Redistribution Through Taxation: An International Comparison

by

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ABSTRACT

Income tax progressivity is studied using Generalized Entropy measures of inequality. Luxembourg Income Study data sets for ten countries are used for international comparative purposes and analysis. Progressivity indices are generated using the Generalized Entropy family as well as Atkinson measures. This is to test the robustness of our observation of tax progressivity in each country. We further our understanding by looking at pre-tax and post-tax measures of inequality based on gross household income and disposable household income, respectively. The decomposition property is shown to be desirable in order to enhance our view of true inequality and the implication of taxes. Thus decomposition based on quintile, family sizes, and number of earners is conducted. This has allowed an interpretation of results that could be attributed to any of the above characteristics and components which are free of such group characteristics.

I. INTRODUCTION:

One of the basic consequences of income taxation is to modify the distribution of income. The relative economic standing of households will be affected by the tax unless it is proportional. However, most countries profess that their income taxes are progressive. It is an accepted view that progressivity in taxation reduces overall income inequality among households. However a reduction in overall inequality provides us a partial picture in the sense that inequality between certain groups of households (the between-group component of inequality) could be decreasing while inequality among households in the same group (the within-group component of inequality) is rising. Thus, the decomposition of the post-tax inequality moves in a different direction to pre-tax decomposition. Thus, when comparing the degree of tax progressivity of two or more nations, it is desirable to look at decompositions of inequality as well as overall inequality. All single-number indices based on the overall measure of inequality suppress detailed information of the underlying distribution. Those distributions represented by aggregated data rather than detailed micro-data at the household or individual level suppress even more potentially very relevant data.

In what follows I will measure and compare income tax progressivity in ten countries by looking at pre-tax and post-tax income inequality based on gross and net incomes among households. I employ Luxembourg Income Study household data sets for the United States, Germany, Israel, the Netherlands, Sweden, the United Kingdom, France, Canada, Switzerland, and Australia. There are a number of interesting questions regarding the alternative tax systems. For example: are taxes more redistributive in Western Europe than in the United States?; is there high correlation between tax progressivity and low inequality?; are the observed benefits due to tax splitting the same across countries?; and etc.

Several inequality indices from the Generalized Entropy family of measures are employed and the robustness of the results is observed. Decompositions of the Generalized Entropy measures are made to obtain further information about changes in the size distribution of income resulting from income taxes. We further compare our approach with those proposed by Blackborby and Donaldson (1984) and Kiefer (1985) using the Atkinson indices of inequality.

This paper outlines the methodology for inequality measurement and measurement of tax progressivity in section II. Sections III through V discuss the results of decompositions based on income quintile, number of earners, and family size respectively. Section VI discusses tax progressivity based on two alternative measures using Atkinson measures. Section VII concludes.

II. THE FRAMEWORK

To measure tax progressivity with insights regarding the treatment of particular sub-groups we need an index of relative inequality that for any population and its partition, overall inequality can be expressed as a weighted sum of the inequalities calculated for each sub-group and a term summarizing between-group inequality. Consequently our choice of index is restricted to the Generalized Entropy measures and they possess the desirable properties of: scale independence, anonymity, the principle of transfer, smoothness, the principle of population, and decomposability see Cowell and Kuga (1981). The inequality measure I(Y; n) is a function of the population size n, i = 1 ... n, and income shares $y \in Y^n = \left\{ y = (y_1; \ldots ; y_n) \geq 0 \right\}$ and $\sum_{i=1}^{n} y_i = 1$. This class of measures is defined as:

$$(1) \qquad I_{\gamma}(y) = \frac{1}{n} \sum_{i=1}^{n} (ny_i)^{\gamma+1} - 1/\gamma(\gamma+1) \qquad \gamma \neq 0, \text{ or } -1$$

$$(2) \qquad = -\sum_{i=1}^{n} y_i \text{ Log } (ny_i) \qquad \gamma = 0$$

$$(3) \qquad = -\sum_{i=1}^{n} n^{-1} \text{ Log } (1/ny_i) \qquad \gamma = -1$$

This family includes Theil's (1967) information measures as I_0 and I_{-1}. γ is the degree of inequality aversion. For every γ there exists a different index so by using a number of different γ 's we can test the sensitivity of measured inequality to the choice of index. The differences in the nature of decomposability sets these measures apart from each other. For example, I_{-1} is different from I_0 in that it is weighted by population shares rather by income shares. Thus, I_{-1} might be better than I_0 if the nature of analysis is such that population shares are preferred to income shares. The latter is sensitive to distributional changes. This family also includes monotonic transformations of measures proposed by Atkinson (1970):

$$(4) \qquad I_{\epsilon}(y) = 1 - \left[1/n \sum_{i=1}^{n} (ny_i)^{1-\epsilon}\right]^{1/(1-\epsilon)} \text{ for } \epsilon \geq 0$$

It is evident that $I_{\gamma}(y)$ and $I_{\epsilon}(y)$ are ordinarily equivalent for values of $\epsilon = -\gamma > 0$. For the value of $\gamma = 0$ this equivalency disappears. Also for $\gamma > 0$ Atkinson measures do not correspond to $I_{\gamma}(y)$.

The measurement of tax progressivity can be approached from (a) the concentration index, or (b) inequality index. The former approach in the measurement of progressivity can be seen in:

1) *Effective Progression [Musgrave and Thin (1948)]*

2) The Pechman-Okner Index [Pechman and Okner (1980)]

3) The Reynolds-Smolensky Index [Reynolds and Smolensky (1977)]

4) The Khetan Poddar Index [Khetan and Poddar (1976)]

5) The Kakwani Index [Kakwani (1977)]

6) The Khetan-Poddar-Suits Index [Khetan and Poddar (1976)]

The above progressivity indexes are all based on the Gini index and concentration indexes. Lambert (1989) provides a general discussion of each of the above.

