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**EMPIRICAL ANALYSIS OF
PROGRESSIVITY OF THE TAX SYSTEM IN
SOUTH AFRICA**

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Abstract

This paper seeks to investigate progressivity of the tax system by investigating whether or not the tax system in South Africa exhibits increasing, decreasing or constant progressivity. This question is addressed by using the effective, redistributive and disproportionality measures of progressivity suggested by Musgrave and Thin (1948) and Kakwani (1977), respectively. The major findings of this study are that effective tax progressivity increased by 4.5 per cent between 1989-2003/4. In terms of the redistributive effect of the tax, it was found that progressivity increased by 2.0 per cent during 1989-1994 while it increased by 51.9 per cent during the tax reforms period, 1994-2003/4. On the other hand, the measure of disproportionality shows that during the period 1989- 1994 progressivity improved by 16.7 per cent and increased by 64.0 per cent during the tax reforms period, 1994 – 2003/4. Bootstrapping procedure was employed to establish the empirical distribution of the calculated Gini coefficients. Inferences based on the bootstrap Gini coefficients and confidence intervals yield results that are consistent with our earlier findings regarding income tax progressivity in South Africa.

Key words: Progressivity; Kakwani index; Musgrave & Thin index; Bootstrap

JEL classification numbers: H; H2; H24

1. INTRODUCTION

The subject of progressivity of the tax system has occupied centre stage in the field of taxation and public policy for a long time with much effort devoted to the understanding and determination of the tax structure that is both fair to the taxpayers and able to raise sufficient revenue to the government. However, little if any studies have been done in South Africa to ascertain whether or not progressivity has been increasing or declining or remained constant over time. The main reason for this is probably the fact that tax data stratified per income groups is not readily available. The earliest works

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towards measurement of tax progressivity is associated with the writings of Pigou in 1929, however, the modern treatment of progressivity is associated with the seminal work of Musgrave and Thin (1948) and Slitor (1948). A tax system may be progressive, proportional or regressive. A progressive tax structure is one in which a person's tax liability as a fraction of income rises with income, which implies that a tax system is more progressive if it tends to redistribute more from those who are better off to those who are worse off.

In the literature (see Musgrave and Thin, 1948; and Kakwani, 1977) tax progressivity is defined relative to a proportional tax system, such that the greater a tax system departs from proportionality, the more progressive it is and otherwise. For example, in the case of income tax, if the tax rate is constant, it means that all taxpayers irrespective of their income, pay the same percentage of income to the government, implying that such a system is proportional. On the other hand, if tax rates rise as income increases, then the system is progressive, however, if the tax rate falls when income rises then it is said to be regressive.

The determination of progressivity, as available evidence shows, is a major challenge in the less developed countries where the efficiency of the tax system is of great concern (Tanzi and Zee, 2001). Essentially, a good tax system should be able to raise sufficient revenue to the government. In a number of developing countries where income is unevenly distributed, the influence exerted by the rich through their economic and political dominance could frustrate fiscal reforms if the tax burden is not proportionally distributed. Due to such dominance the revenue base is often not fully exploited and taxes such as personal income tax and property taxes not fully utilised to achieve progressivity in the tax system. In these countries, for example, revenue from income tax is limited because of the relatively small number of people subjected to this tax, with numbers becoming even fewer as the level of income increases.

As argued by Tanzi and Lee (2001), less developed countries tend to maintain some degree of nominal progressivity in income tax by applying

many rate brackets and are reluctant to adopt reforms that will reduce the number of these brackets. At the same time its effectiveness is inhibited by high personal exemptions that accrue as income rises, however, rate progressivity can improve through systematic reduction in the degree of nominal rate progressivity, reducing the number of brackets and reducing exemptions and deductions.

The rest of the paper is organised as follows. Section 2 discusses income tax reforms since 1994. Section 3 discusses various methods suggested in the literature on how to measure progressivity of the tax system, the concept of bootstrap is briefly discussed in this section too. Section 4 discusses the bootstrap procedure while section 5 presents the empirical results regarding progressivity of income tax in South Africa, and finally section 6 presents conclusions and recommendations.

2. INCOME TAX REFORMS IN SOUTH AFRICA

After the collapse of the apartheid regime in 1994, the new government embarked on massive reforms that affected virtually all aspects of the economy including the tax system. For example, the Katz Commission was appointed and their brief was to inquire into the appropriateness and efficiency of the tax system and to make recommendations taking into account internationally accepted tax principles and practices. Arising from the Commission's reports were recommendations targeted at tax laws with a view to reforming the system. Tax reforms in South Africa that were initiated in 1994, can be categorized into two main phases.

The first phase of reforms covers the period from 1994 to 1999, and was characterised by policy reviews, investigations and reports produced by the Katz Commission, which occasioned numerous tax amendments that were promulgated between 1994 and 1999. With regard to income tax, the Commission was to investigate the status of the system with emphasis on gender issues, tax base, tax thresholds, income brackets, tax rates,

progressivity, fiscal drag and income tax exemptions for charitable, religious and educational institutions.

During the first phase of reforms, transfer pricing and capitalisation rules were introduced into the Income Tax Act in 1995. With increasing levels of both outward and inward investment since 1994, it became necessary to expand South Africa's double taxation treaty network, which has seen the number of treaties rising from 10 prior to 1994, to more than 50 during the period 2003/4. A number of other changes were made to tax legislation to reduce the tax gap and increase tax collections, including the repealing of the general anti-avoidance provision in 1996. Other amendments were also made with a view to narrowing the difference between the taxable value of fringe benefits and the taxable amount of a cash salary, for example, the anti-avoidance provisions introduced in 1997 and 1999 was meant to check the abuse of travel allowances and company car schemes.

The second phase of reform, which covers the period 2000 onwards focused on broadening the tax base and adapting the tax system to conform to international tax laws. Phase two of the reforms that started after 1999, was meant to refocus fiscal policy with a view to broadening the tax base and closing the tax gap. The most fundamental change in the income tax policy was the change from the "source-based" to a "residence-based", system in 2001. This was intended to protect and broaden the tax base and give the South Africa tax system a flavour that conforms to international standards and practices.

Some recommendations were implemented in 2000 when the concept of a 'public benefit organisation' was introduced into the Income Tax Act. By 2002, the number of tax brackets had been reduced to six; the child rebate was removed to reduce fraud, but the primary rebate continues to increase on an annual basis. To compensate for inflation, the tax brackets and tax thresholds are also adjusted on an annual basis. There have been two amnesties in South Africa since 1994. The first amnesty, announced in 1995, was aimed at persons who had not previously registered as taxpayers, as

recommended by the Katz Commission. The second amnesty, announced in 2003, was aimed at assisting taxpayers who had transgressed the South African exchange control regulations by transferring funds offshore without proper authorization.

3. MEASUREMENT OF TAX PROGRESSIVITY

As pointed out by Masgrave and Thin (1948) the degree of tax progressivity is ambiguous, this is because of different perceptions and definitions employed in empirical research. This section discusses some of the methods that are available in the literature and have been used to measure progressivity of the tax systems.

