we came to the conclusion that the IDPU was not readily comparable to later data sources.

²⁴This is not done using our own tax-benefit calculations but using a precise microsimulation model for Ireland, SWITCH (Simulating Welfare and Income Tax Changes).

lowances or tax credits. Pay Related Social Insurance (PRSI) contributions are made by both the employer and employee. In 2005, PRSI is made up of a social insurance element (which goes towards payment of social welfare benefits in the Social Insurance Fund) and a health contribution which goes directly to the Department of Health and Children to fund health services. These are two flat rates of 4% and 2% respectively for the year 2005. Under a certain income limit (EUR 364 per week in 2005), employees do not have to pay the social insurance element but remain covered. An earning ceiling (EUR 847 per week in 2005) also exists above which a cap is placed on the social insurance element.

Social welfare benefits in Ireland are divided into two main types, contributory and non-contributory. Entitlement to contributory benefits is dependent upon having an adequate number of social insurance contributions made by workers during employment. The main social welfare benefit available to single people is the Jobseekers Benefit (JB), previously known as Unemployment Benefit (basic amount of EUR 149 per week in 2005). This benefit is not means-tested and can only be received for up to a maximum continuous period of 12 months. It may be kept for work on a very temporary basis or in case of forced job-sharing (and is received on a pro-rata basis in this case). Claimants who have exhausted their 12-month entitlement to JB or have not contributed enough to be eligible can apply for the means-tested benefit known as Jobseekers Allowance (previously Unemployment Allowance). The basic amount is identical to the JB and the means-test includes incomes of all other family members. Finally, a Rent Allowance Supplement is payable to those whose only income is from social welfare and ensures that an individual income after paying rent does not fall below a certain level. Other benefits exist for special circumstances, including the Carers Allowance, the Mortgage Interest Supplement, the Disabled Persons Maintenance Allowance, the Deserted Wives Benefit and the Lone Parent Allowance, but most of them do not affect the childless single individuals in our selection. The taper rate of most of these benefits is as high as 100% leading to high implicit marginal tax rates on earnings.

Labour Supply Estimations and Simulation of Elasticities

We rely on a discrete choice model of labour supply (multinomial logit) estimated by simulated maximum likelihood. The approach has become relatively standard and hence we simply refer to Aaberge et al. (1995), van Soest (1995) and Blundell et al. (2000). Nonetheless we summarize here the choices made to estimate the model and to predict elasticities. Following Blundell et al. (2000), we specify consumption-leisure preferences using a quadratic form so that the deterministic part of the utility of a person i choosing

Table 2: Taxation, Social Insurance and Social Welfare System: Ireland 1987-2005

	1987	1994	1999	2005
<i>Income Taxation</i>				
Number of tax brackets*	3	2	2	2
Standard tax rate	35%	27%	22%	20%
Higher tax rate	48%	48%	44%	42%
Top tax rate	58%	-	-	-
Lower bounds of tax brackets: **				
Standard rate bracket @	162	140	183	273
Higher rate bracket @	418	475	728	694
Top rate bracket @	571	-	-	-
<i>Social Insurance (PRSI)</i>				
Rate % (employee, private sector)	6.0%	5.5%	4.5%	4.0%
Income Ceiling @	843	853	850	847
Income Exemption Limit @	-	128	378	364
Health Levy	1.3%	1.3%	2.0%	2.0%
Employment and Training Levy	1.0%	1.0%	-	-
<i>Benefits</i>				
Unemployment benefit / allowance change in real terms (wage inflation)	120	130	130	149
change in real terms (price inflation)		8%	0%	15%
		23%	4%	14%
Gini	0.33	0.32	0.3	0.33
Party in power	Fianna Fail	Fine Gael & Labour Coalition	Fianna Fail & P.D.'s coalition	Fianna Fail & P.D.'s coalition

@ Tax thresholds and benefit payments are in real terms (2005 Euro, adjusted using the CSO's Average Industrial Wage Index)

* Exclude the zero-rate bracket

** Thresholds on weekly income. The 0% income range corresponds to a system of tax allowances for year 1987-2001 and by tax credits from 2002 onwards.

the discrete choice $j = 1, \dots, J$ can be written:

$$U_{ij} = \alpha_{ci}C_{ij} + \alpha_{cc}C_{ij}^2 + \alpha_{hi}H_{ij} + \alpha_{hh}(H_{ij})^2 + \alpha_{ch}C_{ij}H_{ij} - F_{ij}.$$

with household consumption C_{ij} and worked hours H_{ij} . In this expression, coefficients on consumption and worked hours, namely α_{ci} and α_{hi} , vary linearly with several taste-shifters (gender, polynomial form of age, region). They also incorporate random components so the model allows for unobserved heterogeneity and unrestricted substitution patterns between alternatives. The fit is improved by the addition of fixed costs of work F_{ij} , expressed here in utility metric, which capture the fact that there are very few observations with a small positive number of working hours.

