The Fashionable Inflation and "Food Inflation" Rhetoric in Ghana: Is there any substance behind all the hype?

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Abstract

The causes and implications of inflation and food inflation are yet to be fully grasped by both the electorate and the mass media of some developing countries like Ghana. Food inflation is of particular concern for low income earners and the numbers of low income earners are high in developing countries. As a result of the hype about inflation, in every Ghanaian electoral cycle since 1992, inflation becomes "an issue." The run up to and the aftermath of Ghana's 2012 election is replete with discussions, albeit often misguided, about inflation and food inflation. While the National Democratic Congress touted their achievement of having kept inflation low, the opposition New Patriotic Party brought up the short-run Phillips Curve relationship between low inflation and high unemployment and the lack of jobs that that implied. Given the ambiguity in the development literature and political rhetoric about the effects of inflation, this research sought to answer the following questions: (a) Why do inflation and food inflation so dominate Ghanaian politics and what are the palpable effects of inflation and food inflation specifically on the welfare of the average Ghanaian and (b) what is the implication of changing levels of inflation and food on standard of living of Ghanaians? Using both qualitative and quantitative techniques, the research finds that inflation causes confusion for the Ghanaian electorate and entrepreneurs. Food inflation makes it difficult for the poor to plan current and future expenditure. The research also

finds a statistically significant inverse relationship between inflation and standard of living in Ghana even in the short run. The adverse impact of inflation on standard of living increasingly worsens as inflation increases. The researchers recommend that policy makers and the government should devote more effort to ensuring that food inflation and inflation levels are kept low.

Keywords: Inflation, Food Inflation, Ghana, National Democratic Congress, New Patriotic Party

Introduction

Inflation and Food inflation have emerged as rather controversial indicators of economic health and standard of living in Ghana although it is debatable whether the average Ghanaian can correctly interpret inflation and food inflation statistics, decipher what inflation and food inflation actually mean or appreciate the different steps needed to measure both food inflation and inflation. Note that while inflation refers to the general increase in prices in an economy, food inflation refers to the general increase of the price food items in a country.

Despite the apparent lack of proper grasp of the inflation concept most newspaper pundits and policy analysts refer to food inflation and inflation (justifiably or not) in discussing the economic health and well being of the country. This often inadvertently or intentionally confuses Ghanaian citizens even more about what inflation and food inflation really mean and the relevance of inflation to the political discourse.

According to Romer (2006), maintaining low inflation and high growth is a central objective of effective policy, and in Ghana, the ruling Democratic National Congress (NDC) government has taken that advice to heart in a literal sense as it has opted for inflation targeting. In order words a major policy objective of the ruling NDC government is to keep inflation from rising to double

digits by maintaining fiscal discipline and avoiding excessive printing of money.[i] Inflation however is historically notoriously hard to push down during election years in Ghana. This is so because the incumbent government borrows in order to spend lavishly on development projects to convince the electorate that they deserve another term in office. Government expenditure on development projects, which in election years, is often financed either by printing money (seignorage) or borrowing because government is unable to increase taxes puts upward pressure on prices leading to inflation. The wage bill also escalates in election years as hitherto ignored labor agitations for salary increases are now meaningfully addressed by government. It is therefore not surprising that in the 2012 election year the behavior of inflation over the years was one of the main points of extensive discussion with the incumbent NDC government boasting of a stable 2-digit inflation over a two-year period as a result of prudent governance. The problem though, for the ruling NDC has been (1) how credible these low inflation numbers are in the face of the rapidly depreciating Ghana Cedi and (2) how to make these low numbers meaningful in the lives of Ghanaians. This is especially pertinent given the arguments by the opposition New Patriotic Party or the (NPP), that based on the Keynesian argument, the potency of low inflation as a panacea for development problems is weak at best and that at least in the short run low inflation actually leads to unemployment (Mankiw, 2010). Keynesians portend that low inflation could mean no jobs for ordinary Ghanaians because deflation discourages production and stalls job creation leading to more severe unemployment.

Given the lack of clarity on the Ghanaian political landscape about the actual implication of inflation on the Ghanaian economy which some have argued emanates out of the tension in the literature between Classical and Keynesian economists about whether or not printing more money

is effective in stimulation growth (Mankiw, 2006), we set out to answer the following questions: (a) Why is inflation such an issue in Ghanaian politics and what are the palpable effects of inflation specifically on the welfare of the average Ghanaian and (b) what is the implication of changing levels of inflation on standard of living of Ghanaians? Please note that he standard of living will be measured although imperfectly by real GDP per capita and also by the United Nations' Human Development Index (HDI)

Literature Review

This section analyses and discusses the work of various authors on implication of changing levels of inflation on the standard of living or the welfare. The criticisms by *Amartya Sen* and *Douglas North* in particular about the inadequacy of GDP growth and GDP per capita as measures of welfare were duly recognized and influenced the choice of the UN's Human Development Indicator (HDI) as a second measure of welfare. The HDI better captures the concerns about the measurement of welfare pointed out by Sen and North because it reflects the health and knowledge dimension of welfare which GDP per capita ignored. However, works linking HDI and inflation are rare and typically link inflation to other indicators of standard of living like GDP per capita, GDP per capita growth and GDP growth. The literature review places the current study in context of other studies and highlights the relevance of the study as well as the contribution it will make to literature.

Theoretical Framework

As far back as the late 17th century money had little and close to a negligible economic importance as a stimulus of inflation (*Blaug, 1996*). Increasing money in circulation was seen as a driving force of the real economy in terms of promoting growth and output. *John Law*, in his paper titled Money Stimulates Trade, offers a good insight into this era explaining that increasing money

supply would only lead to a slight increase in prices and rather result in significant increases in output; a theory which is very contrary to the quantity theory of money (Blaug, 1996).This was followed by *Cantilon's* expansion in the 18th century of the theory explaining that increase in money supply will not only increase the price levels, but will also alter the structure of prices *(Blaug, 1996*).Unable to survive several criticisms, these theories faded away.

A standard theory originating from the 19th century explains that money supply is directly related to price levels all other things held constant (*Blaug, 1996*). So in this context inflation is the outcome of increases in money supply. Today, two dominant theories exist to explain inflation. These are the Quantity Theory of Money and the *Philips Curve's* short run explanation. The quantity theory of money indicates increase in the supply of money as a driving force of high price levels (inflation) in the economy, a case common to developing countries. The Philips Curve, alternatively, shows the relationship negative between inflation and unemployment. Unemployment is a good measure of welfare but it is also a real variable not a nominal variable. The Phillips Curve explanation therefore seem to imply that money has real effects or expanding the money supply leads to less unemployment or more output.

