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Generalised Social Marginal Welfare Weights**

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Which Households Matter Most? Capturing Equity Considerations in Tax Reform via Generalised Social Marginal Welfare Weights

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Abstract

Social marginal welfare weights play an important role in areas of applied public policy analysis such as tax reform. These weights reflect the values of the social planner, or equivalently the underlying social welfare function. A number of recent papers have questioned the “default” Utilitarian-based approach used to derive these weights, and have suggested potential alternatives. However, there are few examples applying these alternative weighting schemes to traditional, nationally representative, datasets, and in particular, few comparisons of how these alternative weighting schemes would affect the distribution of the welfare effects of a specific tax reform in comparison to the Utilitarian-based approach. This paper aims to fill that gap. Using the nationally representative 2009/10 Irish Household Budget Survey, we apply a range of alternatives to Utilitarianism in determining the distribution of social marginal welfare weights, and compare these distributions to that arising from the traditional Utilitarian approach. The alternative weighting schemes we analyse are based upon: the principles of Equal Sacrifice, poverty alleviation, government self-interest and the redistribution of “luck” income. The distribution of welfare weights arising from these approaches are found to differ appreciably from the distribution based upon Utilitarian weights. A simple indirect tax reform model is estimated and applied to the different distributions of welfare weights to investigate the sensitivity of tax reform recommendations to these distributions. Given the importance of social marginal welfare weights in areas of public policy analysis such as optimal labour and commodity tax design, and tax reform evaluation, we believe this detailed examination of the alternatives to Utilitarianism, and their application to a household budget survey dataset, is an important addition to the literature.

JEL Codes: D31, D6, D71, H21, H23

1 Introduction

In evaluating public policies such as optimal taxes and transfers, the standard approach is what has become known as the welfarist approach. It is assumed that the government wishes to maximise a social welfare function, and that this social welfare function depends upon individual utilities, which are in turn represented by utility functions. Social welfare is maximised subject to a budget constraint and account is also taken of behavioural responses to policies.

Seminal papers using this approach include Diamond and Mirrlees (1971) in the area of commodity taxation and Mirrlees (1971) in the area of income taxation. The literature on marginal tax reform also adopts this approach Ahmad and Stern (1984) but in this instance, rather than trying to locate the optimum, instead we search for marginal, welfare-improving, tax-neutral reforms. The social welfare function is typically not explicitly specified in this approach, since rather than trying to maximise social welfare, we are trying to identify local, welfare-improving reforms. In evaluating, for example, a small change in the tax on good i , $d\tau_i$, this will lead to a welfare change dW and also a change in revenue dR . At the optimum, the ratio of dW/dR for each small tax change should be the same. If not, then a welfare-improving marginal tax reform is possible.

In checking for the existence of such tax reforms, analysts must calculate dW , the change in social welfare following the change in the tax on good i . As a first-order approximation, the change in welfare is given by the sum of each household's actual consumption of good i (following Roy's identity) multiplied by its marginal social welfare weight. It is the derivation of these welfare weights which is the principal focus of this paper. Using the welfarist approach referred to above, welfare weights are typically declining (or at least not increasing) in whatever measure of household resources is employed in the analysis (e.g. income or expenditure). Welfare weights which are declining in income are justified via the declining private marginal utility of income.

In a recent contribution Saez and Stantcheva (2013) point out that the welfarist approach is merely one amongst a number of approaches which can be used to generate marginal social welfare weights. They propose instead generalised social marginal welfare weights. These weights simply reflect the relative value of marginal consumption which society places upon each individual and can be used to evaluate marginal tax reforms. The implicit optimum with these welfare weights does not necessarily maximise a "classical" ex ante social welfare function. The weights can instead reflect different approaches to evaluating policies, incorporating issues such as fairness and justice etc, bearing in mind that the specific weights arising from the welfarist approach are nested as a special case. Tax or other policy changes are then evaluated in terms of gains and losses for different agents, where these gains and losses are weighted by the generalised social welfare weights.

Different approaches will generate different sets of generalised social welfare weights and candidates for these different approaches would include perspectives such as Libertarianism, Equality of Opportunity etc. As their name suggests, such generalised welfare weights nest as a special case the welfarist approach, while also accommodating other approaches. Accommodating perspectives other than welfarism is important, as empirical evidence suggests that views on taxation and redistribution typically take into account factors other than those implicit in welfarism (see Weinzierl (2013), Saez and Stantcheva).

One of the central assumptions of welfarism is that of anonymity i.e. an individual's welfare weight is determined solely by their disposable income or expenditure, or whatever

measure of resources is used. In this case disposable income is the only relevant characteristic in terms of determining welfare weights. When a non-welfarist approach is permitted then other characteristics become relevant. This may include someone's net tax payment, as is the case in the approach we label Libertarianism. The composition of an individual's disposable income might also become relevant, with distinctions being made between "fair" and "unfair" sources of income. It could also include demographic information such as gender, ethnicity or age (e.g. pensioners are accorded a higher weight). It could also include marital status e.g. it has frequently been the case that married and cohabiting couples have been treated differently for tax purposes. It could include health information e.g. whether someone is characterised as disabled. Policy makers may also assign welfare weights to individuals for reasons of self-interest. In Section 4.5 below we consider the case where governments explicitly design policy with a view to re-election and so those groups who are (a) most likely to vote and (b) closest to the median voter are accorded a higher weight.

All of the above are examples of differing sets of circumstances which can be regarded as relevant in terms of determining welfare weights and all will give rise to different sets of generalised welfare weights. Many of the weights reflect alternative criteria that may be used in determining which households are most 'deserving' in society, or whose welfare society believes should be valued most in a policy reform scenario. The weights discussed in Section 4.5 are somewhat different. They are designed, not to capture a measure of 'deservingness', but rather to reflect the set of marginal weights the government might use if it is motivated solely by its own self-interest.

Generalised welfare weights share with the marginal tax reform analysis of Ahmad and Stern the feature that the social welfare function is not explicitly specified. Instead, local tax reforms are evaluated and the welfare effect will depend upon the welfare weights chosen. These welfare weights could be generated from individual utility functions and a social welfare function (since welfarism is nested with the generalised approach) but they could also be generated using other principles which more directly reflect society's views on justice, such as those listed above. As explained by Saez and Stantcheva, the analysis of such reforms is likely to be much closer to actual decisions taken by policy-makers, as opposed to the design of an optimal system. As pointed out by Ahmad and Stern, it is also typically less informationally demanding.

Thus marginal tax reform analysis is ideal for examining the sensitivity of recommended reforms to the choice of how welfare weights are generated, and in particular to the implications of departing from welfarism. That is the contribution of this paper: we carry out marginal tax reform analysis on the Irish indirect tax system, using generalised welfare weights including both the welfarist and non-welfarist approaches. The non-welfarist approaches we adopt are to some extent limited by data availability, but we are still able to incorporate a reasonably wide range of generalised welfare weights. We also confine ourselves to cases with non-negative welfare weights, otherwise we would violate the constrained Pareto efficiency property. To the best of our knowledge this is one of the first attempts to empirically examine the sensitivity of actual tax reforms to a wider range of welfare weights than those implied by welfarism. It is perhaps worth stressing at this stage that we are not advocating the use of any particular set of generalised welfare weights, whether arising from welfarism or any other approach. Our goal is simply to empirically investigate how sensitive marginal tax reform recommendations are to the choice of welfare weights, when the menu of welfare weights extends beyond welfarism (for examples of how marginal reforms vary with respect to welfare weights within the welfarist

approach, see Ahmad and Stern (1984) and Madden (1995)).

2 The Utilitarian Approach

The majority of research in the optimal tax design and optimal tax reform literature has derived social marginal welfare weights from a Utilitarian approach. With concave utility of income functions, the poorest agent (individual or household) in society receives the highest welfare weight, and the weights decline as income increases. A parameter indicating the elasticity of the social marginal utility of income is used to determine the rate of decline in the weights (see, for example, Saez (2001), Decoster and Schokkaert (1990), Madden (1995), Ray (1986)). Formally, we have a social welfare function $G(u^h)$ which is a function of household utilities alone. Social welfare is simply a weighted sum of household utilities. The key feature of the Utilitarian approach is that for any positive value of inequality aversion, the weight placed upon the welfare of household h is declining in some measure of household resource.

We can specify the welfare weights as per a commonly used utility of income function due to Atkinson (1970), where household utility, U^h , is a function of household income I^h alone:

$$U^h(I^h) = \frac{k(I^h)^{1-e}}{1-e} \quad \text{if } e \geq 0 \text{ and } e \neq 1 \quad (1)$$

$$U^h(I^h) = k \log(I^h) \quad \text{if } e = 1 \quad (2)$$

k is chosen for normalisation. e is the elasticity of the social marginal utility of income. It captures the level of inequality aversion in society (or of the social planner), and is the key parameter in determining relative welfare weights in the Utilitarian setting. For any $e > 0$ we have welfare weights satisfying strict concavity, so that as household income increases, the welfare weight of that household strictly decreases; the larger the parameter e , the faster the weights decline in income. As we assume a constant inequality aversion parameter¹, for every percentage point increase in a household's income, the welfare weight of that household decreases by e per cent.

β^h is the social marginal welfare weight of household h . In practice, we normalise the welfare weights so that the poorest household has $\beta^h = 1$. We therefore measure the welfare weight of household h relative to the poorest household:

$$\beta^h = \left(\frac{I^1}{I^h} \right)^e \quad (3)$$

where I^1 is the income of the poorest household. Higher values of e result in higher relative weight on the welfare of the poorest household.

Much like Donaldson and Weymark's (1980) *S-Gini* measure of inequality, Atkinson's utility functions allow a range of social preferences to be captured by varying one parameter. The Benthamite, or extreme Utilitarian, case exists where $e = 0$, so society has no aversion to inequality, and each household has $\beta^h = 1$. Social welfare is an therefore unweighted sum of household utilities. As e moves to infinity, we get closer to the Rawlsian case, where only the welfare of the poorest household is taken into account. The Benthamite and Rawlsian cases can be seen as the two limiting cases of the Utilitarian approach. Changing the value of e will alter the relative welfare weights in a given distribution, but will not alter the ranking of

¹Which is equivalent to assuming a constant elasticity of marginal utility of income

households. While the value of e implicit in tax and welfare systems can be estimated on the assumption that the observed system is optimal (see Ahmad and Stern (1984)), there is no “correct” value of e as such. Rather e reflects the inequality aversion of government or society, and so is a value of judgement that may change over time or between societies. As far back as 1939, former UK Chancellor Hugh Dalton suggested that e lay between 1 and 2 (Dalton 1939)².