As we know the Gini index does not satisfy some desirable social welfare axioms [see Atkinson (1970), and Sen (1973)]. The latter approach assumes the existence of a social welfare function, and uses the concept of an "equally distributed equivalent" introduced in Atkinson (1970). Using Atkinson's family of measures the redistributive effect can be gauged by looking at the pre-tax and post-tax income distribution. Consider the progressivity index:

$$(5) \qquad P_{\epsilon} = I_{\epsilon}(GI) - I_{\epsilon}(DI)$$

introduced by Kiefer (1985), where (GI) and (DI) are gross and disposable incomes respectively. If $P_{\epsilon} > 0$, the tax is progressive; if $P_{\epsilon} = 0$, the tax is proportional; and if $P_{\epsilon} < 0$, the tax is regressive. P_{ϵ} is an indicator of the amount by which the tax system has increased the equally-distributed equivalent income, given a social welfare function.

An alternative approach is that introduced by Blackorby and Donaldson (1983) and it is given as:

$$(6) \qquad P^{*}_{\epsilon} = I_{\epsilon}(GI) - I_{\epsilon}(DI)/\left[1 - I_{\epsilon}(GI)\right]$$

This index is normalized to zero and considers the percentage change. Thus if $P^{*}_{\epsilon} > 0$, the tax is progressive; if $P^{*}_{\epsilon} = 0$, the tax is proportional; and if P^{*}_{ϵ}

< 0, the tax is regressive.

In the spirit of Kiefer (1985), I will measure tax progressivity using the Generalized Entropy family of measures. Consider:

$$(7) \qquad I^* = I_\gamma(GI) - I_\gamma(DI)$$

If $I^* > 0$, the tax is progressive; if $I^* = 0$, the tax is proportional; and if $I^* < 0$, the tax is regressive. This type of measure does not account for reranking of households as taxes are imposed. For example, given the pre-tax distribution as [2,5], and the distribution of post-tax income as [3,4] or [4,3] the overall index of tax progressivity does not account for the fact that in the latter case the individuals have traded places. However, since Generalized Entropy measures are decomposable, I^* can be shown as:

$$(8) \qquad I^* = I^{b*} + I^{w*}$$

where I^{b*} is the difference of the pre-tax and post-tax between-group component of income inequality, while I^{w*} is the difference of average within-group inequality before and after taxes. The proportion of change in I^* due to I^{b*} is:

$$(9) \qquad D^b = I^{b*}/\left[I_\gamma(GI) - I_\gamma(DI)\right]$$

while the proportion attributed to the changes within-group is:

$$(10) \qquad D^w = I^{w*}/\left[I_\gamma(GI) - I_\gamma(DI)\right]$$

Thus, by definition $D^w + D^b = 1$. Equations (8) provides valuable information

which can enhance our understanding of the impact of taxes. This information is disregarded if one does not perform the decompositions.

For policy purposes it is very crucial to pay attention not only to the overall measures and their decompositions, but also to the implication of taxation in each group. The decomposition of the overall measure is a good guide as to the importance of the "within-group" results. If the average "within-group" component of the overall inequality constitutes a substantial portion of the overall inequality it is important to analyze pre-tax and post-tax inequality for each group as well. Thus, for each characteristic type (number of earners and family size) the population is divided into sub-groups. Let there be G groups, G = 1,...,g. For each group we measure tax progressivity by:

$$(11) \qquad I^*_g = I^g_\gamma (GI) - I^g_\gamma (DI)$$

where the first term in the right hand side is inequality in group g based on pre-tax income and the second term is inequality for the same group based on disposable income. If the value of I^*_g is shown to move in the opposite direction of I* one must pose a number of question regarding the efficiency of the tax system.

III. INCOME SHARE AND TAX PROGRESSIVITY

In most countries income tax is the major source of government revenue. The effect of income tax is that it modifies the distribution of income unless the tax is proportional. Thus, the relative purchasing power of households is altered. The rationale for subscribing to such a tax has been the subject of much debate. Since governments must raise revenue in order to provide services, and household income provides an elastic source of revenue when

gross household income is growing, a progressive income tax is attractive. There are two equity principles which have helped justify progressive income taxation. On one hand, "horizontal equity" necessitates that income units in similar economic standing be faced with similar tax liabilities. On the other hand, "vertical equity" requires that the tax contribution of income units be directly related to their ability to pay in order to equalize the sacrifice in terms of utility.

Assuming the above principles are desirable from a welfare perspective, our objective is to investigate whether or not they are in fact observed. In doing so, we assume that household members pool their incomes and either at the individual or household level they pay their income taxes. Consequently, we can observe the household's economic standing based on gross income (pre-tax), and disposable income (after-tax). The difference between the two income distributions provides us with an index of progressivity. We can address horizontal and vertical equity by way of our decompositions as well as by looking at the changes in within-group inequality.

Most studies analyze income tax progressivity using changes in the lorenze curve for a particular country based on pre-tax and post-tax income. This has been done with both aggregated data and micro data. Although this approach provides some information, it can mislead the analyst. For example, if for a particular quintile the share of income has changed after taxes, one is not certain about the direction of change in inequality for that particular group. Further analysis of the within-group inequality is needed.

