Expenditure analysis and planning in a changed economy – A case study approach of Gweru City Council, Zimbabwe.

By

Anesu G Kuhudzai

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Supervisor: Prof J. C. Tyler
Declaration

I Anesu Gelfand Kuhudzai hereby declare that the content of this research work is my original work. Information extracted from other sources is acknowledged as such. I further testify that it has not been submitted for any other degree or to any other institution of higher learning.

Signature .................................................................

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Abstract

The purpose of this study is to analyse Gweru City Council’s spending pattern and behaviour and to determine if this spending pattern is directed towards poverty reduction and economic development or not.

Furthermore, to fit a log-differenced regression model to a historical financial dataset obtained from Gweru City Council Finance Department for the time period July 2009 to September 2012. Regression techniques were used to determine how Gweru City Council’s total income (dependent variable) is affected by its expenditure (independent variables). Econometric modeling techniques were employed for the evaluation of estimate tests, conducted to determine the reliability of the estimated model. The study concludes by providing some recommendations for possible financial plans which could be adopted by Gweru City Council and other local authorities in Zimbabwe for the well-being of Zimbabweans and economic development.
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List of Abbreviations

YOY  Year-on-Year
GPA  Global Political Agreement
ZANU-PF  Zimbabwe African National Union Patriotic Front
MDC  Movement for Democratic Change
GCC  Gweru City Council
MCC  Mutare City Council
HCC  Harare City Council
BCC  Bulawayo City Council
GRRA  Gweru Residents Rates Association
ZESA  Zimbabwe Electricity Supply Authority
GDP  Gross Domestic Product
Zilga  Zimbabwe Local Government Association
CCZ  Consumer Council of Zimbabwe
FEWS NET  Famine Early Warning Systems Network
ZW  Zimbabwe
S2SLS  Spatial two-step least squares
OLS  Ordinary Least Squares
GLM  General Linear Model
CLRM  Classical Linear Regression Model
BJ  Bera-Jarque Test
BG  Breusch-Godfrey Test
LIP  Linear-in-Parameter
LIV  Linear-in-Variable
ADF  Augmented Dickey Fuller (ADF) Test
RMSE  Root Mean Squared Error
MAE  Mean Absolute Error
MAPE  Mean Absolute Percentage Error
TIC  Theil Inequality Coefficient
$R^2$  Coefficient of Determination
ZINWA  Zimbabwe National Water Authority
NASSA  National Social Security Authority
ZIMRA  Zimbabwe Revenue Authority
FBS  First Bank Building Society
CBZ  Commercial Bank of Zimbabwe
TB  Tuberculosis
USD  United States Dollars
USA  United States of America
VOP  Voice of the People
EMA  Environment Management Agency
CHAPTER 1: INTRODUCTION

“This chapter shall present the background relevant to this study” (Lundberg 2009). It will start by discussing some serious economic challenges experienced by Zimbabwe from 2000 to 2008. It will then continue to highlight how the Zimbabwean economy has stabilized from 2009 up to date and the need to establish financial plans in this changed economy.

1.1 BACKGROUND OF STUDY

Zimbabwe (See figure 2 for map of Zimbabwe) experienced serious economic challenges from 2000 to 2008. Zimbabwe`s controversial fast track land reform program which began in 2000 contributed to a greater extent to the decline of its economy. The land reform program was meant to address issues of inequality, historical injustices and inefficiencies in production and poverty in communal areas. “Eleven million hectares of mainly white-owned commercial farmland was redistributed to both rich and poor black Zimbabweans” (Derman and Professor 2006). This means that those farmers who had farming equipment, capital and know how were replaced by those without farming equipment, capital and know how.

Until 2000 the three pillars of Zimbabwe`s economy were agriculture, manufacturing and tourism. Subsequently tobacco production has plummeted, maize production has been dramatically reduced and industry linked to agriculture shrank. “The leading export crop, tobacco, yielded fifty five metric tonnes for the international market in 2005 as compared to two hundred and forty metric tonnes prior to fast track land reform program” (Derman and Anne 2006). The rapidity and scale of the fast track land reform program left no resources in place to permit long-term continuity in farm operations, most significantly in terms of irrigation, seed production farm equipment. Little care was taken towards protecting international markets. Tourism suffered from what the government describes as “negative publicity” (Derman and Professor 2006).
“Zimbabwe’s historic economy had become a shell of itself” (Derman and Gonese 2003). “It has been subject to international sanctions and in turn the government blames international sanctions and drought for the depth of its economic difficulties” (Derman and Professor 2006). Estimates of inflation vary and it is difficult to actually provide accurate figures due to high levels of inflation. “At the end of September 2008, independent inflation figures put inflation in excess of 26 000%, with the year-on-year (YOY) figures over a 1.1 trillion % on food inflation” (Ndlela 2008).

“Hyperinflation made the Zimbabwean dollar redundant and continues to push the cost of living beyond the reach of most households” (Hall 2004). “Not only do consumers have to contend with exorbitant prices of basic commodities and services but they also have to grapple with rampant shortages of basic food stuffs such as maize meal, salt, sugar, cooking oil and floor” (FEWS NET Zimbabwe Country Centre 2005).

The collapse of the Zimbabwe Electricity Power Authority (ZESA) has been also a major obstacle to economic recovery. Thermal stations have difficulty accessing coal, partly due to rail system running below the expected capacity. Major power deficit and load shedding is still a routine, constraining industry and agriculture.

Taking into account the relationship between the conduct of politics and economics, the Global Political Agreement (GPA) (i.e. agreement between the Zimbabwe African Union – Patriotic Front (ZANU-PF) and the two Movement for Democratic Change (MDC) formations) signed on 15 September 2008 paved the way to resolve Zimbabwe’s economic challenges. Currently, this Global Political Agreement is being facilitated by President Jacob Zuma of South Africa.

“Zimbabwe’s March 2008 elections resulted in the party of long-serving President Mugabe losing its parliamentary majority for the first time since independence” (Ploch 2011). “Opposition leader Morgan Tsvangirai received more votes than Mugabe in the presidential race, but fell short of the required margin for victory” (Ploch 2011). “Tsvangirai later withdrew his name from the “ballot days before the required runoff, amid widespread political violence”
Mugabe was thus declared the winner. In September 2008, after weeks of negotiations, Tsvangirai and Mugabe reached an agreement to form a unity government, with Mugabe remaining the head of state” (Ploch 2011). “Tsvangirai became prime minister and cabinet and gubernatorial positions were divided among the parties” (Ploch 2011).

These parties agreed to give priority to the restoration of economic stability and growth in Zimbabwe and the unity government was given a role to lead the process of developing and implementing an economic recovery strategy and plan.

To that end, the parties committed themselves to work together on a full and comprehensive economic program to resuscitate Zimbabwe’s economy which was in need of addressing the issues of production, food security, poverty, unemployment, high inflation, etc.

“The US dollar was adopted as the major currency in Zimbabwe. The economy has emerged from near complete collapse with a real growth rate (GDP) of -14.4 per cent in 2008 to 4.1 percent in 2010” (Ploch 2011). According to Reuters (2011) the Minister of Finance reported that the GDP growth for 2011 is 9.3 percent. “Gross Domestic Product (GDP) is defined as the total value of all final goods and services produced within the boundaries of a country in a particular period (usually one year”) (Mohr 2007). “GDP is one of the most important barometers of the performance of the economy” (Mohr 2007).

However, there is a great need to develop and implement financial plans and strategies for City councils in order to enhance service delivery and improve people’s standards of living in this changed economy of Zimbabwe. “In a meeting of the Zimbabwe Local Government Association (Zilga) held in Victoria Falls on 3 December 2011, President Robert Mugabe said he was concerned about the deplorable state of service delivery in the country’s towns and cities” (Staff Reporter 2011). “Moreover, the Minister of Finance reported that 37% of the population in Zimbabwe had no clean water, 45% no access to lavatories and less than 50% access to electricity” (Staff Reporter 2011). The City of Gweru shall be analysed in this study.
1.2 PROBLEM DEFINITION

Gweru City Council is a local authority or local government in the city of Gweru, Zimbabwe. (See figure 3 for map of City of Gweru). It falls under the Ministry of Local Government, Rural and Urban Development. It comprises of five major departments, namely Finance, Housing, Health, Engineering and Chamber Secretary. It provides services such as issuance of business licenses, water and sanitation, infrastructure for industrial, commercial and residential development, education health, recreational parks and community services. Such services are provided at break-even point. This implies that the organization is non-profit making but requires a sound financial base in order to provide services to the community and paying for expenses incurred.

Gweru city council’s spending pattern had changed dramatically over the past few years, in particular from 2005 to 2008, due to economic hardships which Zimbabwe had been experiencing as a nation. The revenue and expenditure management capacity of a municipality determine its ability to contribute towards poverty reduction and economic development. As a result, it is important to monitor trends in the levels and composition of Gweru City council`s expenditure in this changed economic period for better service delivery.

The purpose of this study is to analyse Gweru City Council’s spending pattern or behaviour (expenditure). That is to determine how far Gweru City Council’s expenditure is directed towards poverty reduction and economic development. “Considering the time, human and financial resources constraints required to adequately address the research topic or question at a macro level, a case study approach shall be applied on the basis of the advantages that it offers, without necessarily jeopardizing the quality of the findings” (Kwada 2007).
1.3 OBJECTIVES

- To fit an econometric model on historical financial dataset obtained from Gweru City Council Finance Department (time series data).
- Analyse Gweru City Council’s spending pattern or behaviour and determine if this spending pattern is directed towards poverty reduction and economic development or not.

1.4 METHODOLOGY

The analysis of Gweru City Council’s spending pattern shall be facilitated by use of a historical financial dataset obtained from Gweru City Council Finance department for the time period July 2009 to September 2012 (time series data). Determinants of composition of Gweru City Council’s expenditure shall be modeled using an econometric technique applying a log-differenced regression model. Econometric Views (E-Views) Version 3 shall be used to facilitate the modeling and the analysis process.

