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A STATISTICAL MODEL OF PRICES OF ESSENTIAL COMMODITIES IN GHANA

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ABSTRACT: *The purpose of this study is to report an "index" that can be used as a measure of the standard of living of Ghanaians. To accomplish this objective, secondary data on prices of some selected commodities compiled by the Price Statistics section of the Ghana Statistical Service (G.S.S.) was used to conduct the study. The data covers the period from 2008 to 2013 and it was collected by month and for each Region (nine in all). The data was analyzed using Principal Component Analysis, a multivariate data analysis tool. At the end of the analysis, nine (9) indices were reported, one for each Region. These indices allowed for comparative study of the cost of living for the six years for all the Regions. The cost of living for instance, was highest in Eastern Region and Lowest in Ashanti Region for the period 2008; for 2009, it was highest in Eastern Region and lowest in Central Region; for 2010, it was highest in Volta Region and lowest in the Ashanti Region; for 2011, it was highest in Central Region and lowest in Ashanti Region; for 2012, it was highest in Central Region and lowest in Ashanti Region and lastly, for 2013, it was highest in Central Region and lowest in Ashanti Region*

KEYWORDS*:* Index, Standard of Living, Commodities, Price Section of the Ghana Statistical Service, Principal Component Analysis, Region, Highest and Lowest

INTRODUCTION

A commodity is an item or a product that can be traded, bought or sold espercially an unprocessed material. Over the years, the Ghana Statistical Service (G.S.S) has been collecting prices of commodities for the purpose of computing the Consumer Price Index (C.P.I.) and Inflation Rates. The C.P.I measures the change in price of a fixed market basket of goods and services from one period to another. The C.P.I. is so important that in several countries, it serves several major functions.
Writing in their book tittled "Statistical Techniques in Business and Economics", Mason, Lind and Marchal (1999) write:

> It allows consumers to determine the degree to which their purchasing power is being eroded by price increases. In that respect, it is a yardstick for revising wages, pensions and other income payments to keep pace with changes in price. Equally important, it is an economic indicator of the rate of inflation. In addition to the more general uses of the consumer price indes, it has special uses as well. The consumer price index is used to determine real disposable income, to deflate sales or other series and to esterblish the cost-of-living increases. It is also

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used to adjust alimony and child support payments; attorney fees; workers' compensation; rentals on appartments, homes and office buildings.

This study, by making use of the same body of data used for the computation of the Consumer Price Index will report another 'index' in a somewhat differenct approach and use this index to measure the cost of living of Ghanaians.

We often heard statement like: the cost of living in say Ashanti Region is higher relative to Brong-Ahafoe Region; the cost of living in Western Region is higher relative to Greater Accra Region; the cost of living in the Northern Region is lower relative to Central Region and the cost of living of Volta Region for a particular year was an improvement over another year and so on. But the question is: upon what basis are these assertions made? What measure or index guides people to make these assertions? Could we evolve a criterion which is not imagined or perceived and upon which comparisons about the cost of living can be made? Could we evolve a criterion which will be the basis of comparing the cost of living on Regional level?

Any government will always want the masses on its side. It will thus, embellish most of its activities a little, in the bid of portraying itself in a good light and always saying to the masses that "all is well", the cost of living situation is improving, the standard of living is high amongst others. Such an attitude, may not be intended to mislead, but can potentially have that effect in the long-run (Ngolovoi, 2008).It is worthwile to point out that with current advancement in knowledge, information that can be potentially mislead should bot be accepted. We should kick against prejudice and rather probe every source of information intelligently. Indeed, it is worthwile for every Ghanaians to have reason to say that 'I know what the cost of living in Ghana is and how it pertains to the entire Regions'.

The main objective is to come out with a measure or index upon which comparisons about the cost of living of Ghanaians can be made; to compare on Regional basis the pattern of the cost of living of Ghanaians and to identify which of the commodities have the greatest impact and the least impact on the cost of living of Ghanaians. Thus the significance of the study is to prevent Ghanaians from disseminating potentially misleading information about the cost of living and how it pertains to the Regions. This research work is employing an index upon which comparisons about the cost of living can be made so as to base their knowledge on what is perceived or imagined. A limitation of the study is that due to the nature of the study, the use of primary data would have been ideal. This notwithstanding, the study was restricted to the use of secondary data (Marcucci and Johnstone, 2010).

MATERIALS AND METHODS

The study was conductd using secondary data on prices of some selected commodities compiled on monthly basis by the Ghana Statistical Services (GSS). Secondary data was used for the study because it was found to be time saving and cost-effective. The data covered the entire country and was collected on the basis of Regions and by months. The study made use of nine Regions instead of ten

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(10) because the Ghana Statistical Service had lumped the Upper East and West Regions together as one – "Upper Region", for the purpose of collecting prices of commodities.

PRINCIPAL COMPONENTS

Principal component analysis is among the oldest and most widely used multivariate technique. Originally introduced by Pearson (1901) and independently by Hotelling (1993), the basic idea of the method is to describe the variatio of a set of multivariate data in terms of a set of uncorrelated variables, each of which is a particular linear combination of the original variables. The new variables are derived in decreasing order of importance so that, for example, the first principal component accounts for as much as possible of the variation in the original data. The second component is chosen to account for as much as possible in the remaining variation subject to being uncoreelated with the first component – and so on.

The usal objective of this type of analysis is to see whether the first few components accounts for most of the variations in the original data. If so, they can be used to summarize the data with little loss of information (Rencher, 2002).

Geometric Interpretation of Principal Components

Sharma (1996) gives an insight to principal component in his book titlled "Applied Multivariate Techniques":

> A data set consisting of 'P' variables can be represented graphically in a P-dimension space with respect to the original P axes or P new axes. The first new axis results in a new variable, such that this new variable accounts for the maximum of the total variation. After this, a second axis, orthogonal to the first axis, is identified such that the corresponding new variable accounts for the maximum of the total variance that has not been accounted for by the first new variable, and the two new variables are uncorrelated. This procedure is carried on untill all the P new axes have been identified such that the new variable accounts for successive maximum varianc and the variables are uncorrelated.

Thus, principal component analysis essentially reduces to identifying a new set of orthogonal axes.

Principal Component Analysis as a Dimensional Reduction Technique

As already mentioned, principal component analysis essentially reduces to identifying a new set of orthogonal axes. The principal component scores or the new variables are projections of points onto these axes. However, for the purpose of meeting the objective of principal components analysis it becomes prudent to work with a lower dimmensional space. If we have P variables, one may want to represent the data in a lower 'm'-dimensional space, where 'm' is much less than 'P'. Representing the data in a lower-dimensional space say 'm', instead of the original P-axes is referred to as dimensional reduction. Thus, principal components analysis can also be viewed as a dimensional reduction technique. But the question is; how well can the few new variable(s) represent the information

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contained in the data? Or geometrically, how well can we capture the configuration of the data in the reduced dimensional space? Thses and other matters are tackled under the section on issues relating to the use of principal components analysis. (Sharma, 1996)

Effect of Type of Data on Principal Components Analysis

Principal component analysis can be either done on mean-correlated or standardized data. As a result of this, each data set could give a different solution depending upon the extent to which the variance of the variables differs. In other words, variances of the variables could have an effect on principal component analysis. In general, the weight assigned to a variable is affected by the rlative variance of the variable. If we do not want the relative variance to affect the weights, then the data should be standardized so that the variance of each variable is the same (that is one). However, the choice between the analysis obtained from mean-corected and standardized data depends to a large extent on the objective of the study. If ther is no complling reason to believe that a particular variable is more important than the other, then all the variables should receive weights, ans as such standardized data should be used. On the other, if a particular variable is believed to be more important than the others then it will receive higher weights than those variables. In such a situation, mean-corrected data would be apprpriate (Hair et al. 2006)/

Is Principal Component Analysis the Appropriate Technique?