2.1 Alternatives to (and limitations of) Utilitarianism

Weinzierl (2012, 2013) questioned the “default” assumption of Welfarism in optimal tax design and tax reform research, and suggested that Welfarist principles alone do not underly current tax design. In a US based study, he presented evidence of strong support for tax systems based at least in part on the principle of Equal Sacrifice rather than on pure Utilitarianism. Using a specifically designed online survey, Weinzierl (2013) asked respondents’ opinions on a number of hypothetical tax and benefit systems. The hypothetical systems ranged from one based on Equal Sacrifice, whereby each household paid 12 to 14 per cent of their income in tax, to one based on Utilitarianism, whereby the average tax rate ranged from -731 per cent for the poorest household to 79 per cent for the richest household. In a straight choice between these two extremes, he found that nearly 60 per cent of respondents preferred the Equal Sacrifice system to the Utilitarian system. Offering tax and benefit systems with a combination of the two principles, he found an even larger majority preferred a system with at least some Equal Sacrifice characteristics.

Variations exist in the interpretation of the principle of Equal Sacrifice. The Equal Sacrifice tax system used in Weinzierl (2013) follows the principle of Equal *Proportional* Sacrifice. As Young (1987) suggests, Equal proportional sacrifice means that everyone foregoes the same percentage of utility in paying taxes. An alternative interpretation is Equal *Absolute* Sacrifice, whereby everyone foregoes the same amount of utility in paying taxes, so that, as Stern (1977) suggests, the government’s evaluation of the difference between pre-tax and post-tax income is the same for all individuals who are taxed. Young shows that even with certain concave utility functions, the principle of Equal Sacrifice, in particular Equal Absolute Sacrifice, can result in regressive tax systems.

Saez and Stantcheva (2013) detailed a number of “puzzles” related to the Utilitarian approach. First, if individuals do not respond to taxes, Utilitarianism recommends a 100 per cent tax and full redistribution³. Second, Utilitarianism does not discriminate on the type of income, so that redistribution of “deserved” and “luck” income is equally desirable. Similarly, no distinction is made between “free loaders” (those who would work in the absence of benefits) and “deserving poor” (those who are unable to work) in the Utilitarian framework. Finally, the use of tags can be optimal⁴. More generally, within the Utilitarian framework, only information that enters the household utility function is used to generate the welfare weights. A range of non-utility information that may affect how society values the welfare of particular household is not used. The commonly used Atkinson utility functions, for example,

²In their guide on Appraisal and Evaluation in the UK Central Government, H.M. Treasury (2011) assume a value of $e = 1$ and measure utility as $U = \log C$.

³While Saez and Stantcheva identify this as a criticism of the Utilitarian approach, it could equally be seen as a criticism of the zero elasticity of labour assumption.

⁴Examples of tags include height, race or gender. These are observable characteristics which are correlated with intrinsic earning ability, but are generally deemed unfair to use to determine tax liability

rely solely on income, so that the underlying assumption of Utilitarianism is that the highest welfare weight is associated with the lowest income individual or household.

To address these puzzles, Saez and Stantcheva replaced the “standard” Utilitarian welfare weights with generalised social marginal welfare weights which “directly reflect society’s view for justice”. The generalised approach departs from the Utilitarian framework as the welfare weights are no longer based on underlying individual utility functions or social welfare functions. They argued that the generalised welfare weights solve many of the puzzles of the Utilitarian approach, while they also has the ability to capture a number of prominent alternatives to Utilitarianism, such as poverty alleviation, Libertarianism and redistribution based on the nature of the income in a household, all of which are ignored in the Utilitarian approach. Similar to Weinzierl, Saez and Stantcheva used a specifically designed online survey to elicit social preferences, which showed support for frameworks beyond pure Utilitarianism.

Of course, it is not only in recent years that the limitations of the Utilitarian approach have been recognised. Mirrlees (1974) highlighted shortcomings of the Utilitarian approach, and allowed for agents with different skill levels to “envy” each other based on the number of hours they have to work. Elsewhere, Fleurbaey and Maniquet (2007) allowed for “fairness” in optimal income taxation, by defining social preferences that differentiate between redistribution based on earning ability and preferences for work and leisure. Their model supports redistribution based on inequality between agents who differ in their earning ability, but have identical preferences. However, redistribution between agents with the same earning ability, but differing taste for work, is discouraged. Pirtila and Tuomala (2004) provide a framework whereby poverty alleviation, rather than Utilitarianism, is the objective of the government when designing taxes. In this framework, they show that necessity goods should be taxed lower than other goods, and effective marginal tax rates should be negative for low earners, in order to alleviate poverty. Remaining within the Utilitarian framework, Alesina and Angeletos (2005) allowed individual utility to decline in the amount of “unfair” income in society by including an extra term in the individual utility functions. Saez and Stantcheva (2013) cautioned against this approach however due to the potential for non-standard individual behaviours.

A move outside of the Utilitarian framework does not automatically result in a profile of welfare weights substantially different to that arising from the traditional Utilitarian approach. In an extensive review of the optimal taxation literature, Piketty and Saez (2012) argued that that relative income concerns are a much more powerful and realistic way to justify social welfare weights decreasing with income than standard Utilitarianism with concave utility of income. They argued that specifying the social welfare weights in such a manner captures the idea that a decrease in one person’s income may increase the utility of others. The relatively low welfare weight on a richer person would therefore capture the “external effect” of a decrease in his income increasing the utility of others.

In determining the profile of social marginal welfare weights in tax reform models, the literature reviewed here shows that a number of alternative approaches to Utilitarianism are possible. While several authors have suggested extensions or alternatives to Utilitarian welfare weights, there are few examples applying these alternative weighting schemes to traditional, nationally representative, datasets. In particular, there are few comparisons of how these alternative weighting schemes would affect the distribution of the welfare effects of a specific tax reform in comparison to the Utilitarian-based approach.

We believe this paper makes two contributions to the tax reform literature. First, we examine how the distribution of welfare weights changes as we move away from Utilitarianism.

Recent literature has provided evidence of support for the inclusion of criteria other than pure Utilitarianism in determining the distribution of social marginal welfare weights. These alternative criteria include the Principle of Equal Sacrifice, poverty alleviation, a distinction between “deserved” and “luck” income, and governmental self-interest. We believe this is the first paper to systematically examine how the distribution of these weights change as such criteria are included in the analysis. Second, using these profiles of welfare weights, we examine the extent to which specific public policy recommendations (in this case, an indirect tax reform) are sensitive to these alternatives to Utilitarianism. Given the importance of social marginal welfare weights in areas of public policy analysis such as optimal labour and commodity tax design, and tax reform evaluation, we believe this detailed examination of the alternatives to Utilitarianism, and their application to a specific policy proposal, is an important addition to the literature.

3 Data

The primary source of data used in this paper comes from the 2009/10 wave of the Irish Household Budget Survey (HBS). The survey includes detailed information on household expenditure, income and tax payments, as well as socio-economic variables on 5,891 households. Meyer and Sullivan (2003, 2004, 2008, 2011) suggest that that income is likely to be mis-measured for households with low resources and, in particular, likely to be under-reported. Similarly, Brewer and O’Dea (2012) find evidence from UK data of under-reporting of income among households with low resources. On that basis, we trim the bottom 1 per cent of observations according to household gross income. This eliminates 14 cases of 0 gross income, and also a further 39 cases with household gross income (weekly, unequivalised) of less than €100. A number of the sets of welfare weights in the following sections are dependent on income and expenditure values in the extremes of the distributions. We therefore wish to remove implausibly small income values from the analysis. Removing the bottom 1 per cent reduces the possibility of the marginal welfare weights being significantly affected by errors in the data.

Commonly the first step to determine the social marginal welfare weight of a particular household, in the Utilitarian case in particular, is to measure the resource of that household. Within the HBS data, two measures of household resource exist: income and expenditure. While the primary purpose of the HBS is to measure household expenditure, the data also reports detailed information on income. For each household, direct, gross and disposable income levels are reported, as well as more detailed information on income source, such as level of employment income, state transfer income and income from investments and properties.

Following the most common approach taken in distributional analysis literature, we choose disposable income⁵ as our main measure of household resource. Brewer and O’Dea (2012) argue in favour of using consumption rather than income to measure the resource of a household. The reason that consumption and income will give different impressions, they argue, is that households can borrow or save, so the amount of consumption in any period is not constrained to be equal to income in that period. However, the use of income as the measure of resource

⁵Household disposable income, equivalised using a scale of 1 for the first adult, 0.66 for subsequent adults, and 0.33 for children. This is the scale used by the Central Statistics Office (CSO) of Ireland. Results based on expenditure available on request.

in this analysis is motivated by a number of factors. First, optimal taxation analysis is often based on income surveys, so that household consumption or expenditure is not observed. Using expenditure as a measure of resource is therefore not possible in these cases. Using income as the household measure of resource ensures our results are comparable to the related literature, in particular weights based on the Utilitarian approach. Second, many of the alternative weights examined in this analysis derive in some way from income (for example, net taxes paid, ‘deserved’ income). The choice of income therefore ensures that any differences in the distribution of welfare weights observed when we move beyond Utilitarianism are due to the alternative criteria used to determine the weights, rather than the choice of household resource.

Allowing welfare weights to be determined by the Principle of Equal Sacrifice requires information on household tax payments. Using the HBS data, we either observe or can estimate direct and indirect tax payments, as well as receipt of state transfer payments. Gross income is simply direct income plus state transfer payments. Disposable income is gross income minus income tax and social insurance contributions. It is straightforward therefore to identify each household’s direct tax and social insurance contributions, as well as any state transfer payments received by the household.

The indirect tax payments made by a household are less straightforward to identify⁶. In order to do so, we assign a VAT rate to each of the expenditure components in the HBS⁷. Each item is assigned either the standard rate (21 per cent⁸), the reduced rate (13.5 per cent) or a zero per cent rate (items can have a zero per cent VAT rate applied or be exempt from VAT). For goods where excise duties apply (alcohol, tobacco and fuel), we rely on statistics from the Revenue Commissioners (2012) which report the tax component of the price of a sample good from each of these categories. From the estimates of the VAT and excise duties paid by each household, we can estimate each household’s indirect tax contribution.

Table 1 shows the direct tax payments, state transfer payments, and indirect tax payments as a percentage of gross income in each decile⁹. State transfer payments are concentrated in the bottom part of the income distribution, making up over 80 per cent of gross income in the second decile and over 70 per cent in the first and third deciles. The direct tax system (including social insurance contributions) is highly progressive, with the average tax rate increasing in each decile. A regressive pattern emerges from the indirect tax payments, with indirect taxes accounting for a quarter of gross income in the poorest decile, but only 5.5 per cent in the top decile¹⁰.

