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**Sources of Income Inequality in Ireland**

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# **Sources of Income Inequality in Ireland**

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**Abstract:** This paper analyses inequality in Ireland via a decomposition of the Gini coefficient by source of income. Using data from the Irish Household Budget Survey of 1987, seventeen components of disposable income are identified and their contribution to inequality evaluated. Their contribution to inequality at the margin is also calculated. The paper also examines how policy changes addressing inequality can be assessed in terms of their effect upon both equality and output via an abbreviated social welfare function.

**Keywords:** Inequality; Gini Coefficient; Abbreviated Welfare Function.

**JEL Classification:** D63.

**Please note that empirical results presented in this paper are preliminary and subject to revision. Comments welcome.**

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# Sources of Income Inequality in Ireland

## **1. Introduction**

It seems reasonable to suggest that most policy-making authorities are, to varying degrees, inequality-averse and, other things being equal, prefer less inequality to more inequality. Indeed, many taxation and spending programmes are often explicitly aimed at addressing issues of inequality and redistribution. They also take account of issues such as efficiency and incentives, simplicity of collection etc., but in this paper we will be concentrating mainly on how certain government tax and benefit schemes impact upon inequality. In particular, we analyse the sources of inequality in disposable income via a decomposition of a well-known inequality index, the Gini coefficient.<sup>1</sup> This enables us to analyse at the margin where governments should direct policies so as to have the greatest impact upon inequality. In the next section we show how the Gini coefficient may be decomposed and how we may analyse sources of inequality at the margin. In section 3 we describe the available data for Ireland while in section 4 we apply the methodology to this data and discuss policy implications. In section 5 we try to examine how welfare in general might be affected by changes in equality at the margin, while in section 6 we discuss directions for further research in this area and make some concluding comments.

## **2. Decomposition of the Gini by Sources of Income.**

In this section we show how the Gini coefficient for overall income may be decomposed by sources of income.<sup>2</sup> Before doing so, we briefly discuss general issues concerning the decomposition of inequality. Shorrocks (1982) discusses in general how inequality may be decomposed by factor components. He shows that the contribution of any factor expressed as a proportion of total inequality can be made to give any value between plus and minus infinity. This rather negative result arises from the fact that the particular functional representation used for any

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<sup>1</sup> Note that the Gini coefficient is by no means the only available summary measure of inequality. See Sen (1973) for a discussion of other measures.

<sup>2</sup> This section draws on Lerman and Yitzhaki (1985).

inequality index is not uniquely determined. In this paper a decomposition with reasonable intuitive appeal is used whereby each component's contribution to inequality is the product of its own inequality, its share of total income and its correlation with the rank of total income.

We start off by noting that the Gini coefficient,  $G$ , can be expressed in terms of the area under the Lorenz curve, where the Lorenz curve relates the cumulative proportion of income units to the cumulative proportion of income received when units are arranged in ascending order of their income. A value of  $G=1$  represents maximum inequality while  $G=0$  represents zero inequality. More specifically, we have

$$G = 1 - 2 \int_0^1 L(p) dp \quad 1$$

where  $G$  is the Gini coefficient, and  $L(p)$  is the Lorenz curve. If we integrate this expression by parts we obtain

$$G = 2 \int_0^1 p L'(p) dp - 1 \quad 2$$

Suppose now we transform the variables with the substitution of  $p=F(y)$  where  $F(y)$  is the cumulative distribution of income. This gives us

$$G = -1 + 2 \int_0^\infty \frac{y F(y) f(y) dy}{\mu_y} \quad 3$$

where  $f(y)$  is the frequency distribution of income and  $\mu_y$  is mean income. From the formula for covariance between two random variables  $X$  and  $Z$  we have  $E(XZ)-E(X)E(Z)$ . Letting  $X$  be income,  $y$ , and  $Z$  be  $F(y)$ , the cumulative distribution of income, we have

$$Cov [y, F(y)] = \int_0^\infty y F(y) f(y) dy - \frac{\mu_y}{2} \quad 4$$

since  $E[F(y)] = \int_0^\infty F(y) f(y) dy = \int_0^1 p dp = 1/2$  and  $E(y) = \mu_y$ . Combining (3) and (4) we obtain

$$G = 2 \frac{Cov [y, F(y)]}{\mu_y} \quad 5$$

i.e. the Gini coefficient can be expressed in terms of the covariance between incomes and their ranks.