The issue to consider when deciding on whether principal components analysis is, or is not the appropriate technique is the objective of the study. If the objective of the studey is to reduce numerous variables to a manageable few, then principal components should be used. The principal components retained, should be much less than the number of original variables. In such a case, though, principal components analysis should only be performed if the data can be represented by a fewer number of principal components. However, if the objective is to form new variables that are uncorrelated, one should look at how easily these new variables can be interpreted before subjecting the study to principal components analysis. (Sharma, 1996)

Number of Principal Components to Extract

On how many principal components to retainm Johnson and Wicher (2007) gave some ad hoc procedure to be followed: Retain just enough components to explain some specified, large percentage of the total variation of the original variables. Values between 70% and 90% are usually suggested, although smaller values are appropriate as ‘p’ or ‘n’ [number of original variables] increases. Exclude those principal components, whose eigenvalues are less than the average, $\frac{\sum_i^p = \lambda_i}{p}$. Since $\sum_{i=1}^{p} = \lambda_i = trace(s)$, the average eigenvalue is also the average variance of the original variables. This method then retains those components that account for more variance than the average for the variables. When the components are extracted formthe component matrix, trace (R) = P and the average is therefore 1: components with eigenvalue less than one (1) are therfore excluded. (This rule was originally suggested by Kaiser, 1958, but Jolliffe, 1972, proposes on the basis of a number of

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

simulationstudies that a more appropriate procedure would be to exclude components extracted for a correlation matrix whose associated eigenvalues are less than 0.7.Leach, Barret and Morgan (2005) suggests examination of the plot λ_i against 'i', the so-called scree diagram (plot). The number of components selected is the value of 'I' corresponding to an 'elblow' in the curve, this point being considered to be where 'large' eigenvalues cease and 'small' eigenvalues begin. A modification described by Jolliffe (1986) is the log-eigenvalue diagram consisting of log (λ_i) against 'I'.

Interpretating Principal Component

Since principal components are linear combination of the original variables, it becomes imperative to assign a meaning to the linear combinations. The simple correlation between the original variables and the principal components (new variables) often called 'loadings' is useful in assigning a meaning to the principal components. The higher the loading for a variable, the more influence that particular variable has in the formation of the principal score and vice versa. To this end, one can look at the variables that are influential in forming a particular component, and assign a meaning to that principal component. Ther are no hard and fast rules as to what determines whether a particular loading is influential. But as a guide, researchers have chosen 0.5 or above as a cut off point. (Sharma, 1996)

Derivation of Principal Components

Suppose $X^T = \{X_1, X_2, ..., X_P\}$ is a P – dimensional random variable with mean, μ and covariance matrix $\sum$, we want to find a new set of variables, say, $Y_1, Y_2, ..., Y_P$, which are uncorrelated and whose variances decrease from first to last.

Each Y_i is taken to be a linear combination of the X, s, so that:

$$Y_i = a_{1i}x_1 + a_{2i}x_2 + a_{3i}x_3 + ... + a_{pi}x_{xp} = a_i^T x \quad \text{..... (1)}$$

Where

$$^{T}_{i} = \{a_{1i}, a_{2i}, a_{3i}, ..., a_{pi}\}$$

$$X = \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_3 \end{bmatrix}$$

(Sharma, 1996)

The condition

$$a_i^T a_i = \sum_{K=1}^{P} a_{ki} = 1$$

Which ensures that the distances in the P - space are preserved is imposed. The first principal component, "Y_1" is found by choosing "a_1" so that "Y_1" has the largest possible variance.

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

In other words, we choose "a_1", so as to maximize the variance of $a_i^T x$, subject to the constraints that $a_i^T a_i = 1$.

The second principal component, "Y_2" is found by choosing "a_2" so that Y_2 has the largest possible variance for all combinations of the form of equation one (1) which are uncorrelated with "Y_1".

Similarly, we derive Y_3, Y_4, Y_5, … Yp, so as to be uncorrelated and to have decreasing variances. We begin by finding the first principal component, "Y_1". We wish to choose "a_1" so as to maximize the variance of "Y_1" subject to the constraint that $a_i^T a_i = 1$.

Now

$$Var(Y_1) = Var(a_i^T x)$$
$$= a_i^T \sum a_1$$

Using the Langrange multiplier method, we have

$$L(a_1) = a_i^T \sum a_1 - \lambda(a_i^T a_1 - 1)$$
$$\Rightarrow \frac{\partial L(a_1)}{\partial a_1} = 2\sum a_1 - 2\lambda a_1$$
$$= 2a_1\left(\sum - \lambda I\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Setting this equation to zero we have

$$2\left(\sum - \lambda I\right)a_1 = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Thus a non-zero solution of equation (3) exists if and only if λ is an Eigen value of $\sum$ but $\sum$ will generally have P Eigenvalues. Suppose the eigenvalues are $\lambda_1 > \lambda_2 > \ldots \lambda_p > 0$, which one of these shall we choose to determine the first principal component?

Now,

$$Var(a_i^T x) = a_i^T \sum a_1$$
$$= a_i^T \lambda I_{a_1}$$
$$= \lambda$$

As we want to maximize this variance, we choose λ to the largest eigenvalue, namely λ_1. Then using equation (3) the principal component Y_1, which we are looking for must be the eigenvector of "$\sum$" corresponding to the largest eigenvalue.

The total population variance is given by $\lambda_1 + \lambda_2 + \lambda_3 + \ldots \lambda_p$ where $\lambda's$ are the eigenvalues associated with the covariance matrix $\sum$, and consquently, the proportion of the variance due to (explained by) the Kth principal component is:

(Proportion of the total population due to the Kth principal component)

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

$$= \left(\frac{\lambda_k}{\lambda_1 + \lambda_2 + \lambda_3 + \ldots \lambda_p}\right) * 100\%$$

If most (80% to 90%) of the total population variance for large 'P' can be attributed to the first principal component, or three principal components, then these components can replace the original variable without much loss of information. But what is meant by "without a substantial loss of information". This is best answred by looking at the objective of the study.

Index Numbers

Index numbers or simply indices are used mainly in economics and businesses to describe the percent change in price or a specified quantity from one period in time to another. The index is expressed as a percentage, although the percent (%) is usually omitted. Indices can be classified as:

(i) Price indices, whose purpose is to measure the change in prices from a given base year to another year (e.g. consumer price index)

(ii) Quantity indices, which portray change in quantity from base year to another year (e.g. index of industrial production).

(iii) Special-purpose indices that combine other indices to show change in business activity from one period to another.

Weighted and Unweighted indexes

Basically, what determine that a particular index is weighted or unweighted, are the units of measurements. An unweighted index can be affected by the relative units of the variables under study whiles a weighted index takes the relative units of the variables under study into considerations. Examples of weighted indexes are Laspeyres and the Paasche method and examples of the unweighted indexes are the 'simple average of the price relatives' and the simple aggregate index. Form the foregoing; it appears principal components for mean-correlated data is an unweighted index, whereas principal components for standardized data are a weighted index.

The Laspeyres method and the Paasche method differ only with respect to the period used for weighting. The Laspeyres method uses base-period weights; that is the original prices and quantities of the items bought are used to find the percent change over a period of time in either price or quantity consumed, depending on the problem. The Paasche uses current-year weights for the denominator of the weighted index (Mason et al. 1999).

Fishers's Ideal Index

Laspeyres index tends to overweight goods whose prices have increased. Paasche index, on the other hand tends to overweight goods whose prices have gone down. In an attempt to offset these shortcomings, Irvin Fisher, in his book, "The Making of Index Numbers published in 1922, proposed an index called Fisher's Ideal Index.