Table 1 provides pre-tax and post-tax income shares of households for ten countries based on five quintiles. Quintile 1 represents those with least income while quintile 5 contains those with the highest incomes. There is clearly a transfer from the top 20% (Quintile 5) to the lower quintiles in all ten countries. However in Canada, Germany, Israel, the Netherlands, the

United Kingdom, and Australia, there is transfer from the top 40% to the bottom 60% of the populations in each country. Those quintiles whose share of income has increased, post-tax, have a larger proportion of after-tax income than before-tax income allocated to them. However, due to the differential in treatment, within-group inequality could actually increase in some of those groups, even though overall inequality portrays a declining pattern. Thus, the income shares tell us something about the transfer that is taking place but do not concern themselves with its distribution. From a policy perspective, not only the reallocation of income between groups but also the distribution of income within groups is of interest to insure the principles of horizontal and vertical equity.

The starting point to analyze the impact of a tax is to choose a measure of inequality. I have limited my choice to the Generalized Entropy family due to its decomposability property. I have four choices for γ: 2.0, - 1.0, - 0.5, and 0.0. Table 2 provides the measured inequality for ten countries based on gross income (GI) and disposable income (DI) of the households. Our four choices for γ cover a wide range and allow the analyst to see how measured inequality depends on the choice of index. As shown in table 2, the magnitude of inequality is fairly sensitive to our choice of γ, and as $\gamma \rightarrow 0$, the measured inequality generally is smaller. Furthermore, the ranking of each country depends upon the choice of γ; at times quite dramatically. For example, the United States ranks anywhere from first to third depending on the choice of γ. France's ranking is anywhere from first to fifth depending on the choice of γ. However, for most countries the impact of our choice of γ is small. The post-tax positions of countries also depends on γ. France, Australia, Israel, Canada and the Netherlands improve their ranking or maintain their ranking for all choices of γ. The United States, Switzerland, the United Kingdom and Sweden lose their position in the ranking with at least

one value of γ. It is evident that our choice of γ could influence our view of inequality and tax progressivity.

Also in table 2 measured tax progressivity and the percentage change in inequality based on the four values of γ are provided. I* is sensitive to our choice of index. Generally I* gets smaller as $\gamma \longrightarrow 0$. Furthermore, as $\gamma \longrightarrow 0$ the percentage change in inequality due to taxes gets smaller for Canada, Israel, United Kingdom, Germany and the Netherlands. An interesting question is the existence of such an enormous tax progressivity differential between Sweden (low) and the Netherlands (high). Both countries report some of the lowest observed inequality. One suspects that the initial endowments must play a crucial role in each country.

We can assess the impact of taxation in each country by looking at:

a) pre-tax and post-tax income distributions.

b) an index of progressivity I* , which is the difference between the pre-tax and post-tax income distribution.

c) the between and average within-group components of I* denoted by $I^{b}*$ and $I^{w}*$.

d) the within-group inequality for each quintile, i.e. I_{γ}^{g}.

All of the above are provided for each of the ten countries under consideration. I will limit my analysis of the decompositions to Theil's second measure of inequality with γ = -1.0. This is a member of the Generalized Entropy family of measures which satisfies the income-weighted decomposability property. A complete discussion of the above property is provided in Bourguignon (1979). The results based on γ = - 2.0, - 0.5, and 0.0 can be made available to those interested.

Looking at table 3, the overall inequality and its decomposition based on GI (pre-tax income) and DI (post-tax income) is provided for each of the ten countries. For each of the countries the measured inequality based on GI is

greater than that based on DI. Looking at the progressivity index, $I^* = I_\gamma(GI) - I_\gamma(DI)$, all these countries have progressive income taxation. However the degree of progressivity varies across these countries and it is very hard to rank them. For example, are income taxes more progressive in France than Australia and Germany? The reduction of inequality in each country is about 22%, while in absolute terms Germany ranks as the lowest. It is my judgment that analysis based on the index of progressivity without investigation of the between-group as well as average within-group decompositions is inadequate.

In the case just cited, it is apparent from table 3 that in Germany the cross-group equalization has been much greater than in France or Australia. Within-group inequality in Sweden, the Netherlands, Germany, the United Kingdom and Israel has increased due to progressive taxes, and has partially offset the fall in the between-group component of the overall inequality. That is, in the case of Germany the between-group fall in inequality constitutes 116% of the overall fall while the average within-group has increased by 16%. Looking at the data for Sweden, it appears that a similar pattern is detected where within-quintile inequality has increased while between-quintile inequality has fallen. At the same time Sweden enjoys the lowest recorded inequality among all nations.

It appears that Germany, Israel, the Netherlands, Sweden, and the United Kingdom subscribe to similar patterns of taxation where I^{b*} is falling while I^{w*} is rising. However only in the case of Germany and Sweden is the rise uniform across all quintiles. It is further interesting to note that within-group inequality for quintiles 3 and 4 has increased for all countries. It has been argued that this 40% of the population (the middle and upper-middle class) has shouldered most of the tax burden, partially because it receives few tax breaks.

The movement from the lowest quintile to higher quintiles reveals that inequality among households gets smaller as we move from low-income households to high-income households. This is particularly true with inequality based on GI and the first four quintiles. This pattern changes with DI to the third quintile. A possible explanation is the fact that in most countries households in higher quintiles have incomes closer to the mean for that quintile. This is not true for the highest quintiles where the variation is substantial. It is important to note that our choice of γ does make a significant difference for some countries. That is to say both the magnitude, as well as direction of change in inequality due to income taxes are affected. It is my judgment that covering a wider range of γ's increases reliability.

IV. ARE MULTI-EARNER FAMILIES WORSE OFF?

In the past two decades in most western countries there has been a move toward multi-earner families. There are many possible explanations for this phenomenon and many studies have documented the observed pattern. It is noticeable that barriers for women to enter the labor market are much lower, but this does not suggest that the earnings gap has been narrowed. Most women in these countries are in the secondary labor market with lower wages and benefits. It is further evident that family members pool their incomes and try to take advantage of economies of scale. However, for tax purposes, it is anticipated that some will subscribe to income splitting if such a provision is allowed and makes households better off.