Quantity Theory of Money Explanation of Inflation

The quantity theory of money puts forward a direct relationship between money supply and the general price level in an economy. The theory is simplified into a simple equation, MV=PT. M in this equation is the money stock, V connotes the velocity of circulation of money, P is the general price level and T represents the number of transactions (Pass et al, 2005). Thus, the total money

expenditure on goods and services (MV) is held equal to the monetary value of goods and services that are produced in the given period (Pass et al, 2005).

The quantity theory of money can be summed up in Milton Friedman's quote; that "Inflation is always and everywhere a monetary phenomenon *(Colander, 2010: pp. 387)"* Therefore the price level rises proportionally with increases in money supply. For the quantity theory of money to hold, velocity is held constant, real output is independent of money supply, and causation goes from money to prices (Colander, 2010).

The Philips Curve Explanation of Inflation

The Philips Curve, a reflection of the short-run aggregate supply curve, illustrates the tradeoff between inflation and unemployment such that government attempt to reduce unemployment leads to an expansion in aggregate demand which leads to a general increase in price levels with supply held constant. Therefore, inflation and unemployment tend to move in opposite directions (*Mankiw, 2003*). As the literature review illustrates, the tension in the literature as whether inflation is desirable or inimical for short run growth remains and can only potentially be resolved empirically. A task this research will attempt to undertake.

Methods

Overview and Justification of Research Method

Methodology is an important aspect of any study since it shows how the proposed research is to be carried out. It therefore occupies a critical and integral part of the research process (*Sotirios & Sarantakos, 2005*).This study employs a combination of descriptive and correlational studies. Thus, the research seeks to systematically describe the status of standard of living in relation to

changes in the level of inflation. It is also correlational because it probes into the relationship between inflation and welfare of people in Ghana and seeks to explain the relationship as well. Therefore the study utilizes a quantitative framework for data collection. This follows the fact that the research is interested in measurement, objectivity, validity and an explanation of phenomenon to detect and explain the relationship between the variables in question.

The quest of this study is embedded in the main research question which is: What is the implication of changing rates of inflation on standard of living in Ghana**?** Thus, this research focuses on determining how standard of living of Ghanaians is affected by changing levels of inflation. The study uses simple regression models to objectively determine the response, if any, of standard of living to changes in the level of inflation following *Bruno and Easterly (1995), Barro (1995),* among others. Having explained the relationship between changing levels of inflation and standard of living, a sensitivity analysis will be conducted to determine how sensitive welfare is to changing levels of inflation in Ghana. The quantitative framework is therefore suitable in order to guarantee the objectivity, validity and reliability of the research.

Discussion of Key Variables

The key variables for the measurement aspect for this research are inflation and standard of living of Ghanaians. As defined earlier, inflation refers to the general increase in prices levels. The measure for inflation in this study is the percentage change in Consumer Price Index (CPI) which is the measure of inflation used in Ghana currently. Standard of living is determined using two (2) variables: which are real GDP per capita and the Human Development Index (HDI) also mentioned previously in the study.

Scope of the Research

The context of this study is Ghana. Ghana is a lower middle income country in West Africa with a population of over 24 million according to the 2010 population census. Like many African countries, Ghana is rich in natural resources including but not limited to gold, cocoa and the recently found oil. Oil exploration is therefore currently ongoing with measures in place to hedge against the resource curse. The exploration of oil is also expected to contribute significantly to the country's GDP. Thus, the country attracts many potential investors who invest in the various sectors. Ghana also has good rankings with regards to economic freedom and thereby is known to be a good place to do businesses in Africa (The Heritage Foundation, 2012). It is therefore not surprising that the Ghanaian economy is projected to be one of the fastest growing economies in Africa in the coming years. The focus on Ghana as a whole is made possible because the quantitative analysis takes data that reflects the entire Ghanaian population.

Description of General Population and Sample Area

The heart of this study is the welfare of the Ghanaian population and how it is affected by the changing levels of inflation. Therefore the population area is also the sample area which is Ghana in general. This is because of the use of inflation rates, real GDP per capita and HDI which are annual averages that reflect the status of the entire population of the country. Thus, it is important to note that the population area equals the sample area since data on inflation, GDP per capita and HDI reflect the entire population. The sample is therefore the same as the population to a large extent with the only difference in the two being the quantity of data available and used in the study.

Types and Sources of Data

This study employs secondary data in two forms: research done by others as described in the literature review and annual data for the variables under study. Research done by others is obtained from various academic journals while annual data for the variables under study is obtained from

the World Databank mostly and the CIA World Fact book where necessary. These sources are being used because data from these identified sources are accepted internationally and will enhance the credibility and reliability of the study as opposed to data generated within the country which can be subject to a greater degree of scrutiny.

Sample Size

The sample size for the research is annual data for the variables for the period of 1980-2012. The data set starts from 1980 because data on HDI for Ghana from the World Databank starts from this year. Therefore although GDP per capita and inflation both have annual data dating far back than this period, the need for consistency in analyses has given rise to the choice of period under study.

Model Section

The research uses both qualitative and quantitative techniques. Regression analyses on information gathered from the identified sources are performed in order to determine the correlation among the variables, if any. Two simple regression models will be used for this study with the independent variable being inflation and the dependent variables being real GDP per capita and HDI. Therefore, the explanatory variable, inflation, will be regressed on the response variables, real GDP per capita and HDI, in two separate models. The equation for the model is:

$$\boldsymbol{Y_i = a + bX_i + e}$$

$\boldsymbol{Y_i}$ connotes the dependent (response) variable for each year of observation which is standard of living indicated by real GDP per capita or HDI; $\boldsymbol{X_i}$ connotes the independent (explanatory) variable for each year of observation which is inflation. $\boldsymbol{A}$ and $\boldsymbol{b}$ are the parameters of regression: the intercept and slope of the equation respectively. $\boldsymbol{e}$ represents the error term of the equation; it is added to make room for other variables that may influence the regression analysis which are not

taken into consideration in this study. The main tool used to carry out the regression analyses is Microsoft Excel.