It is the gometric mean of the Laspeyres and Paasche indexes. Fisher's index seems to be theoretically ideal because it combines the best feature of both Laspeyres and Paasche, that is, it has the same basic

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set of problems as the Paasche index. This requeires that a new set of quantities be determined for each year.

ANALYSIS OF RESULTS AND DISCUSSION

This section gives the results of the principal component in deciding upon how many principal components should be retained. From Table A.1, the eienvalue greater-than-one rule suggests that for Ashanti Region, only the first principal component should be retained (eigenvalue, $\lambda_1 = 10.755$). The first principal component accounts for 89.622% of the variation in the prices of the commodities and this is highly significant.

From Table A.2, the eigenvalue greater-than-one rule suggests that for Brong-Ahafo Region, the first two principal component should be retained (eigenvalues are, $\lambda_1 = 10.051$ *and* $\lambda_2 = 1.136$). However, for the objective of this analysis, which is a comparative study of food prices by Regions to examine the cost of living situation in the Regions, only the first principal component was retained. Here, the first principal component could accounts for as much as 83.75% of the variation in the prices of commodities which is quite significant.

Table A.3 indicates that, the eignvalue greter-than-one rule suggest that for Central Region, only the first principal component should be retained (eigenvalue, $\lambda_1 = 10.694$). It accounts for 89.118% of the variation in the prices of the commodities and this is highly significant.
From Table A.4, the eigenvalue greater-than-one rule suggest that for Eastern Region, the first two principal components should be retained (eigenvalues are $\lambda_1 = 9.581$ *and* $\lambda_2 = 1.144$). But for the purpose of this study, the first principal component was retained and the amount of variation accounted for by the first principal component (that is 79.843%) which is quite significant for the first principal component to be used for further analysis.

Table A5 indicated the eigenvalue greater-than-one rule suggests that for Greater Accra Region, only the first principal component should be retained (eigenvalue, $\lambda_1 = 10.253$). The amount of variance explained by the first principal component is 85.438%, which is that significant.
Table A.6 showed that the eigenvalue greater-than-one rule suggests that for Northern Region only the first principal component should be retained (eigenvalue, $\lambda_1 = 9.531$). The amount of variation in the prices of the commodities accounted for by the first principal component is 79.428% and this is significant enough to achieve the objective of the study.

From Table A.7, the eignevalue greater-than-one rule suggest that for the Upper Regions (Upper East and Upper West), only the first principal componet should be retained (eigenvalue, $\lambda_1 = 9.835$). The amount of variation accounted by the first principal component is 81.957%, which, for the purpose of this study can be considered significant

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Also from Table A.8, the eigenvalue greater-than-one rule suggest that, for the Volta Region the first and second principal components should be retained (eigenvalues are $\lambda_1 = 9.947 \, and \, \lambda_2 = 1.010$). However, the second principal component does not account for significant amount of variation in the prices of the commodities (percentage variation accounted for by the second principal component is 8.147%). For the purpose of the study therefore, only the first principal component which accounted for a significant amont of variation in the prices of the commodities was maintained, (that is percentage variation accounted for by the first principal component is 82.892%).

Lastly, for Western Region, and from Table A.9, the eigenvalue greater-than-one rule suggests that the first and second principal component should be retained. However, the first principal component could explain 82.817% of the variationin the prices of the commodities. The second principal component could explain 11.588% which is not very significant compared with the first principal component. The study maintained just the first principal component for further analysis.

An index was developed for further analysis for the purpose of measuring the cost of living across the Region as the variables were coded as follows:

X_1 = Food and non-alcoholic beverages,

X_2 = Alcoholic beverages, tobacco and narcotics

X_3 = Clothinf and footwear

X_4 = Housing, water, electricity, gas and others

X_5 = Furniture, household equipment and routine maintenance

X_6 = Health

X_7 = Transport

X_8 = Communication

X_9 = Recreation and culture

X_{10} = Education

X_{11} = Hotels, cafés and restaurant

X_{12} = Miscellaneous goods and services

Then for, Ashanti Region, and from Table 4.1, the retained principal component P_{AR} is given as

$$P_{AR} = 0.092X_1 + 0.092X_2 + 0.090X_3 + 0.091X_4 + 0.092X_5 + 0.088X_6 + 0.091X_7 + 0.085X_8 + 0.088X_9 + 0.089X_{10} + 0.066X_{11} + 0.091X_{12}$$

For Brong-Ahafo Region, and from Table 4.2, the retained principal component P_{BAR} is given as

$$P_{BAR} = 0.098X_1 + 0.098X_2 + 0.097X_3 + 0.096X_4 + 0.098X_5 + 0.090X_6 + 0.090X_7 + 0.091X_8 + 0.097X_9 + 0.019X_{10} + 0.094X_{11} + 0.094X_{12}$$

For Central Region, and from Table 4.3, the retained principal component P_{CR} is given as

$$P_{CR} = 0.087X_1 + 0.092X_2 + 0.091X_3 + 0.090X_4 + 0.090X_5 + 0.087X_6 + 0.091X_7 + 0.086X_8 + 0.089X_9 + 0.086X_{10} + 0.090X_{11} + 0.079X_{12}$$

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

For Eastern Region, and from Table 4.4, the retained principal component, P_{ER} is given as

$$P_{ER} = 0.099X_1 + 0.102X_2 + 0.102X_3 + 0.099X_4 + 0.100X_5 + 0.069X_6 + 0.101X_7 + 0.086X_8 + 0.099X_9 + 0.083X_{10} + 0.066X_{11} + 0.102X_{12}$$

For Greater Accra Region, and from Table 4.5, the retained principal component, P_{GAR} is

$$P_{GAR} = 0.095X_1 + 0.095X_2 + 0.082X_3 + 0.090X_4 + 0.087X_5 + 0.084X_6 + 0.096X_7 + 0.090X_8 + 0.091X_9 + 0.085X_{10} + 0.095X_{11} + 0.091X_{12}$$

For Northern Region, and from Table 4.6, the retained principal component, P_{NR} is given as

$$P_{NR} = 0.097X_1 + 0.102X_2 + 0.103X_3 + 0.083X_4 + 0.100X_5 + 0.099X_6 + 0.093X_7 + 0.089X_8 + 0.100X_9 + 0.043X_{10} + 0.095X_{11} + 0.101X_{12}$$

For Upper Region, and from Table 4.7, the retained principal component, P_{UR} is given as

$$P_{UR} = 0.096X_1 + 0.097X_2 + 0.100X_3 + 0.098X_4 + 0.100X_5 + 0.079X_6 + 0.093X_7 + 0.090X_8 + 0.085X_9 + 0.077X_{10} + 0.090X_{11} + 0.095X_{12}$$

For Volta Region, and from Table 4.8, the retained principal component, P_{VR} is given as

$$P_{VR} = 0.097X_1 + 0.099X_2 + 0.095X_3 + 0.094X_4 + 0.098X_5 + 0.089X_6 + 0.098X_7 + 0.091X_8 + 0.091X_9 + 0.089X_{10} + 0.046X_{11} + 0.099X_{12}$$

For Western Region, and from Table 4.9, the retained principal component, P_{WR} is given as

$$P_{WR} = 0.098X_1 + 0.097X_2 + 0.100X_3 + 0.99X_4 + 0.099X_5 + 0.092X_6 + 0.095X_7 + 0.092X_8 + 0.091X_9 + 0.022X_{10} + 0.087X_{11} + 0.098X_{12}$$

For the purpose of comparing the cost of living on Regional basis, the study made use of the average prices of the commodities as follows:

For Ashanti Region, using P_{AR} and from Table B.1;

$$2008, P_{AR} = 105.52$$
$$2009, P_{AR} = 128.76$$
$$2010, P_{AR} = 148.85$$
$$2011, P_{AR} = 171.34$$
$$2012, P_{AR} = 199.13$$
$$2013, P_{AR} = 228.97$$

