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ECONOMICS

DETERMINANTS OF INCOME INEQUALITY IN BOTSWANA

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DISCUSSION PAPER 13.15

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Abstract

This paper utilizes regression based inequality decomposition methodology developed by Field (2003) to determine factors driving income inequality at household level in Botswana. Using the Household Income and Expenditure Survey of 2002/03 an income generating function is estimated using OLS. This provides an efficient and flexible way to quantify the roles of household variables like education and age on inequality in a multivariate context. Results of the inequality decomposition indicate that secondary school education, training, Value Added Tax, number of children and number of working adults in the household contribute significantly to inequality in Botswana. On the other hand, variables like primary education, age and owning between 1 and 10 head of livestock equalises income inequality.

We would like to thank Kazi Iqbal for his invaluable comments on the article.

1. Introduction

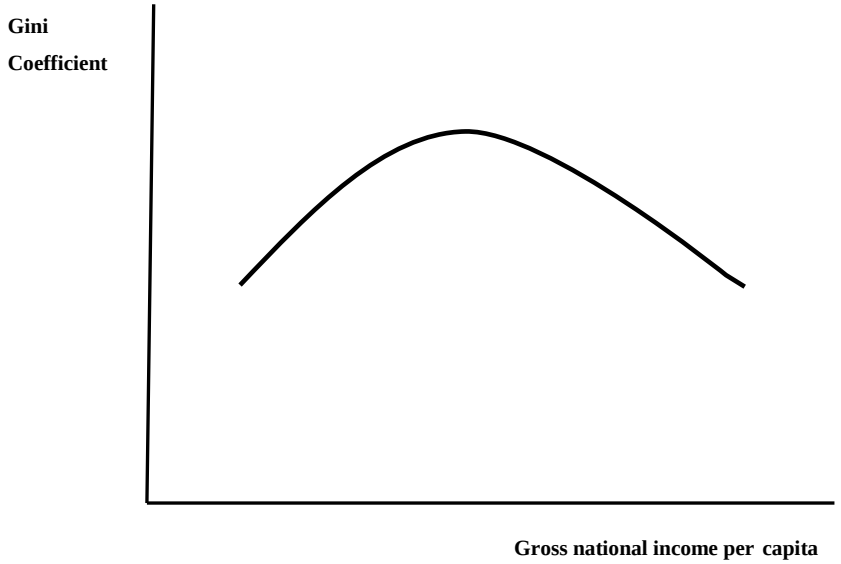
Since the discovery of diamonds in the early 1970s, Botswana has experienced phenomenal growth levels by world standards, with annual growth rates averaging 9% between 1966 and 2002. Growth rates fell to about 7.7% between 2003 and 2006 and have been below 5% in recent years due to the global financial crisis (Government of Botswana, 2010). Other factors such as fiscal discipline and sound economic management have also helped Botswana transform itself from one of the poorest countries in the world to a middle income country with a per capita GDP of $16,300 in 2011. Poverty has also declined significantly over the years. The consecutive Household Income Expenditure Surveys (HIES) undertaken in 1985/86, 1993/94, 2002/03 and 2009/10 indicate that the portion of the population living below the poverty line were 59%, 47%, 30% and 20% respectively. Despite this performance which could be considered quite remarkable by international comparison, the situation is still unacceptable to Botswana as growth has not been evenly distributed amongst the population and inequality levels are relatively high. The HIES data shows that income inequality has worsened over the 1993/94 to 2002/03 period, with the Gini coefficient of disposable income increasing from 0.537 to 0.573, respectively.

The high inequality levels could possibly be attributed to the fact that the mineral sector which drives the economy is highly capital intensive and employs a very small proportion of the labour force, yet this sector accounts for more than one third of GDP, about 70-80% of export earnings, and almost half of government revenue. The 2005/06 Botswana Labour Force Survey indicates that less than 3% of the total labour force was employed by the mineral sector. However, their average earnings were double the average national rate. The sector grew by 7.8% between 1991 and 2005 but this was not accompanied by its growth in employment which remained stagnant during this period. Overall Botswana employment figures have not lived up to the exceptional economic growth as compared to other middle income countries employment lags behind. In 2009/10 overall unemployment in Botswana was estimated at 17.3% by the Botswana Core Welfare Indicator Survey.

The increasing inequality amidst the impressive economic development can be explained by Kuznets curves shown in figure 1 below. Kuznets (1955) shows that as development measured by, per capita income, increases, inequality first worsens then eventually improves. The explanation of the Kuznets curve pivots on the fact that in preindustrial societies, almost

everybody is equally poor so inequality is low. However, inequality will rise as people move from low productive agriculture to more productive industrial sectors. These industrial sectors are characterised by higher average income and less uniform wages. As a society matures and becomes richer, the urban-rural gap is reduced and the provision of old-age pensions, unemployment benefits, and other social transfers lower inequality. Todora (2011) establishes three possible scenarios in which growth, measured in GDP per capita, can be accompanied by an improved income distribution, an unchanged income distribution, or a case where income distribution worsens. Botswana seems to have experienced the latter scenario and is in the industrial phase of the Kuznets curve. This can be demonstrated by the fact that between 1993/94 and 2002/03 real GDP per capita increased from P7154[1] to P11802, while income distribution declined in the same period (Bank of Botswana, 2005).

Figure 1: The Inverted- U Kuznets Curve



The high inequality level and its increase between 1993/94 and 2002/03, irrespective of the economic theoretical explanations, is unacceptable according to Botswana's national development objectives. The National Development Plan 10 (NDP) covering the period between 2009/10 and 2016, Vision 2016 and the National Strategy for Poverty Reduction (NSPR) advocate for eradication of absolute poverty and the significant reduction of income inequality by 2016. In order to create an environment which permits growth to trickle down

[1] P is the symbol for Botswana's national currency, the Pula. Currently $1 (Australian dollar) is equivalent to P7.5

to the poorer segments of the population, the Botswana government has proposed that poverty reduction and income inequality be made central to every policy, programme and any other form of government intervention. With the objective of reducing poverty and redistributing income, new Social Safety Nets (SSNs) programmes have been introduced, since 1996 when Vision 2016 was formulated, while coverage of older programmes have been expanded. Social Safety Nets comprise of the provision of food packages to destitute persons and vulnerable groups, supplementary feeding to primary school children, entitlement programmes such as old-age pension, disaster management schemes to cushion households against natural disasters, orphan care programmes, home based care scheme for assisting the terminally ill and labour based drought relief programme for promoting short-term employment.

Whilst investments in SSNs have gone a very long way in reducing poverty, reducing income inequality requires more knowledge on its nature and determinants. To the best of my knowledge no study has attempted to empirically establish the nature and determinants of income inequality in Botswana. This study is therefore motivated by the fact that studies on this topic are lacking for Botswana yet Government has made reducing inequality a national priority. The objective of this chapter is to shed light on the various forces that drive income inequality at the micro level. The results of this study are expected to have policy implications for addressing inequalities in Botswana in the ongoing process of growth, high unemployment levels and poverty reduction schemes. The results obtained in this chapter will also be used to guide counterfactual policies that will be simulated in the micro simulation model that will be developed in the following chapter. Methodology developed by Field (2003) and Shorrocks (1982a) to decompose the sources of inequality will be employed in this study. The content for the rest of the chapter is as follows; section 2 is devoted to a discussion on the various techniques used to measure inequality, to be followed by a brief overview of inequality in Botswana in section 3. Sections 4 and 5 are dedicated to literature review and methodology, respectively. The final two sections (6 and 7), focus on discussions of the results and provide a conclusion, respectively.

2. Measuring Inequality

Inequality can be considered as a case of different people having different degrees of income or consumption. Income inequality is mainly concerned with the relative position of different individuals within the income distribution. It is basically a summary statistic of the income dispersion. Income distribution can be observed at a personal level or a functional level. Where the functional distribution of income considers the distribution between groups in society who own different factors of production, i.e. the proportion of income going to employees, landowners, and owners of capital respectively. On the other hand, the personal income distribution is concerned with the national distribution of income without paying too much attention to the factors of production. This study will focus more on the personal distribution of income. A number of techniques to measure inequality in a population have notably been developed and employed over time such as the Gini coefficient, the coefficient variation of income, the logarithm of income and generalised entropy class of inequality indices, the Gini coefficient and the Atkinson index. This section will review the desirable properties of the various inequality measures, discuss a few of these techniques and measures and subsequently provide some information on decomposition techniques.

2.1 Properties of Inequality Indices

According to Litchfield (1999), economic literature calls for good inequality measures to satisfy five properties (axioms), namely anonymity, scale independence, population independence, transfer principle and decomposability. The anonymity axiom requires that an inequality metric does not depend on the labelling of individuals in an economy and, hence, concern should be placed only on the distribution of income. This property distinguishes the concept of inequality from that of fairness. Hence, an inequality measure should not concern itself with what kind of income certain people deserve, but rather on how it's distributed. The scale independence property deals with the fact that the inequality measure should not be affected by uniform proportional changes in all individuals' income. For instance if every person's income in an economy is doubled (or multiplied by any positive constant), then the overall measure of inequality should not change. The inequality income metric should be independent of the aggregate level of income.