1.5 STRUCTURE OF THE STUDY

The thesis is divided into five chapters. Chapter one provides the background of the study, problem definition and objectives of the study. Chapter two provides a presentation of earlier studies relevant to the area examined in this study. Chapter 3 presents the theoretical framework that underlies the thesis and the research methodology of the study. Empirical results from econometric estimations are presented and analysed in chapter four (Lundberg 2009). Discussions, conclusions and recommendations on possible financial plans which could be adopted by Gweru City Council and other local authorities in Zimbabwe for the well-being of individuals and economic development are presented in chapter five.
ZW’s ECONOMIC HARDSHIPS
- Hyper inflation.
- Collapse of industry.
- Reduction of agricultural production, etc.

GLOBAL POLITICAL AGREEMENT
- ZANU PF & two MDC formations agreed to solve ZW’s economic challenges.
- Economy has now improved.

FINANCIAL PLANS FOR CITY COUNCILS
- Case study of Gweru City Council.
- Analyse Gweru City Council’s spending pattern or behaviour (total expenditure).

ECONOMETRIC MODEL
- Using e-views.
- Data analysis.

ECONOMIC DEVELOPMENT
- Enhance service delivery in city councils.
- Improve welfare of people.
- Growth of infrastructure, etc.
FIGURE 2: GEOGRAPHICAL LOCATION OF CITY OF GWERU, ZIMBABWE

SOURCE OF MAP:
SOURCE OF MAP:

http://maps.google.co.za/maps?hl=en&cp=20&gs_id=1u&xhr=t&q=Map+of+city+of+Gweru&gs_upl=&bav=on.2,or.r_gc.r_pw.,cf.osb&biw=837&bih=443&rapid=tijp1322046506609042&um=1&ie=UTF-8&hq=&hnear=0x1934949a6ca1c7ad:0x7925dad5634bafd3,Gweru,+Zimbabwe&gl=za&ei=4tPMTtGyPIHPhAfNsITYDQ&sa=X&oi=geocode_result&ct=image&resnum=1&sqi=2&ved=0CBwQ8gEwAA
CHAPTER 2: LITERATURE REVIEW

This section shall provide a presentation of two previous studies within the area examined and relevant to the purpose of this study (as stated under objectives). These earlier studies are on local governments’ spending behaviour in Norway and United States of America respectively and these studies also focus in determining if the expenditure incurred by these local governments was directed towards poverty reduction and economic development. A number of studies have already been conducted on several local governments spending behaviour. “Some studies are based on cross-sectional data, while others make use of panel data to capture any possible unobserved heterogeneity” (Kerimova 2011).

2.1 Study on Norwegian local government spending behaviour in a dynamic context

“This section will start to present a study on Norwegian local government spending behaviour in a dynamic context by Kerimova” (2011). Kerimova (2011) analysed the “Norwegian local government spending behaviour in a dynamic framework facilitated by a panel dataset, combining municipality data for the years 2001 to 2008”. Kerimova’s research was based on existing work of examining the spending behaviour of local governments in Norway by Aaberge and Langorgen (2003), Aaberge and Langorgen (2006), Aaberge, Langorgen, Galloway and Mogstad (2005).

Norwegian local government spending was analysed in a simultaneous framework, using a structural model where the local government expenditure in each service sector is endogenous and dependent on the expenditure in the other sectors, since allocating a larger share of income to one sector will reduce the share of income in other sectors.

The model of municipality expenditures, referred to as KOMMODE, explains variations in spending per capita in various service sectors in which local governments have a responsibility to provide services to their constituencies. The model is designed such that the accounting relationships between revenues, expenses and net operating surplus are always maintained.
The expenditure of the Norwegian local government was found to be distributed to 12 service sectors namely administration, primary schools, other education, child care, health care, social services, child protection, care for the elderly and disabled, culture, municipal roads, other infrastructure, water supply and sanitation.

An analysis was then conducted to determine how the minimum required expenditure (subsistence requirement) varies within the different sectors between municipalities based on demographic, social and geographic factors. A system of equations was developed. It was proposed that each equation in the system should include fixed effects, time effects and / or a combination of the two. These models were then estimated by the maximum likelihood method.

The model with both time and fixed effects performed well in explaining the Norwegian government spending behavior over the years analysed compared to the benchmark model with neither time effects nor fixed effects. This is because the benchmark model predicted a theoretically unjustifiable negative effect of the share of small children on the minimum child care spending. The model with time effects, however predicted the expected positive and significant effect.

Kerimova (2011) found that “child care, care for old people and disabled sectors are much responsible for increasing the Norwegian local government expenditure as compared to other sectors”.
2.2 Study on cities and suburbs in United States of America, focusing mainly on expenditure patterns in the urban fiscal system.

Steven et al (2009) presented a “study on cities and suburbs in United States of America, focusing on expenditure patterns in the urban fiscal system”. The research idea of the study was that the municipal expenditure decisions are affected by strategic interactions between a center city government and nearby suburban governments, and that these strategic interactions are informative.

To test this research idea, expenditure data for a panel of 53 largest municipal governments was collected over the period 1980-1997. The data was then subjected to three different tests. Firstly, Steven et al (2009) tested whether a big city responds to changes in suburban public expenditure. Secondly, it was tested whether cities respond differently to the category of expenditure in suburban budgets (Steven et al 2009). Three categories of expenditures were examined. Thus, basic expenditures (fire, police, parks and roads), income transfer expenditures (welfare, housing, health and hospital) and other spending were examined. Thirdly, it was tested whether institutional features such as city council size and the presence of a city manager influence urban government expenditures.

Steven et al (2009) found that “welfare has large and significant effects on income transfer expenditures”. Also, the results indicate that big cities appear to make their residents worse off when suburbs alter their budgetary choices to make suburban residents better off (Steven et al 2009). City managers were found to be misusing the urban government expenditure for their own personal benefit.
2.3 Study on revenue allocation and economic development in Nigeria.

Dang (2013) “empirically examined the impact of revenue allocation on economic development in Nigeria”. The study looks at how revenue allocations to federal government, states and local governments affect real gross domestic product (RGDP) in Nigeria using time series data for the period 1993 to 2012. Gross Domestic Product (GDP) is “defined as the total value of all final goods and services produced within the boundaries of a country in a particular period (usually one year)” (Mohr 2007). “GDP is one of the most important barometers of the performance of the economy” (Mohr 2007). The study adopted the following log-differenced regression model:

\[
\Delta LRGDP = \beta_0 + \beta_1 \Delta LREVALFGN_{t-1} + \beta_2 \Delta LREVALSTATES_{t-1} + \beta_3 \Delta LREVALLG_{t-1} + \beta_4 ECT_{t-1} + \mu,
\]

Where LRGDP = log of RGDP
LREVALFGN = log of revenue allocation to federal government of Nigeria
LREVALSTATES = log of revenue allocation to state governments
LREVALLG = log of revenue allocation to local governments
\(\beta_0\) is a constant
\(\beta_1, \beta_2, \beta_3\) and \(\beta_4\) are coefficients of the regression model
ECT is the error correction term
\(\mu\) is the error term (disturbance term)
and \(t\) is time.

The study concludes that “revenue allocations to federal government, states and local governments have a causal relationship with economic development in Nigeria with only revenue allocation to states having a negative significant relationship”. However, this study does not reveal how revenue allocation has contributed to economic development in Nigeria. Thus, how the economy of Nigeria has grown which leads to good standard of living of its people.
2.4 CONCLUSION

There is inadequate literature on expenditure analysis and planning of local governments or municipalities using econometric techniques particularly focusing on how the expenditure has led to poverty reduction and economic development in different municipalities or local governments across the world. However, the results in the first two studies show that the patterns of local government expenditures in Norway and USA respectively are poverty alleviation oriented in terms of providing better standards of living to the people which is exactly related to the second objective of my study. The present study shall adopt the log-differenced regression model approach by Dang (2013).
CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

RESEARCH DESIGN
This section shall present the theoretical framework that underlies this study.

3.1 DEFINITION OF ECONOMETRICS AND ITS HISTORY
According to Rombouts et al (2004), “econometrics is the application of mathematical statistics to economic data to lend empirical support to the models constructed by mathematical economics and to obtain numerical estimates”. Also, “econometrics is about analyzing and explaining relationships between variables of the economic model” (Bajracharya 2010).

The term “econometric” came to use with the start of the Econometric Society in the 1930s (Watson et al 2002). “The Econometric Society was founded at the initiative of the Yale economist Irving Fisher (the Society’s first president) and the Norwegian economist Ragnar Frisch, who some forty years later was the first economist (together with Jan Tinbergen) to be awarded the Nobel Prize” (Rizzi 2012). “The first organizational meeting of the society was held in Cleveland Ohio on 29 December 1930” (Rizzi 2012). “The first scientific meetings of the society were held in September 1931 at the University of Lausanne, Switzerland and in December, 1931 in Washington D.C” (Rizzi 2012).

3.2 STEPS IN ECONOMETRIC MODELLING
Although there are many different ways to go about the process of model building, a logical and valid approach would be to follow the steps below.

3.2.1 Step A: Specification of the econometric model
“The first and the most important step the econometrician has to take in attempting the study of any relationship between variables is to express this relationship in mathematical form” (Koutsoyiannis 1977). This is called the specification or formulating of the econometric model.
It involves the determination of the following:

a) **Variables of the model**

The econometrician should be able to make a list of the independent variables (regressors) which might influence the dependent variable (regressand). The number of variables to be included in the model depends on the nature of the phenomenon being studied and the purpose of the research. The influence of less important factors is taken into account by the introduction in the model of a random variable.

b) **Mathematical form of the model**

Economic theory may or may not indicate the precise mathematical form of the relationships among variables. “It is the econometrician who must decide whether the phenomenon being studied can be adequately described by a single equation model or a system of simultaneous equations, whether it is a linear or non-linear etc.” (Dhliwayo 2002).