For Brong-Ahafo Region, using P_{AR} and from Table B.2;

$$2008, P_{BAR} = 106.28$$
$$2009, P_{BAR} = 134.03$$
$$2010, P_{BAR} = 152.40$$
$$2011, P_{BAR} = 173.53$$
$$2012, P_{BAR} = 214.30$$
$$2013, P_{BAR} = 220.29$$

For Central Region, using P_{CR} and from Table B.3;

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

2008, $P_{CR} = 105.85$
2009, $P_{CR} = 123.46$
2010, $P_{CR} = 152.79$
2011, $P_{CR} = 211.53$
2012, $P_{CR} = 261.00$
2013, $P_{CR} = 286.47$

For Eastern Region, using P_{ER} and from Table B.4;

2008, $P_{ER} = 110.84$
2009, $P_{ER} = 139.44$
2010, $P_{ER} = 156.14$
2011, $P_{ER} = 181.30$
2012, $P_{ER} = 204.75$
2013, $P_{ER} = 244.39$

For Greater Accra Region, using and from Table B.5;

2008, $P_{GAR} = 108.15$
2009, $P_{GAR} = 126.98$
2010, $P_{GAR} = 153.74$
2011, $P_{GAR} = 171.76$
2012, $P_{GAR} = 203.35$
2013, $P_{GAR} = 233.25$

For Northern Region, using P_{NR} and from Table B.6;

2008, $P_{NR} = 110.54$
2009, $P_{NR} = 134.39$
2010, $P_{NR} = 152.63$
2011, $P_{NR} = 186.56$
2012, $P_{NR} = 226.82$
2013, $P_{NR} = 241.50$

For Upper Region, using P_{UR} and from Table B.7;

2008, $P_{UR} = 110.05$
2009, $P_{UR} = 137.35$
2010, $P_{UR} = 155.95$
2011, $P_{UR} = 189.01$
2012, $P_{UR} = 210.83$
2013, $P_{UR} = 253.45$

For Volta Region, using P_{VR} and from Table B.8;

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

$2008, P_{VR} = 108.67$
$2009, P_{VR} = 130.35$
$2010, P_{VR} = 161.50$
$2011, P_{VR} = 186.21$
$2012, P_{VR} = 225.50$
$2013, P_{VR} = 274.31$

For Western Region, using P_{WR} and from Table B.9;

$2008, P_{WR} = 107.01$
$2009, P_{WR} = 134.99$
$2010, P_{WR} = 158.65$
$2011, P_{WR} = 200.68$
$2012, P_{WR} = 226.98$
$2013, P_{WR} = 259.56$

For the year 2008, we have the Regions in descending order and their corresponding cost of living measure as:

Eastern Region: 110.84
Northern Region: 110.54
Upper Region: 110.05
Volta Region: 108.67
Greater Accra Region: 108.15
Western Region: 107.01
Brong-Ahafo Region: 106.28
Central Region: 105.85 and
Ashanti Region: 105.52

For the year 2009, we have the Regions in descending order and their corresponding cost of living measure as:

Eastern Region: 139.44
Upper Region: 137.35
Western Region: 134.99
Northern Region: 134.39
Brong-Ahafo Region: 134.03
Volta Region: 130.35
Ashanti Region: 128.76
Greater Accra Region: 126.98 and
Central Region: 123.46

For 2010, we hae the Regions in descending order and their corresponding cost of living measure as:

Volt Region 161.50
Western Region: 158.65

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Eastern Region: 156.14
Upper Region: 155.95
Greater Accra Region: 153.74
Central Region: 152.79
Northern Region: 152.63
Brong-Ahafo Region: 152.40 and
Ashanti Region: 148.85

For 2011, we have the Regions in descending order and their corresponding cost of living measure as:

Central Region: 211.53
Western Region: 206.68
Upper Region: 189.01
Northern Region: 186.56
Volta Region: 186.21
Eastern Region: 181.30
Brong-Ahafo Region: 173.53
Greater Accra Region: 171.76 and
Ashanti Region: 171.34

For 2012, we have the Regions in descending order and their corresponding cost of living measure as:

Central Region: 261.00
Western Region: 226.98
Northern Region: 226.82
Volta Region: 225.50
Brong-Ahafo Region: 214.30
Upper Region: 210.83
Eastern Region: 204.75
Greater Accra Region: 203.35 and
Ashanti Region: 199.13

For 2013, we have the Regions in descending order and their corresponding cost of living measure as:

Central Region: 286.47
Volta Region: 274.31
Western Region: 259.56
Upper Region: 253.45
Brong-Ahafo Region: 250.29
Eastern Region: 244.39
Northern Region: 241.50
Greater Accra Region: 233.25 and
Ashanti Region: 228.97

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

As to which commodity has impact on the cost of living and which commodity does not, a look at the communalitie will help answer this question. Basically, the communalities explain the amount of variance or variation in each variable that is accounted for. Therefore, the higher the value of the communality for a variable, the more the variable can explain variations in the data.

\For Ashanti Region (refer to Table C.1), 'Alcoholic beverages, tobacco and narcotics' generally has the greatest impact on the cost of living with a communality of 0.972 and Hotels, cafés and restaurants has the least impact on the cost of living with a communality of 0.511, with the other commodities falling in between these two.

For Brong-Ahafo Region (refer to Table C.2), "Alcoholic beverages, tobacco and narcotics' generally has the highest impact on the cost of living with a communality of 0.979 and the variable that had the least impact on the cost oof living with a communality of 0.850, was communication.

For Central Region, (refer to Table C.3) the greatest impact on the cost of living was made by Alcoholic beverages, tobacco and narcotics with a communality of 0.965. Miscellaneous goods and services on the other hand made the least impact on the cost of living with a communality of 0.722

For Eastern Region (refer to Table C.4), again Alcoholic beverages, tobacco and narcotics had the greatest impact on the cost of living with a communality of 0.979. Education on the other hand had the least impact on the cost of living with a communality of 0.725.

Greater Accra Region had the greatest and least impacts made be 'transport' and 'clothing and footwear' respectively with their communality being 0.962 and 0.704 (refer to Table C.5).

For Northern Region (refer to Table C.6), clothing and footwear made the highest impact on the cost of living by recording a communality of 0.961. Education made the least impact on the cost of living eith a communality of 0.169.

Upper Region had the greatest and least impacts made by 'clothing and footwear' and education respectively, with their respective communalities being 0.976 and 0.575 (refer to Table C.7).

For Volta Region (refer to Tablee C.8), Alcoholic bevereage, tobacco and narcotics made the highest impact on the cost of living with a communality of 0.981. Health on the other hand made the least impact with a communality of 0.789

Western Region had the greatest and least impacts made by 'clothing and footwear' and communication respectively, with their communalities being 0.987 and 0.852 (refer to Table C.9)

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

From Table 4.10, the cost of living measure for the nine Regions have been ranked from one (1) to nine (9), with one (1) referring to the Region with the highest cost of living and nine (9) the least, based on the cost of living indices developed above.

For 2008, Eastern Region which had the highest cost of livng measure (110.84), will thus be ranked one (1), followed by Northern Region (110.54), Upper Region (110.05), Volta Region (108.67), Greater Accra Region (108.15), Western Region (107.01), Brong-Ahafo Region (106.28), Central Region (105.85) and the Ashanti Region (105.52) which will be ranked respectively as second, third, fourth, fifth, sixth, seventh, eithth and ninth. The same principle was used to rank the Regions for the years 2009 to 2013.

CONCLUSION

The principal issue expounded in this study was the development of a statistical model which would assist in the report on the cost of living of Ghanainans. To this end, principal component – a multivariate data analysis tool – was applied to the data (from the Ghana Statistical Service) using (Statistical Package for Service Solution and Minitab) and this developed nine (9) principal components (indices). With these indices, a comprehensive, comparative analysis of the cost of living for the nine Regions was carried out.