I. Pigouvian Approach: Progression can be measured in two ways, namely the Average Tax Progression Measure and the Marginal Tax Rate Progression Measure. (Pigou, 1929). The Average Tax Progression Measure is founded on the premise that the tax structure is progressive when the average tax rate increases with rising income, and progression therefore means the rate of change of the average tax rate. Formally stated, suppose the initial income is Y_0 and the tax rate at this level of income is T_0 , when income rises to Y_1 and the tax rate increases to T_1 , the average rate progression (P_a) is given as;

$$P_a = \frac{\frac{T_1}{Y_1} - \frac{T_0}{Y_0}}{Y_1 - Y_0} \quad 1$$

Based on this formula, the average rate progression is zero when the tax is proportional, positive when the tax is progressive and negative when it is regressive.

Marginal Rate Progression, on the other hand, unlike the Average Tax Rate Progression, measures the rate of change in the marginal tax rate and is calculated as follows;

$$P_m = \frac{\frac{T_2 - T_1}{Y_2 - Y_1} - \frac{T_1 - T_0}{Y_1 - Y_0}}{Y_2 - Y_1} \quad Y_2 > Y_1 > Y_0 \text{ and } T_2 > T_1 > T_0 \quad 2$$

Using this criteria, a tax structure is proportional if the coefficient P_m is equal to zero, progressive if the coefficient is positive and regressive if the coefficient is negative.

II. Slitor Index Approach: This index is based on Slitor (1948), it measures progressivity as follows: a tax system is progressive, proportional or regressive if the marginal tax rate is greater, equal or less than the average tax rate, respectively. According to this method progressivity is measured as follows³;

$$\frac{dt(Y)}{dY} = \frac{m(Y) - t(Y)}{Y} \quad 3$$

where $t(Y)$ is the average tax rate at income level Y and $m(Y)$ is the marginal tax rate at the same level of income.

III. Musgrave and Thin Approach: Musgrave and Thin (1948) developed measures that sought to address the limitations of the Pigovian and Slitor indices. They suggested that progressivity be measured using the Liability Progression Index, Residual Income Progression Index and Effective Progression Index. The Liability Progression Index is based on changes in tax liability and is defined as the ratio of the percentage change in tax liability to the concurrent percentage change in income. This is formally stated as;

³ Assuming the tax liability T is expressed as a proportion of income as $T = f(Y)$, the average rate for tax is therefore expressed as $\frac{f(Y)}{Y}$. If this function is differentiated with respect to Y , we obtain $\frac{1}{Y^2} [Yf'(Y) - f(Y)] = \frac{1}{Y} \left[f'(y) - \frac{f(Y)}{Y} \right]$.

$$P_L = \frac{T_1 - T_0}{T_0} \frac{Y_0}{Y_1 - Y_0} \quad 4$$

In this case the liability progression coefficient will take on a value of 1 where the tax is proportional, exceeds 1 where the tax is progressive and less than 1 when the tax is regressive.

The Residual Income Progression Index, on the other hand, defines progression as the ratio of the percentage change in income after tax to the percentage change in income before tax, that is

$$P_R = \frac{(Y_1 - T_0) - (Y_0 - T_0)}{Y_0 - T_0} \frac{Y_0}{Y_1 - Y_0} \quad 5$$

A tax is considered to be proportional when it has a value of 1, exceeds 1 when it is regressive and less than 1 when it is progressive.

The methods discussed above, however, suffer from a serious limitation, namely they are only capable of measuring progression at a given point on the taxable income scale and therefore do not provide a unique index to determine whether or not the tax system, generally, exhibits progressivity, regressivity or proportionality. This limitation is addressed by the methods discussed below.

Effective progression index: This index measures progression in terms of the rate structure and in terms of income distribution. In this regard, effective progression measures the extent to which a given tax structure results in a shift in the distribution of income towards equality. It uses Lorenz curves to visualise progression and Gini coefficients to measure the extent to which a change in the tax rate can affect income distribution as shown in Figure 1. In this regard Gini coefficients for income distribution before and after tax are calculated and the effective progression, π_{ef} is calculated as;

$$\pi_{ef} = \frac{G_a}{G_b} = \frac{\int_0^1 L_a(P) dP}{\int_0^1 L_b(P) dP}$$

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where π_{ef} is the effective progression index, G_a is the Gini coefficient of equality of income distribution after the tax, while G_b is the Gini coefficient of income distribution before tax. $L_a(P)$ is the Lorenz curve for income after tax and $L_b(P)$ is the Lorenz curve for income before tax. If the tax structure is proportional the coefficient will be 1, exceeds 1 where the tax is regressive and is less than 1 where it is progressive. In this regard progressivity is said to improve when the effective progression index tends to zero.

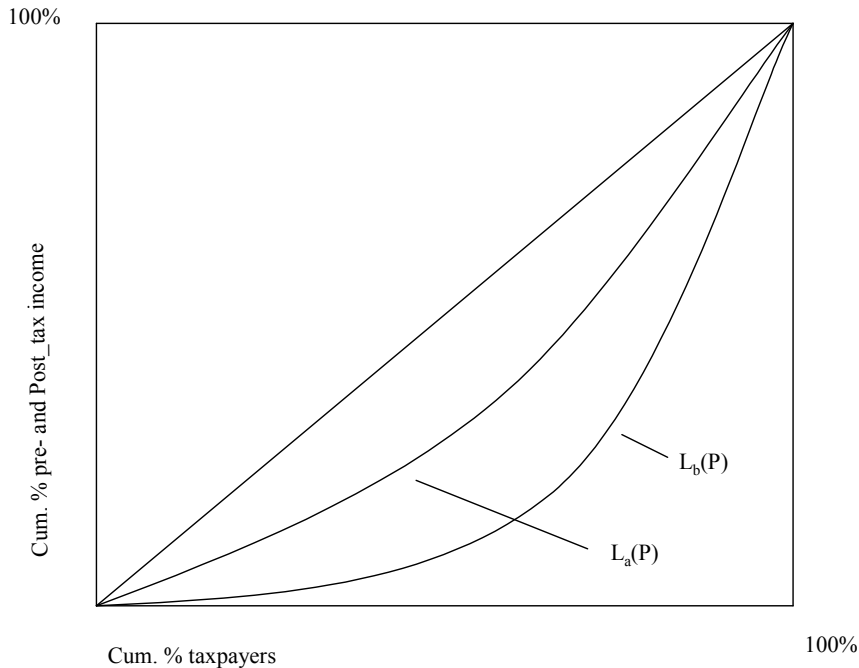
Reynolds and Smolensky (1977) suggested modification a to the Musgrave and Thin (1948) method, stating that the redistribution effect of a tax be measured as the difference between the distribution of income before tax and income after tax, which is formally stated as:

$$\pi_M = 2 \int_0^1 [L_b(P) - L_a(P)] dP = G_a - G_b$$

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If the index π_M is negative, it means that income is distributed more equally after the tax and therefore income tax is regressive. On the other hand if this expression is positive then the tax system is progressive, however, if this expression is zero in which case a tax does not cause any effect on the distribution of incomes, then the tax is said to be proportional. The Figure below serves to illustrate this measure of progressivity.

