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Income and Income Tax Inequalities in Ireland – New Evidence and Further Illustration of the Progressivity of the Irish Income Tax System

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Abstract: This paper presents new estimates of income and income tax inequalities in Ireland during 2001-2012, using publicly available (grouped) data from the Revenue Commissioners. The analysis is based on a novel estimator for the Gini coefficient given grouped data developed by Abounoori and McCloughan (2003) and the income data pertain to income before taxes and social welfare payments. As expected, the Gini coefficient by gross income ('market inequality') is higher than that of income after taxes and transfers ('net inequality'). The key findings are as follows. First, the Gini coefficient of gross income inequality has fallen since the crisis, in contrast to its rise pre-crisis. Secondly, the Gini coefficient of income tax inequality is much higher than that of gross income inequality, meaning that the share of all income tax among higher earners has been substantially larger than their share of all gross income. This implies that higher income earners have accounted for a much larger proportion of total income tax than their share of all gross income, and provides further illustration of the progressivity of the Irish income tax system, thus complementing existing research, including the Department of Finance's assessment. Third, the wedge between the two Ginis has broadened since the crisis, meaning that the Irish income tax system has become even more progressive in recent years. Consideration of the policy implications of the results, and of complementary research, suggest little scope for increasing income tax in the coming years.

***Keywords*:** income distribution and inequality, Gini coefficient, income tax progressivity.
***JEL Classifications*:** D31, H24

1. INTRODUCTION

This paper seeks to contribute to the research on income inequality in Ireland and the progressivity of the Irish income tax system by presenting new evidence on the extent of income inequality over the past decade and the degree of income tax inequality or the extent to which the total income tax burden is accounted for by higher earners. The results stem from new analysis of the Gini coefficient applied to publicly available (grouped) data on the distributions of income and income tax from the Revenue Commissioners to shed light on the following questions:

- Has income inequality risen or fallen since the crisis (from 2007)?
- How has the burden of income tax been distributed since the crisis and, in particular, has the burden fallen more or less heavily on higher or lower earners compared with before the crisis?

[1] 30 Pembroke Street Upper Dublin 2 Email: pat@pmca.ie. The research findings presented in this paper are based on independent analysis conducted using publicly available data and are unrelated to any consultancy assignment. The paper was presented at the December 2013 meeting of the Statistical and Social Inquiry Society of Ireland (SSISI) held at the Royal Irish Academy. The author would like to thank John Fitzgerald (Chair), Sean Lyons (Honorary Secretary), discussants Tim Callan of the ESRI and David Hegarty of the Department of Finance, and those who contributed to the discussion from the floor. Any errors are the responsibility of the author and the usual disclaimer applies.

- Related to this is the progressivity of the Irish income tax system and how this might have changed in recent years, following the introduction of the austerity measures to address the deterioration in the public finances stemming from the crisis.

We also explore whether income and income tax inequalities trend cyclically, and carry out parametric analysis of the Irish income distribution using classic probability distributions, which may be of interest to researchers working on parametric modelling of the income distribution, including for simulation purposes.
In a progressive income tax system, we may expect the Gini coefficient of income tax to be higher than the Gini coefficient of gross income, meaning that higher income earners account for a larger share of all income tax compared with their share of all income. In other words, while income is generally skewed towards higher earners, we would expect to observe even greater skewness in the distribution of income tax and the difference between the two measures of inequality, or Gini coefficients, may be interpreted as an (alternative) measure of income tax progressivity.

To the best of our knowledge, we estimate for the first time both types of Gini coefficient in Ireland and study their difference during the past decade, thereby contributing to the literature on the progressivity of the Irish income tax system in a novel way.

In regard to existing research, a comparison of austerity measures since the crisis in six EU countries by Callan *et al.* (2011) found over 30% of the overall adjustment was borne by the richest 10% of the population and approximately 70% by the richest four deciles. Ireland's adjustment was found to be the most progressive of the six countries.[2] According to subsequent research by Callan *et al.* (2012), the greatest losses incurred during 2009-2012 were among those with high incomes and the smallest losses were for those with the lowest incomes. In particular, estimated losses for low income deciles ranged from 4 to 6%, for middle income deciles from 7.5 to 9.5%, and 11-13% for the top two income deciles. The Organisation for Economic Cooperation and Development (OECD) (2012) found that Ireland had the second most progressive income tax system among its member countries in 2011 and the most progressive among the EU Member States (see also the Department of Finance (2013) document on the distributional aspects of recent budgets in response to the crisis).

The progressivity of the Irish income tax system internationally contrasts with the country's low overall burden of tax and income tax by European comparison. According to Eurostat (2013), total tax revenue as a proportion of gross domestic product (GDP) was 28.9% for Ireland compared with 38.8% for the EU27 and 39.5% for the euro zone in 2011; in regard to the implicit tax rate on labour, Eurostat records the rate of 28% for Ireland, compared with 35.8% and 37.7% for the EU27 and euro zone respectively in that year. Addressing the discrepancy between GDP and GNP (gross national product) in Ireland, Callan *et al.* (2013) develop a hybrid measure of GDP and GNP for Ireland and find that it continues to emerge as a low overall income tax country (2011) but that marginal tax rates faced by higher earners in Ireland are among the highest in the EU15, a finding echoed by Department of Finance research, which shows that the country's top marginal income tax rate is currently high in comparative terms, and critically that the entry point to the top rate as a multiple of the average wage is one of the lowest – at the average wage in Ireland – compared with an OECD average of over 4 times average income. Concerning the possibility of a higher top marginal tax rate (48%) on incomes above €100,000 in Ireland, Callan *et al.* (2013), while not seeking to provide a comprehensive assessment of the costs and benefits of such a proposal, nevertheless find that there is "limited scope for tax increases on such high incomes to contribute to a substantial upward shift in the ratio of tax to national income" (p. 13) and conclude that "if Irish income taxes were to approach European levels, it is likely that marginal tax rates in low to middle income range would have to rise" (p. 21).

The progressivity of the Irish income tax system is not without cost. In a paper published in 1987, Honohan and Irvine find that high rates of taxation, combined with the narrowness of the Irish tax base then (as now), lead to losses which are "very high" (as high as "one pound per pound of revenue raised at the margin").

The existing research on the progressivity of the income tax system in Ireland makes use of survey micro-data or administrative tax data. This paper falls within the latter, and all of the data used here are publicly available. The official source of gross income distribution data in Ireland is the Office of the Revenue Commissioners. As the primary State body responsible for the assessment and collection of taxes and duties in Ireland, the Revenue also provides corresponding income tax data. A feature of the publicly available Revenue gross income and income tax data is that they are grouped into gross income bands. It might be thought that this feature of the

[2] As well as Ireland, the other countries studied by Callan *et al.* (2011) were Estonia, Greece, Portugal, Spain and the UK.

data would render it difficult or impossible to accurately estimate the Gini coefficient. However, Abounoori and McCloughan (2003) derive, and show how to apply, an estimator for the Gini coefficient given grouped data. It is this technique that is employed here.[3]

The estimates of the Gini coefficient presented in this paper are appreciably higher than those published by the Central Statistics Office (CSO) in its Survey on Income and Living Conditions (SILC). This reflects the fact that the CSO's estimates are based on disposable income, given as gross income adjusted for income tax and social welfare transfers. While measurement of the Gini coefficient by disposable income (and adjusting for household size) may be useful for comparing income inequalities across countries, it does not provide an assessment of underlying income inequality as captured by income generated in work or from market activities by self-employed individuals. Inclusion of taxes and social welfare payments generally serves to reduce the Gini coefficient, meaning that the Gini coefficient of gross income inequality (or 'market inequality') will be higher than that of disposable income inequality ('net inequality'). This is confirmed here, where the estimated Gini coefficient of gross income inequality averages 0.48 during 2001-2012; whereas the SILC estimates of the Gini coefficient of disposable income inequality have ranged in the low 0.30s in recent years. The OECD provides Gini coefficients of income before taxes and transfers as well as Gini coefficients of disposable income after taxes for member countries. Inspection of the OECD's estimates shows that the percentage gap between the two Ginis has been higher in Ireland compared with the average for the OECD countries during 2004-2009 (namely 41% in Ireland compared with 34% in the OECD average). This in turn suggests a comparatively generous social welfare system in Ireland, as well as a progressive income tax system, even if, according to the OECD's estimates, the gross income Gini is relatively high in Ireland.[4]

2. THE GINI COEFFICIENT AND ITS ESTIMATION GIVEN GROUPED DATA

The Gini coefficient is the most widely used measure of income inequality and so called after the Italian statistician Corrado Gini (1884-1965). It captures the whole income distribution and varies from zero, indicating perfect equality (everyone has the same income), to one (or 100 on the percentile scale), which expresses total inequality (one person has all income). In practice, the polar values are not observed and higher values are associated with greater inequality. To further understand the Gini coefficient, reference may be made to the Lorenz curve, named after the US economist Max Lorenz (1876-1959), whose paper in 1905 represents the first method for estimating the Gini coefficient.

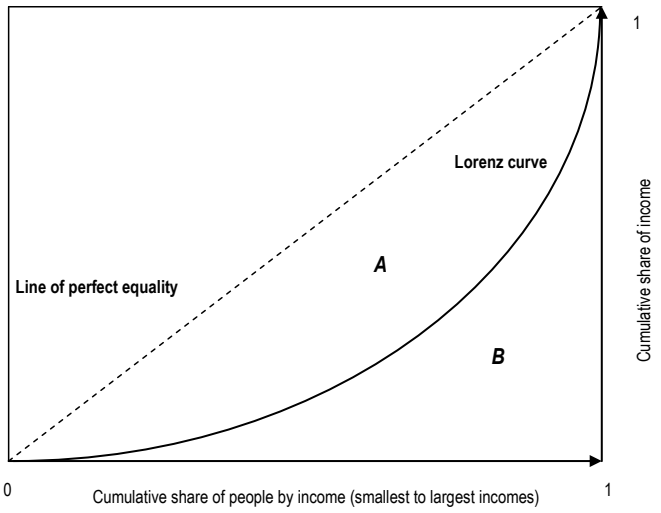
The general Lorenz curve shown in Figure 1 plots the cumulative share of the number of individuals by income (from smallest to largest incomes) (on the x-axis) and the cumulative share of income (on the y-axis). The broken line represents perfect equality and means that, for example, the bottom 10% of people account for the same proportion (i.e. 10%) of all income, the bottom 20% of people for 20% of all income etc. The equality diagonal therefore illustrates the situation in which everyone has the same level of income. The other extreme of the Lorenz curve is where it coincides with the arrowed lines of the x- and y-axes – this is where all income is captured by one person and represents absolute inequality. The Lorenz curve depicted is illustrative of empirical Lorenz curves.

More formally, the Lorenz curve plots ordered pairs where the abscissa (x-value) is the cumulative distribution function (cdf) of the number of people by income (the 'original distribution') and the ordinate (y-value) is the cdf of income by income (the 'first moment distribution'). The Gini coefficient, G, is given as the ratio of the difference between the Lorenz curve and the equality diagonal (area A in Figure 1) and the area under the equality diagonal ($A+B$) (i.e. $G=A/(A+B)$). Since $A+B=0.5$ (the axes scale from 0 to 1), $G=2A$ so that the Gini coefficient is determined by A: Lorenz curves further from the equality diagonal (larger A) imply higher G values and thus greater income inequality, and Lorenz curves closer to the equality diagonal (smaller A) indicate lower Ginis.

[3] The AM technique is a non-parametric method – it does not impose any assumptions on the distributional form of the data. Parametric estimates of the Gini coefficient are presented subsequently in the paper for comparison with the AM method.