From Table 4.10, Western, Upper, Volta and the Northern were the Regions with the highest cost of living for the period under study. With the exception of the year 2002 which had Western Region ranked sixth (6^{th}) on a scale of one (1) to nine (9) in terms of cost of living, it always featured amongst the first four Regions with the highest cost of living (ranked third, second, second, second and third respectively in 2009, 2010, 2011, 2012 and 2013).

The Volta and Northern Regions also featured amongst the first four Regions with high cost of living, displaying similar patterns as the Western and Upper Regions. With the exception of the years 2003 and 2005 where the Volta Region ranked sixth and fifth respectively, it ranked fourth, first, fourth and second respectively in 2008, 2010, 2012 and 2013. The Northern Region ranked second, fourth, fourth and third respectively in 2008, 2009, 2011 and 2012 and ranked seventh in 2010 and 2013.

Central, Eastern, Brong-Ahafo, Greater Accra and Ashanti Regions on the other hand are better placed in terms of the cost of livng in these Regions. These Regions are spread between the fifth and ninth in terms of the ranks for the cost of living. Particularly, Ashanti Region appears to be the Region with the lowest cost of living for all the years with the exception of 2009, where it ranked seventh (7^{th}).

These results do not generally deviate from the cost of living situation as it pertains to the Western, Upper, Volta and the Northern Regions. When the economic situation was reviewed, it was seen that the standard of living was particularly low in the three Northern Regions and some towns along the coast. Perhaps these are due to the apparent high cost of living and generally lower average incomes in

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

these Regions. One should bear in mind that there could be a situation where the cost of living is high but people have just enough income to live on, and so standard of living may not be necessarily be low. For instance a village community where most homes do not own refrigerators, cars, television sets, and have no electricity; then the standard of living for this village may not be high, but if most of these homes are not living hand to mouth, well sheltered and clothed and can not feed well, then the standard of living may not be low either. It is commonly said that prices of commodities and services in mining and oil communities like Tarkwa and Takoradi is high. This is perhaps attributable to the fact that a good proportion of the people in these communities earns good salaries and do not feel constrained by lackof funds not to buy, which does help in keeping prices at resonalble levels.

Chieftancy and tribal disputes may be factors that have a negative effect on the cost of living situation in the three Northern Regions. Potential investors, who find the Northern part of the country 'attractive' to do business with, will feel reluctant to do so because discord and strife amongst the people will not augur well for their business and may put their investment at risk. Consequently, the lack of investments in these areas will mean fewer income generation opportunities and lack of services and commodities which will in turn drive prices up and with it the cost of living.

Could it also be that the cost of living being high in the Northern Regions is as a result of these Regions being far from the ports and as such the high cost of transportating commodities to the Northern Regions adds to the prices of commodities which translate into high cost of living? Perhaps, this is an issue that warrants further investigation. Is it also possible that the high cost of living in the Norther regios is as a result of absence of industries in the Region, which makes the prices of some essential commodities which are imported form the industrialized Regions into the Norther rgion to increase? This too is an issue that calls for further investigation.

During the fishing season, most market women move large quantities of fish form the coastal towns and Regions into the hinterlands. One will thus find the prices of fish in Ashanti Region to be cheaper compared to say, the Western Region and Volta Region. This is because; the fish that is left behind after the market women have moved their stock will now sell on the market at a higher price. People will have to buy the same quantity of fish at higher prices which can potentially translate into a high cost of living in coastal Regions like Western and Volta Region.

From the communalities (refer to Table D.1-9), discussed 'Alcoholic beverages, tobacco and narcotics' seem to be a force in determing the cost of living for Ashanti Region, Brong-Ahafo Region, Central Region, Eastern Region and the Volta Region. The question of interest when is what could be contributing to 'alcoholic beverages, tobacco and narcotics' being a major factor in determining the cost of living in Ashanti, Brong-Ahafo, Central, Eastern and the Volta Region? Is it that the consumption aof alcoholic beverage is high in these Regions and for this reason, the demand for these drinks is also high and this forces the prices of alcoholic beverages to rise? Perhaps, this issue should be looked in to.

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Perhaps it is a little wonder that transportation is a major determining factor in the cost of living in the Greater Accra Region considering the amount of commuting the average person does in the Region.

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Table A.1: Total Variance Explained for Ashanti Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	10.7555	89.622	89.622	10.755	89.622	98.622
2	.617	5.142	94.764			
3	.218	1.817	96.581			
4	.129	1.077	97.658			
5	.097	.808	98.466			
6	.048	.401	98.867			
7	.043	.359	99.255			
8	.033	.275	99.501			
9	.020	.168	99.669			
10	.018	.148	99.816			
11	.014	.120	99.937			
12	.008	.063	100.000			

Extraction Method: Principal Component Analysis

Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table A.2: Total Variance Explained for Brong-Ahafo Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	10.051	83.754	83.754	10.051	83.754	83.754
2	1.136	9.469	93.224	1.136	9.469	93.224
3	.240	1.997	95.220			
4	.201	1.672	96.892			
5	.102	.854	97.746			
6	.072	.600	98.346			
7	.066	.549	98.895			
8	.059	.492	99.387			
9	.030	.250	99.637			
10	.024	.196	99.833			
11	.011	.095	99.928			
12	.009	.072	100.000			

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table A.3: Total Variance Explained for Central Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	10.694	89.118	89.118	10.694	89.118	89.118
2	.435	3.628	92.747			
3	.325	2.707	95.454			
4	.143	1.192	96.646			
5	.114	9.52	97.598			
6	.077	.640	98.238			
7	.062	.518	98.756			
8	.054	.450	99.206			
9	.043	.356	99.561			
10	.023	.194	99.756			
11	.021	.178	99.934			
12	.008	.066	100.000			

Extraction Method: Principal Component Analysis
Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table A.4: Total Variance Explained for Eastern Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	9.581	79.843	79.843	9.581	79.843	79.843
2	1.144	9.537	89.381	1.114	9.533	89.381
3	.514	4.283	93.663			
4	.305	2.541	96.204			
5	.202	1.684	97.888			
6	.103	.860	98.748			
7	.056	.466	99.214			
8	.030	.247	99.461			
9	.021	.172	99.633			
10	.019	.159	99.792			
11	.016	.133	99.925			
12	.009	.075	100.000			

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table A.5: Total Variance Explained for Greater Accra Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	10.235	85.438	92.647	10.253	85.438	85.438
2	.865	7.209	95.854			
3	.385	3.207	97.064			
4	.145	1.210	97.930			
5	.104	.866	98.588			
6	.079	.658	99.086			
7	.060	.498	99.436			
8	.042	.351	99.649			
9	.026	.213	99.802			
10	.018	.153	99.802			
11	.015	.127	99.930			
12	.008	.070	100.000			

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table A.6: Total Variance Explained for Northern Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	9.531	79.428	79.428	93.531	79.428	79.428
2	.867	7.223	86.651			
3	.567	4.726	91.377			
4	.288	2.399	93.776			
5	.288	1.903	95.679			
6	.214	1.783	97.462			
7	.114	.951	98.413			
8	.067	.560	98.974			
9	.062	.517	99.490			

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

10	.038	.317	99.807
11	.016	.134	99.940
12	.007	.060	100.000

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table A.7: Total Variance Explained for Upper Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	9.835	81.957	81.957	9.835	81.957	81.957
2	.724	6.032	87.989			
3	.471	3.928	91.917			
4	.297	2.478	94.395			
5	202	1.680	96.075			
6	1130	1.085	97.160			
7	.127	1.061	98.222			
8	.085	.712	98.933			
9	.074	.621	99.554			
10	.031	.256	99.810			
11	.013	.108	100.000			
12	.010	.083				