The key assumptions according to Pindyck and Rubinfield (1998) that are necessary for this regression analysis to be valid are:

1. The relationship between X and Y is linear
2. The values of X have a random probability distribution
3. The error term has a zero expected value
4. The error term has a constant variance for all observations
5. The random variables are statistically independent
6. The error term is normally distributed

The regression analysis described above will help determine the theoretical relationship between inflation and standard of living as well as the strength of the relationship. In order to determine the sensitivity of the standard of living to inflation in the study, a measure of elasticity will be used. Thus, by checking the responsiveness of standard of living to inflation, the sensitivity of standard of living to inflation is determined. Elasticity will be calculated in two ways: one at the means of the datasets, the other at five different levels of inflation and the corresponding standard of living (real GDP per capita or HDI). Thus, aside determining how sensitive standard of living is inflation generally, elasticity as various levels will determine the effect on inflation on standard of living at different inflation levels. .

The elasticity equation is given as:

$$\boldsymbol{E}_{x,y} = \frac{Change\ in\ y\ /\ Level\ of\ y}{Change\ in\ x\ /\ Level\ of\ x}$$, which can be rewritten as:

$$\boldsymbol{E}_{x,y} = \frac{Change\ in\ y}{Level\ of\ y} * \frac{Level\ of\ x}{Change\ in\ x}$$

$$\boldsymbol{E}_{x,y} = \frac{Change\ in\ y}{Chnge\ in\ x} * \frac{Level\ of\ x}{Level\ of\ y}$$

But $\frac{Change\ in\ y}{Chnge\ in\ x}$ = slope (given as b, the regression coefficient)

Thus, $\boldsymbol{E}_{x,y}$ = b * $\frac{Level\ of\ x}{Level\ of\ y}$

Thus, the elasticity equation is also a two-variable equation ***(x, y)*** where ***x*** is the independent variable which is inflation, and ***y*** is the dependent variable which is standard of living (given as real GDP per capita or HDI) in the context of this study.

Findings, Data Analysis And Discussion Of Results

Description of Relevant Data Collected

All the data employed in the analyses are taken from the World Databank Indicators (WDI). The data set comprises rates of inflation, real GDP per capita, HDI and other relevant data from 1980 – 2012. The period for which the data was collected was restricted to begin from 1980 to allow for consistency since datasets for all three variables as explained earlier. Since data is collected from a secondary source; from a party with no interest in this particular research, the results obtained can be relied upon as free from strategic manipulation.

Regressing inflation on real GDP per capita

This section focuses on the regression analysis between inflation and real GDP per capita. All relevant details relating to the regression of these two variables are presented in this section.

The first analysis done in this study is a regression of inflation on real GDP per capita. One factor taken into consideration is that changes in inflation will not immediately translate into real GDP per capita. Thus, a time lag of 1 year is introduced. The study therefore assumes that a change in inflation in a particular year translates into real GDP per capita the following year. Values for inflation in given years are thus, matched against corresponding real GDP per capita values in the

following year. Based on this provision, inflation rates from 1979-2011 are regressed on GDP per capita figures for the 1980-2012 period. Secondly, annual data for the variables are finalized and published with the exception of data for 2012. Real GDP per capita for 2012 was estimated from a provisional real GDP figure. To obtain real GDP per capita, the real GDP value obtained was divided by the population of Ghana; the result was further divided by the end of year Ghana cedi exchange rate to the dollar. Thus the real GDP per capita value for 2012 was not obtained from the World Databank Indicators (WDI). It is therefore not unexpected that the confirmed figure to be released in the future could be different from the computed figure.

There were a few outliers in the datasets for both inflation and real GDP per capita. The inflation dataset had two outliers while the real GDP per capita dataset had one outlier. Analyses were performed on the entire datasets for the two variables (outliers inclusive) as well as the entire datasets after all outliers had been removed. There were differences in the outcomes from both datasets; however, those outliers were not too significant. Consequently, the analyses and discussion of results presented here are based on the outcomes from the datasets that did not include outliers. This is because the presence of outliers could yield misleading results. However, although this section is based on the data set without outliers, results from analysing datasets with and without outliers have both been provided in the appendix for references, if any.

Summary of Data used

Using a confidence level of 95% the average inflation rate (mean) was 25.64%. The median value of 24.72%, which is somewhat not far away from the mean, suggests that the dataset for inflation approximately approaches a normal distribution. However, the value of kurtosis being 0.02distorts

the assumption of an approximately normal distribution considering the fact that *0.02 is significantly lower than the ideal normal distribution kurtosis value of 3. Nonetheless, the skewness value of 0.91 is not too far away from zero to suggest a normal distribution of the dataset*. Therefore overall, the dataset for inflation can be said to approximate a normal distribution. This fulfills one of the assumptions outlined in the methodology section: the values of x (which is inflation in the context of this study) follow a random probability distribution. The standard deviation gives the information that values in the dataset are spread within ±14.10 deviations about the mean.

Using a confidence level of 95%, the average real GDP per capita is 259.90USD while the median value is 244.13USD. The sample data are dispersed within ±51.19deviationsaround the mean. The data is more peaked relative to that of inflation with a kurtosis value of 0.87. The data sample for real GDP per capita also gives the indication of a right skewed data with a skewness value of 1.11.

Regression Results

Table 1: Regression of *Inflation* on *Real GDP per capita*

Regression Results	
Regression Equation	-1.58x + 300.51
Multiple R (Correlation)	0.4323
Coefficient of Determination	0.1869
Total Sum of Squares (SST)	75989.6866
Regression Sum of Squares (SSR)	14202.7604
Residual Sum of Squares (SSE)	61786.9261
Test of Significance:	
Critical Value	4.1960
Test Statistic	6.4363

Source: Field Data

The regression equation is given as y = -1.58x + 300.51 as seen from the table above. The slope of -1.58 indicates that for every percentage increase in inflation, real GDP per capita reduces by 1.58USD. Thus, there is an inverse relationship between inflation and real GDP per capita. The extent of the negative relationship can be explained further by the multiple R (correlation) value of 0.4323. Thus, the strength of the inverse relationship between inflation and real GDP per capita is 43.23%.

