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

By

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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 …….

March 2014

Acknowledgement

Firstly, I would like to praise God for giving me the strength throughout my study period. It was not easy to work and study at the same time. Also, I would like to extend my sincere gratitude to my project supervisor Professor J C Tyler, for providing a great deal of support and constructive criticism on this project.

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Thank you all once again.

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”

(Ploch 2011). “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.

FIGURE 1: A **Flowchart diagram** showing expenditure analysis and planning in a changed economy – A case study of Gweru City Council, Zimbabwe

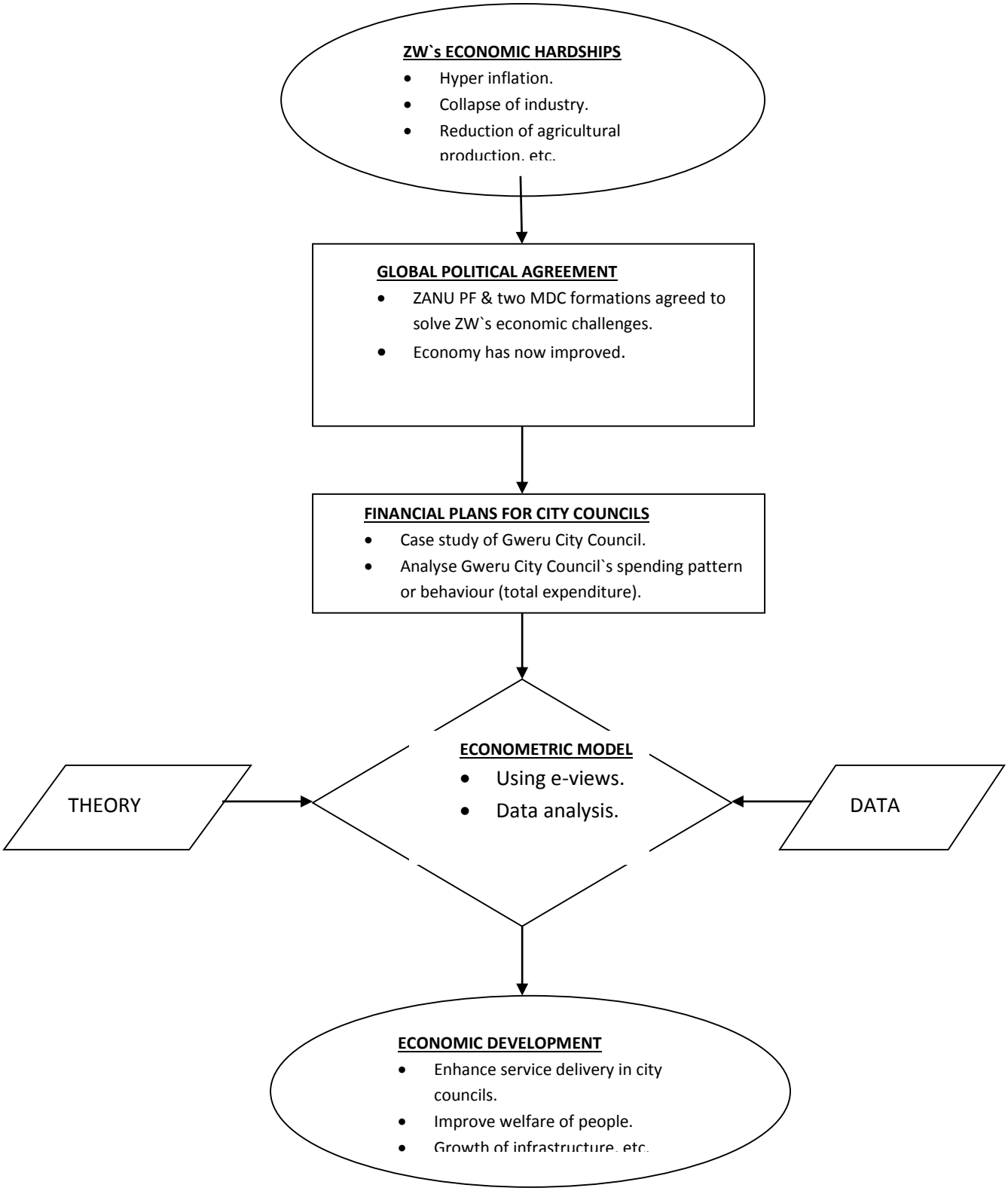
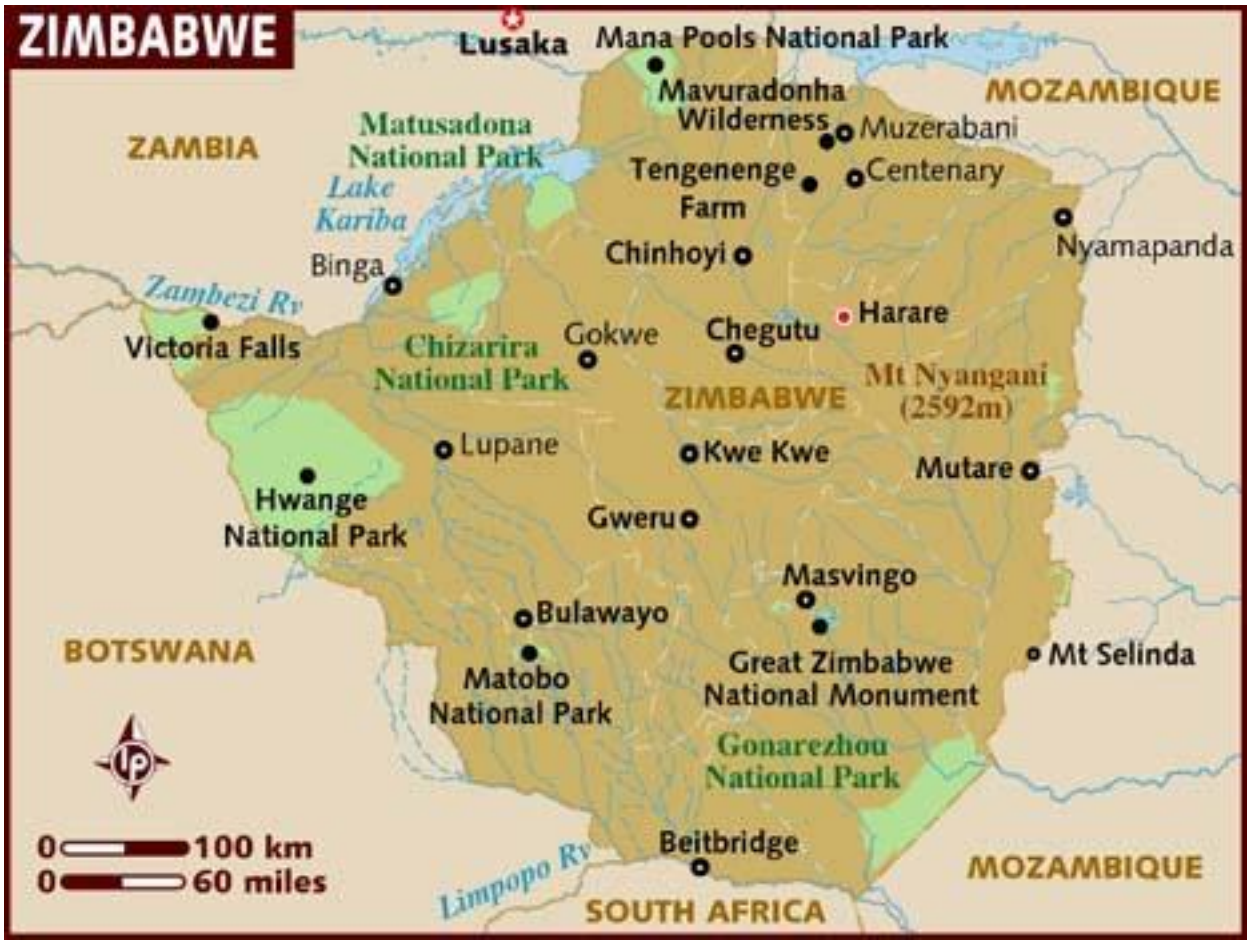