Figure 1: Lorenz Curves for Pre-tax and Post-tax Income

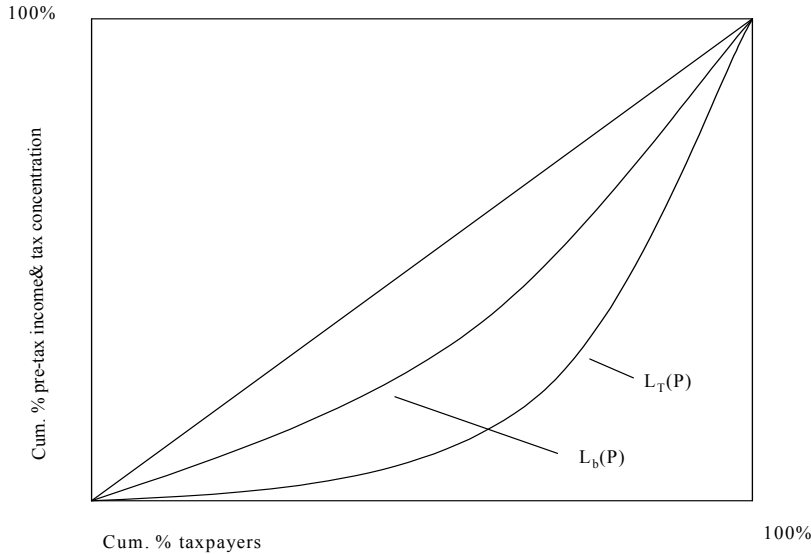


The figure above shows income distribution using the Lorenz curve representation. In the Figure, $L_a(P)$ is the Lorenz curve of income after tax while, $L_b(P)$ is the curve for the income distribution before tax. On this basis, it is argued that if the tax is progressive, $L_a(P)$ curve will lie above the, $L_b(P)$ curve, this is because a progressive tax is associated with a decrease in income inequality. However, where the tax is regressive, the $L_b(P)$ curve will lie above the $L_a(P)$ curve, as regressive taxes are associated with high income inequality, and it is proportional if the two curves are identical. The redistributive effect measure of progressivity is double the area between the two Lorenz curves.

IV. Kakwani Index Approach: This index not only considers the income distribution before and after tax as suggested by Musgrave and Thin (1948), but also the level of concentration of the tax. Kakwani (1977) argues that simply comparing the income distribution before and after tax may not yield a suitable measure of progressivity, instead, he suggested that the Lorenz curve of income be compared to the concentration curve of a tax. A

concentration curve of a tax is defined as a curve that plots the cumulative taxes and cumulative number of the individuals paying the tax.

Figure 2: Lorenz curve and tax concentration curve



The figure above shows a representation of the Lorenz curve for income distribution and that of taxes i.e. the tax concentration curve. To measure progressivity, Kakwani (1977) developed an index in which progressivity is defined in terms of the departure from proportionality, defined formally as follows;

$$\pi_K = 2 \int_0^1 [L_b(P) - L_T(P)] dP = C_T - G_b \quad 8$$

where, $L_b(P)$ is the Lorenz curve of gross income, $L_T(P)$ is the concentration curve for the net tax liabilities, C_T is the concentration index for net tax liabilities and G_b is the Gini coefficient for pre-tax income. According to this method if the tax system is progressive, that is payments expressed as a fraction of income rise with income, $L_T(P)$ will lie below $L_b(P)$. Similarly if a tax system is regressive $L_T(P)$ lies above $L_b(P)$. It is only when the tax is proportional that the two curves coincide. As pointed by Wagstaff and Van Doorslaer (2001), the index developed by Kakwani, π_K is defined as double the area between $L_b(P)$ and $L_T(P)$.

4 BOOTSTRAP PROCEDURE

In the sections above, the measurement of progressivity is discussed using the Gini coefficients. However, it is also important in empirical work to determine the distribution of the Gini coefficients and set confidence intervals for the same. Following Efron (1979), the empirical distribution of a statistic, such as the Gini coefficient is determined by using the bootstrap procedure. Bootstrapping involves resampling the original data a number of times each time calculating the associated statistic of interest, in this case the Gini coefficient. That is, the bootstrap procedure uses the observed data to estimate the theoretical and usually unknown distribution from which the data came. Bootstrap samples of the same size as the original sample are repeatedly drawn by sampling with replacement from the observed data, each time calculating the Gini coefficient. The distribution of the Gini coefficients obtained from the bootstrap sampling is then used to estimate the standard deviation and to set confidence limits of the bootstrap Gini coefficients.

It is important to note that the bootstrap procedure does not require any knowledge of the distribution of the Gini coefficients. Dixon *et al.* (1987), notes that the accuracy of the bootstrap procedure can be evaluated by repeatedly generating random samples from a distribution with a known Gini coefficient. As argued in the literature (Efron, 1979; Efron and Tibshirani, 1997; Mills and Zandvakili, 1997; Glasser, 1962; and Dixon et al., 1987) the small sample variance properties of the Gini coefficient are not known, which therefore necessitate confidence intervals to be calculated via bootstrap re-sample methods. Bootstrap confidence intervals may be calculated using the percentile method or bias-corrected method. In this study we use the percentile method, which is formally stated as

$$G_{\alpha/2}^*, G_{1-\alpha/2}^*$$

9

where G^* is a Gini coefficient estimated from a bootstrap sample and α is (100-confidence level)/100.

5. EMPIRICAL RESULTS OF PROGRESSIVITY IN SOUTH AFRICA

The empirical results reported in this section are based on the procedures developed by Musgrave and Thin (1948) and Kakwani (1977)⁴. Data for this study was obtained from the database of the Bureau for Economic Policy and Analysis at the University of Pretoria (BEPA). BEPA produces its own tax data based on estimates and the profile of tax the paying population. In this study a total of 2500 re-samples are drawn from the original data, and the Gini coefficient calculated for each resample. The frequency distribution of these 2500 resample Gini coefficients is the bootstrapped estimate of the sampling distribution. In our study, bootstrap confidence intervals are computed using the percentile method. The percentile method sets a 95 per cent confidence interval such that 2.5 per cent of the bootstrap Gini coefficient values are below the lower bound and 2.5 per cent are above the upper bound.

5.1 Income tax progressivity based on the Musgrave and Thin approach

The graphical representation of progressivity as suggested above is done by constructing the relevant Lorenz curves, which are shown in Appendix 1. As argued by Musgrave and Thin (1948), a tax system is said to be progressive if the “post-tax” Lorenz curve for income distribution lies below the “pre-tax” Lorenz curve, and is proportional if the “post-tax” and the “pre-tax” Lorenz curves are identical. The figures in Appendix 1 show that the Lorenz curves for the after tax income distribution lies below the Lorenz curves of income before tax. This therefore, shows that during the period under study, the tax structure exhibits progressivity. The affect of tax on income distribution is double the area between the “ pre-tax” and “post-tax” Lorenz curves. However, in order to know whether progressivity has been rising, falling or remained constant over the period under study and also establish the

⁴ To conserve space the results from other measures of progressivity that are discussed in this article are not reported, they are available on request from the authors, however.

distributional effects of the various tax regimes, the respective Gini coefficients for each year are calculated and presented in the Table below.