Now we let  $y_1, \dots, y_k$  represent components of income. Then since  $y = \sum_{k=1}^K y_k$  we can write

$$G = 2 \frac{\sum_{k=1}^K \text{cov}[y_k, F(y)]}{\mu_y} \quad 6$$

where  $\text{cov}[y_k, F(y)]$  is the covariance of income component  $k$  with the cumulative distribution of income. Multiplying and dividing each component  $k$  by  $\text{cov}[y_k, F(y_k)]$ , i.e. the covariance between income component  $y_k$  and the cumulative distribution of that component, and  $\mu_k$  yields the decomposition

$$G = \sum_{k=1}^K \frac{\text{cov}[y_k, F(y)]}{\text{cov}[y_k, F(y_k)]} \bullet \frac{2 \text{cov}[y_k, F(y_k)]}{\mu_k} \bullet \frac{\mu_k}{\mu} \quad 7$$

i.e.  $G = \sum_{k=1}^K R_k G_k S_k$  where  $R_k$  is the "Gini correlation" between income component  $k$  and total income,  $G_k$  is the relative Gini of component  $k$ , and  $S_k$  is component  $k$ 's share of total income. As discussed in Stark, Taylor and Yitzhaki (1986) the Gini correlation has the following properties:

(a)  $-1 \leq R_k \leq 1$ . If  $y_k$  and  $y$  are independent, then  $R_k$  equals zero. If  $y_k$  is an increasing function of  $y$ , then  $R_k$  is 1, while if it is a decreasing function, then  $R_k$  is -1 (this property is similar to Spearman's rank correlation, since it tells us that if households' rank according to  $y_k$  is exactly the same as their rank according to  $y$ , then  $R_k=1$ .)

(b) If  $y_k$  and  $y$  are normally distributed, then  $R_k = \rho$ , Pearson's correlation coefficient.

Using the above decomposition of inequality by source, we can examine how changes in particular income sources will affect overall inequality. Suppose we have an exogenous change in each household's income component  $j$  by a factor of  $e$ , such that  $y_j(e) = (1+e)y_j$ . Then<sup>3</sup>

$$\frac{\partial G}{\partial e} = S_j (R_j G_j - G) \quad 8$$

Dividing by  $G$  we also obtain

$$\frac{\partial G / \partial e}{G} = \frac{S_j G_j R_j}{G} - S_j \quad 9$$

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<sup>3</sup> For the derivation of (8) see Stark, Taylor and Yitzhaki (1986).

Thus the relative effect of a marginal percentage change in component  $j$  upon inequality equals the relative contribution of component  $j$  to overall inequality minus the relative contribution to total income. Thus if the Gini correlation between component  $j$  and total income,  $R_j$ , is negative or zero, an increase in component  $j$  will *decrease* inequality. If  $R_j$  is positive, then the impact upon inequality depends upon the sign of  $R_j G_j - G$ . A necessary condition for inequality to *increase* is that the inequality of component  $j$  must exceed the inequality of total income i.e.  $G_j > G$  since  $R_j \leq 1$ .

### **3. Data for Ireland**

We apply the methodology outlined above to data from the Irish Household Budget Survey (HBS) of 1987. The HBS is carried out every seven years and is a random sample of over 7000 urban and rural households throughout the country. The purpose of the survey is primarily to determine in detail the current pattern of household expenditure in order to update the weighting basis of the Consumer Price Index, but other information including sources of household income etc. is also collected.

Since this study concerns itself with sources of income inequality, the natural variable over which to rank households is income. However, different definitions of income are possible. We choose disposable income as it is given in table of the HBS. This definition of income falls short of a comprehensive Haig-Simons definition, excluding undoubtedly important items such as imputed rents from home or vehicle ownership. For the moment, we also ignore indirect taxes and public expenditure on items such as education, health and housing which affect household welfare. Given that these expenditures are often designed to explicitly address issues such as inequality and poverty it is likely that their exclusion will lead to an overall *overestimate* of measured inequality but should not affect the main focus of this paper which is the contribution of individual items of disposable income to inequality. In all we have seventeen sources of disposable income as can be seen from Table 1. Bear in mind that sources such as income tax have a *negative* share of disposable income.