We make use of a simple discretization with $J = 4$ (choices are 0, 20, 40 and 50 hours per week). We have checked that thinner discretizations do not affect the size of elasticities significantly. Consumption (equivalent to disposable income in a static framework) is calculated as a function $C_{ij} = D(w_i H_{ij}, y_i)$ of labour income $w_i H_{ij}$ for each discrete hour choice and non-labour income y_i . The function D is approximated by numerical simulation of tax and benefit rules in force at each point in time (see Table 2). Wages w_i are calculated using earnings and work hours for workers and predicted for non-workers. Because the model is nonlinear, we take the wage rate prediction errors explicitly into account for a consistent estimation. Both types of disturbance terms (random preferences and the wage error term) are integrated out in the likelihood, practically by summing over a tractable number of draws (see Train 2003).

We have calculated several types of elasticities, including "standard" income and wage elasticities and the particular elasticities used in the optimal tax model, as defined in expressions (2) and (3). In the present non-linear model, labour supply elasticities cannot be derived analytically but it is possible to rely on numerical simulation, i.e., to uniformly increase non-labour income or wage rates marginally and to simulate labour supply responses. We follow a calibration method which is consistent with the probabilistic nature of the model at the individual level. It consists of drawing a set (here 200 draws) of $J + 1$ random terms from an $EV - I$ distribution for each household that generates a perfect match between predicted and observed choices. The same draws are kept when predicting labour supply responses to a shock on wages or non-labour income. Averaging individual supply responses over a large number of draws provides robust transition matrices.²⁵

Mobility and participation elasticities used in the optimal tax model are produced for each group $i = 1, \dots, I$ (by definition, the elasticities of group 0 are zero) using this calibration method. For the mobility (resp. participation) elasticity, this is done by simulating

²⁵Confidence intervals for elasticities are obtained by repetitive random draws of the preference parameters from their estimated distributions and, for each draw, by applying the calibration procedure.

the proportion of moves from group i to group $i - 1$ (resp. group 0) in case of a 1% decrease in the difference of disposable income between the two groups. These simulations require translating individual transitions in terms of work hours into transitions in terms of gross earnings. Individual transitions are aggregated at the group level to produce elasticities ζ_i and η_i for each group (see also Blundell et al., 2008). Note that results are not sensitive to the specification – we have experimented higher polynomial forms for the deterministic utility function and find insignificant differences.

Robustness Analysis

We provide some robustness analysis of the main result, namely that redistributive preferences appear relatively stable over time in Ireland.

Alternative Elasticity Scenarios

In Figure 6 we examine how results may change when high or low elasticity scenarios are used instead of point estimates. As said in the text, we simply use the bounds of the 95% confidence interval for the elasticity in each income group. We focus on 1994 and 2005, the years with the most contrasted results. Social welfare weights are normalized, i.e., expressed relatively to the weight of group 0, for a more precise comparison. Figure 6 shows that in fact only the drop in the welfare weight of group 1 in 1994 is significantly different to the situation in the 2000s when the variance of elasticities is taken into account. Time changes in other parts of the income distribution, and for the two years not represented in Figure 6, are not significant. Hence, at first glance, the result that social preferences are very stable in Ireland seems robust to some variation on the assumptions made – by the analyst or the social planner – about elasticity size.