Table 1: Progressivity measured by effective and redistributive effect

	1989	1990	1994	1999/00	2003/04
Pre-tax income inequality	0.584	0.523	0.504	0.626	0.619
Post-tax income inequality	0.535	0.489	0.454	0.578	0.541
Effective Progression, π_{ef}	0.915	0.933	0.901	0.920	0.874
Effective Progression, π_{efB} ⁵	0.911	0.926	0.897	0.931	0.873
Redistributive effect, π_M	0.049	0.034	0.050	0.048	0.078
Redistributive effect, π_{MB}	0.051	0.039	0.052	0.051	0.079

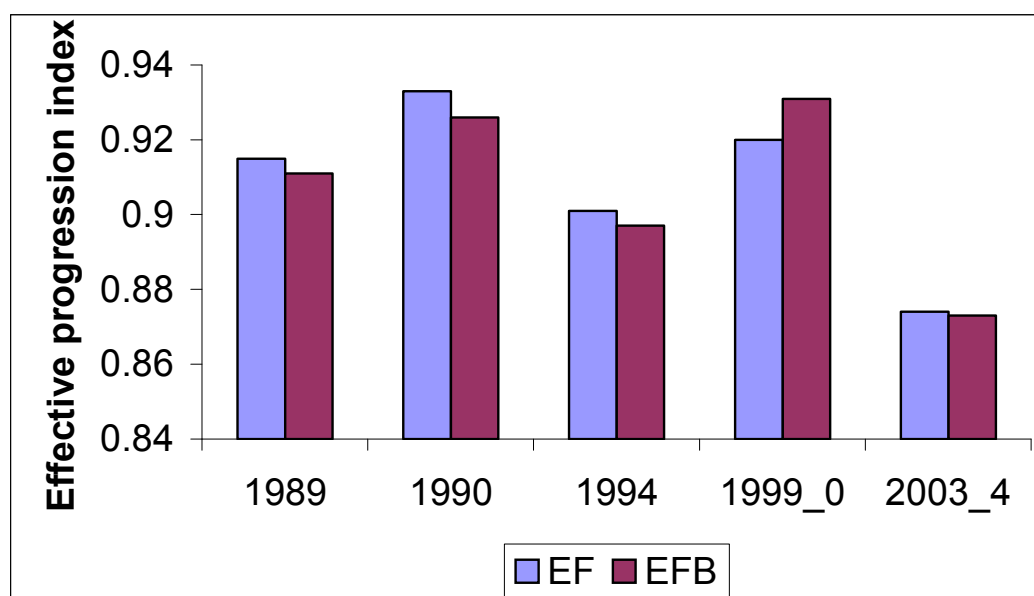
The Table above shows the indices of progressivity realised over the period 1989 to 2003/4. It is evident that the before tax income distribution improved by 10.4 per cent between 1989 and 1990, however, it decelerated to 3.6 per cent between 1990 and 1994. During the period 1989- 1994, the income distribution before tax improved by 13.7 per cent. During 1994 to 1999/0, the equality of pre-tax income worsened by 24.2 per cent, however, during the period 1999/0 to 2003/04, it improved marginally by 1.1 per cent. Overall, during 1989 to 2003/4 the before tax income distribution worsened by 6.0 per cent. The after tax income distribution, on the other hand, reveals that during 1989 and 1990, the income distribution improved by 8.6 per cent with a further improvement of 7.2 per cent between 1990 and 1994. During the period 1989 to 1994, the inequality of the after tax income distribution declined by 15.1 per cent. During 1994 to 2003/4, inequality increased by 19.1 per cent. Overall, during the period 1989 to 2003/4, the after tax inequality increased marginally by 1.1 per cent.

In terms of effective progression of the tax system, it is clear that the system displays characteristics of a progressive system over the period 1989 to 2003/4. However, it is noted that the system did not display increased progressivity over the entire period. During the period 1989 to 1990, the degree of progressivity declined by 2.0 per cent, while from 1990 to 1994, progressivity improved by 3.4 per cent. This suggests that during 1989 to

⁵ The bootstrap effective progression, redistributive effect and disproportionality measures of progressivity are derived from the bootstrap Gini indices that are shown in Appendix 3.

1994, tax progressivity improved by 1.5 per cent. A decrease in effective progressivity of 2.1 per cent was realised in 1994-1999/00, however, it increased by 5.0 per cent during 1999/0 to 2003/4. Overall, effective progressivity of the tax system in South Africa increased by 4.5 per cent during 1989 to 2003/4. Figure 3 below shows that trend of actual and bootstrap progression.

Figure 3: Trend in Effective progression of income tax

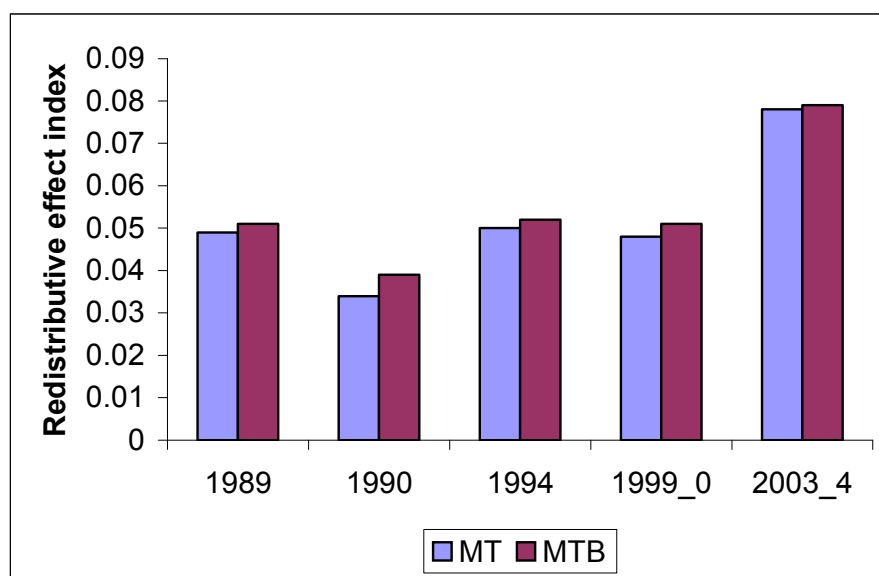


Consistent with the actual effective progression reported, the bootstrap results show that during the period 1989 to 1994, effective progression improved by 1.5 per cent, however, during the first phase of reforms, 1994 to 1999/0, effective progression declined by 3.8 per cent. During the second phase of reforms, there was improvement of 6.2 per cent. Overall, it was found that effective progression improved by 4.2 per cent, which is lower than the actual effective progression by 6.7 percent. This result therefore shows that during the period under study, progression of the tax system improved modestly.

In terms of the redistributive effect of the tax burden, it is noted that during the period 1989 to 1990, the tax system's redistributive power declined by 30.6 per cent, while it more than doubled during 1990 to 1994. There was a decline in the redistribution of 4.0 per cent during the first phase of tax reforms during,

1994-1999/0 and an increase of 62.5 per cent during the second phase of reforms, 1999/0-2003/4. Overall, there was an improvement in redistribution of 59.2 per cent during the period 1989 to 2003/4. In light of the above, it is clear that the tax system in South Africa was less progressive before 1994. Any reforms that may have been put in place after 1994 up to 1999, seems to have reversed progressivity. However, the second phase of tax reforms seems to have reversed the loss of progressivity realised during the first phase. The Figure below shows the trends of the redistributive effect of income tax in South Africa over the period 1989-2003/4, where MT is the actual Musgrave and Thin index of progressivity (redistributive effect) and MTB the bootstrap of the same index.