There are further important points regarding the current state of the data we use. Firstly, at present information from the HBS is not available on a household basis for use by private researchers. The most disaggregated breakdown available is at quintile ( i.e 5%) level and so our

observations are effectively sample means for each quintile.<sup>4</sup> One of the consequences of the small number of observations is that it imparts an upward bias to the value for  $R_k$ . It seems reasonable to suggest that the correlation between ranks by individual components of income and total income will be higher for twenty observations of cell sample means, than for individual households.<sup>5</sup> Secondly, the unit of assessment for which the sample means are presented is the household. We do not address issues of within-household welfare.<sup>6</sup>

Finally, we must take into account differences across households in size and composition. A weekly disposable income of, say £200, will presumably confer higher welfare on a household of one adult than on a household of two adults and two children. To overcome this problem we adjust household income via the use of an appropriate equivalence scale. The choice of an appropriate equivalence scale is a matter of some debate. Here we adopt the relatively simple approach of using the square root of family size as the equivalence scale. Thus the income of a family of four persons is divided by 2. This approach does not explicitly distinguish between adults and children and the sensitivity of our results to alternative equivalence scales is a topic for future research.<sup>7</sup>

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<sup>4</sup> I am grateful to Kevin McCormack of the Central Statistics Office for providing me with the data.

<sup>5</sup> For a discussion of the small sample properties of  $R_k$  see Schechtman and Yitzhaki (1987).

<sup>6</sup> For a recent approach which does, see Bourguignon and Chiappori (1994).

<sup>7</sup> For a discussion of choice of equivalence scale etc. see Buhmann et al (1988).



#### **4. Sources of Income Inequality.**

In Table 1 we present income inequality by source of equivalised income, while in Table 2 we present the results for unequivalised income to illustrate the effect on the results of the introduction of equivalence scales.<sup>8</sup> Before looking at the marginal contributions to inequality, the individual values for  $R_k$ ,  $G_k$  and  $S_k$  are of interest. Note the very high values of  $R_k$  for some sources of income, including values of 1.0 for Wages and Salaries, Income Tax and Social Insurance, when rounded to three significant places. This shows the extremely high correlation between the rankings of households by these income sources and the ranking by Disposable Income. As stated above, we believe this may reflect an upward bias to  $R_k$  owing to the small sample size. We also note the negative correlation for most transfer payments, as we might expect. Childrens Allowance has a high positive correlation and as can be seen by comparison between tables 1 and 2 this survives the adjustment of income by equivalence scales. Note that the equivalence scales used here adjust for household size but not composition. A further explicit adjustment for composition might lead to a reduction in this value.

The  $G_k$  column shows the Gini coefficients for each source of income. The overall Gini for equivalised Disposable Income, which we label  $G$ , is 0.291.<sup>9</sup> This is well below the Gini for Wages and Salaries, reflecting the equalising effect of the tax and transfer system. The income source with the highest value for  $G_k$  is Income Tax. This reflects the progressivity of the direct tax system, with better-off households paying proportionately more tax than less well-off ones. The lower value of  $G_k$  for Social Insurance, which it could be argued many people regard purely as a tax, shows that, compared with income tax at least, it is regressive.

Once again, comparing tables 1 and 2 we see that the reduction in the overall Gini in moving from Wages and Salaries to Disposable Income is greater in the case of equivalised than non-equivalised incomes, showing the importance of the demographic dimension of certain transfer payments (e.g. old-age and widows pensions) in terms of their impact upon inequality.

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<sup>8</sup> Note that some of the columns do not add consistently owing to rounding.

<sup>9</sup> Callan and Nolan (1993) present an estimate of the Gini coefficient for Ireland for 1987 of 0.352. The discrepancy between their estimate and ours may be explained by the fact that they use a different household sample and also do not adjust household income for size. Our Gini of 0.35 for unadjusted income is much closer to their estimate.

The third column,  $S_k$ , shows the overwhelming importance of Wages and Salaries, and to a lesser extent Income Tax for Disposable Income. It also shows that the two most important transfer payments, in terms of share of Disposable Income, are Old Age Pensions and unemployment related payments.

The fourth column shows the contribution to the overall Gini,  $G$ , made by the individual sources of income. As our discussion of the first three columns would lead us to expect, Wages and Salaries and Income Tax are the largest contributors to  $G$ , although, of course, they are working in opposite directions.

Columns five to eight give various measures showing the impact of different sources of income on inequality. Column five merely deflates column four by the overall Gini, thus giving the weighted share of each income source in the overall Gini. Once again, Wages and Salaries and Income Tax are dominant, but the values for some of the other sources are also of interest. For example, transfers such as scholarships and educational grants, which are often alleged to be highly regressive, contribute only around 0.1% to the overall Gini.