[4] According to the CSO (2012a), average gross income among households increased modestly by 3.9% between 2004-2005 and 2009-2010, within which direct income fell by 6.1% but State transfers increased by 73.2%. Further evidence of the generous nature of the redistributive system in Ireland comes from the CSO (2012b), which includes the finding that: Ireland had the second highest percentage of population at risk of poverty, *before* pensions and social transfers, in the EU in 2011, after Hungary; however, the at-risk-of-poverty rate in Ireland, *after* pensions and social transfers, at 15%, was lower than the average EU rate of 17%. Further, the at-risk-of-poverty rate in Ireland, as calculated by Eurostat, declined from over 20% in 2003 to 15% in 2011.

Figure 1: Illustration of the Lorenz Curve from which the Gini Coefficient Derives



Source: Author.

In 1905, Lorenz proposed his frequency polygon (Lorenz curve) as a means of estimating the Gini coefficient and the method remains accurate for ungrouped data (i.e. data on the incomes of all individuals in the sample). Later researchers proposed further methods (for ungrouped data). Noteworthy is the method of Milanovic (1994), which also has attractive decomposition properties. Abounoori and McCloughan (2003) modify the Milanovic (1994) method for the case of grouped data and outline a worked example of how to apply the technique, using grouped US income tax returns data for 1972, as reported in Cowell (1977).[5] The worked example, which Abounoori and McCloughan (2003) compare with other methods, illustrates the accuracy of the AM technique for grouped data. A technical summary of the AM method is given in Appendix 1 in this paper.

3. DATA

The most comprehensive source of information on the distribution of income in Ireland is from the Revenue, whose core function is the assessment and collection of taxes and duties. Revenue's publicly available Statistical Reports contain annual data on all the taxes and duties for which the organisation is responsible. Separate reports are available for total revenue, specific income and transactions taxes, and the distribution of income.

In respect of the latter, comparable data are available for the years 2001-2010 (the latest Statistical Report 2011 at the time the analysis for this paper was carried out in 2013 covers the year ended 2010). The relevant data are provided in Table IDS1, which gives the aggregate distribution of (i) the number of incomes, (ii) gross income charged and (iii) tax (by range of gross income). Gross income is defined as income before adjustments are made in respect of capital allowances, interest paid, losses, allowable expenses, retirement annuities etc. but after deduction of superannuation contributions by employees. Gross income does not include certain other income which is not income for tax purposes or is exempt from tax, such as profits or gains from stallion fees (pre-August 2008), profits from commercial forestry and certain income from patent royalties, certain investment income arising from personal injuries, child benefit, maternity benefit and unemployment assistance, certain earnings of writers, composers and artists, bonus or interest paid under certain savings schemes, interest on certain government securities, certain foreign pensions exempt from tax in the foreign paying country, portion of certain lump sums received by employees on cessation of their employment, statutory redundancy payments and certain military pensions. Other income sources which are either not included or not fully included include unemployment benefit, disability benefit and the incomes of certain self-employed persons, including some farmers, as well as some individuals in receipt of pensions, who are not processed annually on tax records because their incomes are below the income tax thresholds.

[5] The worked example is provided in Table 3 of Abounoori and McCloughan (2003). There are two small printing errors in the table: the term *C* should not appear in the heading to Column 8 (Col. 8) and the heading to Column 9 (Col. 9) should include multiplication of the sum of Col. 8 by *C*.

Table 1 reproduces the (*finalised*) distribution of gross income and income tax in 2010. In that year, there were almost 2.1 million income cases, with total gross income of over €77.7 billion and total income tax of over €9.8 billion. The data have been grouped (by Revenue) into 18 gross income groups and, with the exception of 2001 and 2003, the distributions for each of the other years during 2001-2010 have this number of groups (whereas each of the distributions in 2001 and 2003 has 19 groups). The number of groups does not impact on the application of the AM technique.

Table 1: Distribution of Gross Income and Income Tax (2010)

	Gross Income Group		Frequency		Gross Income Charged		Income Tax	
No.	From (€)	To (€)	Number of Cases	% of Total	€m	% of Total	€m	% of Total
1	...	10,000	387,175	18.54%	1,703.28	2.19%	4.82	0.05%
2	10,000	12,000	71,719	3.43%	790.75	1.02%	2.49	0.03%
3	12,000	15,000	109,788	5.26%	1,484.70	1.91%	6.17	0.06%
4	15,000	17,000	72,768	3.48%	1,164.97	1.50%	5.06	0.05%
5	17,000	20,000	122,603	5.87%	2,270.22	2.92%	14.02	0.14%
6	20,000	25,000	200,619	9.61%	4,512.90	5.81%	95.58	0.97%
7	25,000	27,000	74,917	3.59%	1,946.94	2.50%	66.81	0.68%
8	27,000	30,000	102,601	4.91%	2,923.31	3.76%	122.69	1.25%
9	30,000	35,000	152,930	7.32%	4,963.25	6.39%	265.82	2.71%
10	35,000	40,000	137,680	6.59%	5,154.61	6.63%	351.66	3.58%
11	40,000	50,000	198,857	9.52%	8,878.49	11.42%	843.49	8.59%
12	50,000	60,000	130,636	6.26%	7,138.55	9.18%	870.71	8.87%
13	60,000	75,000	124,574	5.96%	8,333.70	10.72%	1,183.06	12.05%
14	75,000	100,000	102,146	4.89%	8,745.83	11.25%	1,497.35	15.26%
15	100,000	150,000	63,191	3.03%	7,506.02	9.66%	1,618.46	16.49%
16	150,000	200,000	17,101	0.82%	2,922.48	3.76%	739.03	7.53%
17	200,000	275,000	9,308	0.45%	2,156.82	2.77%	583.30	5.94%
18	Over 275,000		9,830	0.47%	5,131.87	6.60%	1,544.93	15.74%
Totals			**2,088,443**	**100.00%**	**77,728.69**	**100.00%**	**9,815.45**	**100.00%**

Source: Revenue, author analysis (to confirm the Revenue's totals and percentages).
Note: The 2010 figures are the latest finalised figures available from the Revenue (Statistical Report 2011) at the time the analysis was carried out in 2013.

While the 2010 figures are the latest *finalised* figures publicly available from Revenue's published Statistical Reports, estimates of the corresponding gross income and income tax distributions for 2011 and 2012 are available from Written Answers (Numbers 69-77) to the Dáil Debates (2 May 2013). The income groups differ from those in the finalised publicly available Statistical Reports on the Revenue's website and were put together by Revenue in response to the Dáil request, which specified the income bands (there are 26) with which to group the gross income and income tax data for 2011 and 2012. The data for these two years are "provisional and likely to be revised" (they were estimated from Revenue's tax-forecasting model using actual data for the year 2010 adjusted as necessary for income and employment trends in the interim). As shown below, the analysis of the provisional 2011 and 2012 data produces Gini coefficients in the range of those arising from the analysis of the finalised data during 2001-2010.[6]

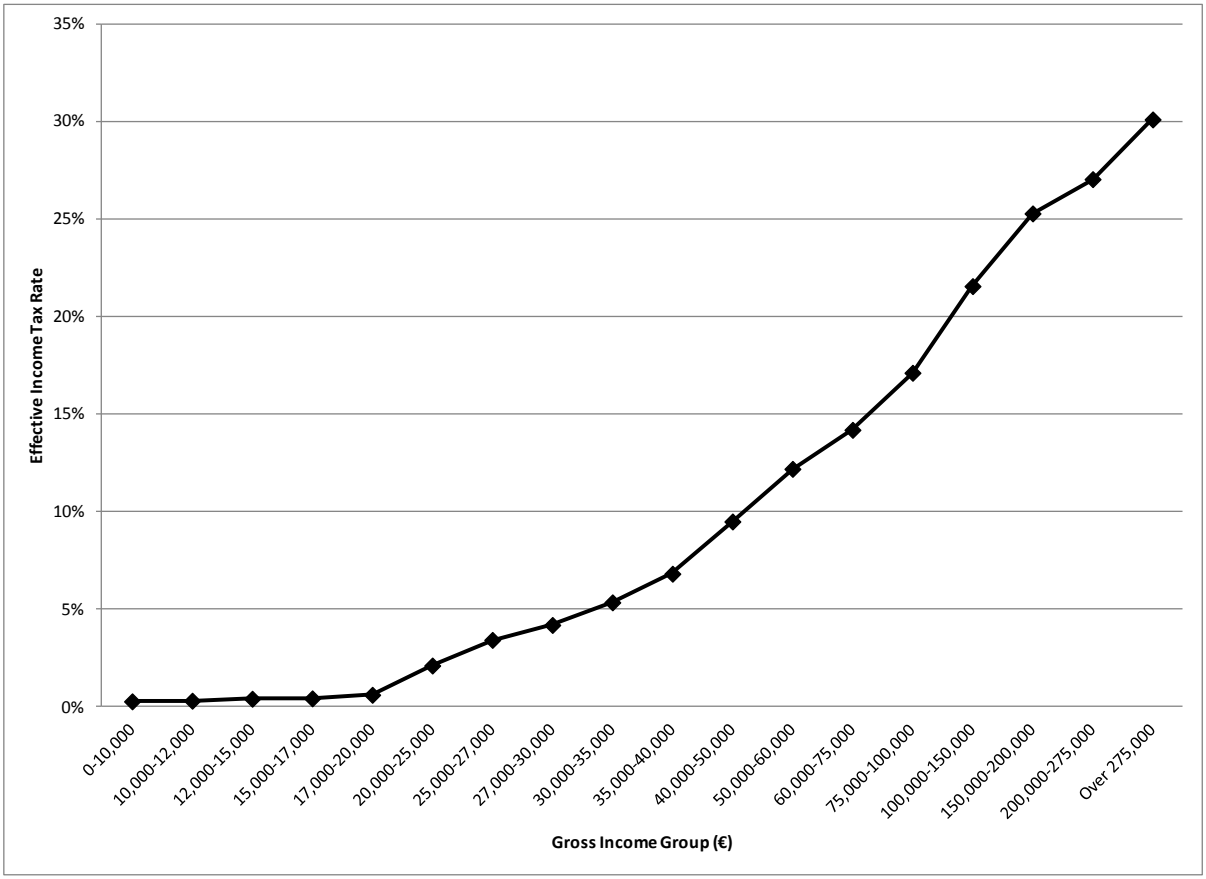
[6] The publicly available finalised Statistical Reports of the Revenue also provide grouped data relating to (i) total income and (ii) taxable income (in addition to gross income). These are explained in Appendices 2 and 3 of this paper, where the corresponding estimated Gini coefficients of income and income tax for 2001-2010 are also provided. No request for income distribution data pertaining to these two types of income (i.e. total income and taxable income) compiled by the Revenue were requested in the aforementioned Dáil Debates (2 May 2013). The focus here is on the gross income data (2001-2012).

4. DESCRIPTIVE DATA ANALYSIS

4.1 Progressivity of the Irish Income Tax System

From the Revenue data reproduced in Table 1, we can calculate the 'effective' income tax rate per income group by dividing the income tax (€m) by the gross income charged (€m) for each group. This exercise illustrates the progressive nature of the Irish income tax system because it is evident from Figure 2 that low levels of income incur low effective tax rates and the effective tax rate is seen to rise steeply with income. The progressivity of the income tax system reflects the progressiveness of the income tax credit system, which results in low income earners being exempt from income tax until a threshold income level is reached (which the International Monetary Fund (2012) has described as high). The same pattern of progressive income tax as that shown in Figure 2 is evident in all of the other years examined, including for the provisional Revenue data for 2011 and 2012.

Figure 2: Effective Income Tax Rates by Gross Income Group (2010)



Source: Revenue, author analysis.

Note: The effective income tax rate is calculated by dividing income tax (€m) by gross income charged (€m) for each gross income group (the data are shown in Table 1). It reflects income tax credits and marginal tax rates.

4.2 Trends in Gross Income and Income Tax during 2001-2012

Table 2 shows the trends in gross income and income tax during 2001-2012 and reveals a number of noteworthy developments, which are summarised in the growth rates at the bottom of the table.