It is not clear if multi-earner families are made any better off after taxes, and whether economies of scale are evidenced by lower inequality among households as the number of earners is increased. Furthermore, the observed reduction of overall inequality is expected to be most attributed to the reduction of average within-group inequality. If this is not observed, it

could be argued that the tax is distortionary, in the sense that we observe cross-group equalization. A second category of households consists of those who are not engaged in market activity, but are retired or receiving some kind of payment from the government.

For each country, the information provided in table 4 is:

a) overall inequality based on GI & DI

b) the between-group and average within-group inequality based on decomposition by the number of earners in the household

c) the within-group inequality

d) a measure of tax progressivity for the total population and for each group within the population.

e) the between and within-group components of I* i.e. $I^{b}*$ and $I^{w}*$

Looking at the results of overall inequality based on GI and DI, the following observations are made:

a) France and the United States trade places as we move from GI to DI. Australia and Switzerland follow in the same fashion and trade rankings. They are followed by Canada, Israel, and the United Kingdom, where the latter two trade place after taxes. The lowest inequality levels are reported by Germany, the Netherlands and Sweden, where the Netherlands takes lowest measured inequality after taxes.

b) The observed change in inequality due to taxes can be converted into a measure of progressivity by looking at the difference of the two distributions denoted by I*. The ranking by tax progressivity, as a percent of pre-tax inequality is shown to be: Israel, the Netherlands, France, Australia, the United States, Canada, the United Kingdom, Switzerland, and Sweden.

It is surprising to see Israel with a high rate of tax progressivity. More

surprising is that Sweden, with lowest measured pre-tax inequality and second lowest post-tax inequality, has one of the least progressive tax structures. I suspect the distribution of the initial endowments are a major reason.

The decomposition based on the number of earners in the household is also provided in table 4. The following general observations can be made:

a) The post-tax inequality has created more equalization within each group and it is a larger component of the overall reduction. In case of Sweden it is 100% of the total reduction.

b) Germany and the United Kingdom are exceptions to the above observation; the tax has brought about more cross group-equalizations. In the case of Germany, post-tax inequality is larger than pre-tax inequality for single earner households.

c) It is further observed that in most countries the measured pre-tax and post-tax inequality decreases as the number of earners rises. The exceptions are Sweden and the Netherlands.

V. IS THERE A TAX ADVANTAGE FOR LARGER HOUSEHOLDS?

It is a common practice to provide a deduction based on family size when calculating taxable income of households. There are many other deductions involved as well, but this deduction is the most common and straight forward when itemization is not required. It is not clear if this deduction provides an incentive to have larger households or whether in fact those with smaller households are being penalized. One could argue that a fall in between-group inequality is not desirable because households of different sizes are not comparable in terms of economic standing. However, a fall in the average within-group component of overall inequality is desirable since households of the same size are treated more equally.

To address the above concerns, decomposition based by the size of family

is provided in table 5. The grouping was based on families of size one through five and more. The following observations are made:

a) The average within-group component is the dominant portion of the overall inequality based on GI and DI.

b) The post-tax inequality for each group is smaller than the pre-tax inequality with the exception of largest household (group five+) in Germany.

c) The fall in overall inequality after taxes has resulted in greater reduction within each group so cross-group equalization is minimal.

The above observations indicate that households of equal sizes are affected in such a fashion that inequality among them has decreased. The between-group component of the reduction of the overall inequality constitutes a very small proportion of this reduction, and in the case of Sweden it has increased. Thus, these countries do in fact favor differential treatment of similar households. However, in Germany, Israel, Switzerland, and the Netherlands, between 12%-32% of the overall reduction is due to tax progressivity and it is attributed to the cross-group equalizations. In these countries there is a stronger tendency for similar treatment of households, regardless of size.

There also seems to be a pattern with respect to the size of families and the measured inequality in some of these countries. The measured inequality for each group gets smaller as the household size gets larger. This is particularly true for households of up to four people, the exceptions being the Netherlands, France and Switzerland. Thus, in some countries there seem to be fewer tax incentives available for larger households. On the contrary, it could be that larger households are of two different kinds: those who are financially sound and can afford to have large families, and those who must remain in the same household to take advantage of economics of scale. Consequently we observe a large amount of measured inequality. The above

patterns are true with respect to within-group tax progressivity. That is, generally smaller households have higher progressivity than do larger households of up to four. Taxes are much more punitive the smaller the household in these countries. The exceptions are once again the Netherlands, France, and Switzerland.

VI. ATKINSON MEASURES AND TWO MEASURES OF TAX PROGRESSIVITY

An alternative approach to measure inequality in each country is to use the measures provided by Atkinson (1970). A brief description of such measures was provided in equation (4), the where index of relative inequality is given as $I_{\epsilon}(y)$ and ϵ is the inequality aversion parameter. Looking at table 6, three values of ϵ are used to measure inequality based on gross income (GI), and disposable income (DI) for each of the ten countries. The ranking of these countries is not much different from those shown in table 2. However, there are differences in the magnitude of the measured inequality in each country for each choice of ϵ. It is evident that the choice of ϵ (measure of inequality) effects the measured inequality, although the ranking of each country may not change. The results indicate that as $\epsilon \rightarrow 0$, the measured inequality gets smaller as well. This is true regardless of the choice of household income i.e. GI vs DI. As anticipated, the post-tax distribution is more equal. Thus, $I_{\epsilon}(DI)$ is smaller than $I_{\epsilon}(GI)$. The after-tax ranking of the Netherlands and Israel has improved regardless of the choice of ϵ, but the opposite holds true for Sweden, the United Kingdom, Switzerland, and Germany. Using Atkinson measures, Kiefer (1985) suggested the progressivity index given in equation (9), i.e. P_{ϵ}. The results based on this index are given in table 6. It is clear that generally as $\epsilon \rightarrow 0$, the measured P_{ϵ} gets smaller. The exceptions are those for the United States and France. In absolute terms, the reduction in the measured inequality has been

substantial for Israel, the Netherlands, and Germany. Also, these are countries with some of the lowest observed inequality. The magnitude of our observations and those results are sensitive to the choice of ϵ.