Ideally, whether measuring income, expenditure or taxes paid, one would use a lifetime measure, rather than the static measures contained in most survey data. The proportion of income spent on indirect taxes, for example, may prove to be less regressive than when

⁶We measure only the VAT and excise duty payments made by a household. Smaller indirect tax schemes, such as the air travel tax, are omitted. See Collins and Turnbull (2013) for an approach that attempts to measure such smaller indirect tax payments.

⁷We are grateful to Sean Lyons for help identifying the relevant VAT rate on each expenditure component in the HBS.

⁸The standard VAT rate was reduced from 21.5 per cent to 21 per cent in Budget 2010. We assume the 21 per cent rate applied to all expenditure in the survey, although some will have been taxed at the higher 21.5 per cent. More recently, the standard VAT rate in Ireland was increased to 23 per cent.

⁹The two tax columns can be interpreted as average tax rates (direct and indirect) for each decile.

¹⁰Savage and Callan (2015), Collins and Turnbull (2013) and Leahy et al. (2011) find a similar pattern of tax payments by decile in Ireland.

measured on a snapshot basis if we observed higher income households in future periods spending any savings they make in the current period. In common with most expenditure surveys however, we are restricted to using a static measures, which exclude these lifecycle issues.

Table 1: Tax and Welfare Payments as Percentage of Gross Income by Decile of Equivalised Disposable Income

Decile	State Transfers	Direct Tax and SSCs	Indirect Taxes
<i>As % of Gross Income</i>			
Bottom	71	1	24
2	82	2	16
3	73	2	14
4	58	3	12
5	43	5	12
6	29	8	11
7	15	12	9
8	11	14	8
9	6	18	8
Top	2	23	5

4 Social Marginal Welfare Weights

In this section, we use the HBS data discussed above to examine the distribution of social marginal welfare weights based on a number of alternative criteria. We follow Creedy’s (2006) advice that “the main contribution economists can make is to examine the implications of adopting a range of alternative value judgements”. Rather than attempting to identify the profile of weights that policy makers in Ireland should or do use in tax and benefit design, our aim is simple - to make clear the implications for tax reform analysis of using different criteria to determine which households are most “deserving” in society, in the sense of being assigned the highest social marginal welfare weights. Section 5 then examines the if a specific tax reform is sensitive to the choice between the alternative weights.

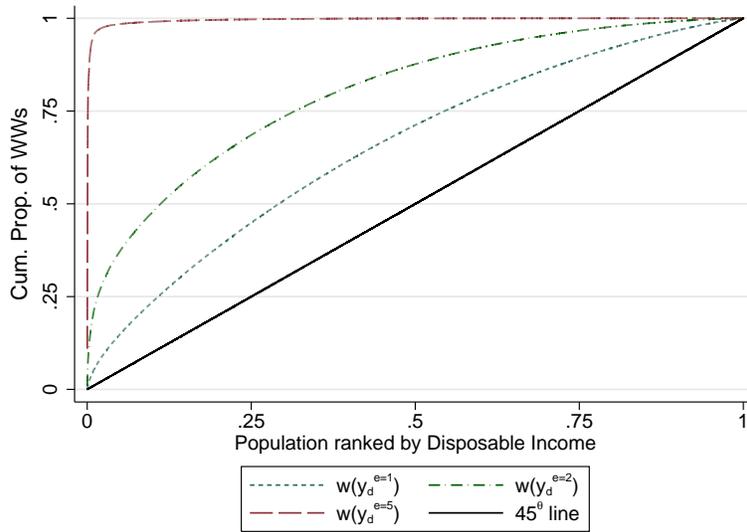
4.1 Utilitarian Social Welfare Weights

As discussed in Section 2, the Utilitarian approach places the highest weight upon the welfare of the poorest household. Higher household income results in a lower welfare weight. Figure 1 compares the distribution of the Utilitarian social marginal welfare weights, $w(y_d)$, as we vary the value of e . The profile of welfare weights in this and the following sections are presented via concentration curves, with the population ranked by equivalised disposable income. By design, the Utilitarian welfare weights decline in income, so for any positive value of e the concentration curves are strictly concave. The more concave the curve, the more concentrated are the weights among poorer households¹¹. As expected, as e becomes larger, the weights

¹¹See Appendix A for a detailed guide on interpreting the concentration curves.

become more and more concentrated in the lower end of the income distribution. With $e = 5$, we are close to the Rawlsian case where only the welfare of the poorest household matters. The 45 degree line can be interpreted as the case where $e = 0$, so that all households have equal weight.

Figure 1: Concentration Curve for Utilitarian Welfare Weights



In the following sections, we examine how a number of proposed alternatives to Utilitarianism can be incorporated using the Irish Household Budget Survey. Under each specification, we examine how the distribution of weights differs from the traditional Utilitarian approach shown in Figure 1. We specify a number of alternative profiles of welfare weights within both normative and positive frameworks which, as Weinzierl (2013) suggests, incorporate concerns such as “freedom, rights, and rules, rather than the ends emphasised by Utilitarianism”.

4.2 Equal Sacrifice and the Libertarian Criterion

Utilitarianism is not the only approach that can be used to determine the profile of welfare weights. A growing literature has provided evidence of support for a range of alternative criteria that can also be used. Two such alternatives are the related concepts of Equal Sacrifice and Libertarianism. Weinzierl (2013) questioned the “default assumption” of Utilitarianism in tax design and tax reform models. Using a specifically designed online survey, Weinzierl asked respondents’ opinions on a range of hypothetical tax and benefit systems. The systems ranged from one based on pure Utilitarianism, where the poorest households had a negative average tax rate subsidised by high taxes on the rich households, to one based on the principle of Equal Sacrifice, where each household faced the same average tax rate. He showed that the vast majority of respondents would choose a system based at least in part on the principle of Equal Sacrifice. In his model, Weinzierl’s approach was to represent each normative criterion with a loss function that depends on deviations in the allocation of resources from the criterion’s optimal allocation. This is an alternative, although related, approach to the social

marginal welfare weight approach taken in this paper, and in Saez and Stantcheva (2013). The interrelated nature of the two approaches is evident from Weinzierl’s suggestion that one could translate a mixed objective function from his approach into a set of social marginal welfare weights.

A related concept is that of Libertarianism. Libertarianism in its absolute form, according to Murphy and Nagel (2002), is that no compulsory taxation is legitimate, as the confiscation of income is unjust. Murphy and Nagel argued that “if (and only if) [Libertarianism] is the theory of distributive justice we accept, the principle of Equal Sacrifice does make sense” (Weinzierl 2013).

The principles of Equal Sacrifice and Libertarianism result in a similar motivation for determining the profile of social marginal welfare weights. In both cases, the highest weight is placed on the household that pays the highest proportion of its gross income in tax payments and receives least state benefits, while the lowest weight will be placed on the household that pays least tax and receives most state transfers as a proportion of its gross income. Weinzierl showed that in a tax system motivated by the principle of Equal Sacrifice, each household along the income distribution would face approximately the same average tax rate, so that each household’s “sacrifice” (in terms of utility) imposed by the tax and benefit system would be proportionally equal. In terms of social marginal welfare weights, households facing a relatively high average tax rate should therefore have the highest weight placed on their welfare in any tax reform scenarios. The extreme Libertarian view is that the confiscation of income is unjust, so that households losing the highest proportion of income through the tax system should be the first ones compensated by tax reform. As Saez and Stantcheva (2013) argue, the Libertarian view is that the level of one’s disposable income is irrelevant and only the tax contribution matters for how socially deserving an individual is. With social marginal welfare weights motivated in this way, a progressive transfer may lead to a fall in social welfare.

We can specify a simple function to model the Equal Sacrifice or Libertarian welfare weights, where the higher the average tax rate faced by a household, the more “deserving” it is in tax reform scenarios. We measure the welfare weight on household h as:

$$\beta^h = \left(\frac{t^h}{t^N} \right)^\phi \tag{4}$$

where t^N is the highest proportion of gross income paid in tax observed in the data. The household with the highest net (equivalised) tax payment will therefore have the highest welfare weight, normalised to 1. By setting $\phi = 1$, the welfare weights motivated by the principle of equal sacrifice increase at a constant rate in the proportion of income paid in tax¹².

We are faced with a number of choices about the measure to use for t^h . $w(tt)$ is the profile of welfare weights when we measure t^h as the average tax rate faced by household h , including both direct and indirect tax payments, as well as any social transfers received. It therefore acts as a measure of the net payment between household and state¹³. In order to test the sensitivity of our measure to the exclusion of either tax system, and to be able to identify if the

¹²Our default specification here is $\phi = 1$ as it allows constant returns to increasing tax payments. However, one can also impose the desired degree of concavity or convexity to the concentration curve by setting ϕ not equal to one in equation 4

¹³An extension of this measure might be to include the value of public goods consumed. However, it is unclear if the consumption of public goods should be included here. With pure public goods, one household’s consumption will not affect another household’s consumption. This distinction is not as clear with semi-public goods or non-marketed

direct or indirect tax system is driving the distribution of $w(tt)$, we construct two alternative measures of t^h . The first alternative is to set t^h equal to the direct taxes paid by a household minus the benefits received by a household, expressed as a proportion of gross income, which results in a set of welfare weights $w(dt)$. A second alternative is to set t^h equal to indirect tax paid as a proportion of gross income, resulting in $w(it)$.

One problem that arises with $w(tt)$ and $w(dt)$ is that we observe negative values for t^h in the cases where a household receives more in state transfer payments than it pays in taxes. This results in negative welfare weights¹⁴. To get around this issue, in cases where we observe negative t^h , we normalise the welfare weight by:

$$\beta^{*h} = \left(\frac{t^h - t^1}{t^N - t^1} \right)^\phi \quad (5)$$

where t^1 is the minimum observed value of t^h .

Figure 2 shows the distribution of welfare weights based on these three measures of net tax paid. The concentration curve of $w(dt)$ has a high a high degree of convexity in income, indicating that the welfare weights are strongly concentrated in the top income deciles. Interestingly, the weights are not monotonically increasing in income - the bottom decile has a larger share of weights than the second decile, resulting in the relatively steep section of the curve at the bottom of the income distribution. Callan et al. (2013) show that over the 2008 to 2011 period in Ireland, increased welfare payments offset falls in employment income for those in the 2nd and 3rd deciles, but falls in employment income in the bottom decile were not offset by increases in welfare payments. A similar pattern emerges here, whereby those at the very bottom of the income distribution receive a smaller share of their income in transfer payments than those slightly higher up the income distribution¹⁵. Despite having lower income, those in the bottom decile may have lower welfare payments due to reduced eligibility¹⁶, a lack of take-up, or non-eligibility for non-means-tested benefits such as the old age pension or child benefit, for example¹⁷.