Another feature of interest is that state Old Age Pensions on average contribute considerably more towards reducing inequality than do unemployment payments (to the tune of around 81%). This effect comes through considerably more for equivalised incomes reflecting the fact that pensions can be a significant source of income for smaller, less well-off households (they typically form a relatively large share for households in the second and third lowest quintiles which have average household sizes of less than 2). An interesting contrast can be drawn between state pensions and private retirement pensions. The latter contribute to inequality to a small degree, while the former, as outlined above, make the most significant contribution to lowering inequality of all state transfers. This may well be a reflection of the dynamics of income inequality, since those well-off households who could afford to make private pension provision during their working lives remain in the upper part of the income distribution, while less well-off households rely more heavily on state transfers in their retirement. Ideally, we would need a panel to properly investigate the dynamics of income inequality, but the figures shown here are suggestive.

Column eight is perhaps the most relevant in terms of policy-making conclusions since it examines the marginal effect of changing an income source on overall inequality.<sup>10</sup> Other

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<sup>10</sup> Note that the sum of all marginal effects must equal zero.

approaches to this issue have often compared inequality with and without the source in question e.g. Danziger (1980), which amounts to posing the not very realistic scenario of how the total elimination of one source of inequality would affect overall inequality.

Before commencing our analysis, however, we must remember that in this section, we are looking at the goals of the policy-maker in terms of inequality only. It is possible that policy-makers care very little for inequality and it is almost certainly the case that policy-makers have other goals, the pursuit of which may be in conflict with the aim of reducing inequality. Thus an increase in unemployment benefit payments may reduce measured inequality, but may also have adverse supply-side effects. In this section we will confine ourselves to the case where the policy-maker is concerned with inequality only, but, as we shall see in the next section, it may be possible to make some progress towards analysing the case where other goals are taken into consideration.

Leaving the above caveat aside, we can identify which policies would have the greatest marginal impact on inequality, as measured by the Gini coefficient. We ignore the case of Wages and Salaries, even though it has the largest coefficient in column eight, since presumably this source is outside the direct control of policy-makers. The source with the highest coefficient (in absolute terms) which is within the control of policy-makers is Income Tax. Thus our analysis suggests that the government could reduce inequality by increasing Income Tax. Once again, we have to be careful in interpreting this result. Firstly, there is the issue referred to above whereby increasing income tax may affect welfare apart from its effect on measured inequality.<sup>11</sup> Secondly, our measure of income tax here is quite crude and does not take account of the complexities of actual income tax schedules. Effectively, we are aggregating all income tax payments into the one total and ignoring the fact that some income tax is paid at the standard and some at higher rates, the existence of tax-free allowances etc.. Thus the impact upon inequality of an income tax change could vary considerably depending upon which particular rate was changed, or whether a tax-free allowance or tax band was widened.

After income tax, the source with the greatest marginal impact on inequality is Old Age Pensions. The coefficient suggests that a one per cent increase in such pensions could reduce the

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<sup>11</sup> This essentially reflects the fact that welfare prescriptions made purely on the basis on inequality measures of income distributions must assume that average income remains unchanged. See Lambert (1994).

overall Gini by almost 0.2 of a per cent. Once again note that the relative impact of Old Age Pensions on the Gini is higher with equivalised than non-equivalised incomes. It is arguable that increases in these particular transfer payments may have less adverse efficiency effects than some other transfer payments since presumably many of the recipients are no longer in the labour force. After pensions, unemployment payments have the next greatest impact on inequality at the margin with a coefficient of -0.12. Note that the difference in the contribution of these two sources to inequality is less at the margin than on average.

A further feature of column eight which is worth pointing out is that should an income source's contribution to the overall Gini,  $I_k$ , be less than its share in overall income, then a marginal increase in that source's income will reduce measured inequality. Retirement pensions and scholarships and grants are two such examples.

Finally, we note that all but three of the elements in column eight have negative values, those three being wages and salaries and self-employed incomes (farm and non-farm). An increase in all other sources of income (apart from Income Tax and Social Insurance where an increase implies a decrease in Disposable Income) would, at the margin, lead to a fall in inequality.

## **5. Welfare Effects of Changes in Inequality.**

In section 4 above we discussed the difficulties of inferring welfare effects from changes in inequality alone, given that other factors e.g the level of overall output will also contribute to social welfare. In this section we examine how changes in equality might affect social welfare when the social welfare function takes on a very particular form, that which Lambert(1994) calls the *Abbreviated Social Welfare Function*. In this case social welfare is merely a function of overall output and some measure of inequality. Thus we require that a social welfare function of the form:

$$v(y) = W[U_1(y), U_2(y), \dots, U_N(y)] \quad (10)$$

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where  $W$  is strictly increasing and  $v$  is symmetric can be abbreviated to the form

$$v(y) \equiv V(\mu, I) \quad (11) \quad 11$$

where  $y$  is the distribution of income,  $\mu$  is mean income  $=\Sigma y_i/N$  and  $I$  is some inequality index. The case we are interested in here is where  $I$  is represented by  $G$ , the Gini coefficient.