FIGURE 2: GEOGRAPHICAL LOCATION OF CITY OF GWERU, ZIMBABWE



SOURCE OF MAP:

http://www.lonelyplanet.com/maps/africa/zimbabwe/map_of_zimbabwe.jpg

FIGURE 3: CITY OF GWERU

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&wrapid=tljp1322046506609042&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:

$$\Delta LRGDP = \beta_0 + \beta_1 \Delta LREVALFGN_{t-1} + \beta_2 \Delta LREVALSTATES_{t-1} + \beta_3 \Delta LREVALLG_{t-1} + \beta_4 ECT_{t-1} + \mu_t$$

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

β_0 is a constant

$\beta_1, \beta_2, \beta_3$ and β_4 are coefficients of the regression model

ECT is the error correction term

μ 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 multicolinearity 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 auto correlation, multicolinearity, 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 $y = b_0 + b_1 x$. 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:

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

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,

$$\text{var}\left(\mu_t\right) = \sigma^2 \text{ for all } t .$$

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, Barttlet 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 (http://agecon2.tamu.edu/people/faculty/mjelde-james/ageco317/read/assumptions-11.doc) 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 (σ^2). Thus,

$$\mu_t \sqcup N\left(0, \sigma^2\right).$$

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) Var (Y_t) = constant for all t.

c) 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, $Y = AL^{a}K^{\beta}e^{\mu}$.
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

μ = 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 Δ ln (TOTAL EXPENDITURE)

H_0 = Δ ln (TOTAL EXPENDITURE) does have a unit root problem.

H_1 = Δ ln (TOTAL EXPENDITURE) does not have a unit root problem.

ADF Test Statistic	-9.121134	1%	Critical Value*	-2.6261
		5%	Critical Value	-1.9501
		10%	Critical Value	-1.6205

*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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNTE(-1)	-1.394720	0.152911	-9.121134	0.0000

R-squared	0.697968	Mean dependent var	0.002573
Adjusted R-squared	0.697968	S.D. dependent var	0.574245
S.E. of regression	0.315590	Akaike info criterion	0.557911
Sum squared resid	3.585499	Schwarz criterion	0.601449
Log likelihood	-9.321352	Durbin-Watson stat	2.290426

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 Δ ln (EMPLOYEE COSTS)

H_0 = Δ ln (EMPLOYEE COSTS) does have a unit root problem.

H_1 = Δ ln (EMPLOYEE COSTS) does not have a unit root problem.

ADF Test Statistic	-8.689956	1% Critical Value*	-2.6261
		5% Critical Value	-1.9501
		10% Critical Value	-1.6205

*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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNEC(-1)	-1.358392	0.156317	-8.689956	0.0000

R-squared	0.677148	Mean dependent var	-0.007261
Adjusted R-squared	0.677148	S.D. dependent var	0.805939
S.E. of regression	0.457935	Akaike info criterion	1.302478
Sum squared resid	7.549374	Schwarz criterion	1.346016
Log likelihood	-23.09584	Durbin-Watson stat	2.335983

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 Δ ln (ZESA AND ZINWA)

H_0 = Δ ln (ZESA AND ZINWA) does have a unit root problem.