Issues surrounding population independence require that the inequality measure should not be dependent on the size of the population, such that merging two identical distributions should not alter inequality. The transfer principle (commonly referred to as the Pigou–Dalton transfer principle) indicates, in its weak form, that if some income is transferred from a rich person to a poor person, while still preserving the order of income ranks, then the measured inequality should not increase. However, in its strong form, the measured level of inequality should actually decrease.

There should be a coherent relationship between inequality in the whole of society and inequality in its constituent parts states the decomposability property. For example if inequality is seen to rise amongst all sub-groups of the population then overall inequality should also increase. Some measures, such as the Generalised Entropy class of measures, are easily decomposed and into intuitively appealingly components of within the group inequality and between the group inequality. In this case total inequality is the sum of the within the group inequality and between the group inequality. Whereas within the group inequality refers to the inequality that exists in a particular group of income earners with certain characteristic, if the average income of all groups were equalized. On the other hand, between the groups inequality prevails, if all individuals of each population sub-groups have the mean income of their sub-group (Cowell, 1985).

2.2 Inequality Indices

The Gini coefficient is one of the most widely used measures of inequality and it measures the extent to which the Lorenz curve departs from the line of equality. It is valued between zero and one. With zero representing a situation of complete equality, and one a case where there is absolute inequality. Hence larger values of the Gini represent greater inequality. The Gini coefficient satisfies the principle of anonymity, scale independence, population independence and Pigou–Dalton transfer principle. It is widely used across countries and as it enables easy comparison. It is also available over a series of years and therefore enables comparisons over periods of time. Despite its advantages, the Gini coefficient, fails the decomposability axiom in cases where sub-vectors of income overlap. However, there are ways of decomposing the Gini, but the component terms of total inequality are not always intuitively or mathematically appealing (Litchfeild, 1999). A generalization of the Gini

coefficient, called the extended Gini coefficient, was introduced by Yitzhaki (1983). The new index accommodates differing aversions to inequality. The Gini Coefficient can be calculated using the formula in equation 1.

$$Gini = \frac{1}{2\,n^2\bar{y}}\sum_{i=1}^{n}\sum_{j}^{n}|y_i - \bar{y}| \qquad (1)$$

where n is the number of individuals in the sample, y_i is the income of individual i, $i \in (1, 2, \ldots, n)$, and $\bar{y} = (1/n)\sum y_i$, the arithmetic mean income.

There are a number of measures of inequality that satisfy all five criteria. Among the most widely used are the Theil indexes and the mean log deviation measure. Both belong to the family of generalized entropy inequality measures. Though the Theil index, satisfy all the 5 properties, it has been criticised for lacking a straightforward representation and an appealing interpretation of the Gini coefficient. Members of the Generalised Entropy (GE) class of measures have the general formula as follows:

$$GE(\alpha) = \frac{1}{\alpha^2-\alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \qquad (2)$$

The value of GE ranges from 0 to ∞, with zero representing an equal distribution and higher values representing higher levels of inequality. The parameter α in the GE class represents the weight given to distances between incomes at different parts of the income distribution, and can take any real value. For lower values of α, GE is more sensitive to changes in the lower tail of the distribution, and for higher values GE is more sensitive to changes that affect the upper tail. The commonest values of α used are 0, 1 and 2: hence a value of α=0 gives more weight to distances between incomes in the lower tail, α=1 applies equal weights across the distribution, while a value of α =2 gives proportionately more weight to gaps in the upper tail.

Litchfeild (1999) indicates the GE measures with parameters 0 and 1 become two of Theil's measures of inequality. The mean log deviation (also known as Theil's L index) and the Theil index respectively, are given as follows:

$$GE(0) = \frac{1}{n}\sum_{i=1}^{n}\log\frac{\bar{y}}{y_i} \qquad (3)$$

$$GE(1) = \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}\log\frac{y_i}{\bar{y}} \qquad (4)$$

With α = 2 the GE measure becomes 1/2 the squared coefficient of variation, CV:

$$CV = \frac{1}{\bar{y}}\left[\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2\right]^{1/2} \quad (5)$$

Other used inequality measure in literature is the Atkinson class of measures. Atkinson's set of inequality measures can be decomposed, but the two components of within- and between-group inequality do not sum to total inequality. It has the general formula given below

$$A_\varepsilon = 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\right]^{1-\varepsilon}\right]^{1/(1-\varepsilon)} \quad (6)$$

Where ε is an inequality aversion parameter and can take values between 0 and infinity. The higher the value of ε, the more society is concerned about inequality. The Atkinson class of measures range from 0 to 1, with zero representing no inequality. Setting α =1-ε, the GE class becomes ordinally equivalent to the Atkinson class, for values of α < 1 (Cowell, 1995).

Another measure of inequality is the Foster-Greer-Thorbecke (sometimes referred to as FGT). In fact the headcount index, the poverty gap and poverty gap index and the squared poverty gap index all belong to the Foster-Greer-Thorbecke class of measures using similar notation. FGT measures the outfall from the poverty line. Therefore it is also considering the inequality among the poor and it is measured as follows where

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}(z - y_i/z)^\alpha \ \ (\alpha \geq 0) \quad (7)$$

Where z is the poverty line, n is the sample size, q is the number of poor (those with incomes at or below z), y_i are individual incomes and α is a sensitivity parameter. If α is low then the FGT metric weights all the individuals with incomes below z roughly the same. If α is high, those with the lowest incomes (farthest below z) are given more weight in the measure. The higher the FGT statistic, the more poverty there is in an economy. If α =0, then the headcount index is used in the calculation. If we use α=1, we have the poverty gap index being used. When α =2, then the squared poverty gap index is utilized and this reports both the poverty and inequality levels among the poor.

Sen Index developed by Sen (1976) takes into consideration the number of poor, the depth of their poverty, and the distribution of poverty within the group. The index is given by

$$P_S = P_O(1 - (1 - G^P)\frac{\mu^P}{Z} \qquad (8)$$

where P_O is the headcount index, μ^P is the mean income (or expenditure) of the poor, and G^P is the Gini coefficient of inequality among the poor.

The Sen Index has the virtue of taking the income distribution among the poor into account. However the index is almost never used outside of the academic literature as it lacks the intuitive appeal of some of the simpler measures of poverty. It also cannot be used to decompose poverty into contributions from different subgroups (Deaton, 1997).

2.3 Inequality Decomposition

Inequality decomposition literature can be traced back to be found in Shorrocks (1980, 1982b and 1984). In these articles Shorrocks examined decomposition of inequality by income sources (such as earnings, investment income and transfer payments), by population sub-groups (such as single persons, married couples, and families with children) and or by sub aggregates of observations which share common characteristics like age, household size, region, occupation, or some other attributes. He shows that a broad class of inequality measures can be decomposed into components reflecting the size, mean and inequality value of each population sub-group or income source. Generally inequality decomposition is a standard procedure used to examine the contribution to inequality of particular characteristics. It can help to shed light on both the structure and dynamics of inequality (Litchfield 1999). The other pioneer in this field are Bourguignon (1979), Cowell (1980), and Shorrocks (1982a, 1982b, 1984).Recent literature has gone beyond this and has used Shorrock's original decomposition concept, and applied to regression analysis in order to decompose inequality by explanatory variables. However, regression basis decomposition will not be discussed in this section but will be tackled in more detail when reviewing the literature, and in the methodology section. This section will only look at decomposition by population sub group and by income source.

2.3.1 Decomposition by population sub-group.

Decomposition by sub groups allows for the impact of the contribution to overall inequality of inequality with and between different sub-groups of the population to be accessed. In this case total inequality in the distribution can be separated into a component of inequality between the chosen groups (I_b), and the remaining within-group inequality (I_w). This type of decomposition can only be conducted for one variable at a time. Using this technique total inequality, I, is decomposed by population subgroups, the Generalised Entropy class can be expressed as the sum of within-group inequality, I_w, and between group inequality, I_b. Within-group inequality I_w is defined as,

$$I_w = \sum_{j=1}^{k} w_j GE(\alpha)_j \quad (9)$$

$$w_j = |v_j^{\alpha} f_j^{1-\alpha} \quad (10)$$

where f_j is the population share and v_j the income share of each partition j, j=1,2,..k. In practical terms the inequality of income within each sub-group is calculated and then these are summed using weights of population share, relative incomes, or a combination of these two, depending on the particular measure used. Between-group inequality, I_b, is measured by assigning the mean income of each partition j.

Inequality decomposition by population sub groups can indeed be a useful descriptive tool but has certain limitations. Morduch and Sicular (2002) state that this approach is limited as decomposition can only be carried out over discrete categories, even though some factors like age are more appropriately considered as continuous variables. Another weakness involves the fact that handling multiple factors is often cumbersome, since the number of groups increases multiplicatively with the number of categories for each factor. Indeed, as more factors and categories are added to the analysis, the number of observations in each group can diminish to the point where the within-the-group means and variances are highly unreliable estimates of the population subgroup's inequality. Lack of control for endogeneity also limits the decomposition to being a purely descriptive analysis.