Newbery (1970) and Lambert (1985) have shown that when preferences are individualistic and thus symmetry of  $v$  requires that a common utility of income function be applied for all individuals, then no such abbreviated function exists when  $G$  is used as the summary measure of inequality. Nevertheless, when we allow preferences to be *non-individualistic* then rationales can be found for an abbreviated social welfare function defined over  $\mu$  and  $G$ . Sen (1973) shows that a welfare criterion which he terms *pairwise maximin* will generate such a function: "Suppose the welfare level of any pair of individuals is equated to the welfare level of the worst-off person of the two. Then if the total welfare of the group is identified with the sum of the welfare levels of all pairs, we get the welfare function underlying the Gini coefficient". (Sen, 1973, p.33).

This generates a welfare function of the form

$$V(\mu, G) = \mu (I - G). \quad (12)12$$

Other rationales apart from Sen's have been used to suggest a slightly more general form of (12) where we have

$$V(\mu, G) = \mu (I - kG), \quad k > 0. \quad (13)13$$

Examples include Runciman (1966) who motivates such a function in terms of an individual's deprivation relative to other incomes and Layard (1980) who invokes an individual's altruistic concern in terms of the incomes of those less well-off.<sup>12</sup> Effectively  $k$  is a parameter measuring envy/altruism and the greater is  $k$ , the greater is the reduction in mean income acceptable for a given reduction in inequality. Note that for  $\partial V/\partial \mu > 0$  we require  $k < 1/G$ . If the deprivation (altruism) effect is very strong then for very unequal distributions a reduction in mean income may be welfare-enhancing.

In terms of the analysis we have carried out in this paper we can use such an abbreviated social welfare function to examine the welfare effect of a marginal increase in an income source,  $y_j$ .

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<sup>12</sup> An abbreviated social welfare function can also be derived using Yitzhaki's generalised Gini Coefficient (Yitzhaki, 1983). In this case the motivation comes from a  $v$ -tuple pairwise comparison along the lines of Sen, where  $v$  is the parameter of inequality aversion from the generalised Gini. When  $v=2$ , we have the case of the "ordinary" Gini.

Once again we examine the effect on welfare of a change in income component  $j$  by a factor of  $e$ , such that  $y_j(e)=(1+e)y_j$ . Then we have:

$$\frac{\partial V}{\partial e} = \frac{\partial \mu}{\partial e}(1 - kG) - k\mu \frac{\partial G}{\partial e} \quad (14)$$

The derivative of mean income with respect to  $e$  is simply mean income from source  $j$ , i.e.  $\mu_j$ ,

while the derivative of  $G$  is given by equation (8). Thus re-arranging we have:

$$\frac{\partial V}{\partial e} = \mu_j(1 - kR_jG_j) \quad (15)$$

and the proportionate change in welfare is given by

$$\frac{\partial V / \partial e}{V} = S_j \frac{1 - kR_jG_j}{1 - kG} \quad (16)$$

Estimates of all the relevant parameters in (16) are available apart from  $k$ , which indicates the degree of altruism (or envy). In table 3 we show the proportional change in welfare for different values of  $k$ . If we set  $k=1$ , i.e. equal weights attached to equity and mean income, then we see, for example, that a 1% increase in wages and salaries will give rise to an increase in welfare of 0.448%.

Part of the increase in welfare is “lost” owing to the increased inequality. Similarly, a 1% increase in taxes leads to a fall in welfare of only 0.09%. As we lower the value of  $k$ , then the rise in welfare associated with an increase in any given source of income rises.

We can also analyse which sources of income give the “biggest bang per buck” by looking at the ratio of expression (16) to  $S_j$ , the sources share of income, which we label  $\alpha$ . Sources that have either a negative value of  $R_j$  or a Gini value well below  $G$ , the overall Gini will tend to give “good value” in terms of their effect on welfare. Examples include pensions and various social welfare payments.<sup>13</sup>

A further way of addressing the issue of appropriate values for  $k$  is to calculate those values of  $k$  for which expression (16) is zero i.e. the level of  $k$  for which a change in  $y_j$  begins to have a non-positive impact. We call this value  $k^*$  and we can see for example that a value of  $k$  in excess of

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<sup>13</sup> Policy-makers may be reluctant to increase certain welfare payments owing to adverse incentive effects. We hope to incorporate such incentive effects in future analysis.