3.2.2 **Step B: Estimation of the Model**

“After the model has been specified (formulated) the econometrician must obtain numerical estimates of the coefficients of the model” (Nworuh 2010). The stage of estimation involves the following steps:

a) **Gathering data for the estimation of the model**

The data used in the estimation of a model may be of various types. Thus, time series, cross-sectional data, panel data etc. The data may be available electronically through a financial information provider, such as Reuters or from published government figures. Alternatively, “the required data may be available only via a survey after a distributing a set of questionnaires i.e. primary data” (Brooks 2008).
b) **Examination of the degree of correlation among the explanatory variables**

“Most economic variables are correlated, in the sense that they tend to change simultaneously during the various phases of economic activity” (Nworuh 2010). Thus, a degree of multicollinearity is inherent in the economic variables due to the growth and technological progress. “If however, the degree of collinearity is high, the results (measurements) obtained from econometric applications may be seriously impaired and their use may be greatly misleading because in these conditions it may not be computationally possible to separate the influence of each one explanatory variable” (Nworuh 2010).

c) **Choice of the appropriate econometric technique**

The coefficients of econometric models may be estimated by various methods, which may be classified in two main groups, namely single-equation techniques and simultaneous-equation techniques. Single-equation techniques are techniques that are applied to one equation at a time. These are the classical least squares or ordinary least squares method, the indirect least squares or reduced form technique and the two stage least squares method. Simultaneous-equation techniques are techniques which are applied to all the equations of a system at once and give estimates of the coefficients of all the functions simultaneously. The most common one are the three-stage least squares method and the full information maximum likelihood technique.

3.2.3 **Step C: Evaluation of Estimates (Diagnostic Checking)**

After the estimation of the model the econometrician must proceed with the evaluation of the results of the calculations. Thus, determining the reliability of the results. Tests for autocorrelation, multicollinearity, heteroscedasticity, etc should be performed before using the model.

3.2.4 **Step D: Use of model**

When an econometrician is finally satisfied with the model, it can then be used for forecasting or any other relevant purposes of the research.
3.3 REGRESSION ANALYSIS

According to Brooks (2008) “regression analysis is the most important tool at the econometrician’s disposal”. “Regression techniques have long been central to the field of econometrics” (Sykes 2005). “Regression analysis is the process of estimating value of a dependent variable on the basis of explanatory variable/s” (Kinney 2002). For instance, what will be the effect of job training, experience and education on the salary of an employee? “This is an example of multiple regression where more than one explanatory variable, namely job training, experience and education affect the salary of an employee” (Bajracharya 2010). “Regression model is a model which shows how explanatory variable/s affects the dependent variable” (Kinney 2002).

3.4 FUNCTIONAL FORMS OF REGRESSION MODELS

In order to express the relationship between variables in mathematical form (formulating an econometric model), a specific functional form must be chosen. If an incorrect functional form is chosen, then the model should be re-specified. “The process of re-specification of the model and re-estimation will continue until the results pass all the economic, statistical and econometric tests” (Nworuh 2010). A regression model can assume a variety of functional forms. These functional forms could be linear or non-linear. In particular, in this study linear regression models shall be discussed, using one dependent variable (y) and one independent variable (x). Thus, using two-variable models. However, these functional forms could be extended to more than one independent variable (multiple regression models). Linear regression models can be subdivided into two types. Thus, linear-in-parameters/linear-in-variables (LIP/LIV) and linear-in-parameters/non-linear-in-variables regression models.

3.4.1 Linear Model

“This model is in the form of \( y = b_0 + b_1x \). It is both linear-in-parameters as well as its variables” (Porter 2010). The rate of change (gradient or slope or \( b_1 \)) of the dependent variable remains constant for a unit change in the independent variable.
3.4.2 Log-Linear Model
This model is in the form of \( \ln y = b_0 + b_1 \ln x \). Since this model has both variables in log form it is also called double-log or log-linear model. The rate of change (gradient or slope or \( b_1 \)) measures the elasticity of \( y \) with respect to \( x \). That is the percentage change in \( y \) for a given (small) percentage change in \( x \).

3.4.3 Log-Lin Model
This model is in the form of \( \ln y = b_0 + b_1 x \). In this model the dependent variable is logarithmic but the independent variable is linear. This model is also known as the semi log or growth model. The rate of change (gradient or slope or \( b_1 \)) measures the proportional or relative change in \( y \) for a given absolute change in \( x \). If the relative change is multiplied by 100, we obtain the percentage change or the growth rate.

3.4.4 Lin-Log Model
This model is in the form of \( y = b_0 + b_1 \ln x \). In this model the dependent variable is linear but the independent variable is logarithmic. The rate of change (gradient or slope or \( b_1 \)) measures the absolute change in the dependent variable for a percentage change in the independent variable.
3.5 GENERAL LINEAR MODEL ASSUMPTIONS, VIOLATIONS AND DIAGNOSTIC TESTS

The General Linear Model (GLM) or the Classical Linear Regression Model (CLRM) provide a general framework for a large set of models (mentioned under section 3.4 of this chapter) whose common goal is to explain or predict a dependent variable by using a set of independent variables. The General Linear Model is easily estimated by the Ordinary Least Squares (OLS) method. Ordinary Least Squares regression is the core of econometric analysis. The validity of the OLS results obtained depends on the following series of assumptions called the General Linear Model assumptions.

3.5.1 Linearity
The first assumption is that the dependent variable can be calculated as a linear function of a specific set of independent variables, plus a disturbance term. This can be expressed mathematically as:

\[ y_i = b_0 + b_1 x_i + \mu_i \text{ where } i = 1, 2, \ldots, n \text{ with } \text{E}(\mu_i) = 0. \]

3.5.2 Independence
This assumption asserts that all disturbance terms are independently distributed, or are not correlated with one another, so that:

\[ \text{cov}(\mu_t, \mu_s) = 0 \text{ for all } t \neq s. \]

When this assumption is violated then there will be auto-correlation. They are serious undesirable consequences of auto-correlation which are:

a) Inefficient parameter estimation. Thus, model coefficients will have inflated variances or standard errors.

b) Low forecasting power of the resulting model.

“Auto-correlation can be tested by conducting tests such as the Durbin Watson test or the Breusch-Godfrey” (BG) test (Dhliwayo 2002).
3.5.3 **Homogeneity (Homoskedasticity)**

This assumption states that all disturbance terms have the same variance. Thus,

\[ \text{var} (\mu_t) = \sigma^2 \text{ for all } t. \]

When this assumption is violated we say that there is heteroscedasticity. Heteroscedasticity has got negative impact on estimation and inference. Heteroscedasticity implies that:

a) Model coefficients will be inaccurate.

b) Error variance is underestimated by Ordinary Least Squares Estimation.

c) The estimated model has low predictive power.

“Heteroscedasticity can be tested by conducting tests such as the Goldfeld-Quandt test, Bartlett test and the Arch test” (Dhliwayo 2002).

3.5.4 **Multicollinearity**

This assumption asserts that exact linear relationships should not exist among independent variables. Thus, variation in the \( x \)'s is necessary. The more variation in the independent variables the better the Ordinary Least Squares estimates will be in terms of identifying the impacts of the different independent variables on the dependent variable.

Accessed on 10/09/12. Multicollinearity has negative impact on estimation and inference as well.

Multicollinearity can be tested by measuring the correlation among the independent variables.

3.5.5 **Normality**

This assumption assumes that the disturbance term is normally distributed with mean zero and variance \( (\sigma^2) \). Thus,

\[ \mu_t \sim N(0, \sigma^2). \]

One of the most commonly applied tests for normality is the Bera-Jarque (hereafter BJ) test. “BJ uses the property of a normally distributed random variable that the entire distribution is characterized by the first two moments – the mean and the variance” (Brooks 2008).
3.6 TIME SERIES

“A time series is a set of numeric data collected over regular time intervals and arranged in chronological order of time” (Wegner 2012). For instance, weekly, monthly, quarterly, yearly, etc.

3.6.1 COMPONENTS OF A TIME SERIES

They are various factors that affect a time series. They are namely:

a) Trend ($T_t$) – long term movements in the mean.

b) Seasonal effects ($I_t$) – cyclical fluctuations related to the calendar.

c) Cycles ($C_t$) – other cyclical fluctuations (such as business cycles).

d) Residuals ($E_t$) – other random or irregular fluctuations.

3.6.2 STATIONARITY

Stationarity is a very important concept underlying time series processes. According to Dimitrios et al (2007), “if a series is non-stationary then all the typical results of the classical regression analysis are not valid”. Regressions with non-stationary series may have no meaning and are therefore called “spurious” (Dimitrios et al 2007).

Nau (2005) defined a stationary time series as a “series whose statistical properties such as mean, variance, autocorrelation, etc are all constant over time”.

Thus, a time series $Y_t$ is said to be stationary if:

a) $E(Y_t) =$ constant for all $t$.

b) $\text{Var}(Y_t) =$ constant for all $t$.

c) $\text{Cov}(Y_t, Y_{t+k}) =$ constant for all $t$. 
3.6.3 DATA TRANSFORMATIONS

Logarithm transformations are commonly used in econometrics for the following reasons:

a) To linearize an exponential trend (since the log function is the inverse of an exponential function).

b) To linearize a model which is non-linear in the parameters e.g. the Cobb – Douglas production function. Thus, $Y = AL^\alpha K^\beta e^\mu$.

c) To enable the regression coefficients to be interpreted as elasticities since change in $\log x$ relative change in $x$ itself.