Using these same measures, Blackorby and Donaldson (1984) approached the concept of progressivity differently. For them, the measured progressivity is basically "one minus inequality." This is shown in equation (10) to be as P^*_ϵ. The results based on P^*_ϵ are shown in table 6 as well. P^*_ϵ is very sensitive to the choice of ϵ. The following observations are made about this index:

a) as $\epsilon \to 0$, P^*_ϵ becomes smaller.

b) countries such as the United States and France could be viewed as having the <u>most</u> progressive index and the <u>least</u> progressive index depending on the choice of ϵ. Therefore, there is value judgment to be made about the tax system in each of these countries.

c) the ranking of Israel, Australia, the Netherlands, Germany, Canada, the United Kingdom, and Sweden does not change much with the choice of ϵ.

It is evident from our observations above that one needs to look at a family of such measures in order to broaden our view of the existing pre-tax and post-tax income distribution. More importantly the decompositions are crucial to learn about the source of inequality and the fashion in which it is changing after taxes.

VII. CONCLUSION

This paper has provided comparisons of pre-tax and post-tax income inequality among households in ten different countries. In addition I have introduced a measure of tax progressivity using Generalized Entropy Measures. The decomposition property of the indices allows us to learn about factors that might contribute to inequality and might further be a source in which to

provide after-tax benefits. It is clear that generally there is a reduction of inequality after taxes. However, at the same time, within-group inequality can increase. Taxes are shown to be progressive in each of these countries, but one has to be very cautious in making judgments about the nature and the effect of income taxation. The family of progressivity indices, based on Entropy Measures and Atkinson measures, shows the sensitivity of our results to the choice of inequality measure used. In general the ranking of those countries with higher reported inequality both before and after taxes is sensitive to the choice of index used,i.e., France, the United States, Australia, Switzerland and Israel. The ranking based on pre and post-tax income for countries with low inequality in general is less variant to the choice of index,i.e., Sweden, the Netherlands, Germany, the United Kingdom and Canada. This study has also shown the richness of the data sets currently available in Luxembourg Income Study.

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TABLE 1

RANKING OF NATIONS
PRE-TAX & POST-TAX INCOME SHARE BY QUINTILE*

Country		Quint 1	Quint 2	Quint 3	Quint 4	Quint 5	Sample Size
France#	GI	.051	.097	.143	.205	.505	5454
1979	DI	.059	.109	.158	.221	.453	
United States@	GI	.041	.098	.165	.251	.445	4468
1979	DI	.050	.113	.176	.254	.407	
Australia@	GI	.047	.104	.173	.249	.428	4730
1981	DI	.058	.119	.180	.248	.395	
Switzerland	GI	.057	.117	.161	.214	.450	6877
1982	DI	.065	.124	.166	.215	.431	
Canada@	GI	.049	.112	.178	.251	.409	4478
1981	DI	.056	.122	.184	.249	.389	
Israel	GI	.052	.114	.171	.246	.417	2271
1979	DI	.069	.132	.186	.243	.370	
United Kingdom	GI	.050	.108	.183	.252	.407	6878
1979	DI	.059	.116	.184	.250	.391	
Germany	GI	.061	.126	.182	.247	.383	2787
1981	DI	.077	.140	.184	.245	.354	
Netherlands#	GI	.069	.128	.177	.244	.382	4747
1983	DI	.087	.139	.178	.240	.355	
Sweden#	GI	.070	.129	.181	.198	.422	4754
1981	DI	.084	.140	.186	.201	.390	

*Only households with positive income have been selected. Some inequality measures are not defined for income values of zero. The German data set excludes some 8% of households with foreign national heads of household. The data set for Israel does not represent some 10% of the rural population. Also the United State data set has a tope coding of $50,000. The noted problems with data sets alter the true inequality.

#@ only 50 and 30 percent of the sample are used respectively.