1.78 would imply that a 1% increase in wages and salaries would in fact give rise to a fall in welfare, owing to the high weight placed on equity. Note that some sources of income have negative values of  $k^*$ , indicating that increasing these sources will have a beneficial effect on mean income *and* on measured inequality.

We can explore further interpretations to put upon the value of  $k$ . Returning to expression (13) where we see that for given  $V$  we have

$$\gamma = \frac{G}{\mu} \frac{d\mu}{dG} = \frac{kG}{1 - kG} \quad 16$$

i.e. to achieve a 1 per cent reduction in inequality a reduction in mean income of  $\gamma$  per cent would be accepted. Note that  $\partial k / \partial \gamma > 0$ . If we take as a measure of *equality*  $E = (1 - G)$ , then we obtain

$$\eta = \frac{E}{\mu} \frac{\partial \mu}{\partial E} = - \frac{kE}{1 - k + kE} \quad (17)$$

showing how much of a percentage change in output we are willing to swap for a 1% increase in equality, keeping welfare constant. Once again note that  $\partial k / \partial \eta < 0$ .

It seems fair to suggest that many people would have some idea of reasonable values for  $\gamma$  and  $\eta$  which in turn imply values for  $k$  (see table 4). Table 3 shows the implied values of  $\gamma$  and  $\eta$  consistent with  $k^*$ . Thus, taking the example of wages and salaries once again, we see that the value of  $\gamma$  consistent with  $k^*$  is 1.07 implying that if we were prepared to trade a reduction in mean income of 1.07% for a fall in inequality of 1% then we should be indifferent to a rise in wages and salaries of 1%, given the calculated value of  $G$ . Note that many values of  $\gamma$  are negative, thus implying that in terms of incomes and equity there is no trade-off following an increase in these sources of income. An increase in any one of these sources of income will lead to both higher mean income *and* lower inequality. Note that  $\gamma$  is negative for all sources of income whose  $I_j/S_j$  is less than one. These can be broken down into two sub-categories: those whose  $I_j/S_j$  is less than one but positive and those whose  $I_j/S_j$  is negative. Recall that a value of  $I_j/S_j$  which is positive but less than one implies that a source of income has a lower weight in overall inequality than it does in overall income. An increase in this source of income thus gives rise to a *fall* in inequality and the value of  $\gamma$  shows the implied trade-off between incomes and inequality for us to be indifferent, in welfare

terms, to a rise of 1% in these sources of income. Similarly, for those sources of income for which  $I_j/S_j$  is negative, an increase in any one of these sources will bring about a fall in inequality.

The final column in table 3 shows values of  $\eta$  consistent with zero change in welfare. They suggest, for example, that indifference to a 1% increase in wages and salaries implies that we are willing to trade a 2.6% fall in mean incomes for a 1% increase in equality, when equality is measured by  $(1-G)$ . The trade-off between incomes and equity would need to be considerably higher (6.5) for indifference to an increase in self-employed (farm) incomes of 1%. Once again, we note that  $\eta$  takes on a positive value for many sources of income, for the same reason that  $\gamma$  takes on a negative value for these sources.

Finally, it may be of interest to examine what a 1% fall in measured inequality actually implies. It implies that a Gini coefficient of, say, 0.3 would fall to about 0.297. Is this a "large" fall? To get some idea of this we can examine how calculated Gini coefficients have changed over time. In a recent study Atkinson, Rainwater and Smeeding (1995) examined the evolution of the Gini coefficient for a number of countries over the 1970-1990 period. For example, many commentators have expressed concern over the rise in measured inequality in the UK since the mid-1970s.<sup>14</sup> The Gini coefficient rose from a low of 23.4 in 1977 to 33.7 in 1991, a rise of 44%. Examining the year-on-year changes the arithmetic average of the absolute value of the yearly percentage change over the 1970-1991 period was 2.6%, with five years over that period showing changes in excess of 4%. For Sweden over the 1975-1991 period the average yearly change in absolute terms was 2.5% and for other European countries where the data is not as frequent, yearly changes of the same order of magnitude can be observed.