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table A.8: Total Variance Explained for Volta Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	9.947	82.892	82.892	9.947	82.982	82.892
2	1.010	8.417	91.309	1.010	8.417	91.309
3	.325	2.709	94.019			
4	.207	1.726	95.745			
5	.170	1.415	97.160			
6	.120	.999	98.159			
7	.080	.666	98.825			
8	.051	.426	99.251			
9	.035	.294	99.545			
10	.032	.265	99.811			
11	.017	.141	99.951			
12	.006	.049	100.000			

Extraction Method: Principal Component Analysis
Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table A.9: Total Variance Explained for Western Region

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cummulative %	Total	% of Varianc	Cummulative %
1	9.938	82.817	82.817	9.938	82.817	82.817
2	1.391	11.588	94.406	1.391	11.588	94.406
3	.242	2.020	96.425			
4	.130	1.080	97.505			
5	.086	.714	98.219			
6	.071	.588	98.808			
7	.050	.420	99.228			
8	.039	.328	99.556			
9	.024	.198	99.754			
10	.011	.094	99.849			
11	.010	.084	99.933			
12	.008	.067	100.000			

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.1: Component score coefficient matrix for Ashanti Region

Description	Component 1
Food and non alcoholic beverages	.092
Alcoholic beverages, tobacco and narcotics	.092
Clothing and footwear	.090
Housing, water, electricity, gas and others	.091
Furnishing, household equipment and routine maintenance	.092
Health	.088
Transport	.091
Communication	.085
Recreation and culture	.088
Educatio	.089
Hotels, cafés and restaurants	.066
Miscellaneous goods and services	.091

Extraction Method: Principal Component Analysis
Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table 4.2: Component score coefficient matrix for Brong-Ahafo Region

Description	Component	
	1	2
Food and non alcoholic beverages	.098	-.015
Alcoholic beverages, tobacco and narcotics	.098	0.19
Clothing and footwear	.097	.065
Housing, water, electricity, gas and others	.096	-.002
Furnishing, household equipment and routine maintenance	.098	092
Health	.090	-.210
Transport	.090	-.244
Communication	.091	.071
Recreation and culture	.097	.038
Educatio	.019	.848
Hotels, cafés and restaurants	.094	.130
Miscellaneous goods and services	.094	-.143

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.3: Component score coefficient matrix for Central Region

Description	Component
	1
Food and non alcoholic beverages	.087
Alcoholic beverages, tobacco and narcotics	.092
Clothing and footwear	.091
Housing, water, electricity, gas and others	.090
Furnishing, household equipment and routine maintenance	.090
Health	.087
Transport	.091
Communication	.086
Recreation and culture	.089
Educatio	.089
Hotels, cafés and restaurants	.090
Miscellaneous goods and services	.079

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.4: Component score coefficient matrix for Eastern Region

Description	Component	
	1	2
Food and non alcoholic beverages	.099	.127
Alcoholic beverages, tobacco and narcotics	.102	-.154
Clothing and footwear	.102	.059
Housing, water, electricity, gas and others	.099	-.150
Furnishing, household equipment and routine maintenance	.100	-.163
Health	.069	.517
Transport	.101	-.124
Communication	.086	.219
Recreation and culture	.099	-.189

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Educatio	.083	-.271
Hotels, cafés and restaurants	.066	.575
Miscellaneous goods and services	.102	-.104

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.5: Component score coefficient matrix for Greater Accra Region

Description	Component 1
Food and non alcoholic beverages	.095
Alcoholic beverages, tobacco and narcotics	.095
Clothing and footwear	.082
Housing, water, electricity, gas and others	.090
Furnishing, household equipment and routine maintenance	.087
Health	.084
Transport	.096
Communication	.090
Recreation and culture	.091
Educatio	.085
Hotels, cafés and restaurants	.095
Miscellaneous goods and services	.091

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.6: Component score coefficient matrix for Northern Region

Description	Component 1
Food and non alcoholic beverages	.097
Alcoholic beverages, tobacco and narcotics	.102
Clothing and footwear	.103
Housing, water, electricity, gas and others	.083
Furnishing, household equipment and routine maintenance	.100
Health	.099
Transport	.093
Communication	.089
Recreation and culture	.100
Educatio	.043
Hotels, cafés and restaurants	.095
Miscellaneous goods and services	.101

Extraction Method: Principal Component Analysis.095
Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table 4.7: Component score coefficient matrix for Upper Region

Description	Component 1
Food and non alcoholic beverages	.096
Alcoholic beverages, tobacco and narcotics	.097
Clothing and footwear	.100
Housing, water, electricity, gas and others	.098
Furnishing, household equipment and routine maintenance	.100
Health	.079
Transport	.093
Communication	.090
Recreation and culture	.085
Educatio	.077
Hotels, cafés and restaurants	.090
Miscellaneous goods and services	.095

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.8: Component score coefficient matrix for Volta Region

Description	Component	
	1	2
Food and non alcoholic beverages	.097	.110
Alcoholic beverages, tobacco and narcotics	.099	-.113
Clothing and footwear	.095	.181
Housing, water, electricity, gas and others	.094	.015
Furnishing, household equipment and routine maintenance	.098	.088
Health	.089	-.043
Transport	.098	-.125
Communication	.091	.031
Recreation and culture	.091	-.179
Educatio	.089	-.355
Hotels, cafés and restaurants	.046	.863
Miscellaneous goods and services	.099	-.052

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.9: Component score coefficient matrix for Western Region

Description	Component	
	1	2
Food and non alcoholic beverages	.098	.030
Alcoholic beverages, tobacco and narcotics	.097	-.156
Clothing and footwear	.100	.000
Housing, water, electricity, gas and others	.099	-.005
Furnishing, household equipment and routine maintenance	.099	.032
Health	.092	.225
Transport	.095	-.206
Communication	.092	-.079

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Recreation and culture	.091	-.170
Educatio	.022	.684
Hotels, cafés and restaurants	.087	.295
Miscellaneous goods and services	.098	-.100

Extraction Method: Principal Component Analysis
Source: Output from SPSS

Table 4.10: Cost of living scores for the nine Regions by ranks

REGIONS	RANK					
	2008	2009	2010	2011	2012	2013
Western	6	3	2	2	2	3
Upper	3	2	4	3	6	4
Volta	4	6	1	5	4	2
Northern	2	4	7	4	3	7
Central	8	9	6	1	1	1
Eastern	1	1	3	6	7	6
Brong-Ahafo	7	5	8	7	5	5
Greater Accra	5	8	5	8	8	8
Ashanti	9	7	9	9	9	9

Source: Output from SPSS

Table B.1: Average prices of commodities for Ashanti Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.1033	123.6792	136.0383	154.1375	172.1642	196.4762
Alcoholic Beverages, Tobacco and Narcotic	100.0008	110.7033	123.3892	146.3733	167.4125	181.8667
Clothing and Footwear	99.98833	102.5708	115.6092	131.555	152.1267	154.7167
Housing , Water, Electricity, Gas and others	99.99833	158.5017	179.2117	211.8133	280.7392	298.625
Furnishings, Household Equipment and Routine Mentainance	100.0050	105.1358	117.0392	132.2108	143.0392	164.1933
Health	100.0000	135.2850	149.3633	184.5833	191.8542	226.48
Transport	100.0008	145.7000	167.4267	232.4092	296.3433	359.7092
Communications	100.0017	124.4908	166.6183	156.0092	173.6567	224.436
Recreation and Culture	100.0017	119.5133	145.3508	165.9567	252.1300	297.1558
Education	100.0033	106.7900	108.7100	111.4217	119.15000	119.1500
Hotels, Cafes and Restaurants	100.1250	128.7717	172.9450	195.4450	152.1533	194.5492
Miscellaneous Goods and Services	100.0217	105.7017	121.7750	135.6700	154.375	182.7042