TABLE 2
RANKING BY SEVERAL INEQUALITY MEASURES
BASED ON GROSS (GI) AND DISPOSABLE (DI) INCOME

		Rank	$\gamma = -1.0$	Rank	$\gamma = -2.0$	Rank	$\gamma = -0.5$	Rank	$\gamma = 0.0$
France	GI	(1)	.3508	(5)	.5927	(1)	.3514	(1)	.4073
	DI	[2]	.2737	[5]	.4782	[1]	.2655	[1]	.2882
	I*		.0771		.1145		.0859		.1191
			(21.9%)@		(19.3%)		(24.4%)		(29.2%)
United States	GI	(2)	.3427	(1)	1.5697	(2)	.2902	(3)	.2739
	DI	[1]	.2762	[1]	1.2495	[3]	.2331	[3]	.2175
	I*		.0665		.3202		.0571		.0564
			(19.4%)		(20.3%)		(19.6)		(20.5%)
Aust.	GI	(3)	.2997	(2)	1.0835	(3)	.2605	(4)	.2506
	DI	[4]	.2323	[2]	.8225	[4]	.2020	[4]	.1924
	I*		.0674		.2610		.0585		.0582
			(22.4%)		(24.0%)		(22.4%)		(23.2%)
Switz.	GI	(4)	.2875	(3)	.7689	(7)	.2851	(2)	.3318
	DI	[3]	.2509	[3]	.5996	[2]	.2497	[2]	.2864
	I*		.0366		.1693		.0354		.0454
			(12.7%)		(22.0%)		(12.4%)		(13.6%)
Canada	GI	(5)	.2695	(4)	.6840	(5)	.2324	(6)	.2187
	DI	[5]	.2293	[4]	.5629	[5]	.1990	[6]	.1873
	I*		.0402		.1211		.0334		.0314
			(14.9%)		(17.7%)		(14.3%)		(14.3%)
Israel	GI	(6)	.2573	(7)	.3978	(4)	.2356	(5)	.2333
	DI	[7]	.1840	[8]	.2549	[7]	.1732	[7]	.1750
	I*		.0733		.1429		.0624		.0583
			(28.4%)		(35.9%)		(26.4%)		(24.9%)
United Kingdom	GI	(7)	.2512	(6)	.4207	(6)	.2259	(7)	.2166
	DI	[6]	.2135	[6]	.3413	[6]	.1962	[5]	.1912
	I*		.0377		.0794		.0297		.0254
			(15.0%)		(18.8%)		(13.1%)		(11.7%)
Germany	GI	(8)	.2025	(10)	.3262	(8)	.1831	(8)	.1764
	DI	[9]	.1574	[9]	.2356	[8]	.1454	[8]	.1421
	I*		.0451		.0906		.0377		.0343
			(22.2%)		(27.7%)		(20.5%)		(19.4%)
Neth.	GI	(9)	.1897	(9)	.3306	(9)	.1719	(9)	.1677
	DI	[10]	.1439	[10]	.2309	[10]	.1328	[10]	.1305
	I*		.0458		.0997		.0391		.0372
			(24.1%)		(30.1%)		(22.7%)		(22.1%)
Sweden	GI	(10)	.1854	(8)	.3584	(10)	.1659	(10)	.1599
	DI	[8]	.1611	[7]	.2927	[9]	.1436	[9]	.1369
	I*		.0243		.0657		.0223		.0230
			(13.1%)		(18.3%)		(13.4%)		(14.3%)

@ The values in the brackets are percentage change in inequality due to taxes.

TABLE 3

REDISTRIBUTION THROUGH TAXATION, INEQUALITY BY QUINTILE, γ = -1.0

	Overall	Between	Within	Quint 1	Quint 2	Quint 3	Quint 4	Quint 5
Country: France, 1979								
GI	0.3508	0.2958	0.0551	0.0988	0.0077	0.0054	0.0069	0.1567
DI	0.2737	0.2291	0.0448	0.1001	0.0081	0.0060	0.0073	0.1027
I^*, I^{b*}, I^{w*}	0.0771	0.0667	0.0103					
D^o, D^b, D^w	1.0	0.8651	0.1336					
Country: United States, 1979								
GI	0.3426	0.2936	0.0492	0.1777	0.0157	0.0093	0.0065	0.0369
DI	0.2762	0.2289	0.0474	0.1759	0.0153	0.0097	0.0072	0.0293
I^*, I^{b*}, I^{w*}	0.0664	0.0647	0.0018					
D^o, D^b, D^w	1.0	0.9744	0.0271					
Country: Australia, 1981								
GI	0.2997	0.2559	0.0440	0.1420	0.0209	0.0062	0.0060	0.0448
DI	0.2323	0.1930	0.0395	0.1392	0.0149	0.0067	0.0063	0.0304
I^*, I^{b*}, I^{w*}	0.0674	0.0629	0.0045					
D^o, D^b, D^w	1.0	0.9332	0.0668					
Country: Switzerland, 1981								
GI	0.2875	0.2267	0.0610	0.1268	0.0080	0.0032	0.0039	0.1622
DI	0.2509	0.1941	0.0570	0.1180	0.0087	0.0040	0.0050	0.1487
I^*, I^{b*}, I^{w*}	0.0366	0.0326	0.0040					
D^o, D^b, D^w	1.0	0.8907	0.1093					
Country: Canada 1981								
GI	0.2695	0.2318	0.0378	0.1327	0.0155	0.0056	0.0051	0.0300
DI	0.2293	0.1925	0.0370	0.1293	0.0141	0.0070	0.0068	0.0275
I^*,I^{b*}, I^{w*}	0.0402	0.0393	0.0008					
D^o, D^b, D^w	1.0	0.9776	0.0199					
Country: Israel, 1979								
GI	0.2573	0.2251	0.0323	0.0859	0.0099	0.0055	0.0060	0.0542
DI	0.1840	0.1495	0.0345	0.0740	0.0145	0.0132	0.0146	0.0566
I^*, I^{b*}, I^{w*}	0.0733	0.0756	-0.0022					
D^o, D^b, D^w	1.0	1.0314	-0.0300					
Country: United Kingdom, 1979								
GI	0.2512	0.2313	0.0202	0.0366	0.0233	0.0053	0.0045	0.0311
DI	0.2135	0.1918	0.0219	0.0382	0.0206	0.0092	0.0075	0.0340
I^*, I^{b*}, I^{w*}	0.0377	0.0395	-0.0017					
D^o, D^b, D^w	1.0	1.0477	-0.0451					
Country: Germany, 1981								
GI	0.2025	0.1761	0.0265	0.0817	0.0099	0.0039	0.0040	0.0333
DI	0.1574	0.1237	0.0338	0.0844	0.0136	0.0159	0.0120	0.0432
I^*, I^{b*}, I^{w*}	0.0451	0.0524	-0.0073					
D^o, D^b, D^w	1.0	1.1619	-0.1619					
Country: Netherlands, 1983								
GI	0.1897	0.1589	0.0309	0.1068	0.0074	0.0037	0.0046	0.0323
DI	0.1439	0.1113	0.0327	0.1019	0.0102	0.0092	0.0105	0.0320
I^*, I^{b*}, I^{w*}	0.0458	0.0476	-0.0018					
D^o, D^b, D^w	1.0	1.0393	-0.0393					
Country: Sweden, 1981								
GI	0.1854	0.1516	0.0339	0.1223	0.0058	0.0036	0.0026	0.0307
DI	0.1611	0.1106	0.0507	0.1378	0.0270	0.0247	0.0248	0.0369
I^*, I^{b*}, I^{w*}	0.0243	0.0410	-0.0168					
D^o, D^b, D^w	1.0	1.6872	-0.6914					