Table 2: Trends in Gross Income and Income Tax (2001-2012)

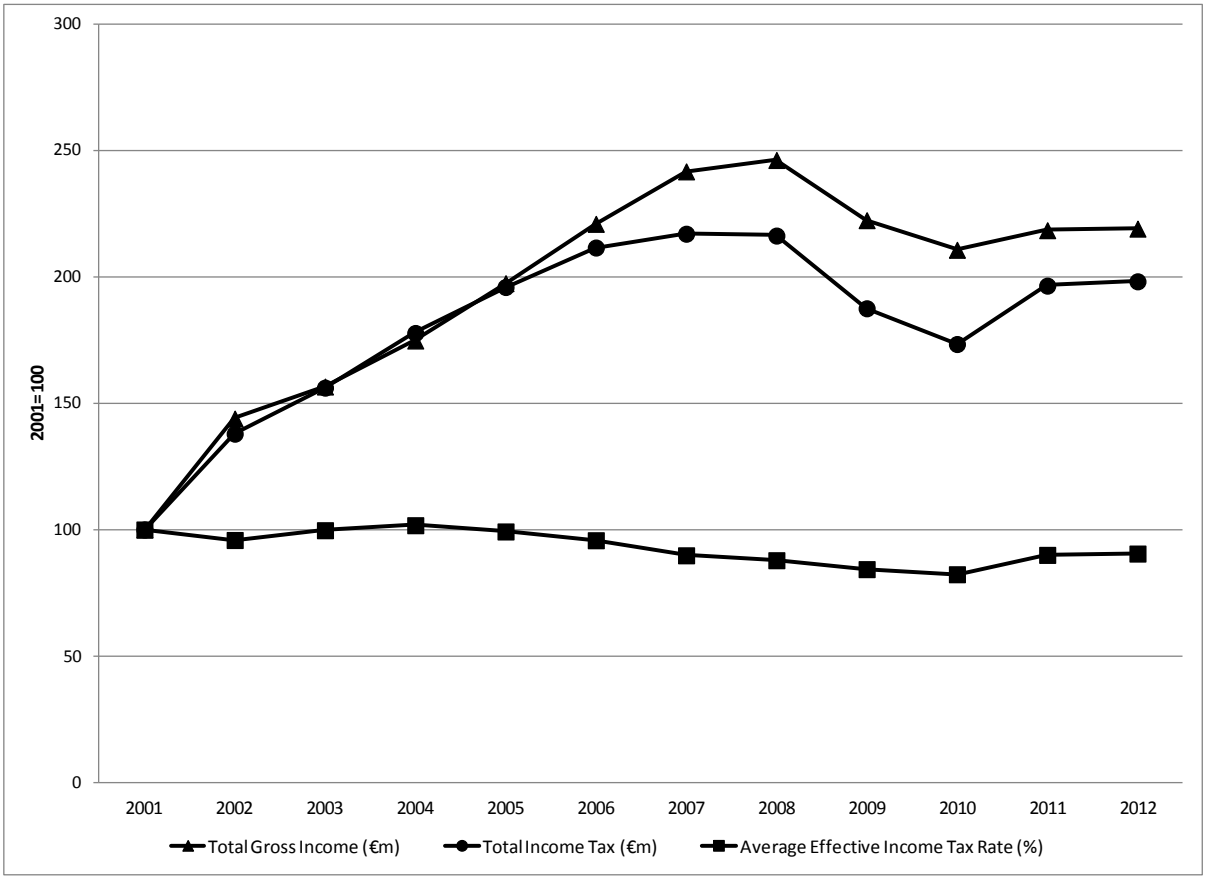
		Gross Income		Income Tax		
Year	Total Cases	Total (€m)	Average (€)	Total (€m)	Average (€)	Average Effective Income Tax Rate (%)
2001	1,763,859	36,899	20,919	5,662	3,210	15.3%
2002	1,824,878	53,091	29,093	7,807	4,278	14.7%
2003	1,875,331	57,769	30,805	8,839	4,713	15.3%
2004	1,955,670	64,485	32,973	10,063	5,145	15.6%
2005	2,126,877	72,857	34,256	11,093	5,215	15.2%
2006	2,261,136	81,518	36,052	11,976	5,297	14.7%
2007	2,365,448	89,172	37,698	12,286	5,194	13.8%
2008	2,333,223	90,837	38,932	12,244	5,248	13.5%
2009	2,151,456	82,051	38,138	10,616	4,934	12.9%
2010	2,088,443	77,729	37,218	9,815	4,700	12.6%
2011	2,162,630	80,588	37,264	11,123	5,143	13.8%
2012	2,156,830	80,818	37,471	11,220	5,202	13.9%
Changes						
2001-2007	***34.1%***	***141.7%***	***80.2%***	***117.0%***	***61.8%***	***-10.2%***
2007-2010	***-11.7%***	***-12.8%***	***-1.3%***	***-20.1%***	***-9.5%***	***-8.3%***
2010-2012	***3.3%***	***4.0%***	***0.7%***	***14.3%***	***10.7%***	***9.9%***

Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011). The Revenue figures for 2011 and 2012 from Revenue are "provisional and likely to be revised". The average effective income tax rate is given as total income tax (€m) divided by total gross income (€m).

Before the full-scale eruption of the crisis, there were large increases in the number of cases taxed, total income and total income tax during 2001-2007 (i.e. the period roughly corresponding to the pre-crisis 'bubble'). This coincided with a cumulative reduction of over 10% in the average effective income tax rate as well as rapid (but unsustainable) economic growth that saw more people at work. However, during 2007-2010, there was a substantial reversal, with income plummeting by almost 13% and income tax crashing by even more (20.1%). Since 2010 and the arrival of the Troika, the burden of taxation has increased and income tax has risen accordingly – of interest later in the paper is to consider how the higher tax burden has been distributed among high and low income earners and we examine this by reference to the Gini coefficients of gross income and income tax inequalities.

Figure 3 graphically illustrates the rapid deterioration in income and income tax between 2008 and 2010, with the decline in income tax even more rapid than that in income. The graph also shows the 'recovery' in both series from 2010, although both income and income tax levels in 2011 and 2012 were still below the levels observed in 2007 and 2008. The average effective income tax rate declined between 2004 and 2010 before rising slightly in 2011 and 2012, although the rates in these years were still lower compared with those during 2001-2006 (nevertheless the Irish tax base has been broadened somewhat since the arrival of the Troika coupled with the process of public expenditure reform).

Figure 3: Trends in Gross Income, Income Tax and the Average Effective Income Tax Rate (2001-2012) (2001=100)



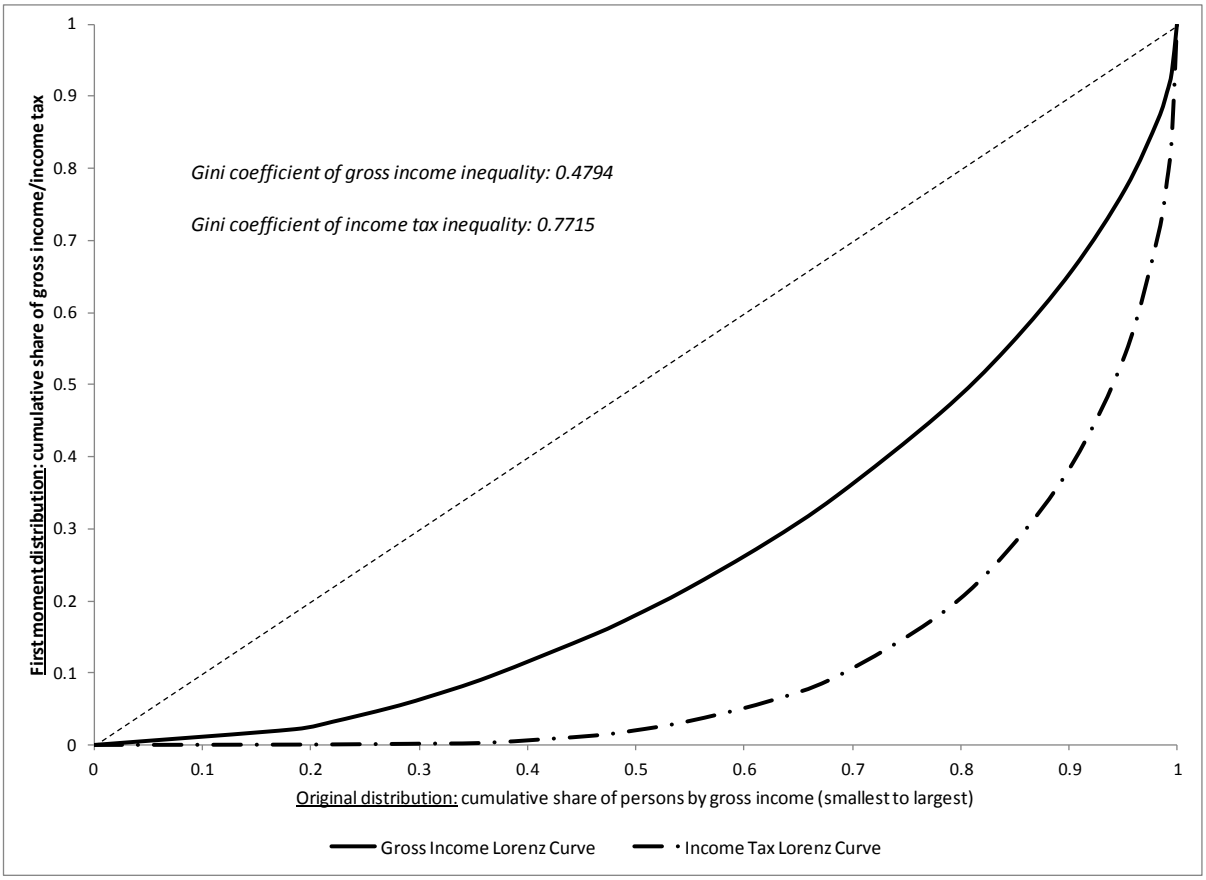
Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011). The figures for 2011 and 2012 from Revenue are provisional.

5. ANALYSIS OF THE GINI COEFFICIENTS OF INCOME AND INCOME TAX INEQUALITIES

5.1 Gross Income and Income Tax Inequalities in 2010

Figure 4 shows the empirical Lorenz curves relating to the distributions of gross income and income tax in Ireland in 2010, the latest year for which *finalised* data are available from Revenue in its publicly available Statistical Reports (at the time the analysis was carried out in 2013). It is evident from the position of the curves that the distribution of income tax is much more unequal than that of income. In that year, the Abounoori and McCloughan (AM) Gini coefficient of gross income inequality was 0.4794 and that of income tax inequality 0.7715, providing further illustration of the progressive nature of the Irish income tax system: the share of all income tax accounted for by higher earners was appreciably higher than their share of all income in 2010. The comparison of the two types of Gini coefficient can be made at each year during 2001-2012 to infer how the progressivity of the Irish income tax system has changed since the crisis and after the arrival of the Troika in 2010.

Figure 4: Empirical Lorenz Curves and Gini Coefficients of Gross Income and Income Tax Inequalities (2010)



Source: Revenue, author analysis.
Note: 2010 is the latest year for which finalised figures are publicly available from Revenue.

5.2 Trends in Gross Income and Income Tax Inequalities 2001-2012

The results in Table 3 below show the trends in the AM Gini coefficients of gross income and income tax inequalities and their relative differences during 2001-2012. Some interesting patterns are evident, which are illustrated graphically in Figure 5.