Source: Output from Excel

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table B.2: Average prices of commodities for Brong-Ahafo Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.0592	116.7567	133.652	145.2092	176.5758	192.6783
Alcoholic Beverages, Tobacco and Narcotic	100.0317	118.9642	134.1767	149.2933	166.5183	187.4325
Clothing and Footwear	100.0017	112.9683	123.7375	137.8158	145.0133	159.3625
Housing , Water, Electricity, Gas and others	100.0017	161.2375	174.8658	214.6008	244.4833	315.4808
Furnishings, Household Equipment and Routine Mentainance	99.9983	113.8650	125.3758	132.6200	141.3683	155.0683
Health	99.9992	125.1783	130.9325	129.1425	208.7967	246.0588
Transport	100.0000	152.4358	151.0475	210.2550	421.8233	438.0058
Communications	99.9975	142.7158	170.0133	161.9892	180.8867	242.7283
Recreation and Culture	100.0000	105.9550	130.6783	149.9383	165.7875	187.0217
Education	100.0000	100.2583	118.82	114.0920	105.5833	105.6292
Hotels, Cafes and Restaurants	100.0267	140.6125	194.78	254.3142	254.5617	336.5108
Miscellaneous Goods and Services	100.6883	105.9250	116.8717	125.5625	158.1225	177.2350

Source: Output from Excel

Table B.3: Average prices of commodities for Central Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	101.43417	94.8500	106.9967	117.6242	132.4267	152.4333
Alcoholic Beverages, Tobacco and Narcotic	100.09833	121.7008	141.4433	151.4525	176.3258	197.6592
Clothing and Footwear	99.9992	113.9200	132.7458	151.8375	159.2775	167.2117
Housing , Water, Electricity, Gas and others	100.0000	166.1733	183.1792	320.8858	433.6967	502.5408
Furnishings, Household Equipment and Routine Mentainance	98.9333	101.2242	108.3825	119.6317	124.0250	141.3542
Health	100.0000	104.9592	182.5617	541.3733	752.1425	706.8017
Transport	99.9992	174.3467	158.7492	201.76	274.9092	318.5500
Communications	99.9983	115.6575	158.7492	201.76	274.9092	318.5500
Recreation and Culture	100.0008	118.3775	135.2250	163.5558	191.7575	221.0708
Education	100.0000	107.69	111.5350	115.3800	119.1500	119.1500
Hotels, Cafes and Restaurants	99.9992	92.7717	144.8300	193.1767	246.595	289.1167
Miscellaneous Goods and Services	100.1408	113.2858	157.1058	156.9275	161.5925	175.1133

Source: Output from Excel

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Table B.4: Average prices of commodities for Eastern Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.0342	136.2400	160.8792	182.7725	191.2358	208.635
Alcoholic Beverages, Tobacco and Narcotic	100.1150	111.8858	130.8908	156.2267	190.3825	223.4908
Clothing and Footwear	100.0017	118.8783	133.3692	145.2617	156.6558	167.9567
Housing , Water, Electricity, Gas and others	100.0017	147.1375	164.3617	264.1958	361.2592	467.8600
Furnishings, Household Equipment and Routine Mentainance	100.0233	100.7242	113.3558	123.8733	133.9042	160.2525
Health	100.0000	113.0233	137.8525	140.4383	125.2175	135.2492
Transport	100.0000	119.3058	153.1458	189.5475	224.8525	272.2908
Communications	100.0017	162.5008	167.7575	157.6525	175.6317	229.4417
Recreation and Culture	100.0150	101.6358	108.3125	129.4900	147.5833	167.1708
Education	99.9967	106.3800	107.0350	108.9717	133.1000	161.0000
Hotels, Cafes and Restaurants	100.0650	215.3308	201.4867	239.2483	205.0000	246.0250
Miscellaneous Goods and Services	100.2100	106.3917	130.8225	135.8767	153.2075	183.8317

Source: Output from Excel

Table B.5: Average prices of commodities for Greater Accra Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.0817	115.4375	132.7183	166.7108	159.9667	174.27
Alcoholic Beverages, Tobacco and Narcotic	100.1000	118.3825	136.1558	170.1725	226.0333	254.4133
Clothing and Footwear	100.0700	100.9283	119.7608	133.2850	150.9033	166.6967
Housing , Water, Electricity, Gas and others	100.0008	170.0925	200.8025	272.5042	472.7400	320.9917
Furnishings, Household Equipment and Routine Mentainance	100.0317	111.5683	125.4933	137.2042	154.6983	157.6408
Health	100.0000	114.8817	120.3475	184.8517	236.3767	304.9392
Transport	100.0000	138.8467	129.3475	184.8517	236.3767	304.9392
Communications	99.9992	143.3267	166.6875	155.5833	173.1433	223.1367
Recreation and Culture	100.0000	108.7542	144.5483	165.6267	186.0525	228.3008
Education	99.9992	101.6550	108.0233	136.7025	133.7225	162.6108
Hotels, Cafes and Restaurants	100.0725	129.0642	139.6133	173.1642	163.6208	193.0733
Miscellaneous Goods and Services	100.0200	107.875	130.4795	143.4533	148.6225	161.3125

Source: Output from Excel

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Table B.6: Average prices of commodities Northern Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.0817	115.4375	132.7183	166.7108	159.9667	174.2700
Alcoholic Beverages, Tobacco and Narcotic	100.1000	118.3825	136.1558	170.1725	226.0333	254.4133
Clothing and Footwear	100.0700	100.9283	119.7608	133.2850	150.9033	166.6967
Housing , Water, Electricity, Gas and others	100.0008	170.0925	200.8025	272.5042	472.7400	320.9917
Furnishings, Household Equipment and Routine Mentainance	100.0317	111.5683	125.4933	137.2042	154.6983	157.6408
Health	100.0000	114.8817	120.3475	184.8517	236.3767	304.9392
Transport	100.0000	138.8467	129.3092	187.5492	261.0108	264.0900
Communications	99.9992	143.3267	166.6875	155.5833	173.1433	223.1367
Recreation and Culture	100.0000	108.7542	144.5483	165.6267	186.0525	228.3008
Education	99.9992	101.6550	108.0233	136.7025	133.7225	162.6108
Hotels, Cafes and Restaurants	100.0725	129.0642	139.6133	173.1642	163.6208	193.0733
Miscellaneous Goods and Services	100.0200	107.8750	130.4792	143.4533	148.6225	161.3125

Source: Output from Excel

Table B.7: Average prices of commodities for Upper Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.4150	118.5642	137.6342	167.0550	162.9050	181.4092
Alcoholic Beverages, Tobacco and Narcotic	100.0067	119.1783	129.7175	160.3608	192.8567	198.9958
Clothing and Footwear	99.9992	112.7450	131.5792	146.3342	159.2875	178.5350
Housing , Water, Electricity, Gas and others	100.0000	163.4267	184.4108	217.1883	310.5908	334.5767
Furnishings, Household Equipment and Routine Mentainance	99.9992	113.0242	121.7758	132.9908	152.2392	172.7450
Health	100.0000	115.0017	123.7533	224.1192	274.2075	309.2317
Transport	100.0000	162.9300	140.2633	182.6017	205.8555	243.8450
Communications	100.0000	154.4742	173.2358	168.2592	188.4033	261.7383
Recreation and Culture	100.0367	100.4442	140.9017	123.2117	151.6058	167.8825
Education	99.9992	101.1775	110.7367	195.0233	158.1225	203.1467
Hotels, Cafes and Restaurants	99.9992	128.3392	182.4825	231.9975	211.2017	350.8500
Miscellaneous Goods and Services	100.0242	103.0592	120.0650	126.3567	137.4767	175.4575