Alternative Sources to measure Disposable Income

The HBS (and direct information on taxes and benefits) was our primary choice because of large sample size, representativeness and comparability over time. Yet it seems reasonable to replicate the analysis using alternative data sources and alternative measures of disposable income. In Figure 7, we report the patterns of social welfare weights obtained with three different measures of disposable income for the years 1999/2000: direct survey information from the HBS 1999 (our baseline), survey information from the LII 2000 and microsimulated disposable income (using SWITCH and the LII 2000). Microsimulated income and HBS income sources provide similar results and hence increase the confidence in the analysis based on reported income in the HBS. At least for our selection of childless single individuals, aforementioned issues related to benefit non-take-up,

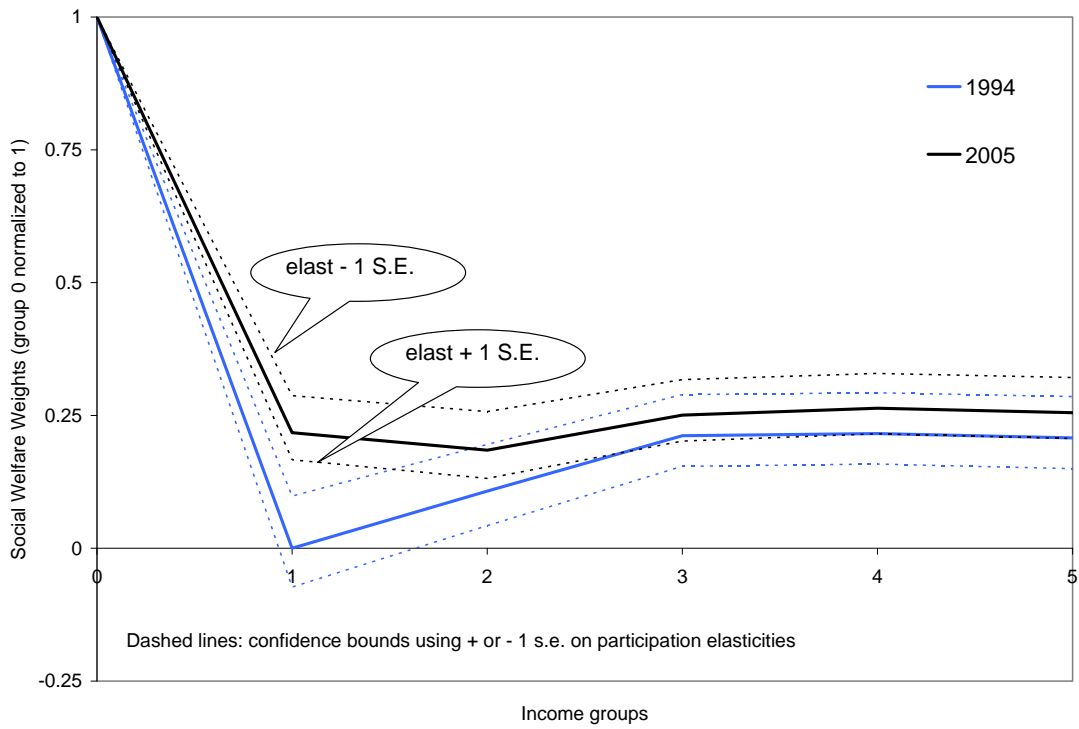


Figure 6: Normalized Social Welfare Weights, Confidence Bounds on Elasticities (HBS, Cutoffs based on quintiles)