The distribution of $w(it)$ is quite different than it's direct tax and benefits counterpart. In this case, the weights are decreasing in income, so the concentration curve is concave. This reflects the regressive nature of indirect taxes. Indeed, using a the 1995 wave of the same survey data used in this paper, O'Donoghue and Baldini (2004) showed that the indirect tax system added more than 10 per cent to the Gini Coefficient in Ireland.

services provided by the state, such as free education. Either way, the HBS data used in this paper does not identify public good consumption so we do not include it in our measure of t^h and leave analysis of this issue to further research.

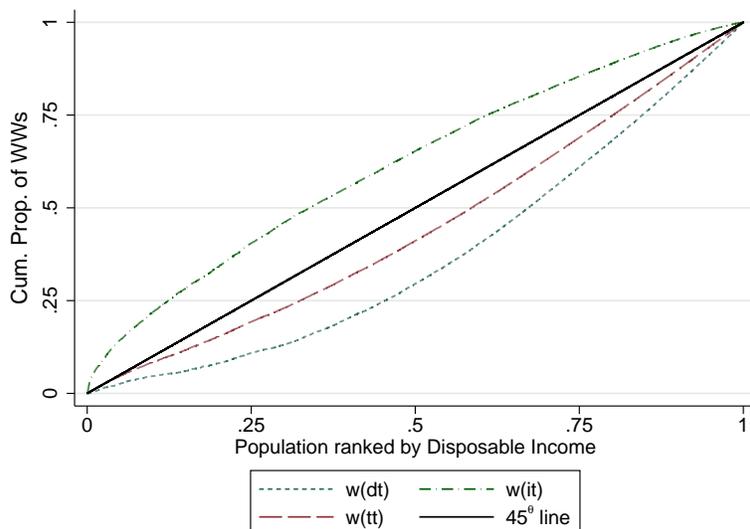
¹⁴Non-negative welfare weights ensure any tax optimum is constrained Pareto efficient. See Saez and Stantcheva (2013)

¹⁵The majority of households in the bottom deciles will not have income high enough to be liable for direct taxation, so patterns of welfare receipt explain the majority of differences for these deciles.

¹⁶For example, previously self-employed individuals may have reduced eligibility to unemployment supports due to a lack of social insurance contributions

¹⁷Based on the findings of Brewer and O'Dea (2012), this phenomenon may also be due to misreporting of income in the bottom decile

Figure 2: Concentration Curve for Libertarian Welfare Weights



The concentration curve of $w(tt)$, the combination of the direct and indirect taxes paid, and benefits received, as a proportion of gross income, dominates¹⁸ both $w(dt)$ and $w(it)$. The low concentration of welfare weights in the low income households in $w(dt)$ is compensated by the high concentration for the same households in $w(it)$. The distribution is weakly convex in income as households in Ireland tend to pay more of their income in direct taxes than indirect taxes.

The approach in this section contrasts strongly with the Utilitarian approach. While the Utilitarian welfare weights presented in the previous section resulted in weights decreasing in income, the Equal Sacrifice/Libertarian weights, in particular when we included direct tax and benefits, results in the opposite. Of course, a distribution of welfare weights similar to the Equal Sacrifice/Libertarian case can be achieved in the Utilitarian framework by specifying a convex transformation of the utility function in the social welfare function, which undoes the concavity of the utility function. However, Saez and Stantcheva (2013) argue that this seems much more artificial than directly stating that society considers redistribution as unjust confiscation.

4.3 Poverty-Based Social Welfare Weights

Poverty alleviation is another criteria that can be used to generate welfare weights. A measure often used to describe the number of low income households in society is the poverty rate. The “at-risk-of-poverty” (AROP) rate measures the proportion of persons with equivalised disposable income below 60 per cent of the median income, and is used by the European Commission to measure poverty across the EU. Given this rate is often the focus of public debate, public policy decisions can be made with the AROP group in mind¹⁹. In a tax reform

¹⁸Meaning the curve is closer to the 45 degree line at all points. See Appendix A for details.

¹⁹see, for example, the Department of Social Protection’s Social Impact Assessment of Budget 2013, which includes the impact of Budget 2013 on the AROP rate (Department of Social Protection 2013)

scenario, a tax analyst may therefore wish to concentrate the welfare weights on those at or below the poverty line.

Foster et al. (1984) provided a class of widely used poverty measures upon which we can measure poverty:

$$P_\alpha(y_d, z) = 1/h \sum_{h=1}^H \left(\frac{g^h}{z} \right)^\alpha \quad (6)$$

where z is the predetermined poverty line, and g^h is the gap from z to y_d^h for households below the poverty line²⁰. The parameter α captures the desired level of poverty aversion. By setting $\alpha = 0$, we have the headcount ratio. Increasing α to 1 we have the poverty gap measure. With $\alpha = 2$ we have the squared poverty gap measure. In general, a larger α places more weight on the poorest poor.

From equation 6, we can construct a poverty-based household weight, by:

$$P_\alpha^h(y_d, z) = \begin{cases} \left(\frac{g^h}{z} \right)^\alpha & \text{if } y_d \leq z \\ 0 & \text{if } y_d > z \end{cases} \quad (7)$$

The profile of these weights, which concentrate the weights on the households in poverty, is dependent on the values of the parameters in equation 7. We represent the AROP measure by setting z equal to 60 per cent of median income. We therefore calculate three sets of welfare weights which represent the FGT index with $\alpha = 0$, $w_{\alpha 0}(y_d, z)$, $\alpha = 1$, $w_{\alpha 1}(y_d, z)$, and $\alpha = 2$, $w_{\alpha 2}(y_d, z)$. In all cases, households above the poverty line have a weight of zero. $w_{\alpha 0}(y_d, z)$ is a set of binary weights where AROP households have $\beta^h = 1$. $w_{\alpha 1}(y_d, z)$ and $w_{\alpha 2}(y_d, z)$ have weights which increase in the poverty gap, according to equation 7. $w_{\alpha 1}(y_d, z)$ has the welfare weight given by the gap to the poverty line g^h . $w_{\alpha 1}(y_d, z)$ sets the weight as the square of the gap. In each of $w_{\alpha 1}(y_d, z)$ and $w_{\alpha 2}(y_d, z)$, we normalise the weights so that the household with the highest observed value of g^h has the highest $\beta = 1$.

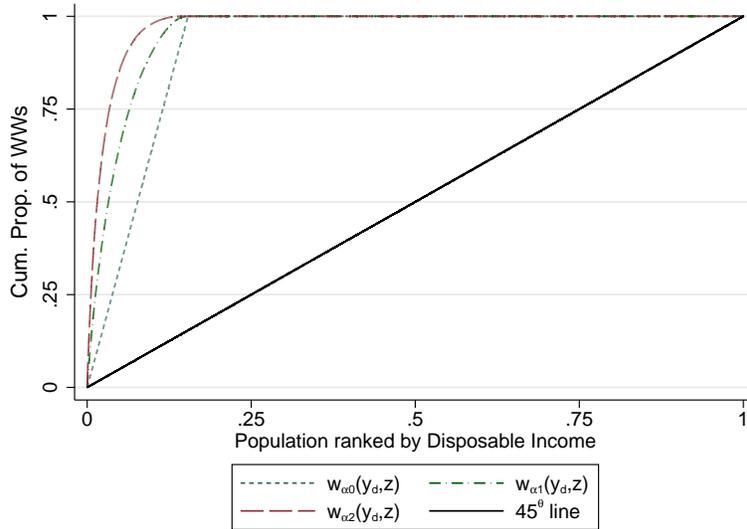
By design, the distribution of weights is fully concentrated in the low income households²¹. In each case, the concentration curve becomes precisely flat at the poverty line, as households above this line have a zero weight. Figure 3 shows that as α increases, the welfare weights become more and more concentrated in the poorest households. By splitting the population into deciles, this pattern becomes particularly clear. The bottom decile has a 62 per cent share of weights under $w_{\alpha 0}(y_d, z)$, with the remainder of the weights located in decile 2. $w_{\alpha 1}(y_d, z)$ has 89 per cent of weights in the bottom decile, while $w_{\alpha 2}(y_d, z)$ has 98 per cent of weights in the bottom decile. As expected, the higher the level of poverty aversion, the higher the relative weights placed on the poorest household²².

²⁰ $g^h = 0$ otherwise

²¹ z , measured as 60 per cent of median disposable income, is located in the second decile.

²² We can restrict $\beta^h > 0$ to households with children if we are most concerned about child poverty - see Appendix B.1 for the distribution of welfare weights in this scenario

Figure 3: Concentration Curve for Poverty-based Welfare Weights



4.4 “Deserved” Income

To this point, we have treated all income in a household equally, regardless of the source or nature of that income. In this section, we question that assumption. Evidence exists that society values income earned from different sources differently. Indeed, Saez and Stantcheva argued that an important belief society seems to hold is that it is fairer to tax income due to ‘luck’ than income earned through hard effort. On a similar theme, Boadway and Martineau (2013) discussed the role of social norms in determining how income, and the taxation of income, is valued in society. They allow social norms to affect participants and non-participants in the labour market in different ways. In the case when outcomes are determined by luck, preferences for redistribution are increased due to the moral benefit of not stigmatizing non-participants for their fate, and redistributing income towards them. On the other hand, when economic outcomes are attributed to effort, the social norm is included as the moral cost for non-participants: this reflects the stigma incurred by those who do not work, as a result of societal attitudes towards idleness. They argue that in the case of a norm embodying the view that outcomes are dictated by luck, the weights on all employed individuals will be lower, for a given system of taxes and transfers. The opposite result holds when the norm is based on the view that outcomes are the product of effort. Significant normative judgements are required to identify whether income, or elements of income, were earned through “luck” or earned through “effort”. Here we use one possible approach to make this distinction. The aim is to produce a profile of welfare weights where “deserved” or “earned” income is valued higher than “luck” income, so that society more readily accepts the redistribution of the luck element of income.

Our approach is to base the welfare weights not only on the level of income within a household, but also on the number of hours worked to earn that income. More formally, we have a set of weights $w(y_d, H)$, where the weights increase in the numbers of hours worked, H , and decrease (as before) in disposable income, y_d . We have:

$$w(y_d, H) = \delta w(H) + (1 - \delta)w(y_d) \tag{8}$$

where $w(y_d)$ is as before. $w(H)$ is calculated by $\beta^h = (H^h/H^N)^\phi$ where H^h is the average number of hours worked per person in household h ²³. δ captures the relative weight given to the two criteria, and so determines the trade-off between earning an extra unit of income versus working an extra hour. Setting $\delta = 1$ results in the Utilitarian profile of welfare weights²⁴, whereas setting $\delta = 0$ results in a profile of weights which increase in hours worked per adult in the household.