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

ADF Test Statistic	-8.630847	1% Critical Value*	-2.6261
		5% Critical Value	-1.9501
		10% Critical Value	-1.6205

*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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNZZ(-1)	-1.348434	0.156234	-8.630847	0.0000

R-squared	0.674183	Mean dependent var	0.000271
Adjusted R-squared	0.674183	S.D. dependent var	1.447156
S.E. of regression	0.826042	Akaike info criterion	2.482313
Sum squared resid	24.56444	Schwarz criterion	2.525851
Log likelihood	-44.92279	Durbin-Watson stat	2.199766

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 Δ ln (STORES PAYMENTS)

H_0 = Δ ln (STORES PAYMENTS) does have a unit root problem.

H_1 = Δ ln (STORES PAYMENTS) does not have a unit root problem.

ADF Test Statistic	-8.312480	1%	Critical Value*	-2.6261
		5%	Critical Value	-1.9501
		10%	Critical Value	-1.6205

*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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNSTP(-1)	-1.313040	0.157960	-8.312480	0.0000

R-squared	0.657451	Mean dependent var	0.004279
Adjusted R-squared	0.657451	S.D. dependent var	0.831198
S.E. of regression	0.486481	Akaike info criterion	1.423416
Sum squared resid	8.519885	Schwarz criterion	1.466954
Log likelihood	-25.33320	Durbin-Watson stat	1.808147

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 Δ ln (SUNDRY PAYMENTS)

H_0 = Δ ln (SUNDRY PAYMENTS) does have a unit root problem.

H_1 = Δ ln (SUNDRY PAYMENTS) does not have a unit root problem.

ADF Test Statistic	-10.71958	1% Critical Value*	-2.6261
		5% Critical Value	-1.9501
		10% Critical Value	-1.6205

*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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNSP(-1)	-1.508254	0.140701	-10.71958	0.0000

R-squared	0.761281	Mean dependent var	0.019205
Adjusted R-squared	0.761281	S.D. dependent var	0.739319
S.E. of regression	0.361223	Akaike info criterion	0.828013
Sum squared resid	4.697358	Schwarz criterion	0.871552
Log likelihood	-14.31825	Durbin-Watson stat	2.083406

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

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

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:

H_0: There is no positive serial correlation

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 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 = 2.825636 $\geq$ 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) =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

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	7.621033	Probability	0.011131
Obs*R-squared	7.217587	Probability	0.007219

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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000508	0.008620	-0.058978	0.9535
DLOG(EC)	-0.015154	0.019934	-0.760227	0.4548
DLOG(ZZ)	-0.011718	0.016423	-0.713543	0.4827
DLOG(STP)	0.000439	0.018971	0.023131	0.9817
DLOG(SP)	0.027825	0.030859	0.901677	0.3766
RESID(-1)	-0.576967	0.208999	-2.760622	0.0111
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 = fail to reject H_0

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

Conclusion:

Since the probability of the Obs*R-squared = 0.007219 < 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

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

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.

$4 - d_L = 4 - 1.143 = 2.857$ $4 - d_U = 4 - 1.739 = 2.261$

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

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.011673	Probability	0.914987
Obs*R-squared	0.015556	Probability	0.900743

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

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.26E-05	0.004790	-0.004713	0.9963
DLOG(EC)	0.000274	0.020216	0.013539	0.9893
DLOG(ZZ)	-0.000325	0.015147	-0.021476	0.9831
DLOG(STP)	-6.08E-05	0.014730	-0.004129	0.9967
DLOG(SP)	-0.000259	0.026493	-0.009771	0.9923
AR(1)	0.014057	0.210363	0.066824	0.9474
RESID(-1)	-0.032594	0.301685	-0.108040	0.9150
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 : There is no serial correlation

H_1 : There is serial correlation

Table 10: Correlogram of residuals

Date: 02/27/14 Time: 12:15
Sample: 3 30
Included observations: 28
Q-statistic probabilities adjusted for 1 ARMA term(s)