The coefficient of determination (R-square) is used to determine how much variation is y is attributable to x. In the context of this analysis, R-square explains how much, or what percentage, of variation in real GDP per capita can be attributed to changes in inflation rate. From the regression analysis, the coefficient of determination is 0.1869 indicating that 18.69% of the changes in real GDP per capita can be attributed to inflation. Explained differently, comparing the regression or explained variation (SSR) value of 14202.76 to the total variation value of 75989.69, it is apparent that inflation accounts for 18.69% changes in real GDP per capita. Using a statistical hypothesis test, the significance of the slope obtained from the regression analysis. A one-tailed hypothesis test is used to test the significance of the slope of the regression equation. The null hypothesis (H_0) and alternate hypothesis (H_1) are given below:

H_0 = There is no relationship between inflation and real GDP per capita

H_1 = There is a significant statistical relationship between inflation and real GDP per capita

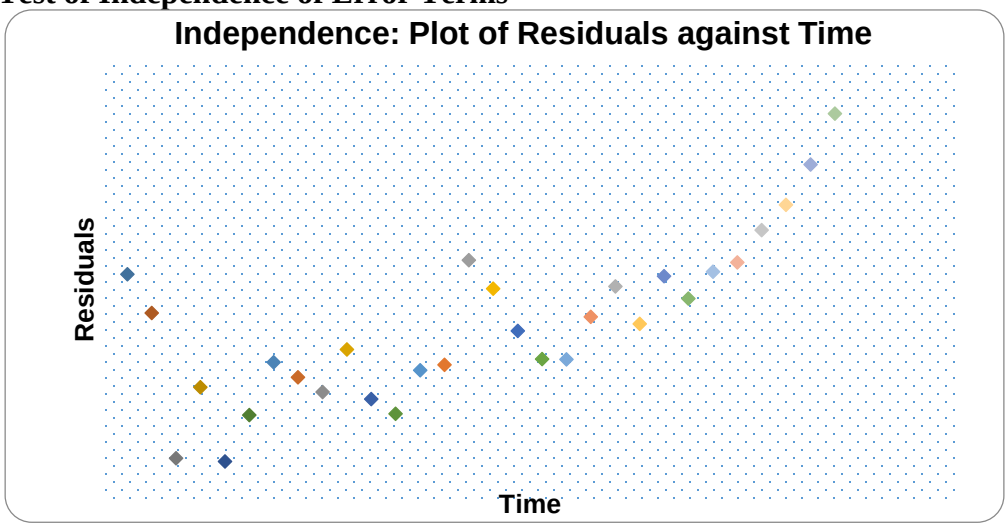
The F-test is used. A confidence level of 95% gives an alpha value of 0.05. The F value given alpha and the degrees of freedom is given as 4.1960 (thus, $F_{(0.05, 1, 28)} = 4.1960$) which is also the critical value. The test statistic given from the regression analysis is 6.4363. This value (6.4363) falls within the area of rejection and therefore the null hypothesis is rejected with the reason that

there is sufficient evidence of a significant statistical relationship between inflation and real GDP per capita.

Robustness of Regression Results

This section checks the robustness of the regression analysis and thus the results obtained from the regression analysis. It is necessary to prove the robustness of the model adopted for this study in order to determine that the model fits the data. Assessing the robustness of the model adopted is also a way of assessing the validity of the regression results. A major assumption underlying the simple linear regression model: independence is tested using the residuals from the regression analysis.

Chart1: Test of Independence of Error Terms



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The independence of errors is tested by plotting residuals over time illustrated in Chart 1. This test is critical in the study because data observed over time for both inflation and real GDP per capita is being used for the study. Independence of errors is established if no pattern in observed from the plot. As seen from the plot of residuals over time, there are no consistent patterns observed at time intervals. Although residuals towards the latter end (recent years) are considerably higher than the residuals at the beginning (past years), there is evidence of a random rise and fall of data points on both sides. Thus, to some extent, independence is present although it may be only partial.

Regressing Inflation on HDI

Once again, it is understood that changes in inflation will not influence HDI in the same years which accounted for the changes. Therefore, a lag of 1 year is also introduced in the analysis such that inflation values in a given year are regressed on corresponding HDI values in the following year. Consequently, data used comprises inflation data from 1979 – 2011 and HDI data from 1980-2012. Further issues relating to data for this regression is the fact that HDI values are mostly recorded at 5-year intervals as obtained from the main source of data for this analysis – World Databank. Instead of computing 5-year averages for inflation data and performing a regression analysis of inflation averages on the HDI data, it is assumed that HDI values are constant for 5 years. For instance, it is assumed in this study that HDI values for 1981, 1982, 1983 and 1984 are the same as the HDI value for 1980. This follows that the HDI value recorded for 1985 will also be used for 1986-89 and so on. Furthermore, there is also the issue of outliers in the data collected and used for this analysis. Just as done in the regression of inflation on real GDP per capita, analyses are performed on entire datasets with and without outliers. However, results and discussions presented are based on analyses of datasets without outliers. This is because although differences in the results for the two data sets (with and without outliers) are only marginal, the

presence of outliers could influence the outcome of analysis and thus mislead the research in terms of the results obtained. However, the results obtained for both datasets are presented in the Appendix.

Summary of Data used

The mean for HDI data analyzed is 0.41 at a confidence level of 95%. The standard deviation value gives evidence that the HDI dataset is spread within ±0.03 deviations from the mean. The distribution of the HDI data is very likely to be flat evident from a negative kurtosis value of -1.09. The skewness value of -0.1169 implies that the data is left skewed.

Regression Results

Table 2: Regression of *Inflation* HDI

Regression Results	
Regression Equation	-0.0011x + 0.4398
Multiple R (Correlation)	0.4608
Coefficient of Determination	0.2123
Total Sum of Squares (SST)	0.0314
Regression Sum of Squares (SSR)	0.0067
Residual Sum of Squares (SSE)	0.0247
Test of Significance:	
Cricital Value	4.1960
Test Statistic	7.5461

Source: Field Data

The regression equation is given as -0.0011x+0.4398 as seen from the table above. This indicates an inverse relationship between inflation and HDI as a result of the negative slope of -0.0011. The multiple R gives a further explanation to the relationship; it explains that extent of the inverse relationship between inflation and HDI is 46.08%. The coefficient of determination helps to explain how much influence inflation has on HDI. The value of the coefficient of determination (R-square) is 0.2123. This specifically means that inflation accounts for 21.23% change in HDI. With regards to total and explained variation (SST and SSR respectively) which is also another way of interpreting coefficient of determination, the regression results show that in an HDI total variation of 0.0314, 0.0067 can be attributed to inflation. A statistical hypothesis test for the significance of the slope of -0.0011as per the regression analysis is done using a one-tailed hypothesis test. The null and alternate hypotheses are stated below respectively:

H_0 = There is no relationship between inflation and HDI

H_1 = There is a significant statistical relationship between inflation and HDI

Using an F-test for the one-tailed hypothesis test and assuming a confidence interval of 95%, the value of alpha is 0.05. The critical value reading from the F-distribution is the same as what was obtained in the first regression since the degrees of freedom and alpha are the same. This critical value thus, is 4.196. The F-statistic is 7.5461and which significantly higher than the critical value of 4.196. This means that the null hypothesis should be rejected leading to the conclusion that there is enough evidence of a significant statistical relationship between inflation and HDI.