TABLE 4

REDISTRIBUTION THROUGH TAXATION, INEQUALITY BY NUMBER OF EARNERS, $\gamma = -1.0$

	Overall	Between	Within	One	Two	Three	None
Country: France, 1979							
GI	0.3508	0.0349	0.3160	0.3703	0.2173	0.1552	0.3732
DI	0.2738	0.0354	0.2385	0.2931	0.1554	0.1157	0.2614
I^*, I^{b*}, I^{w*}	0.0770	-0.0005	0.0775	0.0772	0.0619	0.0395	0.1118
D^o, D^b, D^w	1.0	-0.0065	1.0065				
Country: United States, 1979							
GI	0.3427	0.1056	0.2372	0.3023	0.1430	0.1058	0.3079
DI	0.2762	0.0824	0.1939	0.2451	0.1039	0.0802	0.2803
I^*, I^{b*}, I^{w*}	0.0665	0.0232	0.0433	0.0572	0.0391	0.0256	0.0276
D^o, D^b, D^w	1.0	0.3489	0.6511				
Country: Switzerland, 1982							
GI	0.2875	0.0498	0.2378	0.2691	0.1245		0.2762
DI	0.2510	0.0410	0.2101	0.2431	0.1073		0.2301
I^*, I^{b*}, I^{w*}	0.0365	0.0088	0.0277	0.0260	0.0172		0.0461
D^o, D^b, D^w	1.0	0.2411	0.7589				
Country: Canada, 1981							
GI	0.2695	0.0902	0.1794	0.2349	0.1126	0.0959	0.2348
DI	0.2293	0.0787	0.1507	0.1965	0.0901	0.0770	0.2094
I^*, I^{b*}, I^{w*}	0.0402	0.0115	0.0287	0.0384	0.0225	0.0189	0.0254
D^o, D^b, D^w	1.0	0.2861	0.7139				
Country: Israel, 1979							
GI	0.2573	0.0625	0.1948	0.1974	0.1063	0.0869	0.3639
DI	0.1840	0.0392	0.1448	0.1286	0.0720	0.0571	0.3554
I^*, I^{b*}, I^{w*}	0.0733	0.0233	0.0500	0.0688	0.0343	0.0298	0.0085
D^o, D^b, D^w	1.0	0.3179	0.6821				
Country: United Kingdom, 1979							
GI	0.2513	0.1395	0.1119	0.1420	0.0747	0.0588	0.1433
DI	0.2136	0.1170	0.0967	0.1247	0.0657	0.0544	0.1184
I^*, I^{b*}, I^{w*}	0.0377	0.0225	0.0152	0.0173	0.0090	0.0044	0.0247
D^o, D^b, D^w	1.0	0.5968	0.4032				
Country: Germany, 1981							
GI	0.2026	0.0952	0.1074	0.1023	0.0738	0.0505	0.1610
DI	0.1575	0.0505	0.1069	0.1032	0.0724	0.0462	0.1598
I^*, I^{b*}, I^{w*}	0.0451	0.0447	0.0005	-0.0009	0.0014	0.0043	0.0012
D^o, D^b, D^w	1.0	0.9911	0.0111				
Country: Netherlands, 1983							
GI	0.1898	0.0543	0.1355	0.1268	0.1219	0.1872	0.1510
DI	0.1440	0.0402	0.1038	0.0977	0.0949	0.1327	0.1149
I^*, I^{b*}, I^{w*}	0.0458	0.0141	0.0317	0.0291	0.0270	0.0545	0.0361
D^o, D^b, D^w	1.0	0.3079	0.6921				
Country: Sweden,							
GI	0.1854	0.0531	0.1325	0.1613	0.0631	0.1093	0.1839
DI	0.1612	0.0531	0.1082	0.1369	0.0422	0.0988	0.1353
I^*, I^{b*}, I^{w*}	0.0242	0.0000	0.0242	0.0244	0.0209	0.0105	0.0486
D^o, D^b, D^w	1.0	0.0000	1.0000				