This approach captures the view that the more effort (measured here by hours of work) a household exerts to earn its income, the more society cares about the welfare of that household. It also reflects the concept of “full income”, whereby the amount of leisure time available to a household (which reduces in H), as well as disposable income, should also be taken into account. For example, if two households have the same income, but one household works twice as hard as the other to earn that income, the harder working household will have the higher welfare weight as it has exerted more effort to earn the same level of income, and as a result will have a lower amount of leisure time available. Alesina and Angeletos (2005) suggest that regional variation exists in societies’ beliefs regarding what constitutes ‘luck’ and ‘deserved’ income. Americans, they argue, believe that poverty is due to bad choices or lack of effort while Europeans view poverty as a trap from which it is hard to escape. The approach used here, in which the welfare weights increase in effort but decrease in income, can be seen as a combination of the two. Saez and Stantcheva (2013) find mixed evidence for differing welfare weights based on hours of work. In an online survey conducted by the authors, 42.7 per cent of respondents support a tax break for an individual who works longer hours than another with equal income. 54.4 per cent of respondents, however, think hours of work is irrelevant. Specifying the marginal welfare weights in such a manner may simply be punishing the higher educated by assigning them a lower weight. If hourly wages are a function of education, then two households that have the same (weekly or annual) income but work a different number of hours will have different weights. The higher educated household, which will have a higher hourly wage under the simplified assumptions, would have a lower welfare weight. Careful consideration of the effect on the incentive to invest in education would be necessary under this specification²⁵.

²³Of course, hours of work also vary within households. This within household variation may also be important in determining relative welfare weights. However, due to the nature of the HBS data, we do not take account of this within household variation.

²⁴In this specification, we set $e = 1$; we also set $\phi = 1$.

²⁵Lifecycle issues may again be important here, as higher educated households would likely have had periods of lower income while acquiring the education.

Figure 4: Decile Share of “Deserved” Income Welfare Weights

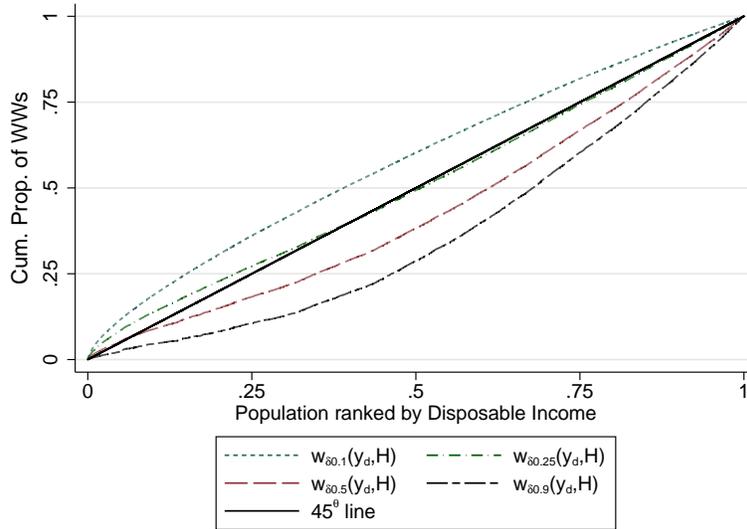


Figure 4 shows the distribution of welfare weights in this framework. We vary δ between 0.1 and 0.9, resulting the profiles of weights $w_{\delta 0.1}(y_d, H)$ to $w_{\delta 0.9}(y_d, H)$, to examine the effect of varying the relative weight on the two factors. The concentration curves show that the profile of these weights are quite sensitive to the value of δ . With $\delta = 0.1$, the distribution of weights remains quite similar to the Utilitarian weights, displaying a concave in income pattern. However, increasing δ to 0.25, the concentration curves loses its concavity, and crosses the 45 degree line around the 4th decile. This indicates that, under this specification, the poorest households still have a proportionally large share in of the welfare weights. Households slightly higher up the income distribution, however, have relatively low welfare weights due the positive effect of having low income being eroded by the negative effect of having relatively low hours of work. Those from the 6th decile onwards have approximately a proportional share of welfare weights. With δ equal to 0.5, the concentration curve cuts the 45 degree line much lower down the income distribution, indicating the positive effect of low income is eroded much sooner when we place more weight on hours worked. Compared to the Utilitarian case, households higher up the income distribution have a relatively high welfare weight, due to the positive effect of working a high number of hours. This pattern becomes emphasised as we increase the value of δ , thereby increasing the weight we place on hours worked relative to income.

4.5 Governmental Self-Interest

In the previous four subsections, we examined a range of weights that reflect individual utility, or some other basic principle like fairness or justice. Each was motivated by the collective good, with different principles used to determine which household’s utility should matter most when aggregating welfare changes. The Utilitarian approach suggests that the household with the least resources is most deserving, while under the principle of Equal Sacrifice the household that contributes the highest proportion of it’s income in taxes is considered most deserving.

But the question remains: when making tax reform decisions, do policy makers place most emphasis on the welfare of the household that society cares most about, or do they have their own motivations for valuing the welfare of certain households? In this section, we examine weights that capture a scenario where the policy-maker makes policy decisions based on pure self-interest, rather than attempting to reflect societies preferences.

A literature exists which suggests that the primary aim of an incumbent government is to get reelected, rather than maximise social welfare. Suiter and O'Malley (2013) argued that political parties will often target distributive spending on particular groups of voters. They argued that, depending on the type of electoral system and decision-making rules in place, such public spending can be important for the re-election of certain candidates or to help a party achieve or maintain a majority in parliament. This may be particularly true in Ireland, they reasoned, because there is strong incentive to garner the personal vote. In Ireland, the ballot structure allows voters choose between party's candidates. Candidates may therefore be unable to differentiate themselves via ideology or policy, and so may target government spending on particular voters to maximise their support. Similarly, Kayser (2005) suggested that incumbent governments are more likely to enact expansionary economic policy before election time in order to maximise it's chances of reelection. In such a scenario, a policy maker may not place most weight upon the welfare of the household that society values most, but may use a distribution of weights such that he maximises the chances of reelection²⁶.

We adopt two approaches to model this scenario. First, we follow the median voter literature. As Romer and Rosenthal (1979) reason, in the crudest version of this economic theory, the median voter has median income. We therefore maximise the weight on the household with the median disposable income. Atkinson and Stiglitz (1980) identified a number of restrictive criteria that must be satisfied in order for the median voter to have median income. They found that if quantity demanded (of public spending) is not a monotonic function of income, or if tastes are not identical, then the median voter cannot necessarily be identified by median income. However, this approach gives us a starting point for examining the distribution of weights under a governmental self-interest motivation, and reflects what Piketty and Saez (2013) term "the most popular model...among economists" for modelling the political decision making process. Formally, we calculate the weights as:

$$\beta^h = \left(\frac{x}{g_{my}^h} \right)^\phi \tag{9}$$

where x is the expenditure of the median voter normalised to one, and g_{my}^h is the absolute value of the difference between income of household h and the median income, with minimum value of one. This specification results in a profile of welfare weights $w(y_{med})$.

Of course, the median voter framework is a considerable simplification of a complex political process, requiring single peaked preferences a with respect to a unidimensional policy decision. Romer and Rosenthal found no evidence that empirical results based on the median voter model are superior to any reasonable alternative models. With this in mind, a number of

²⁶For simplicity, we take the government and policy maker as one individual decision-making unit. In reality of course, multiple decision makers exist within most governments, and so each may use a different distribution of welfare weights when making decisions. In addition, the electoral and decision making rules may affect the policy decisions made in government (Suiter and O'Malley (2013)), while other models of governmental decision-making suggest the primary aim is to build a bureaucratic empire rather than gain reelection. It is beyond the scope of this paper to address these concerns here.

authors have attempted to identify the group of voters that a government would target in order to maximise its likelihood of re-election. From a review of the political economy literature, it seems unclear which group of voters this represents. Cox and McCubbins (1986) suggested that politicians will target their core supporters, as these voters promise a higher return on their investment. However, Lindbeck (1987) theorised that expected returns are maximised by targeting swing voters, as core voters' choices are generally between voting for their own party or non-participation. More recently, Suiter and O'Malley (2013) suggested that only once factors such as decision-rules have been taken into account can we assess whether core or swing voters are the primary target of partisan spending. Due to this uncertainty, we construct an alternative model of governmental self-interest whereby the policy maker maximises the welfare weight on those most likely to vote, ignoring the distinction between core and swing voters. To model this scenario, we use datasets which record voter participation to model individual level likelihood to vote.

Ideally, we would like to use voter participation modules from the same time period as the main HBS data. However, such a dataset does not exist in Ireland²⁷. The closest available data comes from a Quarterly National Household Survey (QNHS) special module on voter participation from the 2002 Irish General Election.

We combine the main HBS data with the QNHS voter dataset to construct a household level probability to vote measure using a two-step procedure. In the first step, we estimate a parsimonious individual level model estimating the probability of voting with the QNHS data, based on K characteristics identifiable in both datasets. We have:

$$\pi_i^{qnhs} = Pr(Y = 1|X_1, X_2, \dots, X_K) = F(\gamma_0^{qnhs} + \sum_{k=1}^K \gamma_k^{qnhs} X_k^{qnhs}) \quad (10)$$

In the second stage, these estimates are used to construct a likelihood to vote in our main dataset, the HBS, so that:

$$\hat{\pi}_h^{hbs} = L(\gamma_0^{qnhs} + \sum_{k=1}^K \gamma_k^{qnhs} X_{kH}^{hbs} + \gamma_0^{qnhs} S_h + \sum_{k=1}^K \gamma_k^{qnhs} X_{kS}^{hbs} S_h) \quad (11)$$

where $L(x)$ returns the inverse logit of x , S_h is a dummy variable indicating the presence of a spouse of the head of household, X_{kH} are the characteristics of the head of household, and X_{kS} are the characteristics of the spouse of head of household for $k = 1$ to K . As the HBS only records the required information (X_1, X_2, \dots, X_K) for the head of household and the spouse, we can only construct a likelihood to vote for two people per household in the HBS. $\hat{\pi}_h^{hbs}$ is therefore a household level probability of voting measure.