Source: Output from Excel

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table B.8: Average prices of commodities for Volta Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	100.4450	119.7350	170.9592	195.4317	217.0025	241.0233
Alcoholic Beverages, Tobacco and Narcotic	100.0858	102.6292	111.2775	125.9467	142.4092	155.3517
Clothing and Footwear	99.9867	116.1267	121.4933	137.8158	147.2908	145.1958
Housing , Water, Electricity, Gas and others	99.9983	164.7692	174.5075	191.8933	235.2983	255.2150
Furnishings, Household Equipment and Routine Mentainance	100.0017	113.5583	131.9733	167.9942	177.4550	198.5333
Health	99.9992	131.6708	239.9667	277.2975	368.0333	661.8633
Transport	100.0000	137.6858	154.0225	225.2192	306.0233	358.8308
Communications	100.0000	154.4742	173.2358	168.2592	188.4033	261.7383
Recreation and Culture	100.0367	100.4442	140.9017	123.2117	151.6058	167.8825
Education	99.9992	1011775	110.7367	195.0233	158.1225	203.1467
Hotels, Cafes and Restaurants	99.9992	128.3392	182.4825	231.9975	211.2017	350.8500
Miscellaneous Goods and Services	100.0242	103.0592	120.0650	126.3567	137.4767	175.4575

Source: Output from Excel

Table B.9: Average prices of commodities for Western Region

Description	2008	2009	2010	2011	2012	2013
Food and Non-Alcoholic Beverages	99.9475	126.9558	164.9375	187.3383	209.6808	225.6692
Alcoholic Beverages, Tobacco and Narcotic	100.0808	113.0333	121.2408	136.0825	161.6617	182.5917
Clothing and Footwear	100.0000	118.8983	139.8142	165.6983	183.6525	202.6525
Housing , Water, Electricity, Gas and others	100.0000	157.2400	174.0708	211.4200	246.9192	269.0817
Furnishings, Household Equipment and Routine Mentainance	100.0008	115.5300	133.9358	174.2575	184.3600	210.3358
Health	99.9992	132.6225	142.5917	178.0767	164.2800	181.3867
Transport	100.0008	137.3608	138.9317	223.2733	349.8058	413.5158
Communications	100.0025	121.7192	171.7658	167.2408	184.9767	253.0717
Recreation and Culture	100.0383	103.4900	129.4033	213.6442	300.0658	336.4525
Education	100.0000	113.9925	156.5142	295.0555	121.3508	121.3508
Hotels, Cafes and Restaurants	100.0308	161.3758	194.02	246.2917	208.5717	249.6417
Miscellaneous Goods and Services	99.9992	104.8933	122.7808	143.1025	165.3350	181.0700

Source: Output from Excel

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table C.1: Communalities for Ashanti Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.970
Alcoholic Beverages, Tobacco and Narcotic	1.000	.972
Clothing and Footwear	1.000	.928
Housing , Water, Electricity, Gas and others	1.000	.955
Furnishings, Household Equipment and Routine Mentainance	1.000	.969
Health	1.000	.901
Transport	1.000	.955
Communications	1.000	.838
Recreation and Culture	1.000	.888
Education	1.000	.914
Hotels, Cafes and Restaurants	1.000	.511
Miscellaneous Goods and Services	1.000	.955

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.2: Communalities for Brong-Ahafo Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.969
Alcoholic Beverages, Tobacco and Narcotic	1.000	.979
Clothing and Footwear	1.000	.962
Housing , Water, Electricity, Gas and others	1.000	.934
Furnishings, Household Equipment and Routine Mentainance	1.000	.975
Health	1.000	.870
Transport	1.000	.893
Communications	1.000	.850
Recreation and Culture	1.000	.947
Education	1.000	.967
Hotels, Cafes and Restaurants	1.000	.913
Miscellaneous Goods and Services	1.000	.928

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.3: Communalities for Central Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.875
Alcoholic Beverages, Tobacco and Narcotic	1.000	.965
Clothing and Footwear	1.000	.940
Housing , Water, Electricity, Gas and others	1.000	.933
Furnishings, Household Equipment and Routine Mentainance	1.000	.924
Health	1.000	.858
Transport	1.000	.949
Communications	1.000	.848
Recreation and Culture	1.000	.915
Education	1.000	.847
Hotels, Cafes and Restaurants	1.000	.919

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Miscellaneous Goods and Services	1.000	.722

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.4: Communalities for Eastern Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.925
Alcoholic Beverages, Tobacco and Narcotic	1.000	.979
Clothing and Footwear	1.000	.956
Housing , Water, Electricity, Gas and others	1.000	.936
Furnishings, Household Equipment and Routine Mentainance	1.000	.961
Health	1.000	.786
Transport	1.000	.960
Communications	1.000	.740
Recreation and Culture	1.000	.955
Education	1.000	.725
Hotels, Cafes and Restaurants	1.000	.840
Miscellaneous Goods and Services	1.000	.963

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.5: Communalities for Greater Accra Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.951
Alcoholic Beverages, Tobacco and Narcotic	1.000	.944
Clothing and Footwear	1.000	.704
Housing , Water, Electricity, Gas and others	1.000	.855
Furnishings, Household Equipment and Routine Mentainance	1.000	.792
Health	1.000	.743
Transport	1.000	.962
Communications	1.000	.843
Recreation and Culture	1.000	.873
Education	1.000	.759
Hotels, Cafes and Restaurants	1.000	.955
Miscellaneous Goods and Services	1.000	.872

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.6: Communalities for Northern Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.859
Alcoholic Beverages, Tobacco and Narcotic	1.000	.951
Clothing and Footwear	1.000	.961
Housing , Water, Electricity, Gas and others	1.000	.619
Furnishings, Household Equipment and Routine Mentainance	1.000	.900
Health	1.000	.899
Transport	1.000	.782

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Communications	1.000	.722
Recreation and Culture	1.000	.916
Education	1.000	.169
Hotels, Cafes and Restaurants	1.000	.818
Miscellaneous Goods and Services	1.000	.936

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.7: Communalities for Greater Upper Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.892
Alcoholic Beverages, Tobacco and Narcotic	1.000	.911
Clothing and Footwear	1.000	.976
Housing , Water, Electricity, Gas and others	1.000	.937
Furnishings, Household Equipment and Routine Mentainance	1.000	.971
Health	1.000	.611
Transport	1.000	835
Communications	1.000	.788
Recreation and Culture	1.000	.691
Education	1.000	.575
Hotels, Cafes and Restaurants	1.000	.775
Miscellaneous Goods and Services	1.000	.874

Extraction Method: Principal component Analysis
Source: Output from SPSS

Table C.8: Communalities for Volta Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.938
Alcoholic Beverages, Tobacco and Narcotic	1.000	.981
Clothing and Footwear	1.000	.925
Housing , Water, Electricity, Gas and others	1.000	.877
Furnishings, Household Equipment and Routine Mentainance	1.000	.952
Health	1.000	.789
Transport	1.000	.962
Communications	1.000	.820
Recreation and Culture	1.000	.854
Education	1.000	.915
Hotels, Cafes and Restaurants	1.000	.968
Miscellaneous Goods and Services	1.000	.975

Extraction Method: Principal component Analysis
Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)

Table C.9: Communalities for Western Region

Description	Initial	Extraction
Food and Non-Alcoholic Beverages	1.000	.956
Alcoholic Beverages, Tobacco and Narcotic	1.000	.982
Clothing and Footwear	1.000	.987
Housing , Water, Electricity, Gas and others	1.000	.959
Furnishings, Household Equipment and Routine Mentainance	1.000	.969
Health	1.000	.943
Transport	1.000	.964
Communications	1.000	.852
Recreation and Culture	1.000	.882
Education	1.000	.953
Hotels, Cafes and Restaurants	1.000	.909
Miscellaneous Goods and Services	1.000	.974

Extraction Method: Principal component Analysis

Source: Output from SPSS

ISSN 2053-2229 (Print), ISSN 2053-2210 (Online)