Table 3: Trends in the Gini Coefficients of Gross Income and Income Tax Inequalities and their Relative Difference (2001-2012)

	Estimated Gini Coefficient		
Year	Gross Income	Income Tax	% Difference
2001	0.4735	0.7184	51.7%
2002	0.4815	0.7306	51.8%
2003	0.4822	0.7234	50.0%
2004	0.4860	0.7345	51.1%
2005	0.4951	0.7520	51.9%
2006	0.5010	0.7637	52.4%
2007	0.4959	0.7705	55.4%
2008	0.4886	0.7672	57.0%
2009	0.4843	0.7693	58.8%
2010	0.4794	0.7715	60.9%
2011	0.4825	0.7557	56.6%
2012	0.4830	0.7550	56.3%

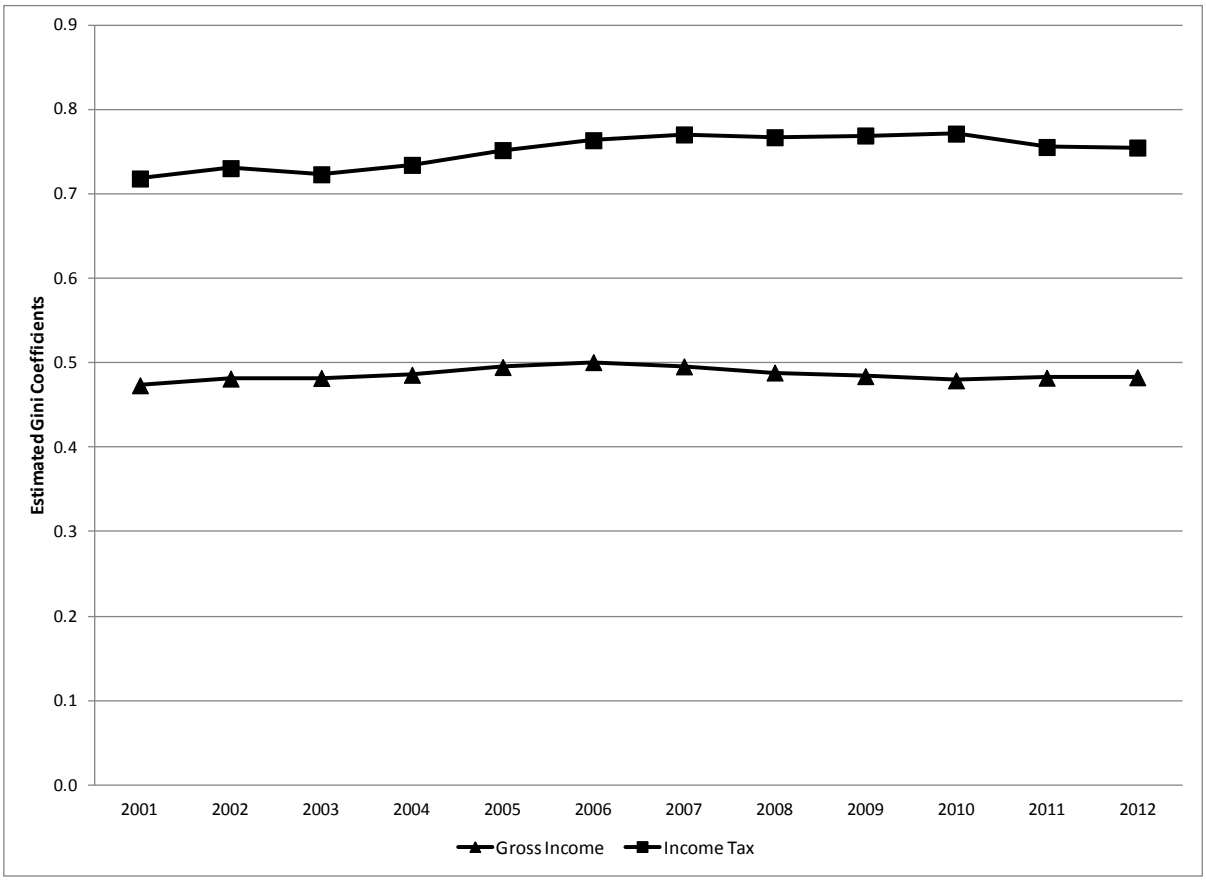
Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011). The figures for 2011 and 2012 from Revenue are "provisional and likely to be revised" (but nevertheless are the latest available comparable figures made publicly available by Revenue).

First, the Gini coefficient of gross income inequality rose during 2001-2006, from 0.4735 at the beginning of the sub-period to 0.5010. After peaking in 2006, there was a steady decline in the Gini coefficient of gross income inequality between 2007 and 2010, the latest year for which *finalised* data are available from Revenue (when the research for this paper was conducted in 2013). Since 2010, the analysis of the provisional data from Revenue indicate a slight rise in the Gini coefficient of gross income inequality but the Gini is still below that observed in 2006. It therefore appears that gross income inequality has trended pro-cyclically over the past decade – rising during the boom/bubble years of 2001-2006 before falling between 2007 and 2012. The pro-cyclical nature of gross income inequality 2001-2012 is illustrated further later in the paper.

(As referred to earlier, the Gini coefficient by disposable income is expected to be less than that of gross income and this is confirmed here. Figure A1 in Appendix 2 compares the estimates of the Gini coefficient of gross income inequality presented here with estimates of the disposable income Gini (after taxes and social welfare transfers) from the CSO's SILC during 2004-2012. Separately, corresponding Gini coefficients based on the Revenue's total income and taxable income data (2001-2010) are reported in Table A1 and Table **A2** in Appendices 3 and 4 respectively.)

Second, Figure 5 indicates that there was a strong increase in the Gini coefficient of income tax inequality between 2003 and 2007, after which it levelled-off at a relatively high value during 2007-2010 before falling in 2011 and 2012 (remembering that the 2011 and 2012 data from Revenue are provisional). Of particular interest is the fall in the Gini coefficient of income tax inequality in 2011 and 2012 – reflecting the unchanged marginal tax rates of 20% and 41% and the reductions in the standard cut-off levels in these years compared with 2010. This suggests that the extent to which higher income earners have accounted for the overall income tax burden has eased since the arrival of the Troika at the end of 2010, although we cannot be definitive on this owing to the fact that the Revenue data for 2011 and 2012 are provisional and likely to change.

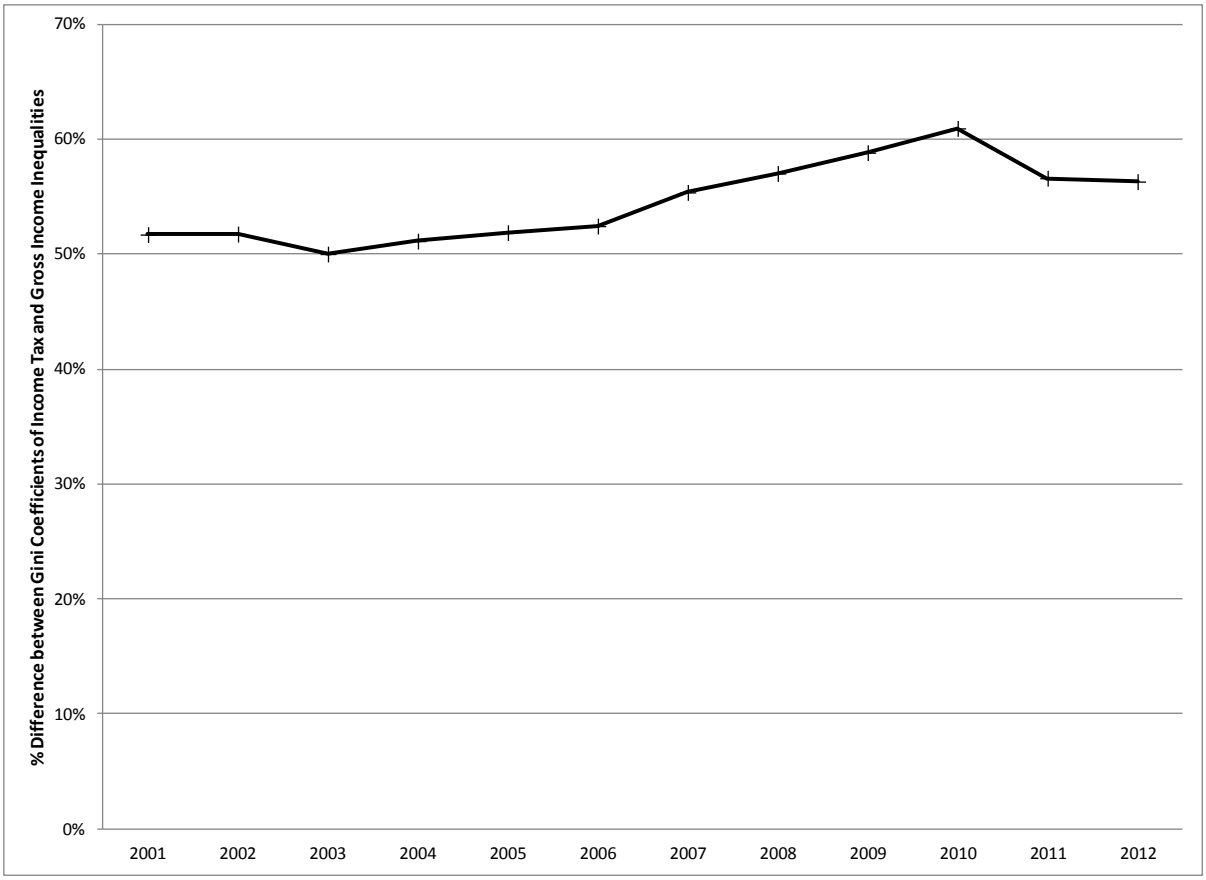
Figure 5: Trends in the Gini Coefficients of Gross Income and Income Tax Inequalities (2001-2012)



Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011). The figures for 2011 and 2012 from Revenue are "provisional and likely to be revised" (but nevertheless are the latest available comparable figures made publicly available by Revenue).

Third, we may compare the percentage difference between the Gini coefficients of gross income and income tax inequalities over the period. The percentage differences between the two forms of Gini tabulated in Table 3 are illustrated in Figure 6 below and reveal that the proportionate wedge of the Gini coefficient of income tax inequality over the Gini coefficient of gross income inequality broadened markedly between 2006 and 2010 but has fallen since the arrival of the Troika in 2010 (although bearing in mind that the Revenue data for 2011 and 2012 are provisional and likely to change). The evidence therefore indicates that higher earners have accounted for a larger relative share of the income tax burden over the past decade but the analysis also suggests that the larger relative share has eased in the two most recent years (2011 and 2012), coinciding with the arrival of the Troika in late 2010. Notwithstanding the dip in the wedge between the two Ginis in these two years, it is nonetheless evident that the income tax system was more progressive in 2012 compared with before the crisis and compared with the situation a decade earlier. In other words, over the course of the past decade, the Irish income tax system has become more progressive.

Figure 6: Percentage Difference between the Gini Coefficients of Gross Income and Income Tax Inequalities (2001-2012)



Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011). The figures for 2011 and 2012 from Revenue are "provisional and likely to be revised" (but nevertheless are the latest available comparable figures made publicly available by Revenue).