2.3.1 Decomposition by income source

Decomposition can also be carried out by income source on the basis that the manner in which the different types or components of income are distributed is likely to explain the overall inequality in the distribution of the total income. Shorrocks (1982b) shows that when total income is disaggregated into various components, it is possible to determine the exact contribution (decomposition) of each of the components to the overall inequality.

Total income of household i, y_i, can be expressed as the sum of component incomes, y_i^k, coming from K different sources such as pension, employment income, transfers, e.t.c., as given in equation 9, below.

$$y_i = \sum_j^n y_i^k \qquad (11)$$

Let n denote the total number of income recipients.

Methodology provided by Shorrocks (1982b) mainly answers the question "what fraction of total income inequality, gauged by an inequality measure is accounted for by labour income, by capital income, by transfer income, etc.?". Using six assumptions, he (Shorrocks, 1982b) indicates that the relative inequality contribution for income source k, s_k, is given by;

$$s_k = cov(y^k, y)/\sigma^2(y) \qquad (12)$$

Such that $\sum_k s_k = 1$, for any inequality index which is continuous and symmetric.

3. National Inequality in Botswana between 1993/94 to 2002/04

Botswana has one of the highest income inequality levels in the world, with the CIA World Factbook website ranking Botswana as the country the fourth highest Gini coefficient out of a total of 102 countries. The three countries that had higher inequality levels than Botswana were Namibia, South Africa and Lesotho. The Gini coefficient of these three countries was 70.7, 65.0 and 63.2, respectively, while that of Botswana was 63.0. Ironically, all the top 5 namely Namibia, South Africa, Lesotho and Sierra Leone, with the exception of Lesotho, are countries that are highly dependent on minerals. Indeed minerals extraction could have

played a significant role in the high levels of inequality because, as stated earlier, they are capital intensive in nature and relative to its output employment provided by this sector is limited. While overall employment in Botswana between the 1994/95 and 2002/03 increased by 23%, employment in the mineral sector only increases by 2%. Yet the output of this sector more than doubled in real terms.

The Household Income Expenditure Survey 02/03 will be used to conduct an analysis in this chapter and were data exist the same survey conducted in 1993/94 will be utilised for comparison purposes. The HIES 02/03 was conducted from June 2002 to August 2003. The aim of the survey was to provide up to date information on household incomes and expenditures and to update the existing benchmark statistics required in monitoring and development planning. A Sample size of 6053 households, which comprised of 25069 individuals, was included in the survey. Of these households, 2826 were from urban cities/towns, 1 763 were from semi urban areas and 1,464 were from rural areas. The Survey conducted in 1993/94 comprised of 3608 households living in randomly selected dwellings all over Botswana. Of the 3608 households, 1719 resided in the urban areas, 981 resided in semi urban locations and 908 in rural areas.

Between 1993/94 and 2002/03 GDP and final consumption recorded in the national accounts increased by 43% and 83%, respectively. Statistics from both surveys (1993/94 and 2003/03) also indicates that real income and consumption increased between the two periods. In fact there was an increase in these variables even between 1985/86 and 1993/94 as well, as shown Table 1. The growth rates of real per capita income and consumption are positive for all quintiles in the period between 1985/86 and 1993/94. This implies that all quintiles enjoyed an improvement in the average standard of living although the top 2 quintiles enjoyed greater improvement. In the later period (1993/94-2002/03), the growth rates are negative for the bottom quintile, suggesting that the bottom 20 percent of the population suffered a fall in the standard of living between 1993/94 and 2002/03 despite the fact that the average standard of living improved impressively in the same period.

Table 1: Annual growth rates of per capita real income and consumption by quintiles

Period	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	All
	Per capita real consumption (%)					
1985/86 – 1993/94	4.2	3.7	4.1	3.9	5.2	4.8
1993/94 – 2002/03	-0.2	0.5	0.9	3.0	4.0	3.3
	Per capita real income (%)					
1985/86 – 1993/94	5.9	5.3	5.1	5.2	5.0	5.1
1993/94 – 2002/03	-0.2	0.3	1.0	3.1	3.5	3.0

Source: Central Statistics Office (2004)

Consumption usually provides a better indicator of standard of living as opposed to income. Using consumption instead of income statistic reveals that the Gini coefficient has risen from 0.58 in 1985/86 to 0.60 in 1993/94 and then to 0.65 in 2002/03 (Central Statistics Office 2004).

3.1 Decomposition of inequality by sub groups

In order to obtain an appreciation of overall inequality in Botswana, inequality decomposition in this this section will be conducted by sub groups. This will help provide information on which groups are more affected by inequality. Where data exist, a comparison will be conducted for 1993/94 and 2002/03. The population will be divided into the following by region, age of the household head, by education of the household head and by the gender of the household head, for purposes of the decomposition. The Gini coefficient, GE (0) and GE (1) which are Theil indices are used for the decomposition

3.1.1 Decomposition of inequality by Region

It is generally thought that inequality may be more noticeable in urban areas as they are denser and more heterogeneous. Urban areas are generally more developed with a variety of sectors requiring different skills and technical knowhow. This may results in differentials and gaps in wages that trigger higher inequality in urban areas. Table 2, provides inequality decomposition by region for the HIES dataset for 1993/94 and 2002/03. Botswana only has two cities namely Gaborone, which is the capital city, and Francistown. There are 5 towns in the country namely Lobatse, Selibe-Phikwe, Orapa, Jwaneng, and Sowa Town. The remaining regions in the table are regarded as rural areas. As expected Gaborone as the capital city has the highest population and income share amongst all regions in both the survey years. However, Gaborone's 2002/03 average income, of P5300, is lower than that of the two diamond mine towns, Orapa and Jwaneng, and of the soda ash mine town, Sowa Town. The mean income of Orapa, Jwaneng and Sowa town were P12046, P5785 and P5367, respectively in 2002/03.

According to the Gini and GE (1), in 1993/94 impressively low inequality levels were recorded for Ngamiland and the North East District. Using the Gini Coefficient the inequality for Ngamiland and the North East districts were 0.406 and 0.392 respectively. However, both these districts experienced drastic increases inequality between 1993/4 and 2002/03, with the Gini coefficient increasing from 0.392 to 0.549 for the North East district, and from 0.406 to 0.556 for Ngamiland. The significant rise in inequality after 1993/94 in the North East district can be attributed to opening of a couple of small copper-nickel, diamond and gold mines in this region after the 1993/94 survey such as the Phoenix copper nickel mine, the Tati nickel mine and the Damtshaa diamond mine . The cattle lung disease outbreak in Ngamiland after 1996 eroded framers income. This could have led to an increase in the income gap between those dependant on the agriculture sector and other sectors in this region and hence the increase in inequality. The highest inequality levels in 1993/94 were in Francistown and Gaborone with the GE (1) index being 0.775 and 0.663 respectively. The 2003/04 inequality indices reveal that the inequality levels for these regions are still high, although there is a drop in one or two indices shown in the table. Overall inequality tends to be higher in urban areas as opposed to rural areas with the exception the three major mine towns, Jwaneng, Orapa and Sowa Town have relatively low inequality levels. Reasons for high inequality in the non-mining urban areas can be closely connected to high differentials in wages between

those employed and unemployed, and even amongst the employed. The mine towns have avoided this phenomenon as most of the dwellers in these areas are employed by the mines. Restriction of entry, by permits, into mine towns such as Orapa discourages migration from rural areas seeking employment into these towns and therefore keeping inequality relatively low.

Table 2: Household Inequality Decomposition by Region

	HIES 93/94					HIES 02/03				
	Popn. Share	**Mean Income**	**Income Share**	**GE(1)**	**Gini**	**Popn Share**	**Mean Income**	**Income Share**	**GE(1)**	**Gini**
Gaborone	0.19	2853	0.41	0.663	0.595	0.23	5300	0.38	0.631	0.584
Francistown	0.13	1224	0.12	0.775	0.602	0.1	3914	0.12	0.751	0.615
Lobatse	0.04	1218	0.04	0.496	0.512	0.04	2673	0.03	0.444	0.507
Selibe-Phikwe	0.07	1342	0.07	0.402	0.474	0.07	2676	0.05	0.508	0.521
Orapa	0.01	2308	0.02	0.363	0.463	0.01	12046	0.03	0.328	0.445
Jwaneng	0.03	1826	0.04	0.364	0.47	0.02	5785	0.04	0.448	0.506
Sowa Town						0	5367	0.01	0.155	0.312
Southern districts	0.07	683	0.03	0.537	0.538	0.07	1365	0.03	0.546	0.537
South East District	0.03	928	0.02	0.458	0.504	0.03	3619	0.04	0.62	0.588
Kweneng District	0.1	598	0.04	0.676	0.538	0.09	2039	0.06	0.517	0.527
Kgatleng District	0.03	1033	0.02	0.364	0.451	0.03	2279	0.02	0.525	0.542
Central District	0.22	751	0.12	0.423	0.489	0.21	1874	0.12	0.584	0.569
North East District	0.02	714	0.01	0.287	0.392	0.01	2286	0.01	0.521	0.549
Ngamiland	0.04	809	0.02	0.277	0.406	0.06	2505	0.05	0.549	0.556
Ghanzi	0.02	1046	0.02	0.443	0.516	0.01	3378	0.01	0.334	0.444
Kgalagadi South	0.01	798	0	0.408	0.489	0.01	2109	0.01	0.841	0.642
Within Group				0.57	0.078				0.589	0.263
Between group				0.161	0.306				0.117	0.083

Source: Author's calculation using HIES 1993/94 and 2002/03 dataset

Further decomposition by region is done in Table 3, taking into consideration the level of development for the 1993/94 and 2002/03 surveys. The three categories under consideration are urban, semi urban and rural. It's worth mentioning that the population shares in these regions have not changed significantly between the two survey periods. However, inequality using all the three indices has registered a significant decrease for urban villages and rural areas, inequality in urban areas has also fallen slightly.