These figures suggest that changes in measured inequality of 1% are relatively small in comparison to the typical year-on-year changes experienced in many countries. Thus, in terms of desired changes in inequality, policy-makers may look for reductions in Gini coefficients well in excess of 1%.<sup>15</sup> Suppose then that a policy-maker wishes to reduce the Gini by, say, 5% via higher taxes. Our figures for  $k^*$  and  $\gamma$  suggest that for society to experience no welfare loss following such

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<sup>14</sup> See Atkinson (1995).

<sup>15</sup> It is also worth noting that measured inequality in Ireland is well above the EC norm. See Tsakloglou (1992) and Atkinson, Rainwater and Smeeding (1995).



tax increases then society would have to be indifferent between the fall in the Gini of 5% and a fall in mean incomes of 4.24% ( $=0.848 \times 5$ ).<sup>16</sup> Of course, there may be other ways of achieving the desired change in the Gini apart from raising taxes and the relevant values for  $k^*$  and  $\gamma$  can be read from table 3.

To summarise this section, we have attempted to explore the nature of the equity-efficiency trade-off arising from the empirical results presented in this paper. Our results on the marginal changes in inequality following changes in different sources of income mean that given the choice of an abbreviated welfare function, and more importantly, the choice of the different weights to be attached to equity and efficiency, we can assess the welfare impact of changes in such variables as taxes and certain transfer payments. As Fuchs has recently pointed out in his discussion of values in the context of health care reform (see Fuchs, 1996), disagreement over normative issues can often partly reflect disagreement over positive issues, which should in principle be capable of resolution. Thus when somebody states that they believe that taxes should not be increased to reduce inequality owing to the adverse output effects, this may reflect either (a) beliefs regarding the values of parameters such as  $R_j$ ,  $G_j$  and  $I_k$  (b) beliefs as to the appropriate values for parameters such as  $k$ ,  $\gamma$ , and  $\eta$  or (c) a combination of (a) and (b). An exercise such as the one carried out here will not throw light on (b) but it can present evidence on (a) and thus may be of help to policy-makers who actually have to make such difficult decisions regarding taxes etc..

## **6. Conclusions and Directions for Further Research.**

This paper has provided preliminary evidence on sources of income inequality in Ireland using data from the 1987 HBS and then applied the results to a discussion of equity-efficiency trade-offs using an abbreviated welfare function. There are a number of extensions/amendments which can be made to this work. Firstly, when the complete HBS becomes available, we hope to use the actual household data and not sample means from cells. This will increase the number of observations and ameliorate possible small sample problems with the calculation of the  $R_k$  coefficient. The inclusion of behavioural effects is also a major and desirable extension. Depending upon the richness of the information available at household level, or of that in other cross-section

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<sup>16</sup> Note again, that the fall in incomes reported here is the *impact* fall. Large increases in taxes may also have adverse incentive effects .

surveys (e.g. ESRI Project on Income Distribution, Poverty, and Usage of State Services), it may be possible to take account of the differing tax rates faced by different households. This analysis may also be extended to allow for the effect on inequality of indirect taxes, thus linking in with previous work by the author (Madden (1995)). It may also be possible to analyse equity-efficiency trade-offs with regard to other policy variables, such as unemployment payments. Finally, we have analysed the decomposition of what we may term the "ordinary" Gini. In the future we hope to incorporate differing views on inequality aversion via use of Yitzhaki's extended Gini (see Yitzhaki (1983)). Nevertheless, even as it stands, we believe this approach provides a useful means of analysing sources of income inequality in Ireland and may help to clarify discussions of the thorny issue of the equity-efficiency trade-off.