***Chart 2*: Test of Independence of Error Terms**

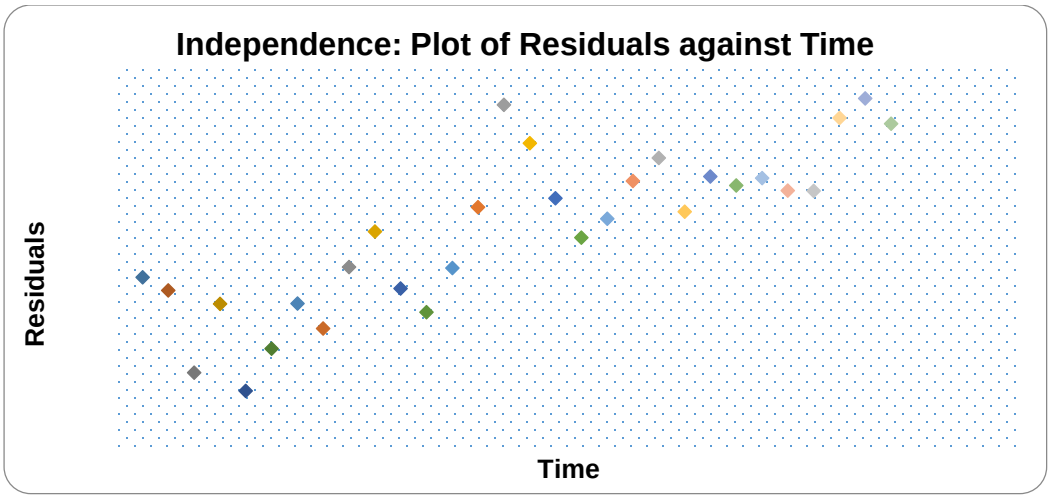


Chart 2 checks for robustness of the regression analysis between inflation and HDI by checking for the independence of the error terms using a plot of residuals against time. The rule of thumb is that there is independence when there is no observed pattern or unique behavior of residuals over time. This assumption appears to be slightly violated as the data points plotted seem to be divided into positive and negative values with the division point at x = 14. Thus, y values are negative at x values below 14 and positive at x values above 14. However, this is not completely the case as there is evidence of a random behavior at either side of the observed division (x = 14). Therefore this seeming violation can be conveniently ignored to some extent. On the whole, the assumptions tested for do hold. Consequently, the conclusion is that the regression model is robust.

Sensitivity analysis

Elasticity is computed in this analysis to identify sensitivity of standard of living to changes in the level of inflation. Elasticity is calculated at the mean of the data points for both real GDP per capita and HDI in relation to how sensitive standard of living is to inflation on the whole. Calculations are also performed at intervals in the dataset to determine how standard of living behaves with respect to inflation at various levels.

Sensitivity of real GDP per capita to inflation at mean of data points:

Let x be inflation and y be real GDP per capita
Mean inflation (x) = 25.6440
Mean real GDP per capita (y) = 259.8959
Slope (b = regression coefficient) = -1.5839
Elasticity = $b * \frac{level\ of\ inflation}{level\ of\ real\ GDP\ per\ capita}$
Elasticity = $-1.5839 * \frac{25.6440}{259.8959}$
Elasticity = 0.1563(negative sign ignored)
Elasticity = 15.63%.

Sensitivity of HDI to inflation at mean of data points:
Let x be inflation and y HDI
Mean inflation (x) = 25.6440
Mean HDI (y) = 0.4120
Slope (b = regression coefficient) = -0.0011
Elasticity = $b * \frac{level\ of\ inflation}{level\ of\ real\ GDP\ per\ capita}$
Elasticity = $-0.0011 * \frac{25.6440}{0.4120}$
Elasticity = 0.0685 (negative sign ignored)
Elasticity = 6.85%

Sensitivity of real GDP per capita to inflation at different points in the data

The different points in the data used in this analysis are chosen in relation to inflation. Using the behavior of inflation as a guide, the dataset is divided in six categories such that any unique behavior of inflation is captured. To calculate the elasticity for each category, the highest value within the category is taken with the corresponding real GDP per capita; elasticity is thus computed. It should be noted here that corresponding real GDP per capita values relate to the following year for the chosen inflation value as a result of the time lag as explained earlier. The same slope (-1.5839) obtained from the regression analysis is used. The data used for computing the elasticity as well as the elasticity results obtained from computing the various points and the resulting chart are illustrated below:

***Table 3*: Sensitivity of Real GDP per capita to Inflation at interval of Data Points**

Intervals	***Inflation Value used***	***Value of corresponding real GDP per Capita***	***Elasticity***
Below 11	10.9152	317.7364	0.0544 (5.44%)
11.01 – 16	15.1182	305.7511	0.0783 (7.83%)
16.01 – 25	24.9598	234.0065	0.1689 (16.89%)

25.01 – 35	32.9054	269.2286	0.1936 (19.36%)
35.01 – 45	39.8151	214.9652	0.2934 (29.34%)
Above 45	59.4616	242.0583	0.3891 (38.91%)

Elasticity is computed for the same way as demonstrated in the computations at the mean of the data points.