Figure 4: Trend of the redistributive effect of Income tax



The bootstrap results on the other hand appear to be higher, with progressivity declining by 23.5 per cent during 1989 to 1990, it however, improved by 2.0 per cent during 1989 to 1994. The first phase of the tax reforms during 1994 to 1999 did not improve progressivity, instead it declined by 1.9 per cent. The second phase of the reforms, 1999/0-2003/4, improved progressivity by 54.9 per cent. During the entire reform period 1994 to 2003/4, progressivity increased by 51.9 per cent from the 1994 level. During the period 1989 to 2003/4, progressivity improved by 54.9 per cent. The bootstrap

results support our earlier findings regarding the trends in progressivity of the tax system in South Africa.

5.2 Income Tax Progressivity based on the Kakwani Procedure

Based on the graphical representations in Appendix 2 it can be concluded that the tax system in South Africa is progressive since in all cases the tax concentration curve lies below the Lorenz curve. The graphs point out that the income tax structure in South Africa has been largely progressive, however, they are not able to address the question as to whether or not progressivity of the system has been increasing, decreasing or remained constant in terms of the disproportionality measure. To address this question we construct the relevant GINI coefficients as suggested by Kakwani (1977), and the results are presented in the table below.

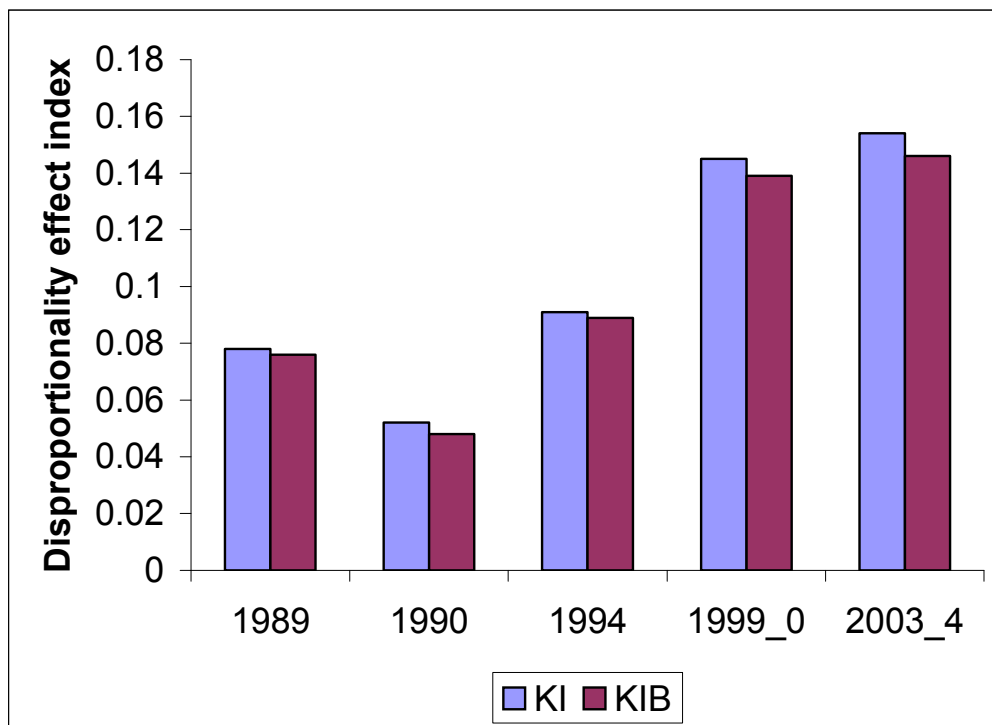
Table 3: Progressivity measured by disproportionality

	1989	1990	1994	1999/00	2003/04
Pre-tax income inequality	0.584	0.523	0.504	0.626	0.619
Tax burden concentration	0.662	0.575	0.595	0.771	0.773
Disproportionality, π_K	0.078	0.052	0.091	0.145	0.154
Disproportionality, π_{KB}	0.076	0.048	0.089	0.139	0.146

As suggested by Kakwani (1977), the Kakwani Index, π_K , is positive (negative) if the tax elasticity is greater (less) than unity, and zero when the tax elasticity equals unity for all income levels. A positive π_K , implies that the tax system is progressive and vice versa. As noted earlier, the inequality of the before tax income decreased by 6.0 per cent during 1989 to 2003/4. It is also evident from the Table that the tax concentration declined by 13.1 per cent during 1989 and 1990, however, it increased by 3.5 per cent between 1990 to 1994. During 1989 to 1994, tax concentration declined by 10.1 per cent, increasing by 29.6 per cent and 0.3 per cent during 1994 to 1999/0, and 1999/0 to 2003/4, respectively. This suggests that during the period 1994 to 2003/4, the tax concentration changed marginally. Overall, tax concentration declined by 16.8 per cent during 1989 to 2003/4.

However, the Kakwani index (disproportionality measure) shows that the tax system largely remained progressive, and the degree of progressivity varied over time. Comparing 1989 to 1990, progressivity declined by 33.3 per cent, after which it increased by 75.0 per cent between 1990 and 1994. During the period 1989 to 1994, progressivity increased by 16.7 per cent. During the first phase of reforms, 1994-1999/0, progressivity increased by 59.6 per cent with a further increase of 6.2 per cent during the second phase of reforms, 1999/0-2003/4. Overall, during 1989 and 2003/4, progressivity nearly doubled. The figure below shows the trends of progressivity in South Africa between 1989-1999.

Figure 5: Disproportionality measure of income tax progressivity



The bootstrap results reported are consistently lower than the actual disproportionality effect measure. During the period 1989 to 1990, progressivity declined by 36.8 per cent while it increased by 17.1 per cent during 1989 to 1994. This suggests that despite the reforms that were being introduced in 1994, income tax was becoming more progressive. During the first phase of the tax reforms, 1994-1999/0, progressivity improved by 56.2

per cent, which suggests that the first phase of the tax reforms did occasion significant growth of progressivity from the one that existed during the apartheid regime. The second phase of the reforms, 1999/0 to 2003/4, on the other hand, led to improvement of progressivity of 5.0 per cent. The two phases combined, therefore, resulted in improved progressivity of 64.0 per cent. It is also worth noting that progressivity nearly doubled during the period 1989 to 2003/4. Figure 4 above compares the actual progressivity index (KA) and the bootstrap progressivity index (KAB).

6. CONCLUSION AND RECOMMENDATIONS

This paper sought to investigate the progressivity of the tax system in South Africa during 1989, 1990, 1994, 1999/0 and 2003/4 using the various measures used in the literature. It was found that the system displays characteristics of a progressive system over the period 1989 to 2003/4. However, it is noted that the system did not display increased progressivity over the entire period. It was found that during 1989 to 1994, the effective tax progressivity improved by 1.5 per cent. A decrease in effective progressivity of 2.1 per cent was realised over the period 1994-1999/00, however, it increased by 6.1 per cent during the second phase of the reform programme. Overall, effective progressivity of the tax system in South Africa increased by 4.5 per cent. In terms of the redistributive effect of the tax, it was found that there was an improvement of redistribution in the order of 59.2 per cent during the period 1989 to 2003/4. Using the Kakwani (1977) methodology, it was found that the income tax system displayed growth of progressivity, except in 1990, when it declined.