Table 3: Decomposition – Urban vs. Rural

	1994/95						2002/03					
	Popn. Share	Mean	Income Share	GE(0)	GE(1)	Gini	Popn. Share	Mean	Income Share	GE(0)	GE(1)	Gini
Urban	0.48	1967	0.70	0.70	0.69	0.60	0.47	1701	0.65	0.66	0.63	0.58
Semi Urban	0.27	875	0.18	0.48	0.47	0.50	0.29	997	0.24	0.85	0.79	0.64
Rural	0.25	630	0.12	0.46	0.43	0.49	0.24	598	0.12	0.85	0.88	0.66
Within Groups				0.58	0.62	0.24				0.76	0.70	0.24
Between groups				0.12	0.11	0.24				0.08	0.08	0.20
Overlap						0.12						0.20

Source: Author's calculation using HIES 1993/94 and 2002/03 dataset

Inequality increase in rural areas and semi urban regions could be possibly a result of increased development is activities occurring in these regions and the decline of dependence of traditional sector. The share of agriculture in non-mining GDP has decline from about 7% in1993/94 to 3% in 2002/03 (Bank of Botswana, 2005). It should be noted that it is the rural dwellers that are highly dependent on the agriculture sector. It is likely that rural and semi urban areas have entered into the preindustrial stage of the Kuznets curve.

3.1.2 Decomposition by Gender, Education and Age of Household Head

It is widely acknowledged that an income gap exist between males and females (Jones, 1983). Overall men tender to be more active in the labour market and their salaries are by far higher. This to some extent can be attributed to the fact that women are crowded into a small range of occupational niches. In a developing country like Botswana, women tend to assume roles that are correlated to their domestic role such as nursing, teaching, cleaning, providing clerical support and so on. These jobs normally don't pay much relative to male dominated jobs. From Table 4 below it can be observed that male headed households had an income share of 84% in 1993/94, however, this has fallen significantly to 68% in 2002/03, even though their population share has remained relatively the same. This implies that females in the population have greater access to income generating opportunities in recent years. Since a number of female headed households now have access to resources and opportunities, that male headed household initially had, the inequality indices for female headed household shows that inequality has increased in this group. The Gini coefficient for female headed households has

increased from 0.53 in 1993/94 to 0.63 in 2002/03. All indices also indicate that inequality within the groups is a greater problem than inequality experienced between the groups.

Generally there seems to be controversy regarding how education affects income inequality. Education has long been considered a multipurpose policy tool with the main goals customarily attached to this policy being to lower wage inequality. This connection is obtained by the fact that education provides skills that can be utilised in the labour market. Workers with these skills get higher salaries. If more people become educated the income gap lessens hence inequality declines. This, however, is not always the case. Pereira and Martins (2004) argue that increasing education attainment could actually lead to higher, not lower, earnings inequality. This could be a result of poorly designed or out-dated education systems, where students are provided with skills in large supply and yet there is little demand for those skills in the labour market. Studies by Mankiw et al (1992) using Slow**'s** model find a positive relationship between education and income inequality.

Table 4: Decomposition by Gender, Education and Age of Household Head

By Gender													
	1994/95							**2002/03**					
Gender	Popn. share	Mean	Income share	GE(0)	GE(1)	Gini		Popn. share	Mean	Income share	GE(0)	GE(1)	Gini
Male	0.56	1713	0.84	0.72	0.70	0.60		0.55	1532	0.68	0.80	0.72	0.62
Female	0.44	423	0.16	0.54	0.61	0.53		0.45	863	0.32	0.80	0.78	0.63
Within Groups			2.93	0.64	0.69	0.32				2.30	0.80	0.74	0.32
Between groups			0.28	0.21	0.17	0.28				0.04	0.04	0.04	0.13
Overlap						0.05							0.18
By Highest level of Education													
								Popn. share	Mean	Income share	GE(0)	GE(1)	Gini
No schooling								0.24	1392	0.10	0.49	0.53	0.52
Primary								0.33	2163	0.22	0.54	0.53	0.53
Secondary and above								0.43	5169	0.68	0.65	0.59	0.57
Within Groups											0.58	0.57	0.22
Between groups											0.14	0.13	0.27
Overlap													0.12
By Age group													
Age group	Popn. Share	Mean	Income Share	GE(0)	GE(1)	Gini		Popn. Share	Mean	Income Share	GE(0)	GE(1)	Gini
below 25	0.12	690	0.06	0.42	0.41	0.48		0.10	990	0.08	0.54	0.51	0.53
25 -35	0.27	1505	0.31	0.64	0.71	0.58		0.28	1452	0.33	0.63	0.56	0.56
36 -45	0.22	1853	0.31	0.71	0.68	0.60		0.24	1473	0.28	0.87	0.74	0.63
46 -55	0.16	1515	0.18	0.71	0.67	0.60		0.17	1431	0.20	1.04	0.95	0.69
55 - 65	0.11	1067	0.09	0.68	0.82	0.60		0.09	860	0.07	0.98	1.03	0.70
above 65	0.11	591	0.05	0.51	0.46	0.51		0.12	431	0.04	0.61	0.74	0.59
Within Groups			2.19	0.63	0.67	0.12				2.25	0.78	0.72	0.13
Between groups			0.09	0.07	0.06	0.18				0.09	0.07	0.05	0.14
Overlap						0.30							0.37

Source: Author's calculation using HIES 1994/95 and 2002/03 dataset

From Table 4, it can be observed that inequality is more prevalent in the group with the highest level of education being secondary school and above. This could be because this group contains a large number of individuals who have trained further and possess certificates, diplomas and degrees. These levels of training with in the group create greater income disparities. There are a number of graduates unable to secure employment due to the mismatch between the education sector and labour market. This could also explain the high inequality rate between individual with the highest level of education being secondary school and above. Decomposition by age of the household indicates that inequality is highest in groups were household heads are between 36 and 45, 46 and 55, and between 56 and 65 for both survey periods. These three cohorts have experienced a rise inequality between 1993/94 and 2002/03 with the highest increase being realised in the 55 to 65. Using the Gini coefficient inequality increased from 0.60 in 1993/94 to 0.70 in 2002/03. In both surveys inequality is lowest within the lowest and highest cohort. The low inequality levels in household headed by individuals below 25 could be because this group lacks work experience that could lead to high dispersion within the group.

3.1.3 Decomposition by Income Factor

As stated earlier, when total income is disaggregated into various components it's possible to determine the exact contribution of each component's overall inequality contribution. Table 5, provides the inequality decomposition by factor components in Botswana using the HIES 1993/1994 and 2002/03 datasets. Note that unearned income includes all payments that accrue from all factors of production with the exception of wages and business profits. Hence it includes rent and interest payments. Private transfers include remittances and any other transfers made by non-public institutes.