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. | . |	. | . |	1	-0.017	-0.017	0.0090	
. |* . |	. |* . |	2	0.072	0.072	0.1775	0.674
. | . |	. | . |	3	-0.029	-0.027	0.2053	0.902
. *| . |	. *| . |	4	-0.153	-0.160	1.0283	0.794
. *| . |	. *| . |	5	-0.114	-0.118	1.4998	0.827
. | . |	. |* . |	6	0.061	0.082	1.6441	0.896
. |* . |	. |* . |	7	0.070	0.089	1.8387	0.934
. |* . |	. |* . |	8	0.135	0.103	2.6013	0.919
. | . |	. | . |	9	-0.013	-0.057	2.6090	0.956
. | . |	. | . |	10	-0.007	-0.023	2.6112	0.978
. *| . |	. | . |	11	-0.058	-0.011	2.7766	0.986
. | . |	. | . |	12	0.005	0.060	2.7778	0.993

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.

α = 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 $\Delta \ln$ (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.

α = 0.05 (Level of significance)

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

$\therefore$ 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.

α = 0.05 (Level of significance)

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

$\therefore$ We reject H_0.

Conclusion: There is sufficient evidence to conclude that $\Delta \ln$ (Stores Payments) is statistically significant.

d) H_0: $\Delta \ln$ (Sundry Payments) is not statistically significant.

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

α = 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 $\Delta \ln$ (Sundry Payments) is statistically significant.

e) H_0: Intercept is not statistically significant.

H_A: Intercept is statistically significant.

α = 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 theses 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

	Δ ln (Employee Payments)	Δ ln (ZESA & ZINWA)	Δ ln (Stores Payments)	Δ ln (Sundry Payments)
Δ ln (Employee Payments)	1.000000			
Δ ln (ZESA & ZINWA)	0.054	1.000000		
Δ ln (Stores Payments)	0.085	0.008	1.000000	
Δ ln (Sundry Payments)	0.076	0.419	0.477	1.000000

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 $\Delta \ln$ (Stores Payments) and $\Delta \ln$ (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 $\left(R^2\right)$ 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 $\left(R_a^2\right)$ is usually considered rather than R^2"(Roshani 2009). From table 8, the model shows a high significant coefficient of determination $\left(R^2 = 0.988767\right)$ and the adjusted coefficient of determination $\left(R_a^2 = 0.986214\right)$. 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 = None of the independent variables help to explain the variation of dependent variable about its mean.

H_1 = 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

ARCH Test:			
F-statistic	0.180540	Probability	0.674544
Obs*R-squared	0.193585	Probability	0.659949

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/27/14 Time: 12:43
Sample(adjusted): 4 30
Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001554	0.000548	2.833751	0.0090
RESID^2(-1)	-0.084636	0.199190	-0.424900	0.6745
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.

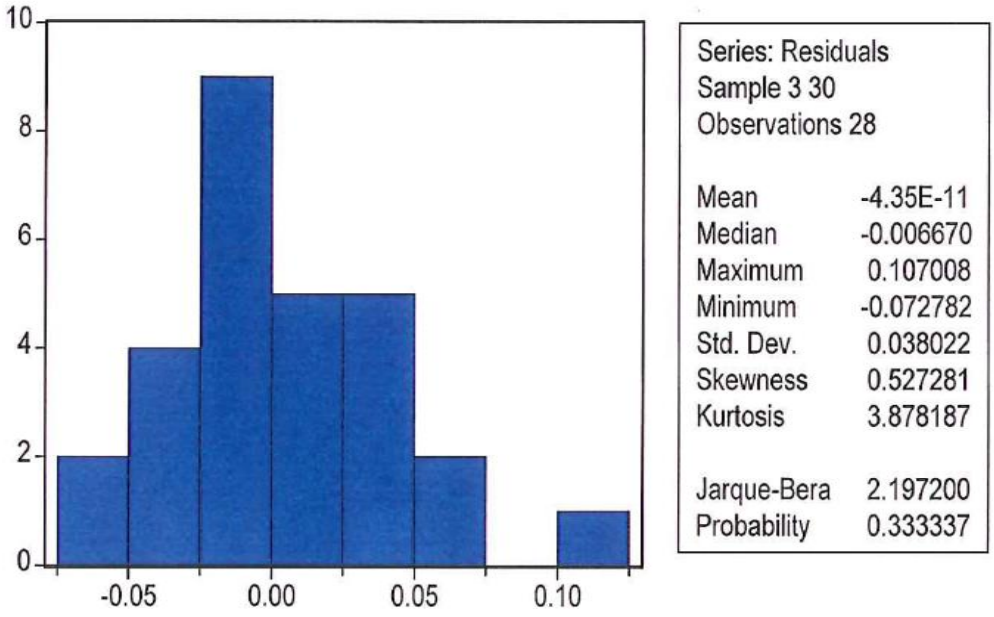
4.14 NORMALITY TEST (IN RESIDUALS)