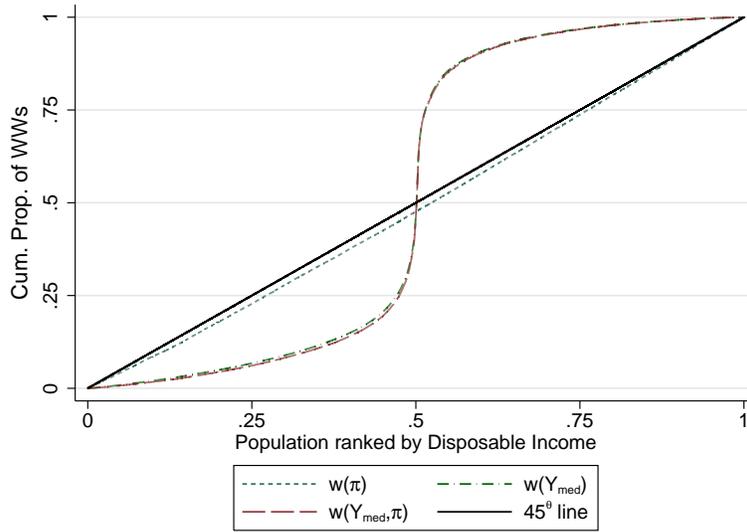
The distribution of $\hat{\pi}_h^{hbs}$ is normalised so that the likelihood in the household with the highest combined likelihood to vote is equal to one. We use this normalised household level probability to vote to construct a set of welfare weights, $w(\pi)$.

Of course, it may be that while policy makers place a higher weight on those most likely to vote, they are most interested not only in those most likely to vote, but in those most likely to have an influential vote. In that sense, a final specification in this setting is to capture elements of both $w(y_{med})$ and $w(\pi)$, by simply interacting the two sets of weights. This new set of weights, $w(y_{med}, \pi)$, maximises the welfare weight on households most likely to vote that are closest to the median voter, by allowing a one-for-one trade off between the two factors.

²⁷This reflects the absence of a major election in 2009/10 rather than a shortcoming of data collectors

Figure 5 shows the distribution of welfare weights under the three governmental self-interest approaches. $w(\pi)$ is convex in income, although is quite close to the 45 degree line at all points. It therefore exhibits a relatively weak positive relationship with income. The concentration curve for $w(y_{med})$ is steepest in the middle of the income distribution, indicating that this profile of weights are highly concentrated among middle income households. This is unsurprising given the specification of these weights in equation 9. $w(y_{med}, \pi)$ is closely related to $w(y_{med})$, which is unsurprising given the reasonably equal distribution of $w(\pi)$.

Figure 5: Decile Share of Govt. Self Interest Welfare Weights



5 Marginal Indirect Tax Reform

5.1 Distributional Characteristic

In this section we use a simple indirect tax reform model to test the sensitivity of results to changes in the underlying social marginal welfare weights. As we want to focus entirely on distributional considerations rather than any efficiency or other concerns that may also influence indirect tax rates (thereby isolating the effect of changes in the welfare weights), our tax reform “recommendations” are based purely on the distributional characteristic for each good. The distributional characteristic of a good, which originates in Feldstein (1972), provides a measure of the degree of concentration of consumption of that good within a particular group of households. Therefore, in the absence of efficiency concerns, tax reform is driven entirely by the distributional characteristic. In an analysis of distributional characteristics of several goods in Ireland, Madden (2009) states that “the most frequently used approach is to let β^h for each household equal its marginal utility of income, where the utility of income function is the well-known Atkinson one”. Here we move beyond the traditional use of Utilitarianism to test the sensitivity of the results to alternative specifications of the welfare weights.

With household consumption of good i denoted x_i^h and aggregate consumption of that

good denoted X_i , the distributional characteristic is calculated by:

$$D_i = \frac{\sum^h \beta^h x_i^h}{X_i} \quad (12)$$

Only the ranking, rather than the absolute value, of the D_i is important here. The ranking of the goods by D_i indicates among which groups consumption of particular goods are concentrated. Higher values of D_i indicate that consumption of good i is concentrated among the “deserving” households, however “deserving” is determined within that particular profile of β^h . Within the Utilitarian framework, for example, goods with a high concentration of expenditure among poorer households will have a relatively high D_i . The distributional characteristic therefore gives the optimal direction of tax reform taking only equity considerations into account, with the recommendation being to reduce the tax on goods with relatively high D_i and increase the tax on goods with a relatively low D_i . The absolute value of D_i will be affected by factors such as normalisation, meaning comparisons of D_i across sets of β^h are not meaningful; the ranking of goods alone drives the tax reform recommendations.

Using the HBS data, we can identify household expenditure across a wide range of goods. For the purpose of this analysis, we aggregate expenditure items into ten aggregate goods²⁸. For each of the goods, we calculate the distributional characteristic by equation 12. Table 2 presents the correlation coefficients from the ranking of the distributional characteristics from each set of welfare weights compared to the standard utilitarian case with disposable income as the measure of resource and with $e = 1$. Within the Utilitarian framework, the rankings are relatively insensitive to the value of inequality aversion e . Despite the increasing concentration of welfare weights on the poorest households as e increases (see Figure 1), the rankings of goods by distributional characteristic remains quite similar, with a correlation coefficient of 0.8 between the rankings when $e = 1$ and $e = 5$.

Comparing the Utilitarian rankings with the non-Utilitarian rankings, the most contrasting rankings are between the Utilitarian and Equal Sacrifice and “deserving” income weights. The correlation between the ranking of goods when D_i is based on $w(tt)$ and $w(y_a)$ is low, at -0.2. The majority of the contrast in the rankings is driven by the direct tax payments. A correlation coefficient of -0.9 between the rankings of goods based on $w(dt)$ and $w(y_a)$ indicates that the rankings of the goods, and so the tax reform recommendations, are almost the direct opposite between the Utilitarian case and the Equal Sacrifice case based on the direct tax and benefit system. Including the indirect tax payments in the Equal Sacrifice profiles of weights increases the degree of correlation between the rankings. $w(it)$ produces a ranking of goods with a positive correlation of 0.4 with the Utilitarian ranking. The “deserving” income weights also produce a strong contrast in the tax reform recommendations compared to the Utilitarian weights, particularly with values of δ greater than 0.1. The rankings diverge with a value of δ as low as 0.2, as shown by a correlation coefficient of -0.85 with $\delta = 0.25$. With $\delta \geq 0.5$, the ranking correlation is above -0.9.

The poverty based welfare weights produce similar distributional characteristic rankings as $w(y_a)$, with the correlation coefficient as high as 0.9 when $\alpha = 0$. As α becomes larger, the rankings diverge²⁹. This is unsurprising given the poverty based weights are effectively a

²⁸The ten goods are food, alcohol, tobacco, clothing, fuel, household non-durables, household durables, housing, transport, and services and other goods

²⁹Increasing the value of e in the Utilitarian weights maintains the high correlation coefficients as α increases in the poverty based weights.

restricted case of the Utilitarian weights. Interestingly, while $w(\pi)$ is concave in income, the resultant rankings of D_i contrast with the Utilitarian rankings, with a correlation coefficient of -0.4 .

Table 2: Correlation Coefficients for Ranking of Goods by Distributional Characteristic

	$w(y_d^{e=1})$		$w(y_d^{e=1})$		$w(y_d^{e=1})$		$w(y_d^{e=1})$
$w(y_d^{e=2})$	0.99	$w(tt)$	-0.22	$w_{\delta 0.1}(y_d, H)$	0.96	$w(y_{des})$	0.99
$w(y_d^{e=5})$	0.82	$w_{\alpha 0}(y_d, z)$	0.89	$w_{\delta 0.25}(y_d, H)$	-0.85	$w(Y_{med})$	0.79
$w(dt)$	-0.96	$w_{\alpha 1}(y_d, z)$	0.73	$w_{\delta 0.5}(y_d, H)$	-0.94	$w(\pi)$	-0.37
$w(it)$	0.43	$w_{\alpha 2}(y_d, z)$	0.47	$w_{\delta 0.9}(y_d, H)$	-0.96	$w(Y_{med}, \pi)$	0.87

Table 3 shows the ranking of goods by D_i under each profile of welfare weights. As was shown in Table 2, the rankings are sensitive to the choice of welfare weights. In the Utilitarian setting, food, fuel and tobacco are the highest ranked goods, indicating that expenditure on these goods is concentrated among income poor households. Services and housing are at the bottom of the rankings, so that richer households spend relatively higher proportions of their incomes on these goods. The tax reform recommendations based on the Utilitarian rankings, taking only equity considerations into account, would therefore be to reduce the tax on the goods with the higher D_i , such as tobacco and fuel, and increase the tax on the lower ranking goods, such as services and, particularly at higher levels of inequality aversion, alcohol.

These tax reform recommendations change significantly as we change the profile of welfare weights. Under $w(dt)$ and $w(tt)$, services, alcohol and transport are the highest ranking goods. Tobacco is consistently towards the bottom of the rankings under these weights, joined by food and fuel, or housing and durables, depending on the choice of welfare weights. $w(it)$ produces a ranking of goods more similar to the Utilitarian case, although alcohol has a relatively high D_i under $w(it)$, which is unsurprising given the high level of indirect taxation that alcohol is subject to in Ireland³⁰. Tobacco, fuel and food are also the lowest ranking goods under $w_{\delta}(y_d, H)$ with larger values of δ , with services, housing and transport at the top of the rankings. Unsurprisingly, with lower values of δ , the rankings more closely match the Utilitarian rankings.

The poverty-based weights also produce a ranking of D_i close to the Utilitarian rankings. Fuel and transport are most sensitive to the value of α , with fuel getting a relatively lower D_i as α increases. Alcohol and tobacco are the bottom of the rankings with $w(y_{med})$.

The rankings in Table 3, and the related correlations in 2, show that indirect tax reform recommendations can be quite sensitive to the specification of the underlying social marginal welfare weights. Within the Utilitarian framework, changing the value of e has a relatively small impact on the tax reform recommendations that result from the distributional characteristic analysis. Moving beyond the Utilitarian framework, it is only when we include non-income information that we observe significant changes in the rankings of goods. Allowing the welfare weights to increase in tax payments, in hours of work, or in the probability of voting, all produce rankings of goods with negative correlations to the traditional Utilitarian ranking. The poverty based weights, which are functions of income alone, produce rankings with high correlations to the Utilitarian case.

³⁰As well as being subject to the standard rate of VAT, it is also subject to excise duties.