Table 5: Inequality Decomposition by Factor Component

	1994/95						2002/03				
Income Source	**Inequality Contribution**	**Source Gini**	**Rk**	**% in Total Income**	**% Change**		**Inequality Contribution**	**Source Gini**	**Rk**	**% in Total Income**	**% Change**
Wage income	83.504	0.61	0.94	0.887	0.114		74.99	0.61	0.91	0.89	0.045
Unearned Income	0.032	0.415	0.48	0.002	-0.0004		23.91	0.76	0.70	0.10	0.007
SSNs	-0.027	0.51	-0.34	-0.0008	-0.002		-0.07	0.62	-0.01	0.0001	-0.006
Business Profits	17.98	0.79	0.65	0.12	0.012		7.12	0.68	0.69	0.08	0.004
Private Transfers	3.041	0.58	0.28	0.046	-0.105		5.72	0.65	0.41	0.07	-0.082
Income Tax	-4.58		-0.95	-0.053	-0.018		-8.62		-0.77	-0.09	0.009
VAT							-3.06		-0.61	-0.04	0.243
Total	100						100				

Source: Author's Calculations using HIES 1993/94 and HIES 2002/03

In both the survey periods, wages provide the highest contribution income inequality with its contribution towards overall inequality being 84% and 74% in 1993/94 and 2002/03, respectively. The reason for this high percentage is a result of the Rk value in both surveys and the source's high percentage contribution to total income. Rk is the correlation of a household's rank in the distribution of wage income to their rank in total income. A high RK coefficient suggests that a household's rank in the distribution of the source income is strongly correlated with that household's rank in the distribution of total income. The Gini coefficient of wage income is the lowest for both surveys in comparison to other income sources. There has been a significant rise in the contribution made by unearned income and significant drop in the contribution made by business profits. As expected income tax and SSNs have equalising effects on overall inequality, but the effect made SSNs is negligible and has not changed much between the two survey periods. Income taxes, on the other, hand reduced inequality by a significant amount and the equalising effect has increased, with it being recorded at -4.58 percent in 1993/94 to an amount of -8.62 percent in 2002/03. These results reflect the fact that transfer receipts are negatively correlated with total income, while tax payments (i.e., negative receipts) are positively correlated. VAT also had equalising effect in 2003/04. The last column in the table indicates that a 1% change in private transfers will have the greatest impact on the Gini coefficient in both in 1993/94 and 2002/03 followed by

wage income. In 1993/94 it is wage income that dominants in this regard followed private transfers. The importance of private transfers is because low income households are mainly dependant these types of income.

4. Income Inequality in Botswana: Empirical Analysis

4.1 Literature Review

There has been a reasonable shift in research previously focused on economic growth and its determinants to the analysis of income distribution, its development over time and the identification of factors determining it. Heshmati (2004) attributes this shift to the awareness of the growing disparities and the emerging importance of redistribution and poverty reduction. Since, Kuznets (1955) researchers have studied the theoretical causes of income inequality in various ways. Kuznets starts off by indicating that there an inverted U shape explaining the relationship between economic development and income inequality. This hypothesis was supported by De Gregorio & Lee (2002) and Nielsen & Alderson (1995) and has been challenged by Ram (1988) and Ravallion, (2004a).

A number of empirical studies have tried to explain income distribution or inequality from a macro standpoint. Most studies are based on regression analysis on time series data and are often preoccupied with determining the effects of selected macroeconomic variables. In these studies normally the Gini coefficient or other inequality indices are regressed against various determinants. Studies by Mocan (1999) and Blejer and Guererro (1990), include variables like inflation and unemployment level, while some other studies like Auten and Carroll (1999) and Feenberg and Poterba (1993) examine the impact of fiscal policy, especially tax rate, on inequality. Others studies examine the effects of some specific institutional and economic factors on income distribution. For instance, Li et. al. (2000) examines the effect of corruption, Tanninen (1999) tests for the effect of government expenditure, while Bourguignon and Morrison (1998) examine the effects of dualism, especially as it relates to agriculture. Due to limited time series observations for a single country, especially developing countries, most empirical studies have been based on multi-country data sets were the range of potential determinants of income distribution being tested is wider.

Determinants of inequality at micro level using household survey data have also been conducted. These types of studies normally use decomposition techniques discussed earlier.

Decomposition by population group has been the oldest approach for quantifying how various factors affects overall inequality. The approach begins by dividing a sample into discrete categories (eg, rural and urban residents, individuals with primary school vs. secondary or higher education) and then calculates the level of inequality within each sub-sample and between the means of the sub-samples. This technique is mainly conducted in unpublished articles and a few published articles such as Silber (1989) Jenkins (1995), Cowell and Jenkins (1995) and Shorrocks (1983).

A second type of inequality decomposition commonly used in literature focuses on the decomposition by factor components. Shorrocks (1983) uses data on the distribution of net family incomes in the United States between 1968 and 1977 in order to establish what proportion of total income inequality is attributable to various income sources using a variety of different decomposition rules. Decomposition was carried for the following income sources; wage earnings, capital income, transfer income, and taxes. The findings from this study showed that labour income had the largest amount of inequality contribution followed capital earnings. Tax payments and transfers income generate negative contributions in all years. Results from these types of studies can sometimes have conflicting results depending on the region. For instance income from non-farming activities was found to have an equalizing effect in the following studies by El-Osta et al. (1995) for the United States, Zhu and Luo (2006) for China, Adams (2001) for Egypt and Leones and Feldman (1998) for the Philippines. On the other hand, Elbers and Lanjouw (2001) found that income from non-farming contributed positively to inequality for Ecuador. On the contrary, Canagarajah et. al. (2001) found that in Ghana and Uganda, non-farm self-employment income was much more disequalizing than non-farm wages.

Regression based estimates in inequality analysis are relatively new and dates back to Oaxaca (1973). Regression-based approaches to inequality decomposition are appealing because they overcome many of the limitations of standard decomposition by groups and it's built on techniques used by inequality factor decomposition. Using Regression based analysis allows the use of continuous variables and it is possible to control for endogeneity (Morduch & Sicualar, 2002). Potential influences on inequality that might require separate modelling, as in the case of decomposition by groups or by income components, can be easily and uniformly incorporated within the same econometric model by appropriate specification of the explanatory variables (Cowell and Fioro, 2009).

Morduch & Sicualar (2002) noted that earlier work on regression-based methods of inequality has been piece-meal, with each proposed approach having different properties and using different inequality indices. They use a regression-based income inequality decomposition approach on rural data on china over a period of four years in order examine how different decomposition rules affect the decomposition results. Findings from Morduch and Sicular's work vary enormously with the different inequality decomposition indices giving different results. The Theil-T decomposition shows that human capital and demographic variables have been strongly inequality reducing. On the other hand, the Gini decomposition indicates that these variables contribute positively, although modestly, to inequality. The authors concluded that the Theil-T decomposition provides a better indicator.

Field (2003) presents a methodology to account for income inequality levels in a given country and differences in income inequality between one time period and another. This technique is then applied to the US using survey for two time periods, 1979 and 1999, to analyse labour earnings inequality. The technique starts off by estimating a semi-logarithmic income generating , using OLS, which included the following variables, gender, industry, occupation, education, race, region and experience. Field (2003) further demonstrates the relative factor inequality weights and the corresponding percentage contributions would be virtually the same for any inequality measure used. The study finds that schooling is the variable that contributes most to high levels of inequality followed by occupation, experience, and gender. In explaining the increase in inequality between the two time periods (1979 and 1999), schooling was again the single most important variable followed by occupation. Gender worked in the equalizing direction.

Cowell and Fioro (2009) uses some features of Field's (2003) model and extends it by including the analysis the decomposition by subgroups. This technique is applied to survey data for Finland and the United States for 1986 and 2004, respectively. The regression based results for the United States indicated that Master/PhD qualification and age provided the highest contributions to inequality, while high school education provided an equalising effect. On the other hand, in Finland a college degree and the number of earners in the household were more important. High school education in Finland also provided an equalising effect for Finland.

Wan and Zhou (2005) combine the regression-based decomposition technique and the Shapley value framework developed Shorrocks (1999) in analysing income inequality in rural

China between 1996 and 2002. The decomposition of income inequality is provided by the Theil –L and the Gini coefficient. The study finds that geographical conditions are the most significant contributor followed by capital input. The only equalizing variable is land input but its impact is minimal. Baye and Epo (2011), apply the regression-based inequality decomposition approach to explore determinants of income inequality in Cameroon using the 2007 Cameroon household consumption survey. They use also Shapley value decomposition rule to conduct the decompositions and also use a control function approach that tests for potential endogeneity and unobserved heterogeneity of synthetic variables for education and health. The results of this study indicate that education is the main contributor to inequality.

Bourgguignon et al. (2001) adopt a simultaneous-equation extension of the Blinder-Oaxaca decomposition technique. The model estimates an earnings equation (linking individual characteristics to their remuneration, also known as the occupation effect), a labour supply equation (explaining the decision of entering the labour force depending on individual and other household's members decisions, also known as the participation effect) and a household income equation (aggregating the individual's contributions to household income formation also, known as the population effect). Micro simulation techniques are then used to combine these equations and decompose inequality by each effect. This study finds that between 1979 and 1994, inequality in Taiwan can mainly be explained by the drastic transformation in the economy and the socio demographic structure of the population. With the main contribution being changes in the wage structure which could have been a result a dramatic growth of the educated workers in the economy. Bourguigion et al. (2008) also use this technique to isolate the occupational effect, the participation effect and population effect for USA and Brazil in1999. Results of this study show that most of Brazil's inequality (of 13 Gini points) is accounted for by underlying inequalities in the distributions of education and of non-labor income, notably pensions. Differences in occupational structure, in racial earnings and demographic composition are much less important. While the US the latter are of more importance.