Differencing is a data transformation technique applied to time series data so as to remove the trend component – i.e. to render it stationary. Thus, calculating absolute changes from one period to the next. Symbolically,

$$\Delta Y_t = Y_t - Y_{t-1}$$

The above is called first-order differencing.

When a differenced series still have a trend component, then it needs to be differenced once more or many times to render it stationary.

“Most statistical forecasting methods are based on the assumption that the time series can be rendered approximately stationary” (Nau 2005). It is also important to stationarize a time series so as to obtain meaningful sample statistics such as means, variances and correlations with other variables. Nau (2005) stated that “most business and economic time series are far from stationary when expressed in their original units of measurement”. Likewise, the time series data to be used in the present study is likely not to be stationary.
METHODOLOGY

This section shall deal with the research methodology of this study.

3.7 DATA SOURCE

This study utilized historical financial dataset from Gweru City Council Finance Department for the time period July 2009 to September 2012 (time series data).

3.8 SPECIFICATION OF THE MODEL

To capture the relationship between Gweru City Council’s total expenditure and the factors that contribute to this expenditure, a log-differenced regression model is developed. The logs are used to linearize the exponential trend of the data set and to be able to interpret the regression coefficients as elasticities. The differencing aspect is applied so as to remove the trend component from time series data (i.e. to render it stationary). The log-differenced regression model is the most appropriate model to use in measuring the percentage change in the total expenditure (dependent variable) as affected by each and every independent variable whilst holding other independent variables constant. An econometric programme, E-Views version 3, shall be used for estimation purposes. The log-differenced regression model is defined as:

\[ \Delta \ln y = b_0 + b_1 \Delta \ln x_1 + b_2 \Delta \ln x_2 + b_3 \Delta \ln x_3 + b_4 \Delta \ln x_4 + \mu \]

Where:

\( \Delta \ln y \) = First difference of the logarithm of \( y \)

\( y \) = Total income

\( b_0 \) = Constant term

\( b_i \) = Slope of the parameters (independent variable coefficients)

\( x_1 \) = Employee costs

\( x_2 \) = ZESA and ZINWA payments

\( x_3 \) = Stores payments

\( x_4 \) = Sundry payments
\[ \mu = \text{disturbance term} \]

### 3.9 DEPENDENT VARIABLE

As mentioned earlier in chapter one, this study aims to analyse Gweru City Council’s spending pattern or behaviour and determine if it is directed towards poverty reduction and economic development or not. To assess this, monthly total expenditure (in dollars) is used as a dependent variable. Monthly total expenditure is mainly composed of employee costs, ZESA and ZINWA payments, stores payments and sundry payments. On the other hand, the monthly total income of Gweru City Council is mainly composed of rates and rental charges, water sales, sewerage fees, refuse fees, bus entry fees, clinic and school fees.

### 3.10 INDEPENDENT VARIABLES

These are the factors or expenses which contribute to Gweru City Council’s monthly total expenditure.

#### 3.10.1 Employee Costs

These are mainly wages and salaries. Wages and salaries consist of cash payable to employees at regular weekly or monthly intervals including payments by results and piecework payments plus allowances such as those for working overtime, ad hoc bonuses, cash-in-lieu of leave, vocational education, etc.

Wages and salaries include payments towards social contributions such as NASSA contributions, medical aid schemes, pension funds, income taxes, etc payable by the employees but withheld by GCC and paid directly to social insurance schemes, for instance NASSA, tax authorities such as ZIMRA on behalf of the employees.

Gweru City Council has about one thousand two hundred employees. All these workers are working under the five major departments of GCC. The least paid employee is earning approximately US$280.
3.10.2 ZESA and ZINWA Payments
ZESA payments are costs of electricity used or consumed by GCC paid to Zimbabwe Electricity Supply Authority (ZESA) at the end of every month. GCC uses electricity mainly through street lightning, pumping charges, consumption by administration buildings, etc.

ZINWA payments include raw water charges paid to Zimbabwe National Water Authority (ZINWA). ZINWA owns dams which GCC extracts raw water for purification and supply to Gweru residents and industries. Since ZINWA owns the dams, it charges GCC the amount of raw water (in kilo litres) extracted from these dams on monthly basis. These dams are Gwenhoro, White Waters and Ngamo.

3.10.3 Stores Payments
These are costs incurred by GCC through buying goods or materials in bulk and keep them in a warehouse awaiting distribution to respective departments. These goods include fuel, stationery, water treatment chemicals, uniforms, tyres and tubes, etc.

3.10.4 Sundry Payments
These are costs incurred by GCC in the day to day running of its departments. Sundry departments are further divided into general expenses and repairs and maintenance. General expenses include expenses such as cleaning materials, insurances, legal and professional fees, postages, printing and stationery, advertising, drugs and dressings, conference and travelling, etc.

Repairs and maintenance include expenses such as electrical installations, fences, loose tools, buildings, radio telephones, water meters, etc.
3.11 EVALUATION OF ESTIMATES

This is the determination of the reliability of the estimated model. That is deciding whether the “estimates of the parameters are theoretically meaningful and statistically satisfactory” (Maliwichi 2010). To achieve this, the following tests are to be conducted:

a) Unit root tests for data stationarity
b) Durbin Watson Test for auto correlation.
c) Breusch-Godfrey LM test for serial correlation.
d) Correlogram of Residuals.
e) Significance of regression coefficients.
f) Correlation analysis for multicollinearity.
g) Coefficient of determination to test the goodness of fit.
h) Arch test for heteroscedasticity.
i) Normality test in the residuals.
j) Evaluate the forecasting power of the model.
CHAPTER 4: RESULTS AND ANALYSIS

“This chapter will present the empirical results from the econometric estimations” (Lundberg 2009). Before the model is estimated, unit root tests are done on all variables to check for data stationarity. The results of the log-differenced regression model are presented in table 6. Also, a multicollinearity test is done to check the correlation among the independent variables which is presented in table 7. To further determine the reliability of the estimated model, the Durbin Watson Test for auto correlation, Breusch-Godfrey LM test for serial correlation and arch test for heteroskedasticity were also done.

4.1 DATA STATIONARITY TESTS

It is essential to test data stationarity for all variables before estimation of the model. If the variables in the regression model are not stationary, then the general linear model assumptions will not be valid because non-stationary data, as a rule, are unpredictable and cannot be modeled or forecasted. The Unit Root Tests were done for all variables at first difference of their logarithms. Series statistics from E Views produced the following results:
Table 1: AUGMENTED DICKEY FULLER (ADF) TEST ON $\Delta \ln \text{(TOTAL EXPENDITURE)}$

$H_0 = \Delta \ln \text{(TOTAL EXPENDITURE)}$ does have a unit root problem.

$H_1 = \Delta \ln \text{(TOTAL EXPENDITURE)}$ does not have a unit root problem.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>-9.121134</th>
<th>1% Critical Value*</th>
<th>-2.6261</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5% Critical Value</td>
<td>-1.9501</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% Critical Value</td>
<td>-1.6205</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNTE)
Method: Least Squares
Date: 10/31/13   Time: 16:46
Sample(adjusted): 3 39
Included observations: 37 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLNTE(-1)</td>
<td>-1.394720</td>
<td>0.152911</td>
<td>-9.121134</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.697968</td>
<td>0.002573</td>
<td>0.074245</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.697968</td>
<td>S.D. dependent var</td>
<td>0.557911</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.315590</td>
<td>Akaike info criterion</td>
<td>0.557911</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>3.585499</td>
<td>Schwarz criterion</td>
<td>0.601449</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-9.321352</td>
<td>2.290426</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The calculated ADF test-statistic (-9.121134) is smaller than the critical values (-2.6261, -1.9501, -1.6205) at 1%, 5% and 10% levels of significance respectively. Therefore, we reject $H_0$ and conclude that the first difference of log of total expenditure does not have a unit root problem. This implies that the first difference of log of total expenditure is a stationary series.
Table 2: AUGMENTED DICKEY FULLER (ADF) TEST ON $\Delta \ln$ (EMPLOYEE COSTS)

$H_0 = \Delta \ln$ (EMPLOYEE COSTS) does have a unit root problem.

$H_1 = \Delta \ln$ (EMPLOYEE COSTS) does not have a unit root problem.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>-8.689956</th>
<th>1% Critical Value*</th>
<th>-2.6261</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5% Critical Value</td>
<td>-1.9501</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% Critical Value</td>
<td>-1.6205</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNEC)
Method: Least Squares
Date: 10/31/13   Time: 17:07
Sample(adjusted): 3 39
Included observations: 37 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLNEC(-1)</td>
<td>-1.358392</td>
<td>0.156317</td>
<td>-8.689956</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.677148</td>
<td></td>
<td>-0.007261</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.677148</td>
<td>0.805939</td>
<td>1.302478</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.457935</td>
<td>1.346016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>7.549374</td>
<td>2.335983</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-23.09584</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The calculated ADF test-statistic (-8.689956) is smaller than the critical values (-2.6261, -1.9501, -1.6205) at 1%, 5% and 10% levels of significance respectively. Therefore, we reject $H_0$ and conclude that the first difference of log of employee costs do not have a unit root problem. This implies that the first difference of log of employee costs is a stationary series.
Table 3: AUGMENTED DICKEY FULLER (ADF) TEST ON $\Delta \ln (ZESA AND ZINWA)$

$H_0 = \Delta \ln (ZESA AND ZINWA)$ does have a unit root problem.