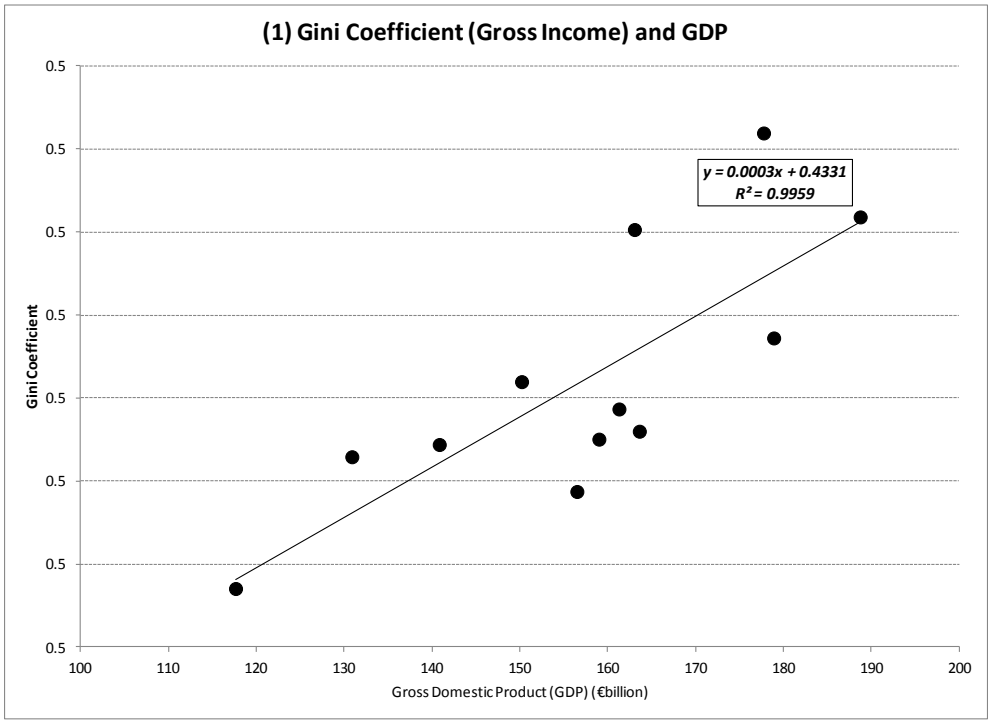
5.3 Further Analysis of Gross Income and Tax Inequalities

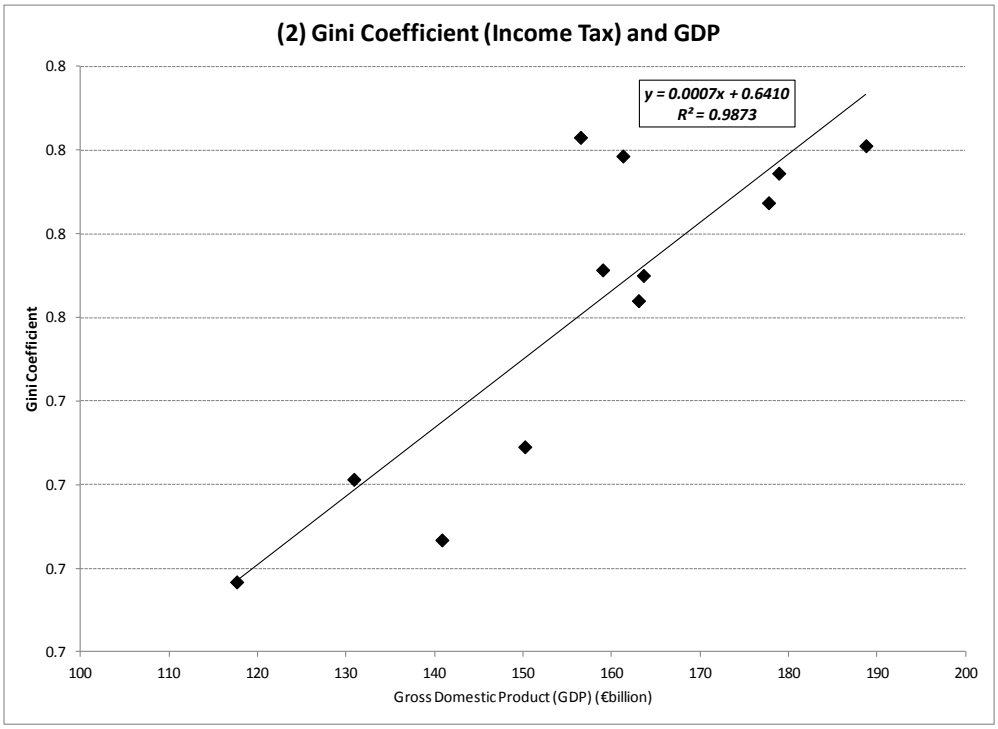
5.3.1 Role of the Economic Cycle

The first panel of Figure 7 plots the Gini coefficient of gross income inequality and GDP during 2001-2012; the bottom panel presents the corresponding scatter diagram of GDP and the Gini coefficient of income tax inequality. In each case, there is a statistically significant positive relationship, in which higher GDP is associated with higher inequality. However, the *quantitative impact* of GDP in each case is small: at the sample means, a 1% increase/decrease in GDP is associated with a 0.1% increase/decrease in gross income inequality and with a 0.17% increase/decrease in income tax inequality. Thus, while gross income and income tax inequalities have trended pro-cyclically during the period, the effects involved are small and a large

increase/decrease in GDP is associated with only a marginal change in the Gini coefficients of gross income and income tax inequalities. This is not surprising because for countries generally the Gini coefficient tends to change only marginally from year to year (whether based on disposable or gross income) and so of greater interest here is the apparent pro-cyclical nature of the Ginis during the past decade in Ireland.

Figure 7: Relationships between (1) Gross Income Inequality and GDP and (2) Income Tax Inequality and GDP in Ireland (2001-2012)





Source: Revenue, IMF (GDP), author analysis.
Note: The bivariate regression analysis was carried out using the Prais-Winsten/Cochrane-Orcutt method because serial correlation was found and the method corrects for this (first-order autocorrelation). The regression analysis was undertaken using Stata SE 12.1.

5.3.2 Parametric Analysis of the Irish Income Distribution and Gross Income Inequality

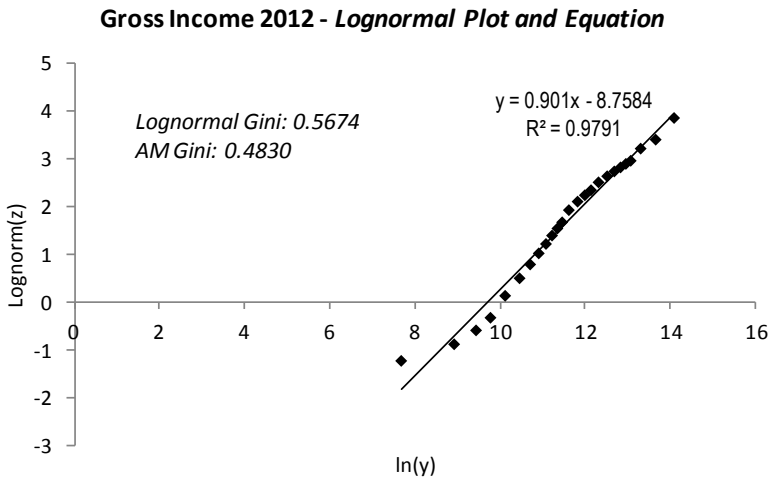
Over many decades, economists and statisticians have been interested in whether income distributions conform to particular probability models. Parametric analysis is also of interest in simulating income distributions and reference to the stochastic processes giving rise to the parametric models may assist in understanding the genesis of observed income distributions.

The (two-parameter) lognormal distribution has its genesis in the Law of Proportionate Effect, which predicts lognormality among a population of individuals each of whose income faces the same odds of growing or shrinking by any proportionate rate; the lognormal basically derives from a process of equality of proportionate growth opportunity and deviations from lognormality may indicate the absence of such opportunity.[7] Another probability distribution that has been considered in the context of income distributions is the (Type I) Pareto distribution (named after the economist Vilfredo Pareto, 1848-1923).[8] A further probability distribution that may be considered is the (two-parameter) log-logistic distribution studied by Abounoori (2000) and Abounoori and McCloughan (2000) in the context of grouped income distribution data from the US and the World Bank. Both studies found the log-logistic to be flexible parametric model of income distributions.

Following the methodology outlined in Abounoori and McCloughan (2000), we may fit the lognormal, Pareto and log-logistic distributions to the grouped income distribution data for Ireland and estimate the corresponding lognormal, Pareto and log-logistic Gini coefficients of gross income inequality, which may then be compared with the AM Gini coefficients. Owing to the accuracy of the AM technique for estimating the Gini coefficient given grouped data, we may judge the relative accuracy of the alternative parametric methods to the Irish data, which may be of interest to researchers interested in the applicability of these models to actual income distributions and for Monte Carlo simulations.

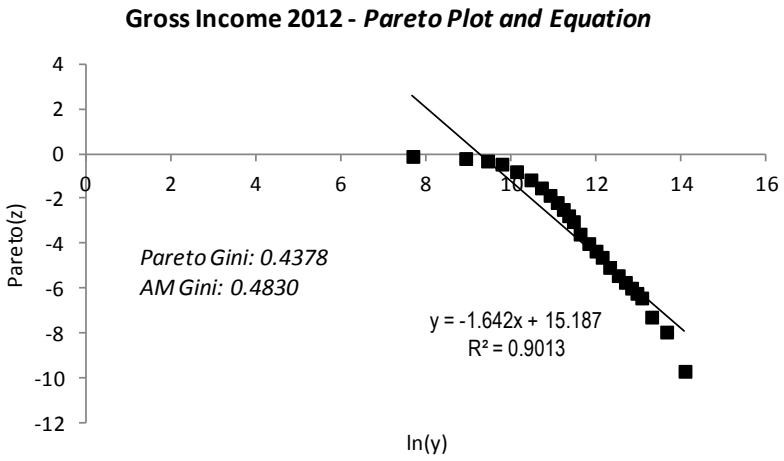
By way of illustration, the top, middle and bottom panels of Figure 8 show the lognormal, Pareto and log-logistic plots in respect of the distribution of gross income in Ireland in 2012. Each observation in each scatter diagram corresponds to a gross income group. In each case, the distributional plot conforms more or less to linearity and the observations are tightly arrayed around the line of best fit, indicating appreciably strong goodness-of-fit.

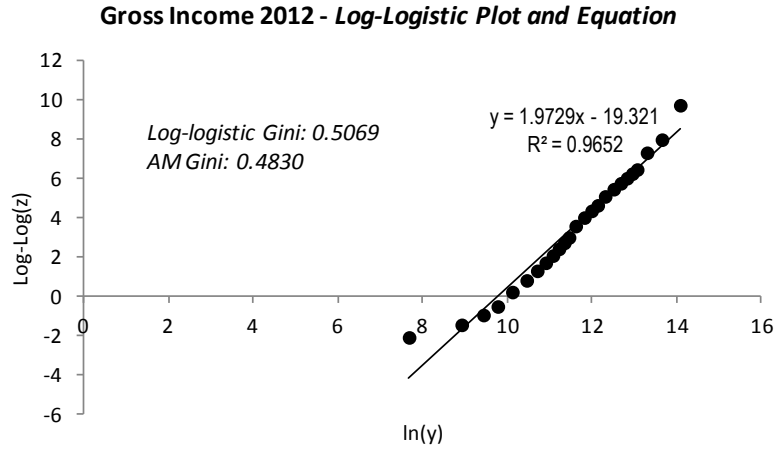
Figure 8: Lognormal, Pareto and Log-Logistic Plots of the Gross Income Distribution in Ireland (2012)



[7] The classic monograph on the lognormal distribution is Aitchison and Brown (1957). See also Gibrat (1931), McCloughan (1995) and Sutton (1997) for a review of Gibrat's legacy in economics.

[8] The Pareto distribution was studied extensively by Nobel Laureate Herbert Simon and others in the last century. See, for example, Simon and Bonini (1958), Steindl (1965) and Ijiri and Simon (1977).





Source: Revenue, author analysis.
Note: See Abounoori and McCloughan (2000) for details of the plotting methods for the lognormal, Pareto and log-logistic distributions and the formulae for calculating the corresponding Gini coefficients.