4.2 Contributions

Although numerous empirical studies have been conducted on the subject, most of these have focused on developed countries and a few developing countries. Due to limited income distribution data on African, very few studies have been conducted to determine drivers of income distribution for African countries. And although African countries have been included in studies that use panel data, the number of African countries covered often constitutes a negligible fraction of the total. Currently there is no record of any study conducted on Botswana. This study will fill the gap that exist in literature and examine the subject from a Botswana perspective. This highly necessary as the government of Botswana has declared fighting poverty and inequality its priority.

4.3 Methodology

This study will use Field's (2003) regression based decomposition technique to establish the determinants of inequality in Botswana. Field (2003) extends Shorrocks' theorem and applies it to an income-generating function in order to account for or decompose the level of income inequality contributed by explanatory variables in a country and its change over time. This is possible as the income generating function has the same additive form as equation 11, which expresses total income as the sum of the income from various components.

The standard income generating function written in the following form;

$$lny_i == a'Z_i \qquad (13a)$$

Where

$$a = [\alpha\ \beta_1\ \beta_2 \dots \beta_j\ 1] \qquad (13b)$$

And

$$Z_i = [1\ x_{i1}\ x_{i2} \dots x_{ij}\ \in_i] \qquad (13c)$$

Where, $\ln y_i$ is a vector of household income in log, Z is an matrix of household characteristics (such as age, education, household size, residence, including the residual), a is a vector of the regression coefficients.

Equation 13a will be estimated using OLS and its parameters can be used to calculate the log of income represented in equation 14.

$$lny = \sum_j^{j+2} a_j Z_j \quad (14)$$

Note that the equation 14 has the same additive form as equation 11, with y_i^kreplacing $a_j Z_j$ and y replacing lny. Now, taking advantage of this homeomorphism and applying Shorrocks theorem, we take the covariance of both sides of equation 14. Since the left-hand side of 14 is the covariance between lny and itself, it is simply the variance of lny. Thus,

$$\sigma^2(lny) = \sum_{j=1}^{j+2} cov\,[a_j Z_j, lny] \quad (15a)$$

Dividing both sides by $\sigma^2(lny)$, we obtain

$$100\% = \frac{\sum_{j=1}^{j+2} cov\,[a_j Z_j, lny]}{\sigma^2(lny)} \equiv \sum_j^{j+2} S_j(lny) \quad (15b)$$

Where, each $s_j(lny)$ is a so-called "relative factor inequality weight" given by

$$s_j(lny) = cov\big[a_j Z_j, lny\big]/\sigma^2(lny) \quad (15c)$$

let $s_j(lny)$ denote the share of the log-variance of income that is attributable to the j'th explanatory factor and let $R^2(lny)$ be the fraction of the log-variance that is explained by all of the Z's taken together. Then the below follows;

$$\sum_{j=1}^{j+2} s_j\,(lny) = 100\% \quad (15d)$$

And

$$\sum_{j=1}^{j+2} s_j\,(lny) = R^2(lny) \quad (15e)$$

The fraction that is explained by the j'th explanatory factor, $p_i(lny)$ is then

$$p_i(lny) \equiv \frac{s_j(lny)}{R^2(lny)} \qquad (15f)$$

Note that equation 13c shows the relative factor inequality weight of explanatory variable j and it's very similar to equation 10 used by Shorrocks (1982a) to decompose inequality by income source k. In equation 13c the product of the OLS coefficient and explanatory variable is regarded as the income flow associated with the explanatory variable. Therefore this product is what is decomposed to obtain the inequality contribution of an explanatory variable.

4.4 Econometric Model, Data Description and Empirical Results

4.3.1 The model

As discussed, this study uses Field (2003)'s model to establish to explain the determinants of *inequality* in Botswana using the 2002/2003 Household Income Expenditure Survey. According to Gindling and Trejos (2007), Field's decompositions have important advantages over other recently-developed regression-based techniques to measure 'quantity' and 'price' effects such as those of Bourguignon, Fournier and Gurgand (2001). The latter decompositions use simulation techniques, such that decompositions of the change in inequality between two years are based on simulations which start with the distribution for year one and then substitute (one at a time) the distribution and price of each characteristic from year two into the earnings equation for year one, measuring the change in inequality in the resulting distribution of earnings in each case. The change in inequality in the simulated distributions resulting from changing the price and quantity of each variable is then interpreted as the contribution of that price or quantity to the change in inequality. A limitation of these simulation-based techniques is that the results of these simulations will be different depending on the order in which the variables are substituted, a problem that Bourguignon, et. al. (2001) calls path dependence. Therefore, the researcher cannot be sure of the contribution of each variable to the change in inequality unless the results from all possible 'paths' are calculated (and are of similar signs and magnitudes). Calculating the distributions using every possible path becomes cumbersome especially if the number of variables to be considered is large.

In addition to the constraints outlined above, Field's technique is used in the study as it allows for decomposition to be done even when only one survey period is available. This is

very important as the 1994/1995 Household income survey has limited variables and hence the Bourguignon et. al.'s (2001) technique cannot be employed. Model specification is mainly guided by previous studies on income inequality and on the available variables in the Household Income Expenditure Survey. As the first step of the regression-based decomposition, an income-generation function must be obtained. The income function below is employed to decompose household inequality by contributing factors.

$$\boldsymbol{InY_i = \sum \beta_j * X_{ij} + \epsilon_i} \qquad \textbf{(16)}$$

Where InY_i is the log of monthly income per capita for household i, X_{ij} are variables j associated with household i that affect income and ϵ_i is the residual term which can be explained as the part of the variation in income among workers that cannot be captured by variation in the variables included in the earnings equation. The use of the semi-log specification is prompted by the finding that the income variable can be approximated well by a log-normal distribution (Shorrocks and Wan, 2004).

The right-hand-side variables included in $X_{ij,}$ whether the household head has a primary education (PRISCH), whether the household head has a secondary education (SECSCH), whether the household head has some form of training and possesses a certificate, a diploma, or a university degree (TRIAN), age of the household head (AGE), age of the household head squared (AGESQ), number of cattle owned by the household (CATTLE), the amount VAT paid by the household (VAT), the whether the household receives social safety nets (SSN), a dummy variable to capture whether the household resides in an urban area (URB), a dummy variable capturing whether the household head is male (MALE), number of persons employed in the household (WORK), number of children in the household (KID). Also included in the regression are dummy variables that equal one if workers belong to one of three industries. The industries included are the public sector (GOVT), mining (MIN), and agriculture (AGRIC), with all the other sectors being used as a reference sector.

4.3.2 Data and Descriptive Statistics

The study uses the Household Income and Expenditure Survey (HIES) of 2002/03, which, as stated earlier covered 6 053 households, which contained a total of 23 823 individuals. From the 6 053 households, 2 826 were from the urban areas, 1 763 were from urban villages and

the remaining 1 464 were from rural areas. The descriptive statistics of the variable used are provided in Table 6.

Murduch and Sicular (2002) state that income sources or variables that contribute positively to total income and are relatively distributed evenly with in the population or mainly available to the poorer segments of the population, then decomposition will registers substantial inequality reductions. On the other hand, variables or income sources that contribute negatively and are distributed relatively evenly will show substantial inequality increases. Hence the contribution to inequality of a variable is not only dependant on its relation to income but also on its distribution amongst the population. As indicated earlier the descriptive statistic for each variable and the distribution of the variable by quartile of income is provided in Table 6. However, in some case the distribution of the variable and its impact on income alone may not be sufficient to explain its impact on inequality as other factor may also come in play. For instance education is normally found to have a positive relationship with income but even in cases where education is evenly distributed amongst the population the overall impact on inequality could be positive. This could occur in cases where there is a mismatch between the labour market and education systems.

From Table 6, it can be observed that household with higher income tend to have household heads that have a secondary school qualification and are trained. Household heads of high income household also tend to be employed in the mining or government sector and have more household members actively engaged in the labour force. On the other hand, it is observed that households in the lower quartile tend to have more children and older household heads. While variables that are skewed towards low income households are no of children, age of the household head, whether household head is engaged in the agriculture sector, SSNs and primary school education. This implies that low income households on average tend to have more children, tend to have household heads who involved in the agriculture sector and rely more on SSNs. Households heads in the lower quartile also tend to have primary school education as the highest level of education attained and have older household heads. This could be the case because older household heads lived their younger years at a time when education was only available to the privileged few. It was only in the 80's that education was made free for all by the government. Changes in the age structure are one of the most important factors affecting income inequality trends especially in the long term (Karunaratne, 2000). In the human capital theory age is normally used as a means to

capture the level of experiences as it is expected that the older one becomes the more experience they acquire. As such an increase in age would lead to an increase in income but this may fall after the retirement age. Hence age squared is included in the regression in order to account for the non-linearity of the variable.

Cattle ownership is an increasing category variable which captures the number of cattle owned. A categorical variable is used instead of the number of cattle owned as this is how the variable is presented in the dataset. A clear breakdown of the varies categories of this variable is provided in Table 6. In Botswana, cattle are very important and considered a symbol of wealth and measure of assets owned. It owed by both low income and high income households alike as shown in table 6. Although asset can be used instead of cattle in the African context this variable is very important and can used to obtain a higher standard of living as it provides milk and can be used for ploughing purposes.