***Chart 3*: Elasticity at Elasticity at various Data Points**

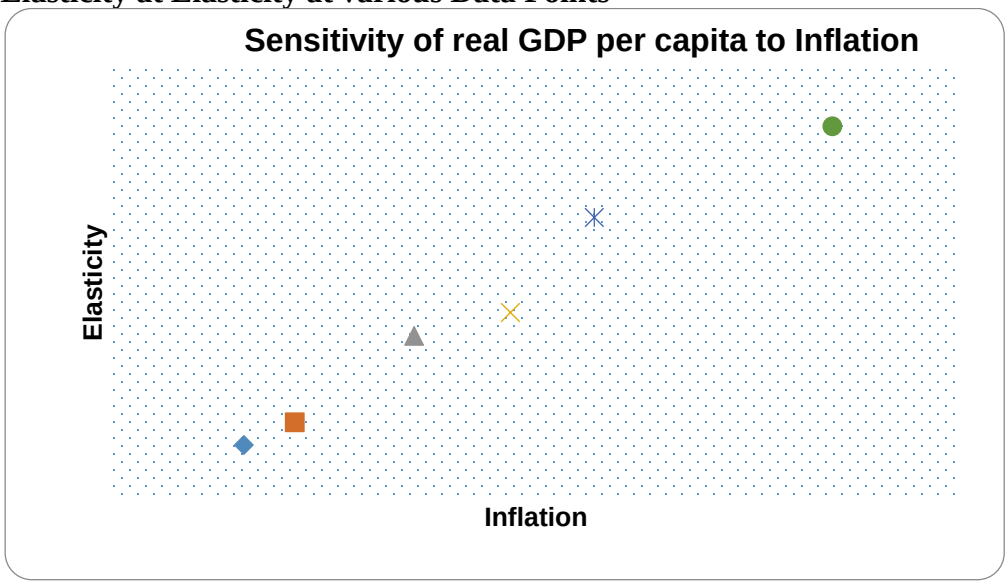


Chart 3 is a plot of elasticity against inflation using the data points for inflation and the elasticity results obtained from the elasticity computations. From the chart above, it is evident that elasticity increases at higher levels of inflation. Therefore all other things being equal, the higher the inflation rate, the more sensitive GDP per capita is to inflation.

Sensitivity of HDI to inflation at different points in the data

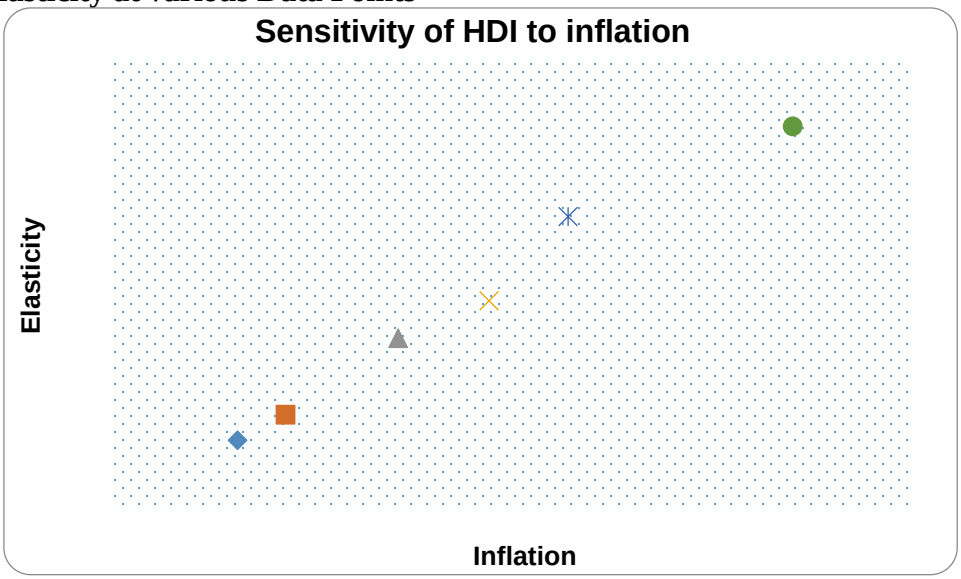
Elasticity is computed at different levels of determine sensitivity of HDI to inflation at different levels. The intervals for inflation are the same as used in earlier in the computation on real GDP per capita to inflation at different data points. The various data points used, elasticity results obtained and the resulting chart are shown below:

***Table 4*: Sensitivity of HDI to Inflation at interval of Data Points**

Intervals	*Inflation Value used*	*Value of corresponding HDI*	*Elasticity*
Below 11	10.9152	0.4425	0.0271 (2.71%)
11.01 – 16	15.1182	0.4425	0.0376 (3.76%)
16.01 – 25	24.9598	0.3989	0.0688 (6.88%)
25.01 – 35	32.9054	0.4306	0.0841 (8.41%)
35.01 – 45	39.8151	0.3698	0.1184 (11.84%)
Above 45	59.4616	0.4212	0.1553 (15.53%)

Elasticity is computed for the same way as demonstrated in the computations at the mean of the data points.

***Chart 4*: Elasticity at various Data Points**



The plot above shows the relationship between inflation and elasticity at the various data points used in computing the elasticity in table 4. It is obvious from the chart that elasticity increases at higher levels of inflation, similar to what was observed in the elasticity analysis of real

GDP per capita. Thus, all other things being equal, HDI increases in sensitivity to inflation as inflation soars.

Discussion of Results

Over the years, research has been conducted on the effects of inflation on: GDP, GDP growth, GDP per capita growth, etc. to identify the relationship between inflation and these variables. However, there is lack of a common conclusion about the effect, if any, of inflation on these variables. Furthermore, such studies done in relation to specific countries are not common – at least not for Ghana. Therefore, it becomes difficult to deduce what the figures (inflation rates) convey as they are reported from time to time as is done in Ghana. Using real GDP per capita and HDI as indicators of standard of living and inflation as determinant of standard of living, regression and sensitivity analyses have been performed to identify how standard of living behaves with respect to changing levels of inflation. The primary objectives of study were to identify the theoretical relationship between inflation and standard of living; as well as determine the sensitivity of standard of living to inflation. The results obtained from the analyses are subsequently discussed. The regression analyses revealed a significant negative statistical relationship between inflation and standard of living: in the case of real GDP per capita, the regression equation was -1.58 x + 300.51; while the regression of inflation on HDI yielded the equation -0.0011x+0.4398. In testing for the significance of these slopes using statistical hypothesis tests, the null hypothesis that there is no relationship between inflation and standard of living was rejected in both cases. Therefore, there is undoubtedly a negative relationship between inflation and standard of living having established that both slopes are significant. GDP per capita reduces by USD1.8USD for an increase in inflation by one percentage point. Considering the fact

that Ghana is a developing country and has issues of poverty such that there are still people who live on less than USD2 a day, this observation should not be taken lightly. Furthermore, HDI reduces by 0.0011 for every 1% increase in inflation. Ghana is yet to record an average score of the HDI (0.5) which makes this diagnosis important. This is because standard of living in terms of HDI is barely average; and thus further decreases in standard of living (as a result of high inflation rates) can therefore be very costly.