Table 3: Rankings of Goods by Distributional Characteristic - Alternative Welfare Weights

	$w(y_d^{e=1})$	$w(y_d^{e=2})$	$w(y_d^{e=5})$	$w(it)$	$w(dt)$	$w(tt)$	$w_{\alpha 0}(y_d, z)$	$w_{\alpha 1}(y_d, z)$
Alcohol	7	7	10	2	3	2	5	3
Clothing	5	6	6	4	6	4	8	5
Food	3	3	4	8	8	6	3	4
Fuel	2	2	1	6	9	7	2	2
Non Durables	4	4	2	7	7	5	4	8
Services	10	10	7	10	1	1	10	10
Tobacco	1	1	3	1	10	8	1	1
Transport	6	5	5	3	4	3	6	7
Durables	8	8	8	5	5	9	9	9
Housing	9	9	9	9	2	10	7	6

	$w_{\alpha 2}(y_d, z)$	$w_{\delta 0.1}(y_d, H)$	$w_{\delta 0.25}(y_d, H)$	$w_{\delta 0.5}(y_d, H)$	$w_{\delta 0.9}(y_d, H)$	$w(y_{med})$	$w(\pi)$	$w(y_{med}, \pi)$
Alcohol	3	8	7	6	5	9	8	9
Clothing	4	6	4	5	6	8	7	7
Food	5	4	8	8	8	5	4	3
Fuel	7	2	9	9	9	3	6	4
Non Durables	8	6	3	7	7	2	5	2
Services	10	10	2	1	1	10	1	10
Tobacco	1	1	10	10	10	1	10	1
Transport	2	5	3	3	3	4	2	5
Durables	9	7	5	4	4	6	3	6
Housing	6	9	1	2	2	7	9	8

Note: Goods ranked by distributional characteristic - Highest(1) to lowest (10).

Of course, the simple tax reform model used here ignores many important considerations that would be taken into account when designing or reforming a tax system, such as efficiency and externality-correcting concerns³¹. Adding such considerations to the tax reform model³² would likely reduce the sensitivity of results to changes in the welfare weights. Madden (1995) and Decoster and Schokkaert (1990) showed that within the Utilitarian setting, tax reform recommendations were quite insensitive to the value of e chosen. The analysis of the distributional characteristic in this section showed that the use of generalised welfare weights introduces far more variation in the welfare weights than simply varying the e parameter in the Utilitarian setting. Whether these changes in the distributional characteristics would result in changes to the tax reform recommendations when efficiency concerns are taken into account would depend on the size of the estimated (own and cross price) elasticities of the goods in question, and how far from the 'efficiency-only' optimal tax scenario the tax system under consideration is. In the presence of large inefficiencies, welfare weights may play a minimal role in determining the tax reform recommendation. As stated previously, the aim of this paper is not to argue in favour of a particular set of weights, or argue in favour of particular tax reforms. Rather, it is hoped that the analysis in this paper makes clear the implications of different specifications of the welfare weights; a choice which is often made *ex ante* by the researcher.

³¹Alcohol and tobacco are often cited as goods which should be taxed at a higher rate due to the negative external effects associated with their consumption (see Mirrlees et al. (2011)).

³²See Ahmad and Stern (1984) for an example of a tax reform model that allows for equity and efficiency concerns.

6 Summary and Conclusion

Social marginal welfare weights play an important role in areas of applied public policy analysis such as tax reform. These weights reflect the values of the social planner, or equivalently the underlying social welfare function. Thus when evaluating the welfare effects of a tax reform, different weights may be assigned to different groups in society, with the weights reflecting the relative importance of these groups in terms of aggregating gains and losses arising from the tax reform. Until recently, the majority of research has adopted social marginal welfare weights based upon a Utilitarian approach, with concave utility of income functions, so that the poorest agent (individual or household) in society receives the highest welfare weight and weights decline as income increases. The rate at which the weights decline in income is determined by the level of inequality aversion specified in the social welfare function.

A number of recent contributions to the literature have questioned the default use of welfarism in this setting (Saez and Stantcheva (2013), Weinzierl (2013)). Using the nationally representative 2009/10 Irish Household Budget Survey, we apply a range of alternatives to welfarism in determining the distribution of social marginal welfare weights, and compare these distributions to that arising from the traditional welfarist approach. With these alternative distributions of welfare weights, we then examine whether marginal tax reform recommendations are sensitive to a move away from welfarism.

The distribution of welfare weights arising from the alternative approaches are found to differ appreciably from the distribution based upon welfarist weights. In applying alternatives to welfarism, weights are based on alternative transformations of income (e.g. an individual's distance from the poverty line, or from median income), on income along with some other factor or household characteristic (deserved income, equal sacrifice), or on some other set of characteristics independent of income (propensity to vote). The alternative weights which rely solely on some monotonic transformation of income produce a distribution of weights that is either very similar to the welfarist distribution, or almost a mirror image of the welfarist distribution, depending on whether the transformation of income is positive or negative. When factors other than income are included in the determination of the marginal social welfare weights, the comparison with the welfarist case becomes more varied. Including these other factors often produces distributions of weights that are not monotonic in income, and so the implications for tax reform becomes less predictable.

The various alternatives to welfarism examined in this paper are by no means exhaustive. We are restricted in the factors we can include in the analysis by the data available. Saez and Stantcheva (2013), for example, suggest a distinction between “deserving transfer beneficiaries” vs “free loaders” in determining the profile of social marginal welfare weights, where free loaders are those who choose to claim benefits rather than work. Using a cross-sectional household budget survey, it is difficult to distinguish between “deserving transfer beneficiaries” and “free loaders” without making some strong assumptions. Further work on this topic that uses alternative data sources, such as panel or administrative data, may be able to include factors that were not possible here. Even within each alternative analysed, there is an extensive number of specifications that could capture the key characteristics of the preferences discussed. For example, in the poverty section, rather than using the AROP measure of poverty, one could use multidimensional poverty measures to measure poverty. One could also focus on household joblessness which has been argued to be an equally important determinant of poverty risk as income (see Watson et al. (2013)). Similarly, one could use a

range of other characteristics for what is considered “luck” income and “deserved” income in Section 4.4. In addition, Weinzierl (2013) found that society’s preferences may be driven by a combination of factors, so that deriving social marginal welfare weights based on just one criterion may not fully capture society’s redistributive preferences. In practice, a combination of the weights derived in this paper may capture this approach.

The use of a single cross sectional dataset also means we are unable to identify dynamic issues, such as lifetime earnings or tax payments, rather than the static measures we observe. In the Equal Sacrifice section, for example, households dependent solely on the state pension would have a relatively low welfare weight, yet may have made large tax payments in previous periods of employment. This is also an issue within the Utilitarian framework, as low current-income households (such as those dependent solely on the state pension) will have a relatively high welfare weight, yet may have large savings or assets from a previous period of high earnings. Thus the alternatives to welfarism which we analyse here should be seen as merely the starting point for a richer analysis which can incorporate a wide range of possible approaches to deriving welfare weights.

Following the generation of a wider range of generalised welfare weights we then apply these alternatives to a specific policy issue viz. the analysis of marginal indirect tax reforms. Much analysis of marginal tax reform has concentrated upon sensitivity to either the specification of the underlying consumer demand model and/or differential welfare weights within a specifically Utilitarian framework (see Decoster and Schokkaert (1990), Madden (1995)). To test the sensitivity of indirect tax reform recommendations to a wider range of welfare weights (including those generated from non-welfarist approaches), we calculated the distributional characteristic of a range of goods under each of the sets of weights. The distributional characteristic allowed us to focus specifically on the role of welfare weights in making tax reform recommendations, as it abstracts from efficiency and other considerations that may also be taken into account in full indirect tax reform models. The degree of correlation between the tax reform recommendations using the welfarist weights and the alternative weights varied from close to perfect correlation (with the poverty-based weights), to a highly negative correlation (with the equal-sacrifice weights). This highlights the importance of careful consideration of the profile of marginal social welfare weights in making tax reform recommendations, as the recommendations, based on equity considerations at least, can be highly dependent on how the weights are determined.

Given the importance of social marginal welfare weights in areas of public policy analysis such as optimal labour and commodity tax design, and tax reform evaluation, we believe this detailed examination of the alternatives to welfarism, and their application to a nationally representative dataset, is an important addition to the literature. This is particularly true following the studies of Saez and Stantcheva, and Weinzierl, among others, which provide empirical evidence that people’s views on tax reform/public policy issues often seem to deviate from welfarist principles. While these studies provided evidence of a demand for social welfare weights based on principles other than welfarism, to the best of our knowledge this is the first attempt to empirically examine the sensitivity of actual tax reforms to a wider range of welfare weights than those implied by welfarism.

Appendix A Concentration Curves

We present the distribution of each set of welfare weights, $w(\cdot)$, by concentration curves according to equivalised disposable income³³. This approach allows us to highlight a number of features of each distribution in one graph. We present the concentration curves relative to the 45 degree line, which represents the case where the welfare of each household is valued equally. Each point on the curve indicates the percentage share of social marginal welfare weights (y-axis) assigned to the corresponding proportion of the population, ranked by equivalised disposable income (x-axis)³⁴. In each case, the welfare weights are normalised so that the household with the highest weight has a weight of one.

Concavity: A strictly concave³⁵ distribution of welfare weights indicates that lower income households have relatively high marginal welfare weights. For example, the concentration curve for the Utilitarian weights (with any positive level of inequality aversion) based on equivalised disposable income is, by design, concave in equivalised disposable income. A strictly convex concentration curve³⁶ indicates that low income households have relatively low marginal welfare weights.

Slope: Related to the degree of concavity is the slope at each point of the concentration curve. The slope of the concentration curve gives the rate of change of the cumulative share of weights with respect to the cumulative share of income. In other words, the slope of the ray tells us the ratio of cumulative share of weights to cumulative share of income. Therefore, a section of the concentration curve with relatively steep slope (more than 45 degrees) indicates that that portion of households have a larger than proportional share of marginal welfare weights. A more shallow slope (less than 45 degrees) indicates a low concentration of welfare weights for that portion of households.

Area between Concentration Curve and 45 Degree Line: The larger the area between the concentration curve and the 45 degree, the more unequal the distribution of welfare weights across the income distribution. As before, if the concentration curve lies above the 45 degree line, then the distribution of welfare weights is concentrated among poor households. The further the curve is above the 45 degree line, the more concentrated are the weights among the poor. If the concentration curve lies below the 45 degree line, the inequality is caused by a larger than proportional share of weights among the higher income households. Again, the larger the gap between the curve and the 45 degree line, the more concentrated are the weights among the rich.

Dominance: The concentration curve approach makes it straightforward to compare the degree of equality across the income distribution in two or more distributions of welfare weights, particularly when all curves of interest lie on the same side of the 45 degree line. If the concentration curve for one set of welfare weights lies closer to the 45 degree line than another at all points of the distribution, the first curve is said to dominate the second and the ranking by degree of inequality is unambiguous. Where concentration curves cross, we cannot unambiguously determine which distribution of weights is more equal across the income distribution than another simply by examining the graph. This approach is similar to Lorenz curve anal-

³³We follow O'Donnell et al.'s (2008) method of graphing concentration curves in Stata.