The hypothesis to be tested is:

H_0: Residuals are normally distributed

H_1: 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 (χ^2_{crit}) = 5.991

The decision rule:

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

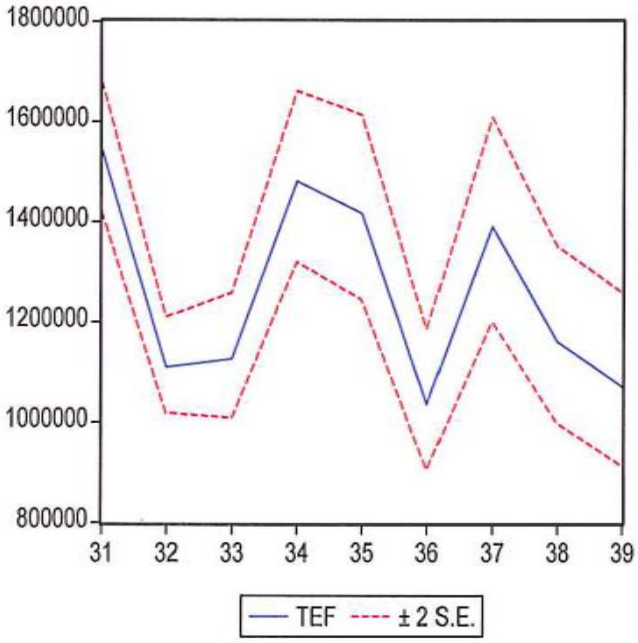
If Jarque-Bera test statistic (JB) > χ^2_{crit} reject H_0.

Conclusion:

Since Jarque-Bera = 2.197200 < 5.991, we fail to reject H_0 and conclude that the residuals are normally distributed.

4.15 TIME SERIES FORECASTING ERROR STATISTICS

Table 14: Plot of Forecast



Forecast: TEF	
Actual: TE	
Forecast sample: 31 39	
Included observations: 9	
Root Mean Squared Error	76367.53
Mean Absolute Error	65994.35
Mean Abs. Percent Error	5.854511
Theil Inequality Coefficient	0.030627
Bias Proportion	0.567268
Variance Proportion	0.080907
Covariance Proportion	0.351825

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:

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

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 $d \ln y$ 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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APPENDIX A: GCC`S EXPENDITURE FROM JULY 2009 TO SEPTEMBER 2012