$H_1 = \Delta \ln (ZESA AND ZINWA)$ does not have a unit root problem.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>-8.630847</th>
<th>1% Critical Value*</th>
<th>-2.6261</th>
<th>5% Critical Value</th>
<th>-1.9501</th>
<th>10% Critical Value</th>
<th>-1.6205</th>
</tr>
</thead>
</table>
*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNZZ)
Method: Least Squares
Date: 10/31/13   Time: 17:24
Sample(adjusted): 3 39
Included observations: 37 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLNZZ(-1)</td>
<td>-1.348434</td>
<td>0.156234</td>
<td>-8.630847</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.674183</td>
<td></td>
<td>0.000271</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.674183</td>
<td></td>
<td>1.447156</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.826042</td>
<td></td>
<td>2.482313</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>24.56444</td>
<td></td>
<td>2.525851</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-44.92279</td>
<td></td>
<td>2.199766</td>
<td></td>
</tr>
</tbody>
</table>

The calculated ADF test-statistic (-8.630847) is smaller than the critical values (-2.6261, -1.9501, -1.6205) at 1%, 5% and 10% levels of significance respectively. Therefore, we reject $H_0$ and conclude that the first difference of log of ZESA and ZINWA payments do not have a unit root problem. This implies that the first difference of log of ZESA and ZINWA payments is a stationary series.
Table 4: AUGMENTED DICKEY FULLER (ADF) TEST ON $\Delta \ln$ (STORES PAYMENTS)

$H_0 = \Delta \ln$ (STORES PAYMENTS) does have a unit root problem.

$H_1 = \Delta \ln$ (STORES PAYMENTS) does not have a unit root problem.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>-8.312480</th>
<th>1% Critical Value*</th>
<th>-2.6261</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5% Critical Value</td>
<td>-1.9501</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% Critical Value</td>
<td>-1.6205</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNSTP)
Method: Least Squares
Date: 11/01/13  Time: 11:58
Sample(adjusted): 3 39
Included observations: 37 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLNSTP(-1)</td>
<td>-1.313040</td>
<td>0.157960</td>
<td>-8.312480</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.657451</td>
<td></td>
<td>0.004279</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.657451</td>
<td></td>
<td>0.831198</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.486481</td>
<td></td>
<td>1.423416</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>8.519885</td>
<td></td>
<td>1.466954</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-25.33320</td>
<td></td>
<td>1.808147</td>
<td></td>
</tr>
</tbody>
</table>

The calculated ADF test-statistic (-8.312480) is smaller than the critical values (-2.6261, -1.9501, -1.6205) at 1%, 5% and 10% levels of significance respectively. Therefore, we reject $H_0$ and conclude that the first difference of log of stores payments do not have a unit root problem. This implies that the first difference of log of stores payments is a stationary series.
Table 5: AUGMENTED DICKEY FULLER (ADF) TEST ON \( \Delta \ln (\text{SUNDRY PAYMENTS}) \)

\( H_0 \) = \( \Delta \ln (\text{SUNDRY PAYMENTS}) \) does have a unit root problem.

\( H_1 \) = \( \Delta \ln (\text{SUNDRY PAYMENTS}) \) does not have a unit root problem.

<table>
<thead>
<tr>
<th>ADF Test Statistic</th>
<th>-10.71958</th>
<th>1% Critical Value*</th>
<th>-2.6261</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5% Critical Value</td>
<td>-1.9501</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% Critical Value</td>
<td>-1.6205</td>
</tr>
</tbody>
</table>

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DLNSP)
Method: Least Squares
Date: 11/01/13   Time: 14:12
Sample(adjusted): 3 39
Included observations: 37 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLNSP(-1)</td>
<td>-1.508254</td>
<td>0.140701</td>
<td>-10.71958</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.761281</td>
<td>Mean dependent var</td>
<td>0.019205</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.761281</td>
<td>S.D. dependent var</td>
<td>0.739319</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.361223</td>
<td>Akaike info criterion</td>
<td>0.828013</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>4.697358</td>
<td>Schwarz criterion</td>
<td>0.871552</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-14.31825</td>
<td>Durbin-Watson stat</td>
<td>2.083406</td>
<td></td>
</tr>
</tbody>
</table>

The calculated ADF test-statistic (-10.71958) is smaller than the critical values (-2.6261, -1.9501, -1.6205) at 1%, 5% and 10% levels of significance respectively. Therefore, we reject \( H_0 \) and conclude that the first difference of log of sundry payments do not have a unit root problem. This implies that the first difference of log of sundry payments is a stationary series.

Since the log-differences of all the variables are stationary, the econometric model can now be estimated.
4.2 ESTIMATION OF THE LOG-DIFFERENCED MODEL

Table 6: RESULTS OF LOG- DIFFERENCED REGRESSION MODEL

Dependent Variable: DLOG(TE)
Method: Least Squares
Date: 11/01/13   Time: 14:36
Sample(adjusted): 2 30
Included observations: 29 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.004662</td>
<td>0.009734</td>
<td>0.478962</td>
<td>0.6363</td>
</tr>
<tr>
<td>DLOG(EC)</td>
<td>0.577688</td>
<td>0.021645</td>
<td>26.68860</td>
<td>0.0000</td>
</tr>
<tr>
<td>DLOG(ZZ)</td>
<td>0.048754</td>
<td>0.017920</td>
<td>2.720632</td>
<td>0.0119</td>
</tr>
<tr>
<td>DLOG(STP)</td>
<td>0.051781</td>
<td>0.021428</td>
<td>2.416565</td>
<td>0.0236</td>
</tr>
<tr>
<td>DLOG(SP)</td>
<td>0.288549</td>
<td>0.032945</td>
<td>8.758628</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared 0.981297   Mean dependent var 0.034031
Adjusted R-squared 0.978179   S.D. dependent var 0.353268
S.E. of regression 0.052184   Akaike info criterion -2.912499
Sum squared resid 0.065356   Schwarz criterion -2.676759
Log likelihood 47.23124   F-statistic 314.7991
Durbin-Watson stat 2.825636   Prob(F-statistic) 0.000000

From the above table, the resultant estimated econometric model is:

$$\Delta \ln y = 0.004662 + 0.577688\Delta \ln x_1 + 0.048754\Delta \ln x_2 + 0.051781\Delta \ln x_3 + 0.288549\Delta \ln x_4$$

The first 30 observations of transformed data (appendix B) out of 39 observations have been used to estimate this model.
4.3 DURBIN-WATSON TEST

a) To test for positive serial correlation

The hypothesis to be tested is:

\( \mathcal{H}_0 : \) There is no positive serial correlation

\( \mathcal{H}_1 : \) There is positive serial correlation

From table 6, the Durbin-Watson test statistic (\( d \)) = 2.825636

Since \( n = 30 \), the lower and upper critical values of Durbin-Watson statistic are the following,

\( d_L = 1.143 \) and \( d_U = 1.739 \) respectively at \( k = 4 \) using 5% level of significance.

Where \( k = 4 \) represents the number of explanatory variables excluding the constant term.

The decision rule is:

1. If \( d \leq d_L \) we reject \( \mathcal{H}_0 \) and conclude in favour of positive serial correlation.

2. If \( d \geq d_U \) we fail to reject \( \mathcal{H}_0 \) and therefore there is no positive serial correlation.

3. In the special case where \( d_L < d < d_U \) the test is inconclusive.

Therefore, \( d = 2.825636 \geq d_U = 1.739 \)

Conclusion:

We fail to reject \( \mathcal{H}_0 \) and conclude that the model suffers no positive serial auto-correlation.
b) To test for negative serial correlation

The hypothesis to be tested is:

$H_0$: There is no negative serial correlation

$H_1$: There is negative serial correlation

From table 6, the Durbin-Watson test statistic ($d$) = 2.825636

Since $n=30$, the lower and upper critical values of Durbin-Watson statistic are the following,

$d_L = 1.143$ and $d_U = 1.739$ respectively at $k = 4$ using 5% level of significance.

Where $k = 4$ represents the number of explanatory variables excluding the constant term.

The decision rule is:

1. If $d \geq 4 - d_L$, we reject $H_0$ and conclude in favour of negative serial correlation.
2. If $d \leq 4 - d_U$, we fail to reject $H_0$ and therefore there is no negative serial correlation.
3. In the special case where $4 - d_U < d < 4 - d_L$, the test is inconclusive.

$4 - d_L = 4 - 1.143 = 2.857$

$4 - d_U = 4 - 1.739 = 2.261$

Now, $2.261 < 2.825636 < 2.857$

Conclusion:

The test is inconclusive. As a result, the Breusch-Godfrey LM test for serial correlation shall be performed so that conclusive results could be obtained.
4.4 THE BREUSCH – GODFREY LM TEST FOR SERIAL CORRELATION

The hypothesis to be tested is:

$H_0$: There is no serial correlation

$H_1$: There is serial correlation

Table 7: Breusch-Godfrey Serial Correlation LM Test

<table>
<thead>
<tr>
<th>Breusch-Godfrey Serial Correlation LM Test:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>7.621033</td>
</tr>
<tr>
<td>Probability</td>
<td>0.011131</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>7.217587</td>
</tr>
<tr>
<td>Probability</td>
<td>0.007219</td>
</tr>
</tbody>
</table>

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/26/14   Time: 17:18

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.000508</td>
<td>0.008620</td>
<td>-0.058978</td>
<td>0.9535</td>
</tr>
<tr>
<td>DLOG(EC)</td>
<td>-0.015154</td>
<td>0.019934</td>
<td>-0.760227</td>
<td>0.4548</td>
</tr>
<tr>
<td>DLOG(ZZ)</td>
<td>-0.011718</td>
<td>0.016423</td>
<td>-0.713543</td>
<td>0.4827</td>
</tr>
<tr>
<td>DLOG(STP)</td>
<td>0.000439</td>
<td>0.018971</td>
<td>0.023131</td>
<td>0.9817</td>
</tr>
<tr>
<td>DLOG(SP)</td>
<td>0.027825</td>
<td>0.030859</td>
<td>0.901677</td>
<td>0.3766</td>
</tr>
<tr>
<td>RESID(-1)</td>
<td>-0.576967</td>
<td>0.208999</td>
<td>-2.760622</td>
<td>0.0111</td>
</tr>
</tbody>
</table>

R-squared 0.248882  Mean dependent var -3.59E-18
Adjusted R-squared 0.085596  S.D. dependent var 0.048313
S.E. of regression 0.046199  Akaike info criterion -3.129727
Sum squared resid 0.049090  Schwarz criterion -2.846838
Log likelihood 51.38104  F-statistic 1.524207
Durbin-Watson stat 2.008145  Prob(F-statistic) 0.221290

The statistic labeled Obs*R-squared is the Breusch-Godfrey Serial Correlation LM test statistic for the null hypothesis of no serial correlation.