With respect to sensitivity of standard of living to inflation, sensitivity results from both real GDP per capita and HDI calculated at the mean of the datasets revealed that standard of living is not highly sensitive to inflation: 15.63% and 6.85% for real GDP per capita and HDI respectively. This can be linked to the fact that the coefficient of determination in the regression analyses of both real GDP per capita and HDI revealed that inflation explains about a fifth of changes in standard of living. Therefore about 80% of the changes in standard of living are due to other causes. This does not mean that inflation should be ignored however. In fact, 15.63% and 6.75% do make a difference. More importantly, sensitivity analysis at interval data points revealed that standard of living becomes increasingly elastic to inflation as inflation rises. In the case of real GDP per capita, elasticity jumped from 19.36% to 29.34% when inflation increased from 32.91 to 39.82%. The same observation was made for HDI values elasticity at various data points were computed.

To some extent, the outcome of this study agrees with the argument of Espinoza et al (2011) that inflation becomes costly at high levels. Furthermore, the results of the study agree with Barro (1995) that there is significant relationship between inflation and economic growth (standard of living in the context of this research). On the other hand, the Stanners (1996) concluded that there

that there was actually no correlation between inflation and an improved growth rate. This results of this study show otherwise. In fact, the inverse relationship between inflation and standard of living, as determined by the analyses, proves that Ghanaians will actually have an improved standard of living and thus, economic growth when inflation reduces. The outcome of the study also agrees with the conclusions by Kremar et al (2009) and Ayyoub et al (2011) in establishing that there is a significant inverse relationship between inflation and economic welfare. Nevertheless, there are still differences in the sense that both studies (Kremar et al, and Ayyoub et al) identified thresholds at and above which inflation became hurtful and below which inflation becomes insignificant; such thresholds have not been identified for Ghana as far this study is concerned. Hence, the inverse relationship applies irrespective of the level of inflation as far as a change in inflation level takes place.

Conclusion, Recommendations And Further Research

Regression and sensitivity (elasticity) analyses were conducted using data on inflation and standard of living taken mostly from the World Databank for the period of 1980-2012. Real GDP per capita and HDI were used as indicators of standard of living, also referred to as welfare in the study. Based on the results obtained from these analyses, this research concludes that there is a significant inverse relationship between inflation and standard of living in Ghana in the short run. The short run stance is taken due to the time lag of one year introduced in the study. However, the inverse impact of inflation on standard of living increasingly worsens as inflation becomes higher. Therefore in Ghana, people are worse off as inflation increases. Note that in contrast the Philips Curve, as described earlier, describes a positive relationship between inflation and improved standard of living such that high inflation actually leads to low unemployment in the short run.

This is the exact opposite in the case of Ghana based on this study. Therefore high inflation will hurt Ghanaians and vice versa. With this in mind, it is in the interest of Ghanaians that low rates of inflation be maintained.

Having established that inflation negatively affects standard of living in Ghana in the short run, it is recommended to policy makers and the government that more effort should be made to ensure that inflation levels are kept low; not only to maintain a decent standard of living but also to avoid a huge negative impact on standard of living since sensitivity of standard of living to inflation increases as inflation gets higher. Policy makers in Ghana tend talk a lot but do little about inflation as compared to other indicators such as unemployment. However, it is clear that inflation accounts for only some of the changes in standard of living. These other indicators, which have the tendency to impact standard of living, should thus receive public attention also.

This study was restricted to one determinant of standard of living: inflation. The results consequently showed that the there are other factors that affect standard of living as standard of living is only partially affected by inflation. Furthermore, these theoretical results observed could actually differ from what prevails in reality. This is because of the prevalence of income distribution inequality in developing countries for which Ghana is not different. Thus, the case could be that the people who are at a disadvantage (the poor) are actually much more affected at high levels of inflation than demonstrated in this study. These identified gaps form a basis for future research. Therefore in carrying out future studies, other factors that could possibly impact standard of living should be identified and analyzed in relation to the extent their of impact. Another aspect of future studies constitutes gathering primary data from sampled Ghanaians to

determine the whether the impact of inflation on welfare on the Ghanaians is exactly as established, or if there are any differences based on the choice of sample selected.

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APPENDICES

APPENDIX 1: Computation of Estimate for Real GDP per capita for 2012 (provisional value)

Provisional Real GDP = GHS28,105,000,000

Estimated Population of Ghana = 24,700,000

Real GDP per capita = $\frac{Provisional\ Real\ GDP}{Estimated\ Population}$

Real GDP per capita = $\frac{GHS28{,}105{,}000{,}000}{24{,}700{,}000}$

Real GDP per capita = GHS1137.85

Real GDP per capita in USD = $\frac{Real\ GDP\ per\ capita\ in\ cedi}{Exchange\ Rate\ as\ at\ year\ end\ (2012)}$

Real GDP per capita in USD = $\frac{\text{GHS1137.85}}{GHS\ 1.9/USD}$

Real GDP per capita in USD = 598.87

Real GDP per capita (2012 estimate) = USD598.87

APPENDIX 2: Raw Data on Inflation, Real GDP per capita and HDI

Year	Inflation, Consumer Prices (annual)	GDP per capita (constant 2000 USD)	HDI
1979	54.4413	246.6445	N/A
1980	50.0701	241.9462	0.3635
1981	116.5036	226.7589	0.3635
1982	22.2956	204.1829	0.3635
1983	122.8745	188.1487	0.3635
1984	39.6653	197.4868	0.3635
1985	10.3054	200.9364	0.3698
1986	24.5654	205.1678	0.3698
1987	39.8151	209.0657	0.3698
1988	31.3593	214.9652	0.3698
1989	25.2237	219.9076	0.3698
1990	37.2591	221.0717	0.3989
1991	18.0314	226.2823	0.3989
1992	10.0561	228.4588	0.3989
1993	24.9598	232.8513	0.3989
1994	24.8703	234.0065	0.3989
1995	59.4616	237.2936	0.4212
1996	46.5610	242.0583	0.4212
1997	27.8852	246.1978	0.4212
1998	14.6242	251.7653	0.4212
1999	12.4087	256.7400	0.4212
2000	25.1932	259.9907	0.4306
2001	32.9054	263.9615	0.4306
2002	14.8162	269.2286	0.4306
2003	26.6749	276.4052	0.4306
2004	12.6246	284.8492	0.4306
2005	15.1182	294.4080	0.4425
2006	10.9152	305.7511	0.4425
2007	10.7327	317.7364	0.4425
2008	16.5221	336.3518	0.4425
2009	19.2507	341.5523	0.4630
2010	10.7076	360.3241	0.4672
2011	8.7268	402.6953	0.4672
2012	*9.1	*598.871	0.4672