EMPLOYEE COSTS(EC)	ZESA&ZINWA(ZZ)	STORES PAYMENTS(STP)	SUNDRY PAYMENTS(SP)	TOTAL EXPENDITURE(TE)
245,980	10,000	16,092	92,795	364,867
247,166	12,000	13,285	56,862	329,313
257,914	20,000	37,380	93,642	408,936
259,748	20,000	59,120	77,896	416,764
274,357	10,000	87,058	107,027	478,442
369,518	10,000	80,670	110,586	570,774
177,589	10,000	95,878	95,050	378,517
192,287	20,110	33,773	150,914	397,084
641,187	40,000	15,265	177,360	873,812
290,412	16,265	19,948	175,178	501,803
379,477	30,872	26,755	250,339	687,443
449,480	67,740	17,302	374,595	909,117
458,162	69,386	37,713	548,561	1,113,822
407,456	22,845	23,997	324,514	778,812
491,687	30,121	22,974	267,030	811,812
558,024	38,533	21,479	338,887	956,923
393,570	38,400	27,827	316,540	776,337
457,630	38,500	43,278	324,657	864,065
385,548	73,961	29,615	259,714	748,838
956,893	90,190	24,702	375,185	1,446,970
538,627	84,853	26,403	368,592	1,018,475
231,132	26,813	11,850	205,182	474,977
494,951	16,501	25,102	312,684	849,238
371,474	52,792	20,126	343,000	787,392
574,944	22,500	33,138	364,535	995,117
465,114	30,171	21,958	223,695	740,938
441,120	22,577	46,368	343,615	853,680
221,540	7,861	24,565	357,508	611,474
392,987	9,483	24,251	371,893	798,614
783,565	15,500	14,364	165,468	978,897
821,666	52,855	36,091	529,691	1,440,303
514,570	23,500	26,443	421,221	985,734
573,889	38,090	20,089	429,499	1,061,567
1,222,383	13,420	25,759	253,634	1,515,196
577,633	162,276	27,220	653,904	1,421,033
497,600	21,033	16,302	426,561	961,496
637,979	10,566	29,772	643,942	1,322,259
544,710	59,592	24,780	432,004	1,061,086
418,383	72,232	23,967	538,744	1,053,326