Social safety nets, the urban dummy and the male dummy are all expected to have a positive relationship in the income function. Generally social safety nets are expected to have an equalising effect on income inequality especially since populations in higher deciles have less access. Urban residency may have either an equalising effect or have a positive impact on inequality. This sign is mainly dependant of the availability of employment, the market size and the general development level and not only on its distribution level. The male dummy is expected to have a positive effect on inequality as male headed households have higher income levels, higher education levels and they normally possess larger amount of assets. The number of workers is a variable to capture the number of household members who are engaged in paid activities. The more workers a household has the greater the income the household will receive. Its contribution to inequality is expected to be high.

Table 6: Variable Descriptive Statistics

Variable	Variable Description	Mean	Std. Dev.	Mean of Variable by Quartile				Ratio of top 25% to bottom 25%
				Bottom	Second	Third	Top	
Y	Per Capita income	1228.58	2095.35	53.51	89.71	224.97	3111.53	58.15
PRISCH	Whether highest level of household head's education is primary school, where 1 if yes and 0 otherwise	0.33	0.47	0.39	0.43	0.34	0.17	0.43
SECSCH	Whether highest level of household head's education is secondary school, where 1 if yes and 0 otherwise	0.43	0.49	0.13	0.28	0.51	0.78	5.85
TRIAN	Whether the household head is skilled/trained (has a either a certificate, diploma or a degree), where 1 if yes and 0 otherwise	0.33	0.47	0.07	0.17	0.35	0.74	11.32
AGE	Household head's age in years	43.45	16.16	50.96	44.70	39.16	38.93	0.76
VAT	Amount of Vat paid by the household	181.91	310.03	54.68	106.62	162.95	401.26	7.33
CATTLE1	Household that own between 1 to 9 cattle	0.18	0.38	0.20	0.18	0.19	0.13	1.54
CATTLE2	Households that own between 10 and 59 cattle	0.14	0.35	0.15	0.13	0.14	0.14	1.07
CATTLE3	Households that own more than 59 cattle	0.02	0.14	0.12	0.13	0.18	0.04	3
SSN	Whether the household receives social safety nets, where yes is 1 and 0 otherwise	0.13	0.34	0.28	1.62	0.06	0.02	0.07
URB	Whether the household resides in an urban, where 1 if yes and 0 otherwise	0.47	0.50	0.19	0.43	0.59	0.66	3.53
MALE	Whether the household head is male, where 1 if yes and 0 otherwise	0.55	0.50	0.41	0.49	0.60	0.69	1.69
WORK	Number employed in the household	0.44	0.37	0.13	0.36	0.56	0.69	5.21
KID	Number of children in the household	1.77	2.06	3.27	1.83	1.17	0.79	0.24
GOVT	Whether household head works in the public sector, where 1 if yes and 0 otherwise	0.12	0.33	0.03	0.09	0.14	0.22	6.90
MIN	Whether household head works in the mining sector, where 1 if yes and 0 otherwise	0.04	0.20	0.01	0.03	0.06	0.07	11.34
AGRIC	Whether household head works in the agriculture sector, where 1 if yes and 0 otherwise	0.09	0.29	0.15	0.12	0.08	0.02	0.16

Source: Authors calculation using the HIES 2002/03, N=6053

The exemption and the zero rating of certain goods in the VAT system plus the variation of expenditure across households and household consumption own produced of goods and services leads to an unequal distribution of VAT tax liabilities across the different households in the population. Although VAT provides a significant amount of Government revenue, it also has distributionary impact on the population at large. There are two VAT rates in Botswana, the standard rate, which is 12% and the zero rate. Zero rated commodities include exports from Botswana and international transport services, which can either be passengers or goods from a place outside Botswana to another place within Botswana or from a place within Botswana to a place outside Botswana. Other zero rated commodities are maize (in all forms, i.e., maize meal, mealie rice, samp) and sorghum (in all forms), and petrol and diesel. Exemptions are extended to the following goods or activities: commercial renting, boarding house or hostel, accommodation in any house, flat, apartment or room, and any other

accommodation. Other exempted goods include international financial services, education and specified drugs, as indicated in the Drugs and Related Substances Act. As indicated in

The HIES dataset provides information on 432 goods and services purchased by the household as well as the value of consumption of goods and services produced by the household. Given this information VAT paid by each household is estimated from the household's expenditure on various goods and services. The estimation ignores the fact that VAT is not paid goods purchased from small businesses that have an annual sales of less than P250 000. This is because the size of the informal sector in Botswana is small (Central Statistic Office,2007).

Pearson Correlation test, shown in Table 7 below, was conducted to establish the pair-wise relationship between variables. The table shows that most of the pair-wise correlation relationships are relatively low with the exception of the correlations between AGE and AGESQ. The results suggest that multicollinearity is not a serious factor in the model.

Table 7: Variable Correlation Matrix

	lnY	PRISCH	SECSCH	TERT	AGE	AGESQ	CATTLE	VAT	SSN	URBAN	MALE	WORK	KID	GOVT	MIN	AGRIC
lnY	1.00															
PRISCH	-0.19	1.00														
SECSCH	0.49	-0.61	1.00													
TRAIN	0.53	-0.20	0.47	1.00												
AGE	-0.26	0.13	-0.51	-0.17	1.00											
AGESQ	-0.27	0.11	-0.47	-0.20	0.98	1.00										
CATTLE	0.03	0.05	-0.05	0.07	0.17	0.16	1.00									
VAT	0.43	-0.14	0.29	0.39	-0.04	-0.06	0.11	1.00								
SSN	-0.27	0.05	-0.20	-0.15	0.18	0.18	-0.02	-0.11	1.00							
URBAN	0.36	-0.06	0.32	0.26	-0.29	-0.31	-0.13	0.18	-0.21	1.00						
MALE	0.22	-0.06	0.03	0.17	-0.04	-0.05	0.15	0.11	-0.11	0.10	1.00					
WORK	0.58	-0.11	0.31	0.22	-0.39	-0.38	-0.10	0.09	-0.28	0.31	0.20	1.00				
KID	-0.46	0.11	-0.25	-0.12	0.25	0.21	0.08	-0.03	0.37	-0.20	-0.14	-0.55	1.00			
GOVT	0.21	-0.03	0.15	0.23	-0.09	-0.10	0.04	0.11	-0.05	0.07	0.07	0.14	-0.04	1.00		
MIN	0.12	0.05	-0.01	0.07	-0.03	-0.05	0.06	0.10	-0.05	0.18	0.14	0.04	0.01	-0.08	1.00	
AGRIC	-0.17	-0.01	-0.20	-0.18	0.12	0.12	0.16	-0.06	0.03	-0.27	0.16	-0.13	-0.01	-0.12	-0.07	1.00

Note: all correlation coefficient are significant at 10% or less with the exception of MIN and SECSCH and MIN and KID
Source: Author's calculation using HIES 2002/03

4.3.1 Empirical Results

The OLS results of the income function and the inequality decomposition for each variable using the 2002/03 HIES is given in Table 7. Two specifications are run. The first specification excludes VAT and SSNs while the second includes them. The inclusion of VAT and SSNs requires justification as these variables are likely to be correlated to dependant variable (per capita household income). However, the correlation coefficients presented in 7 shows that correlation between these variables and income are acceptable. The use of a dummy variable to capture SSNs and categorical variable to capture VAT removes most of the causality effect between these variables and income. The two variables could not be excluded as they are important parts of the study. The results of the income function and variable contribution to inequality of specification 1 are provided in column 2 and 3, respectively, of Table 7. While that of specification 2 are given in column 4 and 5. An increase in all variables with the exception of age squared, number of children and the agriculture dummy have a positive impact on income in both regressions. As stated earlier, generally low income household have more children, tend to be engaged in the agriculture sector and have older household heads and, thus, explaining the negative relationship. If evenly distributed, variables that have a positive impact on income should contribute negatively to inequality as stated by Morduch and Sicular (2002). All variables in both income regressions are statistically significant at 1% and has the expected sign with the exception of SSN and CATTLE 1. SSN could be insignificant as most SSNs programs are not means tested and are received by a low portion of the population. And even the average amount received by these households is very low (an equivalent of 27 Australian dollars per month).