To make a fuller assessment of the relevance of each parametric model to the Irish income distribution, we may compare the Gini coefficients yielded by the three distributions with the AM Gini of gross income inequality in 2012, (0.4830, Table 3). The lognormal Gini coefficient of gross income inequality in Ireland in 2012 is 0.5674, which is much higher than the AM estimate. Whereas the lognormal overestimates the Gini coefficient in this instance, the Pareto underestimates it (0.4378), although the margin of error is lower compared with the lognormal. The log-logistic estimate of the Gini coefficient (0.5069) is the most accurate of the three parametric models.[9]

Table 4 shows the estimated lognormal, Pareto and log-logistic Gini coefficients of gross income inequality in Ireland during 2001-2012 and how they compare with the benchmark AM estimates. Looking at the variances between each parametric model and the AM values, and the correlation coefficients of each model with the AM, the log-logistic emerges as the most flexible model of the three. The lognormal and Pareto distributions, especially the former, are sensitive to the number of gross income groups, which increased in 2011 and 2012, and this is reflected in the relatively large margins of error between each of these distributions and the AM in those years. The Pareto would be preferred to the lognormal for the data at hand and the average value of Pareto Gini over the period (0.4881) is very close to the AM Gini (0.4861).

[9] See Table 1 (p. 10) of Abounoori and McCloughan (2000) for the formulae for estimating the Gini coefficient in the case of 2-lognormal, Type I Pareto and 2-log-logistic distributions.

Table 4: Lognormal, Pareto and Log-Logistic Estimates of the Gini Coefficients of Gross Income Inequality Compared with the Abounoori and McCloughan (AM) Estimates (2001-2012)

		Parametric Models			Variances		
Year	AM Method	Log-Logistic	Lognormal	Pareto	AM *minus* Log-Logistic	AM *minus* Lognormal	AM *minus* Pareto
2001	0.4735	0.4843	0.4918	0.4517	-0.0107	-0.0183	0.0219
2002	0.4815	0.5020	0.4918	0.5132	-0.0205	-0.0103	-0.0318
2003	0.4822	0.4918	0.4924	0.4751	-0.0096	-0.0102	0.0070
2004	0.4860	0.4896	0.4920	0.4630	-0.0036	-0.0060	0.0229
2005	0.4951	0.5008	0.4989	0.4848	-0.0057	-0.0038	0.0104
2006	0.5010	0.5092	0.5025	0.5077	-0.0083	-0.0015	-0.0067
2007	0.4959	0.5116	0.5015	0.5249	-0.0157	-0.0056	-0.0290
2008	0.4886	0.5106	0.4992	0.5336	-0.0220	-0.0105	-0.0450
2009	0.4843	0.5055	0.4972	0.5192	-0.0211	-0.0128	-0.0348
2010	0.4794	0.5018	0.4953	0.5096	-0.0225	-0.0159	-0.0302
2011	0.4825	0.5059	0.5671	0.4360	-0.0234	-0.0846	0.0465
2012	0.4830	0.5069	0.5674	0.4378	-0.0239	-0.0844	0.0452
Average	***0.4861***	***0.5017***	***0.5081***	***0.4881***	***-0.0156***	***-0.0220***	***-0.0020***
Correlation with AM	***1.0000***	***0.5887***	***-0.0835***	***0.4275***			

Source: Revenue, author analysis.
Note: See Abounoori and McCloughan (2000) for details of the plotting methods for the lognormal, Pareto and log-logistic distributions and the formulae for calculating the corresponding Gini coefficients. The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011). The figures for 2011 and 2012 from Revenue are "provisional and likely to be revised".

6. DISCUSSION AND POLICY IMPLICATIONS

At the beginning of the paper, we posed three questions for consideration. First, on the question of whether income inequality has risen or fallen since the crisis, the results presented here indicate that the Gini coefficient of gross income inequality has behaved pro-cyclically. During the pre-crisis or 'boom/bubble' years, the Gini coefficient of gross income inequality rose appreciably from 0.4735 in 2001 to 0.5010 in 2006. After peaking in 2006, the Gini coefficient of gross income inequality fell to 0.4794 in 2010, the latest year for which *finalised* data are available from Revenue (at the time this research was conducted in 2013), before rising to 0.4825 and 0.4830 in 2011 and 2012 respectively (the Revenue data for these two years are provisional and likely to change). Overall, the pro-cyclical behaviour of the gross income Gini indicates that gross income inequality has fallen since the crisis.

Second, regarding how the income tax burden has been distributed since the crisis, the findings of this paper indicate that the share of all income tax accounted for by higher earners has been higher since the crisis compared with before the crisis. However, the results for 2011 and 2012, which are based on *provisional* Revenue data, suggest that the share of all income tax among higher earners has fallen more recently. The fall in the Gini coefficient of income tax inequality in these years (i.e. fall in the extent to which higher earners have accounted for all income tax) reflects the unchanged marginal tax rates of 20% and 41% and the reductions in the standard cut-off levels in these years compared with 2010.
Third, on the progressivity of the Irish income tax system, the analysis indicates that the Irish income tax system has become even more progressive since the crisis with the percentage wedge between the Gini coefficients of income tax and gross income inequalities higher in any year during 2008-2012 compared with any year during 2001-2007.

In respect of the parametric analysis carried out, the log-logistic distribution is found to be the most flexible of the three probability distributions examined and may be a candidate for simulation analysis of the Irish income distribution.

What implications, if any, does the evidence in this paper have for budgetary policy in Ireland? Of particular interest is the possibility of raising the higher marginal tax rate or introducing a new marginal tax rate on incomes above €100,000. The evidence presented in this paper provides new, alternative illustration of the progressivity of the Irish income tax system and shows that it has become even more progressive over the past decade (2001-2012). It would therefore be tempting to say that such higher marginal taxation of higher earners would be unwarranted. However, this may be a step too far from the results presented here. Nevertheless, when

other information is also factored in – including the recent research by Callan and colleagues showing the extent of the adjustments made by higher earners since the crisis and the emphasis now being placed on facilitating growth in the Irish economy – there would seem to be little scope for putting extra income tax burden on *any* earners in the next two years. At the same time, the fiscal targets agreed with the Troika should be adhered to (with continued broadening of the tax base rather than increasing income tax) and structural reforms will become even more important, requiring careful management as well as brave policy decisions to aid underlying, real competitiveness improvements.

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APPENDIX 1: SUMMARY OF THE ABOUNOORI AND MCCLOUGHAN (AM) TECHNIQUE FOR ESTIMATING THE GINI COEFFICIENT GIVEN GROUPED DATA

The Gini coefficient (G) is derived from the Lorenz curve, a twice-differentiable, monotonic increasing and convex function $l = l(z)$, where z is the cumulative proportion of income receivers and l is the corresponding proportion of income received (z is the cdf of the 'original distribution' and $l(z)$ the cdf of the 'first moment distribution'). The Gini coefficient is:

$$G = 1 - 2\int_0^1 l(z)dz$$

The earliest method of estimating G (given a sample of size n) is Lorenz's (1905) idea of approximating his curve using a frequency polygon, namely:

$$G = 1 - \sum_{i=1}^{n}(z_i - z_{i-1})(l_i + l_{i-1})$$

The method proposed by Milanovic (1994) takes the following form (where $\bar{y}$ is the sample mean income).

$$G = \left(\frac{2}{n(n+1)}\right)\cdot(n, n-1, n-2,...,1)\cdot\left\{\begin{pmatrix}1\\1\\1\\\cdot\\\cdot\\\cdot\\1\end{pmatrix} - \frac{1}{\bar{y}}\begin{pmatrix}y_1\\y_2\\y_3\\\cdot\\\cdot\\\cdot\\y_n\end{pmatrix}\right\}$$

Abounoori and McCloughan (2003) modify Milanovic's (1994) formula for grouped data by first re-casting the (ungrouped) estimator above as (where C=2/(n(n+1))):

$$G = C\sum_{j=1}^{n} j\left(1 - \frac{y_{n-j+1}}{\bar{y}}\right)$$

With grouped data, the n individuals are arranged into K mutually exclusive and exhaustive size income groups with n_k individuals in group k (k=1,2,...,K). For each income group, information is available on the mean income $\bar{y}_k$ or total group income from which mean group income can be calculated. After mathematical manipulation, Abounoori and McCloughan (2003) derive the modified Milanovic formula for G given grouped data, namely:

$$G = C\sum_{k=1}^{K} w_k\left(1 - \frac{\bar{y}_k}{\bar{y}}\right)$$

Where generally the k^{th} weight is given as:

$$w_k = \frac{1}{2}\left\{\sum_{k=1}^{K} n_k\left(\sum_{k=1}^{K} n_k + 1\right) - \sum_{k=k+1}^{K} n_k\left(\sum_{k=k+1}^{K} n_k + 1\right)\right\}$$

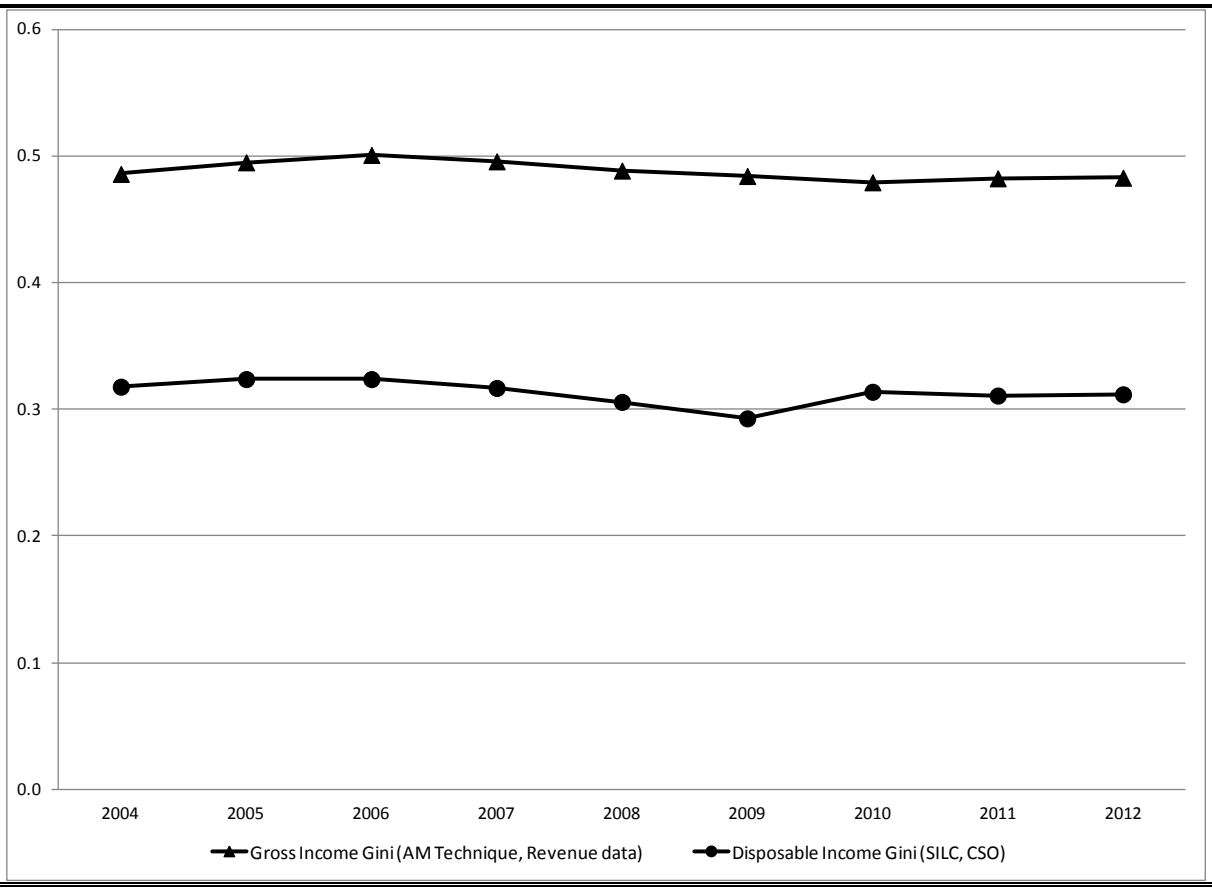
The paper by Abounoori and Abounoor (2003) contains a worked example of the application of the modified Gini coefficient estimator using grouped US income returns data (1972), where the formula yields the same estimate of the Gini coefficient as Lorenz's polygon method. The method proposed by Abounoori and McCloughan is therefore accurate as well as easy to apply.