³⁴Having disposable income on the x-axis can be seen as setting the Utilitarian case with disposable income as the measure of resource as our 'base' case. The concentration curves then show how each alternative differs from this base case.

³⁵Concave in income. Concentration curve above the 45 degree line; increasing at a decreasing rate

³⁶Convex in income. Concentration curve below the 45 degree line; increasing at an increasing rate

ysis. However, unlike Lorenz curves, the welfare weight concentration curves can lie above or below the 45 degree line³⁷. This results in difficulties in comparing curves that lie on opposite sides of the 45 degree line, or when a curve crosses the 45 degree line. For this reason, we include a table of concentration indices in an appendix³⁸.

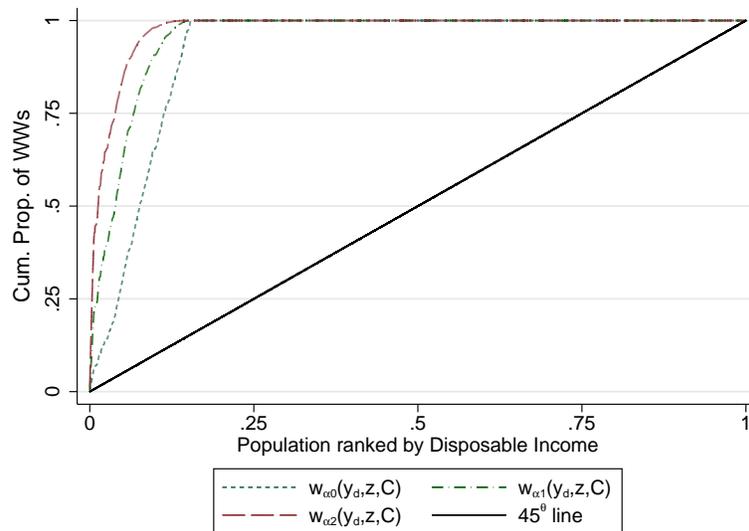
Appendix B Additional Criteria

In this appendix, we highlight a number of other possibilities to use when determining the profile of marginal social welfare weights.

B.1 Child Poverty Welfare Weights

This section describes the poverty-based welfare weights when we further restrict $\beta^h > 0$ only to households with children. This set of weights can be interpreted as the weights a social planner or policy-maker would use if his primary concern was child poverty. Again we can vary the α parameter to vary the measure of poverty - this results in profiles of welfare weights $w_{\alpha 0}(y_d, z, C)$, $w_{\alpha 1}(y_d, z, C)$, and $w_{\alpha 2}(y_d, z, C)$. As can be seen in Figure 6, the concentration curves are no longer smooth at low levels of income. This is due to a number of households below the poverty line having $\beta = 0$, as there are no children in the household.

Figure 6: Decile Share of Child Poverty Welfare Weights



B.2 Working Families

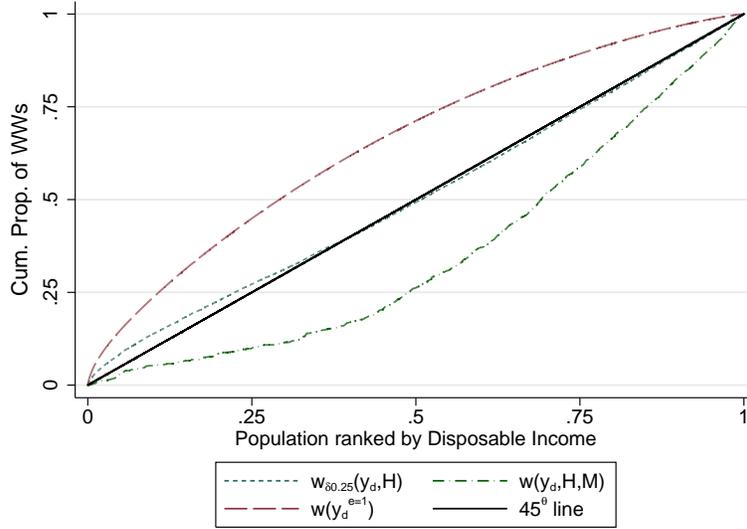
If we wish to concentrate the weights on working families, we can simply use a constrained case of $w(y_d, H)$. By using the same approach, but only allowing those in working-family

³⁷Lorenz curves graph income share from poorest to richest agent, so that the concentration curve must lie below the 45 degree line

³⁸We calculate the concentration index using O'Donnell et al.'s (2008) "convenient covariance" method.

households³⁹ to have $\beta_h > 0$, we maximise the welfare weight on low income families where at least two members of the household are at work. Figure 7 compares the resulting distribution of weights, labelled $w_{\delta 0.25}(y_d, H, M)$ where M is a family status variable, to the distribution of $w_{\delta 0.25}(y_d, H)$, with $\delta = 0.25$ in both cases. The profile of $w_{\delta 0.25}(y_d, H, M)$ is significantly more concentrated towards the top of the income distribution, as it restricts households with less than two workers to have a welfare weight of zero.

Figure 7: Decile Share of Working Family Welfare Weights



B.3 “Luck Income”

An alternative approach in determining the element of income that has been earned through ‘luck’ is to focus on the source of the income. The HBS data allows us to identify the proportion of income that has been earned through returns on investments or earned through property (which we assign as ‘luck’ income). The design of the tax system in Ireland seems to suggest that society accepts redistribution of the ‘luck’ element of income defined in this way more readily than the residual ‘deserved’ element. While the top marginal income tax rate in Ireland is 51 per cent (including social insurance contributions and the universal social charge), Capital Gains Tax⁴⁰ reaches as high as 80 per cent⁴¹. In this setting, we calculate a set of welfare weights $w(y_{des})$ by equation 3, where I^h is the deserved element of income of household h . As before, two households with the same level of disposable income will have different welfare weights if one household and earned that income through “luck” and the other has earned the income through “effort”.

The distribution of $w(t_{des})$ is remarkably similar to that of $w(y_d)$. As can be seen in Table 4, the distribution of “luck” income is concentrated in the top and bottom deciles. The top decile has the highest proportion of income made up of “luck” income, yet it only makes up

³⁹Defined as a household with at least two members at work, and the head of household is married

⁴⁰which is a tax paid upon the sale of an asset such as property

⁴¹This is quite a simplified example as there are likely to be a range of other factors affecting individual tax rates

2.5 per cent of income in that decile. The second and third deciles have the lowest proportion of income consisting of “luck” income, with each between 0.5 and 0.8 per cent. Consequently, deciles 2 and 3 have a slightly larger share of $w(y_{des})$ than $w(y_d)$, yet the differences are small given the low share of “luck” income in each decile.

Table 4: Luck income as percentage of gross income by decile

Decile	“Luck” Income as % of Gross Income
Bottom	2.0
2	0.5
3	0.8
4	1.6
5	1.3
6	1.0
7	1.2
8	1.6
9	1.2
Top	2.5

Appendix C Logit Results for Probability to Vote

Table 5 shows the characteristics associated with a higher probability of voting. Those in the largest urban area in the country, Dublin, are considerably less likely to vote than those elsewhere. Unemployed individuals are less likely to vote than employees, while married individuals are more likely to vote than all other marital statuses. The probability of voting increases with age and education. Usual hours of work seems to have no effect on the voting participation decision, conditional on the other variables.

Appendix D Concentration Indices

Table 6 shows the concentration indices for each of the distributions of welfare weights across the income distribution. Graphically, these can be viewed as a measure of the area between the 45 degree line and the concentration curve for each set of welfare weights. A negative value indicates that the weights are more concentrated in low income households, while a positive value indicates that the weights are more concentrated in high income households. A larger value for the concentration index, in absolute terms, indicates a more unequal distribution of weights across the income distribution. The dominance of one curve over another can be inferred by the absolute size of the coefficient, where a smaller value dominates a larger value.

A complication arises when the concentration curve of interest crosses the 45 degree line, as the positive element of the concentration index (section of curve below the 45 degree line) will be “cancelled out” by the negative element (section of curve above the 45 degree line). A distribution of weights fully concentrated on the median income household would therefore

Table 5: Logit coefficients for likelihood to vote - QNHS 2002

Variable	Category	Coefficient	Standard Error
Sex	Female	0.036	(0.043)
Region	SW, SE, MW, ME	-0.146***	(0.042)
	Dublin	-0.362***	(0.044)
PES	Employee (PT)	-0.013	(0.074)
	Assisting Relative	0.633	(0.388)
	Self-Employed (FT)	0.163**	(0.083)
	Self-Employed (PT)	-0.325*	(0.168)
	Unemployed (Seeking Work)	-0.565***	(0.117)
	Unemployed (Other)	-0.364**	(0.141)
	Home Duties	-0.225**	(0.090)
	Retired	-0.159	(0.107)
	In Education	-0.060	(0.143)
	Other	-0.545***	(0.120)
Marital Status	Married	0.602***	(0.070)
	Separated	-0.272***	(0.075)
	Widowed	-0.005	(0.075)
Age	25-34	0.470***	(0.068)
	35-44	1.177***	(0.075)
	45-54	1.707***	(0.081)
	55-64	1.988***	(0.089)
	65+	2.073***	(0.100)
Education	Secondary	0.405***	(0.049)
	Technical or Vocational	0.466***	(0.069)
	Third Level	0.570***	(0.059)
	Other	0.367**	(0.167)
Usual Hours	UsualHrs	-0.000	(0.002)
Farmers	Farmers	0.502***	(0.126)
Household Composition	Lone Parent	0.258***	(0.081)
	Couple with Children	0.283***	(0.055)
	Other	0.213***	(0.071)
Constant	Constant	-0.427***	(0.123)
Observations		24,805	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

have the same concentration index as an equally distributed set of weights. These indices should therefore be interpreted in combination with the concentration curves.

Table 6: Concentration Indices for Social Marginal Welfare Weights across Income Distribution

Welfare Weight	Concentration Index
$w(y_d^{e=1})$	-0.31
$w(y_d^{e=2})$	-0.6
$w(y_d^{e=5})$	-0.99
$w(dt)$	0.28
$w(it)$	-0.23
$w(tt)$	0.12
$w_{\alpha 0}(y_d, z)$	-0.85
$w_{\alpha 1}(y_d, z)$	-0.92
$w_{\alpha 2}(y_d, z)$	-0.96
$w_{\alpha 0}(y_d, z, C)$	-0.84
$w_{\alpha 1}(y_d, z, C)$	-0.91
$w_{\alpha 2}(y_d, z, C)$	-0.95
$w(y_d, H)$	0.03
$w(y_{des})$	-0.34
$w(E_{med})$	-0.08
$w(\pi)$	0.03
$w(E_{med}, \pi)$	-0.05

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