The decision rule:

p – value of Obs*R-squared $> 0.05 = \text{fail to reject } H_0$

p - value Obs*R-squared $< 0.05 = \text{reject } H_0$

Conclusion:
Since the probability of the Obs*R-squared = 0.007219 $< 0.05$ we reject $H_0$ and conclude that there is serial correlation in the residuals.
This implies that the log-differenced model has got some ARIMA errors (Autoregressive integrated moving average errors). As a result, these test results suggest that the original specification of the model need to be modified to take account of the serial correlation.

4.5 ARIMA MODELS

According to Dimitrios et al (2007), “Box and Jenkins (1976) first introduced ARIMA models”. The term ARIMA is derived from:

AR = Autoregressive
I = Integrated
MA = Moving average

They are several versions of ARIMA models. The autoregressive of order one model AR (1) is the simplest one. In order to correct the problem of serial correlation in the model an autoregressive term of order one shall be introduced in the log-differenced model.
4.6 ESTIMATION OF THE LOG-DIFFERENCED MODEL WITH AN AR (1) SPECIFICATION

Table 8: RESULTS OF THE LOG-DIFFERENCED REGRESSION MODEL WITH AN AR (1) SPECIFICATION

Dependent Variable: DLOG(TE)  
Method: Least Squares  
Date: 02/26/14   Time: 18:31  
Sample(adjusted): 3 30  
Included observations: 28 after adjusting endpoints  
Convergence achieved after 7 iterations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.000349</td>
<td>0.004678</td>
<td>0.074510</td>
<td>0.9413</td>
</tr>
<tr>
<td>DLOG(EC)</td>
<td>0.578324</td>
<td>0.019616</td>
<td>29.48212</td>
<td>0.0000</td>
</tr>
<tr>
<td>DLOG(ZZ)</td>
<td>0.030511</td>
<td>0.014513</td>
<td>2.102393</td>
<td>0.0472</td>
</tr>
<tr>
<td>DLOG(STP)</td>
<td>0.067407</td>
<td>0.014386</td>
<td>4.685677</td>
<td>0.0001</td>
</tr>
<tr>
<td>DLOG(SP)</td>
<td>0.358603</td>
<td>0.025785</td>
<td>13.90768</td>
<td>0.0000</td>
</tr>
<tr>
<td>AR(1)</td>
<td>-0.767046</td>
<td>0.161673</td>
<td>-4.744433</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

R-squared     0.988767  Mean dependent var 0.038908  
Adjusted R-squared 0.986214  S.D. dependent var 0.358755  
S.E. of regression 0.042122  Akaike info criterion -3.309080  
Sum squared resid 0.039034  Schwarz criterion -3.023607  
Log likelihood 52.32712  F-statistic 387.3145  
Durbin-Watson stat 1.964149  Prob(F-statistic) 0.000000  
Inverted AR Roots -.77

From the above table, the resultant estimated econometric model is:

$$\Delta \ln y = 0.000349 + 0.578324 \Delta \ln x_1 + 0.030511 \Delta \ln x_2 + 0.067407 \Delta \ln x_3 + 0.358603 \Delta \ln x_4$$

The following tests shall be performed again in order to test if the problem of serial correlation has been resolved:

a) Durbin Watson Test for auto correlation.

b) Breusch-Godfrey LM test for serial correlation.

c) Correlogram of residuals.
4.7 DURBIN-WATSON TEST (RETEST)

a) To test for positive serial correlation

The hypothesis to be tested is:

\( H_0 \): There is no positive serial correlation

\( H_1 \): There is positive serial correlation

From table 6, the Durbin-Watson test statistic \( d = 1.964149 \)

Since \( n = 30 \), the lower and upper critical values of Durbin-Watson statistic are the following,

\( d_L = 1.143 \) and \( d_U = 1.739 \) respectively at \( k = 4 \) using 5\% level of significance.

Where \( k = 4 \) represents the number of explanatory variables excluding the constant term.

The decision rule is:

1. If \( d \leq d_L \), reject \( H_0 \) and conclude in favour of positive serial correlation.

2. If \( d \geq d_U \), we fail to reject \( H_0 \) and therefore there is no positive serial correlation.

3. In the special case where \( d_L < d < d_U \) the test is inconclusive.

Therefore, \( d = 1.964149 \geq d_U = 1.739 \)

Conclusion:

We fail to reject \( H_0 \) and conclude that the model suffers no positive serial auto-correlation.
b) **To test for negative serial correlation**

The hypothesis to be tested is:

$H_0$: There is no negative serial correlation

$H_1$: There is negative serial correlation

From table 6, the Durbin-Watson test statistic $(d) = 1.964149$

Since $n=30$, the lower and upper critical values of Durbin-Watson statistic are the following, $d_L = 1.143$ and $d_U = 1.739$ respectively at $k = 4$ using 5% level of significance.

Where $k = 4$ represents the number of explanatory variables excluding the constant term.

The decision rule is:

1. If $d \geq 4 - d_L$ reject $H_0$ and conclude in favour of negative serial correlation.
2. If $d \leq 4 - d_U$ we fail to reject $H_0$ and therefore there is no negative serial correlation.
3. In the special case where $4 - d_U < d < 4 - d_L$ the test is inconclusive.

$4 - d_L = 4 - 1.143 = 2.857$  \hspace{1cm} $4 - d_U = 4 - 1.739 = 2.261$

Now, $d = 1.964149 \leq 4 - d_U = 2.261$

Conclusion:

We fail to reject $H_0$ and conclude the absence of negative serial correlation in the residuals.

To confirm the results of the Durbin-Watson test, the Breusch-Godfrey LM test for serial correlation shall be performed.
4.8 THE BREUSCH – GODFREY LM TEST FOR SERIAL CORRELATION (RETEST)

The hypothesis to be tested is:

\( H_0 \): There is no serial correlation

\( H_1 \): There is serial correlation

Table 9: Breusch-Godfrey Serial Correlation LM Test

<table>
<thead>
<tr>
<th>Breusch-Godfrey Serial Correlation LM Test:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.011673</td>
<td>Probability</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>0.015556</td>
<td>Probability</td>
</tr>
</tbody>
</table>

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/27/14   Time: 12:00

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-2.26E-05</td>
<td>0.004790</td>
<td>-0.004713</td>
<td>0.9963</td>
</tr>
<tr>
<td>DLOG(EC)</td>
<td>0.000274</td>
<td>0.020216</td>
<td>0.013539</td>
<td>0.9893</td>
</tr>
<tr>
<td>DLOG(ZZ)</td>
<td>-0.000325</td>
<td>0.015147</td>
<td>-0.021476</td>
<td>0.9831</td>
</tr>
<tr>
<td>DLOG(STP)</td>
<td>-6.08E-05</td>
<td>0.014730</td>
<td>-0.004129</td>
<td>0.9967</td>
</tr>
<tr>
<td>DLOG(SP)</td>
<td>-0.000259</td>
<td>0.026493</td>
<td>-0.009771</td>
<td>0.9923</td>
</tr>
<tr>
<td>AR(1)</td>
<td>0.014057</td>
<td>0.210363</td>
<td>0.013539</td>
<td>0.9893</td>
</tr>
<tr>
<td>RESID(-1)</td>
<td>-0.032594</td>
<td>0.301685</td>
<td>-0.108040</td>
<td>0.9150</td>
</tr>
</tbody>
</table>

R-squared | 0.000556 | Mean dependent var | -4.35E-11 |
Adjusted R-squared | -0.285000 | S.D. dependent var | 0.038022 |
S.E. of regression | 0.043101 | Akaike info criterion | -3.238207 |
Sum squared resid | 0.039012 | Schwarz criterion | -2.905156 |
Log likelihood | 52.33490 | F-statistic | 0.001946 |
Durbin-Watson stat | 1.919301 | Prob(F-statistic) | 1.000000 |

The statistic labeled Obs*R-squared is the Breusch-Godfrey Serial Correlation LM test statistic for the null hypothesis of no serial correlation.

The decision rule:

\( p \) – value of Obs*R-squared > 0.05 = fail to reject \( H_0 \)

\( p \) - value Obs*R-squared < 0.05 = reject \( H_0 \)

Conclusion:

Since the probability of the Obs*R-squared = 0.900743 > 0.05 we fail to reject \( H_0 \) and conclude that there is no serial correlation in the residuals.
To confirm the results of the Durbin-Watson test and the Breusch-Godfrey LM test, Correlogram of residuals shall be performed.