APPENDIX B: LOGARITHMIC AND FIRST DIFFERENCING TRANSFORMATIONS ON GCC`S EXPENDITURE

lnTE	∆ lnTE	lnEC	∆ lnEC	lnZZ	∆ lnZZ	lnSTP	∆ lnSTP	lnSP	∆ lnSP
12.80729		12.41301		9.21034		9.686078		11.43815	
12.70476	-0.10252	12.41782	0.00481	9.392662	0.182322	9.494391	-0.19169	10.94838	-0.48977
12.92131	0.21655	12.46038	0.042566	9.903488	0.510826	10.52889	1.0345	11.44723	0.498852
12.94028	0.018961	12.46747	0.007086	9.903488	0	10.98732	0.458433	11.26313	-0.1841
13.07829	0.138015	12.52219	0.054718	9.21034	-0.69315	11.37433	0.387005	11.58084	0.317707
13.25475	0.176458	12.81995	0.297769	9.21034	0	11.29812	-0.07621	11.61355	0.032712
12.84402	-0.41073	12.08723	-0.73273	9.21034	0	11.47083	0.17271	11.46216	-0.15139
12.8919	0.047887	12.16674	0.079517	9.908972	0.698632	10.42742	-1.04341	11.92447	0.462307
13.68062	0.788717	13.37108	1.204332	10.59663	0.687662	9.633318	-0.7941	12.08594	0.161471
13.12596	-0.55466	12.57906	-0.79202	9.696771	-0.89986	9.900884	0.267566	12.07356	-0.01238
13.44073	0.314771	12.84655	0.267493	10.3376	0.640834	10.19448	0.293592	12.43057	0.357013
13.72023	0.279495	13.01585	0.169297	11.12343	0.785827	9.758577	-0.4359	12.8336	0.403029
13.92331	0.203079	13.03498	0.019131	11.14744	0.024008	10.53776	0.779183	13.21505	0.381453
13.56552	-0.35778	12.91769	-0.11729	10.03649	-1.11095	10.08568	-0.45208	12.69008	-0.52497
13.60702	0.041499	13.1056	0.187909	10.31298	0.27649	10.04212	-0.04357	12.49512	-0.19497
13.77148	0.164454	13.23216	0.12656	10.55927	0.246292	9.974831	-0.06729	12.73342	0.238306
13.56234	-0.20914	12.88301	-0.34914	10.55581	-0.00346	10.23376	0.258931	12.6652	-0.06822
13.6694	0.107061	13.03382	0.150802	10.55841	0.002601	10.6754	0.441638	12.69052	0.02532
13.52628	-0.14313	12.86242	-0.1714	11.21129	0.65288	10.29604	-0.37936	12.46734	-0.22319
14.18498	0.658704	13.77145	0.909026	11.40967	0.198381	10.11464	-0.1814	12.83517	0.367838
13.83382	-0.35117	13.19678	-0.57467	11.34868	-0.061	10.18123	0.066593	12.81745	-0.01773
13.07102	-0.7628	12.35074	-0.84603	10.19664	-1.15203	9.380083	-0.80115	12.23165	-0.58579
13.65209	0.581073	13.11221	0.76147	9.711176	-0.48547	10.1307	0.75062	12.65295	0.421296
13.57648	-0.07561	12.82523	-0.28698	10.87411	1.162939	9.909768	-0.22094	12.74549	0.092537
13.81062	0.234134	13.26203	0.436794	10.02127	-0.85284	10.40844	0.498668	12.80638	0.060892
13.51567	-0.29494	13.05004	-0.21199	10.31464	0.293366	9.996887	-0.41155	12.31804	-0.48834
13.65731	0.141639	12.99707	-0.05297	10.02469	-0.28995	10.74436	0.747478	12.74728	0.429238
13.32363	-0.33368	12.30836	-0.68871	8.969669	-1.05502	10.10908	-0.63529	12.78691	0.039636
13.59063	0.267005	12.88153	0.573173	9.157256	0.187587	10.09621	-0.01286	12.82636	0.039448
13.79418	0.203549	13.57161	0.690077	9.648595	0.491339	9.57248	-0.52373	12.01653	-0.80983
14.18036	0.386182	13.61909	0.04748	10.87531	1.226712	10.4938	0.921318	13.18005	1.163516
13.80114	-0.37922	13.15109	-0.468	10.06476	-0.81055	10.18275	-0.31105	12.95091	-0.22914
13.87526	0.074115	13.26019	0.109104	10.54771	0.482951	9.907928	-0.27482	12.97037	0.019462
14.23106	0.355799	14.01631	0.756122	9.504501	-1.04321	10.15654	0.248612	12.44365	-0.52673
14.16689	-0.06416	13.26669	-0.74962	11.99705	2.492552	10.21171	0.055168	13.39072	0.947068
13.77625	-0.39065	13.11755	-0.14914	9.953848	-2.04321	9.699043	-0.51266	12.96351	-0.42721
14.09485	0.318607	13.36606	0.248509	9.265397	-0.68845	10.30132	0.602281	13.37536	0.411853
13.8748	-0.22005	13.20801	-0.15805	10.99528	1.72988	10.11779	-0.18353	12.97619	-0.39917
13.86746	-0.00734	12.94415	-0.26386	11.18764	0.192362	10.08443	-0.03336	13.197	0.220806

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

OBSERVATIONS	TEF (FORECASTS)	TE (ACTUAL)
1	364867	364867
2	329313	329313
3	408936	408936
4	416764	416764
5	478442	478442
6	570774	570774
7	378517	378517
8	397084	397084
9	873812	873812
10	501803	501803
11	687443	687443
12	909117	909117
13	1113822	1113822
14	778812	778812
15	811812	811812
16	956923	956923
17	776337	776337
18	864065	864065
19	748838	748838
20	1446970	1446970
21	1018475	1018475
22	474977	474977
23	849238	849238
24	787392	787392
25	995117	995117
26	740938	740938
27	853680	853680
28	611474	611474
29	798614	798614
30	978897	978897
31	1574611	1545226
32	1068836	1110218
33	1160895	1126786
34	1492842	1481115
35	1447667	1416970
36	1039798	1036562
37	1354879	1390026
38	1193301	1161010
39	1105528	1071748