In general, based on the Musgrave and Thin and Kakwani procedures it can be inferred that during the period 1989 to 1990, both indices suggest that progressivity of the tax system declined, but with different magnitudes, the same is true during the period 1990 to 1994, where both measures suggest that progressivity increased. However, the first phase of the reform programme produce different results. While the Kakwani index (disproportionality measure) shows that progressivity increased impressively, the Musgrave and

Thin index (redistributive effect measure), on the other hand, shows that progressivity declined marginally. The second phase of the reform programme shows that both measures suggest improved progressivity.

For policy purposes these results show that the growth of progressivity during the second phase of the reform programme is a manifestation of how reforms such as reducing the number of tax brackets, addressing the issue of personal exemptions and allowances, may influence the growth of progressivity.

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APPENDICES

Appendix 1

Figure 1A: Lorenz Curves for Pre-tax and Post-tax income: 1989

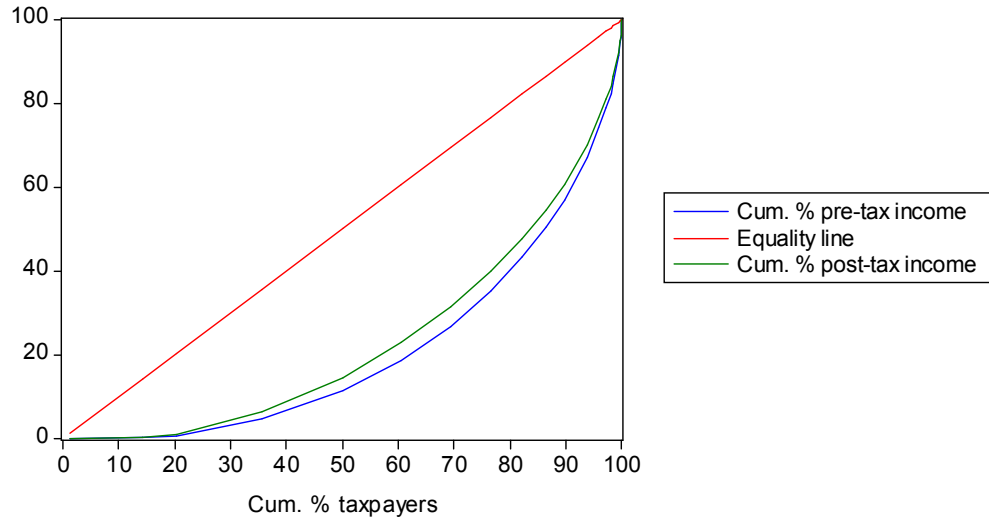


Figure 1B: Lorenz Curves for Pre-tax and Post-tax income: 1990

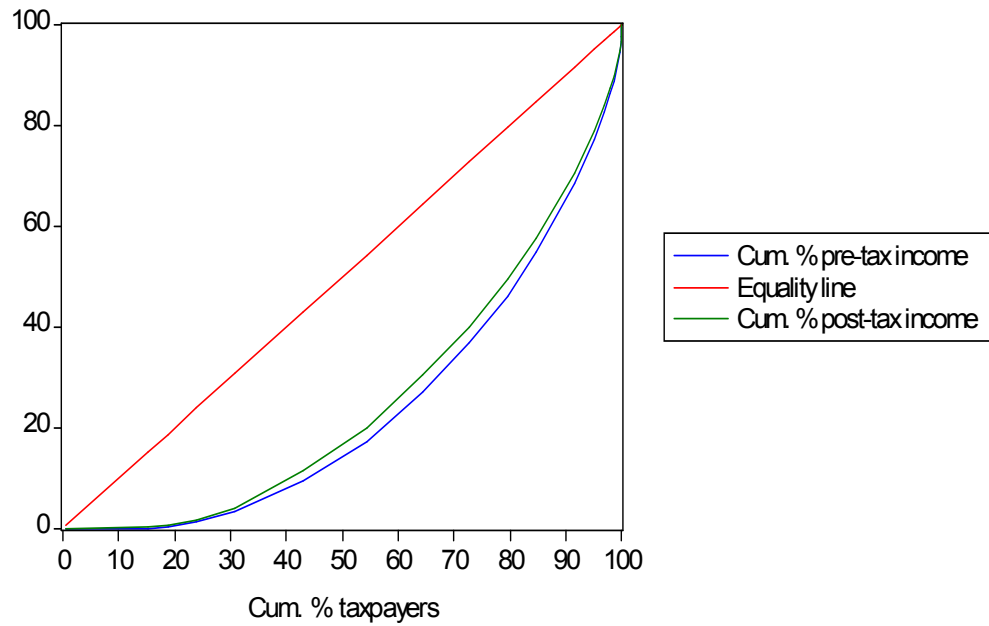


Figure 1C: Lorenz curve for Pre-tax and Post-tax income: 1994

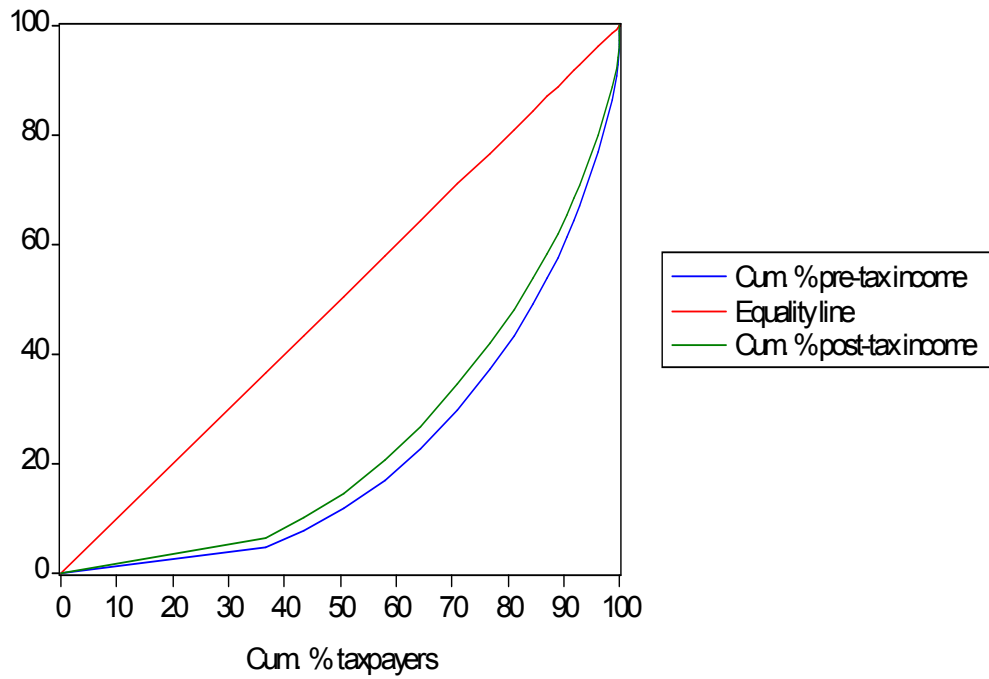


Figure 1D: Lorenz curve for Pre-tax and Post-tax income: 1999/0

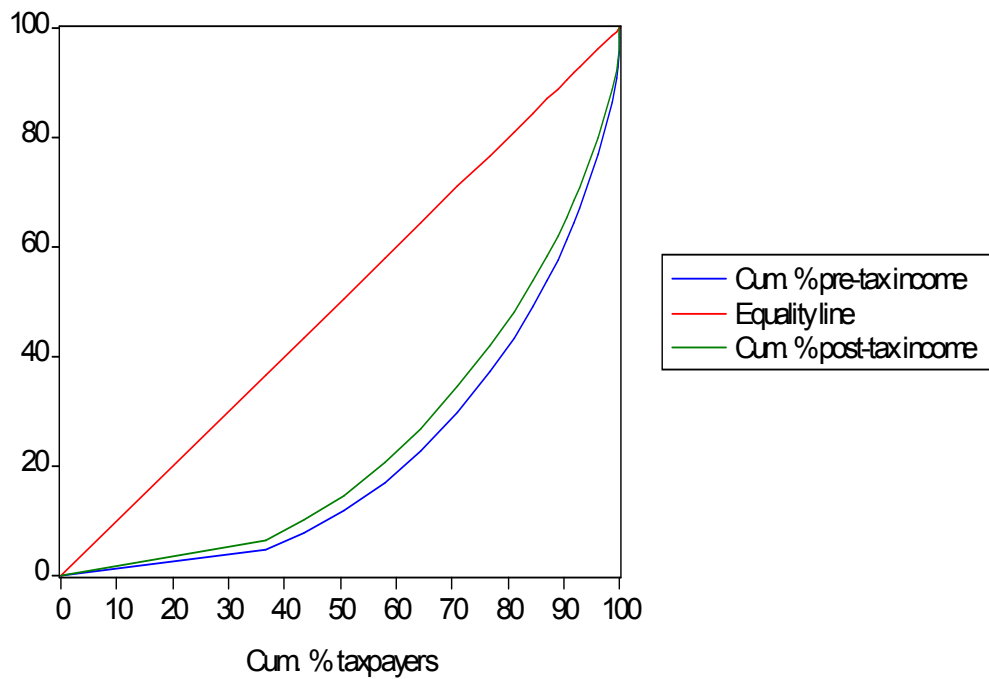
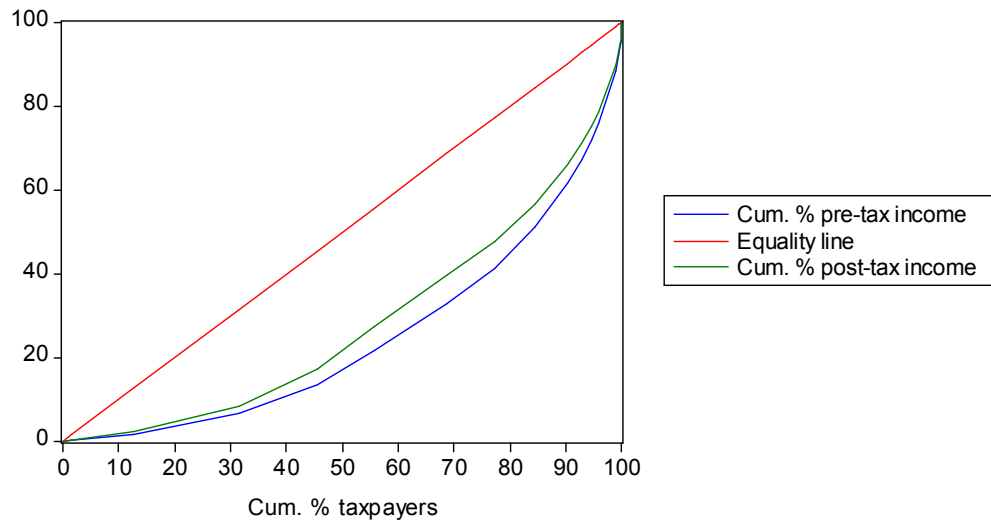