**4.9 CORRELOGRAM OF RESIDUALS TEST FOR SERIAL CORRELATION**

The hypothesis to be tested is:

\[ H_0 : \text{There is no serial correlation} \]

\[ H_1 : \text{There is serial correlation} \]

Table 10: Correlogram of residuals

<table>
<thead>
<tr>
<th>Date: 02/27/14   Time: 12:15</th>
<th>Sample: 3 30</th>
<th>Included observations: 28</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Autocorrelation</th>
<th>Partial Correlation</th>
<th>AC</th>
<th>PAC</th>
<th>Q-Stat</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>.</td>
<td>*</td>
<td>1</td>
<td>-0.017</td>
<td>-0.017</td>
<td>0.0090</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>2</td>
<td>0.072</td>
<td>0.072</td>
<td>0.1775</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>3</td>
<td>-0.029</td>
<td>-0.027</td>
<td>0.2053</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>4</td>
<td>-0.153</td>
<td>-0.160</td>
<td>1.0283</td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td>5</td>
<td>-0.114</td>
<td>-0.118</td>
<td>1.4998</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>6</td>
<td>0.061</td>
<td>0.082</td>
<td>1.6441</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>7</td>
<td>0.070</td>
<td>0.089</td>
<td>1.8387</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>8</td>
<td>0.135</td>
<td>0.103</td>
<td>2.6013</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>9</td>
<td>-0.013</td>
<td>-0.057</td>
<td>2.6090</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>10</td>
<td>-0.007</td>
<td>-0.023</td>
<td>2.6112</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>11</td>
<td>-0.058</td>
<td>-0.011</td>
<td>2.7766</td>
</tr>
<tr>
<td>.</td>
<td>*</td>
<td>12</td>
<td>0.005</td>
<td>0.060</td>
<td>2.7778</td>
</tr>
</tbody>
</table>

The decision rule:

If all \( p \) – values > 0.05 = fail to reject \( H_0 \)

If any \( p \) - value < 0.05 = reject \( H_0 \)

Since all the probabilities in table 10 are greater than 0.05 it implies that they are not significant. Thus, we fail to reject \( H_0 \) and conclude that the model suffers no serial correlation.
4.10 SIGNIFICANCE OF REGRESSION COEFFICIENTS

a) \( H_0 \): \( \Delta \ln \) (Employee costs) is not statistically significant.

\( H_A \): \( \Delta \ln \) (Employee costs) is statistically significant.

\( \alpha = 0.05 \) (Level of significance)

From table 6, \( p(t) = 0.0000 < 0.05 \)

\[ \therefore \text{We reject } H_0. \]

**Conclusion:** There is sufficient evidence to conclude that \( \Delta \ln \) (Employee costs) is statistically significant.

b) \( H_0 \): \( \Delta \ln \) (ZESA & ZINWA) is not statistically significant.

\( H_A \): \( \Delta \ln \) (ZESA & ZINWA) is statistically significant.

\( \alpha = 0.05 \) (Level of significance)

From table 6, \( p(t) = 0.0472 < 0.05 \)

\[ \therefore \text{We reject } H_0. \]

**Conclusion:** There is sufficient evidence to conclude that \( \Delta \ln \) (ZESA & ZINWA) is statistically significant.

c) \( H_0 \): \( \Delta \ln \) (Stores Payments) is not statistically significant.

\( H_A \): \( \Delta \ln \) (Stores Payments) is statistically significant.

\( \alpha = 0.05 \) (Level of significance)

From table 6, \( p(t) = 0.0001 < 0.05 \)

\[ \therefore \text{We reject } H_0. \]

**Conclusion:** There is sufficient evidence to conclude that \( \Delta \ln \) (Stores Payments) is statistically significant.
d) \( H_0 \): \( \Delta \ln \text{(Sundry Payments)} \) is not statistically significant.

\( H_A \): \( \Delta \ln \text{(Sundry Payments)} \) is statistically significant.

\( \alpha = 0.05 \) (Level of significance)

From table 6, \( p(t) = 0.0000 < 0.05 \)

\( \therefore \) We reject \( H_0 \).

Conclusion: There is sufficient evidence to conclude that \( \Delta \ln \text{(Sundry Payments)} \) is statistically significant.

e) \( H_0 \): Intercept is not statistically significant.

\( H_A \): Intercept is statistically significant.

\( \alpha = 0.05 \) (Level of significance)

From table 6, \( p(t) = 0.9413 > 0.05 \)

\( \therefore \) We fail to reject \( H_0 \).

Conclusion: There is sufficient evidence to conclude that the intercept is not statistically significant.

Since all the regression coefficients are significant at 5% level of significance, it implies that interpretation of these coefficients can be safely done and meaningful results can be obtained. These low p-values of the independent variables as shown by table 6, indicates a high significance of these variables in the estimated model (Table 8). Thus, it shows that the model accurately explains the variance for dependent variable.

However, there is no meaningful result which can be obtained from the intercept since it is not statistically significant.
4.11 MULTICOLLINEARITY TEST

Table 11: CORRELATION MATRIX

<table>
<thead>
<tr>
<th></th>
<th>Δ ln (Employee Payments)</th>
<th>Δ ln (ZESA &amp; ZINWA)</th>
<th>Δ ln (Stores Payments)</th>
<th>Δ ln (Sundry Payments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ ln (Employee Payments)</td>
<td>1.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ ln (ZESA &amp; ZINWA)</td>
<td>0.054</td>
<td>1.000000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ ln (Stores Payments)</td>
<td>0.085</td>
<td>0.008</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>Δ ln (Sundry Payments)</td>
<td>0.076</td>
<td>0.419</td>
<td>0.477</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

Table 7 presents the correlation matrix of the independent variables in order to detect if there is a problem of multicollinearity. “The existence of multicollinearity among the independent variables makes it difficult to separate the impact of individual explanatory variables on the dependent variable” (Roshani 2009). As we can see in table 7, the highest value of correlation coefficient is 0.477 between Δ ln (Stores Payments) and Δ ln (sundry payments), which detects a weak relationship between these two variables. This implies that there is no existence of multicollinearity among the independent variables. Thus, this shows that the model is good.

4.12 COEFFICIENT OF DETERMINATION

It is very important to check if the estimated model is good enough to explain the relationship between the dependent variable and independent variables specified. As a result, coefficient of determination \( R^2 \) is often used to test the goodness of fit. “Since coefficient of determination is highly sensitive to the number of independent variables added in the model, adjusted coefficient of determination \( R^2_a \) is usually considered rather than \( R^2 \)” (Roshani 2009). From table 8, the model shows a high significant coefficient of determination \( R^2 = 0.988767 \) and the adjusted coefficient of determination \( R^2_a = 0.986214 \). This is indicative of a tight fit which
suggests a good model. Thus, 98% of the change in total expenditure is explained by the independent variables in this model.

To test the significance of the $R^2$, the F-statistics and $p$ – values of the independent variables are also considered. The F-statistic with $k-1$ and $N-k$ degrees of freedom allows to test the following:

$H_0 = \text{None of the independent variables help to explain the variation of dependent variable about its mean.}$

$H_1 = \text{Independent variables help to explain the variation of dependent variable about its mean.}$

Since the calculated F-statistic = 387.3145 is greater than the F-critic = 2,9752 at 5% level of significance we reject the null hypothesis and conclude that the independent variables in fact explain the variation of dependent variable about its mean in this model (Table 8).
4.13 HETEROSKEDASTICITY TEST

The hypothesis to be tested is:

\( H_0 \) : No heteroskedasticity

\( H_1 \) : Heteroskedasticity

Table 12: ARCH Test

<table>
<thead>
<tr>
<th>ARCH Test:</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.180540</td>
<td>Probability</td>
<td>0.674544</td>
<td></td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>0.193585</td>
<td>Probability</td>
<td>0.659949</td>
<td></td>
</tr>
</tbody>
</table>

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/27/14  Time: 12:43
Sample(adjusted): 430
Included observations: 27 after adjusting endpoints

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.001554</td>
<td>0.000548</td>
<td>2.833751</td>
<td>0.0090</td>
</tr>
<tr>
<td>RESID^2(-1)</td>
<td>-0.084636</td>
<td>0.199190</td>
<td>-0.424900</td>
<td>0.6745</td>
</tr>
</tbody>
</table>

R-squared         | 0.007170    | Mean dependent var | 0.001439 |
Adjusted R-squared | -0.032543   | S.D. dependent var | 0.002442 |
S.E. of regression | 0.002482    | Akaike info criterion | -9.088555 |
Sum squared resid  | 0.000154    | Schwarz criterion | -8.992567 |
Log likelihood     | 124.6955    | F-statistic      | 0.180540 |
Durbin-Watson stat | 2.002873    | Prob(F-statistic) | 0.674544 |

The decision rule:

\( p \)-value > 0.05 = we fail to reject \( H_0 \)

\( p \)-value < 0.05 = reject \( H_0 \)

Conclusion:

Since the probability of the F-statistic = 0.659949 > 0.05 we fail to reject \( H_0 \) and conclude that the model suffers no heteroskedasticity.
4.14 NORMALITY TEST (IN RESIDUALS)

The hypothesis to be tested is:

\[ H_0 : \text{Residuals are normally distributed} \]
\[ H_1 : \text{Residuals are not normally distributed} \]

Table 13: Normality Test

The Jarque-Bera test statistic has a chi-square distribution with 2 degrees of freedom. Thus, one for skewness and one for kurtosis.

From chi-square tables, the critical value at 5% level of significance \( (\chi_{crit}^2) = 5.991 \)

The decision rule:

If Jarque-Bera test statistic (JB) < \( \chi_{crit}^2 \), fail to reject \( H_0 \).

If Jarque-Bera test statistic (JB) > \( \chi_{crit}^2 \) reject \( H_0 \).

Conclusion:

Since Jarque-Bera = 2.197200 < 5.991, we fail to reject \( H_0 \) and conclude that the residuals are normally distributed.
It is important to measure the forecasting accuracy of the estimated model. Table 14 shows the dynamic forecast evaluation results obtained using the last 9 observations out of 39 observations (observations 31-39). The Theil Inequality Coefficient (TIC) lies between 0 and 1, with zero indicating a perfect fit. Since The Theil Inequality Coefficient (TIC) = 0.030627 (very close to 0), it implies that the estimated model is a perfect fit. The bias proportion (0.567268) and the variance proportion (0.080907) are relatively small, indicating good forecasts. Appendix C shows the actual and dynamic forecasted values for total expenditure for observations 31 to 39 of the sample.
4.16 CONCLUSION

From the above tests, the researcher can conclude that the log–differenced model with an AR (1) specification is plausible since none of the General Linear Model assumptions has been violated. Thus, “the estimates of the parameters are theoretically meaningfully and statistically satisfactory” (Maliwichi 2010).