Further details of the derivation of the technique and its practical application are available in the 2003 paper referenced within.

APPENDIX 2: COMPARISON OF GROSS INCOME AND DISPOSABLE INCOME GINI COEFFICIENTS IN IRELAND

Figure A1 below shows the trends in the Gini coefficients of gross income and disposable income inequalities in Ireland during 2004-2012. The latter are from the CSO's SILC and the former are from those estimated in this paper. As expected, the gross income Gini is appreciably higher than the disposable income Gini, reflecting the fact that the inclusion of taxes and social welfare payments serve to moderate income inequality. The trends are roughly similar – income inequality, however measured, fell between 2006 and 2009 but, in the case of disposable income, inequality rose relatively sharply during 2009-2010 and has stayed at about 0.31 since 2010 (while gross income inequality has remained at approximately 0.48 during 2010-2012).

Figure A1: Comparison of Gini Coefficients of Gross and Disposable Income in Ireland (2004-2012)



Source: CSO (SILC), Revenue, author analysis.
Note: The gross income Gini coefficients based on the Revenue data and calculated here relate to gross income or income before taxes and transfers; the CSO SILC Ginis are based on disposable income (income after taxes and social welfare payments).

APPENDIX 3: GINI COEFFICIENTS OF INCOME AND INCOME TAX INEQUALITIES BY TOTAL INCOME

The results in Table A1 below are produced by applying the AM estimator to the data contained in Table IDS8 of the Revenue's Income Distribution Statistics for each year during 2001-2010 (all publicly available data). The estimates reflect those presented in the main body of the paper when grouped by gross income (Table 3), with the wedge between the Gini coefficients by income and income tax apparent here too.

Table A1: Trends in the Gini Coefficients of Total Income and Income Tax Inequalities and their Relative Difference (2001-2012)

	Estimated Gini Coefficient		
Year	Total Income	Income Tax	% Difference
2001	0.4653	0.7225	55.3%
2002	0.4734	0.7340	55.1%
2003	0.4702	0.7223	53.6%
2004	0.4714	0.7328	55.5%
2005	0.4778	0.7385	54.6%
2006	0.4906	0.7676	56.4%
2007	0.4927	0.7734	57.0%
2008	0.4859	0.7704	58.6%
2009	0.4810	0.7732	60.7%
2010	0.4768	0.7752	62.6%

Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011).

According to the latest Statistical Report from Revenue (2011), which pertains to the year ended 2010, total income is the total income of taxpayers from all sources as estimated in accordance with the provisions of the Income Tax Acts. It is net of such items as capital allowances, allowable interest which is not subject to relief at the standard rate, losses, allowable expenses, retirement annuities and superannuation contributions. For the purposes of the exemption limits, interest allowable for tax purposes is a deduction in computing total income. Declared interest income received by individuals and any income such as distributions (i.e. dividends plus tax credits) received is included. Benefits-in-kind are also included to the extent that they are chargeable to income tax.

APPENDIX 4: GINI COEFFICIENTS OF INCOME AND INCOME TAX INEQUALITIES BY TAXABLE INCOME

These results in
Table **A2** are produced by applying the AM estimator to the data contained in Table IDS16 of the Revenue's Income Distribution Statistics for each year during 2001-2010 (all publicly available data).[10] The estimates reflect those presented in the main body of the paper when grouped by gross income (Table 3), with the wedge between the Gini coefficients by income and income tax apparent here as well.

Table A2: Trends in the Gini Coefficients of Taxable Income and Income Tax Inequalities and their Relative Difference (2001-2012)

	Estimated Gini Coefficient		
Year	Taxable Income	Income Tax	% Difference
2001	0.4569	0.7152	56.5%
2002	0.4653	0.7270	56.3%
2003	0.4663	0.7162	53.6%
2004	0.4687	0.7328	56.3%
2005	0.4784	0.7507	56.9%
2006	0.4839	0.7634	57.7%
2007	0.4786	0.7693	60.7%
2008	0.4743	0.7661	61.5%
2009	0.4826	0.7722	60.0%
2010	0.5017	0.7786	55.2%

Source: Revenue, author analysis.
Note: The 2010 figures are the latest finalised figures available from Revenue (Statistical Report 2011).

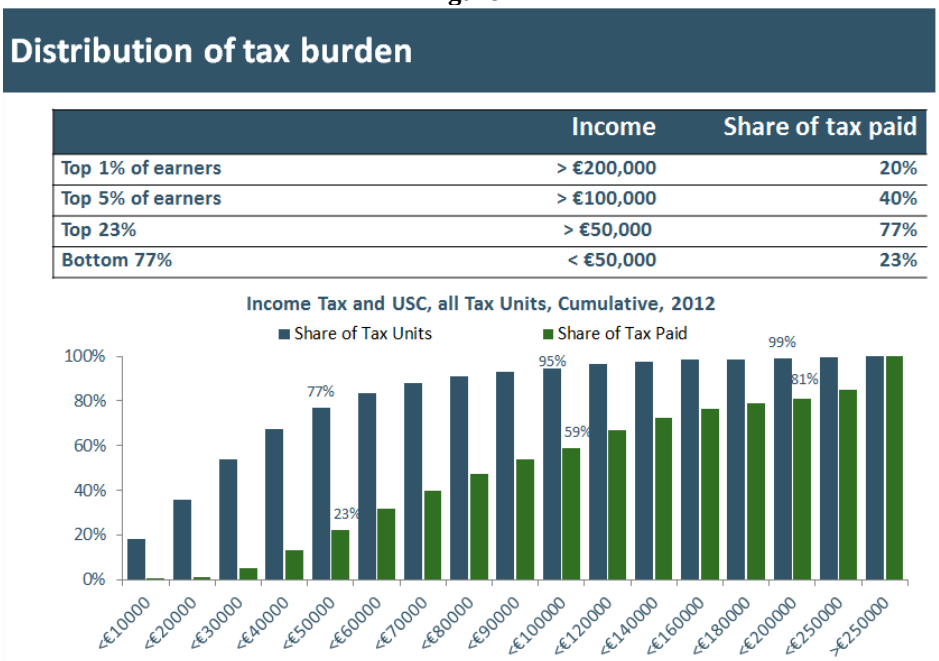
According to the latest Statistical Report from Revenue (2011), which pertains to the year ended 2010, taxable income is that part of income on which tax is actually calculated. It is thus the total income of taxpayers less personal reliefs and other deductions but prior to the application of tax credits and reliefs at the standard rate (which are given by way of a reduction of tax chargeable).

[10] The data for 2001 (presented in the Statistical Report 2003) are given in Table ISD17 rather than Table ISD16 as in the other years.

VOTE OF THANKS PROPOSED BY DAVID HEGARTY, DEPARTMENT OF FINANCE

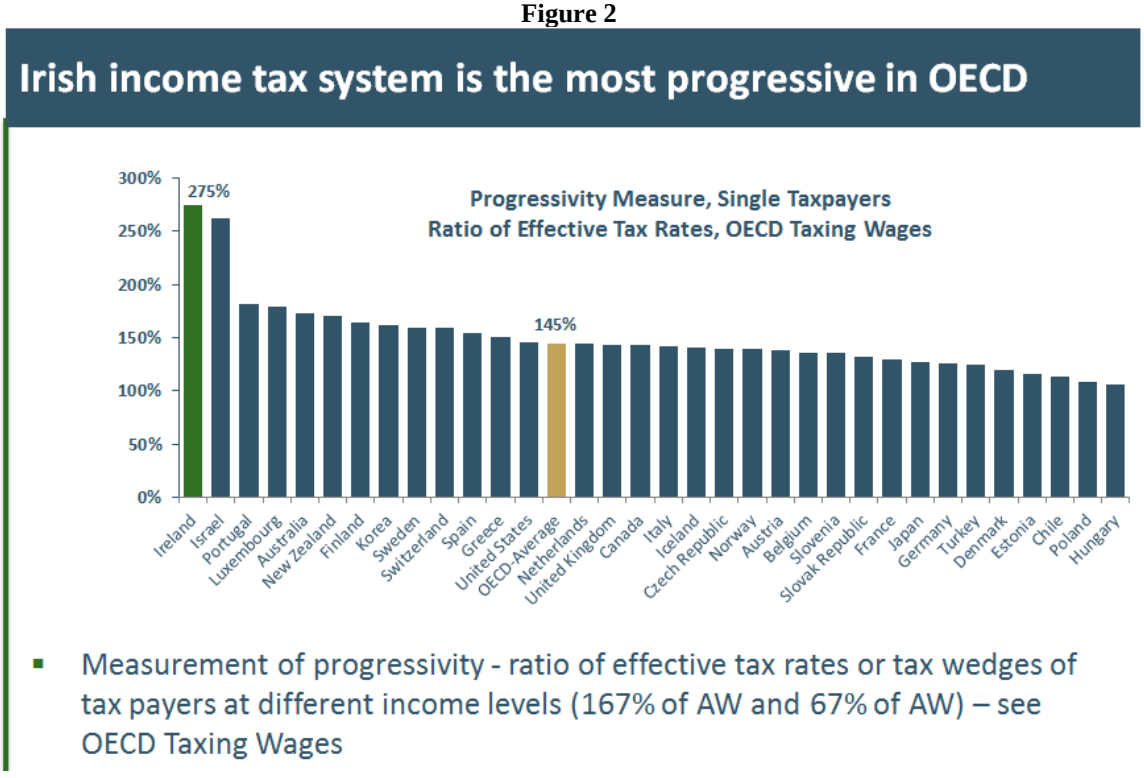
I would like to commend Pat for his interesting paper. Perhaps in this respect I am somewhat guilty of conformation bias as the results of his analysis – essentially that the income tax system is effective in reducing disparities in gross or pre-tax incomes and is highly progressive – corresponds to our own assessment in the Department.I would like to quickly show you a few graphs which support this. This first slide (Figure 1) shows the distribution of income tax and USC by income band on a cumulative basis. For example, it shows that those earning more that €50,000 represent just 23 per cent of tax units but account for 77% of tax paid in 2012.

Figure 1



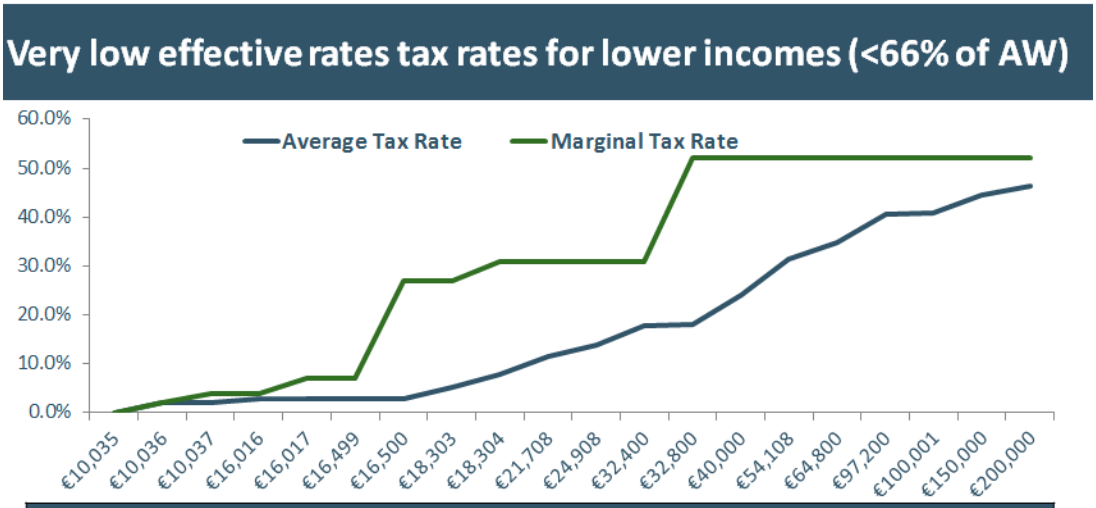
The second slide (Figure 2) looks at the progressivity of our income tax system vis-à-vis other OCED countries. The measure used here is the ratio of the tax wedge for taxpayers at 167% and 67% of the average wage. You will see that on this basis that our income tax system is the most progressive.