TABLE 5

REDISTRIBUTION THROUGH TAXATION, INEQUALITY BY FAMILY SIZE, $\gamma = -1.0$

	Overall	Between	Within	One	Two	Three	Four	Five+
Country: France, 1979								
GI	0.3508	0.0657	0.2852	0.2310	0.3602	0.2809	0.2530	0.2606
DI	0.2738	0.0627	0.2112	0.1915	0.2537	0.2037	0.1860	0.1990
I^*, I^{b*}, I^{w*}	0.0770	0.0030	0.0740	0.0395	0.1065	0.0772	0.0670	0.0616
D^o, D^b, D^w	1.0	0.0390	0.9610					
Country: United States, 1979								
GI	0.3427	0.0642	0.2786	0.3574	0.2888	0.2331	0.2066	0.2123
DI	0.2762	0.0623	0.2140	0.2764	0.2157	0.1822	0.1612	0.1650
I^*, I^{b*}, I^{w*}	0.0665	0.0019	0.0646	0.0810	0.0731	0.0509	0.0454	0.0473
D^o, D^b, D^w	1.0	0.0286	0.9714					
Country: Switzerland, 1982								
GI	0.2875	0.0642	0.2234	0.2512	0.2687	0.1570	0.1442	0.1606
DI	0.2509	0.0597	0.1914	0.2151	0.2236	0.1379	0.1337	0.1430
I^*, I^{b*}, I^{w*}	0.0366	0.0045	0.0320	0.0361	0.0451	0.0191	0.0105	0.0176
D^o, D^b, D^w	1.0	0.1230	0.8743					
Country: Canada, 1981								
GI	0.2695	0.0562	0.2134	0.3125	0.2263	0.1744	0.1471	0.1448
DI	0.2293	0.0552	0.1742	0.2568	0.1811	0.1433	0.1228	0.1174
I^*, I^{b*}, I^{w*}	0.0402	0.0010	0.0392	0.0557	0.0452	0.0311	0.0243	0.0274
D^o, D^b, D^w	1.0	0.0249	0.9751					
Country: Israel, 1979								
GI	0.2573	0.0398	0.2175	0.3742	0.3118	0.1666	0.1505	0.1588
DI	0.1840	0.0289	0.1551	0.2666	0.2401	0.1135	0.1076	0.1013
I^*, I^{b*}, I^{w*}	0.0733	0.0109	0.0624	0.1074	0.0717	0.0531	0.0429	0.0575
D^o, D^b, D^w	1.0	0.1487	0.8513					
Country: United Kingdom, 1979								
GI	0.2512	0.0889	0.1625	0.2258	0.1884	0.1212	0.0981	0.1150
DI	0.2135	0.0858	0.1279	0.1647	0.1446	0.1040	0.0877	0.1003
I^*, I^{b*}, I^{w*}	0.0377	0.0031	0.0346	0.0611	0.0438	0.0172	0.0104	0.0147
D^o, D^b, D^w	1.0	0.0822	0.9178					
Country: Germany, 1981								
GI	0.2025	0.0627	0.1399	0.1944	0.1790	0.1000	0.0786	0.0850
DI	0.1574	0.0481	0.1093	0.1422	0.1305	0.0889	0.0661	0.0880
I^*, I^{b*}, I^{w*}	0.0451	0.0146	0.0306	0.0522	0.0485	0.0111	0.0125	-0.0030
D^o, D^b, D^w	1.0	0.3237	0.6785					
Country: Netherlands, 1983								
GI	0.1897	0.0265	0.1632	0.1697	0.1478	0.1974	0.1272	0.2190
DI	0.1439	0.0211	0.1229	0.1172	0.1058	0.1538	0.1032	0.1778
I^*, I^{b*}, I^{w*}	0.0458	0.0054	0.0403	0.0525	0.0420	0.0436	0.0240	0.0412
D^o, D^b, D^w	1.0	0.1179	0.8799					
Country: Sweden, 1981								
GI	0.1854	0.0305	0.1550	0.2168	0.1571	0.1333	0.1178	0.1172
DI	0.1612	0.0353	0.1259	0.1631	0.1261	0.1158	0.1044	0.0993
I^*, I^{b*}, I^{w*}	0.0242	-0.0048	0.0291	0.0537	0.0310	0.0175	0.0134	0.0179
D^o, D^b, D^w	1.0	-0.1983	1.2025					

TABLE 6

REDISTRIBUTION THROUGH TAXATION
ATKINSON MEASURES

Country	Choice of ϵ	Overall GI	Overall DI	P_ϵ	P^*_ϵ
France	2.0	0.5424	0.4889	0.0535	0.1169
1979	1.0	0.2959	0.2395	0.0564	0.0801
	0.5	0.1680	0.1284	0.0396	0.0476
United States	2.0	0.7584	0.7142	0.0442	0.0730
1979	1.0	0.2901	0.2414	0.0487	0.0596
	0.5	0.1398	0.1132	0.0266	0.0292
Australia	2.0	0.6842	0.6219	0.0623	0.1973
1981	1.0	0.2590	0.2073	0.0517	0.0698
	0.5	0.1260	0.0985	0.0275	0.0315
Switzerland	2.0	0.6060	0.5453	0.0607	0.1541
1982	1.0	0.2499	0.2219	0.0280	0.0373
	0.5	0.1375	0.1210	0.0165	0.0191
Canada	2.0	0.5777	0.5296	0.0481	0.1139
1981	1.0	0.2362	0.2049	0.0313	0.0410
	0.5	0.1128	0.0970	0.0158	0.0178
Israel	2.0	0.4431	0.3376	0.1055	0.1894
1979	1.0	0.2268	0.1681	0.0587	0.0759
	0.5	0.1143	0.0847	0.0296	0.0334
United Kingdom	2.0	0.4570	0.4057	0.0513	0.0945
1979	1.0	0.2222	0.1923	0.0299	0.0384
	0.5	0.1098	0.0957	0.0141	0.0158
Germany	2.0	0.3948	0.3203	0.0745	0.1231
1981	1.0	0.1833	0.1456	0.0377	0.0462
	0.5	0.0895	0.0714	0.0181	0.0199
Netherlands	2.0	0.3981	0.3160	0.0821	0.1364
1983	1.0	0.1728	0.1340	0.0388	0.0469
	0.5	0.0841	0.0653	0.0188	0.0205
Sweden	2.0	0.4175	0.3693	0.0482	0.0827
1981	1.0	0.1692	0.1488	0.0204	0.0246
	0.5	0.0812	0.0705	0.0107	0.0116