The two education variables, PRISCH and SECSCH, and the training variable, TRAIN, have the expected sign and are statistically significant. Of these three variables, secondary education has the greatest impact on income such that obtaining a secondary school qualification increases ones income by close to 70%. Having a secondary school qualification increases ones income so greatly and widens the income gap in the population. Due to this secondary education provided the second largest contribution to inequality, with this contribution being 15.55% in the first specification and 12.30% in the second specification. Primary schooling, on the

Table 7: Results of the Income Function and Inequality Decomposition by explanatory Variables

	Specification 1		Specification 2	
1	2	3	4	5
Variable	Coeff.	Inequality Decomposition	Coeff.	Inequality Decomposition
PRISCH	0.2467***	-1.67	0.2006***	-1.40
	[0.0317]		[0.0305]	
SECSCH	0.8468***	15.55	0.6670***	12.30
	[0.0397]		[0.0388]	
TERT	0.7199***	13.41	0.5888***	11.00
	[0.0292]		[0.0283]	
AGE	0.0405***	-12.92	0.0267***	-8.56
	[0.0040]		[0.0039]	
AGESQ	-0.0003***	9.91	-0.0002***	6.39
	[0.00004]		[0.00004]	
CATTLE1	0.0186	-0.04	0.0265	-0.05
	0.0304***		[0.0291]	
CATTLE2	[0.1071]	-0.02	0.0576***	-0.01
	0.0340***		[0.0326]	
CATTLE3	[0.3348]	0.22	0.2245***	0.16
	0.0814***		[0.0786]	
VAT			0.0010***	9.73
			[0.00004]	
SSN			0.0053	-0.04
			[0.0343]	
URBAN	0.1650***	0.005	0.1162***	0.003
	[0.0258]		[0.0247]	
MALE	0.1506***	1.22	0.1114***	0.90
	[0.0242]		0.0232]	
WORK	1.1937***	19.23	1.1675***	18.81
	[0.0391]		0.0376]	
KID	-0.1275***	9.02	-0.1348***	9.58
	[0.0067]		[0.0066]	
GOVT	0.2083***	1.09	0.2152***	1.13
	[0.0354]		[0.0336]	
MIN	0.4752***	0.90	0.3938***	0.74
	[0.0573]		[0.0546]	
ARIC	-0.1102***	0.41	-0.1055***	0.39
	[0.0421]		[0.0411]	
_cons	3.9558***	41.46	4.3631***	
	[0.1042]		[0.1025]	
residual				37.37
Total		100		100.00
No. of observation		6027	No. of observation	6011
F(15, 6011)		565***	F(19, 6007)	533.00***

*** denotes that variable is significant at 1%, ** variable is significant at 5% and * denotes variable is significant at 10%.
Figures in parentheses are standard errors.

other hand, has an equalising effect on income in reference to household heads that have no formal education. However, this equalising effect is very small with its contribution to inequality being -1.67 and -1.40 in specifications 1 and 2, respectively. The equalising effect of primary school is derived from not only from the fact that the variable is distributed in favour of low income households but also from the fact that primary education enables households to engage in more income generating opportunities compared to their non-educated counterparts. More opportunities are available to individuals with primary education as most employers in Botswana prefer individuals who are literate and able to speak English even for non-skilled jobs. Training also contributed both positively and significantly towards inequality in both income regressions. These results are consistent with previous studies using the regression based inequality decomposition such as studies by Baye and Ngah (2011) for Cameroon, Cowel and Carlo (2009) for Finland, and Wan and Zho (2005). The contribution of secondary school is higher than that of the training variable by about 2%. The training contribution to inequality could be affected by the mismatch between the education sector and the skills required in the labour market as explained by Pereira and Martins (2004). This is a major concern in Botswana and its intensity has been outlined by Siphambe (2008), Bolaane et al (2010), and the Botswana's government National Human Resource Development Strategy.

Age of the household head has a positive sign, while age squared has a negative sign. Both these variables are significant and correctly signed as postulated by the human capital theory, showing that income increases with age, but at a decreasing rate. The overall contribution to inequality by age and age squared combined is -3.01% and -2.17% for the specification 1 and 2, respectively. This result shows that age equalises income inequality. Besides the fact that age is distributed towards low income households, a factor that could explain why age is associated with lower inequality could be that with age comes greater wisdom, knowledge and experience that improves the ability to generate income and improve the quality life of even of poor households.

Increasing the number of paid workers in a household by one unit would lead to an increase of household income. This variable contributes the largest to inequality with the contribution being 19.3% and 18.81% for specification 1 and 2, respectively. Generally it appears that higher income households have a larger proportion of paid employees working relative to low income households. In both regressions the more children one has the less income is acquired. This could be due to the fact that the more kids could potentially reduce the ability

to engage in the labour market as more time is required for child care. The number of children leads to an increase in inequality. The decomposition of inequality contribution is given by the number of children is 9.02% and 9.58% in specifications 1 and 2, respectively.

In reference to such as services and manufacturing, working in the agriculture sector leads to a fall income. While working in the mining sector will lead to an increase in income by 39%. The various sector contributions to inequality are mainly negligible with government providing the largest contribution to inequality followed by mining. Although more low income household ate engaged in agriculture, this variable doesn't equalise income. This could be attributed to the low returns to agriculture as only 7% of Botswana soils are suitable for crop production. The low contribution of mining employment to overall inequality is shocking especially since this variable is highly distributed in favour of high income households. The male and the urban residency variables also provide a small but positive contribution to inequality. In reference to having no cattle households having between 1 to 9 and 10 to 60 cattle provide an equalising effect to inequality, while households with more than 60 cattle contribute positively, although negligible, to inequality.

VAT, in regression 1, is positively related to income showing that higher levels of VAT paid is associated with higher incomes. Similar results were obtained by BIDPA (2005). VAT provides a 9.73% contribution to inequality. Yet VAT payment is relatively fairly distributed amongst the population with Table 6 indicating that ratio of the top 25% to that of bottom 25% is 1.57. Further calculations actually indicate that households in lower deciles pay a slightly lower effect VAT rate than households in higher deciles. With household in the lowest deciles paying an effective VAT rate of 6.25%, while households in the highest decile have an effective VAT rate of 6.89%. So although high income household pay higher amount of money for VAT their effective VAT rate is not much different relatively to poorer households. This is because most of the goods that are zero rated or exempted are goods consumed by the fairly well off such as education, petrol and diesel and air travel to destination outside the country. With regards to education, low income households use the public education system which is free and hence this doesn't count as part of their expenditure while high income households utilise the private education which counts as part of their expenditure. Yet this aspect is VAT exempt and this lowers their overall effective VAT rate for richer households. All food except for the staple food, maize and sorghum, have a rate of 12% yet food consumption accounts for 69% of household expenditure in the lowest decile. While top decile's expenditure on food is less than 10%.

Decomposition of inequality reveals that about 41.46% and 37.37% of inequality in specification 1 and 2, respectively, is derived from the residual term. This residual contribution captures attributes in inequality that are not captured by regression. It captures the unobserved effects on inequality such as the effects of variables like economic growth and trade liberalisation. Though this value may seem high, it is consistent with other studies. In fact most studies have found relatively higher contributions of the residual term to inequality. For instance, Morduch and Sicular have an error term contribution of as high as 90% when decomposition was carried out using Theil's index. The contribution falls to 40% when the Gini coefficient is used. Although they concluded that Theil's index provided a better measure. Wan and Zhou (2005) run a number of regression for a couple of surveys conducted in different years and their highest residual contribution to inequality is recorded at 40%. Yun (2006) finds the contribution of the residual to be as high as 78.3%.

Conclusion and Policy Recommendation

In order to summarise these finding, the explanatory variables can be divided into three groups. With the first group comprising of variables that contribute significantly to income inequality. These variables are secondary school education, training, VAT and number of paid employees and number of children in the household. The second group comprises of variable that have a positive but a small impacts on inequality such as all the sector dummies, the urban dummy, the male dummy and cattle ownership above 60 cattle. While the third group comprises of variables that equalises income such as primary education, age, cattle ownership below 59 cattle and social safety nets.

Policy recommendations is that attempts should be made to reduce the effects on inequality of the first group while increase the impact or effects of the third group. Under the last group the only variable that could effective used to lower inequality is primary education. Although quality free primary and secondary education is provided by government, this education is not compulsory. Therefore, it is recommended that Government make education compulsory at both primary and secondary level. Providing free education for all and making it compulsory would boost the effects of both primary and secondary education on inequality. This is particularly the case as its low income households that have a higher proportion of members who have no education. Therefore increase education to this group at primary level would increasing the equalising effect of primary education and decrease the impact of the

positive inequality contribution of secondary school education. There is, however, a need to increase the number of schools if education is to be made compulsory. Under age the payment amount of old age pension could be should be reviewed. Other social safety nets schemes should also be reviewed in order to improve overall their effectiveness. This is highly important as the sole objective of these programs is to reduce poverty and income inequality.

With respect to variables in the first group, like training and paid employment, it is important to embark on policies that will increase the spread and access of these variables to low income households. Botswana should also consider a child benefit scheme for poor household as it is currently done in South Africa. However this should be carefully designed so as not encourage low household to have more children. An income tax policy could also be introduced that takes into consideration the number of children a household has. VAT on goods heavily consumed by low incomes households, like food items, should be either zero rated or exempted. While VAT should be imposed or increased on goods heavily consumed by high income households. In the following chapter these recommendations will be taken on board and counterfactual tax and benefit policies will be designed and simulated in a micro simulation model in order to observe their overall impact on inequality and poverty.

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2011

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ECONOMICS DISCUSSION PAPERS 2012		
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ECONOMICS DISCUSSION PAPERS 2013		
DP NUMBER	**AUTHORS**	**TITLE**
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