Figure 1E: Lorenz curve for Pre-tax and Post-tax income: 2003/4



APPENDIX 2

Figure 2A: Lorenz curve for Pre-tax income and Tax concentration: 1989

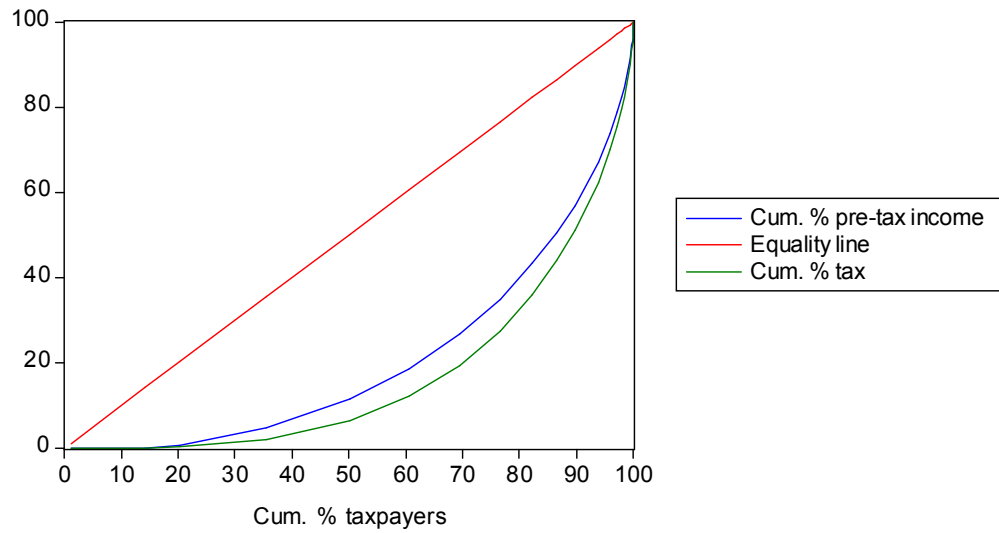


Figure 2B: Lorenz curve for Pre-tax income and tax concentration: 1990

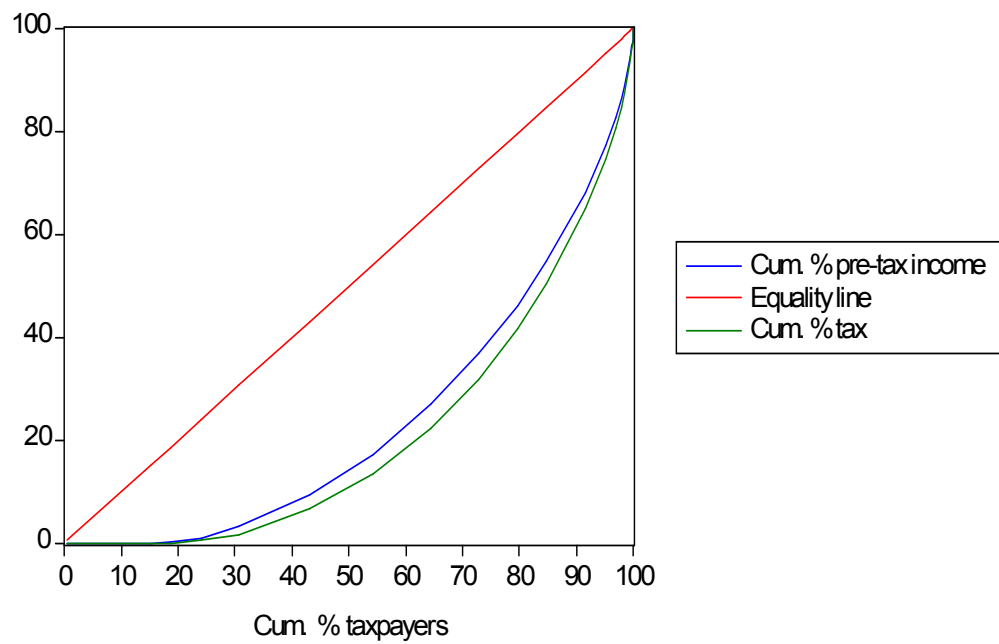


Figure 2C: Lorenz Curve for Pre-tax income and Tax Concentration: 1994

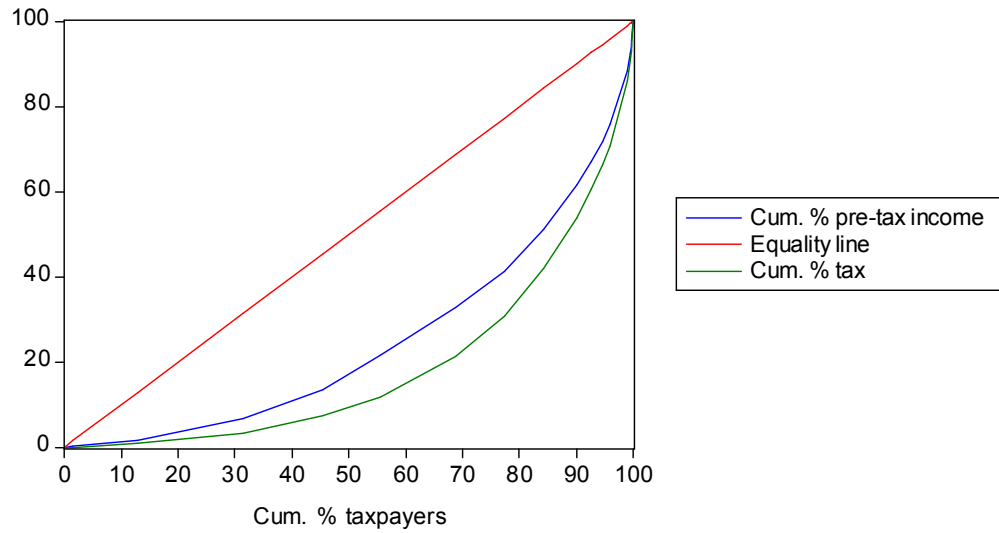
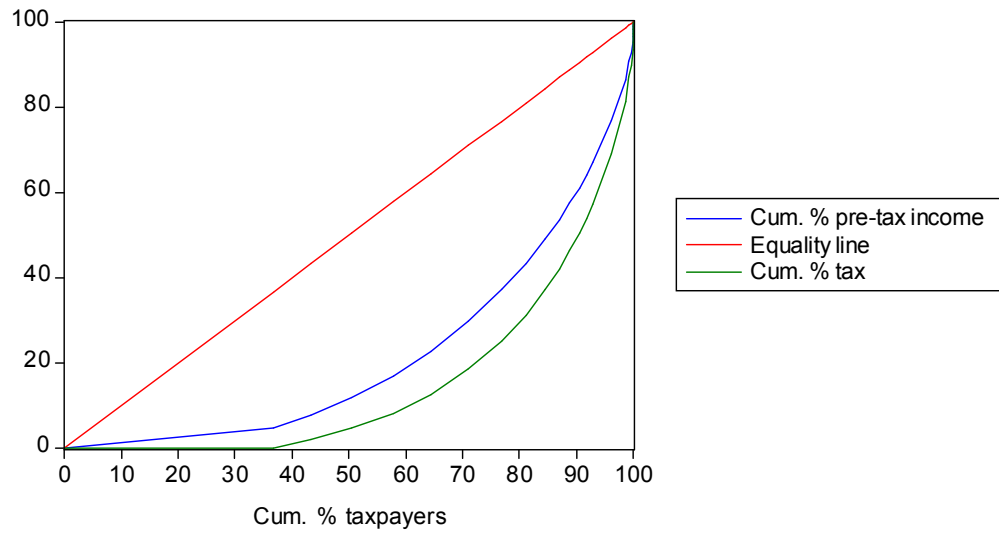
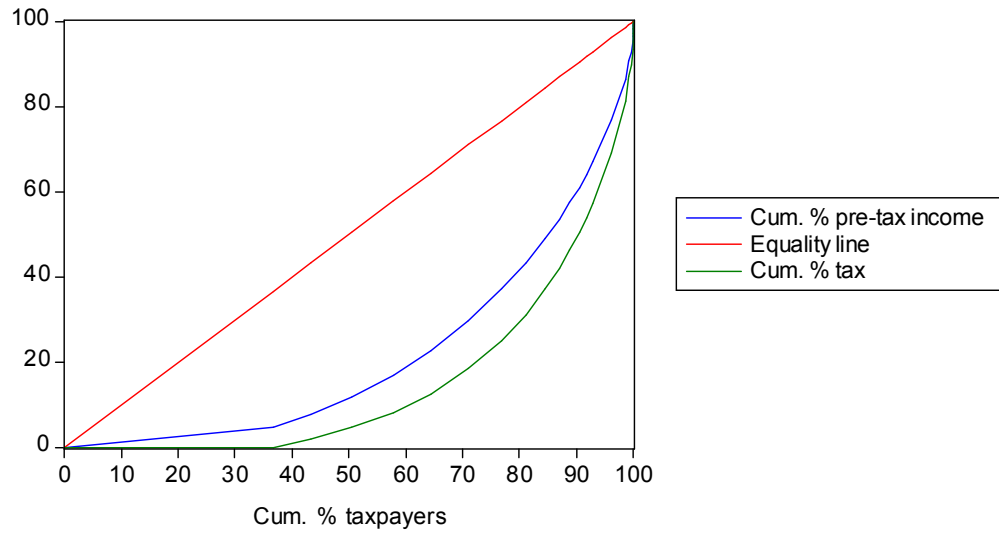


Figure 2D: Lorenz Curve for Pre-tax income and tax Concentration: 1999/0



**Figure 2E: Lorenz Curve for Taxable Income and tax Concentration:
2003/4**



APPENDIX 3

Table 4: Bootstrap Results (n=2500)

Gini coefficient	Bias	Bootstrap Gini index	95 % Confidence Interval
Pre- tax income 1989	-0.002	0.582	0.447 – 0.724
Pre- tax income 1990	0.002	0.525	0.402 – 0.628
Pre-tax income 1994	-0.001	0.503	0.395 – 0.602
Pre-tax income 1999/0	0.005	0.631	0.512 - 0.712
Pre-Tax income 2003/4	0.002	0.621	0.558- 0.646
Post- tax income 1989	-0.004	0.531	0.476 – 0.698
Post- tax income 1990	-0.003	0.486	0.363 – 0.598
Post- tax income 1994	-0.003	0.451	0.391 – 0.565
Post-tax income 1999/0	0.002	0.580	0.452- 0.641
Post-Tax income 2003/4	0.001	0.542	0.465- 0.649
Tax concentration 1989	-0.004	0.658	0.538 – 0.779
Tax concentration 1990	-0.002	0.573	0.481 – 0.745
Tax concentration 1994	-0.003	0.592	0.463 – 0.768
Tax concentration 1999/0	0.001	0.770	0.692 - 0.801
Tax concentration 2003/4	0.006	0.767	0.649 - 0.880