**Table 1: Sources of Inequality Using Equivalised Income**

Income Source	$R_k$	$G_k$	$S_k$	$R_k G_k S_k$	$R_k G_k S_k / G = I_k$	$I_k / S_k$	$G(I_k - S_k)$	$(I_k - S_k)$
Wages and Salaries	1.000	0.563	0.726	0.409	1.405	1.934	0.198	0.679
Self Employed (NF)	0.987	0.461	0.076	0.034	0.118	1.559	0.012	0.042
Self Employed (F)	0.954	0.420	0.071	0.028	0.097	1.372	0.008	0.026
Ret. Pensions	0.411	0.221	0.041	0.004	0.013	0.316	-0.008	-0.028
Investment Inc.	0.890	0.305	0.013	0.004	0.012	0.902	0.000	-0.001
Property Inc.	0.664	0.429	0.008	0.002	0.008	0.988	0.000	0.000
Farm Produce	0.543	0.161	0.011	0.001	0.003	0.280	-0.002	-0.008
Other Disp. Inc.	0.622	0.206	0.028	0.004	0.012	0.424	-0.005	-0.016
Childrens All.	0.781	0.170	0.022	0.003	0.010	0.448	-0.004	-0.012
Old Age Pensions	-0.850	0.436	0.075	-0.028	-0.096	-1.280	-0.050	-0.171
Widows Pensions	-0.927	0.417	0.023	-0.009	-0.030	-1.316	-0.015	-0.053
Other LT SW	-0.798	0.371	0.031	-0.009	-0.031	-1.016	-0.018	-0.062
UB, UA	-0.635	0.357	0.067	-0.015	-0.053	-0.786	-0.035	-0.120
Scholarships etc.	0.491	0.259	0.003	0.000	0.001	0.303	-0.001	-0.002
Other Transfers	-0.443	0.210	0.025	-0.002	-0.008	-0.327	-0.009	-0.033
Income Tax	1.000	0.634	-0.179	-0.114	-0.391	2.179	-0.062	-0.212
Social Insurance	1.000	0.535	-0.041	-0.022	-0.075	1.847	-0.010	-0.034
Disposable Income	1.000	0.291	1.000	0.290	0.999	7.827	-0.001	-0.001

Note: Some columns do not add due to rounding.

**Table 2: Sources of Inequality Using Non-Equivalised Income**

Income Source	$R_k$	$G_k$	$S_k$	$R_k G_k S_k$	$R_k G_k S_k / G = I_k$	$I_k / S_k$	$G(I_k - S_k)$	$(I_k - S_k)$
Wages and Salaries	0.999	0.577	0.765	0.441	1.260	1.647	0.173	0.495
Self Employed (NF)	0.991	0.484	0.079	0.038	0.108	1.367	0.010	0.029
Self Employed (F)	0.966	0.459	0.073	0.032	0.092	1.260	0.007	0.019
Ret. Pensions	0.557	0.252	0.040	0.006	0.016	0.400	-0.008	-0.024
Investment Inc.	0.918	0.360	0.013	0.004	0.012	0.923	0.000	-0.001
Property Inc.	0.771	0.470	0.008	0.003	0.008	1.000	0.000	0.000
Farm Produce	0.736	0.206	0.010	0.002	0.004	0.400	-0.002	-0.006
Other Disp. Inc.	0.904	0.247	0.027	0.006	0.017	0.630	-0.003	-0.010
Childrens All.	0.868	0.207	0.022	0.004	0.011	0.500	-0.004	-0.011
Old Age Pensions	-0.774	0.366	0.063	-0.018	-0.051	-0.810	-0.040	-0.114
Widows Pensions	-0.898	0.300	0.018	-0.005	-0.014	-0.778	-0.011	-0.032
Other LT SW	-0.676	0.337	0.027	-0.006	-0.018	-0.667	-0.016	-0.045
UB, UA	-0.497	0.347	0.062	-0.011	-0.031	-0.500	-0.032	-0.093
Scholarships etc.	0.627	0.298	0.003	0.001	0.002	0.667	0.000	-0.001
Other Transfers	-0.130	0.227	0.023	-0.001	-0.002	-0.087	-0.009	-0.025
Income Tax	0.999	0.646	-0.190	-0.123	-0.350	1.842	-0.056	-0.160
Social Insurance	1.000	0.548	-0.043	-0.024	-0.067	1.558	-0.009	-0.024
Disposable Income	1.000	0.350	1.000	0.349	0.997	9.352	0.000	-0.003

Note: Some columns do not add due to rounding.

**Table 4: Values of  $k$ ,  $\gamma$  and  $\eta$**

$\gamma$	$k$	$\eta$	$k$
0.05	0.16	-0.05	0.07
0.10	0.31	-0.10	0.14
0.15	0.45	-0.15	0.20
0.20	0.57	-0.20	0.26
0.25	0.69	-0.25	0.32
0.30	0.79	-0.30	0.38
0.35	0.89	-0.35	0.43
0.40	0.98	-0.40	0.48
0.45	1.07	-0.45	0.54
0.50	1.15	-0.50	0.59
0.55	1.22	-0.55	0.63
0.60	1.29	-0.60	0.68
0.65	1.35	-0.65	0.72
0.70	1.41	-0.70	0.77
0.75	1.47	-0.75	0.81
0.80	1.53	-0.80	0.85
0.85	1.58	-0.85	0.89
0.90	1.63	-0.90	0.93
0.95	1.67	-0.95	0.96
1.00	1.72	-1.00	1.00

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