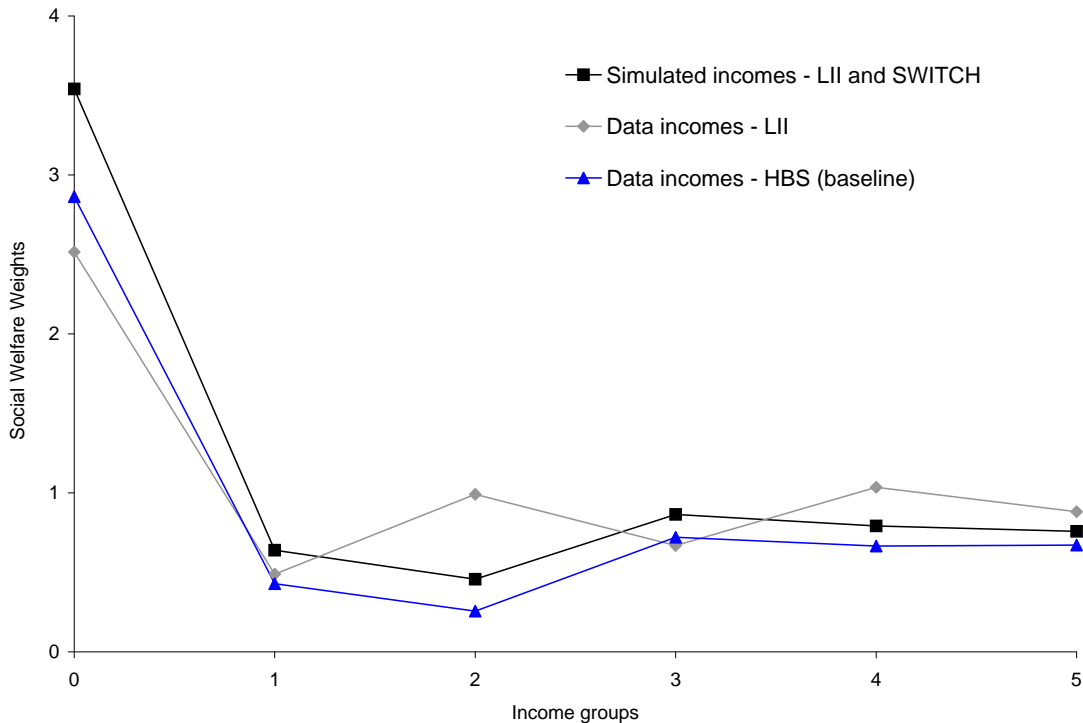


Figure 7: Robustness Check: Varying Data Sources for Disposable Income (year 1999/2000)

tax evasion or misreporting do not seem to matter much. The pattern obtained using directly survey information from the LII is also close but shows unexpected variations, which are difficult to explain other than by measurement problems. In Figure 8, we conduct the same type of sensitivity analysis on year 2005, using HBS and SILC data. Here again, the social welfare weights obtained with survey-based disposable income from the HBS 2005 and microsimulated income using SWITCH and SILC 2005 are very similar.

Income Groups: Alternative Cutoff Points

Finally, we provide a robustness check of the definition of income groups. Naturally, group 0 remains unchanged. The main issue is how to make these groups comparable over time. For that purpose, we oppose the baseline definition (groups 1 to 5 are simply quintiles of the nonzero income distribution) to one where the 1987 quintile-based cutoffs are used in following years after (wage) nominal adjustment.²⁶ Other alternative group

²⁶That is, we "freeze" the quintiles for year 1987 and uprate the cutoff points by the average wage growth over time to define the groups in other years.

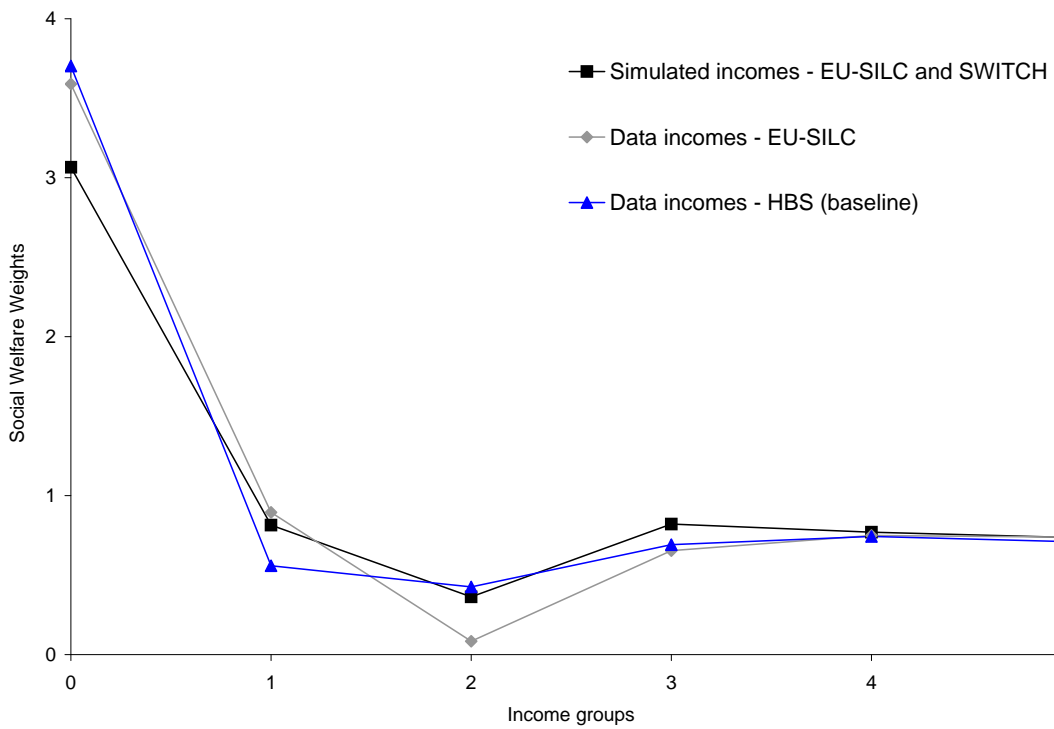


Figure 8: Robustness Check: Varying Data Sources for Disposable Income (year 2005)