*values are provisional

APPENDIX 3: **Data as Used for Regression Analysis**

Inflation	Real GDP per Capita	HDI
54.4413	241.9462	0.3635
50.0701	226.7589	0.3635
*116.5036	204.1829	0.3635
22.2956	188.1487	0.3635
*122.8745	197.4868	0.3635
39.6653	200.9364	0.3698
10.3054	205.1678	0.3698
24.5654	209.0657	0.3698
39.8151	214.9652	0.3698
31.3593	219.9076	0.3698
25.2237	221.0717	0.3989
37.2591	226.2823	0.3989
18.0314	228.4588	0.3989
10.0561	232.8513	0.3989
24.9598	234.0065	0.3989
24.8703	237.2936	0.4212
59.4616	242.0583	0.4212
46.5610	246.1978	0.4212
27.8852	251.7653	0.4212
14.6242	256.7400	0.4212
12.4087	259.9907	0.4306
25.1932	263.9615	0.4306
32.9054	269.2286	0.4306
14.8162	276.4052	0.4306
26.6749	284.8492	0.4306
12.6246	294.4080	0.4425
15.1182	305.7511	0.4425
10.9152	317.7364	0.4425
10.7327	336.3518	0.4425
16.5221	341.5523	0.463
19.2507	360.3241	0.4672
10.7076	402.6953	0.4672
8.7268	*598.871	0.4672

*****Figures constitute outliers and were removed together with corresponding values in computations without outliers.

APPENDIX 4: Summary of Data (Outliers Inclusive)

Inflation		Real GDP per Capita		HDI	
Mean	30.8310	Mean	266.5884	Mean	0.4107
Standard Error	4.6434	Standard Error	13.6381	Standard Error	0.0061
Median	24.8703	Median	242.0583	Median	0.4212
Standard Deviation	26.6746	Standard Deviation	78.3451	Standard Deviation	0.0350
Sample Variance	711.5332	Sample Variance	6137.9560	Sample Variance	0.0012
Kurtosis	6.2621	Kurtosis	9.5294	Kurtosis	-1.2338
Skewness	2.4056	Skewness	2.6701	Skewness	-0.0190
Range	114.1477	Range	410.7223	Range	0.1037
Minimum	8.7268	Minimum	188.1487	Minimum	0.3635
Maximum	122.8745	Maximum	598.8710	Maximum	0.4672
Sum	1017.4244	Sum	8797.4168	Sum	13.5545
Count	33.0000	Count	33.0000	Count	33.0000
Confidence Level(95.0%)	9.4584	Confidence Level(95.0%)	27.7800	Confidence Level(95.0%)	0.0124

APPENDIX 5: Summary of Data (Without Outliers)

Inflation		Real GDP per capita		HDI	
Mean	25.644	Mean	259.896	Mean	0.41201
Standard Error	2.55098	Standard Error	9.34583	Standard Error	0.00601
Median	24.7178	Median	244.128	Median	0.42123
Standard Deviation	13.9723	Standard Deviation	51.1892	Standard Deviation	0.03291
Sample Variance	195.225	Sample Variance	2620.33	Sample Variance	0.00108
Kurtosis	0.02059	Kurtosis	0.87462	Kurtosis	-1.0905
Skewness	0.90739	Skewness	1.10638	Skewness	-0.1169
Range	49.4054	Range	214.547	Range	0.10373
Minimum	10.0561	Minimum	188.149	Minimum	0.36346
Maximum	59.4616	Maximum	402.695	Maximum	0.4672
Sum	769.319	Sum	7796.88	Sum	12.3603
Count	30	Count	30	Count	30
Confidence Level(95.0%)	5.21733	Confidence Level(95.0%)	19.1144	Confidence Level(95.0%)	0.01229

APPENDIX 6: Regression of Inflation on Real GDP per capita (Outliers Inclusive)

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.4034031					
R Square	0.162734					
Adjusted R Square	0.1357255					
Standard Error	72.834601					
Observations	33					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	31963.33976	31963.3	6.02527	0.019915886	
Residual	31	164451.2522	5304.88			
Total	32	196414.592				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	303.11772	19.55044112	15.5044	3.7E-16	263.2443304	342.99111
Inflation	-1.1848231	0.482686524	-2.4546	0.01992	-2.16926873	-0.200377

*APPENDIX 7:*Regression of Inflation on Real GDP per capita (Without Outliers)

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.43232371					
R Square	0.18690379					
Adjusted R Square	0.15786464					
Standard Error	46.9752694					
Observations	30					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	14202.76044	14202.8	6.43627	0.017036288	
Residual	28	61786.92615	2206.68			
Total	29	75989.68658				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	300.51266	18.1623951	16.5459	5.5E-16	263.30868	337.7166
X Variable 1	-1.5838722	0.624313938	-2.537	0.01704	-2.862721315	-0.305023

APPENDIX 8: Regression of Inflation on HDI (Outliers Inclusive)

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.5357819					
R Square	0.2870622					
Adjusted R Square	0.2640642					
Standard Error	0.0299909					
Observations	33					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	0.01122706	0.011227	12.4821	0.001311578	
Residual	31	0.027883138	0.000899			
Total	32	0.039110198				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.4323919	0.008050239	53.71169	3.7E-32	0.415973353	0.448810496
Inflation	-0.0007022	0.000198755	-3.532995	0.00131	-0.001107562	-0.00029684

APPENDIX 9: Regression of Inflation on HDI (Without Outliers)

SUMMARY OUTPUT						
Regression Statistics						
Multiple R	0.460750283					
R Square	0.212290823					
Adjusted R Square	0.184158352					
Standard Error	0.029724956					
Observations	30					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	0.006667542	0.00667	7.54611	0.01039642	
Residual	28	0.024740044	0.00088			
Total	29	0.031407586				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.43984056	0.011492779	38.271	1E-25	0.41629867	0.463382
Inflation	-0.00108522	0.000395053	-2.747	0.0104	-0.00189445	-0.000276

[i] Unfortunately at the time of writing this paper (December 25th 2013) inflation stood just shy of 14% percent, an apparent failure of the much touted inflation targeting policy