Figure 2



Essentially what these slides illustrate is explained by a number of factors but in particular by low effective tax rates for those on lower incomes. For example, as shown here (Figure 3), our effective tax rates are much lower than the OECD at average and particularly at below average incomes.

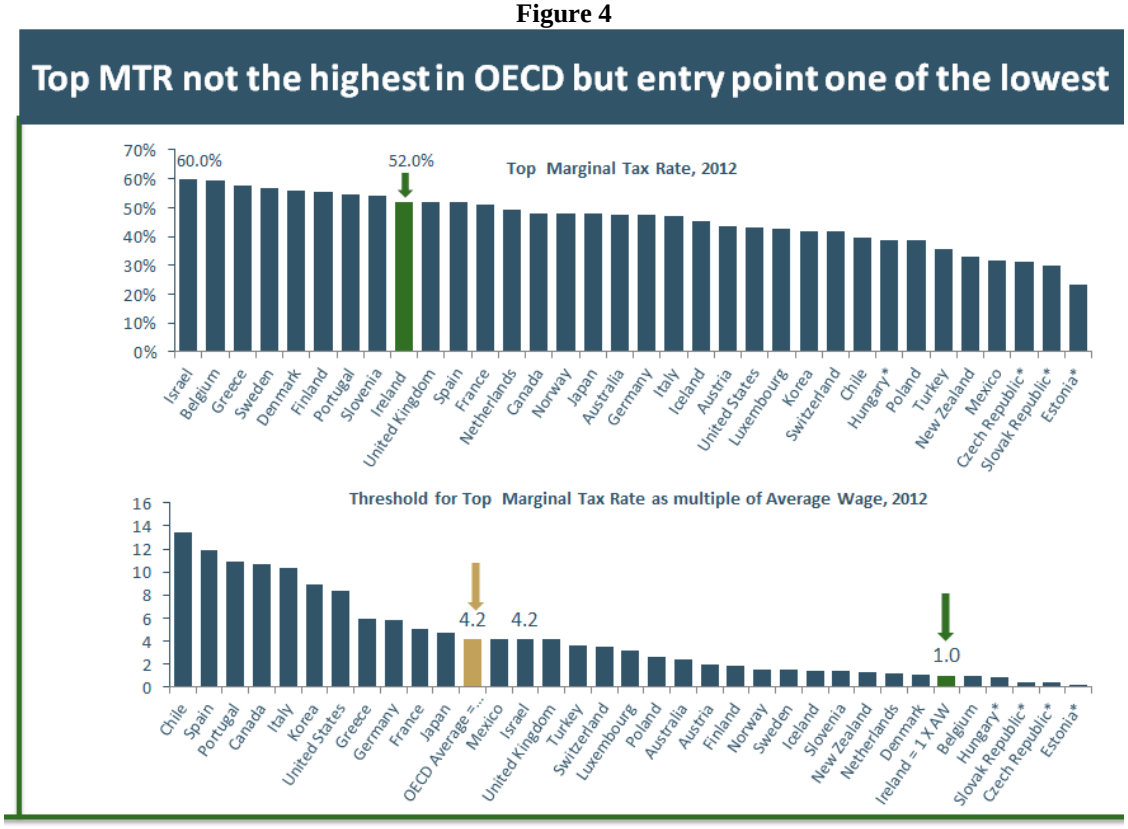
Figure 3



	66% of AW	100% of AW	166% of AW
Income tax (incl USC) and SSC			
Ireland	11.5%	18.0%	31.5%
OECD average	21.1%	25.1%	30.5%

Another factor shown on this slide (Figure 4) is that our top marginal income tax rate is fairly high in comparative terms. And critically, the entry point to the top rate as a multiple of the average wage is one of the lowest – at the average wage in Ireland – compared with an OECD average of over 4 times average income.

Figure 4



Essentially, these slides illustrate in another way the key finding as to the progressivity of the income tax system in Pat's paper.

In passing, I think it also worth noting the results of separate ESRI research published yesterday which pointed to the relatively high effectiveness of social transfers in Ireland in alleviating poverty compared to other European countries. What these separate streams appear to show is that both our income tax and social transfer systems perform well in terms of reducing inequality and poverty respectively.

In terms of what all of this means for policy, I note the view expressed in the paper to the effect that there is little scope for increasing income tax in the next couple of budgets. Separately, Tim has previously made the point that if it was desired to push income tax closer to average European levels this would most likely require increases in marginal tax rates at low to middle income ranges.

Of course, decisions in this respect are ultimately a political matter. What our own research - undertaken by my colleague Brendan O' Connor illustrates is that a rebalancing of the overall tax burden – away from tax on labour towards consumption and or property - would boost GDP and employment. What we have not yet been able to establish yet are the likely economic impacts of a re-balancing within income tax, which could take the form of a revenue-neutral adjustments of credits, rates and bands or some combination of these.

To explore what might be the economic effects of these types of changes we would need to adopt an approach based on microeconomics and endeavour to estimate the magnitude of income and substitution effects at different income levels or marginal tax rates.

One important factor that should not be forgotten in analysis in this area is the distortions that high marginal tax rates give rise to. Back in the late 1980s, research by Patrick Honohan and Ian Irvine indicated that the then prevailing high marginal tax rates particularly on labour were such that the deadweight cost of taxation could be anything between 92 pence to £2.68 in the pound. This work formed the basis for the incorporation of a shadow cost of public funds of 150 per cent into cost-benefit appraisals. While more recent official guidance is that a rate of about 130 per cent should be used, the principle is clear. High marginal tax rates impose economic costs and these have to be borne in mind in framing tax policy.

So progressivity comes with a price. Whether this price is worth paying is ultimately a matter for political judgement but it is important that decision makers are aware of the trade-offs involved.

In conclusion, I would like to once again thank Pat for his valuable contribution to an important topic.

DISCUSSION

Tom Healy: The paper draws attention to the importance of measuring the way in which taxation impacts on different groups. Taxation is the price we pay for public services and goods as well as protection for those vulnerable to economic conditions. That income tax progressivity – as measured in this paper – grew over most of the last decade is not a surprise considering the narrowness of the income tax base at the beginning of the period under examination. Many on low to average incomes paid little or no income tax. Changes in Budget 2009 onwards began to address this. However, it should be borne in mind that the total amount of tax paid through direct and indirect taxation as a proportion of household income is highest for those on the lowest and highest income levels while lowest for those on middle to just below average income. In this sense total taxation is a lot less progressive than is assumed or claimed in public discourse. Even though the average effective tax rate increases sharply from relatively modest income levels, as shown in the paper and presentation by Mr Hegarty, it is still the case rates of tax paid as a proportion of gross household income fall in the 30-40% range at very high levels of income. Care is needed in comparing different data sources such as those published by the Revenue Commissioners and by the Central Statistics Office using the EU-SILC data. Definitions of gross income do not align completely. As noted by other speakers there are significant differences in average and marginal effective rates paid. Inclusion of PRSI and USC (or levies on income prior to the introduction of the USC) is dealt with differently in different sources. A complete, comprehensive and timely release of data on taxes paid by different types of households and 'tax cases' would greatly help to inform public debate and policy choices. The conclusion of the paper that 'Consideration of the policy implications of the results, and of complementary research, suggest that there is little scope for increasing income tax in Budgets 2014 and 2015' is a very strong one and does not appear sufficiently grounded in the descriptive analysis of this paper – informative and useful as it is.

Tom O'Connell: Further to the very progressive nature of Ireland's tax system as confirmed in the paper, it is worth noting that Ireland's higher marginal tax rate applies at very modest income levels. For a single person, the marginal tax rate - some 52 per cent when account is taken of the Universal Social Charge and PRSI - becomes applicable at about €33.000, less than the average industrial wage. In most other developed countries, the marginal rate takes effect at a sizeable multiple of average pay. Some adjustment, essentially a widening of the standard rate band, is necessary if unemployment and poverty traps are to be limited, and if people are to be rewarded for moving up the income scale.

One respondent has noted that Ireland's relatively high take from indirect taxes is regressive. However, this need not necessarily be so. It all depends on the structure of the indirect tax system. In Ireland's case, food, for example, is zero-rated for VAT purposes, and what might generally be regarded as luxury goods are heavily taxed.

Even though Ireland's income tax system is progressive, it is striking that the effective tax rate on very high incomes is quite modest (Figure 2) - no more than 30 per cent for incomes over €275,000. Simple arithmetic will show that very high income earners must be availing extensively of tax avoidance schemes. A paper by Michael Collins of Trinity College some time back actually pointed out that tax foregone as a result of such schemes i.e., tax expenditures in the terminology, actually amounted to €15 billion. From my recollection, the major vehicles in this regard were pension contributions, mortgage interest relief and property tax incentives with the latter, as we know only too well, contributing to Ireland' run-away property bubble. While some limitations in these have been made, tax equity and the continuing need to reduce the fiscal deficit would seem to call for further curtailment of such schemes.

Rory O'Farrell: Although it may be a pedantic point, it is worth bearing in mind that we do not measure inequality. Equality is just a logical relationship. 2+2=4, true or false. At best we can rank distributions to say one is more equal, and to do that we need to show second order stochastic dominance. Although the Gini coefficient is a standard measure of dispersion, people can choose another measure to tell a story they want. Therefore I think it would be good if some other measures of dispersion were also included, such as the standard deviation.

Finally, when I think of a progressive tax system, I think of tax rates, rather than the absolute amount paid. So perhaps instead of looking at the Gini coefficient of income-tax, it might be useful to look at the Gini-coefficient of effective tax-rates. As lots of low-income people have gone from a zero effective tax rate to something positive, the tax system may now be less progressive if measured in this way.

Noel Cahill: The conclusion (from other research) that Ireland has among the most progressive income tax systems is based on the structure of the tax system. It does not take account of tax expenditures that affect in practise the degree of progressivity. By contrast the method used in the paper presented this evening to calculate the degree of progressivity of the tax system does take account of tax expenditures. If this approach could be applied to data from other countries it would be possible to compare progressivity of income tax systems in a way that would take account of tax expenditures.

I have a separate question regarding Figure 3 in the paper. This shows a fall in the effective tax rate in the years 2008 to 2010. Can you offer any interpretation as to why effective tax rates would have fallen in these years?

John FitzGerald: In the 1980s marginal tax rates were very high, even higher than today. David Hegarty referred to the Honohan-Irvine, 1987, estimate of the deadweight costs resulting from high marginal tax rates in the 1980s. It would be interesting to look at the Gini coefficient for the mid-1980s using the Revenue Commissioners data. With very high marginal tax rates, and hence deadweight loss, did the Gini coefficient suggest greater redistribution than with today's tax system? This would help answer the question as to whether the tax system can be used to produce a lower Gini coefficient without necessarily imposing very high deadweight losses.

I suspect that an important factor in high deadweight losses arising from high marginal tax rates is due to the impact of taxation of couples. The high marginal tax rates can provide a big incentive for one partner to drop out of the labour market – resulting in significant lost output and, hence, deadweight losses. This issue would not arise in the same way with individualisation. Thus individualisation, while it would have other effects, might reduce the cost of higher marginal tax rates.