definitions should focus on the crucial role of group 1 (working poor) and reflect the important tension going on in the optimal tax model between group 0 (workless poor, living on welfare), group 1 and higher income groups (tax payers). The group of ‘working poor’ is central to this redistribution problem because it usually does not receive transfers nor does it pay taxes. Yet this population is affected by important financial disincentives to work and, as a result, lower social welfare weights. Since ‘working poor’ is a ill-defined concept,²⁷ we suggest alternative income group definitions based on different definition of group 1. In the baseline of Table 1, the upper cutoff points on gross income for that group were EUR 252 and 387 per week in 1999 and 2005 respectively. This corresponds to around 16% more than a full-time job paid at the minimum wage. In adjusting the upper cutoff for this group, we alter the proportion of people falling into the "working poor" category – either a smaller group than our baseline, where income is at most a full-time paid at exactly the minimum wage, or a larger group with this income level plus 30%.²⁸ Upper groups are defined as quantiles of the remaining population.

Results reported in Figure 9 for year 2005 show little variation in all cases. Hence the analysis seems robust to alternative ways of comparing a discrete income distribution over time or of capturing the working poor category.

²⁷For instance, it is not clear which poverty line to choose. More fundamentally in our inversion problem, the view of the social planner may differ from the analyst’s.

²⁸An official minimum wage was introduced in Ireland in 2000, at EUR 5.6/hour. It reached EUR 7.65/hour in 2005. For other (early) years, we transpose the minimum wage level using the detailed income distribution.

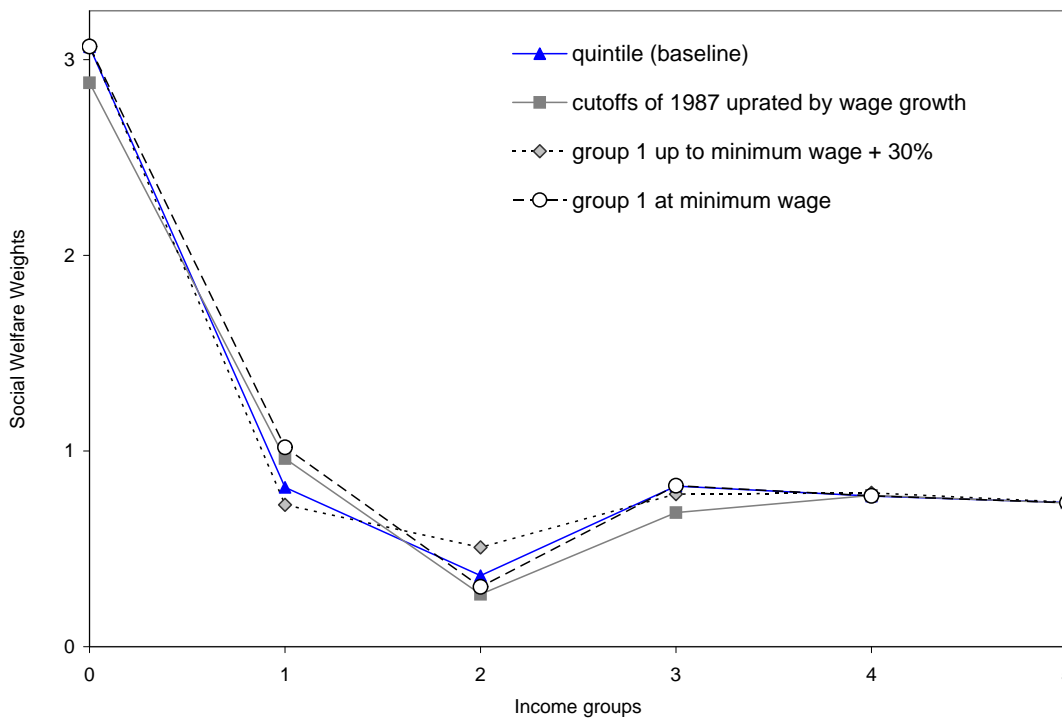


Figure 9: Robustness Check: Varying Cutoff Points for Income Groups (year 2005)