Hence, the model can now be used to analyse Gweru City Council’s spending pattern and to determine if this spending pattern is directed towards poverty reduction and economic development or not.
CHAPTER 5: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents and discusses the findings of the study with respect to the research objectives. Conclusions and possible recommendations are also presented in this chapter.

5.1 DISCUSSIONS AND CONCLUSIONS

One of the objectives of this study was to fit a log-linear model on historical financial dataset obtained from Gweru City Council Finance Department. The resultant estimated econometric model is:

\[
\Delta \ln y = 0.000349 \Delta \ln x_1 + 0.578324 \Delta \ln x_2 + 0.030511 \Delta \ln x_3 + 0.067407 \Delta \ln x_4 + 0.358603 \Delta \ln x_5 - 0.767046
\]

The above results can be interpreted as follows:

The partial slope coefficients of 0.578324, 0.030511, 0.067407 and 0.358603 measure the percentage change of total expenditure with respect to employee costs, ZESA and ZINWA payments, stores payments and sundry payments respectively. These partial slope coefficients shall assist in measuring which independent variable greatly affects the total expenditure (dependent variable) whilst holding other independent variables constant.

These partial coefficients imply that:

a) Holding ZESA and ZINWA payments, stores payments and sundry payments constant, if the employee costs increase by 1 percent on the average, total expenditure goes up by about 57.8324 percent.

b) Holding employee costs, stores payments and sundry payments constant, if the ZESA and ZINWA payments increase by 1 percent on the average, total expenditure goes up by about 3.0511 percent.

c) Holding employee costs, ZESA and ZINWA payments and sundry payments constant, if the stores payments increase by 1 percent on the average, total expenditure goes up by about 6.7407 percent.
d) Holding employee costs, ZESA and ZINWA payments and stores payments constant, if the sundry payments increase by 1 percent on the average, total expenditure goes up by about 35.8603 percent.

The intercept of 0.000349 means that the average value of $\ln y$ is 0.000349 if the value of all other independent variables is equal to zero. “The mechanical interpretation of the intercept does not have a concrete economic meaning” (Porter 2010). Also, since the p-value of the intercept is greater than 0.05, there is no meaningful result which can be obtained from the intercept as the p-value is not statistically significant in the model.

Another objective of this study was to analyse Gweru City Council’s spending pattern and behaviour and to determine if this spending pattern is directed towards poverty reduction and economic development or not.

According to the partial slope coefficients estimated, the larger share of Gweru City Council’s total expenditure is directed towards the employee costs. This means that Gweru City Council is significantly assisting unemployed members of the Zimbabwean population in securing employment. However, “the least paid employee of GCC is earning about US$280 which is US$292.63 less than the consumer basket as at 06 December 2012”, according to a recent survey conducted by the Consumer Council of Zimbabwe (CCZ) (Gamma 2012). The consumer basket is a crucial national economic tool used to measure the vulnerability of the urban low income earner.

“The CCZ survey is conducted twice during the first and the last weeks of each month” (Gamma 2012). “The total cost of the food basket and the price of each commodity are arrived at by averaging prices gathered from several retail outlets throughout the country” (Gamma 2012).

The GCC through its housing department is also enhancing job creation in the economy of Zimbabwe by providing self-employment facilities such as flea markets, market stalls, taxi and bus ranks.
Besides employee costs, GCC is also spending a significant amount of money on sundry payments. These are costs incurred by GCC in the day to day running of its departments. Under the health department, GCC is running seven clinics and one isolation hospital for Tuberculosis (TB) patients. Also, under housing department, GCC is running four primary schools. Thus, one in Senga Village and 3 in Mkoba Village. The provision of these basic services (primary health care and education) contributes to a better quality of life and enhances economic productivity.

Part of GCC total expenditure is spent towards ZESA and ZINWA payments and stores payments. The magnitude of the partial slope coefficients estimated of ZESA and ZINWA payments and stores payments are very small, implying that less money is spent on these expenses respectively. These expenses contribute towards the provision of water and sanitation services.

However, GCC is experiencing several challenges in the provision of water and sanitation services. According to the Chronicle dated 09 March 2012, “Gweru residents have for the past four years enduring erratic water supplies” (Chronicle 2012). “Mkoba Village 19 residents have not been receiving water from their taps for the past 10 years with the council failing to pump water to the suburb” (Chronicle 2012). As a means of remedying this situation to a little extent, boreholes have been drilled in some parts of Mkoba Village. “The lack of basic services such as water supply and sanitation is a key symptom of poverty and underdevelopment”(Department of Water Affairs and Forestry 1994). As a result, this has a negative impact on human health and economic development.

It is alleged that lack of funding from the National Government has resulted in GCC failing to provide basic services such as water and sanitation services, housing and road networking. It is difficult to undertake major service delivery projects using tariffs paid by residents as most of them owe the city council. “The city council owed more than US$10 million in tariff arrears by residents” (Chronicle, 2012). In the past the National Government used to provide local governments with loans at subsidized rates to undertake major service delivery projects.
Due to the rise in population of Gweru residents, there is great need for the city council to provide more housing facilities to its residents. However, due to lack of finance to clear land, service it and build affordable houses for its residents, the city council has resorted to sell virgin land to private companies for them to undertake housing projects. For instance, First Bank Building Society (FBBS) and Commercial Bank of Zimbabwe (CBZ) which have committed themselves to housing projects in Mkoba Village 14 and Senga township respectively.

Lack of funding has also resulted in GCC failing to maintain its roads around the city. Most roads are full of potholes such that accessibility to other places within the city is becoming a challenge.

GCC is facing some various challenges which are hindering its ability to provide basic services effectively and efficiently. According to the Zimbabwean dated 27 April 2010, “GCC is misusing its expenditure by buying top of the range vehicles for senior managers who include the Mayor, Town Clerk and city council directors” (The Zimbabwean 2010). Instead simple type of vehicles could be bought for these managers to conduct council business and the rest to be used towards service delivery. Revenue and expenditure management capacity of a city council determine its ability to contribute towards poverty reduction and economic development.

Moreover, unnecessary expenditure by GCC is said to be attributed to the unfettered powers of the Minister of Local Government, Rural and Urban Development. According to Radio Voice of the People (VOP), “the minister directed cash strapped Gweru City Council used twenty three thousand dollars (USD$23 000) as payment for the investigation team the minister appointed to investigate the council” (RadioVop Zimbabwe 2011). In this regard the council paid about USD$9 000 for the investigation team at the expense of service delivery and welfare of its workers (RadioVop Zimbabwe 2011).
In conclusion, the econometric results of this study show that GCC`s pattern of expenditure is poverty alleviation oriented in terms of providing human like living standard to its residents although a lot needs to be desired in other aspects of its expenditure management to improve service delivery because it is the poor who suffer most as a result of poor service delivery.

5.2 RECOMMENDATIONS

In view of the above discussions and conclusions, the researcher came up with the following recommendations as possible financial plans which could be adopted by Gweru City Council and other local authorities in Zimbabwe for the well-being of Zimbabweans and economic development:

a) The National Government should fund local authorities for the provision of major basic service delivery projects such as water and sanitation services in order to replace obsolete water pumps and pipes and construct more sewer treatment plants as expected by Environmental Management Agency (EMA). Also, to conduct housing projects and maintain road network.

b) ZINWA should construct more dams for adequate supply of water in towns and cities.

c) ZESA to improve on its electricity supplies since load shedding is still a routine.

d) Increase workers` salaries especially those who are still earning below the consumer basket or poverty datum line. Increase in their salaries means improvement in their quality of life as well.

e) Improve on revenue and expenditure management. Thus, initiate transparency and accountability measures.

f) Positive interference in the running of local authorities by the Minister of Local Government, Rural and Urban Development is highly expected.
g) Council officials or workers to be appointed on merit rather than on political loyalty. Appointment of council officials or workers on the basis of political loyalty could comprise service delivery.

h) Taking into account the relationship between the conduct of politics and economics, a stable political situation should be maintained. Violence is a major threat to the economy. Stable political environment attracts foreign investors to form partnerships with local authorities, start new businesses and donate financial resources to various organisations.

For instance, a Germany company called GIZ donated two refuse trucks for refuse collection, three motorbikes for meter readers, one tractor and trailer for grass cutting and two small motor vehicles for running council business to GCC.

Also, “Mutare City Council (MCC) is earmarked to cut its 50,000 housing waiting list by half as the local authority partners with Chinese investors to build houses for low income earners” (Manica Post 2012).

Moreover, the Bill and Melinda Gates Foundation provided a US$5 million fund to Harare City Council (HCC) for developmental projects in Harare. “The fund is expected to see the construction of houses for low-income earners and less-privileged members of society in Dzivaresekwa Township” (Staff Reporter 2012). “Part of the funds will be used to improve waste management in the capital” (Staff Reporter 2012).

“Last but not least the Chinese investors donated US$1.2 billion to Bulawayo City Council in order to facilitate the completion of the Zambezi Water Project” (Staff Reporter 2013). This project could be a permanent solution to the water crisis in Bulawayo.
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    09/09/12.


## APPENDIX A: GCC’S EXPENDITURE FROM JULY 2009 TO SEPTEMBER 2012

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<th>EMPLOYEE COSTS(EC)</th>
<th>ZESA&amp;ZINWA(ZZ)</th>
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### APPENDIX B: LOGARITHMIC AND FIRST DIFFERENCING TRANSFORMATIONS ON GCC’S EXPENDITURE

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### APPENDIX C: ACTUAL AND DYNAMIC FORECASTED VALUES ON GCC’S TOTAL EXPENDITURE (TE)

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